A century of capital flows:

An international perspective, 1920-2020

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To Julia, Thomas and Linh

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Abstract

This dissertation explores the relationship between foreign capital and the macroeconomy over the past century, proceeding in three steps. In the first step, I use newly digitized Balance of Payments data, covering 33 countries, to study international capital flows and their economic implications during the interwar period. I begin by documenting the boom-bust pattern in capital flows centered on the Great Depression and, linking flows with business cycles, show that gross foreign credit is the decisive link between capital flows and adverse economic outcomes. Increases in gross foreign borrowing are associated with lower subsequent output growth, higher crisis risk, and, conditional on a crisis, more severe post-crisis recessions. Crucially, gross foreign borrowing plays a more important role than net foreign borrowing and domestic credit.

In the second step, I expand on the widely documented negative relationship between credit expansions and economic outcomes. This section employs financial account data from 33 OECD countries since the 1970s to identify the ultimate counterparties financing these credit expansions. Lifting the veil of financial intermediation reveals that a significant portion of the expansion in household credit over the past four decades was funded from abroad, with gross capital flows serving as the primary driver of the cyclical relationship between credit and real activity. Household credit expansions financed from abroad predict lower future GDP growth and higher risk of banking crises, but domestically financed credit expansions do not.

The third part examines the connection between the economy and demography. It utilizes staggered difference-in-differences to link state-level banking deregulation during the 1980s in the United States to two demographic outcomes: mothers' age at first childbirth and fertility rates. Following deregulation, the average age of first-time motherhood increases, with a more pronounced effect observed among the non-white population. The average effect on total fertility is initially positive, but reverts back to zero over longer horizons. For the non-white sample, however, this reversion outweighs the previous increase, resulting in a net fertility decrease. Importantly, these trends are stronger for interstate compared to intrastate deregulation, indicating that it is especially the inflow of foreign capital driving these results.

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1. — Introduction

Any reader of this book will come away with the distinct notion that large quantities of liquid capital sloshing around the world should raise the possibility that they will overflow the container.

- Robert M. Solow

This quote, from the foreword to Kindleberger (1978) captures the essence of this thesis like no other possibly could. It describes a current of capital, barely restrained by the boundaries of its container, the global financial system, and this current threatens to flood those regions whose defenses are not strong enough to withstand it. But let's start from the beginning.

Research on international capital flows has a long tradition,[1] yet it was the global financial recession of 2008 that reinvigorated academic interest in capital flows after the 'Great Moderation' (Bernanke, 2004) seemingly made any further interest in them superfluous. Since then, numerous authors have emphasized the continued (or resurgent) importance of capital flows for the economy.[2] What sets this recent branch of literature apart from earlier works, besides its methodological advancements, is its focus on a specific type of capital flows, which has previously been dismissed as being of little importance. This new emphasis is on gross capital flows, which

[1]see, e.g.: Hume (1758); Fisher (1935); Keynes (1941); Crowther (1949); Kindleberger (1978); Calvo (1998).

[2]see, e.g.: Obstfeld et al. (2010); Obstfeld (2012); Shin (2012); Borio (2016); Caballero and Simsek (2020)

have been noted to dwarf the previous focal point of research – net capital flows – in magnitude and demonstrate a stronger association with various financial variables of interest, such as balance sheet risk and capital flight. Empirical evidence linking gross capital flows to future macroeconomic and social outcomes, however, remains scarce.

This thesis consists of three parts, each addressing a distinct question regarding the state of research on capital flows in economic history. These questions – to continue the metaphor of the container full of capital – can be summarized as follows: I. What do we observe when we look into the container? In essence, the first and foremost inquiry revolves around the nature of capital flows, the timing of their spillage from the container, and their implications for the economy. II. When the container overflows, what are the surges of foreign money used for? Simple accounting dictates that all available capital must be either spend or saved, thus forcing a domestic financial system receiving foreign capital inflows to decide where to allocate it. III. What are the societal consequences of suddenly being exposed to a wave of foreign capital? While the movement of capital may seem an abstract concept itself, its economic implications translate into very tangible consequences for affected individuals. After all, if the container full of capital were inconsequential, why has it already been of interest for, at least, half a century?

The three separate settings stretch over the past century, each combining a particular place in time with one of the questions described above. The first study covers the interwar period, centered on the Great Depression, where I will document the development of international capital flows during this early era of financial globalization and investigate their implications for economic outcomes. Here, capital flows are understood in their broadest possible sense: as any kind of financial transaction moving across national borders. They are analyzed for a large panel of countries, marking the first comprehensive analysis of this kind during the interwar era.

The second project advances in time, covering the period between the 1960s and

2020 for a panel of OECD economies, and narrowing the definition of capital flows by restricting them to the portion of inflows that are captured by the financial balance sheets of domestic economic sectors. This provides the possibility to examine the other side of these balance sheets, addressing the second of the questions outlined above: What assets do international capital flows finance domestically, and does it matter for the economy whether the same asset is domestically or internationally funded?

The final project narrows its focus even further, concentrating solely on the United States between 1970 and 2000. Instead of examining variations in capital flows themselves, it exclusively considers changes in the timing of states deregulating their financial systems and permitting the influx of foreign capital. Utilizing detailed county-level statistics compiled by the U.S. government, this project investigates the demographic consequences of exposure to foreign capital across diverse socioeconomic groups, thereby addressing the third of the questions raised above.

All three projects are approached from an empirical point of view, and thus combine extensive data collection efforts with the application of state-of-the-art econometric methodology. The combination of historical and modern data, financial developments and economic outcomes, and traditional topics in economic history (such as the Great Depression) and modern econometrics, places the thesis at the intersection of several fields of study. It touches on economic and financial history, as well as empirical finance and macroeconomics, drawing methods, data, literature, and inspiration from each of them.

The individual parts of the thesis are self-contained, with each providing details on the construction of the data, the methodology employed, and its contribution to the relevant literature. They are based on three standalone working papers titled: I. "*Golden Fetters or Credit Boom Gone Bust? A Reassessment of Capital Flows in the Interwar Period*" (Diebold, 2023), II. "*When Two Become One: Foreign Capital and Household Credit Expansion*", co-authored with Björn Richter from the University Pompeu Fabra

(Diebold and Richter, 2021), and III. "*Financial Deregulation and Fertility Decisions: The Unintended Consequences of Banking Legislation*", co-authored with Julian Soriano-Harris from the University of Alicante (Diebold and Soriano-Harris, 2023). All three working papers have been modified and expanded for this dissertation.

Providing a general overview of how the different parts of this thesis contribute to the existing literature is not an easy endeavor. In any case, each chapter has its own section dedicated to precisely this purpose: highlighting gaps in the current state of research and detailing how the respective chapter is attempting to close them. So instead of going into a detailed discussion of these gaps now, I will defer it to the respective chapters and focus on providing a clearer intuition of how the questions I am trying to answer have evolved to the point where they are now.

The significance of (gross) capital flows during the interwar period can be approached from two perspectives: one focusing on the global dimension of the Great Depression, the other on the study of capital flows themselves. The question of what made the Great Depression a global phenomenon already intrigued contemporaries, who attributed it to international contagion, facilitated by the interconnectedness of the global financial system (Fisher, 1935; Keynes, 1941). But while the financial aspects of the depression remained important, subsequent literature concentrated on domestic financial affairs, emphasizing financial fragility or monetary policy limitations (Bernanke and James, 1990; Bernanke, 1994; Eichengreen, 1996). Following the renewed interest in capital flows post-2008, research on capital flows during the Great Depression experienced a resurgence. Since then, an increasing number of studies have sought to reconstruct the interwar financial system, describe the movement of capital, and link it to financial fragility (Borio et al., 2014; Accominotti and Eichengreen, 2016; De Broeck et al., 2018; End et al., 2019; Collet and Postel-Vinay, 2021).

As noted initially, the interest in capital flows as an object of research traces back at least to Hume (1758), who contemplated the relevance of stable 'external balances' for internal stability. The pursuit of balanced external budgets in Gold Standard countries, as documented by Eichengreen and Temin (2000), made perfect sense, when concentrating on the monetary limitations of a country on the Gold Standard. This focus, however, persisted after the Gold Standard was abandoned and the idea to avoid external imbalances was enshrined in the Bretton Woods system (Crowther, 1949). Yet, the distinction between net debtor and creditor nations appeared to offer limited explanatory power for economic outcomes and the Current Account, long relied upon as the workhorse for the analysis of capital flows, came under scrutiny (Bernanke, 2005; Obstfeld et al., 2010; Jordà et al., 2011; Obstfeld, 2012). Consequently, the theoretical (Rey, 2013; Hahm et al., 2013; Caballero and Simsek, 2020), as well as empirical focus shifted towards gross capital flows (Shin, 2012; Broner et al., 2013; Borio and Disyatat, 2015). Chapter I. represents the first comprehensive effort to explicitly connect gross capital flows to economic outcomes across a broad panel of countries during the interwar period. This reconciles the two branches of literature by extending the analysis of gross capital flows to the only global financial crisis outside the 2008 financial recession, while simultaneously providing a novel explanation for the global dimension of the Great Depression.

The second chapter considers the potential uses of additional funds from abroad. Having access to credit is by no means inherently negative, but what if its growth is rapid, unsustainable and disconnected from the real economy? This question is central to the seminal work by Jorda, Schularick, and Taylor, who demonstrated that rapid credit expansion and high levels of private indebtedness have adverse effects on financial stability and macroeconomic outcomes in the long run (Schularick and Taylor, 2012; Jordà et al., 2013). In their wake, data collection on credit took off, and with the improvements in available data, the question of how credit is connected to the economy evolved. It became feasible to differentiate between various recipients of credit, leading Mian et al. (2017, 2020a) to ask: does the recipient of credit during booms matter for economic outcomes? Making the distinction between household and corporate credit, they found that it was especially credit to households which was driving the aggregate results reported in Schularick and Taylor (2012) and Jordà et al. (2013).

Both households and corporates represent heterogeneous categories though. Regarding households, Mian et al. (2020b) discovered that the recipient's socioeconomic status significantly influences the impact of household credit. Interest payments on credit reduce disposable income for poor borrower households (much more than for rich ones), which have a high marginal propensity to consume, while transferring it to wealthy creditor households with a low marginal propensity to consume. This leads to a decrease in aggregate demand (Mian et al., 2021). On the corporate side, access to credit can be used to invest in productive capacity, potentially fostering long-run growth. However, the productivity growth among corporates varies significantly across industries. Muller and Verner (2021) show that credit to the non-tradeable sector tends to be associated with less productive investment, while credit to the tradeable sector is followed by higher future economic growth.

So while much of the existing literature has emphasized the importance of the *recipient* of credit during expansions, the question of the significance of the *supplier* remains largely unresolved. Chapter II. reveals that the source of credit matters for economic outcomes, showing significant heterogeneity in outcomes between domestic and foreign sources of credit. Effectively, this unites the literature on credit with the literature on capital flows (hence the title: "When Two Become One").

The final chapter examines the demographic implications of exposure to foreign capital through its influence on the economy. Demography and the economy are intertwined, because families respond to economic conditions when contemplating fertility. This much has been clear at least since Galbraith and Thomas (1941) and Becker (1960), who first framed the question as a trade-off between the cost of having children and the potential earnings from wage-based labor. Going even further, Sobotka et al. (2011) state that the notion of a link between economic circumstances and fertility *'has been pursued for centuries'*. However, the nature of this connection — whether it operates in a pro-cyclical or counter-cyclical manner — remains a subject of debate. Both scenarios are easily conceivable and while different formulations have been used, the discussion boils down to the two (very simplified) statements "I cannot afford to have a child right now due to poor economic conditions" and "I cannot afford to have a child right now because the opportunity cost of foregoing work is too high".[3] The answer to the question of which force eventually outweighs the other is ultimately empirical, as evidenced by the numerous studies that have attempted to answer it.

Most studies suggest a positive correlation between favorable economic conditions and increased fertility (Macunovich, 1996; Sobotka et al., 2011; Coskun and Dalgic, 2022), but arguments for a counter-cyclical relationship have also been made (Galbraith and Thomas, 1941; Butz and Ward, 1979; Monstad et al., 2008). Recent research has emphasized the crucial role of the housing market in family planning (Dettling and Kearney, 2014; Pavlidis et al., 2016; Daysal et al., 2021), with varying effects for different socioeconomic groups: homeowners typically benefit from house price increases, while prospective buyers may suffer, with significant heterogeneity depending on their access to credit (Hacamo, 2021; Yang, 2023). As we shall see in Chapter II., foreign capital finances household and particularly mortgage credit, which, in turn, is highly correlated with increasing house prices (Mian et al., 2020a; Favara and Imbs, 2015).

Chapter III. demonstrates that both pro-cyclical and counter-cyclical scenarios may hold true, depending on the socioeconomic group in question, with some more influenced by economic booms and others by busts. As access to credit, financial wealth, and homeownership rates are distributed highly unequally across races in the United States, with the white population holding a significant advantage in all categories (Coulson and Dalton, 2010; Taylor et al., 2011; Haughwout et al., 2020),

[3]The respective inverses are: "I can afford to have a child right now because the income loss would be negligible" and "I can afford to have a child right now because I have high economic security".

chapter III. is also closely connected to the extensive and expanding literature on racial inequality. Moreover, short-term economic booms can lead to long-term busts, emphasizing the need for a careful assessment of the relative strengths of these opposing effects over varying time horizons. Put more generally, and returning to the citation at the beginning of this thesis: domestic economic fluctuations tend to be amplified by exposure to foreign capital (Kindleberger, 1978), which, along with more recent advances in the literature, indicates that foreign capital also plays a crucial role in determining fertility outcomes and even weighs on racial inequalities via its effects on house prices and credit.

The data underpinning the research presented here has been newly constructed for this dissertation, and each chapter leverages its own unique dataset. Chapter I relies on newly digitized Balance of Payments data, published by the League of Nations between 1930 and 1939, encompassing ten volumes in two separate publication series (League of Nations, 1930-1932, 1933-1939). This dataset includes the Current and Capital Accounts for over 30 countries throughout most of the interwar period and is complemented by the balance sheets of commercial banks (League of Nations, 1931-1940), along with bilateral US investments in foreign countries (Dickens, 1931, 1930; Lewis and Schlotterbeck, 1938), all of which have also been newly digitized for this thesis. This comprehensive compilation of information represents a significant enhancement over previously available data, facilitating a more thorough reconstruction of the international financial system during the interwar period.

The second chapter utilizes OECD financial accounts data, which is in principle accessible online, yet limited to records dating back only to the mid-1990s in the publicly accessible version. Leveraging the so-called 'Golden Book' of the OECD (OECD, 1970-1998), which was published infrequently since the early 1960s, this dataset has been expanded backwards until deep into the 1960s. This data offers a remarkably cohesive, standardized, and exceptionally long-term perspective of the entire economy of the covered countries. It encompasses sectoral balance sheets of all major economic sectors, providing a detailed breakdown of the financial instruments featured on these balance sheets. By capitalizing on the fundamental accounting principle that anybody's liability corresponds to another's asset, the asset and liability sides of the balance sheet consistently balance, allowing for a mapping between the debtors and creditors in the economy over the entire period.

The primary data source for the third chapter is the National Vital Statistics System of the National Center for Health Statistics (2023), compiled by the National Bureau of Economic Research (NBER), which encompasses data on virtually every birth in the United States. It includes an extensive array of control variables, covering mothers' race, age, marital status, and education, as well as the county and state of residence since 1969. It is supplemented with county-level population data by race from the NBER's compilation of the Survey of Epidemiology and End Results, (SEER) (2023), alongside information on the timing with which each state deregulated its financial system, allowing out-of-state banks to operate within its borders. These dates are obtained from Mian et al. (2020a) and Amel (1993). Although various components of this data have been used independently, their combination, and particularly the length of historical coverage are novel, and based on merging millions of observations by the county of birth for children born in the United States since 1969. Together, this combined dataset can shed new light on the macro-determinants of fertility over the long term.

Vital to all parts of the dissertation is the understanding that the very 'foreignness' of capital makes it, to some extent, different to domestic capital. And while the historical context, the data, the measurement of capital movements and the way the argument is presented are important, the identification of what it means for capital to be 'foreign' needs to be sound.[4] Here, it is crucial to differentiate between the

[4]The precise channels through which the literature has linked foreign capital dynamics to economic outcomes, including e.g.: capital flight (Broner et al., 2013), sudden stops (Calvo, 1998), maturity mismatches (Obstfeld, 2012), capital flow bonanzas (Reinhart and Rogoff, 2009), exchange rates (Schmitt-Grohé and Uribe, 2016; Fornaro, 2021), or excessive risk taking (Collet and Postel-Vinay,

idiosyncratic demand for capital specific to a country (or state), which may be met by strategically accessing international financial markets, and the global supply of capital, which fluctuates independently of domestic conditions. This differentiation is akin to choosing the optimal time and place to tap into the container full of capital to access its contents, as opposed to being caught off guard when it overflows. Recently, the concept of a global financial cycle has made this distinction explicit, attempting to measure global financial sentiment (supply) and utilize it to explain aspects of domestic lending, risk-taking, and financial stability that cannot be accounted for by local factors (demand) (Rey, 2013; Miranda-Agrippino and Rey, 2020). Arguably, what matters most for capital flows is not so much the foreign place of origin but rather its foreignness to the domestic economy.

Identifying the portion of capital flows driven by global financial conditions, independent of domestic economic factors, presents a fundamental empirical challenge throughout this dissertation. In practice, classifying specific transactions as supply or demand-driven often proves difficult, necessitating a diverse array of identification methodologies, as varied as the literature on the individual topics itself. To address the challenge, Chapter I. employs a variation of the Bartik-style instrument, widely used in empirical research (Bartik, 1991; Goldsmith-Pinkham et al., 2020). It interacts prior exposure to foreign inflows with an aggregate credit supply shock, effectively allocating the shock based on predefined vulnerability, and uses it to instrument capital flows. Chapter II. takes a more direct route (conceptually), by decomposing flows in the international banking network into separate components (supply, demand, and trend), according to the methodology developed by Amiti et al. (2017, 2019). The demand-cleaned shocks can then again be used to instrument capital flows, isolating the portion not driven by idiosyncratic demand. Lastly, Chapter III. exploits the timing of entities allowing foreign capital inflows, comparing it to a control group yet to permit such inflows. Recently, a novel class of estimators — staggered

2021) will be discussed in the coming chapters.

difference-in-differences — has emerged for precisely this purpose (Borusyak et al., 2022; Roth et al., 2023), facilitating the assessment of changes in bank lending due to increased exposure to foreign capital via legislative changes, rather than local demand for additional credit.

Central Findings: Chapter I. begins by documenting the boom-bust pattern in capital flows centered on the Great Depression. Gross capital flows are shown to be highly cyclical, peaking in 1929, while net flows are found unable to describe the state fo global finance. Increases in gross foreign inflows (foreign borrowing) are associated with depressed future output growth, higher risk of financial crisis and, conditional on a crisis, a more severe post-crisis recession. Turning to the channels facilitating this relationship, I find an important role for the foreign supply of capital. I propose two instrumental variable approaches to identify foreign capital supply shocks and show that they are key to understanding the documented macro-financial dynamics. The Gold Standard played a crucial role by exposing countries to foreign capital via integration into the global financial system, while at the same time restricting the scope of action to respond to increased inflows.

Chapter II. is constructed around an "unveiling exercise" that allows the allocation of credit to the ultimate counterparties financing credit expansions. This reveals that the rapid expansion in household credit in the last decades was to a large extent financed with foreign capital. Credit expansions predict lower output growth, higher unemployment and banking crises, but the response is contingent on the ultimate financier of the expansion. When decomposing the response to credit by financing counterparty, household credit expansion financed from abroad can be identified as driving the aggregate results. Potential channels for this relationship include an increased risk of capital flight, higher debt service payments to foreigners and depressed consumption. Exploiting an instrumental variable based on cross-border banking flows shows that it is, once again, supply driven capital inflows that are crucial in financing household credit and explaining economic outcomes.

Chapter III. shows that the implications of financial developments extend well beyond the realm of finance. Using staggered difference-in-differences to link state level banking deregulation in the United States to two demographic outcomes: mothers' age at first childbirth and fertility rates. Conditional on deregulation the average age at which women become mothers for the first time increases, with the effect being more pronounced for the non-white population. Total fertility rates first increase, but revert back to a net response of zero for longer horizons. For the non-white sample this reversion outweighs the previous increase, resulting in a net fertility decrease. I argue that the main channel for these effects is the boom in house prices induced by deregulation, allowing the inflow of out-of-state capital. On the one hand, this boom delays fertility by prolonging the period of saving before a home purchase, on the other, it reflects a wealth gain for home owning families, linked to increased fertility. Given the stark discrepancy in financial constraints and home ownership rates between the white and non-white population in the US, the relative strength of the channels differs, resulting in significant heterogeneity in outcomes.

Over the course of these chapters, this dissertation embarks on a data driven exploration through the sometimes complicated relationship between exposure to foreign capital and economic outcomes. To the best of my knowledge, only small parts of this data have ever been used before and thus the main contribution of the thesis, as a whole, consists in its compilation and the results that can be drawn from its analysis. While there certainly is a large body of literature on the topic, this literature's fundamental changes over the last decades have opened up an array of further avenues of research. With this thesis, I hope to advance along some of them, but also potentially discover others.

2. — Golden Fetters or Credit Boom Gone Bust?

Disclaimer: The majority of the following chapter is based on my standalone working paper titled "*Golden Fetters or Credit Boom Gone Bust? A Reassessment of Capital Flows in the Interwar Period*", available at `https://ssrn.com/abstract=4316384`.

In 1929, few believed that the world economy was on the brink of its first truly global economic crisis (Irwin, 2014), and more than 60 years later Bernanke (1994) stated that we are still a long way off from understanding 'the holy grail of macroeconomics'. We do know, however, that the unique duration and severity of the Great Depression was linked to fragile financial systems and capital markets (Bernanke and James, 1990; Bernanke, 2009; Schnabel, 2004). But where did this fragility come from? The international nature of the depression already led Fisher (1935) and Keynes (1941) to think about the role of the global financial system in creating and transmitting financial fragility. Kindleberger (1978) later added that foreign financing amplified the boom-bust pattern around crises.[1] Crucially, their approaches center on gold or net capital flows, like the current account, whereas by comparison we still know very little about gross international capital flows and their implications during the interwar era (Accominotti and Eichengreen, 2016). But

[1] The idea to explain domestic conditions with international finance is older still, as already Hume (1758) regarded the management of the external balance as vital for the supply of gold and domestic stability.

this knowledge is important, as it allows us to better understand the link between capital flows, business cycles and financial crises in general and during the Great Depression in particular.

In this chapter, I go beyond the traditional emphasis on gold and net capital flows and contribute to the emerging literature on gross flows as a source for financial fragility during the interwar period (Borio et al., 2014; Accominotti and Eichengreen, 2016). I find that exposure to gross foreign credit is the most important predictor of business cycle downturns, financial crises and recession severity. Net flows, in contrast, capture this exposure only imperfectly and are insignificant whenever gross flows are included in the analysis. Recently, a 'global financial cycle' (Rey, 2013) has been identified as an important driver of foreign capital supply and Bazot et al. (2022) have taken this idea into the era of the classical Gold Standard. Using a Bartik-style instrumental variable (Bartik, 1991) and principal component analysis, I show that foreign capital supply is also crucial to understanding capital flow dynamics in the interwar period. In doing so, I offer an alternative interpretation of the influential 'Golden Fetters' thesis (Eichengreen, 1996), and argue that the Gold Standard created exposure to gross capital inflows by integrating countries into the global financial system, while at the same time restricting the scope of action for governments to respond to surging capital flows.

The central source of data for this chapter are the newly digitized Balance of Payments (BoP) statistics from the League of Nations (LoN) (League of Nations, 1930-1932, 1933-1939). I establish the validity of this data by showing that it accurately reflects previous findings from the literature, like the movement of physical gold and the pattern of international lending around German reparations.[2] Putting gold flows into the larger context of the BoP reveals that gold made up only a tiny fraction of

[2]The latter, also called 'debt carousel', refers to international lending after WWI driven by war debts and reparations. See: Spoerer and Streb (2013) for a sketch of how the 'carousel' was supposed to function, De Broeck et al. (2018) for an estimation of bilateral flows and End et al. (2019) for a detailed description of the involved financial instruments. For a discussion of gold movements in the interwar period see: James (1992) and Irwin (2012).

international flows during the Gold Standard era.[3] Similarly, the ratio of net to gross capital flows reached its trough in 1929. Both measures are consequently ill suited to characterize the global financial system on the eve of the Great Depression. In other words: when it matters most. Additionally, neither measure exhibits the strong boom-bust pattern often tied to the business cycle and financial crises (Schularick and Taylor, 2012; Jordà et al., 2013; Reinhart and Rogoff, 2009). Gross capital flows, in contrast, are not only magnitudes larger, but also show the expected cyclical pattern, with a boom until 1929, followed by a sharp and long lasting bust.

In a first exercise I use local projections (Jordà, 2005) to link capital flows to interwar business cycle dynamics, showing that gross capital inflows are followed by growth slowdowns over medium-term horizons. These results are economically meaningful with a one standard deviation increase in gross capital inflows being associated with cumulative growth being lowered by about 4 percentage points after 4 to 5 years. Yet, responses to yearly flows are only part of the story, as inflows accumulate into foreign debt positions over time. To study the relationship between cumulative foreign inflows and the business cycle, yearly flows are summed over a three year window and used in predictive regressions of GDP growth, similar to Mian et al. (2017). Again, gross inflows, accumulated into gross foreign debt, emerge as the single most significant predictor of economic downturns. The responses are larger than in the local projections, suggesting that the effect of continued foreign inflows is, to some extent, additive. Both findings hold in a battery of robustness checks where neither net inflows, nor gross outflows, show comparable dynamics.

The interwar business cycle cannot be discussed without the crisis sitting at its heart. The literature has shown that crises tend to be preceded by surges in international capital flows (Caballero, 2016; Reinhart and Rogoff, 2009) and succeeded

[3] Nevertheless, gold is often considered synonymous with interwar financial flows (James, 1992; Eichengreen, 1996), and continues to be identified as the main culprit in the transmission of the Great Depression (Fernández-Villaverde and Sanches, 2022). In fact, the volume of gold flows only increased after most countries had abandoned it as their currency base and it was allowed to flow freely between countries.

by capital flight and sudden stops in lending (Krishnamurthy and Muir, 2017; Romer and Romer, 2017; Broner et al., 2013; Diebold and Richter, 2021). The Great Depression fits this pattern perfectly. Using a probit estimation, I confirm that gross foreign inflows are the single most reliable predictor of financial crises. In fact, adding other capital flow variables to a model already containing gross foreign inflows does not increase predictive accuracy whatsoever. Similarly, I show empirically that while the total volume of capital flows decreases, in- and outflows respond differently. Outflows slightly increase (flight), and inflows decrease sharply (stops). Given the cyclicality of capital flows around the Great Depression these results align well with economic intuition. The question is: can heterogeneous exposure to these dynamics explain the heterogeneity in economic outcomes?

In a setting similar to Jordà et al. (2013), where the authors find that recessions become more severe when the preceding domestic credit boom was large, I study recession severity conditional on previous exposure to foreign inflows, and find that higher exposure amplifies crises. Again, the result holds in a variety of robustness checks, including different measures of exposure. This corresponds to theory developed in Caballero and Simsek (2020), where the fickleness of foreign capital turns out to be harmful due to its run-like tendencies during crises. But where does the capital run to? In the same article the authors show that the repatriation of capital can moderate recessions, as returning foreign assets can be used to buffer the effects of decreasing foreign capital availability. Inverting the previous setting to analyze capital exports (instead of imports) before crisis, I find empirical evidence for this channel. The accumulation of foreign assets helps to moderate recessions, but cannot fully offset the negative implications of foreign liabilities.

What determines the inflow of foreign capital into individual countries? Apart from the policy stance on capital mobility, this depends on the idiosyncratic domestic demand for capital and the supply of capital on international markets (Rey, 2013; Miranda-Agrippino and Rey, 2020). While borrowing abroad against future fundamentals is unlikely to have negative aggregate effects, foreign supply, unrelated to domestic conditions, is particularly crucial for adverse outcomes. The baseline specification is unable to distinguish between the two factors and potentially underestimates the effects of foreign credit. Utilizing newly collected data on bilateral portfolio investments of the United States, I isolate foreign capital supply by constructing a Bartik-style instrument (Bartik, 1991). This instrument interacts the past portfolio investment position of the United States in any individual country with the present change in the total US portfolio position. The instrumented coefficients of gross foreign inflows are highly significant and larger than the OLS-baseline, confirming a baseline bias towards zero. Following Aldasoro et al. (2020), I also adopt a more general approach to the question of foreign capital supply. Concretely, I employ principal component analysis to construct a measure of the 'Global Financial Cycle' (Rey, 2013) and use it to instrument capital inflows.[4] The instrumented coefficients remain highly significant and larger than the baseline.

Crucial to the surge in capital flows during the interwar years was the Gold Standard. As the dominant monetary system of the 1920s, it facilitated global financial integration, reduced currency risk, and signaled a commitment to the free flow of capital for member countries (Wandschneider, 2008; Bordo and Kydland, 2005). Consistent with this, I find that upon adopting the Gold Standard, countries experienced a significant increase in gross capital inflows. Simultaneously, the Gold Standard's 'fetters' constrained the scope of actions for governments to respond to increased exposure to foreign capital, as it neither allowed for capital account management, adjustments of exchange rates, nor monetary policy interventions during crises (Eichengreen, 1996). In line with this, I find that being off the Gold Standard provides some protection against the adverse effects of foreign credit, similar to employing a measure for a closed capital account. This aligns with the findings of Mitchener and Wandschneider (2015), who observe that leaving the Gold

[4]The principal component is individually constructed over the capital inflows of all countries, excluding the country whose inflows are later instrumented.

Standard led to capital controls, while the option for independent monetary policy was underutilized.

Contractions in bank lending, which could be addressed via monetary policy, may result from maturity mismatches between the asset and liability sides of bank balance sheets. During crises, when short-term funding dries up, financial institutions are often forced to resort to rapid liquidation of illiquid (long-term) assets to service the withdrawal of liquid (short-term) assets. Over time, sustained contractionary pressure on bank balance sheets leads to reduced credit creation, with adverse implications for future real economic outcomes (Adrian and Shin, 2010; Chodorow-Reich, 2014). When bank balance sheet expansions have been foreign-financed, vulnerability to sudden reductions in capital availability increases, as foreign inflows typically have shorter maturities than the domestic investments they fund (Obstfeld, 2012). Using a variance decomposition exercise based on Eren et al. (2023), I show that gross foreign inflows are indeed associated with bank balance sheet expansions and that these expansions consist of short-term instruments on the liability side and long-term instruments on the asset side, creating maturity mismatches. No such relationship exists between bank balance sheets and net capital inflows. A similar point has been made by Collet and Postel-Vinay (2021) for the case of interwar Germany, where sudden capital inflows heightened banks' risk-taking behavior via increased leverage.

Borrowing on international markets today implies future interest payments to foreign creditors. This leads to a reduction in available domestic income, suppressing domestic activity, especially when debtors face financial constraints and creditors exhibit a lower marginal propensity to spend their additional income domestically (Eggertsson and Krugman, 2012). This condition is likely to be fulfilled when foreigners are the recipients of these interest payments. Relying again on data from the BoP, which reports 'interest and dividend payments to foreigners' as a current account item, I confirm in the first step that this variable increases with past foreign inflows. In the second step, I link contemporary interest payments to future GDP growth, finding that higher present time interest payments to foreigners are followed by reduced output growth.

Finally, to address the potential concern that the interwar period may not be a comparable testing ground for insights into the contemporary relationship between capital flows and business cycle dynamics, the main specifications are repeated using recent Balance of Payments data for OECD economies. This sample, starting in the late 1970s, contains twice as many observations as the interwar data. All results hold in the modern sample, with coefficients being remarkably similar across datasets. This suggests that my findings capture exposure to foreign capital in integrated global capital markets rather than being a peculiarity of the interwar period.

Why is increasing foreign indebtedness so robustly linked to adverse economic outcomes? On its most fundamental level is the fact that the borrower usually bears the first losses in times of crises with the lender only being affected once the borrower is forced into default (Mian and Sufi, 2015). Because it is exceptionally costly to default on international credit obligations, this can easily be applied to a situation where a country facing crisis has to cut back on domestic spending first and foreign debt payments second.[5] Peculiar to international debt is that interest payments flow abroad, which has long been acknowledged as a drain on domestic incomes (Lerner, 1948). This suppresses economic activity when debtors are financially constrained and creditors are less likely to spend their additional income domestically (Eggertsson and Krugman, 2012).

Equally important are the dynamics associated with the international supply of capital, the 'global financial cycle' (Rey, 2013). This cycle is potentially unrelated to the domestic economy and has been shown to increase financial fragility due to capital retrenchment (Milesi-Ferretti and Tille, 2011), and run like dynamics

[5] Reinhart and Rogoff (2009) argue that this is due to international defaults cutting countries off from international capital markets for an extended period of time. In line with this, Tomz and Wright (2007) find only a weak relationship between economic downturns and defaults on foreign debt and argue that the norm is to continue debt service in the face of adverse economic shocks. This is particularly true for countries more reliant on foreign credit (Erce and Mallucci, 2018).

in times of crises (Broner et al., 2013; Forbes and Warnock, 2012; Caballero and Simsek, 2020). A variation of this are 'sudden stops' where foreign funds suddenly become unavailable and financial conditions tighten (Calvo, 1998; Accominotti and Eichengreen, 2016). This chapter confirms that countries which are more exposed to these dynamics also suffer more from their consequences. Gross flows are crucial in this context, as net flows can neither fully capture the exposure to foreign credit (net credit can decrease, while gross credit increases), nor is it possible that all countries experience net inflows before or net capital flight after a global crisis (Borio et al., 2014). It is, however, both possible and consistent with empirical evidence that most countries face expanding gross foreign credit before and contracting gross foreign credit after crises.

The chapter contributes to three strands of literature. First, the study of international capital flows. Traditionally, from Hume (1758) thinking about external balances, over Fisher (1935) asking if capital flows transmit domestic conditions internationally, to long run studies of external imbalances like Jordà et al. (2011), the current account is at the center of attention, but findings have been dependent on sample composition and analysis.[6] This first gave rise to the question: 'does the current account still matter?' (Obstfeld, 2012; Edwards, 2002), and ultimately the insight that 'we have asked the current account to do too much' (Borio, 2016). Recent literature consequently argues for an increased focus on gross measures (Borio and Disyatat, 2015; Shin, 2012; Calderon and Kubota, 2012), to which I contribute by extending their documentation and analysis into the interwar period.

Second, the chapter explores the relation between capital flows and economic outcomes. Surges in capital flows have been shown to precede downturns in the business cycle and crises (Reinhart and Rogoff, 2009; Caballero, 2016), followed by capital flight and contracting flow volumes (Broner et al., 2013; Caballero and Simsek,

[6]See Adalet and Eichengreen (2007); Jordà et al. (2011); Hoffmann and Woitek (2010) for long run and historic samples and Mian et al. (2017); Kiley (2021); Liadze et al. (2010) for more recent sample compositions.

2020; Forbes and Warnock, 2012). This tends to amplify the boom-bust-pattern of the business cycle (Kindleberger, 1978). While Kiley (2021) finds a link from current account deficits to crises, other studies have shown that historically, crises are equally likely in surplus and deficit countries (Obstfeld et al., 2010; Jordà et al., 2011). I show that any link between net flows and the business cycle disappears whenever gross flows are included in the model. Gross inflows instead are robustly related to adverse outcomes across all specifications.

The third contribution is to the interwar and Great Depression literature. The iconic boom-bust pattern around the Great Depression has been explained with the systematic vulnerability and pro-cyclicality of financial systems (Bernanke and James, 1990), but what makes financial systems vulnerable in the first place? The idea that it was the mismanagement of a restrictive financial system, the Gold Standard, is manifested in the metaphor of the 'golden fetters', which needed to be shed to break the downward spiral of the depression (Eichengreen, 1996; Eichengreen and Temin, 2000; Ellison et al., 2023). This explanation is compelling, as it identifies a common factor among a large sample of countries experiencing severe recession. But while much of the previous focus has been on what the Gold Standard hindered countries from doing domestically, I focus on what it enabled countries to do internationally.

In Eichengreen and Mitchener (2003) the authors narrate the Great Depression as a domestic credit boom gone wrong, while Borio et al. (2014) argue that countries with large credit booms prior to the Great Depression were connected via gross capital flows. Drawing on his interwar experience, Keynes (1941) linked contractionary biases in countries heavily reliant on foreign capital to capital retrenchment, focusing on net measures. Additionally, Accominotti and Eichengreen (2016) find a sudden stop in capital flows during the depression. This is related to Quinn (2003), who shows that countries with more open capital accounts had deeper recessions. I combine these perspectives to tell the story of the Great Depression as an international credit boom that went bust. For this, the Gold Standard was instrumental by increasing exposure to global capital movements. This channel is further underlined by showing that all results hold in a modern sample without the Gold Standard, but nevertheless increasing global financial integration.

2.1. Data and Balance of Payments mechanics

This section gives an overview over the digitization effort of the League of Nations data and provides an introduction to the mechanics of the Balance of Payments.

2.1.1. Data

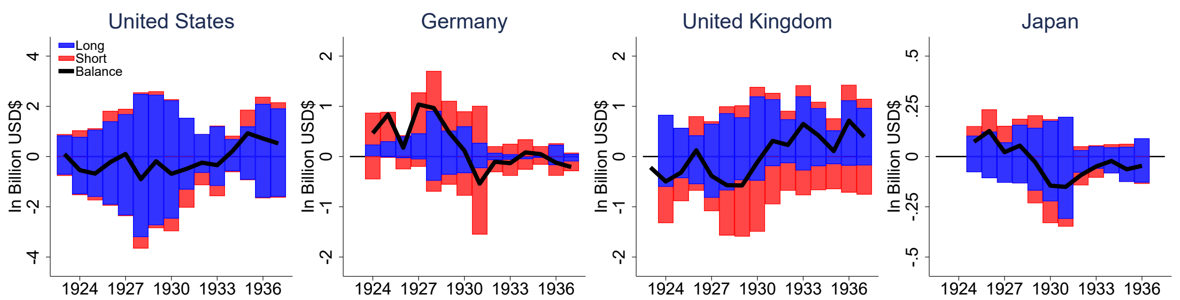
My main data source are the Balance of Payments statistics, covering the years between 1922 and 1939, compiled by the League of Nations. They were first published in three volumes from 1930 to 1932 under the title 'Memorandum on International Trade and the Balance of Payments' (League of Nations, 1930-1932). These first attempts at homogenized national accounting include over 40 countries and cover the period between 1922 and 1930. The format was replaced in 1933 with the updated and revised 'Balance of Payments' (League of Nations, 1933-1939), published in seven volumes starting in 1933 and covering the years between 1929 and 1938. Across formats and volumes the coverage of countries and granularity of data differs. After digitizing all volumes and dropping countries with less than five years of coverage, I obtain an unbalanced panel of 33 countries.

The data in the Balance of Payments contains information on financial inflows and outflows of countries over a given period. It is separated into the current account, dealing with the payments connected to the purchase and sale of goods and services, and the capital account, dealing with the purchase and sale of financial assets. Importantly, the Balance of Payments distinguishes between net and gross flows. When using the current account as a measure of international flows, this conventionally refers to its balance. The balance is the difference between credit and debit items within the current account, and thus can be above or below zero. The same is true for its inverse: the capital account balance. Gross flows on the other hand, are strictly positive values in both accounts. A more detailed discussion of the Balance of Payments mechanics is deferred to the next section.

Since series frequently overlap across publications, more recent entries are used first and extended backwards with earlier data. No data is extrapolated out of range, but gaps inside existing time series are filled using linear interpolation. An example of the original publication is given in Figure A1.1 and a table with the full combined coverage of each country is shown in Table A1.1. Initially, the data is collected in domestic currency, but each publication contains the main aggregates for each country in US-dollars, using the pre-1933 Gold-Dollar parity. From this, I infer yearly exchange rates and convert all data into US-dollars. Exploiting the BoP mechanics described below, capital account balances are filled with inverted current account balances when missing, and vice versa.

To link the BoP to the business cycle, and ensure maximum coverage, it is complemented with Maddison style GDP estimates from Bolt and van Zanden (2020), GDP estimates for the Baltic states collected by Norkus and Markevičiūtė (2021) and Klimantas and Zirgulis (2020), GDP growth rates from Baron et al. (2021) and economic activity indicators (EAI) constructed by Albers (2018). Growth variables are expressed in log-changes, while BoP variables are normalized using z-score normalization. The baseline financial crisis indicator is the crisis chronology of Baron et al. (2021), which is supplemented by Reinhart and Rogoff (2009), and Grossman (1994), when countries are not covered. An overview of crises is given in Table A1.19. Gold Standard indicators are likewise from Reinhart and Rogoff (2009) and supplemented by Eichengreen (1996) and Wandschneider (2008). The capital account openness measure is based on Quinn (2003). Bilateral data for portfolio investments of the United States are collected from Dickens (1931, 1930) and Lewis and Schlotterbeck (1938). Commercial bank balance sheets for the interwar period

Figure 2.1: *Capital account composition*



Notes: This figure shows the annual gross financial flows from the capital account side of the Balance of Payments for the United States, Germany, the United Kingdom and Japan. Figures are in billion US-dollars. Blue and red represent flows in long- and short-term capital flows respectively. The black line represents the capital account balance, with a positive balance indicating the net inflow of capital.

are connected from League of Nations (1931-1940) Summary statistics for the main interwar variables are shown in Table A1.3.

2.1.2. The Balance of Payments

The Balance of Payments is a summary of the transactions between residents and nonresidents over a year. It is separated into the current and the capital account, whose balances (the difference between credit and debit) are the inverse of each other, with their sum consequently equaling zero (IMF, 2009).[7] Figure 2.1 shows the capital account collected from the BoP for the US, Germany, the UK and Japan, and Figure A1.2 in the appendix reports the current account for the same set of countries. Being the inverse of each other, surpluses and deficits in the two accounts have inverse implications. A current account surplus is offset by a capital account deficit, signifying increased claims on external financial assets. Consistent surpluses are consequentially equivalent to an accumulation of foreign assets over time. A deficit, on the other hand, needs to be financed by the sale of financial assets on international markets or borrowing abroad, accumulating into net foreign liabilities. The implication is that net flows accumulate into net international investment positions, which might change due to either the revaluation of the existing position or by adding (subtracting) to it

[7] Small deviations, due to changes in accounting, defaults, lagged payments or exchange rates are possible.

via BoP flows (Obstfeld, 2012; Bleaney and Tian, 2013; Lane and Milesi-Ferretti, 2004). This is captured in Equation 2.1

$$\Delta NIIP_{t+1} = NIIP_{t+1} - NIIP_t = Current_{B,t} + R_{N,t}, \tag{2.1}$$

where a change in the net international investment positions $\Delta NIIP_t$ equals the current account balance $Current_B$, plus the revaluation of existing net assets R_N. The NIIP can be separated into the gross international asset position (GIAP) and the gross international liability position (GILP). Similarly, net revaluations R_N are split into gross revaluations of assets (A) and liabilites (L), $R_N = R_A - R_L$, which are added to gross capital flows. This is generalized for changes over n periods in Equation 2.2 for the GILP:

$$\Delta_n GILP_{t+n} = GILP_{t+n} - GILP_t = \Sigma_t^n Capital_{C,t} + \Sigma_t^n R_{L,t}. \tag{2.2}$$

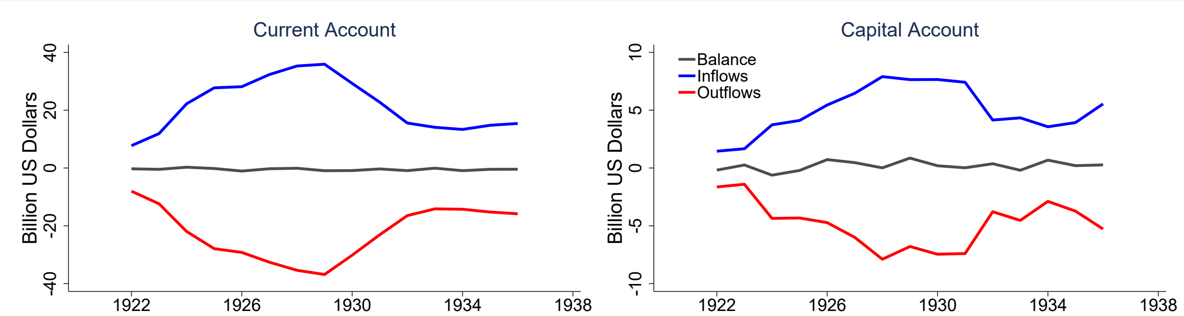
Here $Capital_C$ refers to capital account credit and $R_{L,t}$ to the revaluation of existing gross liabilities.[8] Because accumulated flows, less revaluations, reflect changes in international investment positions, the magnitude of revaluations determines how precisely flows approximate changes in these positions. When revaluations are cyclical, financial flows provide close approximations. When valuations steadily move in one direction, accumulated flows grow gradually less precise (Atkeson et al., 2022). Equation 2.3 formalizes the approximation of changes in investment positions using BoP flows over n periods for the GILP.

$$\Sigma_{t=0}^n Capital_{C,t} = \Delta_n GILP_{t+n} - \Sigma_t^n R_{L,t}. \tag{2.3}$$

As revaluations are not included in the LoN statistics and are difficult to calculate, the left hand side of Equation 2.3 is used as the main independent variable throughout

[8]Changes in the $GIAP$ are defined analogously as: $\Delta_n GIAP_{t+n} = GIAP_{t+n} - GIAP_t = \Sigma_t^n Capital_{D,t} + \Sigma_t^n R_{A,t}$, where $Capital_D$ refers to capital debit and R_A to the revaluation of existing gross assets.

Figure 2.2: *The Balance of Payments, sample properties*



Notes: This figure shows gross financial flows, summed over all sample countries, between 1922 and 1936. The left panel shows the current- and the right panel the capital account. Inflows (credit) and outflows (debit) are shown in blue and red respectively. Their difference is shown in grey.

this chapter. It is to be understood as the change in international investment positions, excluding revaluations. It is important to emphasize that while the current account balance accumulates into the NIIP, gross current account flows do not accumulate into a stock of assets or liabilities and are not a theoretically meaningful concept. First, because the items concerned are goods and services and not connected to the acquisition of financial assets. Second, these items do not pile up into goods and service positions, but the capital streams financing them potentially do. Third, already consumed goods are not subject to revaluations. Additionally, variation in the current account must be driven by residents of other countries deciding to purchase fewer, or more, goods from a particular country, a decision unrelated to the gross financial flows attached to these transactions. This means that, ultimately, the current account is driven by capital flows and not vice versa (Borio, 2016).[9]

Sample Properties: The total amounts of worldwide credit and debit flows are always equal, because the world is a closed financial system. Any sample not covering the entire world or not representing a perfectly closed system might deviate from this parity. If a sample becomes large enough to approach either condition, the difference between credit and debit will consequently converge to zero. This also implies

[9]Borio points out: that capital flows drive the current account and not vice versa, stating: 'If we think of the current account items, a current account "sudden stop" could only take place if foreigners decided not to export to the country any longer, giving up on the corresponding revenues, or residents freely decided to purchase fewer goods. Both of these mechanisms are implausible. Surely the sudden stop must be in gross financing flows, domestic and external, which force agents to cut imports and pre-finance exports'.

that the average net exposure to foreign capital across such a sample will likewise converge to zero.

Figure 2.2 shows that this is the case for the group of countries covered by the League of Nation's BoP statistics. The left panel plots the credit and debit entries summed up over all sample countries for the current account. The right panel does the same for the capital account. In both cases the series for credit and debit almost perfectly mirror each other, as indicated by their difference fluctuating around zero. This shows that the sample forms an almost closed system of trade and capital flows, in which gross flows are highly synchronized with the business cycle, while net flows on aggregate cannot capture this pro-cyclicality. Gross current account flows peak in 1929 and roughly half during the Great Depression. Capital flows already peak in 1928, but do not shrink significantly until 1931. This relates back to this being a period of capital retrenchment, where new lending stops, but foreign capital is being repatriated, resulting in large gross flow volumes in and out of countries.

2.2. A short history of capital flows in the interwar period

This section takes a closer look at the development of financial flows in the interwar period. It shows first how key findings from the literature map into the Balance of Payments, followed by a discussion of the key trends in interwar capital flows.

2.2.1. From gold flows to net flows to gross flows

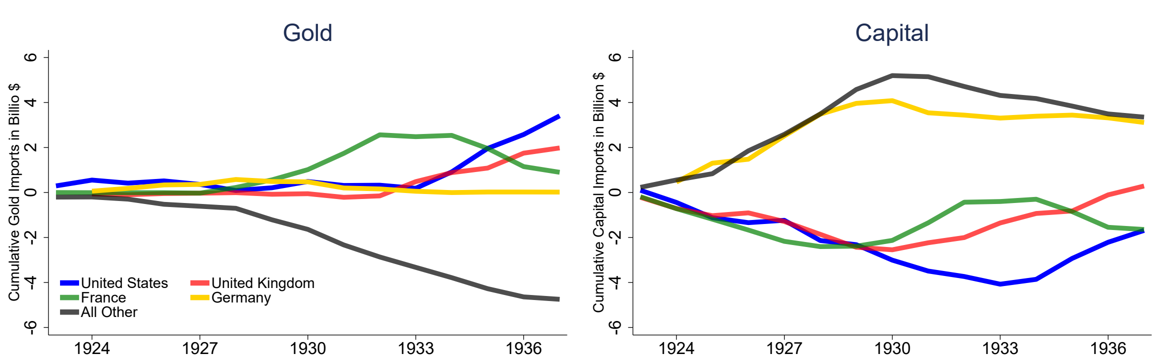
Two prominent topics of the interwar literature are the Gold Standard (and its abandonment) and the 'debt carousel' revolving around Germany, the United States, the United Kingdom and France. The focus on external imbalances, inherent to both, continued to shape the approach to international capital flows, with gross and net capital flows often being treated as synonymous until long after the Gold Standard had been abandoned and the debt carousel had stopped spinning.

The interwar Gold Standard was flawed from the get go, this much seems to be a common understanding. Most countries returned to gold on parities that no longer reflected their economic conditions, disrupted by World War I, hyperinflation and the unraveling of global trade (Irwin, 2012; Eichengreen and Temin, 2000; Eichengreen, 2008).[10] The internal logic of the Gold Standard dictates that countries with undervalued currencies and inflationary policies attract gold, as it can be used to acquire domestic currency cheaply. Consequentially, countries with deflationary policies and gold parities above the market price for gold will fail to attract gold (Bordo and Kydland, 2005; Wandschneider, 2008). The countries taking center stage in this story are France, returning to gold at a vastly discounted rate, set in 1926 and formalized in 1928, and the United Kingdom returning to gold at the overstated pre-war parity in 1925. The United Kingdom's subsequent failure to attract gold resulted in it being the first major economy to abandon gold and devalue its currency as early as 1931. France, instead, started to accumulate gold from 1927 onward and remained on the Gold Standard until 1936. The other major economies experienced gold inflows of smaller magnitude during the 1920s (Bernanke, 2009; Irwin, 2012).

These developments are shown in the left panel of Figure 2.3 using BoP data. It plots cumulative net gold inflows since 1923, with France standing out as the largest importer of gold. This gold, however, did not come by way of draining the other major economies of gold, but only hindered them to accumulate as much gold themselves as they desired. The net gold inflow to France and, in smaller magnitude, to Germany

[10]Countries differed hugely in how and when it was implemented. Before WWI the Gold Standard was largely homogeneous (Bordo and Kydland, 2005), but when countries returned to it (US in 1922, Germany in 1924, UK in 1927, France implicitly in 1926 and explicitly in 1928 (Reinhart and Rogoff, 2009)), that changed. Some returned at overstated parities (US and UK), others at discounted rates (France) (Irwin, 2012). Some had large gold reserves (US), others almost none (Germany) (Eichengreen and Mitchener, 2003). Most reinstated circulation of physical gold, but others (Germany) never did (Deutsche Bundesbank, 1976). Some had accumulated gold in the 1920s (France), while others only had small positive (US and Germany) or negative (UK) net inflows. The exit from gold was equally heterogeneous. Most countries left gold during the Great Depression, but the gold block, led by France, accumulated enough gold to believe it could stay on gold throughout the crisis, holding on until the mid 1930s (Bordo and Edelstein, 1999; Eichengreen and Irwin, 2010).

Figure 2.3: *Cumulative net gold- and net capital flows*



Notes: This figure plots in the left panel the cumulative net gold inflows for the four major economies of the time, the US, UK, Germany and France, as well as a fifth category including all other countries. In line with the interwar literature, France absorbs more gold than any other country in the late 1920's and early 1930's. It also shows that the moment the UK and the US abandon gold and devalue their currencies in 1931 and 1933, they start to attract gold inflows. The right panel plots the cumulative capital account balance for the same group of countries. It shows that the US, the UK and France supplied money to debtor countries and particularly Germany in the 1920's, but also that these net positions had largely reversed by the mid 1930's.

and the United States instead came from peripheral countries (Eichengreen, 2008), as indicated by the gray line. In 1931, the United Kingdom, having failed to attract gold in the 1920s, left gold and devalued its currency with immediate effect. Gold started to flow into the country. In 1933, the US followed suit, devaluing the dollar and subsequently entering a period of consistent gold inflows. This effectively appreciated the Franc, even though the Banque du France fought to maintain the previous parity (Wandschneider, 2008; Irwin, 2012), with the result that gold started to flow out of France starting in 1934 and before it left gold in 1936.

The return to gold was meant to be a signal for the return of the pre-war stability. Yet it also turned out to be a facilitator of the external imbalances of the interwar years (Wandschneider, 2008; Bordo and Kydland, 2005). These imbalances are manifested in the metaphor of a debt carousel in which a group of creditor countries, centered on the United States, supplied a group of debtor countries, centered on Germany, with credit (End et al., 2019; Spoerer and Streb, 2013). International lending picked up steam during the Roaring Twenties when a common peg to gold ensured predictable exchange rates and the free flow of capital. The result was an accumulation of imbalances and an increasingly intertwined global 'web' (De Broeck et al., 2018) of financial relations. The onset of the Great Depression and the gradual abandonment of gold broke this cycle and led to capital retrenchment and financial disintegration (Kindleberger, 1978; Bernanke, 2009).

The right panel of Figure 2.3 visualizes these developments by plotting the cumulative capital account balance. It confirms the impression from Figure 2.2 that the sample approaches a closed system where total net inflows equal net outflows. Three net creditors - the United States, the United Kingdom and France - supply money to the global financial system in general and Germany in particular. Interestingly, the Great Depression does not lead to a stagnation of net positions (as would be the expected result of a total breakdown in financial flows), but a reversal of imbalances as creditors begin to repatriate their foreign assets.[11] An exception is Germany which, after settlements with its creditors and the rise of the National Socialists to power, stagnates on a high level of net foreign credit (Ritschl, 2014). Surprisingly, and against conventional wisdom, no sudden stop or withdrawal of *net* foreign lending is discernible for the United States.[12] In fact, the United States continued to be a net capital exporter until 1933, reflecting the structure of its foreign assets, which were mostly long-term and difficult to repatriate on short notice (Ritschl, 2009).

Establishing a direct connection between gold and net capital flows is difficult, but gold might still help to explain the persistent focus on net capital flows. The Gold Standard's mandate for stability and the fact that it was the *net* availability of gold which was relevant, resulted in a desire for 'balanced' capital flows. This was formulated as early as Hume (1758) and is well documented in Eichengreen and Temin (2000). Similarly, Keynes (1941) linked countries' net foreign deficits to contractionary biases in the Great Depression.[13] But why should we care? The idea

[11]Figure A2.3 in the appendix quantifies these findings for a larger group of countries, showing that net capital exporters before 1930 become net capital importers afterwards and vice versa.

[12]For gross flows, the story is quite different, with a sudden stop occurring in 1928 (Accominotti and Eichengreen, 2016). Later sections will address this development in greater detail.

[13]Determined to evade these imbalances in the future, he worked to enshrine rigid capital controls in the Bretton Woods agreement in 1944, where again the overarching mandate was stability. Keynes advocated for the reduction of imbalances by increasing the supply of international money. This effectively meant increasing the smaller of the gross positions to decrease imbalances. The plan was

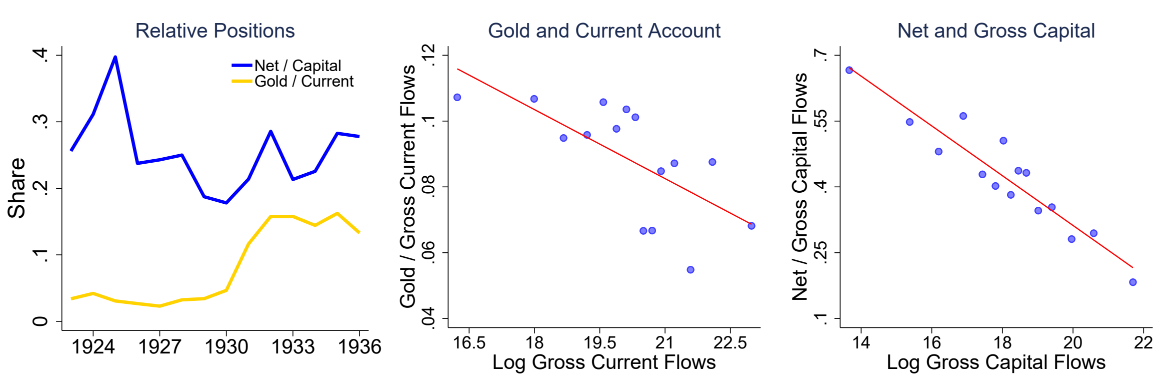
of economies in surpluses, deficits and imbalances continues to frame the debate on capital flows, even though net flows are dwarfed by their gross counterparts. Net flows also tell us little about gross flows, as it is easily possible for net flows to decrease while gross flows increase (Borio, 2016; Borio and Disyatat, 2015). Focusing on net flows consequently lets the volume of financial relationships go largely undetected. Only recently has this come under scrutiny with Bernanke (2005) questioning the adequacy of the current account in describing the large global capital flows prior to the 2008 crisis and Borio (2016) stating that *'current accounts have been asked to do too much and focusing on them excessively can lead policy astray'*. Shin (2012) and Obstfeld (2012) similarly state the limits of net values and argue for an increased awareness of gross measures.

2.2.2. Trends in Balance of Payments flows

A study of the Gold Standard or external imbalances, by definition, is concerned with net flows. Net gold flows determine the level of currency coverage and net capital flows determine the buildup of imbalances. Figure 2.3 can track both, but yields no information on the magnitude of either. To get a sense of these magnitudes, the left panel of Figure 2.4 plots ratios of net to gross capital- and gold to gross current account flows over time. Net flows fluctuate around 25 percent of gross flows and reach their slump in 1929, at below 20 percent. While gross flows peak on the eve of the Great Depression, this is the moment when net flows are least adequate to describe global capital movements. The ratio of gold to gross current account flows stays flat below 5 percent through the 1920s until it triples between 1930 and 1931. This has two reasons. First, gross current account flows decrease sharply as global trade collapses. Second, the United Kingdom leaves the Gold Standard in 1931, devalues its currency and starts to attract large gold inflows, in the process increasing the volume of traded gold. Similar to net flows, gold flows can hardly

abandoned in favor of a tuned down version with capital controls and 'special drawing rights' for net debtor countries (Crowther, 1949).

Figure 2.4: *Gold flows, net flows and gross flows compared*



Notes: This figure relates gold and net to gross financial flows. The left panel plots the ratios of net- to gross capital (blue) and gold to gross current account flows (gold) over time. The middle and right panel quantify the relationship using binned scatterplots with 15 equal sized bins. The middle panel plots the ratio of gold to gross current account flows against log gross current account flows, the right one the ratio of net- to gross capital flows against log gross capital flows. The implication is clear: when gross flows grow large during business cycle peaks, net and gold flows become less representative of international capital flows.

characterize the interwar capital cycle, as they neither show the characteristic cyclical variation, nor make up a large share of total capital movements.

The middle and right panel quantify these findings using binned scatterplots. The middle panel plots the ratio of gold to gross current account flows against log gross current account flows, the right panel the ratio of net to gross capital flows against log gross capital flows. Both relationships are distinctly negative, suggesting that the larger gross flows get, the less they can be represented by gold- or net flows, which do not grow by the same proportion. Consequently, the exposure to global uncertainty, capital retrenchment and financial fragility that has been attributed to international capital flows, cannot fully be captured by either of them. These observations echo the mixed success net measures have had elsewhere when trying to tie capital flows to domestic economic and financial conditions (Kiley, 2021; Jordà et al., 2011; Mian et al., 2017; Gourinchas and Obstfeld, 2012).

Figure A2.4 in the appendix plots the sub-components of the current and capital account individually. The boom-bust-pattern, already observed in Figure 2.2, is now not separated into credit and debit, but into separate account items. The main variation in the current account comes from flows connected to trade in merchandise. With a big gap, the second and third largest items are services and flows related to secondary incomes such as interest and dividends. Gold follows last, making up the smallest fraction of the current account and only gaining in relative importance after the worlds two major economies, the United Kingdom and the United States, have left gold in 1931 and 1933 respectively. Within the capital account long-term flows are the largest item, but short-term flows still contributed around 30% before the Great Depression. Afterwards, the composition changes sharply as long-term flows plummet while short-term flows increase, stabilizing total capital flows on a high level for an additional year into the crisis. The boom-bust pattern, centering on the Great Depression, is similar to the current account. The rightmost panel confirms the visual impression of a high co-linearity between the two accounts by plotting them against each other and producing a 45° line.

2.3. Capital flows and business cycle dynamics

How do capital flows map into the business cycle and is it possible, despite the high colinearity between credit and debit, to distinguish the effects of individual BoP components? This section starts with local projections (Jordà, 2005) of GDP growth using BoP variables and then continues by computing cumulative BoP positions, building on the intuitions developed in section 2.1, to study the medium term relationship between BoP flows and the business cycle.

2.3.1. Output dynamics after Balance of Payments flows

To model the dynamic response of output following BoP flows I estimate local projections (Jordà, 2005) based on the following equation:

$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \sum_{j=0}^{2} \beta^h_{C,j} Credit_{i,t-j} + \sum_{j=0}^{2} \beta^h_{D,j} Debit_{i,t-j} + \gamma^X X_{i,t} + u_{i,t+h}\,, \tag{2.4}$$

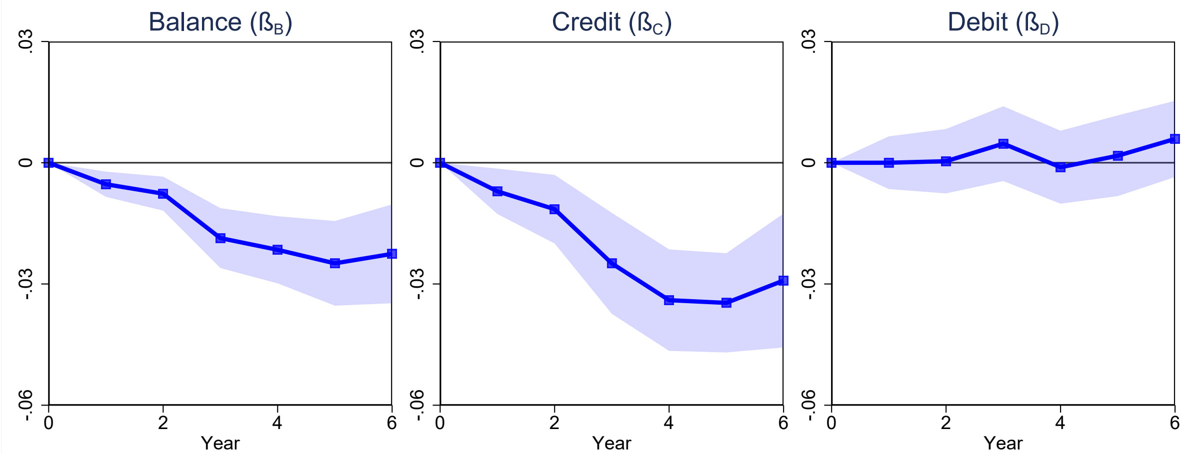
where $\Delta_h y_{i,t+h}$ is log GDP growth[14] for horizons $h = 1, ..., 6$ and *Credit* and *Debit* refer to the corresponding items in the capital account. Since the *Balance* is a linear combination of gross flows the response to it cannot be estimated in the same regression and is computed individually. All BoP variables are normalized to unit standard deviation on country level. Ultimately of interest are the β_0^h coefficients for balance, credit and debit over horizons h. All specifications control for two lags of the independent variables and country fixed effects. The control vector $X_{i,t}$ additionally includes two lags of GDP growth in the baseline and additional controls in later robustness exercises.

The left panel of Figure 2.5 plots the response to the capital account balance. A one standard deviation increase in the capital account balance (net inflows) is followed by a cumulative growth slowdown of about 2.5 percentage points in $t+5$. The response is statistically significant at the 95% level across all horizons. Given that the capital account balance is simply the inverse of the current account balance, these estimates directly map into findings where a deterioration in the current account balance is linked to adverse outcomes (Kiley, 2021; Jordà et al., 2011; Gourinchas and Obstfeld, 2012). The middle and right panel decompose the capital account balance into its separate components by plotting the jointly estimated GDP responses to credit and debit flows in year t respectively. The estimates show that the result in the left panel is driven entirely by credit in the middle panel, while the response to debit is insignificant over all horizons. In response to a one standard deviation increase of gross capital inflows in year t, cumulative GDP growth is reduced by 4 percentage points in $t+5$.

Conceptually, this closely corresponds to BoP mechanics and the argument in Borio (2016) and Borio and Disyatat (2015), where excess spending on goods and services, as captured in the current account balance, needs to be financed with capital

[14] Log differences from all sources for GDP are combined to ensure maximum coverage. For transparency, the results for sub-samples and the combined coverage are presented separately in Table A3.5

Figure 2.5: *Capital flows and business cycle dynamics*



Notes: This figure shows local projection results from Equation 2.4. The left panel plots the cumulative response of log GDP growth to the capital account balance. The middle and right panel do the same for credit and debit respectively. The response to the capital account balance (net flows) in the left panel can be seen to be driven by the response to gross credit flows in the middle panel. This response is significantly negative over all horizons and reaches its trough in $t + 5$, when GDP growth is cumulatively reduced by 4 percentage points in response to a one standard deviation increase in credit in year t. The GDP response to gross debit flows is insignificant across all horizons, and, if anything trends in the opposite direction of the credit response. Standard errors are dually clustered on country and year. Shaded areas represent 95% confidence intervals.

inflows from abroad. Over time these inflows accumulate into foreign debt, but it is not the excess spending captured by net flows, but the payment streams attached to them that ultimately matter for economic outcomes.

2.3.2. BoP flows and business cycle dynamics in the medium term

Yearly flows have a measurable relation with future output dynamics, despite not taking into account the accumulation of international investment positions over time. Yet, for capital inflows this is particularly important as they accumulate into foreign debt positions, which have been linked to economic downturns empirically (Reinhart and Rogoff, 2009; Caballero, 2016; Forbes and Warnock, 2012; Diebold and Richter, 2021), as well as theoretically (Schmitt-Grohé and Uribe, 2016; Mian et al., 2020a). Building on the intuition of section 2.1, I now compute cumulative BoP positions and use them in predictive regression of GDP growth similar to Mian et al. (2017) in Equation 3.2

$$\Delta_h y_{i,t+h} = \alpha_i + \beta_B^h \sum_{j=0}^{2} Balance_{i,t-j} + \beta_C^h \sum_{j=0}^{2} Credit_{i,t-j} + \beta_D^h \sum_{j=0}^{2} Debit_{i,t-j} + \gamma^X X_{i,t} + u_{i,t+h}, \tag{2.5}$$

where $\Delta_h y_{i,t+h}$ is log GDP growth from year t to $t+h$ and BoP flows are summed over the three years from t to $t-2$. All specifications again control for country fixed effects and the vector $X_{i,t}$ additionally includes two lags of GDP growth in the baseline and additional controls in robustness checks. Due to every part of the BoP being a linear combination of the other two, only two coefficients can be estimated jointly.

Columns (1), (4) and (7) in Table 2.1 report the coefficient for the cumulative capital account balance. It is significantly negative across all three specifications, confirming the dynamic response from the local projection exercise. Adding gross inflows in columns (2), (5) and (8) shifts predictive power away from net inflows entirely. Both the coefficient and R^2 increase twofold when gross capital inflows are included in the model, while the coefficient for net inflows becomes close to zero and insignificant. The p-value reported in the table consequently soundly rejects the equality of the two coefficients. Including both types of gross flows in columns (3), (6) and (9) does not change the estimate for gross capital inflows, which remains large and negatively significant. The coefficient for cumulative capital outflows is zero. Again, the equality of coefficients can be rejected.

Along the time dimension the results in Table 2.1 are similar to the local projections in Figure 2.5. Coefficients increase between the two and three year forecast horizon, but begin to phase out in $t+4$. This suggests that the majority of the response to capital inflows is concentrated in the first few years with decreasing effects over time. As the sample is largest for the forecast horizon in columns (1) to (3) and the majority of the effects is concentrated in this period, this horizon is chosen as the baseline for the remaining chapter. All results, however, also hold with alternative forecast

Table 2.1: *Capital flows and business cycle dynamics, 3-year cumulative capital flows*

	$\Delta_2 Y_{i,t+2}$			$\Delta_3 Y_{i,t+3}$			$\Delta_4 Y_{i,t+4}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	-0.02***	0.01		-0.03***	0.01		-0.03***	0.01	
	(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)	
$\Sigma_{j=0}^{2} Credit_{i,t-j}$		-0.04***	-0.04***		-0.06***	-0.05***		-0.05***	-0.05***
		(0.01)	(0.01)		(0.02)	(0.01)		(0.02)	(0.01)
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			0.00			0.00			-0.00
			(0.01)			(0.01)			(0.01)
R^2	0.123	0.232	0.229	0.216	0.339	0.338	0.417	0.497	0.497
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
p-value, $\beta_{Credit} = \beta_{Balance}$		0.01			0.01			0.01	
p-value, $\beta_{Credit} = \beta_{Debit}$			0.00			0.00			0.00
Observations	363	363	363	336	336	336	305	305	305

Notes: This table presents estimation results from Equation 3.2. The dependent variable is log GDP growth over horizons t to $t + h$. The independent variables are cumulative capital account flows summed from $t - 2$ to t. All specifications control for country fixed effects. Adjusting for longer time spans, lagged growth indicates two, three and four year distributed lags of GDP growth, depending on the length of the forecast horizon. The reported p-value refers to a test for the equality of coefficients. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

lengths. Coefficients for cumulative credit are notably larger (4 to 6 percentage points) than the yearly flow coefficients estimated in the local projection (3 to 4 percentage points). This suggests that the effect of repeated gross foreign borrowing is at least partially additive. When foreign credit accumulates, growth slowdowns become more severe.

2.3.3. Robustness

How robust are these results and how do they compare to other variables that have been used to explain the interwar business cycle? Starting with the latter question, columns (1) and (2) of Table 2.2 display the individually estimated coefficients for capital flows from Table 2.1 for the fixed sample for which additional variables are available. Column (3) shows that, in line with Eichengreen and Mitchener (2003), domestic credit growth has a significantly negative relationship with future GDP growth. Column (4) and (5) confirm the same for the Gold Standard and financial crises. Column (6) adds the ratio of central bank gold holdings to money in circulation,

Table 2.2: *Capital flows and business cycle dynamics, comparison to other explanatory variables*

	$\Delta_2 Y_{i,t+2}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.04***								-0.04***
	(0.01)								(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$		-0.03***							0.01
		(0.01)							(0.01)
$\Sigma_{j=0}^{2} Domestic\ Loans_{i,t-j}$			-0.02**						-0.01
			(0.01)						(0.01)
$Gold\ Standard_{i,t}$				-0.07***			-0.07***	-0.04	0.00
				(0.02)			(0.02)	(0.03)	(0.02)
$Crisis_{i,t}$					-0.06**		-0.02	-0.02*	-0.00
					(0.03)		(0.01)	(0.01)	(0.02)
$Gold\ Coverage_{i,t}$						-0.00	-0.00	-0.00	0.00
						(0.00)	(0.00)	(0.00)	(0.00)
$Gold\ Standard_{i,t} \times Crisis_{i,t}$							-0.03	-0.03	-0.04
							(0.03)	(0.03)	(0.03)
$Gold\ Standard_{i,t} \times Gold\ Coverage_{i,t}$								-0.00	-0.00*
								(0.00)	(0.00)
R^2	0.278	0.146	0.120	0.204	0.111	0.071	0.225	0.231	0.348
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	296	296	296	296	296	296	296	296	296

Notes: This table presents estimation results from Equation 3.2. The dependent variable is log GDP growth over horizons t to $t+h$. The independent variables are cumulative capital account flows summed from $t-2$ to t and additional variables that have been used to explain business cycle dynamics in the interwar period. See text. All specifications control for country fixed effects and two lags of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

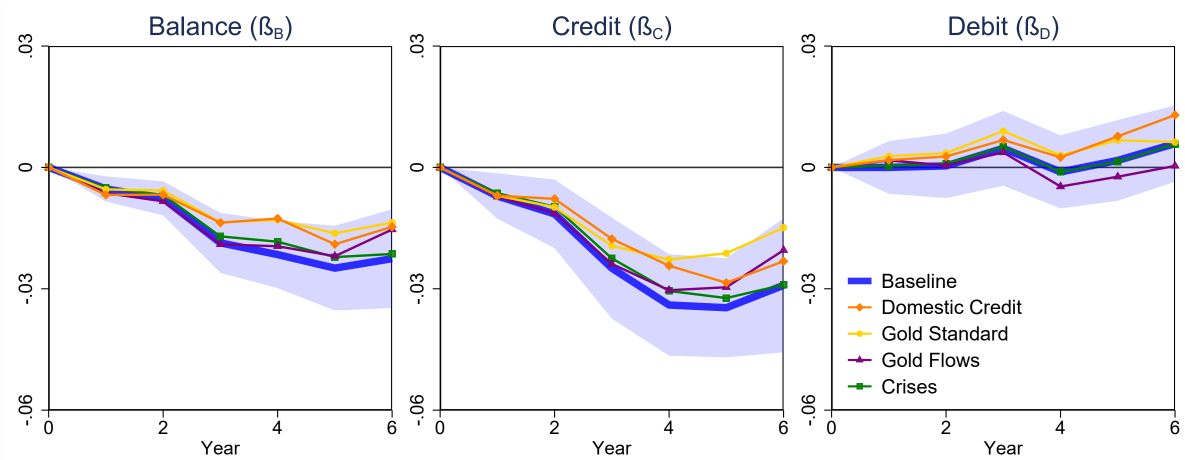
which does not produce a significant coefficient. Arguably, the Gold Standard in conjunction with financial crises exacerbates downward pressure on the economy (Eichengreen, 1996), so column (7) interacts the two variables. While both remain individually significant, their interaction coefficient goes in the expected direction, but without being significant. To test if the Gold Standard's deflationary effects are contingent on a country's gold coverage, column (8) interacts the Gold Standard with the central bank gold ratio. Again the interaction coefficient is insignificant. Finally, column (9) display all coefficients jointly, with the result, that gross foreign credit emerges as the single most robust predictor of economic downturns in the medium term.

Looking at the dynamic response of GDP upon the inclusion of other variables in greater detail Figure 2.6 repeats the local projection exercise including additional control variables. For comparison, the baseline estimation from Equation 2.4 is plotted in blue. The specifications reported in orange and gold include the growth in domestic credit and a Gold Standard indicator for years t to $t-2$, respectively. This results in slightly dampened coefficients, but overall similar dynamics. The purple line includes the net in- and outflow of gold for the same three years, with very little effect on the baseline coefficients. The same is true for the inclusion of a financial crisis indicator, plotted in green. Together, the results confirm that the link between gross foreign inflows and future growth dynamics is a consistent property of the data.

Table A3.4 in the appendix addresses the question of robustness over different periods of capital flows. BoP variables are summed over five, instead of three years with results remaining similar to the baseline. As this reduces sample size, but does not add much predictive power to the model, the baseline specification of three-year sums is employed throughout the chapter. Because GDP data is compiled from a variety of sources, to ensure maximum coverage, I show in Table A3.5 that it is not a sub-sample of GDP data driving the results. Coefficients for the two largest contributors to GDP data and the total sample are estimated separately, with coefficients being almost identical. Similarly, it might be possible that the aggregate results are driven by large outliers. Figure A3.5 reports country level coefficients for gross inflows, showing that the negative relationship with GDP growth holds for the vast majority of countries. Table A3.6 provides evidence that the impact of BoP flows is not constrained to GDP by estimating their relationship with financial and non-financial equity returns. Again, only gross foreign credit exhibits a significantly negative coefficient.

Finally, Table A3.7 checks the baseline specification itself for robustness against potentially biasing factors. I first address the concern that the long downturn of the Great Depression might be the sole driver of the observed relationship and split the

Figure 2.6: *Capital flows and business cycle dynamics, robustness specifications*



Notes: This figure shows local projection results from Equation 2.4 including additional control variables. The left panel plots the cumulative response of log GDP growth to the capital account balance. The middle and right panel do the same for credit and debit respectively. For the coefficients reported in orange the growth in domestic credit in years t to $t-2$ is added to the baseline specification. The coefficients in gold and purple include a Gold Standard indicator and gold flows for the same years respectively. The green line corresponds to estimates including a dummy for financial crises in the same years. Standard errors are dually clustered on country and year. Shaded areas represent 95% confidence intervals.

sample in 1929. The relationship holds in both sub-samples. Is only a small group of core countries producing the results? To answer this question I report coefficients for the core countries of North America and Europe[15] and all other countries separately. Again, the results hold in both groups. Continuing the discussion about the relevance of net positions, I split the sample along the current account being positive or negative in year t, which produces virtually identical coefficients. Lastly, the link between gross capital inflows and output might be non-linear, with one tail of the distribution accounting for all variation in outcomes. I interact credit with a dummy for credit between t and $t-2$ being above or below zero[16] and show that the relationship is, in fact, close to linear.

[15]The United States, United Kingdom, France, Germany, Canada and the Netherlands

[16]Since all variables are normalized, this is equivalent to credit growth being above or below mean growth.

2.4. Capital flows and financial fragility

Large international capital flows, and especially inflows tend to precede financial crises (Caballero, 2016; Reinhart and Rogoff, 2009). Inflows are potentially unrelated to domestic conditions, cause maturity and currency mismatches and increase exposure to global uncertainty (Rey, 2013; Obstfeld, 2012). After crises, these flows tend to revert (sudden stops or capital flight) (Broner et al., 2013; Caballero and Simsek, 2020; Forbes and Warnock, 2012), when the cost of financial intermediation increases (Romer and Romer, 2017; Jordà et al., 2013). Earlier work has linked current account balances and particularly deficits to crises (Kiley, 2021; Caballero, 2016), while historically, crises seem just as likely in surplus, as in deficit countries (Obstfeld et al., 2010; Jordà et al., 2011). This section takes a closer look at capital flows around crises in the interwar period. Given the predominance of the Great Depression, this approaches a case study of the Great Depression exploiting its varying starting points across countries.

2.4.1. Capital flows and financial crises

I begin by establishing a descriptive link between capital flows and the frequency of financial crises. The crisis classification is based primarily on Baron et al. (2021), with missing countries being covered by Reinhart and Rogoff (2009) and Grossman (1994).[17] Figure A4.6 shows crisis probabilities in different quartiles of cumulative capital flows from $t-2$ to t. Crisis frequency in the highest quartile of gross foreign inflows is about 15% (the highest of any quartile), but only 2% in the lowest one. This pattern of increasing crisis frequencies from low to high quartiles is much less pronounced for net inflows and gross outflows. To more formally exploit the connection between capital flows and crisis occurrences I turn to a probit estimation, as it is widely used in the literature. Coefficients are estimated based on Equation 3.3,

[17] The final set of crises in the interwar period is described in Table A1.19.

Table 2.3: *Capital flows predicting financial crises*

	Combined interwar crisis indicator$_{i,t}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	0.01	-0.03			0.03	-0.02		
	(0.02)	(0.02)			(0.02)	(0.03)		
$\Sigma_{j=0}^{2} Credit_{i,t-j}$		0.06***	0.03**	0.04***		0.08***	0.06***	0.06***
		(0.02)	(0.01)	(0.01)		(0.03)	(0.02)	(0.02)
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			0.02				0.02	
			(0.02)				(0.02)	
AUC	0.72	0.75	0.75	0.75	0.79	0.81	0.81	0.81
s.e.	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.04
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Country fixed effects					✓	✓	✓	✓
Observations	385	385	385	385	258	258	258	258

Notes: The table shows estimation results of a probit model from Equation 3.3 for financial crises, reporting mean marginal effects. The independent variables are cumulative capital flows from year $t-2$ to t. AUC is the area under the ROC-Curve, below it is its standard error. Standard errors in parentheses are clustered on country level and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

where a financial crisis in country i in year t is denoted by the indicator variable $F_{i,t}$, conditional on capital flows from the Balance of Payments $X_{i,t-n}$

$$Pr[F_{i,t} = 1 | X_{i,t-1}] = \Phi(\boldsymbol{\beta} X_{i,t-n}). \tag{2.6}$$

Gross capital flows, as shown, are highly pro-cyclical and the Great Depression dominates the interwar crisis chronology. Because of this, the crisis dating exercise relies on country specific gross capital im- and exports as well as heterogeneity in the starting dates of crises across countries. The results are reported as mean marginal effects in Table 2.3. The predictive accuracy is reported in the AUC-statistic (Area Under Curve), which is an integral of the space under the ROC-Curve (Receiver Operating Characteristic) and the standard benchmark for classification accuracy. The AUC takes the value 0.5, if the choice of the indicator variable based on the model is random. It approaches 1, if the model becomes perfectly able to distinguish between crisis and non-crisis observations.

In line with the idea that crises are equally likely in surplus and deficit countries (Obstfeld et al., 2010; Jordà et al., 2011), net capital flows in column (1) are not significantly related to future crises occurrences. Together with the two included lags of GDP growth, however, the model does have some ability to sort the data into crisis and non-crisis bins, as indicated by the AUC of 0.72. Column (2) adds gross capital inflows to the model, which unlike net inflows, are significantly related to crisis occurrence, with a one standard deviation increase in gross inflows implying an increase in crisis probability of 0.6 percentage points. Given a sample frequency of about 6%, this corresponds to crises being 10% more likely. Importantly, the AUC increases to 0.75, indicating improved precision in crises identification relative to the benchmark. Column (3) includes both types of gross flows, with gross capital outflows being insignificant. Finally, column (4) shows that the single factor model of gross capital inflows has the same predictive accuracy as models including other BoP flows. In other words: neither gross outflows, nor net inflows add to the predictive power already contained in gross inflows. As some sample countries, in particular developing economies or colonies, do not report any crises for the sample period, columns (5) to (8) repeat the previous specifications including country fixed effects. While the number of observations drops sharply, the results remain robust.

To check if the results are a feature of the crisis indicator, Table A4.8 repeats the exercise using only the Reinhart and Rogoff (2009) crisis database. Although sample composition, number of crises and individual starting dates differ, the results remain virtually identical. Together, these results indicate that the information contained in gross foreign inflows best captures the capital flow dynamics that have been observed in the run-up to financial crises.

2.4.2. Crises, capital flight and sudden stops

Crises are preceded by large capital flows and predictive power for crises is concentrated in gross inflows. Once a crisis occurs, uncertainty in financial intermediation increases, which is followed by stops in lending, capital flight and contractions in flow volumes.[18] I explore these dynamics in the aftermath of the Great Depression, using the following specification

$$\sum_{h=1}^{n} Capital^{T}_{i,t+h} = \alpha_{i,h} + \sum_{j=0}^{2} \beta^{T,h}_{Cr,j} Crisis_{i,t-j} + \gamma^{X} X_{i,t} + u_{i,t+h}, \tag{2.7}$$

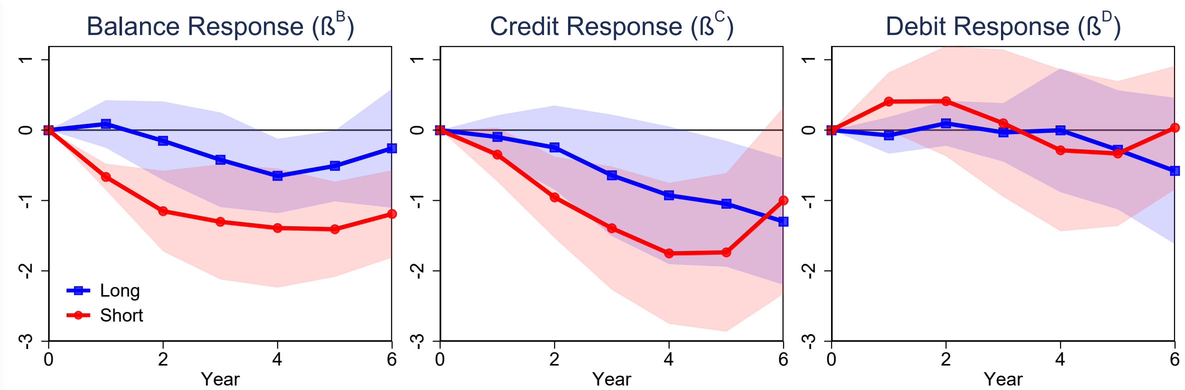
where $\sum_{h=1}^{n} Capital^{T}_{i,t+h}$ are cumulative capital flows of Type $T \in \{Balance,\ Credit,\ Debit\}$ from year t to $t+h$. Flows are split into long and short-term flows to emphasize the difference in response time to the crisis. The $\beta^{T,h}_{Cr,0}$ coefficient measures the response of the respective flow type to a crisis in year t over the various horizons h. All specifications include country fixed effects and two lags of crises. The vector $X_{i,t}$ contains two lags of GDP growth and BoP flows.

The left panel of Figure 2.7 plots the response of long- and short term balances. The short-term balance immediately drops in the first year after crises, indicating a net outflow of short-term capital, and remains significantly negative at the 90% level over all horizons. The response of long-term capital is not significantly different from zero over most horizons. This response is a combination of a decrease in inflows (sudden stop), and an increase in outflows (flight). Gross inflows consistently trend downward, with long-term flows naturally taking longer to react than short-term flows. The response for outflows is less clear cut, but trends in the opposite direction after crises, with short-term flows being significantly elevated in $t+1$. Again, long-term flows take longer to react, remaining unchanged over the medium term before beginning a slow decrease. They are not significantly different from zero over any horizon.

These findings relate to Accominotti and Eichengreen (2016), who term the contraction in foreign lending during the Great Depression the "mother of all sudden stops", focusing on net capital flows. Interestingly, they time the reversal precisely to 1929, while my estimates rely on a crisis indicator which is heterogeneous across

[18] See (Krishnamurthy and Muir, 2017; Romer and Romer, 2017; Jordà et al., 2013) for disintermediation and (Broner et al., 2013; Forbes and Warnock, 2012; Calvo, 1998) for decreasing capital flows after crises.

Figure 2.7: *Cumulative capital flows after crises*



Notes: This figure shows local projection responses of capital flows following financial crises, based on Equation 3.4. The left panel plots the response of the capital account balance, split into long- and short term capital flows. The middle and right panel do the same for credit and debit respectively. The response in the left panel can be seen to be driven by the response of decreasing gross capital inflows and increasing gross capital outflows in the middle and right panel, respectively. Standard errors are dually clustered on country and year. Shaded areas represent 90% confidence intervals.

countries and might classify two consecutive years as crisis. Crucial to the timing to 1929 is a change in the bilateral relation between the world largest creditor and the world's largest debtor. Under the *transfer protection clause* of the Dawes plan, foreign investors had privileged access to German debt payments in the event of a payment crisis. In the first half of 1929, the Young plan effectively inverted the previous seniority on German payments by establishing that reparations had to be payed under any circumstances. Given Germany's position as the worlds largest net borrower, this created exposure for foreign investors, especially private US-creditors, and triggered a sharp reduction in US capital exports (Ritschl, 2014; Ritschl and Ho, 2023). My results can be seen as an expansion of these earlier results on an aggregate level, showing that while the initial reversal was triggered in 1929, the starting points of crises in individual countries remain important for capital flow dynamics around these dates.

2.5. Recession severity: aggravation and moderation

Crises are preceded by large capital movements and succeeded by capital flight and sudden stops. When a country is more reliant on foreign financing, the contraction in the availability of funds is consequently larger than for countries less reliant on foreign funds. Keynes (1941) already linked capital retrenchment to contractionary biases in borrower countries and it seems to be consensus that the overseas-disinvestment of the United States exacerbated the crisis by causing liquidity problems (Kindleberger, 1978; Eichengreen, 2008). This section provides empirical evidence that large exposure to foreign inflows before crises was followed by more severe recessions, but also that the accumulation of foreign assets provided some protection against this mechanism.

2.5.1. Exposure to foreign inflows before financial crises

Jordà et al. (2013) show that countries have deeper recessions after crisis when the preceding boom in domestic credit was large. Borio et al. (2014) confirm this in a case study of the Great Depression and argue that these countries were linked via large capital flows. Figure A5.7 in the appendix approaches this idea descriptively by plotting gross foreign inflows from 1927 to 1930 against log GDP growth from 1930 to 1933. A negative link between gross capital inflows and GDP growth is visible. This, however, does not account for country specific starting points of the Great Depression. The right panel addresses this concern by splitting the sample along the median recession severity in the first three years after a crisis, similar to Borio et al. (2014). Plotting average gross capital flows for both groups in a six-year window around crises reveals that countries, where the recession after a crisis was deeper than the median decline, consistently had higher gross inflows before crises, but experienced a sharper contraction in foreign inflows afterwards.

This finding corresponds to literature suggesting that sudden stops and capital flight happen after periods of elevated capital flows and that this sudden unavailability of funds during crisis is potentially harmful to the economy (Broner et al., 2013; Forbes and Warnock, 2012; Reinhart and Rogoff, 2009). To take a closer look at the economic development of countries that where exposed to large levels of gross capital inflows before crises Equation 2.8 defines gross exposure as large, when gross inflows were above the yearly median in $t-1$ and $t-2$

$$GED_{i,t} = \begin{cases} 1, & \text{if } Credit_{i,t-1} > \widetilde{Credit}_{i,t-1} \ \wedge \ Credit_{i,t-2} > \widetilde{Credit}_{i,t-2} \\ 0, & \text{Otherwise.} \end{cases} \tag{2.8}$$

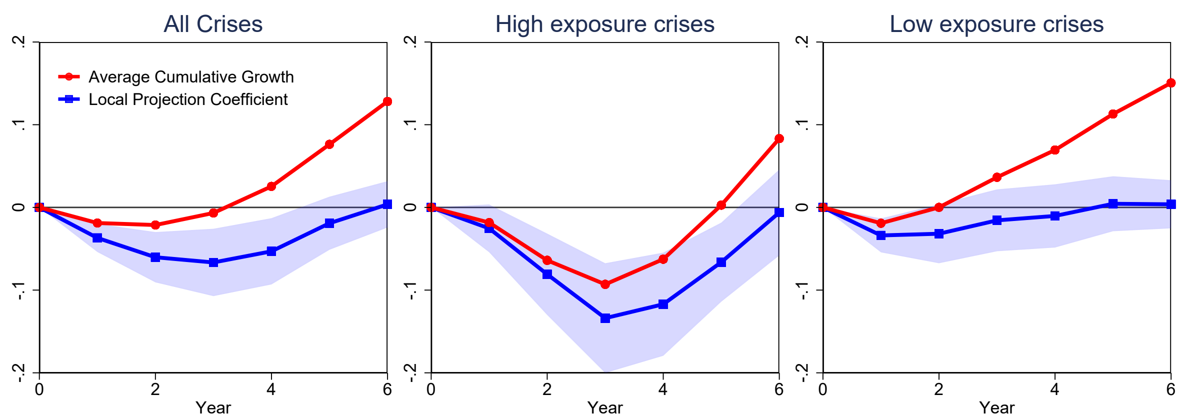
Interacting the gross exposure dummy (GED) with a crisis indicator for time t identifies crises with high previous exposure to gross inflows. This classification applies to about 25% of crises in the sample. Figure 2.8 shows that GDP-growth after such an inflow-crisis is much lower than for other crises over the six year window following the beginning of the crisis. Importantly, this relationship is already visible in the purely descriptive exercise of displaying the average cumulative GDP-growth after crisis, where no further estimation is involved. The corresponding graphs are plotted in red. Local projections, plotted in blue, allow me to repeat the exercise while controlling for country fixed effects and two lags of GDP-growth and financial crises. The results are confirmed, with the predictive coefficient of GDP growth for GED-crises being significantly lower than for Non-GED-crises at the 90% level at horizons 3 and 4.

To test the observation of crises being amplified by exposure to gross capital inflows more systematically, Equation 2.9 runs predictive regression of GDP growth from t to $t+2$ on crises interacted with the previously constructed GED measure

$$\Delta_2 y_{i,t+2} = \alpha_i + \beta^{Cr} Crisis_{i,t} + \beta^{GED} GED_{i,t} + \beta^{Cr\times GED} Crisis_{i,t} \times GED_{i,t} + \gamma^X X_{i,t} + u_{i,t+2}, \tag{2.9}$$

where the dependent variable $\Delta_2 y_{i,t+2}$ again is log GDP growth. All specifications control for country fixed effects and two lags of GDP growth. Column (1) in Table 2.4 reports coefficients for crises and the GED-variable individually. The coefficient

Figure 2.8: *Recession depth after exposure to gross capital inflows*



Notes: This figure shows cumulative GDP growth over a six year window after financial crises. The left panel shows the average across all crises, which are split into crises with large prior exposure to foreign inflows in the middle and all other crises in the right panel. High exposure crises are defined by the interaction of the GED measure from Equation 2.8 with a financial crisis indicator. The average cumulative GDP growth is plotted in red. Plotted in blue are estimates based on a local projection including country fixed effects and two lags of GDP growth and crises. Shaded areas represent 90% confidence intervals.

for crises is negative, while it is zero for the GED-measure. When the two are interacted in column (2), the picture is strikingly different. The interaction is larger in magnitude than the coefficient for crises and significantly negative. To make sure that the interaction does not proxy for the documented negative link between gross inflows and growth, column (3) adds the baseline BoP variables. The interaction coefficient remains unchanged, while the gross inflow coefficient is identical to the baseline. This suggests that being reliant on foreign credit before crises adds to the negative association that has been shown to persist for gross inflows and economic outcomes across all specifications. Column (4) adds the Gold Standard to control for the potential effects of restrictive monetary policy, which does not change either of the coefficients. Some countries - in particular colonies and developing economies - do not report any crises for the sample period. To make sure that the interaction does not capture countries without crises *not* being exposed to foreign inflows, columns (5) to (8) repeat the previous specifications, but restrict the sample to countries that report at least one crisis. The results remain unaffected.

Robustness: Is this result driven by the dummy classification or the choice of crisis chronology? I turn the question upside down and define the dummy not as the relatively small sample with high exposure in two consecutive years, but

Table 2.4: *GDP growth, crises and exposure to gross capital inflows*

	$\Delta_2 Y_{i,t+2}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Crisis_{i,t}$	-0.05**	-0.02*	-0.01	-0.00	-0.05**	-0.02*	-0.01	-0.01
	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
$GED_{i,t}$	-0.01	-0.00	0.03**	0.02*	-0.02	-0.01	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
$Crisis_{i,t} \times GED_{i,t}$		-0.08***	-0.07***	-0.07***		-0.08**	-0.07***	-0.07***
		(0.03)	(0.02)	(0.02)		(0.03)	(0.03)	(0.03)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$			-0.04***	-0.04***			-0.04***	-0.04***
			(0.01)	(0.01)			(0.01)	(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$			0.00	0.00			0.00	0.00
			(0.01)	(0.01)			(0.01)	(0.01)
$Gold\ Standard_{i,t}$				-0.03*				-0.02
				(0.02)				(0.02)
R^2	0.093	0.111	0.271	0.290	0.126	0.146	0.325	0.330
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Crisis in Sample					✓	✓	✓	✓
Observations	342	342	342	342	241	241	241	241

Notes: This table presents estimation results from Equation 2.9. The dependent variable is log GDP growth over the period t to $t+2$. The independent variables are a financial crisis indicator, the GED-variable capturing exposure to large capital inflows, the baseline BoP variables accumulated over t to $t-2$ and the Gold Standard. All specifications additionally control for country fixed effects and a two year distributed lag of GDP growth. Columns (5) to (8) restrict the sample to countries that report at least one crisis episode. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

instead simply take the first lag of my baseline variable (such that it does not overlap with a potential crisis in t) and define exposure as high if it is in the top 80% of the entire sample. When interacted with a crisis indicator this effectively excludes countries with low exposure, while capturing the vast majority of crises. The result is reported in Table A5.9 and shows that focusing on the exclusion of low exposure countries produces very similar results. In Table A5.10 I re-estimate Table 2.4 using the Reinhart and Rogoff (2009) crisis dating. The results remain unchanged. Together, these result confirm that exposure to gross inflows prior to crises adds to the negative link between gross inflows and economic outcomes.

2.5.2. Accumulation of foreign assets before financial crises

The accumulation of foreign debt in one country implies the accumulation of foreign assets in another. Similarly, capital flight during crises implies the repatriation of foreign assets by another country, which now experiences capital inflows. Potentially, the inflow of capital, due to retrenchment, even outweighs the flight of foreign capital. While gross foreign credit decreases, some countries may cushion the effect on their economy by the repatriation of their own foreign assets (Caballero and Simsek, 2020). Contrary to recessions being more severe due to foreign credit exposure, this channel proposes the moderation of recessions via the liquidity insurance provided by foreign assets.

In Table 2.5 I define a dummy for the accumulation of gross foreign assets (GFA) analogously to the GED-measure. It takes the value 1, if gross outflows were above the yearly median in $t-1$ and $t-2$. Its interaction with crises in column (2) is positive, providing evidence for the hypothesis that foreign assets can dampen the effects of crises. Assuming that the boom before crisis splits countries into capital ex- and importers, *GFA* and *GED* might capture the same information, showing on the one hand that gross importers fare worse and on the other that gross exporters fare better. Including capital flow variables and the GED-crisis interaction in (3), however, reveals that the two channels are independent from each other. This corresponds to the model in Caballero and Simsek (2020), where it is possible for a country to be adversely affected by exposure to inflows, but simultaneously benefit from its own foreign assets. To verify that it is not ultimately the net availability of funds in a crisis that drives these effects, column (4) interacts a dummy for positive net inflows in year t (NID) with crises. The coefficient is positive, confirming that the net availability of funds during crises matters. It does, however, not affect the other coefficients.[19] Column (5) adds the interaction of crises with the Gold Standard, showing that neither result proxies for Gold Standard adherence. Columns (6) to (8) restrict the sample to countries with at least one crisis, again with unchanged results.

The positive effect of foreign assets is less pronounced than the negative effect of foreign liabilities. It is generally of lower magnitude and statistical significance.

[19]Naturally, the coefficient has to be cautiously interpreted since it might be impacted by the crisis in the same year.

Table 2.5: *Crisis moderation via foreign asset accumulation*

	$\Delta_2 Y_{i,t+2}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crises3	-0.05**	-0.07***	-0.03	-0.06***	-0.05**	-0.07***	-0.06***	-0.05***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
$GFA_{i,t}$	-0.00	-0.01	0.01	0.01	0.01	0.00	0.02*	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$Crisis_{i,t} \times GFA_{i,t}$		0.05*	0.04**	0.05**	0.04*	0.04**	0.04**	0.03*
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$Crisis_{i,t} \times GED_{i,t}$			-0.07***	-0.07***	-0.07***		-0.06**	-0.06**
			(0.03)	(0.03)	(0.02)		(0.03)	(0.03)
$Crisis_{i,t} \times NID_{i,t}$				0.05**	0.05**		0.05**	0.05**
				(0.02)	(0.02)		(0.02)	(0.02)
$Crisis_{i,t} \times Gold_{i,t}$					-0.02			-0.02
					(0.04)			(0.04)
R^2	0.090	0.096	0.278	0.286	0.307	0.125	0.349	0.356
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Capital Flow Controls			✓	✓	✓		✓	✓
Crisis in Sample						✓	✓	✓
Observations	342	342	342	342	342	241	241	241

Notes: This table presents estimation results from altering Equation 2.9 to include additional sets of interaction terms. The dependent variable is log GDP growth over the period t to $t + 2$. The independent variables are a financial crises indicator and its interaction with the accumulation of gross foreign assets (GFA), gross exposure to foreign credit (GED), net capital inflows in year t (NID) and Gold Standard adherence (Gold). The individual terms of each interaction are always included in the specification. The baseline capital flow variables from the BoP, accumulated over t to $t - 2$, are included when indicated. All specifications control for country fixed effects and a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Under the assumption that they are perfect substitutes for each other, and considering that their volumes across the whole sample are identical, their coefficients should outweigh each other. A potential explanation for the discrepancy lies in the reason why foreign funds return home during crisis. For the positive effect of repatriated assets to fully counter the withdrawal of foreign funds, all repatriated funds would need to be re-employed domestically. This, however, is unlikely, as theoretical models suggest that during crises the need for precautionary savings increases, depressing aggregate demand (Guerrieri and Lorenzoni, 2017). Instead, it is more likely that they are repatriated due to increased caution and put into domestic savings accounts. Empirically, Degorce and Monnet (2020) find that during the Great Depression the reluctance to invest or consume led to an increase in precautionary savings. In the context of capital flows, this suggests that repatriated assets are only partially channeled back into the domestic economy. This cushions the shock of foreign capital being withdrawn, but cannot fully substitute for it.[20]

2.6. Instrumental variable results

Borrowing against future fundamentals or searching for external funds to finance investment is unlikely to have adverse aggregate effects. Instead it is the foreign supply of funding, unrelated to the domestic economy, that likely drives the negative association between foreign inflows and economic downturns (Rey, 2013; Miranda-Agrippino and Rey, 2020). This section proposes two instrumental variable approaches to identify the component of capital inflows being driven by foreign supply, which cannot be independently observed in the Balance of Payments. Following this line of reasoning, the baseline coefficient should be downward biased, because it cannot distinguish between capital supply and demand. A working instrument that succeeds in identifying foreign capital supply should consequently lead to an upward correction of the OLS coefficient.

2.6.1. The United States as a creditor nation

The baseline instrumental variable exploits the special role of the United States, which had become the world's greatest creditor nation during the boom years of the Roaring Twenties. This fact, well appreciated by contemporaries, resulted in a magnitude of publications addressing the American role in world finance, and trying to assess how large the American investment position abroad actually was.[21] Later scholars observed the change from 'debtor to creditor nation' as America becoming the 'world's banker' (Woodruff, 1975). When the United States drastically reduced

[20]This argument is also consistent with the 'paradox of thrift' (Keynes, 1936), where an increase in savings does not translate into increased output because it depresses aggregate demand. This leads to the paradox where increased savings today lead to lower total savings in the long run.

[21]See for example: Dickens (1931, 1930) and Lewis and Schlotterbeck (1938) for data collection and Jolliffe (1935) for a more narrative approach.

their foreign lending during the Great Depression, countries that were previously subject to most capital inflows from the US, consequently now experienced the most severe reduction in available foreign capital. To empirically test this line of reasoning, I collect data from Dickens (1931, 1930) and Lewis and Schlotterbeck (1938), and construct the bilateral portfolio investment position of the United States with individual countries.

To highlight the significance of US capital for domestic financial systems, I compute 'pass-through' coefficients to domestic bank balance sheets using newly collected data from the League of Nations (1931-1940) These coefficients, in Table A6.11, assess the marginal importance of US-capital inflows and indicate that one additional dollar of US portfolio investment was, on average, associated with an increase of 0.97 dollars in domestic balance sheet size. Further analysis, building on the method developed in Eren et al. (2023), reveals that out of this 0.97$ increase, 0.45$ is lent as domestic credit, and 0.35$ is used by banks to acquire securities.[22] All three 'pass-through' coefficients are highly statistically significant. This confirms a direct connection between US portfolio investments and the financial systems of recipient countries, with the majority of US funds providing liquidity to credit and financial markets. To express the importance of US capital in relative terms, Figure A6.8 plots the ratio of the US portfolio position to domestic bank balance sheets over time for Germany, the UK, France, and Japan. Although magnitudes and pre-crisis trends vary, this ratio sharply declines in all four countries from 1931/32 onward, indicating that the US portfolio position contracted more rapidly than domestic bank balance sheets during that period.

Having established a link from US foreign investments to domestic financial conditions, I now turn to the economic relevance of having strong financial ties to the United States. Concretely, I regress three year future GDP growth on the lagged

[22]For comparison, an additional dollar of gross foreign credit as recorded in the BOP is only associated with a 30 cent increase in domestic bank balance sheet size. This is because gross inflows also include transactions less likely to pass through domestic balance sheets, such as foreign direct investment, land purchases, and trade credits.

ratio of US portfolio investments to domestic bank balance sheet size for every year between 1923 and 1934 individually. The results in Figure A6.9 show that closer financial ties to the US during the expansionary years before and after the Great Depression are positively associated with domestic GDP growth. This relationship, however, turns significantly negative towards the end of the 1920s and the onset of the Great Depression, showing that exposure to potential US capital withdrawals had adverse effects on the economy.

2.6.2. A Bartik-Style instrument

Arguably, the flight of US capital from (or supply to) any individual country is driven as much by that country's economic conditions as by the United States' willingness to invest abroad. The aggregate withdrawal (or expansion) of foreign investments by the United States, however, is more likely to be driven by decisions taken in the United States rather than their individual partner countries. To exploit this variation in foreign inflows not driven by economic conditions of specific countries, but by changing conditions in the United States (like the 1920s boom and 1930s bust), I construct a Bartik-style instrument (Bartik, 1991) and use it to instrument the capital inflows of other countries. Specifically, I interact exposure to US portfolio investments in 1927 with the change in the total US portfolio position. To minimize potential endogeneity with domestic economic conditions, the change in the total US portfolio position is computed as excluding changes in investments to the instrumented country i. The key identifying assumption here is that the pre-existing exposure measure for individual countries is exogenous to the aggregate developments (excluding i) in period t (Goldsmith-Pinkham et al., 2020). Equation 2.10 shows the construction of the instrument

$$Interaction\ IV_{i,t} = \frac{USP_{i,1927}}{BBS_{i,1927}} \times \sum_{i \neq j} \Delta USP_{j,t}, \tag{2.10}$$

where $USP_{i,1927}$ is the United States' portfolio position in country i in 1927, scaled by that countries bank balance sheet size $BBS_{i,1927}$.[23] This exposure is time invariant which leaves the second term to create variation in the instrument. This second term is the total change in the US portfolio position, excluding the instrumented country i to make sure that US capital supply is not conflated with capital demand by country i. Finally, I normalize the instrument to make the reduced form coefficients comparable to the coefficients obtained from Balance of Payments variables.

The first stage of this instrument is shown in a scatterplot against gross foreign inflows in Figure A6.10. The relation between the two variables is, in line with intuition, strongly positive and gets strengthened upon the inclusion of control variables and country fixed effects in the second panel. I now fix the sample to the observations where both the instrument and the BoP variables are available, which reduces the total number of observations to around 200, and report OLS coefficients together with reduced form and instrumented estimates in Table 2.6.

The table mirrors the baseline table with increasing forecast horizons of GDP over the different specifications. The independent variables, however, are reduced to yearly capital inflows to correspond to the time horizon of the instrument. Across all horizons, the reduced form and especially the instrumented coefficients are larger than the baseline OLS-coefficients and highly significant. The Kleibergen-Paap statistic of around 25 further confirms the visual impression of a good first-stage fit. Together, this confirms the intuition of a baseline bias towards zero, when domestic demand and foreign capital supply cannot be distinguished. As the number of observations is reduced, due to limited data availability before 1927, I re-estimate the previous table with exposure to the US being re-defined as the average bilateral US portfolio position (relative to bank balance sheet size) over the last two years, instead of 1927. While this increases the number of observations by allowing the inclusion of

[23] 1927 is chosen as it is the first year for which comprehensive data is available for many countries. The specification provides similar estimates when choosing earlier years, which reduces the sample along the cross-sectional dimension, as well as later years, which reduces the sample along the time dimension.

Table 2.6: *Gross foreign inflows and GDP dynamics, Bartik-style instrument*

	$\Delta_2 Y_{i,t+2}$			$\Delta_3 Y_{i,t+3}$			$\Delta_4 Y_{i,t+4}$		
	OLS (1)	*Reduced* (2)	*IV* (3)	*OLS* (4)	*Reduced* (5)	*IV* (6)	*OLS* (7)	*Reduced* (8)	*IV* (9)
$Credit_{i,t}$	-0.03***		-0.07***	-0.05***		-0.11***	-0.04***		-0.14***
	(0.01)		(0.02)	(0.01)		(0.02)	(0.02)		(0.02)
Interaction IV		-0.04**			-0.07***			-0.07***	
		(0.02)			(0.02)			(0.02)	
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			24.88			26.88			23.83
Observations	201	201	201	201	201	201	192	192	192

Notes: This table presents OLS, reduced form and instrumented coefficients for a regression of log GDP growth between t and $t+h$ on gross foreign inflows at time t. The instrument is constructed as described in Equation 2.10 and used to instrument gross inflows in columns (3), (6) and (9). Reduced form and instrumented coefficients are larger than OLS-coefficients, suggesting a baseline bias towards zero. All specifications control for country fixed effects, a two year distributed lag of GDP growth and net capital flows. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

data points before 1927 wherever available, it opens up the possibility of variation in the instrument also being driven by changes in the exposure measure. Being aware of this trade-off, I report this alternative specification in Table A6.12. The displayed estimates confirm the previous results in a larger sample.

2.6.3. Robustness: The Global Financial Cycle

A potential caveat of the previous approach is that it might be too US-centric, given that the United States had only just overtaken the United Kingdom as the primary creditor country. To model the global supply of capital in a more general way, I therefore follow Aldasoro et al. (2020), who construct a measure of the Global Financial Cycle using principal component analysis.[24] This global cycle is unrelated to the capital demand of individual countries and thus helps to isolate the component of capital inflows being driven by foreign capital supply. Trying to minimize the endogeneity of the global cycle to any individual country, I estimate it for every country individually as the first principal component of capital inflows over all

[24]The concept of the GFC was pioneered by Rey (2013) and describes a situation where global financial conditions spill over into domestic economies, irrespective of the domestic financial cycle (Rey, 2013; Miranda-Agrippino and Rey, 2020; Aldasoro et al., 2020).

Table 2.7: *Gross foreign inflows and GDP dynamics, global financial cycle instrument*

	$\Delta_2 Y_{i,t+2}$			$\Delta_3 Y_{i,t+3}$			$\Delta_4 Y_{i,t+4}$		
	OLS (1)	*Reduced* (2)	*IV* (3)	*OLS* (4)	*Reduced* (5)	*IV* (6)	*OLS* (7)	*Reduced* (8)	*IV* (9)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.04***		-0.13***	-0.06***		-0.17***	-0.06***		-0.17***
	(0.01)		(0.03)	(0.02)		(0.04)	(0.02)		(0.04)
$\Sigma_{j=0}^{2} GFC_{-i,t-j}$		-0.05***			-0.07***			-0.07***	
		(0.01)			(0.01)			(0.01)	
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Net Capital Inflows	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			25.40			24.59			24.37
Observations	321	321	321	294	294	294	266	266	266

Notes: This table presents OLS, reduced form and instrumented coefficients for a regression of log GDP growth between t and $t+h$ on BoP variables, summed over the period from $t-2$ to t. In columns (3), (6) and (9) gross foreign inflows are instrumented with the global financial cycle. Reduced form and instrumented coefficients are larger than OLS-coefficients, suggesting a baseline bias towards zero. All specifications control for country fixed effects, a two year distributed lag of GDP growth and net capital flows. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

countries, excluding country i itself.[25] This corresponds to Equation 2.11

$$GFC_{-i,t} = PC_1(\Sigma_{i \notin j} Credit_{j,t}), \tag{2.11}$$

where j is the set of countries excluding country i, over which the first principal component PC_1 for capital inflows $Credit_{j,t}$ is calculated. $GFC_{-i,t}$ consequently refers to the global financial cycle for country i, estimated over all countries, but i itself. I then use this measure to instrument capital inflows into country i.

While this constructed global cycle is certainly not fully exogenous to any individual country, I argue that it still goes some way isolating the global supply of capital, as it seems unlikely that the capital inflows of all other countries are strongly influenced by the inflows of the omitted country i. To accurately resemble the baseline specification, I calculate normalized three year sums of the GFC-measure, identical to the BoP variables, and establish the relevance of the instrument in a first stage scatterplot in Figure A6.11. It shows a strong positive correlation that

[25]The construction of the principal component is only conducted for the years between 1924 and 1936 to ensure that a sufficient number of countries reports unabridged data for the entire period.

is robust to the inclusion of country fixed effects and control variables. I again fix the sample to observations where the instrument is available and instrument gross capital inflows with the *GFC*-measure in Table 2.7. The reduced form and especially the instrumented coefficients are again larger than the baseline OLS-coefficients and highly significant across all horizons, confirming the intuition of a baseline bias towards zero.

2.7. The Gold Standard, bank balance sheets, foreign interest payments, and findings in modern data

The preceding sections have illustrated that foreign inflows tend to revert after crises, and that countries relying on them before, often experience amplified post-crisis recessions. Moreover, it is specifically the supply of foreign capital, unrelated to domestic economic conditions, that contributes to the documented negative relationship between borrowing from abroad and adverse economic outcomes. But what exposes countries to these inflows in the first place, and does it matter for outcomes if countries have the option to respond to increasing inflows? To address these questions, this section first investigates how capital inflows surged following the adoption of the Gold Standard and how the Gold Standard simultaneously constrained the tools available to manage them. Subsequently, it examines the connection between foreign inflows and financial vulnerability through maturity mismatches on commercial bank balance sheets. It then considers that borrowing from abroad today comes with interest payments to foreigners tomorrow, showing that these interest payments are negatively related to future growth prospects. Finally, I explore if these findings from the interwar period can help us understand the link between capital flows and business cycles also for more recent times. I re-estimate the chapter's main specifications using modern data for OECD-economies and show that coefficients are remarkably similar across samples.

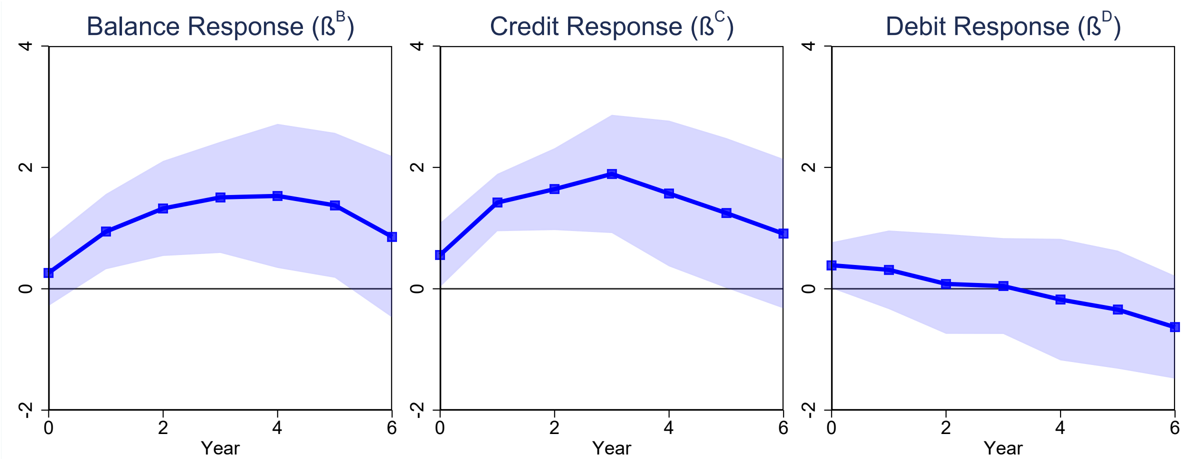
2.7.1. The Gold Standard

The Gold Standard was a commitment to the free flow of capital, reduced risk in international lending relations and fostered financial integration via the common peg to gold (Bordo and Kydland, 2005; Wandschneider, 2008; James, 1992; Eichengreen, 2008). This increased access to international financial markets and, conversely, created a multitude of potential destinations for foreign investments. To estimate the contribution of Gold Standard adoption to the observed boom in international capital flows, Equation 2.12 runs local projections of capital flows on a Gold Standard dummy variable

$$\sum_{h=0}^{n} Capital_{i,t+h}^{T} = \alpha_{i,h} + \sum_{j=0}^{2} \beta_{G,j}^{T,h} Gold_{i,t-j} + \sum_{j=1}^{2} \beta_{j}^{T,h} Capital_{i,t-j}^{T} + \gamma^{X} X_{i,t} + u_{i,t+h}. \tag{2.12}$$

Here $\sum_{h=0}^{n} Capital_{i,t+h}^{T}$ are cumulative capital flows from year t to $t+h$ of type T, where $T \in \{Balance, Credit, Debit\}$. *Gold* refers to a Gold Standard indicator that is included for years t to $t-2$. Ultimately of interest is the $\beta_{G,0}^{T,h}$ coefficient for all capital flow types across horizons $h = 0, ..., 6$. Estimations for gross capital flows include two lags of both credit and debit, while estimations for the balance include two lags of the capital account balance. The vector $X_{i,t}$ contains two lags of GDP growth. The results are reported in Figure 2.9. They show that upon Gold Standard adoption, net capital inflows increase, and that this effect is exclusively driven by the increase in gross capital inflows, shown in the middle panel. The increase in inflows is positively significant between horizons 1 and 5, with gross foreign inflows cumulatively increasing by about 1.5 standard deviations. The results for gross outflows are insignificant over all horizons.

Figure 2.9: *Cumulative capital flow in response to Gold Standard adoption*



Notes: This figure shows local projection responses of capital flows to a Gold Standard indicator variable, based on Equation 2.12. The left panel plots the response of the capital account balance, the middle and right panel do the same for credit and debit respectively. The response in the left panel can be seen to be driven by the response of increasing gross capital inflows in the middle panel. The response of debit in the right panel is flat, indicating that the Gold Standard exposed countries to inflows from abroad, while capital exports saw little change. Standard errors are dually clustered on country and year. Shaded areas represent 90% confidence intervals.

Under the Gold Standard, gross capital inflows increase and gross inflows precede periods of lower growth. Increasing inflows, however, might be due to a Gold Standard mechanism, rather than increased financial integration. The functioning of the monetary system in Gold Standard countries is dependent on the availability of gold (Eichengreen, 1996; Bernanke, 2009). This availability in turn is determined to a large extent by the net in- and outflow of physical gold. If the gross inflow of capital is tied to foreigners trying to acquire gold, which is then moved out of the country, inducing contractionary pressure, the negative link between capital inflows and GDP growth would proxy for a Gold Standard mechanism. Table A7.13 in the appendix shows that the baseline specification is robust to the inclusion of gold flows in various sub-samples, including a sample restricted to observations within the Gold Standard. The Gold Standard mechanism, where the outflow of physical gold is negatively associated with future growth, can be observed in a single factor model including only gold flows, with the sample restricted to Gold Standard countries before 1933.[26]

[26]The only countries that continued to hold onto gold after 1933 were the gold block countries, led by France, which had gold reserves large enough to effectively not having to fear falling below their

Internationally, the Gold Standard enabled financial integration and contributed to increased exposure to foreign capital inflows. But the magnitude of the relationship between inflows and the macroeconomy is contingent on the domestic dimension of the Gold Standard. Under the open economy trilemma, the Gold Standard restricted the abilities of domestic policy makers to counter the effects of inflows via monetary policy, capital flow management or exchange rate adjustments. This effectively translated into a situation where the rules of the Gold Standard created exposure to global credit, but left countries unable to adequately respond to it. In line with this Obstfeld et al. (2004) argue that the '*inability to pursue consistent policies in a rapidly changing economic environment*' makes the trilemma one of the key factors in understanding the interwar crisis. Column (1) of Table 2.8 interacts a dummy for not being on gold for the duration of capital inflows in the *Credit* variable between t and $t-2$ with gross inflows. The interaction coefficient is positive, of similar magnitude to the *Credit* coefficient and statistically significant. In columns (2) and (3) I control for net inflows and gross outflows respectively, which does not change the results in any way. This suggests that the option to react to foreign inflows matters for the magnitude of their effects.

Davis et al. (2016) emphasize that an open capital account is important for current account deficits (a net measure) to have adverse domestic effects, and Quinn (2003) finds evidence for countries with more open capital accounts having deeper recessions during the Great Depression. Following this reasoning I interact gross inflows with a dummy for the capital account being less than completely open (below 100%) between t and $t-2$.[27] The interaction coefficient again is positive, significant and slightly larger than the previous interaction with Gold Standard adherence. I repeat

coverage threshold. As the mechanism of gold being linked to lower growth is only binding when countries are approaching the lower bound of their gold coverage, including these countries after 1933 produces no significant coefficient for gold flows. For a discussion of the gold blocks adherence to gold and its eventual dissolution see: Bordo and Edelstein (1999); Madsen (2001); Hallwood et al. (2007); Eichengreen and Irwin (2010).

[27]I use the capital account openness measure from Quinn (2003), which is highly correlated with the Gold Standard. During the Gold Standard, the average openness score is 93, versus only 49 outside of it.

Table 2.8: *Capital flows, the Gold Standard and capital account openness*

	$\Delta_2 Y_{i,t+2}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.04***	-0.04***	-0.05***	-0.06***	-0.06***	-0.06***	-0.06***	-0.06***	-0.06***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times No\,Gold_{i,t\rightarrow t-2}$	0.03*	0.03**	0.03**						
	(0.02)	(0.02)	(0.02)						
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times Closed\,(<100)_{i,t\rightarrow t-2}$				0.04**	0.04**	0.04**			
				(0.02)	(0.02)	(0.02)			
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times Closed\,(<67)_{i,t\rightarrow t-2}$							0.05**	0.05**	0.05**
							(0.02)	(0.02)	(0.02)
R^2	0.274	0.274	0.277	0.409	0.409	0.409	0.383	0.383	0.383
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Net Capital Inflows		✓			✓			✓	
Gross Outflows			✓			✓			✓
Observations	342	342	342	234	234	234	234	234	234

Notes: This table presents estimation results from interacting gross capital inflows with measures for Gold Standard adherence and capital account account openness. The dependent variable is log GDP growth from t to $t+2$. Columns (1) to (3) interact gross inflows with a dummy for not being on gold between t and $t-2$. Columns (4) to (6) perform a similar interaction with a dummy for the capital account being less than 100 percent open, based on the Quinn (2003) capital account openness measure. Columns (7) to (9) repeat the specification for capital account openness being in the lower two thirds. The interaction terms are also included individually in all specifications. All specifications control for country fixed effects and lagged growth refers to a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

the specification with an indicator for capital account openness being below 66% (less open), with the result that the interaction coefficient again slightly increases in magnitude. Together, this implies that capital account management, which was only possible outside the Gold Standard, can help moderate the negative implications of foreign inflows. The similarity in results between the Gold Standard and the capital account measure also relates to Mitchener and Wandschneider (2015), where the authors find that leaving gold led to capital controls, while the option for independent monetary policy was underutilized. For robustness, Table A7.14 reports the full set of interactions for all included BoP variables with the various openness measures. The results remain unchanged.

Mitchener and Pina (2022) show that during the classical Gold Standard countries import financial conditions that are unrelated to their economies via Gold Standard mechanisms. This is directly related to the Gold Standard providing some insulation against the effects of capital inflows. Table A7.15 in the appendix follows this reasoning and tests if not being on gold for the baseline three-year window of capital inflows from $t-2$ to t provides protection against the global financial cycle, using the previously constructed principal component instrument. Capital inflows are again interacted with a *No Gold* dummy in an OLS, a reduced form and an instrumented setting.

The results correspond closely to the previous findings, with highly significant and larger coefficients for the reduced form and instrumented specifications relative to the baseline. Interestingly, the positive effect of not being on gold, visible for the OLS results in (1) to (3), vanishes in the reduced and IV estimates, while its interaction term with the global financial cycle is highly significant. A potential explanation could be, that the protective effect of not being on gold is captured better in the interaction with the global financial cycle and that in the absence of these variables in (1) to (3) the coefficient of not being on gold partially proxies for this channel. The Kleibergen-Paap statistic diminishes slightly in the fully instrumented interaction model in column (9), but remains above the standard benchmark of around 10. Taken together these results allow for a reinterpretation of the metaphor of the golden fetters. The Gold Standard effectively exposed countries to the global financial cycle, while deposing them of the instruments to react to it.

2.7.2. Balance sheet expansions and maturity mismatches

[28]Bank balance sheets 'breathe' with the economy. They expand during periods of economic growth when asset valuations rise and capital flows into the financial system, but contract during economic downturns when asset values decline and capital is withdrawn. During downturns, financial institutions with insufficient short-term assets are often forced to resort to rapid liquidation of illiquid (long-term) assets to service the withdrawal of liquid (short-term) assets, further exacerbating the decline in asset prices and hastening capital outflows (Adrian and Shin, 2010).

[28]The results presented in this section are preliminary, and further work on the link between global and local financial conditions via the bank balance sheet channel is currently in progress.

Ultimately, it is the role of banks, as intermediaries between short-term saving and long-term investment, that exposes them to risk during economic downturns.

Beyond short-term "fire sales", continued contractionary pressure on bank balance sheets leads to reduced credit creation, which has been shown to adversely affect future real economic outcomes (Chodorow-Reich, 2014). When previous expansions of bank balance sheets have been foreign-financed, vulnerability to sudden reductions in capital availability increases, as foreign inflows typically have shorter maturities than the domestic investments (such as household or corporate credit) they fund (Obstfeld, 2012). Additionally, sudden increases in loanable funds tend to lower bank lending standards, with assets with low credit ratings being difficult to liquidate during busts (Dell'Ariccia and Marquez, 2006).

Importantly, Obstfeld (2012) argues that these maturity mismatches extend beyond the marginal availability of capital from abroad, as it is not the net inflow or outflow of funds that determines the extent to which bank balance sheets can be foreign-financed. Instead, balance sheets can expand due to capital inflows in both surplus and deficit countries, because countries can simultaneously be international investors and recipients of foreign investment. Thus, once again, it is gross capital flows that reflect the exposure of bank balance sheets to foreign inflows. In the event of a sudden capital withdrawal (or a depreciation in the value of bank assets due to large-scale asset sales by foreign agents), even a country with an overall surplus of foreign assets and sufficient liquid assets at the national level is vulnerable to the extent its banking system relies on gross foreign funding. This vulnerability arises because the agent holding foreign assets may not be the same one facing the withdrawal of capital (Obstfeld, 2012). As soon as there are any frictions between domestic sectors, this leads to a reduction in liquidity and lending capacity in the financial sector at the aggregate level. The global contraction in lending becomes a local one.

To test this mechanism, I link bank balance sheets, and specifically the different instruments on their asset and liability sides, to net and gross capital inflows from the Balance of Payments. Bank balance sheets are collected from the League of Nations (1931-1940) and correspond to the data already used in subsection 2.6.1. This data contains a breakdown of the balance sheet into deposits, debt instruments (such as cheques, drafts, acceptances, re-discounts, interbank credit), reserves, and 'other instruments' on the liability side, and loans, securities, cash holdings, and 'other instruments' on the asset side. Both sides sum to the total bank balance sheet size $BBS_{i,t}$.

Eren et al. (2023) establish an accounting identity that allows for the decomposition of (co-) variances across different subsets of a larger total. In my context, this corresponds to the decomposition of the relationship between $BBS_{i,t}$ and capital flows, into the linkages between capital flows and the individual instruments on the balance sheet, such that the instrument specific coefficients by construction add up to the coefficient for the total. This is expressed in Equation 2.13

$$\frac{BBS^j_{i,t} - BBS^j_{i,t-1}}{Total\, BBS_{i,t-1}} = \alpha_i + \beta^j \frac{Credit_{i,t}}{Total\, BBS_{i,t-1}} + u_{i,t}, \tag{2.13}$$

where $BBS^j_{i,t} - BBS^j_{i,t-1}$ refers the one year balance sheet growth of instrument j in country i at time t. This growth is scaled by the total size of the balance sheet in $t-1$. On the right hand side, the familiar gross inflow of capital over a one year period ($Credit_{i,t}$), is likewise scaled by total balance sheet size. All specifications additionally include country fixed effects and values on both sides of the equation are in US-dollars at the 1933 US-dollar to gold parity.

Panel A of Table 2.9 shows in column (1) that one additional dollar of gross capital inflows is, on average, related to a bank balance sheet expansion of 30 cents.[29] This relatively low value can be partially explained by the fact that capital inflows in the Balance of Payments cannot distinguish between capital repatriation and

[29]As mentioned before, this compares to a 97 cents 'pass-through' for US foreign investments, which have a higher likelihood of reflecting transactions captured by bank balance sheets. BoP flows instead also capture foreign direct investment, land purchases, and trade credits.

investment from abroad. Consequently, inflows might even be related to reductions in domestic BBS if banks liquidate their foreign holdings, leading to capital inflows, but reductions in bank balance sheet size.[30] Due to this caveat of the data, a sensible way to check for the existence of a channel from capital inflows to contractionary pressures on bank balance sheets is via maturity mismatches between bank assets and liabilities conditional on the inflow of foreign capital, as outlined above.

Out of the 30 cent expansion conditional on one dollar of additional inflows, 16 are funded with an increase in deposits (column (2)), 9 with an increase via debt instruments (column (3)), and the remainder with increases in reserves and via other instruments (columns (4) and (5)).[31] Except for the low (2 cent) increase in reserves, these results are statistically significant at the 5 percent level. While deposits are undoubtedly a short-term financing instrument, it is unclear of what average maturity the bank debt recorded in the national aggregation of balance sheets is.[32] James (1984) however, vividly describes how the expansion in trade initially enabled banks to expand short-term trade credits and acceptances, which, toward the end of the 1920s, were increasingly repurposed to finance fixed domestic investments, with short-term international obligations. An analysis of the liability side, however, is insufficient to argue for a higher vulnerability of banks due to foreign funding. Columns (6) to (9) therefore look at the other side of the balance sheet and consider in which type of assets the bank invested its additional 30 cents.

Column (6) reveals that slightly less than half of the total increase, 13 out of 30 cents, is related to an expansion in loans, while 11 cents (column (7)) are allocated to investments in securities. With 1 and 4 cents respectively, cash holdings and other instruments experience only marginal growth. Certainly, the transformation from

[30]Capital outflows, similarly, do not distinguish between capital flight and foreign investment, and thus the relationship between capital outflows and bank balance sheet size must not necessarily be negative. If a bank expands its holdings of foreign assets, it may, in fact, be strongly positive.

[31]By construction these coefficients add up perfectly to the change in the total. Any deviations from this parity are due to rounding.

[32]For the case of Germany Collet and Postel-Vinay (2021) and Schnabel (2004) argue that the most common form of foreign investments were in fact foreign deposits in German banks.

Table 2.9: *Foreign capital inflows and changes in bank balance sheet size*

	$\Delta Size_{i,t}$	$\Delta Liabilities_{i,t}$				$\Delta Assets_{i,t}$			
		Deposits	*Debt*	*Reserves*	*Other*	*Loans*	*Securities*	*Cash*	*Other*
Panel A:									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Credit_{i,t}$	0.30**	0.16**	0.09**	0.02	0.03**	0.13**	0.11**	0.01	0.04*
	(0.12)	(0.07)	(0.04)	(0.02)	(0.02)	(0.05)	(0.05)	(0.01)	(0.02)
R^2	0.084	0.050	0.111	0.014	0.034	0.068	0.062	0.001	0.046
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	363	363	363	363	363	363	363	363	363
Panel B:									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Balance_{i,t}$	0.01	0.00	0.01**	-0.01**	-0.00	0.03	-0.01	-0.01***	0.00
	(0.03)	(0.03)	(0.01)	(0.00)	(0.00)	(0.02)	(0.01)	(0.00)	(0.00)
R^2	0.000	0.000	0.008	0.005	0.000	0.008	0.001	0.004	0.001
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	363	363	363	363	363	363	363	363	363

Notes: This table presents 'pass through' coefficients from gross foreign credit (Panel A) and net foreign credit (Panel B) to changes in domestic bank balance sheets (BBS). Bank balance sheet changes are further decomposed into the changes in deposits, debt instruments (including cheques, drafts, acceptances and re-discounts, interbank credit), reserves and other instruments on the liability side and loans, securities, cash and other instruments held by domestic banks on the asset side. Changes are computed based on Eren et al. (2023) as described in Equation 2.13 and the individual components on the asset and liability side both sum to the total bank balance sheet growth in columns (1.) All specifications include country fixed effects. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

deposits on the liability side to loans on the asset side is a transformation of short-term to long-term maturities. If we are to believe Obstfeld (2012), suggesting that international inflows tend to have shorter maturity periods compared to the domestic investments they support, a similar shift is observed in the increase of relatively short-term financing through 'debt instruments' and longer-term investments in securities. Consistent with this perspective, End et al. (2019) document a rapid expansion of internationally traded long-term government debt. While these findings do not permit a causal interpretation, as the precise channel from an inflow of capital to an increase in bank liabilities remains unclear, they do suggest that banks are willing to take on additional risk associated with transforming short-term foreign assets into long-term domestic instruments.

For the interwar period, a similar point has been made by Collet and Postel-Vinay

(2021), who find, for the case of Germany, that sudden capital inflows significantly increased the risk-taking behavior of banks via a rapid increase in leverage. They also find the described transformation of short-term foreign deposits and trade credits into long-term domestic investments, especially in the form of municipal bonds. Both developments contributed to later financial instability and, ultimately, the German banking crisis of 1931. Instead of establishing a direct link from the inflow of capital to the growth in bank balance sheet size, they conduct their analysis based on detailed bank-level information of the German banking system.

Panel B of Table 2.9 replicates the analysis for net capital inflows. While these inflows represent the marginal increase in available capital to a given country, their correlation with bank balance sheet expansions is virtually zero across all specifications. This observation supports the argument presented by Obstfeld (2012) that both surplus and deficit countries can experience expansions in bank balance sheets at the national level. Although preliminary, the findings from this section provide additional evidence that gross capital inflows also play a crucial role in linking global financial developments with domestic risk-taking and financial fragility through balance sheet expansions and maturity mismatches of commercial banks.

2.7.3. Interest payments to foreign creditors

Borrowing today comes with interest payments in the future. What is peculiar about borrowing from abroad is that these interest payments will flow to foreigners. This has long been acknowledged as a drain on national income since it represents the transfer of wealth abroad (Lerner, 1948). More recent authors phrase a similar insight in terms of the different marginal propensities to consume out of additional income between creditors and debtors. In this view, economic activity is suppressed when debtors are financially constrained and creditors have a lower marginal propensity to spend their additional income, resulting in an aggregate loss in demand (Eggertsson and Krugman, 2012). In the case of foreign creditors, this condition likely applies since foreigners presumably have a low propensity to spent their additional income in the countries of their debtors.

My data allows me to directly test the implication of this argument in the context of the Balance of Payments. While gross foreign inflows are recorded in the capital account, the current account, on the other side of the balance, contains information on "interest and dividends paid to foreigners". Column (1) in Table 2.10 confirms the intuition that interest payments to foreigners in $t+1$ increase in past foreign borrowing, indicated by the baseline *credit* variable. In columns (2) and (3) I confirm that this is not a spurious link between two Balance of Payments variables by including net inflows and gross outflows. Past net inflows also have a slightly positive relationship with future interest payments, which makes sense conceptually, since the net inflow of capital ultimately relies on the gross inflow of capital. Further confirming the link between inflows and interest payments is the coefficient for gross outflows in (3) which is closest to zero and statistically insignificant. The inclusion of either variable does not meaningfully change the coefficient for *credit*.

Column (4) tests the second part of the argument, where interest payments to foreigners are assumed to have a negative relationship with future growth, due to a wealth transfer abroad. Here, a high level of interest payments in t is linked to future growth, which indeed produces a large and significantly negative relationship. This negative relationship might be offset if a country in turn receives interest payments on its own foreign lending. Column (5) therefore includes the net interest payments to foreigners, which does not change the coefficient for gross payments in any way. Finally, column (6) includes gross inflows at time t to make sure the negative coefficient is not driven by a mechanical link between current and capital account items within the Balance of Payments. Again, the result for interest payments remains unchanged. The coefficient for credit, despite only covering one year of inflows, retains its negative significance. It is, however, reduced, suggesting that part of the negative effect of foreign borrowing on business cycle dynamics can indeed be

Table 2.10: *Foreign credit, interest payments to foreigners and economic growth*

	Interest Payments$_{i,t+1}$			$\Delta_2 Y_{i,t+2}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Sigma^2_{j=0} Credit_{i,t-j}$	0.48***	0.40***	0.50***			
	(0.09)	(0.09)	(0.10)			
$\Sigma^2_{j=0} Balance_{i,t-j}$		0.12*				
		(0.07)				
$\Sigma^2_{j=0} Debit_{i,t-j}$			-0.08			
			(0.07)			
Interest Payments$_{i,t}$				-0.04***	-0.04***	-0.04***
				(0.01)	(0.01)	(0.01)
Net Interest Payments$_{i,t}$					-0.00	-0.00
					(0.01)	(0.01)
$Credit_{i,t}$						-0.01**
						(0.00)
R^2	0.250	0.259	0.257	0.246	0.248	0.259
Country fixed effects	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓
Observations	330	330	330	325	325	325

Notes: This table shows in columns (1) to (3) that interest payments to foreigners in $t+1$ increase in past gross foreign inflows. In columns (4) to (6) the dependent variable is log GDP growth from t to $t+2$, which is shown to be negatively related to interest payments fo foreigners in t. All specifications control for country fixed effects and two lags of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

explained by interest payments to foreigners.

2.7.4. Findings in modern data

A question remains: how much of the above is a peculiarity of the interwar period, despite its alignment with economic intuition and theory? To address this question I use the OECD (2022) Balance of Payments data, which covers the period from the early 1970's until 2020, in an exercise similar to Broner et al. (2013). This sample of countries contains about twice as many observations as the interwar sample. To confirm the existence of basic BoP mechanics, Figure A8.12 runs local projections for the OECD-sample, corresponding to the specification in Figure 2.5. If anything, the results are more pronounced in the modern sample than in the interwar baseline.

Table 2.11 replicates the baseline from Equation 3.2 using the OECD-sample, as well as the combined dataset. In columns (1) to (4), it shows that cumulative capital flows from t to $t-2$ retain their predictive ability in the OECD-sample, with

Table 2.11: *Capital flows and business cycle dynamics, 3-year cumulative capital flows in OECD data*

	$\Delta_2 Y_{i,t+2}$							
	OECD Sample				*Full Sample*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Balance_{i,t}$	-0.02**		-0.01*		-0.02***		-0.00	
	(0.01)		(0.00)		(0.00)		(0.00)	
$Credit_{i,t}$		-0.03***	-0.03***	-0.04***		-0.03***	-0.03***	-0.03***
		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
$Debit_{i,t}$				0.01				0.00
				(0.01)				(0.00)
R^2	0.189	0.290	0.297	0.292	0.179	0.258	0.259	0.258
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Observations	657	657	657	657	1018	1018	1018	1018

Notes: This table re-estimates the baseline specification for the OECD and the combined sample. The dependent variable is log GDP growth over the period from t to $t+2$. The independent variables are cumulative capital account flows from $t-2$ to t. All specifications control for country fixed effects and a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

coefficients and R^2 being close to identical to the interwar period. Again, neither gross outflows, nor net capital inflows, show significance comparable to gross capital inflows, once the latter are included in the model. Columns (5) to (8) repeat the specifications for the combined sample, now containing over 1000 observations, with identical results.

Table A8.16 uses the combined OECD and League of Nations sample, containing over 70 crises episodes (crisis dating for the OECD sample also relies on the Baron et al. (2021) database), in a probit model. Gross capital inflows again emerge as the most significant predictor of crises. The predictive power, indicated by the AUC, of models containing more than gross capital inflows does not increase when compared to models including only gross capital inflows. Table A8.17 tests if the result of crises being more severe after previous exposure to gross capital inflows holds in the combined sample, using the *GED*-measure. Once again the results are strikingly similar to the interwar period, with the interaction of crises and previous exposure to gross capital inflows adding to the negative link between gross inflows and economic performance.

2.8. Conclusion

The Great Depression as the pivotal event of the interwar years has been studied by innumerable scholars. The classical perspective on by what it was preceded, how it played out and by what it was followed, however, seems to be remarkably consensual (James, 1992). This chapter shows that the established approach from the perspective of international finance, centering on the Gold Standard and net capital flows, can be recreated with novel data from the League of Nations, but also that this approach needs to be expanded. Telling the story of the boom-bust dynamics around the Great Depression requires talking about the boom in gross international credit that went bust.

Enabled by increasing financial integration under that Gold Standard, the global financial cycle and the volume of international capital movements reached its peak in 1929. But while, in theory, global risk sharing and access to an increased pool of potential funding might facilitate higher growth in the future, it turns out that gross capital inflows are robustly related to adverse future outcomes.

Gross capital inflows link international capital flows to economic downturns, financial crises, and are an important factor in determining the severity of post-crisis recessions. This is due to international credit exposing countries to global uncertainty and being prone to capital flight after crises. The relationship cannot be fully captured when focusing solely on net capital flows, as they fail to account for the buildup of foreign debt positions and the potential for net capital flight across countries simultaneously. When considering all types of gross cross-border capital flows, as recorded in the Balance of Payments, the positive implications of international financial integration are inseparable from its negative consequences. Using two instrumental variable specifications, I isolate the component of capital inflows driven by global capital supply, which is unrelated to the domestic economy. In line with intuition, this adjustment corrects the baseline results upwards, which also incorporate idiosyncratic domestic capital demand, and identifies foreign capital supply as the driving force in the negative relationship between borrowing abroad and economic outcomes. These results hold across a battery of robustness checks an in external sample of OECD economies since the 1970's.

The channels through which this relationship operates include the domestic side of the Gold Standard, the expansion of bank balance sheets during the boom, and debt service payments to foreign creditors. These channels represent, in order of appearance, the political failure to respond to the Great Depression, the financial system's failure to cope with the integration into and subsequent severing from the global flow of capital, and the macroeconomic failure to account for the long-run implications of transferring capital from borrowers with a high propensity to consume domestically to foreigners with a low propensity to consume domestically.

Together, my results can be considered as a variation of the Golden Fetters argument (Eichengreen, 1996), because the Gold Standard was instrumental in exposing a country to the documented dynamics via increasing its integration into the global financial system. Simultaneously, it deprived countries of the tools to counter the adverse effects of foreign credit. Not being on the Gold Standard consequently meant having the option of introducing capital account management, which partially protected countries from the adverse effects of gross foreign credit.

3. — When Two Become One

Disclaimer: The majority of the following chapter was written as a joint project with Björn Richter, from the University Pompeu Fabra. A standalone working paper version is available under the title "*When Two Become One: Foregin Capital and Household Credit Expansion*" at `https://ssrn.com/abstract=3817595`.

Rapid credit expansions are associated with banking crises and predictably worse macroeconomic outcomes (Schularick and Taylor, 2012; Mian et al., 2017). To understand these dynamics, recent research has focused on the type of borrower and the constraints they are facing (Mian et al., 2020a; Muller and Verner, 2021; Jordà et al., 2022). However, there is no systematic evidence on who finances credit booms, while the financing counterparty is likely to matter for refinancing risks, the direction of future repayment flows and the transmission of credit expansions to the real economy. Narrative accounts of historical crises emphasize the role of one particular counterparty – foreigners – in financing the booms that precede crises (e.g., Kindleberger, 1978).[1] While an earlier literature found some evidence for this view (see Calvo et al., 1996), after the global financial crisis the focus shifted towards domestic credit as the main culprit, largely neglecting the international dimension (Sufi and Taylor, 2021).

Domestic credit, however, can still be financed by foreigners and this may matter for the macroeconomy. But this channel has been difficult to test. Empirically, the

[1] "*Any reader of this book will come away with the distinct notion that large quantities of liquid capital sloshing around the world should raise the possibility that they will overflow the container*" as noted by Robert M. Solow in the foreword to the recent edition, Aliber and Kindleberger (2015).

main challenge is that credit statistics do not include a breakdown by ultimate financing counterparty that would allow assessing the role of foreign-financed credit. In times of large two-way capital flows among advanced economies (Shin, 2012) this breakdown is crucial to capture the accumulation of gross foreign liabilities that ultimately have to be repaid by domestic borrowers, and to reflect the fragility of financial intermediary balance sheets arising from the transformation of fickle foreign capital into long-term domestic credit (Obstfeld, 2012; Borio, 2016).

In this chapter, I introduce new financial accounts data for 33 countries since the 1970s to study the links between the financing of credit expansions and macroeconomic outcomes. I use this data, newly digitized for the years before 1995, to 'unveil' the balance sheets of financial intermediaries, building on Mian et al. (2020b), and decompose domestic credit by its ultimate financing counterparty: domestic households, the government or the foreign sector. This allows me to trace the transformation of gross capital flows into domestic credit, overcoming the challenges described above. Based on this new decomposition, I can document who financed the secular increase in credit relative to GDP, study the link between credit expansions and business cycle outcomes through the lens of the counterparties financing credit, and investigate the underlying mechanisms.

My results show that domestic household credit ultimately financed from abroad is key: it is both a major driver of the increase in credit-to-GDP ratios since 1970, and the crucial link between credit expansions and business cycle outcomes. Expansions in externally financed household credit are followed by a short-lived boom and a subsequent bust in GDP, and are associated with significantly elevated risk of banking crises. Importantly, neither credit to the non-financial corporate sector nor domestically financed household credit are associated with these dynamics. Focusing on the mechanisms in more detail, I find that the link between foreign-financed household credit and subsequent GDP growth is strongest under fixed and weakest under floating exchange rate regimes. Decomposing GDP, reveals that most of the negative medium term response is due to depressed consumption, which can be linked to debt service payments flowing abroad following a foreign-financed household credit boom. Finally, I exploit supply shocks in the international banking network (based on Amiti et al., 2019) as an instrument, which confirms a strong link going from the foreign supply of funds to domestic household credit and subsequent macroeconomic outcomes.

This chapter thus reconciles the literature on domestic credit expansions and their macroeconomic implications (Schularick and Taylor, 2012; Mian et al., 2017) with the literature on capital flows and the global financial cycle (Calvo et al., 1996; Reinhart and Rogoff, 2009; Rey, 2013). The results show that the combination of the two is crucial. Domestic credit expansions predict lower GDP growth, but only when they are financed with capital from abroad, while capital inflows predict macroeconomic dynamics when large gross flows are used to finance domestic household credit.

Key to the analysis is the unveiling exercise linking borrowers to ultimate financing counterparties, similar to the procedure applied in Mian et al. (2020b) to the United States flow of funds data. Put simply, this methodology assigns credit on the asset side of intermediary balance sheets to the different counterparties that finance intermediary sector liabilities, lifting the veil of financial intermediation. I use the financial accounts data[2] to implement this unveiling approach in a broad panel of OECD countries.[3]

I begin by mapping out the evolution of financial intermediation over the last decades. The textbook model of financial intermediation ties household savings to bank deposits, which in turn finance loans to non-financial corporations. The data

[2]Financial accounts are compiled by statistical agencies as part of the system of national accounts (SNA 2008 and its predecessors) and contain stocks and flows of financial instruments by economic sector: domestic households, the government, non-financial corporations, financial corporations, and the rest of the world (RoTW), where the latter includes all financial relationships of domestic agents with foreigners.

[3]I cross-validate results from the baseline approach used in the broad panel against approaches making use of the more granular data from the U.S. and recent (from the ECB) as well as historical (from the OECD) cross-country data containing granular counterparty information by financial instrument.

suggests that this model was an adequate description of the credit intermediation process until the early 1980s, but it no longer is. On the borrowing side, domestic households play an increasingly important role, as previously documented in, e.g., Jordà et al. (2016). At the same time, the data shows that there has been a shift away from domestic households and towards the foreign sector as a counterparty financing credit.

The growing reliance on cross-border financing has important implications for business cycles. While foreign financing of household debt may allow for better risk sharing, it could also increase the macro-financial vulnerabilities associated with credit. I hence study the role of different counterparties for the relationship between credit expansions and business cycle outcomes and find that the driving force behind the relationship between total household credit and business cycles, documented in Mian et al. (2017), is the foreign-financed component of household credit. It is responsible for the documented short-lived boom in economic activity, as well as the significantly lower economic growth over horizons of more than three years. Importantly, household credit financed by domestic sectors, as well as credit to the corporate non-financial sector, are neither associated with a short-lived boom, nor with the subsequent slowdown in economic activity. The relationship is strongest in countries with exchange rate pegs, while floating rate economies with independent monetary policy seem to be less sensitive to these dynamics.

The following section studies whether intermediation between international capital markets and domestic households through financial sector balance sheets puts a country's financial stability at risk (Reinhart and Rogoff, 2009; Calvo, 2011). I find that funds sourced from abroad and lent out to domestic households are the most important link in the widely documented relationship between credit and crises. Specifications including this single variable achieve higher predictive accuracy than models including non-financial corporate credit decomposed by counterparty, domestically financed household credit, and net capital flows. Intuitively, financing long-term household credit with flighty foreign capital creates maturity mismatches and increases the fragility of financial intermediaries. In line with this idea, the results confirm that the contraction in credit following banking crises is almost exclusively driven by a reduction in credit financed ultimately by foreigners.

What are the economic mechanisms behind these findings? One potential explanation could be that foreigners finance only the largest household credit booms, and business cycle dynamics are linked to size, rather than the financing counterparty of a credit expansion. To study this hypothesis, I focus on a set of large household credit booms and split them by their main source of financing. As it turns out, these large booms are only followed by credit cycle reversals and adverse economic outcomes when predominantly foreign-financed. When financed domestically, they are followed by average growth dynamics.

Which theories predict that the interaction of borrowing sector – households – and financing sector – foreign counterparties – is key for macroeconomic dynamics? Starting from the borrower side, there is a growing literature that incorporates heterogeneity into models of household debt. The idea is that household borrowing today may weigh on future aggregate demand if borrower households are financially constrained or have a high marginal propensity to consume out of their income (Korinek and Simsek, 2016; Farhi and Werning, 2016; Mian et al., 2021). This is because borrowing today comes with future debt service payments to creditors (Drehmann et al., 2017), and the recipients of these payments may consume less of their income. When foreigners are the recipients of debt service flows, they naturally have a low marginal propensity to consume out of their income domestically (presumably even lower than the rich households in Mian et al., 2021).

The results, based on the new decomposition of ultimate financing counterparties, are in line with this channel. When splitting GDP into its components and studying their relationship with foreign-financed household credit expansion, I find that the negative medium-term response of GDP is mostly driven by depressed consumption.

Additionally, debt service payments to foreigners, resulting from foreign-financed household credit, are indeed associated with lower subsequent consumption and GDP growth. Consistent with the finding that the relationship is muted in floating exchange rate economies, this channel could theoretically be offset by monetary policy as argued in Schmitt-Grohé and Uribe (2016). In sum, these results suggest that the counterparty financing credit matters, with foreign counterparties exhibiting a higher propensity to withdraw funding during financial turmoil and a lower propensity to consume the income they receive from debt service payments domestically.

Theoretically, the links between reversals in credit market conditions and debt service on the one hand, and aggregate demand and output on the other, could be countered by monetary policy (see, e.g., Schmitt-Grohé and Uribe (2016)). Due to the open economy trilemma, this option is only available to floating-rate countries. While there is variation between countries regarding the exchange rate regime during the sample period, it is a disadvantage of the post-1970s OECD data that there is little variation in terms of capital account openness. Due to this feature of the sample, I confirm in long-run data from the JST-Macrohistory database (Jordà et al., 2017) that the widely documented negative relationship between credit expansions and the future macroeconomic outcomes (Schularick and Taylor, 2012), is most pronounced under the combination of liberal capital flow regimes and pegged exchange rates.

In the final part of the chapter I employ the Amiti and Weinstein (2018) methodology to construct a measure of foreign supply of capital, and use it as an instrument for foreign-financed household credit expansion. I decompose bilateral international banking flows into a global cycle component, as well as country-specific supply and demand shocks (as in Amiti et al., 2019) and then compute the foreign supply of capital as the combination of country-specific supply shocks from international markets and the global cycle component. This measure, orthogonal to country-specific demand by construction, is then used as an instrument for foreign-financed household credit expansion to better identify the effects of credit supply. Across all specifications the coefficients for instrumented foreign-financed household credit remain highly significant. Moreover, they are larger than the baseline coefficients, suggesting that these specifications, if anything, underestimate the macroeconomic dynamics associated with foreign-financed household credit expansion.

Do market participants and economic forecasters understand the macroeconomic dynamics associated with foreign-financed household credit? When looking at growth forecast errors, the results show that IMF staff forecasts are unaffected by household lending booms financed with foreign capital. Hence, forecasts turn out to be overoptimistic (as for total household credit in Mian et al., 2017). Importantly, this is not the case for domestically financed household credit expansions. Similarly, bank shareholders do not seem to ask for higher compensation during foreign-financed household credit expansions which consequently predict low subsequent returns on bank stocks. This result is similar to Baron and Xiong (2017), but again exclusively driven by the foreign-financed component of household credit. Together, the results suggest that instead of being linked to domestic investment opportunities, foreign financing often reflects capital supply dynamics from the global financial cycle in line with Rey (2013), without expectations adjusting to predictable dynamics associated with these credit expansions.

Contribution to the literature. The chapter contributes to several strands of literature. First, there is a large literature that connects domestic credit market conditions to the business cycle and banking crises. Several papers have linked output dynamics and crisis incidence to rapid credit expansions (Borio and Lowe, 2002; Schularick and Taylor, 2012; Mian et al., 2017, 2020a). Muller and Verner (2021) and Jordà et al. (2022) show that the composition of borrowers during credit expansions matters. On the other side of the financial sector balance sheet, Hahm et al. (2013) and Jordà et al. (2020) highlight the role of liability composition of the banking sector for crisis dynamics. This chapter shows that the identity of the counterparty financing these liabilities is key to understanding the macroeconomic dynamics around credit booms, assigning an important role to foreign counterparties. Studying the transmission channel in more detail, Drehmann et al. (2017) highlight the role of debt service payments of borrowers. This chapter adds that outcomes depend strongly on the counterparty ultimately receiving these debt service payments. This result is in line with a large body of theoretical literature emphasizing heterogeneity in financial constraints or marginal propensities to consume as potential channels for debt to affect aggregate outcomes (Farhi and Werning, 2016; Korinek and Simsek, 2016; Schmitt-Grohé and Uribe, 2016; Mian et al., 2021).

Second, the chapter contributes to the literature linking international capital flows to financial instability. In fact, concerns about imbalances and a global savings glut (Bernanke, 2005) preceded the global financial crisis. In most of the literature studying this question, the focus has been on the current account as a measure of capital flows, which has resulted in mixed findings (Jordà et al., 2011; Kiley, 2021). Gourinchas and Obstfeld (2012) conclude that the empirical evidence for capital flows being associated with crises is much more mixed than for domestic private credit. However, as noted above, credit extended by the domestic banking sector may still be financed externally, with implications for the macroeconomy. The new data allows me to test this prediction for the first time directly.[4] The results show that, once credit is decomposed by counterparty sector, it is exactly the transformation of foreign capital into domestic lending that puts financial sectors at risk (Calvo, 2011). Importantly, I find that this transformation reflects large gross capital flows and is not necessarily captured by net measures (Shin, 2012; Borio and Disyatat, 2015; Borio, 2016).

Third, the chapter also contributes to the literature on liquidity and financial instability. The new measures of credit by financing counterparty capture the refinancing- and run-risks associated with different counterparties (Diamond and Dybvig, 1983).

[4] Previous studies focusing on this channel had to rely on the interaction between measures of capital flows and lending booms, again with mixed results (Benigno et al., 2015; Davis et al., 2016; Caballero, 2016; Mian et al., 2017).

Several recent contributions present micro-level evidence on the run-risk of different creditor groups (Iyer and Puri, 2012; Iyer et al., 2016; Falato et al., 2021; Blickle et al., 2022) and the financial and real implications of the sectoral composition of owners of financial assets (Coppola, 2021; Bretscher et al., 2022). This chapter adds an aggregate view to this literature, showing that banking crises are more likely if long-term household credit is ultimately financed with capital from a particularly run-prone group of investors – foreigners (Broner et al., 2013; Forbes and Warnock, 2012; Caballero and Simsek, 2020). These reversals in the foreign supply of capital also link the findings of this chapter to the literature identifying the lack of credit supply and the forced deleveraging after crises as an important channel from financial fragility to macroeconomic outcomes (Chodorow-Reich, 2014; Huber, 2018).

Fourth, a recent literature has highlighted the important role of a global financial cycle (Rey, 2013; Miranda-Agrippino and Rey, 2020). Bruno and Shin (2015) argue that this cycle is transmitted through the balance sheets of globally operating banks and di Giovanni et al. (2021) show evidence for such a transmission at the micro-level for Turkey. Aldasoro et al. (2020) argue that domestic and global financial cycles come together around crises. My results show that this synchronization results from interlocking balance sheets of domestic households, banks, and the foreign sector, linking the global financial cycle to the macroeconomic consequences of household credit expansions.

More generally, this chapter contributes to the understanding of secular trends in the structure of the global financial system. Several studies have documented the growth of finance in advanced economies (Philippon and Reshef, 2013; Greenwood and Scharfstein, 2013). As shown by Jordà et al. (2016), household credit has been the main driver of increasing debt levels over the past decades. Simultaneously, lending across borders surged (McCauley et al., 2021). The unveiling shows that these trends are two sides of the same coin: household borrowing is increasingly financed across borders, with important implications for financial stability and the macroeconomy.

3.1. Data, unveiling methodology, and trends

The main data source for credit aggregates and their decomposition are sectoral financial balance sheets, which are compiled by statistical agencies as part of the national accounts framework. As a result, the data is fully consistent with other variables used to study macroeconomic effects and transmission channels. The data comes in three distinct formats. The most recent version are the financial balance sheets based on the System of National Accounts 2008 (SNA2008). Before the 2008 revision, financial balance sheets are based on the 1993 version (SNA93). Both series are published online and generally cover most of the post-1995 period for OECD economies.

To extend the coverage of the series, I link this data to *newly digitized financial accounts data* from historical publications of the OECD. This data was published in yearly "golden books" by the OECD up until 1998 (OECD, 1970-1998). A snapshot is shown in Figure A1.13. Since the data is frequently revised and updated, I use the most recent data whenever available, and overlapping years to link variables across data sets and extrapolate recent data backwards with growth rates in historical data. The resulting data set contains an unbalanced panel of 33 countries starting in the 1970s. The SNA08 format roughly covers the period between 1995 and 2019, the SNA93 format the period between 1990 and 2013 and the newly digitized data the period from the 1970's to the 1990's. For the United States SNA08 covers the entire period, providing a template along which variables and definitions can be traced and adjusted. Table A1.18 in the appendix contains an overview of the available years of data for each country. Whenever available, non-consolidated data is used as the baseline.[5]

Financial accounts contain information on stocks and flows of financial instruments by economic sector. This chapter focuses on stocks, which are structured as

[5] I use consolidated data for Australia which does not publish data in the unconsolidated format. In robustness checks, I also confirm that results hold using consolidated data for all countries instead.

sectoral balance sheets.[6] For each sector, the data contains the outstanding amounts of assets (claims) and liabilities by financial instrument.[7] Figure A1.14 provides an overview of sectors and financial instruments available in the baseline data. An important feature of the data is that each claim held by one agent must be recorded as a liability in the balance sheet of some other agent in the economy. As a result, the sum over all sectors of, e.g., deposits recorded as assets must be equal to the sum of all deposit liabilities. Financial relationships of domestic agents with foreign counterparties are recorded in the sector rest of the world. The assets of the rest of the world sector correspond to external liabilities of the respective country reported in the Lane and Milesi-Ferretti (2018) data. All three data sets are structured in the same way, with more recent data expanding on recorded subsectors and financial instruments. Whenever available, this data is complemented with additional counterparty information, i.e. the identity of the sector holding a claim on another sector's liabilities. The baseline unveiling approach does not depend on counterparty data, due to limited availability, but I validate all unveiling results for the subset of observations where granular counterparty data is available.

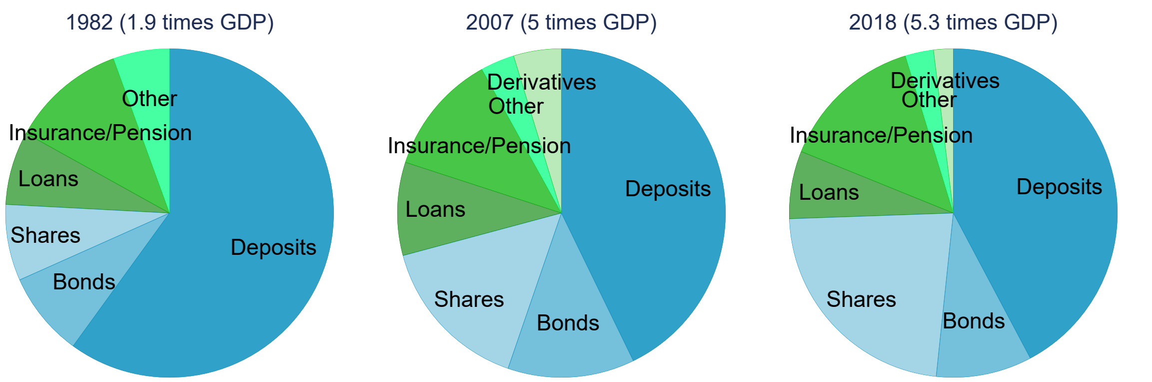
3.1.1. Trends in the raw data

Eventually, I want to establish a link from the borrowings of one sector to the asset holdings of other sectors, who ultimately supply these funds and study trends and cycles in these ultimate borrower-creditor relationships. Changes in borrowing sectors, with households surpassing corporations as the principal debtors over the last decades, have been widely documented (Jordà et al., 2016; Muller and Verner, 2021). At the same time, to fund loans to borrowers, the banking sector increasingly

[6] The baseline set of sectors comprises of domestic households and NPISH, government, financial corporations, non-financial corporations, and foreigners (rest of the world). In many cases, the data contains more granular sectoral information. I exploit this data in a number of robustness exercises for the unveiling.

[7] Reported financial instruments include bonds, loans, shares, deposits, derivatives, insurances, gold/SDR, and other instruments.

Figure 3.1: *Liability composition of the financial sector*



Notes: This graph shows the average composition of total liabilities of the financial sector by financial instrument for a stable sample of countries (Austria, Canada, France, Germany, Japan, Spain, Sweden, and United States) at different points in time. The header contains information on the size of financial sector liabilities relative to GDP.

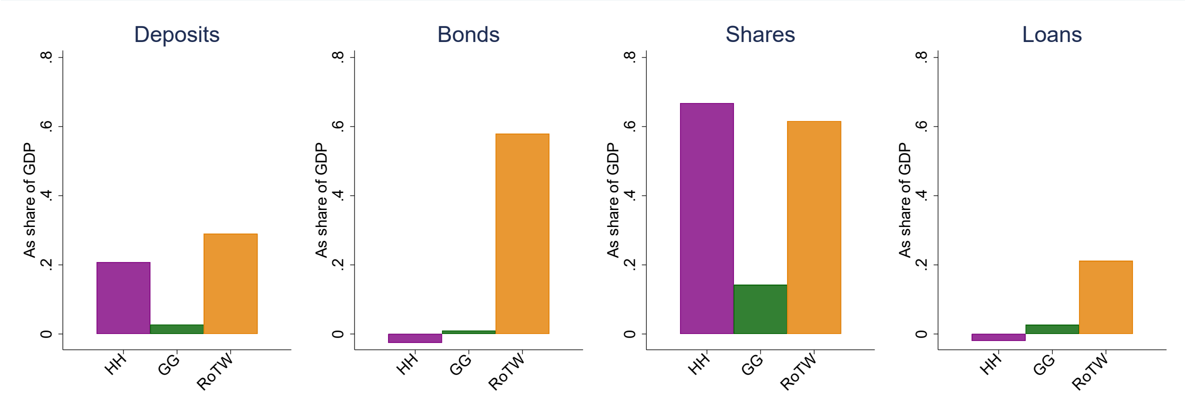
relies on non-core liabilities – non-deposit debt liabilities – as shown in Jordà et al. (2020). In the data, this trend can be seen in Figure 3.1, showing which instruments are used by financial intermediaries to finance their assets, and thereby the loans to households and non-financials. The data display a shift away from deposits and towards financing via bonds and equities. While in 1982 more than 60% of financial sector liabilities were deposits, these only accounted for slightly more than 40% of liabilities on the eve of the 2007/2008 crisis.[8] At the same time, the size of financial intermediary balance sheets relative to the economy increased from a factor of two to more than five.

Accounting dictates that the growth in financial sector liabilities, particularly non-core liabilities, needs to be mirrored in the asset holdings of other sectors. To get a sense of changes in sectoral asset holdings and composition since 1982, Figure 3.2 shows the change in the holdings of the main financial instruments (relative to GDP) for the three ultimate financing sectors.

The ratio of deposits held by the household sector relative to GDP increased on

[8]There are two trends explaining this shift. First, as reported in Jordà et al. (2020) depository institutions have shifted from customer deposits to other sources of funds, especially wholesale funding markets, here reflected by bonds and derivatives. Second, the financial sector increasingly comprises of institutions other than depository institutions which, by definition, do not fund themselves with deposits. It is especially these sub-sectors funding themselves with shares (e.g. different types of mutual funds), leading to an increase in equity financing, while depository institutions operate with comparatively low levels of equity capital.

Figure 3.2: *Change in holdings of instruments 1982-2018 in percent of GDP*



Notes: The figure shows the average changes in asset holdings at the sectoral level for a stable sample of countries (Austria, Canada, France, Germany, Japan, Spain, Sweden, and United States) between 1982 and 2018. The left panel shows the change in the ratio of deposit holdings to GDP for households, governments, and the rest of the world. The other panels show these changes for holdings of bonds, shares, and loans respectively.

average by more than 20 percentage points between 1982 and 2018. Deposit holdings of the foreign sector increased by a similar amount over the same period. Looking at bond holdings in the middle left panel, the picture looks quite different. While households and the government saw little change, there has been an increase in the bond holdings of the foreign sector by about 60% of GDP. Both, households and foreigners, have increased their holdings of shares by more than 60% of GDP between 1982 and 2018. The right panel shows the change in holdings of loans. The foreign sector has increased its loan holdings relative to GDP by 20%. As it held only small amounts of all financial instruments in 1982, these changes imply a strong reallocation towards the foreign sector as a counterparty ultimately financing domestic credit. Financial intermediaries increasingly relied on non-deposit funding to finance credit on the asset side, and foreigners increased their holdings of these instruments in absolute terms and relative to the holdings of domestic agents. The following 'unveiling' describes my approach to study this reallocation in a more systematic manner.

3.1.2. Unveiling

The goal of the unveiling is to allocate credit to households and firms to the counterparty ultimately financing this loan (as done for the U.S. in Mian et al., 2020b) for the largest possible sample of countries.[9] While a loan is normally held as an asset by a bank, the bank is not the ultimate counterparty providing financing. Banks finance loans on the asset side with equity, bonds, deposits or other financial instruments on the liability side of the balance sheet. A loan is thus ultimately financed by the agents that hold the bank's liabilities as an asset. 'Unveiling' the role of financial corporations implies linking the loan to the ultimate financiers. In line with Mian et al. (2020b), it is assumed that ultimate financing sectors (u) can be domestic households, the government, or the rest of the world ($u \in \{HH, GG, RoTW\}$).[10] Corporate sectors (c) that cannot be ultimate counterparties and are unveiled are non-financial and financial corporations ($c \in \{NF, FI\}$). The following section introduces the baseline unveiling procedure, which I label *proportional unveiling*, and its assumptions, in a very abridged fashion.

To allocate credit on the asset side of intermediary balance sheets to ultimate counterparties, we need to know which counterparties are financing intermediary liabilities. This information is, however, only available in a subset of data. I therefore rely on the accounting axiom that every liability is another agent's asset. Given the previously described accounting structure, the data show the liability composition of any given sector, while simultaneously providing information on the asset composition of all other sectors. In the baseline, liabilities are allocated proportionally to the sectoral distribution in holdings of this instrument as an asset. For example, I allocate deposits, used by the financial sector to finance loans, to a counterparty

[9] Unlike Mian et al. (2020b), I do not study the distribution within the household sector.

[10] Previous attempts to quantify the role of the rest of the world as a counterparty for domestic credit relied on net foreign asset positions by economic sector (Blanco et al., 2020) or a combination of direct borrowing from non-resident banks and net foreign financing of the financial sector (Avdjiev et al., 2012). By exploiting the entire balance sheet of all sectors, I can take a more holistic approach to the same question and account for the gross exposures of each sector in individual instruments and document, e.g., the transformation of foreign financing into domestic credit.

sector based on the share this sector has in total deposits in the economy (excluding the financial sector itself). When the household sector holds 70% of all deposits in the economy (excluding deposits held as assets by the financial sector), 70% of the deposit liabilities of the financial sector are assigned to the household sector.

The key assumption being made here is that for a given financial instrument the mix of financing sectors can be computed based on the proportional asset holdings of all other sectors in that instrument.[11] Applying this assumption to data on all available financial instruments (deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, other accounts) I estimate the total pairwise holdings from a sector s supplying financing to a receiving sector r. While in principle allowing all possible $s \to r$ relationships ($(r, s) \in \{HH, GG, RoTW, NF, FI\}$), the direct link from $RoTW$ to HH is set to zero. The reason is that households normally do not directly access international financial markets to borrow.[12] While I believe this to be a reasonable restriction based on observable data, it is important to note that this approach, if anything, underestimates the rest of the world as a funding source for household debt expansions.

To determine the ultimate counterparty financing household and non-financial corporate credit $C^{u \to b}$, with u being the ultimate supplying sector ($u \in \{HH, GG, RoTW\}$) and b the borrowing sector ($b \in \{HH, NF\}$) of credit C, I need to account for both direct and indirect links from u to b. While the direct link above is calculated above, the indirect links still need to be taken into account, which can be very important as credit is usually intermediated. These indirect links can take two forms. First, borrowers and u-sectors could be linked via one intermediary, e.g., domestic households holding deposits of financial intermediaries which then lend to other households. Second, there could be more than one intermediation step: e.g., consumer loans

[11] The same assumption is, e.g., used in Vom Lehn and Winberry (2022) and by the BEA in the context of constructing bilateral sectoral capital-flows tables in the United States.

[12] Whenever counterparty information can be observed in the data, this number is close to zero. Allowing this direct link based on proportionality would therefore likely overestimate the importance of foreign financing for household credit.

to households made by non-financial corporations could be financed with loans from financial intermediaries. To correctly assign credit to the ultimate counterparty, I first estimate the total holdings of u sectors in intermediary corporate c-sectors ($c \in \{NF, FI\}$) and then allocate the claims c-sectors might have on borrowing sectors b proportionally to the u sectors' share in financing c-sectors.

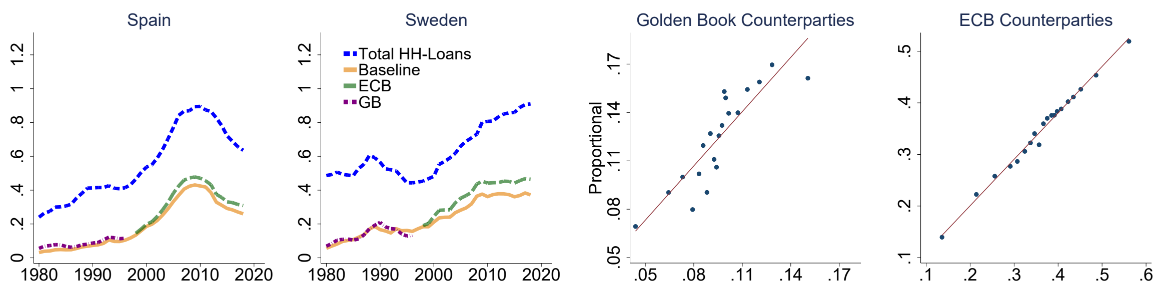
Finally adding up direct and indirect links from $u \rightarrow b$, yields the credit of borrowing sector b, financed by ultimate sector u. Note, that the liabilities of the household sector almost exclusively consist of loans. Corporates, on the other hand, also borrow using other financial instruments. Here, the focus is on loans to be able to allow comparisons with other data sets and results in the literature.[13] Consequently, the final credit variable is denoted as $C^{u \rightarrow HH}$ for households and $C^{u \rightarrow NF}$ for non-financial corporations. A detailed explanation of the baseline unveiling approach can be found in the first part appendix section A2-1.

The baseline unveiling (i) is based on the broadest available sectoral breakdown of sectors. To validate its results I compare them to results using (ii) additional counterparty information, (iii) additional subsector information, (iv) information on the structure of the flow of capital through the economy, and (v) additional data from the Mian et al. (2020b) replication files for the U.S., as well as additional OECD data (see section A2 for details).

(ii) Counterparty unveiling. This first alternative approach resorts to data where counterparty information is available, making the proportionality assumption in the unveiling procedure obsolete. Counterparty data is available from three sources. First, the newly digitized historical data from OECD golden books contain counterparties for some countries, covering the beginning of the sample period. Second, for recent years, detailed counterparty information is available from the ECB's 'who-to-whom-matrices' for Eurosystem countries. Third, the US financial accounts (flow of funds) contain counterparty information which is exploited in Mian et al. (2020b). The left

[13]The main results also hold when including bonds issued by non-financial corporates in $C^{u \rightarrow NF}$.

Figure 3.3: *Household debt financed by the rest of the world, proportional and counterparty unveiling*



Notes: The two left panels show the development of household debt financed by the rest of the world using different unveiling approaches. The short-dashed (blue) line corresponds to total outstanding household debt as a fraction of GDP for comparison. The solid (yellow) line is household debt ultimately financed by the rest of the world based on the baseline unveiling approach. The dotted (purple) line corresponds to an estimate using historical counterparty information. The dashed (green) line employs counterparty data from the ECB financial accounts. The two right panels compare the results using the baseline approach to results using counterparty information in historical OECD data. The right panel compares the baseline approach to results using ECB counterparty data. Observations are collapsed into 20 equal sized bins. Each point represents the group specific means of household credit financed by the rest of the world relative to GDP using the baseline and the respective counterparty approach after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

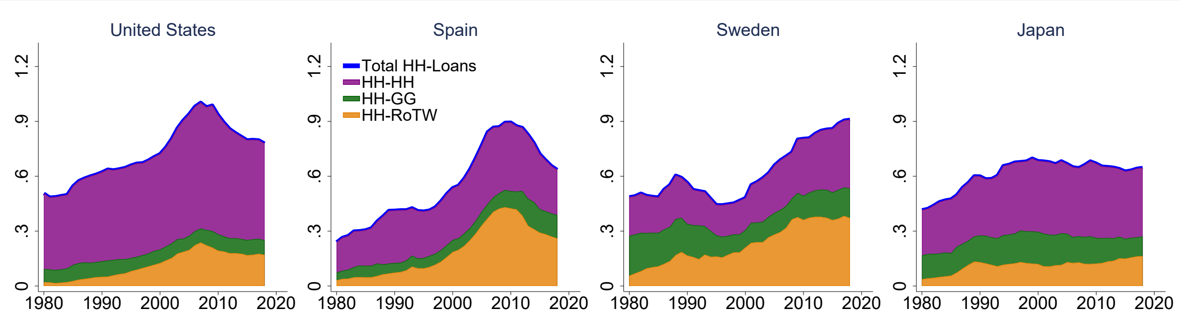
two panels of Figure 3.3 use information from the historical publications and from ECB statistics for cross-validation for Spain and Sweden, two countries for which counterparty information is available from both historical and recent sources. In both countries, the baseline estimate of household debt financed from abroad is almost identical to estimates using either historical or recent counterparty information. More generally, the right two panels of Figure 3.3 show binscatters for the correlation between counterparty-based and the baseline estimates whenever both series are available. As can be seen, the two estimates resemble each other closely. The approach is described in greater detail in subsubsection A2-2.

(iii) Subsector unveiling. The baseline procedure treats the financial sector as a single entity, where it does not matter through which entity or subsector funds enter and leave the financial system. The data, however, sometimes includes additional breakdowns by subsector within the financial sector. The subsector approach exploits this data by looking at the asset and liability composition of each financial subsector individually. It calculates the weighted average financing of every instrument on the asset side of the total financial sector, given the financing structures of its subsectors. This means that the liability composition of the subsector that holds most loans, now matters most when assigning loans to ultimate holders. In doing so, it is assumed that funds are not channeled between financial subsectors, but exit the financial sector through the same subsector that raised them. The subsectors included in this approach are: Monetary Financial Institutions (MFI), Investment Funds (IF), Insurances and Pension Funds (IPF) and Other Financial Intermediaries (OFI). These four subsectors together add up to the total financial sector. The approach is described in greater detail in subsubsection A2-3.

(iv) Structural unveiling. Mian et al. (2020b) use detailed counterparty data from US flow of funds to allocate household debt to ultimate holders, based on the inferred structure of the US financial system. While my data normally contains less information in the large panel, it is possible to impose the structure of the US financial accounts on other countries. In this approach, the financial sector is divided into depository corporations, pensions, insurances, mutual funds, central banks and other financial institutions or pass throughs. The structure changes the assumption of proportional allocation of funds to a hierarchy in which each sector has bilateral relations with only a limited number of other sectors. In later stages of the unveiling process, any sector s that is not one of the three final sectors (HH, GG, RoTW), will be unveiled itself. In this case the total household debt accumulated by s up to that point is summed and divided between the sectors that are permitted to hold assets in s. Finally, the household debt accumulated by the three ultimate sectors $u \in \{HH, GG, RoTW\}$, i.e. the ones that are not themselves divided between other sectors, is summed up over the allocations made in all different stages. Table A2.20 shows the seven stages of the unveiling with r being the sector being unveiled at a given stage and s being the sectors between which it is distributed. The approach is described in greater detail in subsubsection A2-4.

(v) Comparison with Mian et al. (2020b) and additional OECD data. For further verification, I compare the estimates from Mian et al. (2020b), using their replication kit, to the proportional baseline approach. There are some small level differences

Figure 3.4: *Household credit by ultimate counterparty for the U.S., Spain, Sweden, and Japan*



Notes: The figure shows the development of household debt financed by the three final sectors based on the baseline unveiling approach for the United States, Spain, Sweden, and Japan. All series are relative to domestic GDP. Household credit financed from domestic households, the government, and foreigners (RoTW) are shown in purple, green and orange respectively and add up to total household debt (blue line).

in the total household credit series, as they unveil mortgage and consumer credit only, but Figure A2.17 shows that the unveiled series mirror each other closely in levels and dynamics. The baseline relies on non-consolidated data, so for additional robustness, I also replicate my results using the consolidated data series from the OECD System of National Accounts 2008 (SNA08). Using the proportional unveiling with consolidated data, I plot the results against the baseline with non-consolidated data in Figure A2.18, showing that the results are almost identical across datasets. The OECD has also made available a new counterparty dataset under the SNA08 format, but so far, only data for a few countries is available. Employing the previously described counterparty unveiling on this subset of countries, the results are plotted against the baseline in the right panel of Figure A2.19. While the results again confirm the baseline estimates, this figure is not representative for the majority of the data, as the required information is only available for a very small subset of countries.

3.1.3. Trends in the unveiled data

Figure 3.4 shows the results of the unveiling procedure for four countries with data going back to 1980 – the United States, Spain, Sweden, and Japan. The graph shows the development of household credit by counterparty, relative to GDP, since 1980. In

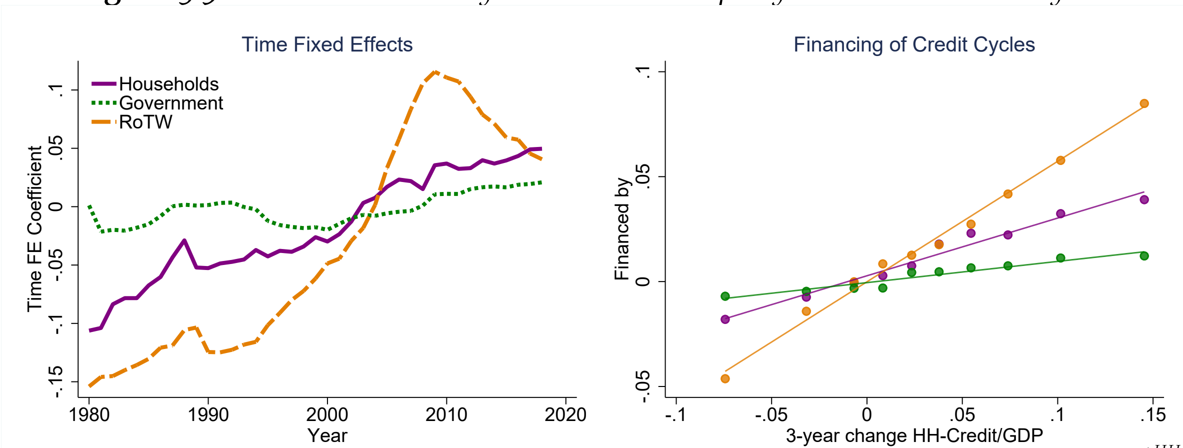
1980, household credit was financed almost entirely by domestic counterparties in all four countries, while foreign counterparties rarely financed household credit. After 1980, all four countries experienced increases in household credit to GDP, although cycles differ. As documented in Mian et al. (2020b), the increase in borrowing of U.S. households between 1980 and 2007 was financed to a similar degree by domestic households and foreigners, with both declining after 2007. Total household credit in Spain displays similar dynamics, but the boom was financed entirely from abroad. In Sweden and Japan foreign financing of household credit increased already before their respective financial crises in the early 1990s. Afterwards, foreign-financed and total household credit remained stable (increased) in Japan (Sweden).[14]

Moving to the full sample, the left panel in Figure 3.5 shows the estimated time effects α_t of a regression of household credit by ultimate counterparty u relative to GDP on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to HH} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government, and the foreign sector respectively. Since 1980, there has been a slight increase in household-financed household debt, while government-financed household credit is almost stable. On the other hand, household credit financed by foreign counterparties increased significantly between 1980 and the 2007/2008 crisis, declining afterwards, but remaining elevated. One concern is that these trends, and the role of foreign capital, could be entirely driven by Euro area financial integration. Hence, in Figure A3.21 I again calculate and plot yearly fixed effects, excluding the Euro area from the sample. Similarly, financial centers with very large RoTW positions (Iceland, Ireland, the Netherlands, Switzerland, and United Kingdom) are excluded in Figure A3.22. In both cases developments look very similar to the ones reported here.

When looking at credit cycle variation, the right panel in Figure 3.5 shows that foreigners are also the marginal counterparty financing credit extended to the

[14] For a stable sample of countries Figure A3.20 displays the total increase in household and non-financial corporate loans relative to GDP along with the sources of funds for this increase. Household debt increased by 30% of GDP since 1980, with foreigners financing the largest share of this increase.

Figure 3.5: *Household credit by ultimate counterparty sector: trends and cycles*



Notes: The left panel plots time fixed effects α_t of a regression of household credit by ultimate sector relative to GDP ($C_{i,t}^{u\to HH}$) on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u\to HH} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government, and the foreign sector respectively. The right panel shows the composition of three-year changes in total household credit by ultimate counterparty. Observations are collapsed into 10 equal sized bins based on three-year changes in the ratio of household credit to GDP. Each point represents the group specific means of three-year changes in total household credit and household credit financed by ultimate counterparty sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

household sector at medium-term frequencies. The graph displays mean values of 3-year changes in the ratio of household credit (x-axis) and household credit by counterparty (y-axis) where the data have been collapsed into ten bins. Focusing on the highest decile, the figure shows that the average three-year change in the ratio of household credit to GDP is close to 15%. Almost two thirds of this increase in credit are financed by foreigners: the average three-year change in household credit funded by the rest of the world for this decile is close to 10% of GDP. Most of the remaining increase is financed by domestic households, while the government does not play an important role as a financing counterparty. Figure A3.23 replicates Figure 3.5 for the non-financial corporate sector, showing that corporate credit is likewise mostly financed with funds flowing in from the rest of the world.

3.2. Sources of credit and business cycles

How do these changes in the structure of financial intermediation affect the macroeconomy? Does increasing reliance on foreign financing alter the links between credit and business cycle dynamics? Recent models that link (household) credit expansion with macroeconomic dynamics usually rely on foreign-financed demand booms (Schmitt-Grohé and Uribe, 2016; Mian et al., 2020a). These are associated with some structural adjustment that is difficult to reverse during dry-ups of foreign-financing Importantly, these models rely on exogenous changes in the (global) supply of capital that is lent to households. Empirically however, this has been difficult to test. Mian et al. (2017) find limited evidence when they analyze accumulated current account deficits as a measure of foreign-financed household credit expansions. The data on credit, disaggregated by the financing sector of funds, allows for a direct test of the hypothesis that capital inflows intermediated to domestic households have consequences for macroeconomic dynamics.

3.2.1. Credit sources and macroeconomic dynamics: main results

To understand the business cycle dynamics associated with credit expansions financed from different sources, household and non-financial corporate credit is decomposed by counterparty sector. I first estimate local projections (Jordà, 2005), including six credit variables (two borrowing sectors b × three ultimate counterparty sectors u) to characterize the dynamics of output following an increase in the respective credit measure

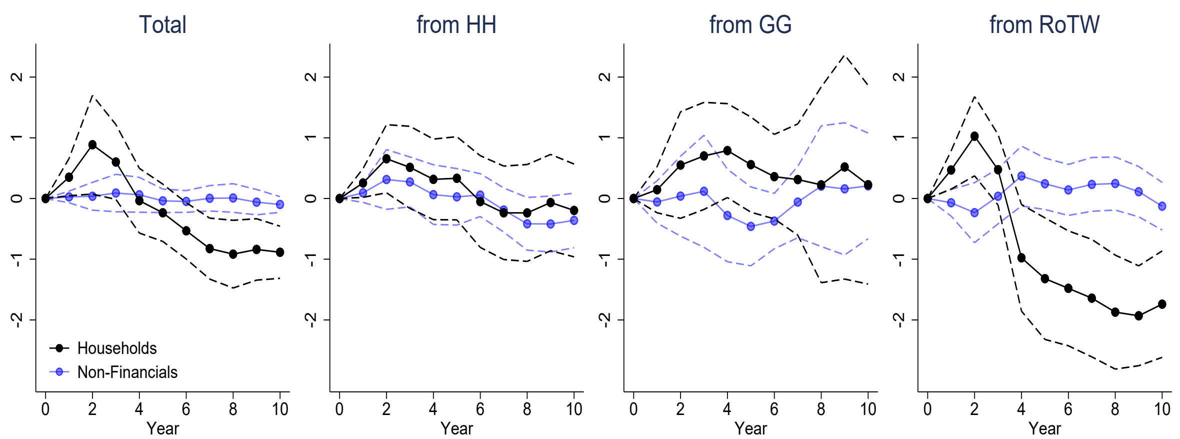
$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \sum_{b \in B} \sum_{u \in U} \sum_{j=0}^{5} \beta_{h,j}^{u,b} \, \Delta C_{i,t-j}^{u \to b} + \sum_{j=0}^{5} \beta_{h,j}^{y} \, \Delta y_{i,t-j} + \gamma X_{i,t} + \epsilon_{i,t+h} \,, \qquad (3.1)$$

where $\Delta_h y_{i,t+h} = y_{i,t+h} - y_{i,t}$ is the growth of log real GDP for $h = 1, ..., 10$. B contains households and non-financial corporates as borrowing sectors and U contains households, governments, and the rest of the world as ultimate counterparty sectors. $\Delta C_{i,t}^{RoTW \to HH}$, e.g., denotes the yearly change in the ratio of household credit financed by the RoTW sector relative to GDP. Ultimately of interest are the $\beta_{h,0}$-coefficients for each of the six sectoral borrower-creditor combinations. The specifications control for contemporaneous GDP growth as well as five lags of GDP growth and of the credit variables. Recently, Brunnermeier et al. (2019) have argued that the response of output to credit is driven by the endogenous response of monetary policy to credit shocks. The estimation therefore includes the contemporaneous values and five lags of changes in short-term interest rates in $X_{i,t}$.

The results are presented in Figure 3.6, showing the response of output to household and non-financial credit financed by domestic households, governments, and foreigners respectively. For comparison, the left panel shows results for a specification that includes total household and non-financial borrowing instead of decomposing these variables by counterparty. The results for this specification in my sample are very close to those in Mian et al. (2017). An increase in household credit (black) is associated with a short-lived boom in economic activity, but the response of cumulative output growth turns negative after year four. Cumulative output growth is then significantly lower six to ten years after the initial increase in household credit. The blue line shows that there is no such relationship for credit to the non-financial sector. These relationships have been demonstrated in Mian et al. (2017), but do the effects also depend on the source of financial funds?

The three right panels in Figure 3.6 show the results from estimating Equation 3.1. All six responses are jointly estimated, but for ease of visibility presented separately by financing counterparty. The second panel shows the sequence of $\{\beta_{h,0}^{HH,HH}\}$ (black) and $\{\beta_{h,0}^{HH,NF}\}$ (blue) coefficients. The two responses are almost identical and an increase in credit financed by domestic households is associated with a small but insignificant increase in output first, and a response close to zero at longer horizons. The middle right panel shows the sequence of $\{\beta_{h,0}^{GG,HH}\}$ and $\{\beta_{h,0}^{GG,NF}\}$ coefficients. Increases in government-financed household credit are associated with a mostly insignificant increase in output until year 4, which reverses in the following years. The coefficients for government-financed increases in non-financial credit are close

Figure 3.6: *GDP responses to changes in credit by borrowing sector and ultimate counterparty*



Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household (black) and non-financial (blue) credit to GDP (left panel). The left panel shows responses to total household and non-financial credit for comparison. The three right panels show responses to increases in the ratio of household and non-financial credit decomposed by ultimate counterparty sector based on Equation 3.1. All six responses are estimated jointly but shown in three panels for better visibility. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

to zero and insignificant throughout. The dynamics for foreign-financed household credit presented in the far right panel are strikingly different. Initially, an increase in household credit financed from abroad is associated with higher output. This is reversed quickly, and starting in year 4 the cumulative response of output to an increase in household credit financed from abroad turns negative. The estimates for horizons larger than 4 years are all significantly negative. Non-financial credit financed by foreigners (blue) is not associated with such dynamics.

In sum, household credit financed by foreigners is strongly associated with a short-lived boom in economic activity followed by a bust, and it emerges as the main driving force behind the association between household credit and business cycles displayed in the left panel (mirroring the results in Mian et al., 2017). At the same time, there is no relationship between credit to the non-financial corporate sector and business cycle dynamics, both in the aggregate or when credit is decomposed by counterparty sector. Hence, in the following analysis the focus will be on the relationship between decomposed household credit and the macroeconomy.

Table 3.1 presents corresponding results from a single-equation model as it is commonly used in the literature (Mian et al., 2017; Muller and Verner, 2021). In particular, it estimates the relationship between three-year changes in household and non-financial credit, decomposed by ultimate financing source of funds, and subsequent real GDP growth and unemployment dynamics using the following specification[15]

$$\Delta_3 y_{i,t+3} = \alpha_i + \sum_{b \in B} \sum_{u \in U} \beta^{u,b} \Delta_3 C^{u \to b}_{i,t-1} + \sum_{j=1}^{3} \beta^y_j \Delta y_{i,t-j} + \gamma X_{i,t} + u_{i,t+3}\,, \qquad (3.2)$$

where $\Delta_3 y_{i,t+3}$ is the growth of real GDP (changes in unemployment) between time t and $t+3$, and $\Delta_3 C^{u \to b}_{i,t-1}$ is the three-year change in credit to borrowing sector b financed by sector u as a ratio to GDP. All specifications control for country fixed effects and lagged dependent variables. The results are presented in Table 3.1. In column (1), $\Delta_3 RoTW \to HH_{i,t-1}$ is the coefficient for lagged three-year changes in loans to the household sector financed ultimately by foreigners relative to GDP. A one percentage point increase in this variable predicts 0.9 percentage points lower output growth over the following three-year window, in line with the dynamic relationship displayed in the right panel of Figure 3.6. The relationship is highly significant and it is robust to the inclusion of year fixed effects in column (2). Like in Figure 3.6, there is no such relationship for other credit variables and a test for the equality of coefficients $\beta^{HH,HH}$, $\beta^{GG,HH}$, and $\beta^{RoTW,HH}$ is soundly rejected.

$\Delta_3 RoTW \to HH_{i,t-1}$ is a measure of gross positions of foreigners that are intermediated through the financial system to domestic households. As discussed earlier, the role of gross capital flows and asset/liability positions has been emphasized after the global financial crisis, while earlier literature focused on net flows, measured as current account dynamics. Column (3) additionally includes changes in the current account to control for net flows. Column (4) further includes changes in financial net worth of the household sector, foreign capital not financing household credit and

[15]All results presented below are robust to the inclusion of non-financial credit decomposed by source sector of funds, which are omitted in some of the following tables to save space.

Table 3.1: *Credit expansion and subsequent macroeconomic outcomes*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.90***	-0.74***	-0.71***	-0.70***	0.30***	0.25***	0.22***	0.20***
	(0.20)	(0.17)	(0.17)	(0.18)	(0.05)	(0.04)	(0.03)	(0.03)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.20	0.20	0.20	0.14	0.04	0.04	0.04	0.04
	(0.17)	(0.13)	(0.14)	(0.15)	(0.06)	(0.06)	(0.06)	(0.06)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.46	-0.28	-0.22	0.10	-0.08	-0.10	-0.13	-0.23*
	(0.30)	(0.28)	(0.27)	(0.31)	(0.09)	(0.10)	(0.10)	(0.12)
$\Delta_3 CA_{i,t-1}$			0.20*	0.15			-0.17***	-0.16***
			(0.11)	(0.10)			(0.04)	(0.04)
R^2	0.351	0.586	0.591	0.616	0.453	0.601	0.625	0.664
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
p-value HH, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Observations	678	664	663	596	634	621	620	566

Notes: This table presents results from estimating Equation 3.2. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector and additional controls include changes in household sector financial net worth and foreign capital not financing household credit (relative to GDP) as well as short-term interest rates. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of credit coefficients by counterparty sector. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

short-term interest rates. The coefficients for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ in columns (3) and (4) are almost unaffected by the inclusion of these variables, suggesting that foreign capital intermediated to domestic households plays an important role that is different from the role of net capital flows, total assets held by foreigners or household sector financial net worth.

The negative relationship between foreign-financed household credit expansion and the business cycle also extends to unemployment, as columns (5) to (8) show. A one percentage point increase in foreign-financed household credit to GDP is followed by an increase of 0.30 percentage points in unemployment between year t and $t+3$. This relationship is robust to the inclusion of year fixed effects and including the full set of additional controls.

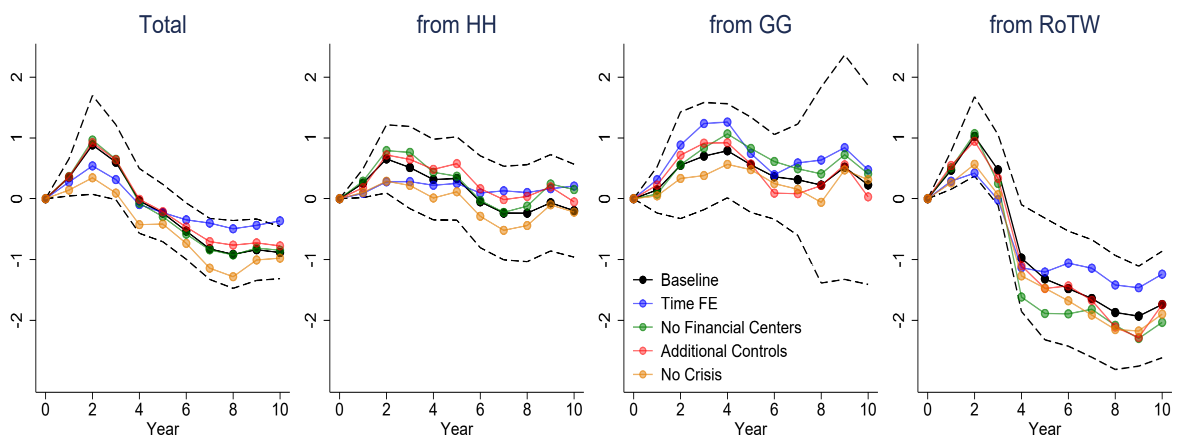
3.2.2. Robustness

This section conducts a battery of robustness checks for these findings. Figure 3.7 shows that the relationships between household credit by source of financing and GDP growth are a robust feature of the data. The panels show the baseline estimates for the relationship between foreign-financed household credit expansion and GDP growth from Figure 3.6 in black. The overlayed colored lines represent added coefficients of several robustness specifications. Red coefficients correspond to specifications that include additional controls: the current account-to-GDP ratio, household sector net financial positions, and foreign capital not financing household credit as in Table 3.1. The graphs show that adding these controls has very little effect on the main results, i.e. household credit financed from abroad contains additional information associated with the boom and bust around credit expansions relative to these other measures.

Figure A4.24 in the appendix shows the responses of GDP to these variables. When included jointly with household credit financed from abroad, the response of GDP to these variables is insignificant. On the other hand, when estimated separately for each variable, including only lags of the variable itself, lagged GDP and interest rate controls (Figure A4.25), the GDP response to the current account is similar as the response to foreign-financed household credit, while financial net worth of the household sector is robustly associated with subsequent GDP growth. Hence, these variables partly capture the relationship between foreign-financed household credit and subsequent macroeconomic dynamics when not including decomposed credit.

The blue line in Figure 3.7 shows that responses are very similar to the baseline estimates, with slightly dampened responses, when adding year fixed effects to the specification. This may, however, underestimate the link between foreign-financed household debt and macroeconomic outcomes, if increases in foreign-financed household credit are driven by global capital supply, as will be discussed later. The estimates plotted in green exclude countries with large foreign sector positions (Ice-

Figure 3.7: *GDP responses to changes in household credit by ultimate counterparty, robustness*



Notes: This figure shows different estimates of impulse responses of real GDP (in %) to increases in the ratio of total household credit to GDP (left panel). The three right panels show responses to increases in household credit decomposed by ultimate counterparty sector based on Equation 3.1. The black line corresponds to the baseline estimates reported in Figure 3.6. Dashed lines represent 95% confidence intervals around this estimate, based on standard errors dually clustered on country and year. Additional specifications include year fixed effects (blue), additional controls such as current account, household net position, foreign inflows not financing household credit (red), excluding financial center countries (green) and excluding three years around a financial crisis (yellow).

land, Ireland, the Netherlands, Switzerland, United Kingdom) from the estimation sample. The specification in yellow excludes a three year window around financial crises from the sample. Both lines show, if anything, a strengthening in the relationship between household credit and subsequent economic outcomes, being close to the baseline estimates. Figure A4.26 in the appendix shows the estimated responses relying on a SVAR-model instead of local projections. The responses look similar to the baseline estimates using this alternative empirical approach. All these tests confirm the main result: household credit funded from the rest of the world is associated with an initial increase in output followed by a reversal that underlies the negative medium-term association between household credit expansion and output reported in Mian et al. (2017).

For the single-equation model, Table A4.21 in the appendix shows that these results are robust to the exclusion of countries with very large rest of the world positions. Table A4.23 shows that foreign-financed household credit expansion in a single variable model achieves an R^2 similar to a regression including all other variables. Table A4.24 shows that the results are robust when utilizing data from alternative unveiling procedures. To make sure that the model does not measure the predictive power of individual credit instruments I split foreign and domestic credit into the instruments byway of which it is raised in Table A4.22. The specification distinguishes between credit intermediated by financial markets (loans, deposits, insurances, pensions, other) and security financed credit (bonds, shares). Again the results are unambiguous. Foreign financed credit, regardless of how it is raised, has a significant negative relation to future output.

3.2.3. Heterogeneity across countries

I now explore heterogeneity in the relationship between credit and output to understand conditions under which these effects are particularly pronounced. This heterogeneity relates to features of the economic system of a country such as exchange rate regimes, financial integration, and size.

Do exchange rate regimes matter? Column (1) in Table 3.2 shows full sample results from estimating Equation 3.2, including the current account. The sample is then split into subsamples of pegged and floating exchange rate regimes, where the pegged sample includes both fixed and intermediate regimes based on the classification in Ilzetzki et al. (2019).[16] This distinction is important, as the relationship between foreign-financed credit expansion and the business cycle, in theory, could be countered by monetary policy.[17] According to the open economy trilemma, the option of using monetary policy is only available to policymakers in floating exchange rate regimes. Without floating exchange rates, countries do not have this

[16] In the sample, Australia, Japan and the United States are consistently classified as floating exchange rate regimes. Furthermore, Canada is classified as floating after 2002, Germany before 1998, and the United Kingdom after 2009.

[17] In Schmitt-Grohé and Uribe (2016) the negative consequences of credit expansions are triggered by hard-to-reverse reallocation dynamics during the boom that are associated with adverse outcomes when the credit cycle reverses. Such reallocation dynamics are identified by Mian et al. (2020a) and Muller and Verner (2021). Table A4.25 shows similar results for foreign-financed household credit expansions in my OECD data. However, there is no strong difference to domestically financed household credit expansions.

Table 3.2: *Heterogeneity in GDP responses to increases in household credit by financing counterparty*

	$\Delta_3 ln(Y)_{i,t+3}$						
		Exchange Regime				Country Size	
Sample:	Full (1)	Float (2)	Peg (3)	Euro (4)	Peg∉Euro (5)	Small (6)	Large (7)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.87*** (0.19)	-0.13 (0.34)	-1.00*** (0.18)	-1.23*** (0.24)	-0.73*** (0.17)	-0.97*** (0.21)	-0.61** (0.15)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.18 (0.17)	0.22 (0.21)	0.06 (0.26)	0.29 (0.43)	-0.16 (0.23)	0.13 (0.26)	0.28 (0.22)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.39 (0.30)	-0.76 (0.57)	-0.33 (0.35)	-0.64 (0.97)	-0.25 (0.31)	-0.35 (0.34)	-0.64 (0.58)
$\Delta_3 CA_{i,t-1}$	0.24** (0.12)	0.55 (0.43)	0.20* (0.11)	0.69** (0.29)	0.10 (0.11)	0.18 (0.12)	0.82** (0.24)
R^2	0.361	0.362	0.405	0.449	0.421	0.378	0.375
Country fixed effects	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓
Mean (in %): $\Delta_3 RoTW \rightarrow HH_{i,t-1}$	2.99	1.75	3.3	4.25	2.59	3.31	2.01
SD (in %): $\Delta_3 RoTW \rightarrow HH_{i,t-1}$	5.53	3.4	5.9	6.36	5.46	5.89	4.12
Observations	667	132	534	233	291	501	166

Notes: This table presents results from estimating Equation 3.2 over different samples. The dependent variables is the growth of real GDP between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

margin of adjustment and have to track policy rate changes in the respective base countries. Columns (2) and (3) in Table 3.2 show that the macroeconomic outcomes associated with credit expansion indeed depend on exchange rate regimes. The coefficient for foreign-financed household credit expansion is closer to zero and insignificant in a sample of floating rates economies (column 2), but negative and significant in economies without monetary autonomy (column 3). Figure A4.27 shows estimates from country level time series regressions, with coefficients for the majority of countries negative and significant. In line with the finding above, floating rate countries have coefficients closer to zero. However, with the exception of Australia, these coefficients are negative and some of them even statistically significant.

Is the relationship only driven by financial integration in the Euro-area? This section explores how the relationship is affected by the introduction of the Euro, where financial integration goes beyond an exchange rate peg. The common currency has been associated with higher volatility of capital flows among member countries

(Kalemli-Ozcan et al., 2010; Fornaro, 2021). This can be seen comparing mean and standard deviation of $\Delta_3 RoTW \rightarrow HH$ at the bottom of Table 3.2, when further splitting observations with an exchange rate peg into Euro and non-Euro pegs in columns (4) and (5). Compared to floating rate countries, but also compared to pegs without a currency union, foreign-financed household credit increased more in Euro-area countries, where it has also been more volatile. Moreover, the common currency is not only associated with higher growth and volatility in foreign funding of domestic credit, the relationship between credit and subsequent macroeconomic outcomes is also stronger in the monetary union. Nevertheless, the coefficient remains significantly negative a sample of non-Euro but pegged economies in column (5). While the mechanisms that link foreign-financed household credit to macroeconomic outcomes seem stronger in a monetary union, they are not limited to these observations.

Are these effects contingent on country size? I define the largest 5 economies in the sample, the United States, Japan, Germany, the United Kingdom, and France as large and the rest of the sample countries as small economies. This distinction is important, as it reflects the potential to finance credit domestically. A large economy, presumably, has more potential to source credit at home, while it seems more likely for small economies to rely on foreign financing. This is reflected by the differences in mean and volatility of $\Delta_3 RoTW \rightarrow HH$ between large and small countries in (6) and (7). The results indicate that the association between credit expansion and output, while felt in both, is indeed stronger in small countries, which are more exposed to the global credit cycle.

3.3. Sources of credit and financial fragility

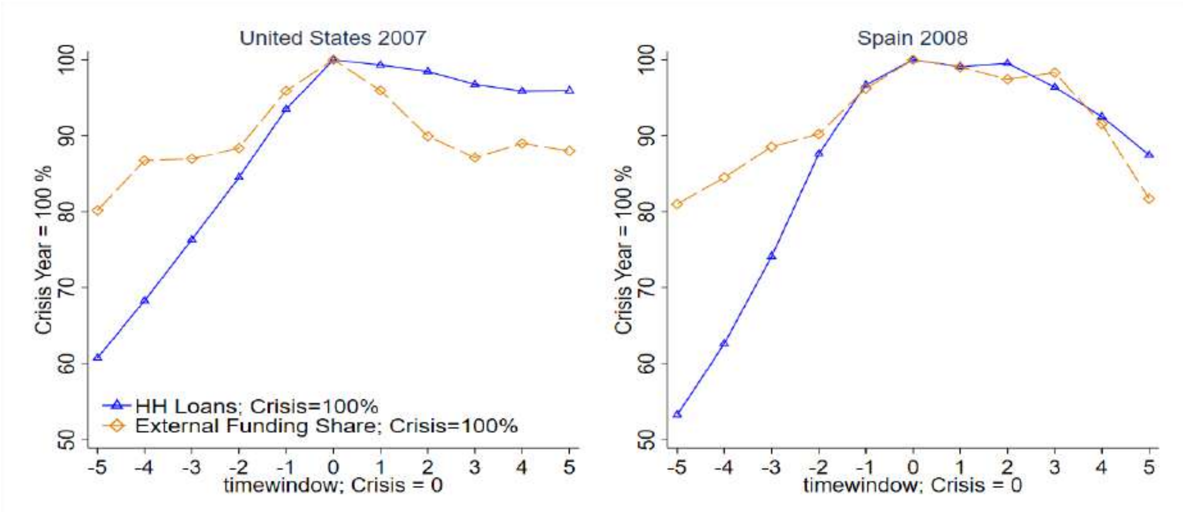
Credit expansions have been shown to predict banking crises (Schularick and Taylor, 2012). Rapid inflows of capital from abroad and the transformation into private domestic credit are one potential channel, but empirical studies have had mixed success in linking capital inflows to credit booms and banking crisis events. One explanation is that the capital flow measures used, mostly based on the current account, do not necessarily reflect the transformation of foreign capital into domestic credit. The following section studies whether my new measure of credit decomposed by financing sector helps predict banking crisis events and whether it allows us to understand what happens to credit intermediation after banking crises.

3.3.1. Case studies

Before turning to a more systematic prediction of crises based on the 'unveiled' variables and later studying the development of credit after a crisis has occurred, this subsection shows two case studies to highlight the main developments. Both the global financial crisis, as well as the Scandinavian crisis, have been associated with large inflows of foreign capital in the years preceding the crisis, as well as a rapid expansion in household debt. As already shown, international markets are the main creditors to domestic credit expansions in the short to medium term. To visualize these developments, Figure 3.8 constructs a time interval from $[t-5, t+5]$ around a financial crisis as defined by Baron et al. (2021), as well as the external financing share of this debt, equal to 100% in the year of the crisis. By using shares of external funding instead of levels (as done for household debt to GDP), the amount of household credit being supplied domestically is implicitly taken into account.

As can be seen from Figure 3.8, both the United States and Spain experienced the described booms, with the peak being reached in the year of the crisis. In both cases, household debt increased by roughly 40% in the 5 years preceding the global financial crisis. If this boom had been financed in equal measure via domestic and international sources, the share of external financing would have remained constant; instead, it rose by around 20% in both countries. This means that the debt newly incurred in the years immediately preceding the crisis was predominantly financed internationally. In line with the argument of international capital being a short- to medium-term source, its share fell after the crisis. If domestic and foreign capital

Figure 3.8: *The United States and Spain in the Global Financial Crisis*

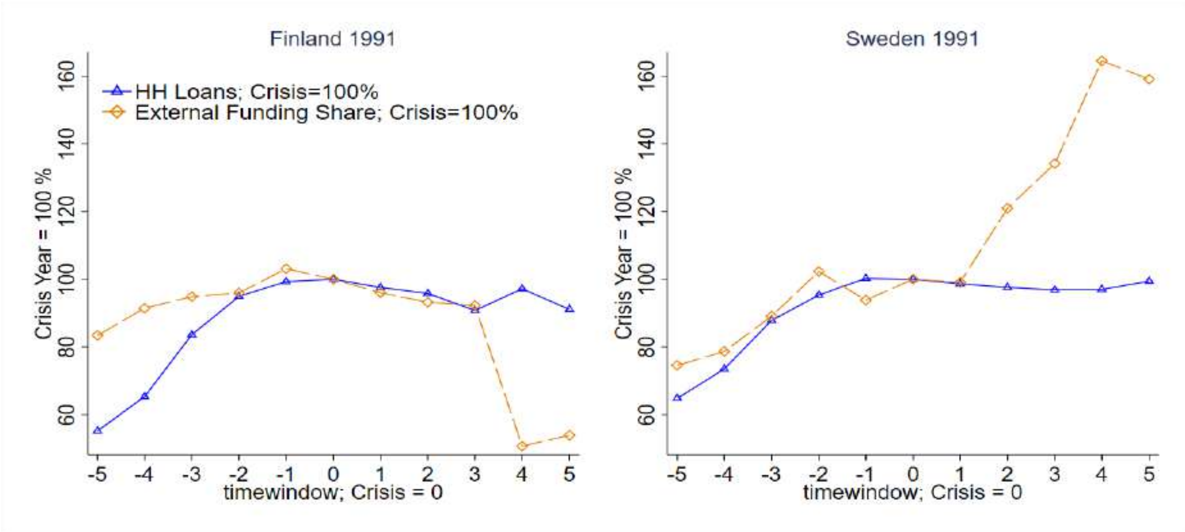


Notes: This figure shows the development of total household debt to GDP (blue) and its external funding share (orange) for the United States and Spain in an interval around their respective starting years of the global financial crisis. Both variables are standardized to equal 100% in the year of the crisis itself.

would have been withdrawn in equal measure as households were deleveraging (indicated by the falling blue line), the share would again have remained constant. A falling share instead indicates that it was predominantly international capital that was being withdrawn.

Figure 3.9 plots the same variables around the Scandinavian crisis of 1991. For Finland, the patterns are comparable in both timing and magnitude. Sweden, on the other hand, only fits the pattern in the run-up to the crisis, even showing the largest increase in the share of foreign capital (starting at below 80% of the crisis level) but diverges afterward. While household debt stagnates or slightly decreases, its internationally held share starts increasing again one year after the crisis. Based on these four examples, the pattern and predictive power of household debt and international credit in the run-up to a crisis seem to be consistent and robust, not only across countries but also across crises. For the development of credit after a crisis, it seems clear that households tend to deleverage, but it is less clear through which channel this is happening. While disintermediation of credit through international financial institutions seems to be an important force, there may potentially be exceptions to this trend.

Figure 3.9: *Sweden and Finland in the Scandinavian Financial Crisis*



Notes: This figure shows the development of total household debt (blue) and its external funding share (orange) for Sweden and Finland in an interval around their respective starting years of the Scandinavian financial crisis. Both variables are standardized to equal 100% in the year of the crisis itself.

3.3.2. Predicting banking crises

To formally study the pre-crisis dynamics of disaggregated credit relationships, I now turn to the standard crisis prediction framework, and ask whether the financing counterparty of credit contains information about crisis risk that goes beyond the information contained in aggregate credit variables. Specifically, I estimate a probit model for a systemic financial crisis starting in country i in year t (based on the Valencia and Laeven (2012)-chronology that covers all sample countries), denoted by the indicator variable $B_{i,t}$ conditional on lagged observables $X_{i,t-1}$

$$Pr[B_{i,t} = 1 | X_{i,t-1}] = \Phi(\boldsymbol{\beta} X_{i,t-1}), \tag{3.3}$$

where $X_{i,t-1}$ includes the three-year changes in credit relative to GDP, with credit disaggregated by borrowing sector and financing source. $\boldsymbol{\beta}$ denotes the vector of coefficients of interest for the various specifications.

For comparison with counterparty estimates, column (1) in Table 3.3 reports mean marginal effects of changes in the ratio of total household credit to GDP between $t-4$

and $t-1$ on crisis likelihood in year t. An increase in the ratio of household credit to GDP is associated with significantly higher crisis likelihood. Three-year changes in credit to non-financial corporates are also associated with significantly elevated financial crisis risk (as recently argued in Greenwood et al., 2020 and Muller and Verner, 2021). As a measure of net capital inflows commonly used in the literature, the three-year change in the Current Account is also included. The coefficient is negative, but insignificant as found in previous studies.[18] All specifications report the AUC-statistic (*area under the curve*), which is a benchmark-summary of predictive accuracy that allows for the evaluation of predictive performance across specifications. The AUC-statistic is 0.5 for a model that does not add any predictive accuracy (a coin toss), and it approaches 1 for models that are perfectly able to sort the data into crisis and no-crisis bins. The benchmark model in (1) including three-year changes in household and firm credit as well as three-year changes in the current account has an AUC of 0.74, a significant improvement relative to the 0.5 random AUC. Column (2) additionally includes country fixed effects. The number of observations is decreasing since some countries did not experience a financial crisis in the sample period. Furthermore, the AUC is slightly higher, as fixed effects add some ability to sort the data into the crisis and no-crisis bins. The findings are, however, unchanged. Household credit expansion, and to a lesser extent credit to the non-financial sector, predict banking crises. Changes in the size of the current account relative to GDP have the expected sign, but as often in the literature, the link is statistically weak and insignificant.

Column (3) decomposes credit by ultimate counterparty sector and displays separate coefficients for all six lender-borrower pairs. The results suggest that the baseline relationship between expansions in household credit and crisis is driven by the component of household credit financed by foreigners. A one standard deviation (6.2 percentage points) increase in the ratio of household credit funded by foreigners

[18]Including three-year accumulated current account levels instead of changes does not affect these results.

Table 3.3: *Predicting banking crises*

	Benchmark		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.24***	0.46***						
	(0.07)	(0.18)						
$\Delta_3 NF_{i,t-1}$	0.04**	0.14*						
	(0.01)	(0.08)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.47***	1.15***	0.44***	1.23***		
			(0.11)	(0.27)	(0.08)	(0.26)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.36	-0.37			-0.09	0.05
			(0.35)	(0.57)			(0.33)	(0.52)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.05	-0.09			0.06	0.08
			(0.23)	(0.40)			(0.26)	(0.39)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.04	0.06			0.06**	0.32**
			(0.04)	(0.10)			(0.03)	(0.14)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.16	-0.04			-0.21	-0.82
			(0.40)	(0.75)			(0.35)	(0.72)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.07	0.20			0.05	0.13
			(0.13)	(0.20)			(0.16)	(0.27)
$\Delta_3 CA_{i,t-1}$	-0.16	-0.26	-0.15	-0.21			-0.30*	-0.60*
	(0.16)	(0.34)	(0.17)	(0.36)			(0.18)	(0.32)
AUC	0.74	0.77	0.80	0.84	0.80	0.83	0.74	0.78
s.e.	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.05
Country fixed effects		✓		✓		✓		✓
Observations	739	534	739	534	739	534	739	534

Notes: The table shows probit classification models where the dependent variable is a banking crisis dummy based on Valencia and Laeven (2012). Coefficients shown are mean marginal effects. AUC is the area under the ROC-curve and below is its standard error. Columns (1) and (2) show results including three-year changes in total household and non-financial credit as a benchmark. In columns (3) and (4) credit variables are decomposed by ultimate counterparty. Columns (5) and (6) only include RoTW-financed household credit and (7) and (8) all other variables (excluding RoTW-financed household credit). Clustered (by country) standard errors in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

is associated with a 3 (= 6.2×0.47) percentage points higher likelihood of crisis. Given a sample frequency of about 3.5%, crisis risk almost doubles. Three-year changes in all other credit variables, as well as changes in the current account are insignificant. In terms of predictive accuracy this model performs significantly better than the model in (1) as indicated by the increased AUC of 0.80. The results in (4), including fixed effects, are very similar, also improving predictive accuracy relative to the model in (2).

Where are these improvements in predictive accuracy coming from? To answer this question, column (5) includes only a single variable, the three-year change in household credit financed by foreigners. The coefficient remains similar to column (3), and more importantly, predictive accuracy is almost the same. A single-factor model, including only household credit expansion financed by the rest of the world, contains almost the same amount of information on crisis likelihood as a model additionally including changes in household credit financed from other sectors, non-financial credit decomposed by source, and the current account. To further illustrate this point, column (7) shows results from a model excluding only three-year changes in household credit funded by the RoTW from the specification in (3) and the AUC drops to 0.75. Together, these results suggest that RoTW-financed household credit expansion contains information on crisis likelihood not contained in other credit measures. The coefficient estimates of the current account and non-financial credit financed externally are slightly significant in (7). Hence, they seem to capture some of the information on foreign funded household credit, albeit very imperfectly (as indicated by the low AUC). These findings are robust to the inclusion of fixed effects in columns (6) and (8).

Robustness. The appendix contains several robustness checks to ensure that results are not driven by the choice of specification or variable definitions. In Table A5.26 I estimate a linear probability model with country fixed effects instead of a probit model and Table A5.27 employs the alternative Baron et al. (2021) chronology for banking crises and panics. In all these specifications, household credit funded by the rest of the world is highly significant and the most important link between credit and crisis, as indicated by the AUC across models.

Discussion. Why does household credit financed by foreigners perform so well as a crisis predictor, while the previous literature found only mixed evidence? First, this measure has the advantage of capturing gross capital flows, not reflected in the current account. These gross exposures play an important role for financial stability, as they capture maturity and currency risks associated with intermediation of foreign savings to domestic households. Household credit in most countries consists of long-term mortgages. Naturally, crisis risk is particularly pronounced when long-term credit is financed short-term, with fickle foreign capital. Second, the unveiling approach has the advantage that it captures funding provided by foreign capital regardless of financial instrument and intermediary used. During the run-up to the 2007/2008 financial crisis, e.g., there was significant heterogeneity in the specific financial arrangements used to intermediate foreign funding to domestic households. Finally, the unveiling approach allows me to focus on the underlying financial relationship between ultimate borrowers and savers, while previous literature did not have one combined measure of these two components.

The downside is that the OECD data only covers a set of advanced economies over the last decades. Since financial crises are rare events, this implies that the results are based on a limited number of financial crises. However, recent long-run evidence on bank liability structure around financial crises is consistent with the patterns described here. Jordà et al. (2020) decompose bank liabilities into capital, deposits and non-core liabilities. In line with the findings here, they argue that increases in the domestic loans-to-deposits ratio, i.e. loans financed increasingly with financing sources other than domestic deposits, are associated with higher crisis likelihood. Hahm et al. (2013) find similar evidence focusing on non-core bank funding in a recent cross-country panel. These results map directly into the relationships documented here.

3.3.3. Sources of deleveraging after crises

What happens once a crisis occurs? Banking crises are often characterized by increases in the price of credit (Krishnamurthy and Muir, 2017; Romer and Romer, 2017) and disintermediation (Jordà et al., 2013). The following exercise asks, whether this disintermediation is specific to foreign-financed credit, since gross capital flows are known to dry up during periods of financial turmoil (Broner et al., 2013). Using the decomposition of credit by source of financing, Equation 3.4 runs local projections of the form

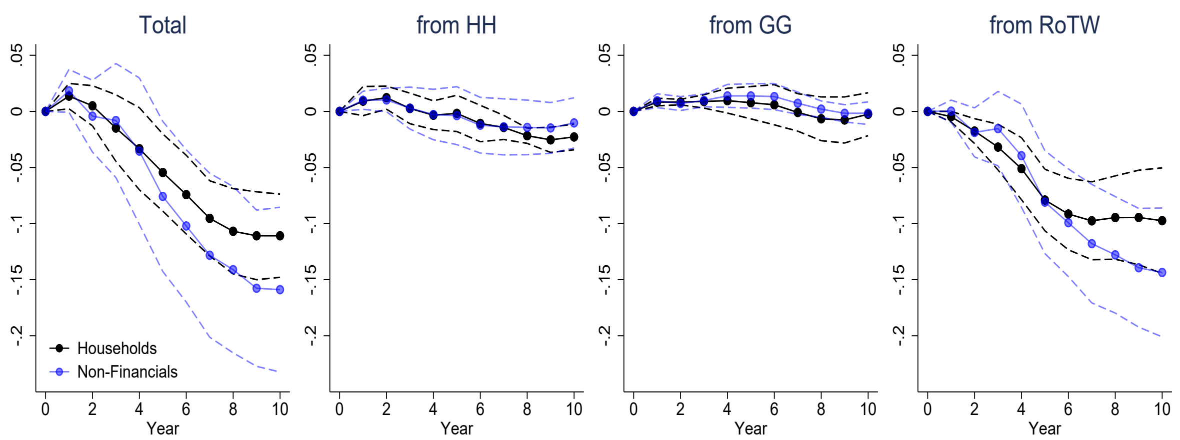
$$\Delta_h C^u_{i,t+h} = \alpha_{i,h} + \sum_{j=0}^{5} \beta^{BC}_{h,j} Crisis_{i,t-j} + \sum_{j=0}^{5} \beta^{u}_{h,j} \Delta C^u_{i,t-j} + \sum_{j=0}^{5} \beta^{y}_{h,j} \Delta Y_{i,t-j} + \epsilon_{i,t+h}, \quad (3.4)$$

where dependent variables $\Delta_h C^u_{i,t+h}$ are changes in the ratio of different measures of credit relative to GDP in country i between time t and time $t+h$. $\beta^{BC}_{h,0}$-coefficients measure the response of the respective credit measure towards a crisis event over varying horizons h. The results are plotted in Figure 3.10 and provide an account of financial intermediation after a banking crisis.

The left panel shows the response of total credit to households and to the non-financial sector to a banking crisis. Following a crisis, loans to the household sector, relative to GDP, slightly increase in the first year, before they start declining in the following years. Ten years after a crisis the ratio of household credit to GDP, on average, decreased by ten percentage points, non-financial credit even more. In the three right-hand panels I repeat this exercise decomposing credit by counterparty sector. To allow comparisons, all graphs are plotted on the same scale. The right panel reveals which financing sector is behind the decline in credit. The ten percentage point difference for household credit in the left panel is almost entirely explained by the decline in credit financed with funds from abroad. Credit financed by domestic sectors does not decline significantly. In fact, the ratio of government-financed credit to GDP is increasing in the first years after financial crises. These effects are, however, difficult to observe in the graph, as they are an order of magnitude smaller than the decline in credit financed by the foreign sector.

Taken together, foreign-financed household credit expansion emerges as a strong predictor of financial crises, driving the previously documented relationship between aggregate credit and crises. It is also this foreign funding that turns out to be most flighty in periods of financial distress. Hence, crises after credit expansions ultimately financed by foreigners are associated with stronger post-crisis deleveraging.

Figure 3.10: *Change in credit after crises by borrowing and ultimate counterparty sectors*



Notes: This figure shows estimates of responses of household credit (black) and non-financial credit (blue) to a financial crisis based on Equation 3.4. The left panel shows total credit for comparison, the three right panels divide credit by ultimate counterparty sector. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered by country and year.

This deleveraging again may have adverse effects on the real economy (see, e.g., Chodorow-Reich, 2014; Huber, 2018).

3.4. Why is foreign-financed household credit linked to macroeconomic dynamics?

How is foreign capital that finances domestic household credit expansions linked to adverse macroeconomic dynamics? Is it just that foreign-financed household credit proxies for large credit booms and therefore moves most around boom- and bust cycles, or are there particular frictions associated with households indirectly borrowing from foreigners? In the following section these two possibilities will be evaluated.

To distinguish between them, this section first looks at the largest household credit booms and studies their association with macroeconomic outcomes depending on their main source of financing. In a second step, it considers further channels where the financing counterparty matters. In models of small open economies, such as Schmitt-Grohé and Uribe (2016), low interest rates in international financial markets cause domestic credit booms financed from abroad and increase demand in the short run. However, this increases the exposure to reversals in international credit market conditions. Consequently, a first test consists of assessing whether a higher share of foreign financing is associated with a higher likelihood of credit market reversals, going beyond the set of crisis observations studied in the previous section. Recent evidence for the bond market suggests that foreign investors have a relatively high demand elasticity (Bretscher et al., 2022) and might therefore be more likely to quickly withdraw funding for credit to the household sector.

Furthermore, as argued in Drehmann et al. (2017), borrowing today comes with debt service payments in the future. When borrowing is financed by foreign counterparties, this implies that future debt service payments will flow to foreigners, reducing consumption of constrained households. Foreigners receiving these payments, on the other hand, are less likely to consume this income domestically. Consequently, I look at the dynamics of individual GDP components around foreign-financed credit expansions (focusing especially, but not exclusively, on consumption), and analyze the role of debt service payments in these dynamics.

3.4.1. Booms and non-linearities

Are foreign-financed credit expansions just larger? It could be that foreign credit supply is more elastic than domestic financing, and, hence, contributes a disproportionate share of the financing during very large credit expansions. In this scenario, foreign-financed credit would simply be a proxy for the largest credit expansions which might be associated with negative macroeconomic outcomes. To evaluate this hypothesis, I follow Greenwood et al. (2020) and identify booms as periods where the three-year change in household credit to GDP is above the 80th percentile of the observations in the baseline specification in Table 3.1. For households this corresponds to the three year change in household credit to GDP being above 9.5%, for non-financial corporations above 11%. Booms in which more than half of this

Table 3.4: *Household credit booms and subsequent macroeconomic outcomes*

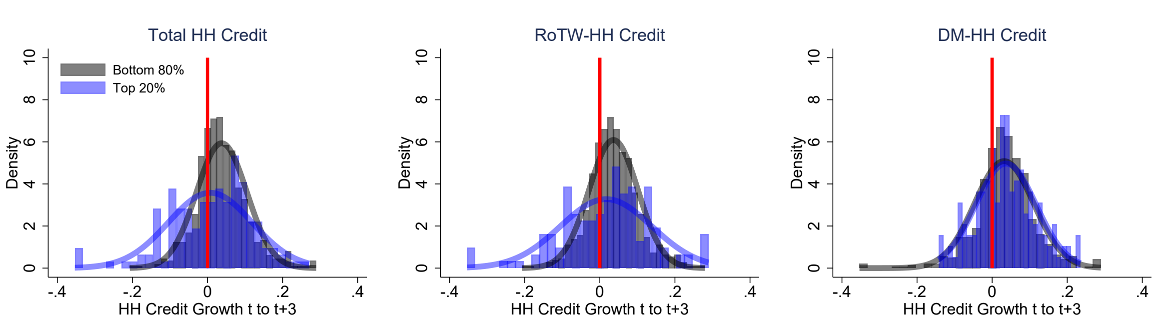
	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$HH\ Boom_{i,t-1}$	-0.07***	-0.06**			0.02**	0.02**		
	(0.02)	(0.02)			(0.01)	(0.01)		
$RoTW \rightarrow HH\ Boom_{i,t-1}$			-0.10***	-0.08***			0.04***	0.03***
			(0.03)	(0.03)			(0.01)	(0.01)
$DM \rightarrow HH\ Boom_{i,t-1}$			-0.03	-0.02			0.01	0.00
			(0.02)	(0.02)			(0.01)	(0.01)
R^2	0.244	0.299	0.271	0.321	0.308	0.395	0.347	0.420
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Boom		✓		✓		✓		✓
Additional Controls		✓		✓		✓		✓
p-value HH, $\beta_{DM} = \beta_{RoTW}$			0.01	0.03			0.00	0.01
Observations	667	667	667	667	623	623	623	623

Notes: This table presents estimation results from a regression of the three year change in log real GDP (unemployment rate) on different classifications of credit booms. An episode is classified as a boom, if the increase in total credit (HH and NF) over the past three years has been above the 80th percentile of the regression sample. Booms with more than half of this increase financed from abroad are then labeled as foreign-financed and others as domestically financed. Specifications control for identically defined booms in non-financial credit when indicated. LDV refers to a distributed lag of the dependent variable and the reported p-value to a test for the equality of the coefficients. Additional controls include changes in household sector financial net worth, foreign capital not financing household credit (relative to GDP) and the current account. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

increase has been financed from abroad are then labeled as foreign-financed (84 out of 135 household credit boom observations). In the raw data, the average growth rate of real GDP over the three years following a foreign-financed boom is 0.1%, while it is 5.7% when a domestically financed household credit boom is detected, and 7.9% when household credit expansion is below the boom threshold. Table 3.4 shows the negative link between household credit booms and GDP growth in columns (1) and (2), now using a boom dummy as the independent variable. Splitting booms by major source of financing in (3) shows that large household credit booms that are predominantly foreign-financed, are associated with 10% lower three-year GDP growth. While domestically financed household credit booms are also associated with slightly negative subsequent GDP growth, this effect is insignificant and, more importantly, significantly different from foreign financed booms. I find similar results when looking at changes in unemployment following large household credit expansions in columns (5) to (8).

Going beyond the largest credit expansions, Table A6.28 in the appendix studies

Figure 3.11: *Household credit expansion distributions, conditional on share of foreign financing*



Notes: This figure shows the distribution of household credit expansion over the period t to $t+3$. The distribution is shown for two groups of observations, comparing observations that were in the top quintile (top 20%) of total-, foreign- and domestic financed household credit in $t-1$ to all other observations, in the left, middle and right panel respectively. The normal distributions, modeled on mean, standard deviation, and range are overlayed in the respective colors. The distributions are winsorized at the 0.5 and 99.5% levels.

potential non-linearities in a more general setting, including all decomposed credit variables. Specifically, it addresses the question, if there is a difference between effects when credit expands ($\Delta_3 C^{u \to b} \geq 0$) compared to deleveraging ($\Delta_3 C^{u \to b} < 0$). These specifications show that the relationship between GDP and foreign-financed household credit is driven by increases, while decreases, just as any other credit variable, are unrelated to future GDP growth.

3.4.2. Reversals

To see how the exposure to credit cycle reversals depends on the counterparty financing credit, Figure 3.11 plots the distribution of future changes in household credit to GDP between t and $t+3$, depending on outstanding household credit at $t-1$. In the left panel, I compare the observations with high household leverage (i.e. the ratio of household credit to GDP is in the top quintile) in blue to all other observations (grey). The graph shows that, when household leverage is high, the mean of future household credit expansion is shifted slightly to the left, but more importantly, that the dispersion is much higher, with significantly more mass on large household credit contractions. The middle graph shows the same pattern when splitting the sample based on foreign-financed household credit to GDP: when foreign-financed household credit to GDP is high, dispersion of future household credit growth increases, and the likelihood of a reversal with large negative changes in household credit to GDP increases. When looking at domestically financed household credit in the right panel, no comparable pattern is evident. Taken together, the results suggest that foreign financing of household credit is associated with a higher likelihood of household credit cycle reversals.

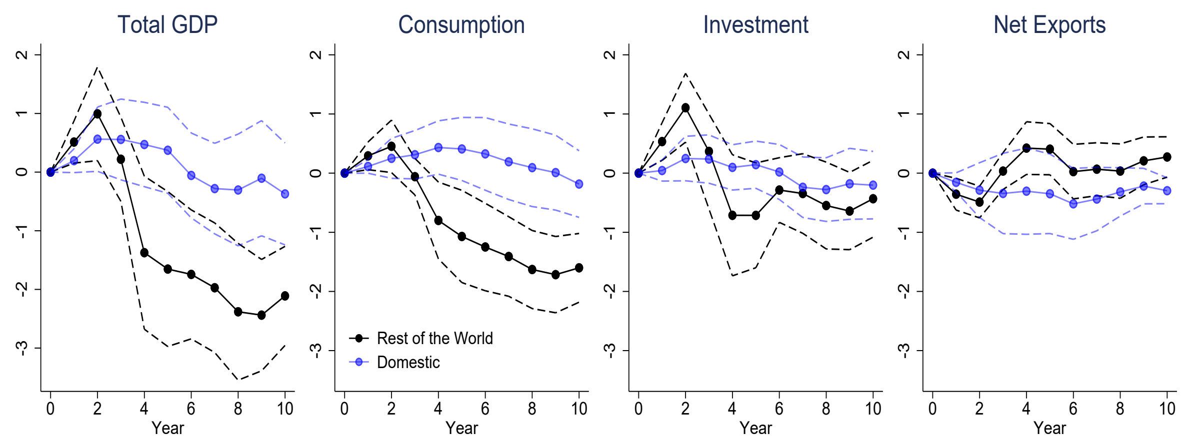
3.4.3. Decomposition of GDP responses

To better understand the channels linking credit and business cycles, I now decompose GDP into its components distinguishing between consumption (of governments and households), investment, and net exports. The responses of each of these components to different types of credit expansions are estimated separately, based on the following specification

$$\frac{y_{it+h} - y_{it}}{GDP_{it}} = \alpha_{i,h} + \sum_{b \in B} \sum_{u \in U} \sum_{j=0}^{5} \beta_{h,j}^{u,b} \Delta C_{i,t-j}^{u \to b} + \sum_{j=1}^{5} \beta_j^y \Delta y_{i,t-j} + \gamma X_{i,t} + \epsilon_{i,t+h}, \qquad (3.5)$$

where the dependent variable is the change in the respective GDP component y between t and $t+h$ scaled by GDP at time t. Based on the previous results, the model distinguishes between domestic and foreign counterparties ($u \in \{DM, RoTW\}$). It additionally includes controls for decomposed non-financial credit, lags of the dependent variable and changes in interest rates. Figure 3.12 shows in blue responses to household credit expansion financed domestically (government and households) and in black responses to household credit ultimately financed by foreigners. For comparison, the left panel shows the response of total GDP. The black line closely corresponds to the estimate in the right panel of Figure 3.6, while the blue line contains the response to increases in the sum of government- and household-financed household borrowing. The three right panels decompose the response of GDP into

Figure 3.12: *GDP component responses to changes in foreign and domestically sourced household credit*



Notes: This figure shows estimates of impulse responses of real GDP components (in % of real GDP at $t = 0$) to increases in the ratio of household credit to GDP financed by the rest of the world (black) and domestic counterparties, i.e. domestic households and the government (blue). Impulse responses are estimated based on Equation 3.5. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered on country and year.

the responses of the individual GDP components. Since responses are normalized by GDP in year t they add up to the total response on the left (up to a small residual).

Starting with the largest component of GDP, the second panel shows that there is a significant difference in the response of domestic consumption to household credit financed from abroad and domestically financed household credit. Foreign-financed household credit expansion is associated with a small, short-lived consumption boom that is followed by a decline in household consumption in the medium term. For horizons longer than four years, consumption growth is significantly lower when foreign-financed household credit increases. This response of consumption contributes significantly to the response of total GDP in the left panel.

The middle right panel shows that the boom and bust pattern following foreign-financed household credit expansions also has an investment component. An increase in foreign-financed household credit is followed by a short-lived investment boom (slightly stronger than for consumption). This boom lasts for two years, and reverses after year three.[19] For horizons larger than three years the response is close to zero

[19]This investment cycle, however, does not directly relate to the productive capacity of the non-financial sector. A large share of increasing investment is investment into dwellings as shown in Table A4.25.

and insignificant. The right panel shows that net exports decrease shortly, but reverse once the investment and consumption booms are over. These responses, in particular of consumption and investment, add up to create the patterns in total GDP shown in the left panel. Domestically-financed household credit expansion is, again, not associated with any of these dynamics.

3.4.4. The role of debt service payments

What explains the strong response of consumption to foreign-financed household credit expansion? As Drehmann et al. (2017) show, real reversals following household credit expansions are closely linked to debt-service payments implied by previous household borrowing. This is consistent with models that feature heterogeneity in marginal propensities to consume or financial constraints between borrowers and lenders (Korinek and Simsek, 2016; Farhi and Werning, 2016; Schmitt-Grohé and Uribe, 2016). In a closed economy context, Mian et al. (2021) argue that debt service payments flow from borrower households with a high marginal propensity to consume to wealthy saver households with a low marginal propensity to consume, weighing on future aggregate demand. In open economies, credit can be financed by foreign counterparties, which will receive future debt service payments from domestic borrowers. These foreigners are likely to have an even lower marginal propensity to consume domestically, and thereby the debt service flow may lower future domestic demand.

To study this channel, this section looks at household debt service payments flowing abroad. As argued in Mian et al. (2020b), the unveiling procedure not only assigns today's liabilities to a financing counterparty, but also contains information on the future flow of debt service and repayments. I compute household debt service payments flowing abroad, $\textit{Debt Service Ratio}_{i,t}^{HH \rightarrow RoTW}$, using household sector debt-service-to-income ratios from the BIS debt service statistics (Drehmann et al., 2015) multiplied by the share of household credit ultimately financed from abroad[20]

$$DSR_{i,t}^{HH \to RoTW} = DSR_{i,t}^{HH} \times \frac{C_{i,t}^{RoTW \to HH}}{C_{i,t}^{HH}}. \tag{3.6}$$

Before turning to the relationship between debt service payments to different counterparties and aggregate dynamics, it is confirmed in Table A6.29 that this measure is increasing in foreign-financed household credit expansion. Since this relationship partly holds by construction, I additionally employ data on "gross primary incomes payable to the rest of the world" as a share of GDP from national accounting data. This variable includes dividend and interest payments to foreign counterparties, capturing the payment streams associated with foreign financing of household credit.[21] Table A6.29 confirms that this measure is likewise increasing in foreign-financed household credit.[22] More broadly, this result also serves as an additional validation of the unveiling exercise: it shows that payment flows from national account data line up well with the estimates from the proportional unveiling approach.

Table 3.5 studies whether debt service payments flowing abroad, $DSR_{i,t}^{HH \to RoTW}$, weigh on future consumption and GDP growth similar to the specification for total household debt service in Drehmann et al. (2017). The estimation additionally includes debt service of households to domestic counterparties $DSR_{i,t}^{HH \to DM}$. The results in column (1) suggest a strong negative link between $DSR_{i,t}^{HH \to RoTW}$ and

[20]Household credit in the OECD data maps directly into the BIS statistics on domestic credit. Hence, this simple calculation provides a proxy for debt service payments to foreigners. It does not account for income of domestic intermediaries in the intermediation chain between households and foreigners, and it would over-/underestimate payments if there are systematic differences in interest rates/returns earned by foreign vs. domestic counterparties. As a simple sanity check, I confirm below that the measure calculated in Equation 3.6 is closely associated with income payments to foreigners from national accounting statistics.

[21]OECD classification code $D1\_D4NFRS2$. This variable also contains other payments associated with, e.g., compensation paid to foreign residents as well as reinvested earnings on FDI.

[22]I additionally report dynamic relationships in the left two panels of Figure A6.28 using local projections with changes in the DSR and in the ratio of primary income payments to the rest of the world relative to GDP as dependent variables. Both measures increase after foreign-financed household credit expansion. The binscatter in the rightmost panel of Figure A6.28 confirms that payment flows to the rest of the world are highly correlated with the computed $DSR_{i,t}^{HH \to RoTW}$.

Table 3.5: *Credit, debt service payments to foreigners, and economic activity*

	$\Delta_3 ln(Cons)_{i,t+3}$				$\Delta_3 ln(Y)_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DSR_{i,t}^{HH \to RoTW}$	-1.39***	-1.28***			-3.42***	-3.15***		
	(0.37)	(0.32)			(0.77)	(0.67)		
$DSR_{i,t}^{HH \to DM}$	-0.44*	-0.40**			-1.02*	-1.13**		
	(0.25)	(0.18)			(0.54)	(0.44)		
$Pay \to RoTW_{i,t}$			-0.38**	-0.34**			-0.97**	-0.89**
			(0.17)	(0.15)			(0.34)	(0.31)
$Net\ Pay \to RoTW_{i,t}$			0.22	0.30			0.24	0.35
			(0.32)	(0.33)			(0.64)	(0.68)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Credit Controls		✓		✓		✓		✓
Additional Controls		✓		✓		✓		✓
p-value, $\beta_{RoTW} = \beta_{DM}$	0.04	0.05			0.01	0.02		
p-value, $\beta_{RoTWPay} = \beta_{RoTWNet}$			0.11	0.11			0.07	0.09
Observations	248	248	248	248	248	248	248	248

Notes: The dependent variable in (1) to (4) is log real consumption growth from t to $t+3$ and log real GDP growth from (5) to (8). Independent variables are debt service ratios from households to foreign and domestic counterparties in (1), (2), (5) and (6). In (3), (4), (7), and (8) independent variables are gross payable incomes and net receivable incomes to and from foreigners. Debt service to foreigners and gross payable incomes to foreigners are shown to increase in foreign financed household credit expansion in Table A6.29. Additional controls include debt service of non-financial corporations, the baseline credit variables for household and non-financial credit growth between $t-4$ and $t-1$, the current account, inflows not financing household credit and changes in household sector net worth. All specifications control for country fixed effects and a distributed lag of GDP growth (LDV). The reported p-values refer to a test for the equality of the coefficients. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

consumption growth over the following years. The coefficient on $DSR_{i,t}^{HH \to DM}$ is also negative and significant, but far from magnitude of the $DSR_{i,t}^{HH \to RoTW}$ coefficient, and a test for the equality of the two coefficients is rejected. These results are consistent with the channel highlighted above: after borrowing from abroad, financially constrained domestic households have to reduce their spending to make debt service payments in the future. Foreigners receiving these payments have a lower marginal propensity to spend domestically, and hence aggregate domestic demand is depressed. This result holds controlling for lagged three-year changes in household and non-financial credit, the current account, household sector financial net worth, and other capital inflows in column (2).

As an additional variable capturing this channel, I again rely on gross primary incomes payable to the rest of the world variable as discussed above. Columns (3) and (4) show that this variable is strongly linked to negative future consumption growth. Domestic agents could also receive income on their foreign investments. Hence both columns additionally include the net income receivable from the rest of the world. While the coefficient for net income receivable from abroad has the expected direction, it is of smaller magnitude and statistically insignificant. One explanation could be that the domestic agents receiving payment flows from abroad are financially less constrained and have a lower marginal propensity to consume out of this income. This finding reinforces the importance of studying these channels based on gross vs. net capital flow measures.

The same set of results holds when employing GDP growth as the dependent variable in columns (5) to (8). Taken together, the findings suggest that there is an important international dimension of heterogeneity between borrowers and savers. While monetary policy could be employed to offset this channel, this option might not be available in fixed exchange rate regimes or close to the zero-lower bound.

3.4.5. Evidence in the (very) long run

High household debt service payments to foreigners are associated with low growth over subsequent years. Theoretically, the links between reversals in credit market conditions and debt service on the one hand, and aggregate demand and output on the other, could be countered by monetary policy (see, e.g., Schmitt-Grohé and Uribe (2016)). Due to the open economy trilemma, this option is only available to floating-rate countries. Without floating exchange rates, countries do not have this margin of adjustment. This aligns well with the results shown in section 3.2.3, showing that the baseline specification produces the strongest results under fixed exchange rate regimes, where independent monetary expansion is not available as a policy tool. While there is variation between countries regarding the exchange rate regime during the sample period, it is a disadvantage of the post-1970s OECD data that there is little variation in terms of capital account openness during this time. Due to this feature of the sample (or the lack of it), I confirm in long-run data from the

Table 3.6: *Credit cycles, exchange rate regime and business cycles in long run data*

	$\Delta_3 ln(Y)_{i,t+3}$					
	Full sample		No peg		Pegged	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 Loans/GDP_{i,t-1}$	-0.16***	0.07	-0.03	0.07	-0.22***	0.10
	(0.05)	(0.09)	(0.08)	(0.16)	(0.04)	(0.08)
$Open_{i,t-1} \times \Delta_3 Loans/GDP_{i,t-1}$		-0.23**		-0.12		-0.33***
		(0.09)		(0.14)		(0.07)
R^2	0.219	0.286	0.085	0.193	0.273	0.346
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Observations	1055	1055	335	335	718	718

Notes: This table shows results for long run data from the JST-Macrohistory database. The dependent variable is GDP growth from t to $t+3$. The independent variable is private credit relative to GDP, interacted, in row two, with a dummy for capital account openness. Estimations are performed for the full sample, pegged and floating exchange rates separately. Controls include lagged GDp growth and the current account (net capital flows). Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See text.

JST-Macrohistory database (Jordà et al., 2017) that credit expansions are associated with negative output dynamics, especially under the combination of liberal capital flow regimes and pegged exchange rates.

The JST-Macrohistory database covers 17 countries starting in the 1870s, but does not allow for a decomposition of credit by source sector. Additionally, the availability of disaggregated credit series distinguishing between household and non-financial business credit in the pre-1970s sample is very limited. Therefore, changes in total private credit relative to GDP are included instead, and their association with business cycle outcomes is studied conditional on capital account openness and exchange rate regime. The results are presented in Table 3.6.

Column (1) begins by confirming that expansions in private credit are associated with lower output growth over the following years in the full sample. The results are quantitatively smaller than the estimates for decomposed household credit, reflecting both the missing distinction between household and corporate credit, as well as no decomposition by source of funds. Interacting credit expansion with a dummy variable for capital account openness, which takes the value 1 if $openness > 75$ on the scale provided by Quinn (2003), shows that this negative association originates from periods when the capital account is open. Presumably, this interaction captures a higher likelihood of domestic credit being funded from abroad. Interestingly, private credit outside open capital account episodes even turns slightly positive, potentially reflecting the positive effect of having access to domestic credit or investment demand.

In columns (3) and (4), the same specification is depicted for the subsample of country-year observations without currency pegs, revealing that while the coefficients retain their signs, they shrink in magnitude and lose statistical significance. The coefficients for the subsample of pegged exchange regimes in columns (5) and (6) trend in the opposite direction. They increase in magnitude, while standard errors shrink, resulting in highly significant results. These results show that the previously documented negative relationship between private credit and business cycle outcomes (Schularick and Taylor, 2012; Jordà et al., 2013) is particularly pronounced when open capital accounts are combined with pegged exchange rate regimes. This makes them fully consistent with my findings in a broader but more short-run sample of OECD economies.

3.5. Foreign credit supply vs. domestic credit demand

The previous sections have shown that the macroeconomic dynamics associated with household credit expansion differ based on the source of capital financing them, and that foreign financing is key to understanding the relationship between credit and business cycles. But why do foreigners finance domestic household credit? Rey (2013) argues that, empirically, it seems that capital flows are often unrelated to a country's macroeconomic conditions and instead driven by supply, often linked to a global financial cycle (see Miranda-Agrippino and Rey (2022) for a review). To study whether these supply-based explanations are associated with the previously presented dynamics, it is necessary to disentangle the role of foreign supply and domestic demand for foreign-financed household credit. To do so I rely on the Amiti and Weinstein (2018) procedure to decompose bilateral banking flows into country-specific demand and foreign supply driven by country-specific and common supply shocks.

In particular, the Amiti and Weinstein (2018) procedure is applied to data from the Locational Banking Statistics (LBS) provided by the Bank for International Settlements (BIS) similar to Amiti et al. (2019).[23] The LBS report the amount of bilateral outstanding claims of creditor banking system c on borrower country b, $L_{c,b,t}$. Using the Amiti et al. (2019)-approach, the growth rate in these claims, $\frac{L_{c,b,t}-L_{c,b,t-1}}{L_{c,b,t-1}}$, can be decomposed into country-specific time-varying demand ($\alpha_{b,t}$) and supply effects ($\beta_{c,t}$) based on the following equation

$$\frac{L_{c,b,t} - L_{c,b,t-1}}{L_{c,b,t-1}} = \alpha_{b,t} + \beta_{c,t} + \epsilon_{c,b,t}. \tag{3.7}$$

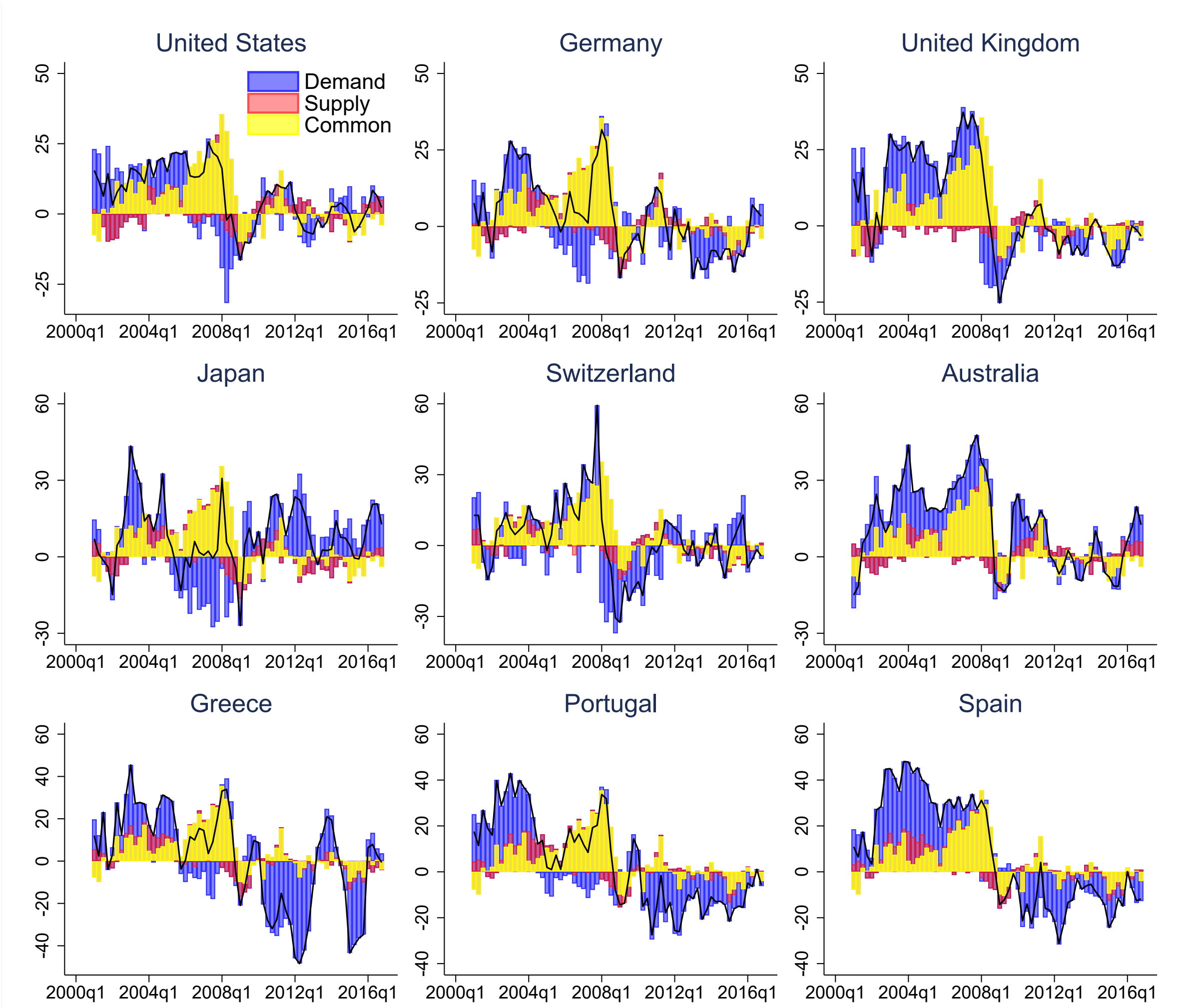
Amiti and Weinstein (2018) show that estimating this equation using weighted least squares (WLS), with the lagged claim level as weights, allows for the computation of supply, demand, and common shocks that add up exactly to the growth rate of pre-existing relationships.[24] I implement their procedure in the LBS data and decompose the growth rate in claims on borrower country b into idiosyncratic demand shocks $\hat{\alpha}_{b,t}$, a common shock $\hat{c}_t$ (the median bilateral growth rate at t), and the idiosyncratic supply shock, a weighted average of supply shocks of creditor banking systems $\sum_c \frac{L_{c,b,t-1}}{\sum_c L_{c,b,t-1}} \hat{\beta}_{c,t}$. As discussed by Amiti and Weinstein (2018), in this approach the underlying assumption is that capital supply is creditor-specific and demand for funds is borrower-specific.

Figure 3.13 shows the estimated growth decomposition for some of the sample

[23] Amiti et al. (2019) apply the procedure using the Consolidated Banking Statistics (CBS). However, the OECD non-consolidated financial accounts are based on the residency principle, as applied in the LBS and hence this data maps conceptually directly into my measure of foreign-financed credit. The claims reported in the LBS are reflected in the RoTW balance sheet in the financial accounts data.

[24] See Amiti and Weinstein (2018) and Amiti et al. (2019) for the derivation. I implement the procedure using the AWshock.ado command for Stata.

Figure 3.13: *Amiti-Weinstein shock decomposition for selected developed economies*



Notes: This figure shows the year-on-year growth in claims of all reporting banks from the BIS locational banking statistics, on the country listed in the panel header. The total growth is decomposed into (i) estimated demand shocks (blue), unique to the borrower country listed in the panel header (ii) supply shocks based on weighted supply shocks to the banking systems that have outstanding claims on the borrower country listed in the title, (iii) shocks that are common to all banking systems and borrower countries. This figure includes the same set of countries as Figure 10 in Amiti et al. (2019).

countries, where the set of countries is chosen in a way such that the estimated shocks can be compared to the results presented in Figure 10 of Amiti et al. (2019).[25] Adding up the common and country-specific supply shocks produces a measure of banking inflow supply shocks that is orthogonal to country-specific demand factors by design. Subsequently, the growth rates are transformed into volumes of funds and summed up over the same three-year window that is used in the baseline regressions.

[25]Their figure is based on the CBS data (compared to the LBS data here) and it also relies on adjustments that cannot be made in the public data. Nevertheless, the estimated series correspond closely to each other.

Finally, these changes are likewise expressed relative to GDP. Figure A7.29 shows that there is a strong positive relationship between this foreign supply of funds and the measure for foreign-financed household credit expansion.

I then study the role of these supply shocks for the relationships documented in the previous sections. Table 3.7 fixes the sample to observations where the newly constructed supply variable is available and reports the baseline OLS relationship between foreign-financed household credit and the business cycle in column (1). Column (2) shows the reduced-form relationship between the GDP-scaled supply shocks and subsequent output dynamics. Reassuringly, the coefficient is negative and highly significant. Supply-driven banking inflows are associated with business cycle slowdowns.

Column (3) employs foreign supply as an instrumental variable for foreign-financed household credit growth. The second-stage coefficient is again highly significant, but more importantly larger than the baseline coefficient reported in column (1), suggesting that the baseline OLS estimates are biased towards zero. Such a bias seems plausible, as households may sometimes borrow from abroad against (expected) good future fundamentals. The reported Kleibergen-Paap statistic of 22.37 confirms the visual impression of a strong first-stage relationship from Figure A7.29. Columns (4) to (6) use changes in unemployment as the dependent variable. Again, the results using reduced form shocks and the instrumental variable specification are highly significant.

As in most macroeconomic applications, there are potential concerns to be considered when interpreting instrumental variable results. One concern is that the common component entering the capital supply variable may be endogenous to expected global macroeconomic developments. Hence Table A7.30 in the appendix focuses on small open economies, excluding the five largest economies in the sample from the estimation. The remaining economies are exposed to the global financial cycle, but it is unlikely that the global cycle responds strongly to their expected

Table 3.7: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds*

	$\Delta_3 ln(Y)_{i,t+3}$			$\Delta_3 Unemployment_{i,t+3}$		
	Baseline (1)	*Reduced* (2)	*IV* (3)	*Baseline* (4)	*Reduced* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.83***		-1.90***	0.23***		0.27***
	(0.17)		(0.57)	(0.04)		(0.07)
$\Delta_3 Supply_{i,t-1}$		-0.25***			0.05***	
		(0.05)			(0.02)	
Country fixed effects	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID	.	.	22.37	.	.	11.93
Observations	653	653	653	609	609	609

Notes: The dependent variable is real GDP growth from t to $t+3$ in (1)-(3) and changes in the unemployment rate between t and $t+3$ in (4)-(6). All specifications control for country fixed effects and distributed lags of the dependent variable (LDV). Credit controls include household credit financed by domestic sectors and non-financial credit. Columns (1) and (4) are based on Equation 3.2. Columns (2) and (5) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3) and (6) use the supply shock measure as an instrument for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

macroeconomic developments. The results remain unchanged.

One could also imagine times where investors across the globe want to invest in a particular country that acts as a safe haven. In that case the supply of capital from around the globe to that particular country may actually (and mistakenly) be reflected in the estimated country-specific demand term. Table A7.31 addresses that possibility by excluding the countries most likely associated with safe haven status, the U.S. and Germany, from the sample. Again, results are very similar to the ones reported for the full sample. Finally, supply shocks in foreign financing may affect the macroeconomy through other channels than foreign-financed household credit expansion. The most obvious candidate channel is foreign-financed credit to the non-financial sector expanding due to global capital supply. Empirically, however, Figure A7.29 shows that there is no clear relationship between international banking supply shocks and lending to non-financial corporates.

This approach can also be applied to the analysis of financial crises. In Table 3.8 I show results for probit models instrumenting foreign-financed household credit expansion. Column (1) shows, again, that foreign-financed household credit ex-

Table 3.8: *Predicting financial crises - foreign supply of funds*

	Baseline (1)	*Reduced* (2)	*IV* (3)	*Baseline* (4)	*Reduced* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	0.44^{***}		0.92^{***}	1.13^{***}		2.89^{***}
	(0.09)		(0.29)	(0.24)		(0.51)
$\Delta_3 Supply_{i,t-1}$		0.18^{***}			0.62^{***}	
		(0.06)			(0.11)	
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Country fixed effects				✓	✓	✓
Kleibergen-Paap Weak ID			25.55			14.97
Observations	725	725	725	523	523	523

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients shown are mean marginal effects. Baseline models are probit specification as in Equation 3.3. Reduced-form specifications replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. IV specifications use the supply shock measure as an instrument for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Credit controls contain three-year changes in household credit financed by domestic sectors and non-financial credit, all relative to GDP. Clustered (by country) standard errors in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

pansion predicts financial crises. Column (2) includes the foreign supply variable instead of foreign-financed household credit and finds a significant relationship with subsequent crises in the reduced form setting. Column (3) contains the instrumental variable results and confirms the strong relationship between $\Delta_3 RoTW \rightarrow HH$ and financial crises. As for the business cycle relationships, the coefficient increases, suggesting a bias towards zero in the simple probit specification. Columns (4) to (6) confirm these results when including country fixed effects. These results suggest that supply-based increases in foreign-financing of household debt are associated with the macroeconomic developments that ultimately end in financial crises.

Expectations. Having established that foreign capital supply is associated with adverse macroeconomic outcomes, the question is whether these are expected at the time when foreigners fund domestic household credit? To answer this question, I follow the literature and look at economic growth forecasts and asset prices, which both contain information on expectations about the future (Mian et al., 2017; Baron and Xiong, 2017). Specifically, Equation 3.8 regresses these measures on lagged household credit expansion, decomposed by financing source

$$y_{t+3} = \alpha_i + \sum_{u \in U} \beta^u \Delta_3 C_{i,t-1}^{u \to HH} + \gamma X_{i,t-1} + \epsilon_{i,t+3}, \tag{3.8}$$

where y_{t+3} refers to growth forecast errors ($e_{t+3|t}$) or cumulative asset returns ($R_{t \to t+3}$). The forecast error $e_{t+3|t}$ is computed as realized growth between t and $t+3$ minus the time t forecast of growth between t and $t+3$ produced by IMF staff. $X_{i,t-1}$ in this case contains non-financial credit and the current account. The results are presented in Table 3.9.

Column (1) shows that this forecast error is significantly negative for foreign-financed household credit expansion. In other words, household credit financed by the rest of the world is associated with low output growth, but IMF staff economic forecasts do not account for this relationship. Domestically financed household credit or credit to the corporate non-financial sector are not associated with such forecast errors. This result holds when instrumenting foreign-financed household credit with the supply measure in column (2).

Foreign investors, supplying capital for household credit expansions, do not necessarily share the same beliefs as IMF forecasters, so it is difficult to assess their private forecasts at the time of financing household sector borrowing. It is possible, however, to assess whether periods of household borrowing financed by foreigners are associated with high aggregate sentiment, and hence low subsequent returns. Column (3) uses the cumulative real total return from t to $t+3$ on the bank index ($R_{i,t \to t+3}^{BankEquity}$) as the dependent variable. Again, household credit expansions financed by foreigners turn out to predict low subsequent returns on the bank index, while credit funded domestically does not.

Financial markets, just as economic forecasters, do not reflect the link between foreign-financed credit growth and subsequent macroeconomic and financial outcomes. This result also holds in the instrumental variable specification in column (4). This finding complements the one in Baron and Xiong (2017), specifying which financing counterparty is behind the negative association between credit and returns.

Table 3.9: *Credit expansion and expectations*

	$e_{t+3\|t}$		$R^{BankEquity}_{t\rightarrow t+3}$		$R^{HP\ Real}_{t\rightarrow t+3}$	
	OLS (1)	*IV* (2)	*OLS* (3)	*IV* (4)	*OLS* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-23.28***	-40.20**	-5.13***	-15.41***	-1.25***	-1.66**
	(7.59)	(16.26)	(1.30)	(4.37)	(0.20)	(0.81)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	0.61	2.45	-2.72	-1.65	-0.64	-0.62
	(4.79)	(4.98)	(2.52)	(2.97)	(0.54)	(0.54)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	-5.59	-0.26	-1.16	0.28	-0.20	-0.09
	(3.72)	(8.40)	(1.57)	(2.01)	(0.38)	(0.45)
Country fixed effects	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.02	0.01	0.01	0.00	0.34
Kleibergen-Paap Weak ID		13.57		34.85		13.03
Observations	594	594	523	523	585	585

Notes: This table reports regression estimates of GDP growth forecast errors, returns on the bank index and changes in the real house price index between t to $t+3$ on changes in credit measures from $t-4$ to $t-1$. IV specifications use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. All specifications control for country fixed effects, non-financial credit and the current account. The reported p-value refers to a test for the equality of credit coefficients by different counterparty sector. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

The results suggest that bank shareholders do not ask for higher returns during periods of large capital inflows being intermediated to households.

Given that loans to the household sector predominantly involve mortgages, the final specification considers whether foreign-financed household credit predicts developments in housing markets. Concretely, it regresses three-year changes in the real house price index ($R^{HP\ Real}_{i,t\rightarrow t+3}$) on measures of past credit expansion. Column (5) shows that foreign-financed household credit expansions are associated with a predictably negative effect on the subsequent growth of house prices over the following years. While this relation is significant for foreign financed household debt expansions, domestically financed credit is not significantly related to future growth in house prices. As before, these findings also hold in the IV-specification, presented in column (6).

3.6. Conclusion

The financial crisis in 2007/2008 painfully demonstrated the long-lasting negative macroeconomic consequences of a shock to the financial sector. More importantly, the transmission of an initially small shock to US mortgage portfolios through the global financial system laid bare the dangers of an interconnected global financial system. As I demonstrate in this chapter, financing across borders does not only transmit shocks, it is intrinsically related to macroeconomic fluctuations.

Schularick and Taylor (2012) have noted the divergence of credit and money since the mid-20th century. This divergence can be explained by the changing role of international financial markets in financing domestic credit in recent decades. Lifting the veil of financial intermediation reveals that financial institutions are moving away from deposit funding and towards funding via securities on their liability side. Coupled with an increased distribution of these securities on international markets, this trend leads banks to rely increasingly on foreign financing. On their asset side, households have largely supplanted corporates as the main borrowers in advanced economies, leading to a sustained rise in household credit, which is increasingly funded from abroad. And this shift matters.

Credit to the domestic household sector ultimately financed with capital inflows is associated with domestic boom and bust cycles. Economic agents seem largely unaware of the impending risks during such credit expansions, but as witnessed in 2007/2008, the risks associated with the booms often manifest themselves in a costly crisis a few years down the road. Some of these relationships were previously documented separately for credit expansions and (less robustly) for capital flows, but this chapter shows that they are strongest when the two measures both reflect the same underlying balance sheet linkages between domestic households and foreigners. The unveiling approach applied in this chapter allows to reflect these exposures in one single variable – household credit ultimately financed by foreigners – that captures future funding risks and payment flows which turn out to be crucial for macroeconomic dynamics.

The changing nature of financial intermediation documented in this chapter has important implications for macroeconomic modeling and policy. Developments in domestic credit markets cannot be disentangled from global capital markets. Policymakers eager to avoid the adverse effects of rapid credit expansions have to account for the role of international capital in local credit cycles. For optimal policy, this may require to jointly assess the role of monetary and macroprudential policies as well as capital controls to insulate economies from these fluctuations. Historically, capital controls have been an important protection against the financial cycle. It may not be a coincidence that the Bretton-Woods period was characterized by very low crisis incidence.

4. — Financial Deregulation and Fertility Decisions

Disclaimer: The majority of the following chapter was written as a joint project with Julian Soriano-Harris, from the University of Alicante. A standalone working paper version is available under the title "*Financial Deregulation and Fertility Decisions: The Unintended Consequences of Banking Legislation*" at `https://ssrn.com/abstract=4544847`.

As fertility rates fall and populations get older across the developed world, demographics has moved to take a top spot in public debate. There are increasing concerns about the economic implications of these trends, while, simultaneously, exuberant house price growth has sparked worries about housing becoming unaffordable (Pavlidis et al., 2016), potentially further impeding family planning. An emerging literature studies the relationship between house prices and fertility outcomes (Li, 2023; Dettling and Kearney, 2014; Daysal et al., 2021; Clark and Ferrer, 2019), but the quantitative impact, the heterogeneous effects on different population groups and the timing with which families adjust to changing macro conditions are not yet fully explored. Using the timing of banking deregulation in the United States as a source of variation in house prices, this chapter sheds light on these questions, showing that financial legislation plays an important role in demographic developments. This not only enhances our awareness of the social consequences of financial legislation, but also constitutes a prerequisite for formulating policy responses aimed at alleviating some of the demographic pressures faced by advanced societies (Goodhart and Pradhan, 2020).

This chapter's contribution to the extant state of research relies on two stylized facts from the literature: 1. banking deregulation is associated with house price booms (Mian et al., 2020a; Favara and Imbs, 2015), and 2. the purchase of a home and the decision to have a child are complements in family planning, usually occurring within a short time of each other (Green and White, 1997; Dietz and Haurin, 2003; Doepke and Zilibotti, 2019). Concretely, I link state-level banking deregulation in the United States during the 1980s, and the boom in house prices it induced, to two key demographic outcomes: the age of mothers at their first childbirth (MAFC) and fertility rates. The timing of the deregulation has been shown to be exogenous to the economy (Jayaratne and Strahan, 1996), and I argue that this exogeneity also applies (presumably even more so) to demographic outcomes.

With these two aspects of banking deregulation in mind (exogeneity to fertility and association with house price booms), this chapter uses staggered difference-in-differences of the Borusyak et al. (2022) variant and finds that the age of mothers at their first childbirth increases by 3 to 12 months over the ten years following deregulation. I attribute this to higher house prices delaying the purchase of a home. When dividing the sample along race and education, we can observe stronger effects for non-white and college-educated women, consistent with more financially constrained groups being more affected by rising housing costs and women with higher opportunity costs in the labor market having a greater incentive to delay childbirth. The average effect on total fertility is positive over short horizons, but reverts back to zero in the long run. I attribute this to a second aspect of rising house prices, which, on the one hand, extend the saving period before home purchases, but one the other, reflect a wealth gain for home owning families. During the boom, this relaxed financial constraint increases fertility, and even outweighs the negative effect of delayed childbirth due to higher costs. Over longer horizons, however, the wealth effect phases out, while elevated house prices continue to decrease fertility for prospective home buyers. This shift in the relative strength of effects is particularly pronounced for non-white couples, who are more affected by the cost-channel due to lower financial wealth and less impacted by the wealth-channel owing to lower home ownership rates. This results in a net fertility decrease for the non-white sample in the long run.

To be able to asses these mechanisms in detail, I rely on a newly constructed dataset, containing MAFC and fertility rates in the United States at the county-level, disaggregated by age, race, education, and marital status. The final dataset covers 288 counties in 31 states from 1969 to 2002 and is based on the National Vital Statistics System of the National Center for Health Statistics (2023). The second key component to the data is the timing of state level banking deregulation from (Amel, 1993). Banking deregulation, in this context, can refer either to intra or interstate deregulation, which describes the process by which regulations on branching and lending are lifted for regional, or foreign banks operating within the state. This enabled banks to lend without (or reduced) government intervention, monitoring or standard-setting (Kroszner and Strahan, 2014), and, in the interstate case, opened the states' banking sector to foreign banks. This, in turn, led to an increased potential for banks to extend credit within states (Mian et al., 2020a). While this potentially promotes economic growth and innovation by facilitating credit at lower interest rates to entrepreneurs (Jayaratne and Strahan, 1996; Black and Strahan, 2002), it also increases mortgage lending, linking it to rising house prices (Justiniano et al., 2019; Saadi, 2020; Favara and Imbs, 2015). Mian et al. (2020a) also argue that this specific deregulation amplified the nationwide economic boom of the 1980s in states that deregulated early.

Banking deregulation is connected to fertility outcomes via several channels, each partially offsetting another. Yang (2023), building on Hacamo (2021), offers a catalogization that outlines three potential channels through which banking deregulation may influence fertility: the housing channel, the credit channel, and the labor market channel. The *housing channel*, as previously mentioned, affects fertility outcomes in two distinct ways. Firstly, higher house prices negatively affect fertility by reducing the affordability of housing for prospective buyers, leading to reduced or delayed fertility. I will refer to this mechanism as the house-cost channel. Secondly, increasing house prices result in wealth gains for homeowners, who can allocate these gains to childbearing costs through, for example, house-equity withdrawals (Aron et al., 2012). I will refer to this mechanism as the house-wealth channel. The *credit channel* emphasizes the positive effect of increased credit supply on fertility, as budget-constrained households might use additional funds to finance childbearing costs. Finally, according to the *labor market channel*, increased wages during economic booms raise the opportunity costs of foregoing employment, leading to reduced or delayed fertility.

I begin by confirming descriptively that my sample reflects the stylized facts reported by Mian et al. (2020a): states that deregulated earlier experienced stronger credit and, particularly, house price growth.

In an extension of their analysis, I also examine the response of mortgage credit individually and observe that a significant portion of the overall credit expansion was due to a surge in mortgage credit. Upon further disaggregation of this response, the expansion in mortgage credit turns out to be faster, steeper, and larger in states with early interstate deregulation compared to those with early intrastate deregulation. Even more striking is the sharp downturn in mortgage credit post-1990 observed for the early interstate deregulation sample, leading cumulative mortgage credit growth to fall below that of later deregulating states. This downturn is absent in the late interstate deregulation and in both the late and early intrastate deregulation samples, where mortgage credit volumes remain relatively stagnant after the boom. The more pronounced boom-bust cycle observed in early interstate deregulation states suggests that it was the inflow of out-of-state funds, facilitated by interstate deregulation, that financed mortgage credit expansion and drove aggregate credit outcomes. By the early 1990s, these funds were being withdrawn, causing a decline in the total volume of available credit.

Repeating the exercise for demographic outcomes, I find that MAFC and fertility rates also rose more quickly in states with earlier banking deregulation. To understand the relative strength of the channels at play, I then directly relate credit and house price growth to MAFC and fertility. In both cases, the association is positive, with the one for house prices being more pronounced. The positive relationship between credit and MAFC is puzzling at first glance, as according to the credit channel, increased credit supply enables couples to opt for earlier parenthood.[1] The increase in aggregate credit, however, is far lower than the increase in house prices (25% vs. 60% compared to the pre-boom period), while, via the disproportionate increase in mortgage loans, being an important driver of house prices itself. While not ruling out the possibility of the credit channel playing a role in individual instances, these results can be interpreted as evidence for the credit channel being dominated by the housing channel on aggregate. Importantly, no diverging trends in fertility outcomes are visible prior to deregulation.

Moving on to a more quantitative assessment which considers the timing of deregulation across different states, I compute the effect of deregulation on MAFC in two cross-sectional regressions proposed by Mian et al. (2020a). Specifically, these models regress the change in fertility outcomes on a measure that ranks states according to the timing of their deregulation. In line with the descriptive evidence, deregulation has a significantly positive effect on both MAFC and fertility when counties are within states that deregulated prior to the boom of the 1980s, but none otherwise. Using the same regression framework, it is reaffirmed that a large part of the increase in credit during the boom period is connected to mortgage lending, and

[1] This is presumably particularly relevant for younger, more financially constrained couples.

that the strongest increase in MAFC coincides in time with the period when house prices, compared to the pre-deregulation period, are elevated the most.

The recent econometric literature has made significant advances in estimating the causal impact of treatments with staggered roll-outs and heterogeneous effects conditional on the timing of treatment (Borusyak et al., 2022; Roth et al., 2023; Callaway and Sant'Anna, 2021). Among the host of available models, I opt for the staggered difference-in-differences estimator proposed by (Borusyak et al., 2022) as the baseline, but consider traditional 'dynamic' and alternative staggered estimators for robustness. The estimates show that in the 10 years after treatment MAFC increases by 4 and 12 months in response to intra- and interstate deregulation respectively. A reoccurring result across methodologies is that effect sizes are larger for inter- than for intrastate deregulation, which suggests that the inflow of out-of-state capital was more consequential than the improved distribution of existing within-state capital. It is equally important to note that the effect turns significantly positive, at the earliest, around four years after deregulation. This can be rationalized with the time it takes for house prices to rise, families to update their fertility planning, and my data being based on birth certificates, which reflect the decision to become parents with a lag of at least 9 months.

A key determinant through which these effects operate is financial wealth, which is distributed highly unequally across races in the United States. As noted in various studies, the white population, on aggregate, holds substantially more wealth than any other group (Haughwout et al., 2020; Coulson and Dalton, 2010; Taylor et al., 2011). High financial wealth would tend to alleviate the fertility delaying effects of high house prices and Liu et al. (2020) argue that more economically constrained groups are more likely to be renters than owners, further increasing the relevance of this channel along the extensive margin. To test these implications, I split the sample by race and find that, compared to white women, the MAFC of non-white women increases significantly faster upon banking deregulation. Prior to deregulation, the time trend for the two groups is virtually indistinguishable. The result holds across inter and intrastate specifications, and is in line with another feature distinguishing the two groups in the data: age. White women are, on average, about two years older than non-white women at the age they become mothers, which presumably further contributes to having greater financial wealth.

High house prices delay childbirth because of financial constraints, but women might also choose to delay or hasten fertility based on the opportunity cost they face on the labor market (Basu, 2002; Monstad et al., 2008; Coskun and Dalgic, 2022). Going back to Galbraith and Thomas (1941) one argument has been that the opportunity costs of childbearing are lower in recessions than in expansions, because wages tend to be depressed and labor in abundant supply. During booms on the other hand, womens' opportunity costs to childbearing rise as labor market outcomes tend to be more favorable (Black and Strahan, 2001). In order to test this hypothesis, the sample is split along college education, as college educated women likely profit disproportionately from an economic boom. In line with this, the results show that college educated women delay the age at which they become mothers more than non-college educated women after banking deregulation. All results are based on changes within groups, so these results can be interpreted as labor opportunity costs adding to the fertility delaying effects of going to college itself.

How do these developments impact the overall fertility rate? While both the house-cost and the labor market channel point towards a negative relationship between financial deregulation and fertility, I find that initially, the effect is in fact positive. For both the white and the non-white population the fertility rate increases by about 2.5 children born to a thousand women per year [2]. This implies that during the initial boom, the positive fertility effects of the credit and the house-wealth channels offset the negative effects of the house-cost and labor market channels. After 6 years a reversion sets in, with significant heterogeneity between white and

[2]The mean sample fertility is around 28 for white women and around 36 for non-white women.

non-white mothers. For white households, the reversion leads to a net long run effect of zero (or, depending on the specification, slightly positive). For non-white households the decrease in fertility rates is significantly greater than the previous increase, resulting in a net fertility decrease 8 years after deregulation.

This can potentially be attributed to the relative weakness of the house-wealth channel and the relative strength of the house-cost channel in a group with lower than average homeownership rates and financial wealth. Additionally, house prices in early deregulated states did not drop nearly as much during the economic downturn of the early 1990s as they rose during the boom. While this provided a wealth buffer for homeowners, it also meant that high house prices now coincided with a period of deteriorating economic prospects, further impeding home purchases for budget constraint households. Arguably, the deterioration of economic conditions disproportionately affects populations with lower average education and socioeconomic status (Schneider and Hastings, 2015), further adding to the effect. This explanation also fits the timeline of events with the economic boom lasting around 7 years from 1983 to 1990, and the estimates turning negative for the first time in year 8.

My line of reasoning throughout the chapter rests on the tacit assumption that parents are not only aware of changing macroeconomic conditions but also consciously adjust their family planning accordingly. To address concerns that the results may not be driven by conscious decision-making but rather by an omitted aspect of legislation directly affecting fertility through an unknown channel, I leverage an additional feature of the data: marital status. Arguably, children born within marriage are less likely to result from accidental pregnancies compared to those born outside of it, making the timing of their birth more responsive to deregulation through the previously discussed channels. I validate this expectation by showing that, upon deregulation, the MAFC of married women increases significantly more than that of non-married women. The second point follows a similar intuition: teenage pregnancies of unmarried women are, presumably, least likely to be the result of informed decisions, and banking deregulation should not impact their frequency. Again, this expectation can be confirmed by showing that fertility rates of unmarried teenage mothers do not respond to banking deregulation. Together, these findings serve as additional supporting evidence for parents consciously adjusting their fertility planning in response to changing macro conditions.

Contribution to the literature: This chapter builds upon the macro-financial literature, which, since Jayaratne and Strahan (1996), has assessed the impact of banking deregulation on economic growth, house prices, credit, wages, and other economic fundamentals (Kroszner and Strahan, 2014; Mian et al., 2020a; Beck et al., 2010). Although a growing body of literature studies the link between economic variables and fertility outcomes, banking deregulation has only recently begun to recognized as an important source of variation in this relationship. Deregulation in the United States occurred in two waves, the first of which, lasting from the mid-1970s to the late 1980s (Amel, 1993), provides the historical backdrop of this chapter.[3] It coincided with a nationwide economic expansion, which was amplified in early deregulated states (Mian et al., 2020a), and terminated in the early 1990s. This chapter contributes to the existing literature by showing that deregulation was a significant factor not only for economic but also for fertility outcomes over this business cycle.

Two other studies have analyzed the effects of banking deregulation on fertility outcomes, yielding conflicting results, which I am able to reconcile. Firstly, Kim et al. (2022) find a positive effect of deregulation on fertility, which they attribute to the credit channel. This chapter expands on their findings along several dimensions. While their analysis is at the state level and focuses on short-term effects, I gather more comprehensive data at the county level, cover a longer period of time, explore heterogeneity between different samples, employ recently developed staggered diff-in-diff estimators, and broaden the scope of interest beyond fertility rates to include

[3]The second wave, from the late 1990s to the early 2000s, is exploited by Yang (2023) in an exercise similar to ours.

the age of mothers at childbirth. The second study by Yang (2023) finds a negative effect of deregulation on fertility during the second wave of deregulation in the late 1990s, which she attributes mainly to the house-cost channel. These findings can be reconciled by employing a sample that covers both periods. The results show that, upon deregulation in the 1980s fertility initially increased, but decreased during the time period analyzed by Yang (2023). Further supporting the argument that both papers examine different parts of a longer cycle is that the timing of deregulation in the second wave is highly correlated with previous deregulation. States that deregulated early in the first wave also did so in the second.[4]

The second contribution regards the relationship between house prices, family planning and its heterogeneity among different groups of the population. In line with the two housing channels described above, the literature has shown that house price increases have positive fertility effects for homeowners and negative effects on non-homeowners (Daysal et al., 2021; Lovenheim and Mumford, 2013; Dettling and Kearney, 2014; Pavlidis et al., 2016). This chapters expands on this finding by showing that the strength of these channels is conditional on financial constraints and homeownership rates, creating heterogeneity in the response strength across racial groups in the US. Non-white households, being younger, less well-off financially, and having lower homeownership rates compared to white households, are more susceptible to the fertility-reducing effects of the house-cost channel. In contrast, white households have high homeownership rates and benefit more from the positive fertility effects of the house-wealth channel. A consistent result across specifications is that elevated house prices contribute to a shift in the age at childbirth. I argue that the underlying mechanism is that younger couples tend to delay fertility, while older couples, more likely to be homeowners, are inclined to increase fertility, resulting in first-time motherhood occurring progressively later in life.

[4] I control for the possibility that the effect of deregulation changed its direction between the two deregulation periods by excluding observations past the second deregulation wave, and find the long-run boom-bust pattern confirmed.

More broadly this chapter also contributes to the analysis of the macro determinants of fertility. The idea that fertility and economic conditions are related *'has been pursued for centuries'* (Sobotka et al., 2011). And while most studies generally argue for a positive link between economic prosperity and fertility (Becker, 1960; Macunovich, 1996; Sobotka et al., 2011; Coskun and Dalgic, 2022) the case has also been made for fertility to become counter cyclical as women's labor force participation, education and opportunity costs continue to rise (Galbraith and Thomas, 1941; Butz and Ward, 1979; Monstad et al., 2008). My findings echo the ambivalence of these opposing views and call for a nuanced assessment of the overall effects. While the results indicate that rising house prices and opportunity costs exert downward pressure on fertility, they also show that deregulation and the following amplified business cycle expansion initially increase fertility. The answer, as always, lies somewhere in between. Which channel ultimately dominates depends on socioeconomic status and education, which continue to be determined by race.

4.1. Literature Review

This section briefly discusses the literature connecting financial deregulation and fertility outcomes. It first provides an overview of the traditional determinants of fertility, followed by a discussion of the macro-financial effects of banking deregulation. Finally, it looks at the literature that has connected these two strands and outline the channels through which deregulation affects fertility.

4.1.1. Traditional determinants of fertility

How is the decision to have children approached in theoretical economics? Going back to Becker (1960), the decision to have children is modeled as rational agents (parents) demanding the optimal amount of a normal good (children) given their preferences, budget constraint and childbearing costs, in order to maximize lifetime utility. Keeping all else equal, increases (decreases) in childbearing costs reduce (increase) the demand for children.

Influenced by this seminal theoretical contribution, the empirical literature seeks to quantify how changes in fertility determinants influence the demand for children. For instance, improvements towards gender equality in education and labor market outcomes have increased women's childbearing opportunity costs (Basu, 2002; Monstad et al., 2008). Conversely, government programs that subsidize or reduce childbearing costs have been found to increase fertility. Raute (2019), for example, finds that the introduction of an earnings-related paid maternity leave in Germany increased fertility, particularly for high-income women, by reducing opportunity costs. Similarly, (Rindfuss et al., 2010) find that increasing the availability of childcare increases fertility. More generally, a household's decision to have children might also be contingent on cultural preferences (Fernández and Fogli, 2006), or simply the access to contraceptives (Rau et al., 2021).

Most relevant to this chapter is the literature exploring the relationship between housing and fertility outcomes. Homeownership has been identified as an investment in-, and a commitment to the upbringing of children. Consequently, families often consider the purchase of a home jointly with the decision to have a child (Green and White, 1997; Dietz and Haurin, 2003; Doepke and Zilibotti, 2019). For non-home owning families, increases in house prices (or rent) reduce the demand for children, as the cost of providing a stable environment increases (Dettling and Kearney, 2014; Atalay et al., 2021; Simon and Tamura, 2009). Further supportive evidence for this channel is provided by Sorvachev and Yakovlev (2020), who show that subsidized home purchases for families increase fertility. The mechanism that connects the cost of housing to family fertility planning is termed the house-cost channel. The same increase in house prices, however, relaxes the financial constraints of home owning families, as high house prices translate into increased net wealth for homeowners. These additional funds can be allocated to pay for the cost of childbearing, and contribute to increased financial security, which has also been found to be an important contributor to family planning (Lovenheim and Mumford, 2013; Daysal et al., 2021; Liu et al., 2020; Clark and Ferrer, 2019; Aron et al., 2012). To distinguish this second dimension of rising house prices from the first, it is termed the house-wealth channel. Which channel ultimately dominates in a given country, region, social or racial group largely depends on the distribution of homeownership.

4.1.2. Banking deregulation and its macrofinancial implications

Banking sector deregulation in the USA, which essentially consisted of dismantling the tight banking regulations implemented during the 1930s, was a continuous process that occurred in two waves. The first of these waves occurred between the late 1970s and the early 1990s and included both intra and interstate banking deregulation. Intrastate deregulation involved lifting branching restrictions and acquisitions of subsidiaries within states, while interstate deregulation enabled out-of-state banks to operate in a given state. The latter first consisted of bilateral agreements between individual states, which were later expanded into multilateral and ultimately nationwide agreements (Kroszner and Strahan, 2014; Amel, 1993).[5]

Jayaratne and Strahan (1996) are recognized as being the first to exploit the timing of banking deregulation as a source of exogenous variation in economic outcomes, including credit and GDP. Kroszner and Strahan (2014) offer a review of the USA banking deregulation literature and list increased banking efficiency and credit supply at lower interest rates among the effects, while emphasizing that deregulation itself was exogenous to the business cycle. Recently, banking deregulation has also been found to increase house prices, in both the first (Mian et al., 2020a) and second

[5]From 1994 onward, the 'Riegle-Neal Interstate Banking and Branching Efficiency Act' ushered in the second wave of interstate banking deregulation, which involved lifting the requirement that banks needed a different capital structure for each branch (Medley, 2013). I show that this second wave of deregulation is highly correlated with the first, with states that deregulated earlier in the first wave also deregulating earlier in the second.

wave of deregulation (Favara and Imbs, 2015). Additionally, Hoffmann and Stewen (2020) have shown that the effects of the first wave of interstate deregulation are quite persistent, with house prices in early-deregulated states being more sensitive to the 1997-2012 aggregate US capital inflow, known as the global saving glut (Bernanke, 2005).[6]

Although it is plausible that financial institutions may have had some anticipation of the timing of deregulation, I argue, that this does not impede the exogeneity of deregulation for family planning for two reasons. Firstly, as demonstrated by Jayaratne and Strahan (1996) and in the literature review by Kroszner and Strahan (2014), the timing of bank deregulation was not linked to the business cycle.[7] While families might indeed adjust family planning based on their expectations of economic conditions, it is implausible that they not only had detailed knowledge of the timing of banking deregulation but also knew about the effects of this deregulation on the economy. Secondly, a response in the key variable through which families are affected by deregulation – increased house prices – was only recently identified by Mian et al. (2020a). It was previously believed that the predominant effect of the first deregulation wave had been on real outcomes such as GDP, income, and employment.[8] Therefore, it seems equally unlikely that (de)regulators were aware of these effects and timed deregulation with the responses of families in mind. Ultimately, if we accept the consensus in the macro-financial literature regarding deregulation being exogenous to economic outcomes, this exogeneity should be even more pronounced concerning fertility outcomes.

[6]A host of other authors have also exploited banking deregulation as a source of exogenous variation. It has been found to decrease income inequality by increasing the relative wage of unskilled workers Beck et al. (2010); to boost blacks' relative wages (Levine et al., 2014); increase women's share of employment in managerial positions (Black and Strahan, 2001); and increase aggregate growth rates by facilitating credit to entrepreneurs (Black and Strahan, 2002).

[7]Jayaratne and Strahan (1996) explicitly state: "We provide evidence that states did *not* deregulate their banks in anticipation of future good growth prospects."

[8]In contrast, the increase in house prices and credit volumes was believed to have been relatively larger in the second wave (Favara and Imbs, 2015; Célerier and Matray, 2019; Yang, 2023).

4.1.3. Banking deregulation and fertility: Channels and evidence

Changing macro conditions, induced by banking deregulation, may affect fertility decision making through several channels. Building on Hacamo (2021), Yang (2023) offers a catalogization involving three channels: the housing channel, the credit market channel and the labor market channel.

The role of rising house prices has already been touched upon, but given its importance, let us reiterate that it is split into two separate components. The house-cost channel is related to the affordability of housing, mainly affects non-homeowners and has a negative effect on fertility (Atalay et al., 2021; Simon and Tamura, 2009; Dettling and Kearney, 2014). The house-wealth channel, which mainly affects homeowners, has a positive effect on fertility (Lovenheim and Mumford, 2013; Daysal et al., 2021; Liu et al., 2020; Clark and Ferrer, 2019). The house-cost channel tends to be stronger for non-white mothers, as they are, on average, more financially constrained and are less likely to buffer the increase in house prices with financial wealth. Simultaneously, given that homeownership rates are significantly lower among the non-white population, the house-wealth effect is muted in this subsample, but more pronounced in the white subsample. Additionally, non-white mothers are on average younger, making it even less likely for them to already be homeowners and more likely to postpone the decision of parenthood in response to an increase in house prices.[9]

The credit market channel is posited to have positive fertility effects. Banking deregulation increases the availability of credit at lower interest rates, increasing the present-time resources of budget constrained households, with which to finance childbearing costs or fund home purchases. Empirically, it particularly improved

[9]See, among others, Segal et al. (1998); Coulson and Dalton (2010); Logan and Parman (2017) for a discussion of the economic inequality across races in the United States. As a summary, Figure A1.31 shows homeownership rates and net wealth by race over the last decades and Figure A1.32 plots the average age at first childbirth for different samples of the population.

access to mortgages for low and middle income, as well as young and black households (Tewari, 2014; Hacamo, 2021), which consequently increased their likelihood of becoming homeowners (Lin et al., 2021) and potentially enabled them to have their first child at a younger age.

The labor market channel can be traced back to Galbraith and Thomas (1941), who argued that the opportunity costs of childbearing are lower in recessions than in expansions. Since deregulation acts as an amplifier for economic growth, it also increases womens' opportunity costs to childbearing as labor market outcomes tend to be more favorable during booms (Black and Strahan, 2001). This counter-cyclical relationship between the economy and fertility is argued for in Butz and Ward (1979) and Monstad et al. (2008). Differently, economic security and prosperity tend to be higher during business cycle upswings hinting at a pro-cyclical relationship between the economy and fertility (Becker, 1960; Macunovich, 1996; Sobotka et al., 2011). Interestingly, Coskun and Dalgic (2022) argue that pro-cyclical fertility in modern times is due to women increasingly working in less volatile conditions than men, leading them to become the main breadwinners in recessions. This channel is addressed by contrasting the fertility outcomes of women with and without college education, based on the argument that the upswing induced by deregulation disproportionately affected the opportunity costs of college educated women. Table 4.1 provides an overview of all channels, including the assumed direction of the effect on the two main fertility outcomes: mothers' age at first childbirth (MAFC) and fertility rates. It also includes a (non-exhaustive) description of the primarily affected group.

Only two papers have evaluated the fertility implications of banking deregulation, yielding opposing results. Kim et al. (2022), studying the first wave of deregulation, find positive short-term effects on fertility rates, which they interpret as arising from the credit channel. Meanwhile, Yang (2023), examining the second wave, finds negative effects, which she attributes mainly to the house-cost channel. Not

Table 4.1: *Banking deregulation and fertility outcomes*

Channels	MAFC	Fertility Rate	Group Characteristic
House-Cost Channel	↑	↓	Home Buyers (young)
House-Wealth Channel	↑	↑	Home Owners (older, white)
Credit Market Channel	↓	↑	Credit constrained (young, non-white)
Labour Market Channel	↑	↓	High labour opportunity cost (college)

Notes: This table provides an overview of the channels potentially affecting fertility outcomes. It includes the two main outcomes variables: mothers' age at first childbirth (MAFC) and fertility rates, as well as a description of the primarily affected group. The house-cost channel is assumed to increase MAFC and decrease the fertility rate due to longer periods of savings and the postponement of fertility. The house-wealth channel likewise increases MAFC by shifting the age profile at childbirth towards older, already home-owning families, while increasing overall fertility (at least over short horizons) due to a positive wealth effect. The credit channel relaxes the constraints of credit-constrained (presumably younger) households, lowering MAFC, and increasing the fertility rate. The labor market channel delays and reduces fertility, as older, college-educated women, face higher opportunity costs on the labor market. For details: see text.

only does she demonstrate that homeowners increase fertility and non-homeowners decrease fertility, but she also notes that counties with stronger fertility decreases were those with less available land for construction (as house prices increased more in housing supply-constrained counties). I reconcile these seemingly conflicting results by considering a longer time horizon. The study by Kim et al. (2022) captures the initial boom in fertility rates, while the study by Yang (2023) captures the subsequent bust. My findings, combined with the observation that the timing of the first and second waves of deregulation are highly correlated, suggest that these two papers are ultimately examining different phases of one long cycle, a perspective this chapter is able to capture for the first time.

4.2. Data

This section introduces the dataset, explains its construction, and descriptively highlights the relationship between the key variables of the analysis: bank deregulation timing, credit, house prices, and ultimately, mothers' age at first childbirth and fertility rates.

4.2.1. Construction

The principal source for demographic variables is the National Vital Statistics System of the National Center for Health Statistics (2023), compiled by the National Bureau of Economic Research (NBER). This dataset contains information on virtually every birth in the United States, along with a rich array of control variables, covering mothers' race, age, marital status, education, as well as the county and state of residence (including the District of Columbia).[10] This dataset enables me to calculate county-level averages of Mothers' Age at First Childbirth (MAFC). To compute fertility rates, defined as the total number of births per 1000 women, I also collect county-level population data by race from the NBER's compilation of the Survey of Epidemiology and End Results, (SEER) (2023). The two sources are merged using state and county FIPS codes. All unmatched counties, observations for which any of the key variables is missing, counties that changed borders and counties that were joined or separated are dropped from the data. Additionally, it is required that all counties in the final sample have at least 20 years of uninterrupted coverage.

The second key ingredient involves data on the year in which each state began its intra and interstate banking deregulation. These dates are obtained from Mian et al. (2020a) and expanded by including Delaware and South Dakota from Amel (1993). A snapshot from the original publication by Amel (1993) is shown for the case of Florida Figure A1.30. Additionally, I collect the state-level House Price Index (HPI) from the Federal Housing Finance Agency, state-level credit data from Den Haan et al. (2005),[11], and state-level GDP from the Bureau of Economic Analysis. Finally, states that entered the sample period already being deregulated are also dropped from the analysis. The final dataset covers 228 counties across 31 states from 1969 to 2002, when the data-collection methodology in the natality statistics changes significantly.

[10]Until the beginning of the 1980s, some states reported statistics for only 50% of all registered births. When tallying the total number of children for individual subgroups, I adjust for this by multiplying the respective number by a factor of 2. This assumes that the selection of the initial 50% retains the proportionality of the total population.

[11]https://www.wouterdenhaan.com/CallReportData.html

Summary statistics for the main variables are presented in Table A1.32.

4.2.2. Bank deregulation dates

Table 4.2 displays the year in which each state began its intra- and interstate banking deregulation. Following Mian et al. (2020a), I also calculate a time invariant deregulation measure, which is referred to as the MSV-score. The background to this measure is that according to NBER dating, the United States experienced a rapid economic expansion from 1983 to 1989, followed by a contraction in 1991. Mian et al. (2020a) argue that early financial deregulation amplified this business cycle, including house prices and credit expansion, to the degree to which states were deregulated. Their measure condenses information on the timing of intra and interstate deregulation with respect to the business cycle peak in 1989, by averaging the distances between the two types of deregulation and 1989. Concretely, the deregulation score of state s is defined as the standardized value of $\frac{1}{2}\sum_{j\in(inter,intra)} max(1989 - DeregYear_{j,s}, 0)$. Ultimately, a higher MSV-score indicates that as of 1989 a state had undergone a longer period of deregulation and was thus subject to heightened exposure to business cycle dynamics.

A state is considered to be an early (late) deregulated state if its MSV-score is above (below) 0, resulting in 101 counties classified as 'early' and 127 counties classified as 'late'. This provides a straightforward method for grouping states (and the counties within them), allowing me to illustrate group-specific developments while considering both intra and interstate deregulation simultaneously. A state exhibiting a "-" in the MSV-score column of Table 4.2 indicates that the state has been excluded from the sample either because no county-level data meeting the described criteria is available, or because it was deregulated prior to the beginning of the sample period in 1969.

The end of my sample period overlaps with the years for which Yang (2023) conducts a similar exercise, building on the timing of the second wave of deregulation

Table 4.2: *Early and late deregulating states*

Early deregulated states				Late deregulated states			
variable:	intra	inter	MSV-score	Variable:	intra	inter	MSV-score
Alabama	1981	1987	0.7243	Arkansas	1994	1989	-1.2105
Alaska	1968*	1982	-	Colorado	1991	1988	-1.0170
Arizona	1968*	1986	-	Florida	1988	1985	-0.2431
California	1968*	1987	-	Hawaii	1986	1995	-
Connecticut	1980	1983	1.6917	Illinois	1988	1986	-0.4366
Delaware	1968**	1981	-	Indiana	1989	1986	-0.6300
Dstrct. Columbia	1968*	1985	-	Iowa	1994	1991	-1.2105
Georgia	1983	1985	0.7243	Kansas	1987	1992	-0.8235
Idaho	1968*	1985	-	Kentucky	1990	1984	-0.2431
Maine	1975	1978	-	Louisiana	1988	1987	-0.6300
Maryland	1968*	1985	-	Michigan	1987	1986	-0.2431
Massachusetts	1984	1983	0.9178	Minnesota	1993	1986	-0.6300
Nevada	1968*	1985	-	Mississippi	1986	1988	-0.4366
New Jersey	1977	1986	1.3047	Missouri	1990	1986	-0.6300
New York	1976	1982	2.0786	Montana	1990	1993	-
N. Carolina	1968**	1985	-	Nebraska	1985	1990	-0.4366
Ohio	1979	1985	1.4982	N. Hampshire	1987	1987	-
Oregon	1985	1986	0.1439	New Mexico	1991	1989	-1.2105
Pennsylvania	1982	1986	0.7243	North Dakota	1987	1991	-
Rhode Island	1968**	1984	-	Oklahoma	1988	1987	-0.6300
S. Carolina	1968*	1986	-	Texas	1988	1987	-0.6300
South Dakota	1968*	1983	-	Washington	1985	1987	-0.0496
Tennessee	1985	1985	0.3373	West Virginia	1987	1988	-0.6300
Utah	1981	1984	1.3047	Wisconsin	1990	1987	-0.8235
Vermont	1970	1988	-	Wyoming	1988	1987	-
Virginia	1978	1985	-				

Notes: This table shows the timing of intra-and interstate deregulation for all states in the sample. A state is considered an early deregulated state if its MSV deregulation score is higher than 0. Years followed by '*', indicate that in these states intrastate deregulation took place in an unknown year prior to 1960. Years followed by '**' indicate that its intrastate deregulation took place prior to 1960 with a know date: Delaware in 1921, Rhode Island in 1956 and North Carolina in 1921. MSV-score refers to the deregulation measure of Mian et al. (2020a), with the reported number being slightly different from theirs, as my sample also includes North Dakota and Delaware. A state exhibiting a dash (−) indicates that it is not included in the sample, either because of insufficient county level data, or because the state has been dropped due to it being treated before the sample begins.

compiled by Rice and Strahan (2010). When comparing the timing of the second wave of deregulation to the timing of the first wave (summarized by the MSV-score), a significant negative correlation becomes visible. The simple pairwise correlation coefficient between the MSV-score and the year of deregulation in the second wave is -0.35. The coefficient from a cross-sectional regression of the deregulation year in the second wave on the MSV-score is -0.5. Both coefficients are statistically significant at conventional levels. The implication is clear: states with a higher MSV-score, indicating earlier deregulation in the first wave, also deregulated earlier in the second wave.[12]

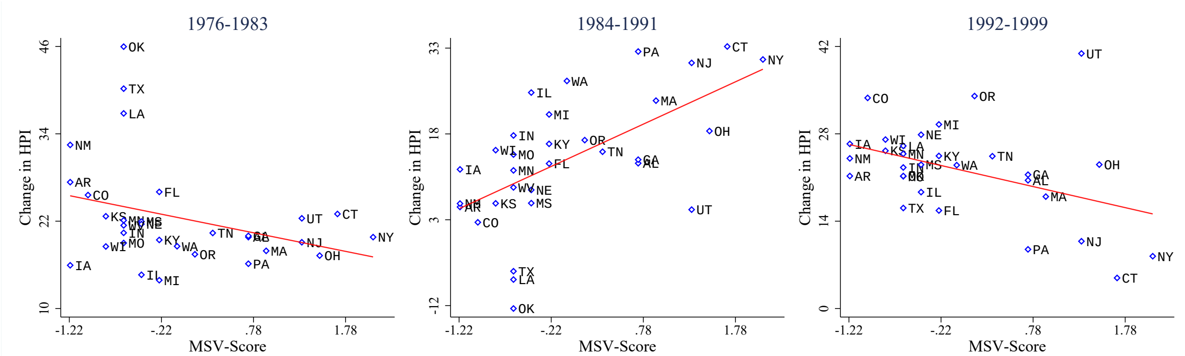
4.2.3. Bank deregulation, house prices and credit

This section begins by demonstrating that the widely documented relationship between bank deregulation and amplified business cycle outcomes (Mian et al., 2020a; Favara and Imbs, 2015; Jayaratne and Strahan, 1996) holds in my sample. Figure 4.1 focuses on the component most relevant to this study —house prices— and plots the time-invariant MSV-score on the x-axis and the growth in house prices for the periods 1976-1983, 1984-1991, and 1992-1999 on the y-axis of the left, middle, and right panels, respectively. The relationship in the middle panel is noticeably different from the other two and confirms that a higher MSV-score was associated with a stronger increase in house prices during the business cycle expansion between 1984 and 1991. The negative association in the left and right panels is much weaker, implying neither a strong pre-trend nor a bust after 1991 equal to the preceding boom in early deregulated states. Figure A1.33 in the appendix confirms a similar pattern for the relationship between the growth in the credit-to-GDP ratio and the MSV-score.

To illustrate these relationships over time, I split the sample into early and late deregulated states based on the MSV-score and plot group-specific averages for state-level GDP, credit, and house prices in Figure A1.34. All variables are indexed to 1983 to highlight differences in growth rates rather than levels. In the left panel, early deregulated states' GDP grew slightly faster during the boom, but the difference is relatively small. The middle panel, in contrast, reveals a significant credit boom in early deregulated states not observed in late deregulated states. The right panel repeats the same exercise for house prices. Before 1983, growth in house prices is similar between early and late deregulating states, but afterward, early deregulating

[12] For completeness, I also include the second wave deregulation timing in the summary statistics in Table A1.32.

Figure 4.1: *House prices and banking deregulation*



Notes: This figure shows scatterplots illustrating the link between the change in the House Price Index (HPI) and the MSV-deregulation measure. The left panel connects the changes in the HPI between 1976 and 1983 with the deregulation measure, while the central and right panels, cover the change between 1984 and 1991 and 1992 and 1999, respectively. Fitted regression lines illustrate the correlation.

states experience a boom. Notably, at the peak in 1990, the difference in house price growth between early and late deregulating states is approximately twice that of credit growth (50% vs. 25% faster, relative to 1983). Despite a slight bust afterward, house prices in early deregulated states have grown approximately 25% faster than those in later deregulated states by 2000, with most of this difference attributable to the late 1980s boom period. The persistent gap in the HPI between early and late deregulated states reflects the enduring effects of deregulation as documented by Hoffmann and Stewen (2020).

4.2.4. Interstate and intrastate mortgage credit booms

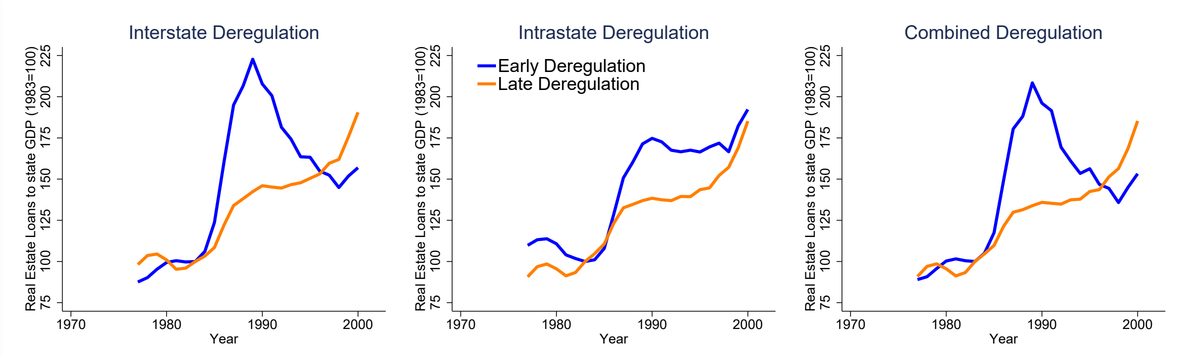
During the business cycle expansion of the 1980s, credit and house prices expanded more in early deregulated states, but house prices did so more rapidly than aggregate credit. Additionally, house prices in early deregulated states remained elevated beyond the business cycle expansion (which ended in 1990) and well into the 2000s. The credit expansion in early deregulated states, in contrast, was followed by a contraction at the beginning of the 1990s, and in the long run, the cumulative excess credit in early deregulated states compared to late deregulated ones became negligible. To rationalize this finding, the following pages take a closer look at the largest component of credit and the one most closely related to house price growth: mortgage credit.

So far, I have followed Mian et al. (2020a) in focusing on a combined measure of banking liberalization, which considers both interstate and intrastate deregulation timing. Now, while keeping the definition of 'early deregulation' referring to a year before 1983 (the start of the nationwide economic expansion), I look at interstate, intrastate, and combined inter and intrastate deregulation separately. Figure 4.2 consequently plots mortgage credit relative to GDP, indexed to 1983, separately for early and late deregulated states. The distinction is based on interstate deregulation in the left panel, intrastate deregulation in the middle panel, and the first year in which both types of deregulation had taken place in the right panel.

The amplification of the nationwide credit boom in early deregulated states, as observed by Mian et al. (2020a), remains evident across all three panels, but with notably different trajectories for the two types of deregulation. In states with early interstate deregulation, the increase in mortgage credit is faster, steeper, and larger compared to states with early intrastate deregulation. Importantly, a sharp bust in credit is observed after 1990 for the early interstate deregulation sample, leading cumulative mortgage credit growth to fall below that of later deregulating states. This bust is absent in the late interstate deregulation group and in both the late and early intrastate deregulation samples, where mortgage credit volume simply stagnates. The more pronounced boom-bust pattern contingent on early interstate deregulation implies that it was the rapid inflow of out-of-state funds, facilitated by interstate deregulation, that financed mortgage credit expansion and drove aggregate credit outcomes. By the early 1990s, these funds were being withdrawn, causing a decline in the total volume of available credit. In the long run, this created a situation where high house prices were coupled with shrinking mortgage credit volumes in states with early interstate banking deregulation.

This aligns with foreign (out-of-state) funding being readily available during

Figure 4.2: *Mortgage credit expansion. Early- vs late-deregulated states*



Notes: This figure shows the average mortgage credit to GDP ratio (normalized to 100 at 1983) across early- and late-deregulated states. The left (central) graph defines a state as early interstate (intrastate) deregulated if it began its interstate (intrastate) deregulation in 1983 or earlier. The graph on the right defines a state as an early deregulated state if it had already began both types of deregulation in 1983 or earlier.

boom periods but also being more prone to capital flight and retrenchment during economic downturns, as documented in the literature on capital flows (Caballero and Simsek, 2020; Broner et al., 2013) and the previous chapters based on Diebold (2023) and Diebold and Richter (2021). The disproportionate response of mortgage credit relative to total credit, and interstate relative to intrastate deregulation, is similarly in line with Diebold and Richter (2021). It confirms that household credit is an important destination for foreign funding, but also that households may be forced to deleverage quickly when economic conditions deteriorate. Based on the reasoning that households adjust their fertility choices in accordance with changing macroeconomic conditions (especially credit and house prices), fertility outcomes would be expected to also respond more strongly to interstate compared to intrastate deregulation.

4.3. Connecting Financial Deregulation and Fertility

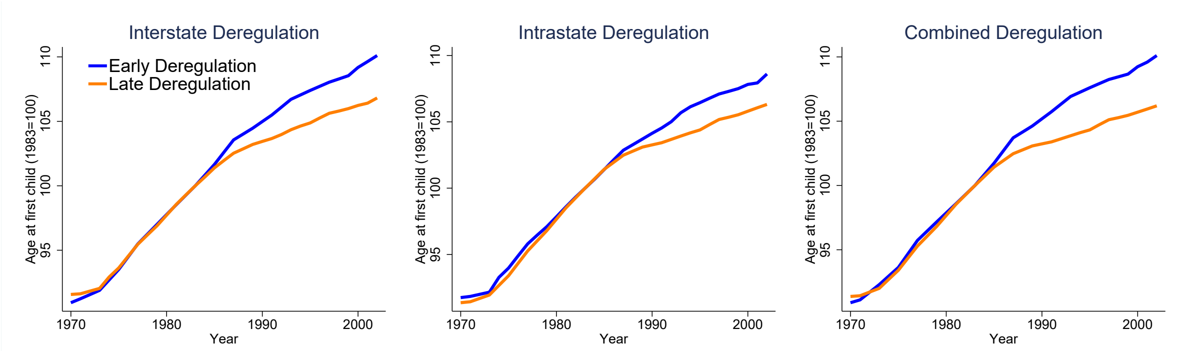
Before formally estimating the net effect of financial deregulation on fertility outcomes in section 4.4 and section 4.5, this section takes a descriptive approach to the same question. It first focuses on MAFC in section 4.1 and then on fertility rates in section 4.2. I begin by showing visually that in early deregulating states, MAFC increased faster, while fertility rates rose compared to late deregulating states. To make sense of these findings, I then take a closer look at possible channels and find a strong positive relationship between house price growth and fertility outcomes.

4.3.1. Mothers' age at first childbirth

What is the aggregate relationship between deregulation and the evolution in MAFC? To answer this question, I follow the criteria of Mian et al. (2020a) and define early deregulated states as those that began their inter-, intrastate, or both deregulation processes in 1983 (the start of the nationwide economic expansion) or earlier. I compute the average MAFC over all counties included in each group, index it to 1983, and plot it in Figure 4.3. The results are striking. Until the end of the 1980s, there is no difference whatsoever between the two groups, but following financial deregulation (with a lag of several years, on which later sections will expand), the age at which women became mothers began to increase faster in early relative to late deregulating states. This pattern is comparable across all three panels, with the rightmost panel, considering both intra- and interstate deregulation, exhibiting the largest divergence. To further quantify this finding, Figure A2.35 scatters the MSV-score against changes in MAFC for the periods 1976-1983, 1984-1991, and 1992-1999. No association between a high deregulation measure and changes in mothers' age at first child is visible prior to 1983, but a positive link emerges for the period between 1984 and 1991. Afterwards, the positive relationship remains, although with more noise around the trend. In Figure A2.36, it is also shows that the increased interstate MAFC variance, documented by Guzzo and Payne (2018), can at least be partially attributed to the diverging trends in MAFC of early and late deregulated states.

What is driving the positive link between banking deregulation and MAFC after 1983? Credit expansion has been identified as one of the primary consequences

Figure 4.3: *Mothers age at first child. Early- vs late-deregulated states*

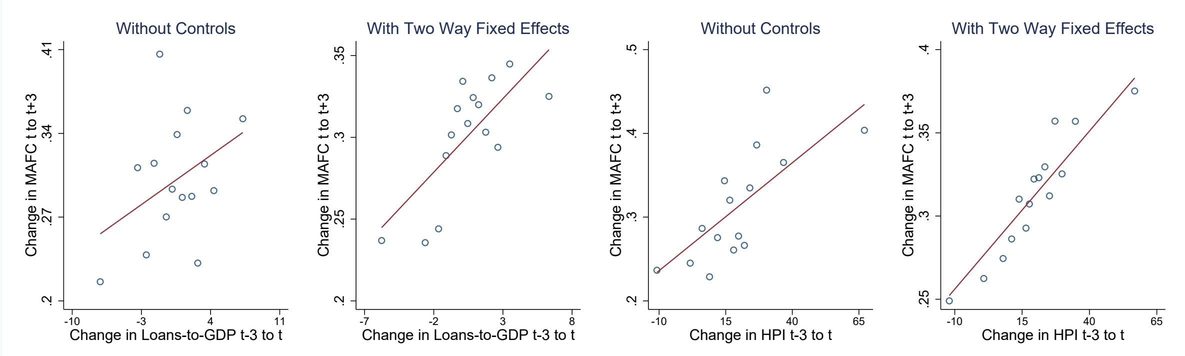


Notes: This figure shows the average Mother's Age at First Childbirth (MAFC) (normalized to 100 at 1983) across counties in early- and late-deregulated states. The left (central) graph defines a state as early interstate (intrastate) deregulated if it began its interstate (intrastate) deregulation in 1983 or earlier. The graph on the right defines a state as an early deregulated state if it had already began both types of deregulation in 1983 or earlier.

of bank liberalization and is, according to the credit channel, a means to finance present-time childbearing costs for younger and more credit-constrained couples. A first-order expectation should therefore be that women with *less* access to credit in late deregulation states would need to, relatively, postpone their pregnancies. And yet, mothers seem to delay pregnancy more in states that deregulated earlier. House prices, on the other hand, would lead to the postponement of pregnancies via the house-cost channel and increased fertility among older couples who are more likely to be homeowners, benefiting from the house-wealth effect.

To systematically distinguish these channels, I relate the state-level growth in loans and house prices to changes in MAFC on the county level in Figure 4.4. It computes the growth in loans-to-GDP between $t-3$ and t and the change in MAFC between t and $t+3$, plotting the two against each other in the left panel. Surprisingly, a positive relationship is visible, which becomes stronger upon the inclusion of county and year fixed effects in the middle-left panel. In the middle-right panel, the exercise is repeated using the growth in house prices instead of loans, which produces the expected distinctly positive relationship. This already strong link improves further when including county and year fixed effects in the rightmost panel. These results can be interpreted as the credit channel being dominated by the housing channel, while simultaneously contributing to it via increased housing demand due to access

Figure 4.4: *Lagged loan and house price growth and forward changes in MAFC*



Notes: This figure shows binned scatterplots for the correlation between the change in Loans-to-GDP (the House Price Index (HPI)) between $t-3$ and t, and the change in Mother's Age at First Childbirth (MAFC) between t and $t+3$. The middle left and rightmost panel include county and year fixed effects. Fitted regression lines illustrate the correlation.

to mortgage lending. For house prices, the results are unambiguous. Larger house price growth in the past is associated with a faster future increase in MAFC, in line with the affordability-delaying effect of the house-cost channel.

4.3.2. Fertility rates

Various authors have argued for fertility being pro-cyclical (Sobotka et al., 2011; Coskun and Dalgic, 2022), or counter-cyclical (Butz and Ward, 1979; Monstad et al., 2008) to economic conditions. Ex ante, it is therefore difficult to determine in which direction fertility should move after deregulation. While there seems to be considerable evidence for the delaying of childbirth, the counteracting forces of improved economic prospects and the house-wealth channel might still tip aggregate fertility rates into a net positive direction. This ambivalence is reflected in the only two previous papers that have, as of yet, addressed this question. While Kim et al. (2022) reported that the first wave of deregulation increased fertility rates at short horizons, the results of Yang (2023) indicate that fertility rates decreased after the second wave of deregulation. Ultimately, however, the direction of the long-run net effect is an empirical question, whose answer depends on the relative strength of the channels at play.

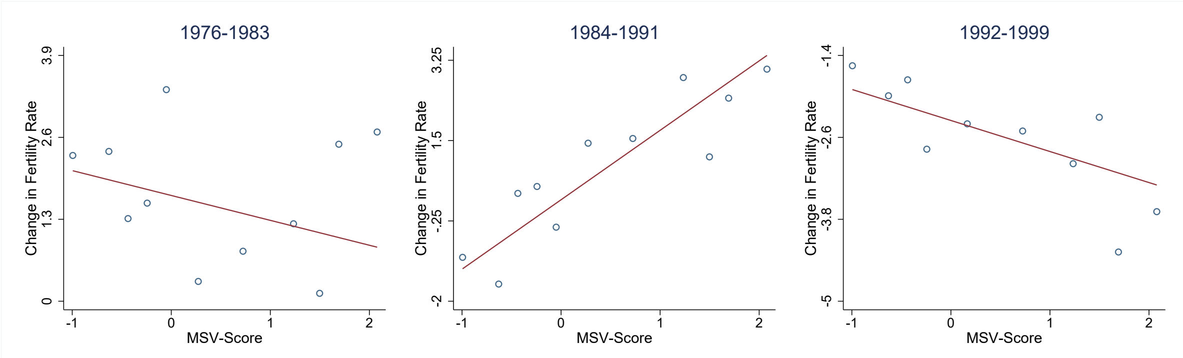
Figure 4.5 examines the relationship between deregulation and fertility rates across the three familiar periods: pre-boom, boom, and post-boom. While the pre-boom period doesn't show an obvious link between fertility rates and deregulation, a clearly positive relationship between the MSV-score and county-level fertility rates emerges between 1984 and 1991. This suggests that the pronounced business cycle upswing and wealth gains through increased house prices in early deregulated states positively affected fertility, consistent with Kim et al. (2022). Conversely, the subsequent negative relationship between deregulation during the 1990s partially coincides with the sample period of Yang (2023), who finds a negative effect of deregulation on fertility. These trends are also reflected in Figure A2.37, which shows that compared to 1983, fertility rates increased in early deregulating states from the 1970s up to 1990, while remaining almost unchanged in late deregulating states. Interestingly, both groups experienced a decline in fertility rates after 1990, but with the drop being more pronounced in early deregulating states.[13]

Figure A2.38 in the appendix plots individual state-level fertility rates over time, showing that when distinguishing between early and late deregulating states, the group averages converge until 1990 but diverge afterward. Figure A2.39 explores potential explanations for these trends by plotting the growth in credit and house prices between $t-3$ and t against the change in fertility rates from t to $t+3$. In both instances, the relationship is positive, aligning with the assumed effects of the credit and the house-wealth channels. Upon the inclusion of county-year fixed effects, however, the relationship becomes more dispersed for credit, while it becomes more pronounced for house prices.

At first glance, it seems contradictory that house price growth raises fertility rates while simultaneously contributing to delayed parenthood. These results can be reconciled by considering the two components of the housing channel. According to the house-wealth channel, home-owning parents (likely older) may opt for increased

[13]Unlike MAFC, pre-deregulation trends diverge, as fertility rates in early deregulating states began to increase already in the late 1970s. It is, however, important to bear in mind that while the beginning of the business cycle expansion is dated 1983, some states deregulated well before then, potentially influencing the pre-trend observed in early deregulated states.

Figure 4.5: *Fertility rate changes and the deregulation measure*



Notes: This graph displays binned scatterplots illustrating the relationship between the county-level change in fertility rates and the MSV-deregulation measure over different time periods. Fertility rates are defined as the number of children born to a thousand women in any given year. The left panel shows the relationship between the change in fertility rate between 1976 and 1983 and the deregulation measure, while the central and right panels do so for the periods between 1984 and 1991, and 1992 and 1999, respectively.

fertility, while according to the house-cost channel, non-home-owning parents (likely younger) may postpone parenthood. Essentially, the latter concerns the decision of whether and when to have children (the extensive margin), while the former may have a stronger influence on the decision of how many children to have (the intensive margin). Over medium-term horizons, the positive effect on the intensive margin outweighs the negative effect of reduced fertility along the extensive margin. However, as pregnancies cannot be delayed indefinitely, an aggregate increase in MAFC will likely be followed by reduced fertility over longer horizons. This section provides tentative evidence supporting this intuition, observing a more pronounced decrease in fertility rates in states the were deregulated earlier.

4.4. Delaying Fertility: Results for Mothers' Age At First Childbirth

After approaching the connections among the key variables in this study descriptively, this section turns to quantifying these relationships in a more formal setting. It begins by adapting two estimations from Mian et al. (2020a) to systematically evaluate whether MAFC increased following banking deregulation, and shed light on the macroeconomic mechanisms driving this development. Subsequently, I employ staggered difference-in-differences estimators to compute the net effect of deregulation on MAFC. The following subsections consider heterogeneous treatment effects for different demographic subsamples of women and compare the baseline results to more conventional 'dynamic' and 'static' difference-in-differences estimators as a robustness exercise.

4.4.1. The starting point

Equation 4.1 starts with a simple cross-sectional setting proposed by (Mian et al., 2020a), regressing the cumulative 7-year change in MAFC on the deregulation measure over different periods:

$$\Delta_7 MAFC_{i,t} = \alpha + \beta^{MSV} \times MSV\text{-}Score_i + \beta^{Z} \times Z_{i,t} + \epsilon_i \,. \tag{4.1}$$

Here, $\Delta_7 MAFC_i$ refers to the seven year change in mothers' age at their first childbirth in county i. $MSV\text{-}Score_i$ denotes the time invariant deregulation measure of the state in which county i is located in. Z_i is a vector of state-level control variables, specifically house prices and credit. I retain the three previously used seven year periods, covering the years prior to (columns (1) to (3)), during (columns (4) to (6)) and after the 1980s business cycle expansion (columns (7) to (9)) and display the results in Table 4.3.

Columns (1), (4), and (7) present the unconditional relationship between the MSV-score and the increase in MAFC over the respective period. In the 'placebo' regression prior to the expansion cycle in column (1), no relationship is visible. The coefficient, however, turns positive and significant during the expansion between 1984 and 1991 in column (4). Afterwards, in column (7), it remains positively significant but decreases in magnitude. Columns (2), (5), and (8) control for contemporaneous state-level growth in credit and house prices. This has no apparent effect in (2), but in column (5), explanatory power shifts from the deregulation measure to house prices,

Table 4.3: *Mothers' age at first child and deregulation. Cross-sectional regressions*

	$Mothers Age\ at\ First\ Child_i$								
	$\Delta_{1976-1983}$			$\Delta_{1984-1991}$			$\Delta_{1992-1999}$		
	OLS (1)	OLS (2)	IV (3)	OLS (4)	OLS (5)	IV (6)	OLS (7)	OLS (8)	IV (9)
$MSV\text{-}Score_i$	-0.02 (0.02)	-0.03 (0.02)		0.17^{**} (0.07)	0.04 (0.06)		0.07^{**} (0.03)	0.06 (0.04)	
$\Delta_7\ Credit_i$		1.32 (0.93)			-0.65 (0.81)			-0.39 (0.39)	
$\Delta_7\ HP\ Index_i$		-0.00 (0.00)	0.01 (0.01)		0.02^{***} (0.00)	0.02^{***} (0.01)		-0.00 (0.00)	-0.02^{**} (0.01)
Kleibergen-Paap Weak ID			4.04			15.39			6.33
Observations	228	228	228	228	228	228	224	224	224

Notes: This table shows results from Equation 4.1. The dependent variable is the cumulative change in Mothers' Age at First Childbirth (MAFC) over different time periods. $MSV\text{-}Score_i$ refers to the previously computed time invariant deregulation measure of the state a county is located in. $\Delta Credit_i$ and $\Delta HPIndex_i$ are, the cumulative change in total credit and the House Price Index over the corresponding periods. For the Instrumental Variable (IV) specifications the reported Kleibergen-Paap f-statistic indicates the strength of the first stage fit. State level clustered errors are in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

reinforcing the interpretation that the primary channel through which deregulation affects fertility outcomes is via house prices. The coefficient for credit is negative, suggesting that increased access to credit might have eased liquidity constraints for couples (when controlling for house price growth), but it is statistically insignificant. In column (8), during the post-boom period, the result is different once again. House price growth is not significantly related to increases in MAFC after 1991, but the MSV-score's coefficient remains virtually unchanged compared to column (7), but falls just short of conventional significance levels. The interpretation of this result again relies on the variation in house prices. House prices in early deregulated states did not experience a bust after 1991 comparable to the preceding boom, and therefore remained elevated without creating additional wealth for homeowners. It is likely that the MSV-score captures the elevated house prices leading to the postponement of pregnancies, while variation in house prices itself is not large enough to further delay (or advance) childbirth.

To alleviate the concern that the effect is running in the opposite direction to the proposed reasoning (an increase in the average age at childbirth might be linked to increased housing demand, stemming from higher financial wealth at the time of childbirth), I instrument the growth in house prices with the MSV-score in columns (3), (6), and (9). In column (3), the IV estimate produces no significant coefficient, and more importantly, the f-statistic is below the conventional benchmark of 10, indicating that the MSV-score is not a relevant instrument in the placebo period. Conversely, column (6) not only replicates the HPI's coefficient from column (5) in an IV-setting but also exhibits an f-statistic above 15, satisfying the relevance condition of the instrument. For the period 1992-1999 in column (9), the f-statistic drops back below 10, while the coefficient turns negative.[14] I want to emphasize, however, given that state-level deregulation has been linked to a number of economic outcomes beyond the channels discussed here[15], that I do not claim for the exclusion restriction to hold. Ultimately, the causal interpretation of the effect of deregulation on fertility does not rest on an IV-specification but on results obtained from difference-in-differences estimators. These models estimate the *net* impact on fertility, for which house prices, arguably, play an important role.

Turning to a more exact estimation of the timing of the relationship between banking deregulation, credit, house prices and mothers' age at first childbirth Equation 4.2 follows another specification proposed by (Mian et al., 2020a)

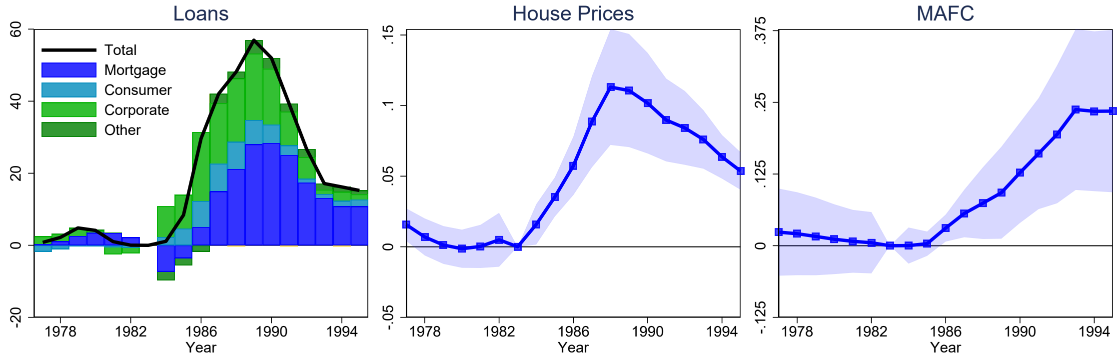
$$Y_{i,t} = \alpha_i + \lambda_t + \sum_{q \neq 1983} \beta_q \times \mathbf{1}_{[t=q]} \times MSV\text{-}Score_i + \epsilon_{i,t}\,, \tag{4.2}$$

where $Y_{i,t}$ refers to state-level loans, the state-level house price index (divided by 100) and to the county-level MAFC average at time t. $MSV\text{-}Score_i$ again refers to the time invariant deregulation score of the state in which county i is located in. By interacting a yearly dummy with the deregulation measure (excluding the year 1983), this specification yields a series of estimates of β_q, which can be interpreted as the

[14]This potentially reflects the business cycle downturn during which elevated house prices might have been a stabilizing factor, moderating the drop in fertility that occurs disproportionately for young childless couples during economic downturns (Sobotka et al., 2011).

[15]Banking deregulation has also been found to increase local economic growth (Jayaratne and Strahan, 1996; Huang, 2008); increase income inequality (Beck et al., 2010); facilitate entrepreneurship (Black and Strahan, 2002); and affect state business cycles (Morgan et al., 2004)

Figure 4.6: *The amplifying effect of deregulation on MAFC by year*



Notes: This figure plots the estimates of the coefficient of interest (β_q) for different years (q), except for q = 1982) from Equation 4.2. The left panel plots the yearly coefficients for state-level house prices and the right panel the coefficients for county-level Mothers' Age at First Childbirth (MAFC). Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

amplification effect of the 1980s expansion on more deregulated states (Mian et al., 2020a). All specifications additionally include unit and year fixed effects.

The left and central panels of Figure 4.6 corroborate the findings of (Mian et al., 2020a) in my sample. Starting from 1983 (the beginning of the national economic expansion), states with higher MSV-Scores (indicating earlier deregulation) experienced increased credit and house price growth, peaking around 1999. Afterwards, they slowly decline, but nevertheless remain elevated in earlier deregulated states. While the housing and credit channels have distinct implications for fertility outcomes, disaggregating credit in the left panels reveals that mortgage lending contributed around 50% to the credit expansion at the peak of the boom, which is likely to have contributed to the increase in house prices. The right panel shows that MAFC likewise increased, although with a time lag of several years compared to the other variables, becoming statistically significant at the 90% level in the second half of the 1980's and only peaking in 1995. This difference in the timing of the three trajectories suggests that the increase in house prices during the 1980s took time to influence family planning decisions, and became increasingly significant for fertility decisions once they where sufficiently elevated. Additionally, the MAFC data, based on birth certificates, reflects the decision to become parents with a lag (at the very least) of nine months. Importantly, none of the three variables exhibits a clear trend before

1983, satisfying the no pre-trend assumption required for the difference-in-differences estimation in the following section.

4.4.2. The baseline: staggered difference-in-differences

Banking deregulation in the United States took place at different points in time across states. After deregulating, states never switched back to the previous regime, making deregulation equivalent to a staggered roll-out of treatment. Together with the widely accepted exogeneity of deregulation timing to the business cycle (Kroszner and Strahan, 1999, 2014; Mian et al., 2020a)[16] this sets the stage for a difference-in-differences approach. I opt for the new class of staggered diff-in-diff estimators as the most suitable in this setting, since more conventional 'static' and 'dynamic' diff-in-diff estimators have been shown to suffer econometric pitfalls and interpretation ambiguity in the case of staggered roll outs (Callaway and Sant'Anna, 2021; Roth et al., 2023; Baker et al., 2022). In particular, they assume that the effect after one year from implementation is the same, regardless of any potentially differing conditions at the time of treatment. Additionally, Roth et al. (2023) explain that *'Longer-run treatment effects will often receive negative weights. Thus, for example, it is possible that the treatment-effect is positive and grows over time since the expansion, and yet* β^{post} *will be negative'.* Mian et al. (2020a) and Baker et al. (2022) further note that changing the panel length alone can change the weights applied to each group and confound estimates.

In my setting, treatment effects are very likely to depend on time of implementation. For instance, the effect of banking deregulation implemented during the USA's 1980s expansion (for example 1983) will likely be different to the effect of a treatment during the posterior recession (for example 1991). Staggered diff-in-diff

[16] The argument generally involves that technological change eroded the competitiveness of local banks, which reduced state level opposition to deregulation. While states under republican control tended to deregulate earlier, establishing *political* endogeneity, Kroszner and Strahan (2014) show that there is no correlation between the state level business cycle and the timing of deregulation, refuting *economic* endogeneity.

estimators try to fully account for the differences in the timing of treatment. They allow for unbiased estimates even in cases where there is no control group of never treated instances, by estimating differences to the 'not-yet-treated' observations. Two estimators that have gained popularity recently are the Callaway and Sant'Anna (2021) (the CS-estimator, hereafter) and the Borusyak et al. (2022) (the BJS-estimator, hereafter). The main difference between them, as explained in Roth et al. (2023) is that the CS-estimator computes the average treatment effect on the treated (ATT) based on differences between individual treated and not-yet-treated time periods, while the BJS-estimator's ATT is based on differences with respect to the pre-treatment period average.

Roth et al. (2023) illustrate the difference for a non-staggered case with three time periods $(t = 1, 2, 3)$ and units being treated in $t = 3$ or never $t = \infty$. The CS-estimator for period 3, in this setting, compares treated and untreated units between periods 2 and 3

$$\widehat{ATT}_{CS(3,3)} = \underbrace{\bar{Y}_{(3,3)} - \bar{Y}_{(3,\infty)}}_{Diff\ at\ t=3} - \underbrace{\bar{Y}_{(2,3)} - \bar{Y}_{(2,\infty)}}_{Diff\ at\ t=2}, \tag{4.3}$$

where $\bar{Y}_{(t,g)}$ is the average outcome in period t for units that were treated in period g. The BJS-estimator, on the other hand, uses the average pre-treatment outcome as the reference point:

$$\widehat{ATT}_{BJS(3,3)} = \underbrace{\bar{Y}_{(3,3)} - \bar{Y}_{(3,\infty)}}_{Diff\ at\ t=3} - \underbrace{\bar{Y}_{(pre,3)} - \bar{Y}_{(pre,\infty)}}_{Avg.\ Diff\ in\ Pre-Periods} \tag{4.4}$$

Here $\bar{Y}_{(pre,g)}$ is the average pre-treatment outcome for the group that was treated in g, which in this illustrative setting with 3 periods corresponds to $\frac{1}{2}(\bar{Y}_{(1,g)} + \bar{Y}_{(2,g)})$.

Therefore, while the CS-estimator makes all comparisons relative to the last pre-treatment period, the BJS-estimator compares periods relative to the average of pre-treatment periods. Roth et al. (2023) note that the two estimators tend to produce similar estimates when the parallel trends assumption prior to treatment is satisfied. In the context of banking deregulation, where treatment is not uniformly distributed across years, I consider the BJS-estimator to be preferable because, by averaging, it is more robust to outlying values. With the CS-estimator, it is possible that the ATT for certain groups in different periods is calculated based on very few period-to-period differences or even converges to point estimates based on individual period-to-period differences in extreme cases.[17] Nevertheless, later sections provide estimates using the CS-estimator for comparison and, consistent with intuition, find that results over short horizons are similar to the BJS-estimates when sufficient comparison groups are available to the CS-estimator.

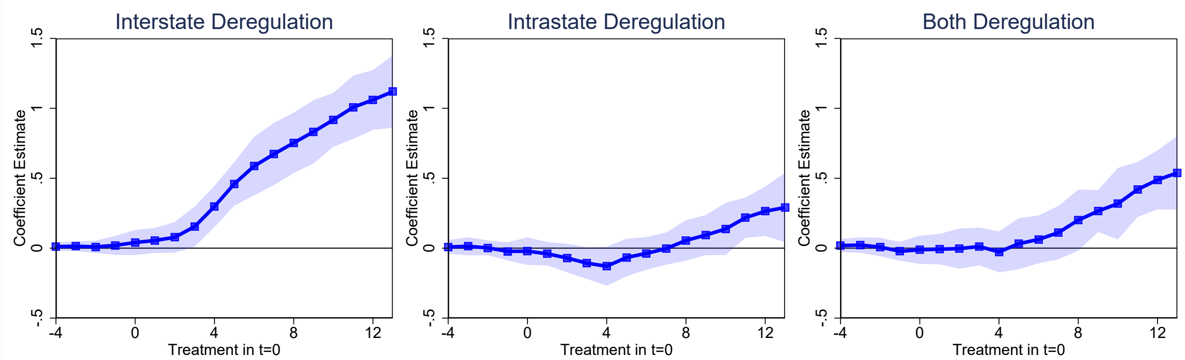
The pre-treatment average of the BJS-estimator is computed by fitting a two-way fixed effects regression (TWFE-regression) of the outcome variable on unit and time fixed effects, using only the observations that are not-yet-treated, i.e., for units such that $g_i > t$:

$$MAFC_{i,t} = \alpha_i + \lambda_t + \epsilon_{i,t} \quad |t < g_i. \tag{4.5}$$

The never treated potential outcome for each treated unit, denoted as $\widehat{Y}_{i,t}(\infty)$, is inferred using the fitted values of this regression. The difference between the realized outcomes of treated units and the previously calculated fitted values, $Y_{i,t} - \widehat{Y}_{i,t}(\infty)$ is then considered as the individual-level treatment estimate, $\widehat{\beta}_{BJS(i,t)}$. In order to obtain the average treatment effect at horizon p, the BJS-estimator aggregates the

[17]Note that the sample includes 228 counties, with treatment variation at the state level for only 31 states, which is not uniformly distributed. In 1986, eight of these states deregulated (interstate), compared to only one in 1990. This state is Nebraska, for which only two counties report data. Additionally, the length of the horizon around treatment for which estimates can be computed using the CS-estimator depends on the time-distance between the first and last treated state. For interstate deregulation, the first state in my sample is New York in 1982 and the last one is Kansas in 1992. For an estimation longer than nine periods after treatment, the CS-estimator lacks a not-yet-treated group for comparison and cannot compute a coefficient. In the extreme case of a nine-year treatment impact estimation, the only not-yet-treated state to compare New York to would be Kansas. By averaging, the BJS-estimator mitigates this problem and allows for the computation of coefficients over longer time horizons, which I believe is necessary due to the lagged effect of deregulation on fertility through house prices.

Figure 4.7: *Mothers' age at first child and deregulation. BJS-Estimator*



Notes: This figure shows results using the BJS-Estimator from Equation 4.6. The graphs plot the estimated treatment effect p periods before and after treatment on mothers' age at first childbirth (MAFC). In the left (central-) panel, treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both inter- and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

treatment estimates p periods after treatment over the n units:

$$\widehat{ATT}_{BJS(p)} = \frac{1}{N}\sum_{i}^{n}\widehat{\beta}_{BJS(i,t=g+p)}, \tag{4.6}$$

where $\widehat{\beta}_{\beta(i,t=g+p)}$ is the estimated treatment effect for unit i, p periods after treatment, which occurred at time g_i. $\widehat{ATT}_{BJS(p)}$ is its average across units. Instead of relying on a time invariant deregulation measure, like the $MSV - score$, this allows to compute the treatment effects of interstate, intrastate, and both types of deregulation combined (the first year in which both have taken place), separately from one another. The baseline estimation consequently consist of computing the effects of the three different types of deregulation on county level averages of MAFC, using the BJS-estimator.

The results are reported in Figure 4.7 and display estimates for interstate, intrastate and combined deregulation in the left, middle, and right panel respectively. They reveal: (i) MAFC responds positively to deregulation in all three specifications. (ii) No statistically relevant pre-treatment trend is visible in either panel. (iii) A lagged response of fertility decisions to treatment. This lag can be attributed to the time it takes for house prices to increase, this rise to impact family decision making, and the data being recorded at the time of birth which, at the earliest, reflects family decisions being made 9 months ago. (iv) The response is more pronounced for interstate deregulation than of intrastate regulation. This result is reoccurring across all following specifications and suggests that the inflow of out-of-state capital was more consequential than the more efficient distribution of existing within state capital enabled by intrastate deregulation.

These findings are consistent with the previously developed intuition and indicate a substantial and statistically significant association between financial deregulation and the increased age at first childbirth. The effect is cumulative, ranging between 0.3 (equivalent to four months) and 1 (equivalent to one year) ten years after treatment. To put this into perspective, between 1970 and 2000, the average age at first childbirth across the entire United States increased by approximately three years, from around 22 to around 25 (refer to: Figure A1.32). If my results are accurate, house price growth induced by financial deregulation seems to have played a significant role in driving this trend.

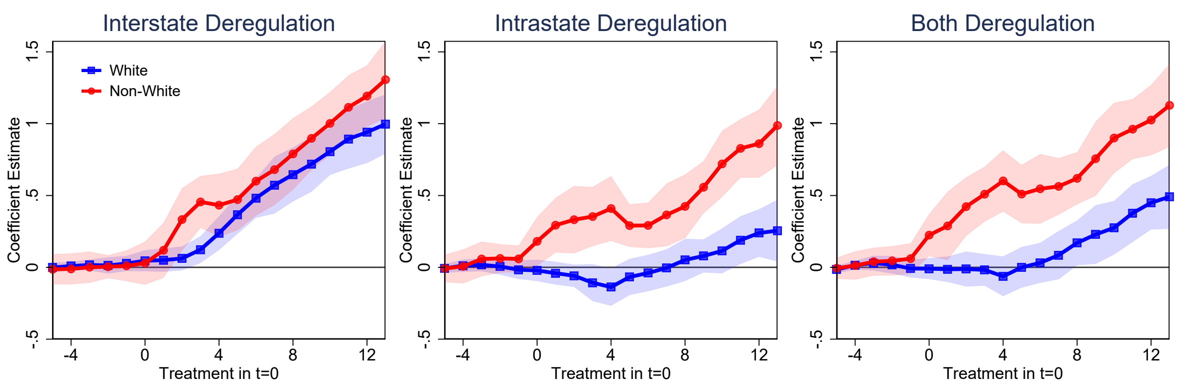
4.4.3. Channels and population heterogeneity

Depending on the socioeconomic situation of each household, the relative strength of the different channels connecting deregulation to fertility decisions varies. This section divides the sample along various dimensions, which serve as proxies for heterogeneous exposure to house price movements and labor market outcomes.

I begin by splitting the sample between white and non-white mothers[18], which proxies for very different average financial wealth and homeownership rates (Haughwout et al., 2020; Coulson and Dalton, 2010; Taylor et al., 2011). To illustrate these differences, Figure A1.31 shows the extent to which financial wealth and homeownership rates differ between the white and non-white populations in the US. These two metrics are crucial for the relative strength of the two variants of the housing channel. Due to the fact that non-white households have significantly lower wealth and are more financially constrained than white households, the house-cost channel

[18]This binary labeling is due to changing and expanding racial classifications across the sample period, representing the only consistent and unchanging distinction.

Figure 4.8: *Mothers' age at first child and deregulation, by race of mother. BJS-Estimator*



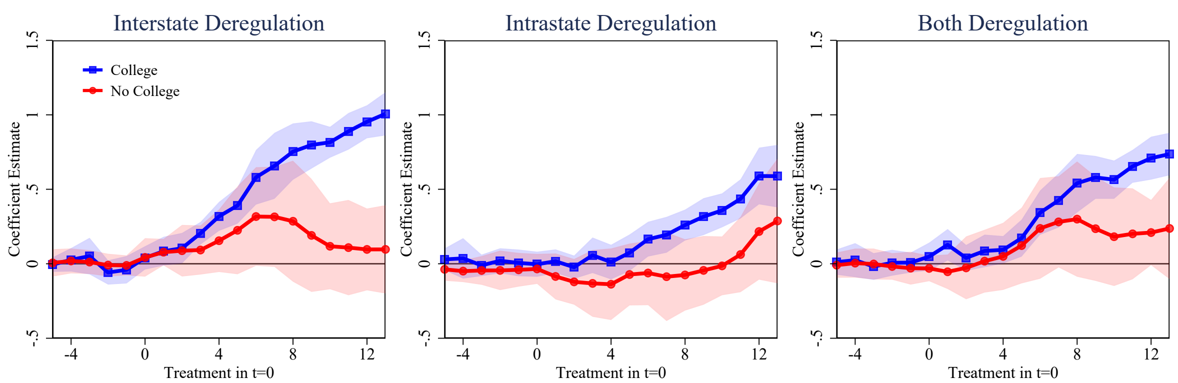
Notes: This figure shows results obtained from the BJS-Estimator conditional on mothers' race. Results in blue (red) are estimated on the sub-sample of white (non-white) mothers. The graphs plot the cumulative treatment effect p periods before or after treatment on Mothers' Age At First Childbirth (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

presumably has a stronger impact on their fertility decision-making. White households, in contrast, have significantly higher homeownership rates and consequently benefit relatively more from the house-wealth channel. Figure 4.8 plots the results for MAFC for white and non-white mothers in blue and red, respectively.

The first significant observation from Figure 4.8 is that the increase in MAFC is more pronounced for the non-white population across all horizons. Interestingly, this difference becomes evident almost immediately after treatment and continues to widen only slightly afterwards. This observation potentially indicates that the house-cost channel comes into effect more rapidly for the economically constrained non-white sample, compared to the less constrained white sample. Approximately five periods after deregulation, both estimates display similar dynamics, with the non-white population consistently exhibiting a stronger responsiveness. Again, neither group or panel shows a pre-trend prior to deregulation at $t = 0$.

The credit channel disproportionately affects younger, non-white and financially constrained couples and their homeownership rates (Tewari, 2014; Hacamo, 2021; Lin et al., 2021). As early deregulated states also experienced a significant expansion of credit alongside house price growth, this should, in theory, lower the age at childbirth

Figure 4.9: *College and non-college educated mothers' age at first child and deregulation. BJS-Estimator*



Notes: This figure shows results obtained from the BJS-Estimator conditional on whether mothers are college educated or not. Results in blue (red) are estimated on the sub-sample of college (non-college) educated mothers. The graphs plot the cumulative treatment effect *p* periods before or after treatment on Mothers' Age At First Childbirth (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

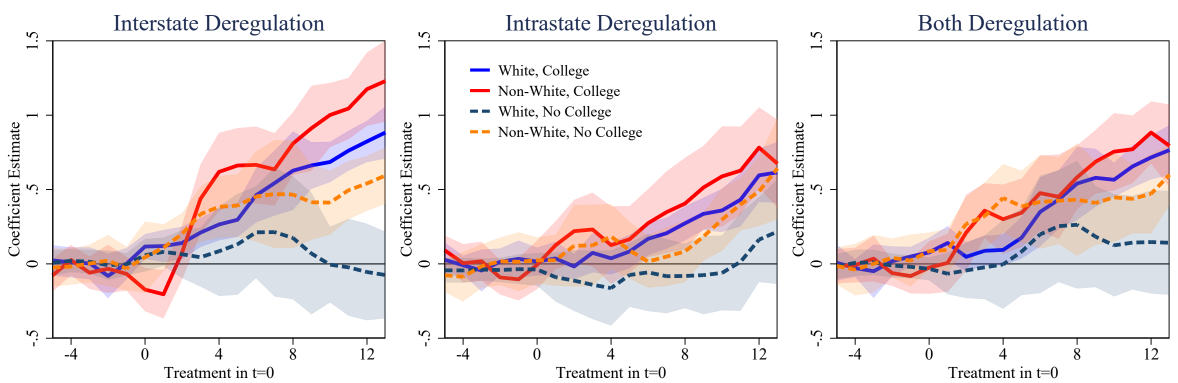
for the more affected group - non-white households. However, as discussed in section 4.3, the results seem to indicate that the credit channel is dominated by the house-cost channel.

How do these results relate to the labor market channel? To address this question, the sample of mothers is divided into two groups: those with college education and those without. Given that banking deregulation can stimulate economic activity, it is plausible that the wage opportunity costs for women employed in white-collar professions are higher compared to those in blue-collar jobs. Consequently, we would expect the delaying effect of deregulation on motherhood, due to labor market opportunity costs, to be more pronounced for college-educated women. Figure 4.9 presents the response of MAFC to deregulation, conditional on mothers' college education. In line with this reasoning, the age at childbirth of college-educated mothers increases relatively more compared to those of mothers without a college education. In fact, the response of non-college-educated mothers never reaches conventional significance levels, despite generally exhibiting a positive MAFC response to deregulation. One point to bear in mind when interpreting this result is that the share of non-college-educated mothers might have decreased in early deregulated states due to better economic prospects. This, in turn, may have led the sub-sample without college education to represent a demographic less likely to respond to changing economic conditions and more inclined to have children at younger ages, irrespective of developments in the labor market, house prices, or credit availability.

Figure 4.10 seems to corroborate this interpretation. In addition to college education, it now also conditions the estimations on whether women are white or non-white. As can be seen, irrespective of race, college-educated women delay motherhood by roughly twice as long as non-college-educated women, in line with their expected higher wage-opportunity costs. Also note that, irrespective of education, non-white women exhibit stronger MAFC increases than white women, in line with their higher responsiveness to the house-cost channel. Additionally, the differences between college-educated white and non-white women are smaller than the differences between college and non-college-educated women within white or non-white households.

Presumably, conditioning on education for both white and non-white women captures similar socioeconomic backgrounds, responding to the same economic forces. Conversely, non-college-educated women of both white and non-white mothers are socioeconomically similar and respond less to these developments. This confirms that (i) the house-cost channel has a stronger effect on the less financially well-off population and that the delaying effect of wage-opportunity costs is stronger for college-educated women, and (ii) that the two channels co-exist, reinforcing or moderating each other. This reasoning would imply that white women without college education (comparatively well-off financially and comparatively unresponsive to economic conditions) should exhibit the lowest fertility responsiveness to deregulation. Conversely, non-white women with college education should exhibit the strongest responsiveness. Both expectations are confirmed across all three panels.

Figure 4.10: *White and non-white college and non-college educated mothers' age at first child. BJS-Estimator*



Notes: This figure shows results obtained from the BJS-Estimator conditional on whether mothers are college educated or not. Results in blue (cyan) are estimated on the sub-sample of college (non-college) educated white mothers. Results in red (orange) are estimated on the sub-sample of college (non-college) educated non-white mothers The graphs plot the cumulative treatment effect p periods before or after treatment on Mothers' Age At First Childbirth (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

4.4.4. Robustness across estimators

The econometric literature on difference-in-differences estimators has developed rapidly in recent years. This section provides an overview of results using alternative estimators. It shows that 'conventional' types of estimators indeed suffer from the pitfalls discussed in the literature, while more recent estimators display results similar to the baseline BJS-estimator. I only provide a high level overview in this section and refer to section A3 in the appendix for a more formal representation of the individual estimators and their respective results.

The 'static' diff-in-diff estimator expands the classic two-way fixed effects model (TWFE) by including a dummy that is 'switched on' when units are in the post-treatment period, capturing the coefficient of interest. As it treats observations the same, regardless of how long they have been within the post-treatment sample, it implicitly assumes that the treatment always has the same effect, irrespective of its timing (Roth et al., 2023). Additionally, 'static' estimators may suffer from a weighting problem, where the weights of observations late in the sample turn negative, potentially inverting the coefficient's sign and making it dependent on the length of the post-treatment sample (Mian et al., 2020a; Baker et al., 2022; Roth et al., 2023). Table A3.33 displays results for a static diff-in-diff estimation. It confirms the literature's finding that this type of estimator indeed suffers from 'negative sign problems'. Regardless of whether I estimate post-treatment with respect to inter-, intrastate or both types of deregulation, the deregulation coefficient for MAFC is consistently negative. This result persists, even when including control variables. Since it is in stark contrast to the previous results and conforms to a problem well known in econometric literature, I conclude that the static diff-in-diff approach is incapable of correctly identifying the treatment effect in the setting of staggered deregulation.

The 'dynamic' diff-in-diff approach partially alleviates these problems by modifying the static specification to include a dummy for each individual period around the treatment (excluding the treatment period itself). This accounts for the negative weighting by computing individual treatment coefficients for each horizon instead of a weighted average across all post-treatment periods (Roth et al., 2023; Sun and Abraham, 2021). I report the results of a 'dynamic' diff-in-diff estimation in Figure A3.40 and find that they closely correspond to the baseline from Figure 4.7 in both dynamics and magnitude. While this is reassuring, Sun and Abraham (2021) have shown how the estimator can become unreliable and difficult to interpret when the treatment effect depends on the date of implementation (e.g., the effect might differ for late and early treated units).[19] Since states deregulated during different phases of the business cycle, this is likely to be the case in my sample. I conclude that the 'dynamic' estimator presents a valuable and intuitive robustness check but does not fully account for all potential variation in the effect size of treatment in the sample.

Finally, Figure A3.41 displays results for an alternative staggered diff-in-diff esti-

[19]Roth et al. (2023) and Goodman-Bacon (2021) have further argued that it may still suffer from a downward bias due to 'forbidden' comparisons and the 'negative weighting problem'.

mator, corresponding to the variant suggested by Callaway and Sant'Anna (2021). As explained in the previous section, this estimator computes the average treatment effect on the treated as the differences between individual treated and not-yet-treated periods. For implementation, I utilize their Stata replication package and find that the estimates closely correspond to the BJS-estimator over short horizons. Afterwards, the estimates begin to become less precise due to the decreasing number of potential pairwise comparisons. Nine years after treatment, when no not-yet-treated observations are available for comparison anymore, the CS-estimator terminates. Again, the conclusion is that the CS-estimator provides a valuable robustness check, confirming the baseline estimates in another class of staggered diff-in-diff estimators, while also reaffirming that the baseline BJS-estimator is better suited to a sample with a non-uniform distribution of treatment.

4.5. Booms and Busts: Results for Fertility Rates

The age of mothers at their first childbirth increases after banking deregulation. This implies that the labor market and the house-cost channels dominate the credit channel, which would have predicted a decrease in MAFC. The link between fertility rates and deregulation is more complex still, as rising house prices, which are firmly linked to delayed childbirth, now also positively contribute to the fertility rates of home-owning families. As discussed, the house-cost channel potentially weighs stronger on the question of 'whether and when to have kids?' on the extensive margin, while the house-wealth channel exerts a stronger influence on the question of 'how many kids to have?' along the intensive margin. Which channel ultimately outweighs the other with regard to the total change in fertility rates is, to a large extent, conditional on financial constraints and the likelihood of homeownership of the group in question. This section estimates the net effect of financial deregulation on fertility rates, defined as the number of children born to a thousand women in any given year. Similar to previous sections it will again attempt to isolate the individual channels by considering different sub-samples of the population and their varying exposure to the different channels.

4.5.1. The starting point

I again begin by employing the cross-sectional regression model proposed by Mian et al. (2020a), as shown in Equation 4.2, with fertility rates (by race) as the dependent variable.[20] Consequently, Table 4.4 presents the regression coefficients depicting the impact of higher MSV-scores on fertility rates by race. Columns (1) to (3) demonstrate that between 1976 and 1983 (the 'placebo' period), there is no significant relationship between the deregulation measure and fertility rates, neither in the full sample nor in the white and non-white sub-samples. This picture changes dramatically when examining the period between 1984 and 1991 (the 'boom' period). The effect for the total population in column (4) is positive, statistically significant, and slightly lower than the coefficient for the fertility rate of white mothers in column (5). Although the coefficient for non-white mothers in column (6) is also positive, it is halved in size and statistically insignificant. This finding aligns well with the intuition that more financially constrained groups of the population benefited less from the economic boom induced by deregulation, and especially the wealth increase through rising house prices that came with it.

Focusing on the last three columns, corresponding to the post-boom period from 1992 to 1999, we can observe a decrease in fertility rates conditional on deregulation. This likely reflects shifting economic conditions, the previous increase in MAFC (as fertility cannot be postponed indefinitely), and house prices that remain elevated, thereby reducing affordability without further increasing the wealth of homeowners. The breakdown by race again reveals heterogeneous responses. The coefficient for non-white mothers in column (9) is approximately twice as large as the coefficient

[20] Fertility rates by race are computed as the number of children born to a thousand women belonging to the racial group, not the total population of the county, to account for different population compositions across counties.

Table 4.4: *Fertility rates and deregulation, by race. Cross-sectional regressions*

	Birth Rate by $Race_i$								
	$\Delta_{1976-1983}$			$\Delta_{1984-1991}$			$\Delta_{1992-1999}$		
	All	White	NonWhite	All	White	NonWhite	All	White	NonWhite
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MSV-Score$_i$	-0.39	-0.49	0.19	1.51***	1.54***	0.83	-0.45***	-0.40**	-0.89***
	(0.39)	(0.40)	(0.42)	(0.34)	(0.35)	(0.65)	(0.14)	(0.18)	(0.31)
R^2	0.020	0.030	0.001	0.249	0.251	0.016	0.047	0.032	0.027
Observations	228	228	228	228	228	228	224	224	224

Notes: This table shows coefficients from Equation 4.1 where the dependent variable has been substituted with the change in the fertility rate (by race). Coefficients are computed over different periods on the county-level. *MSV-Score$_i$* refers to the previously computed time invariant deregulation measure of the state a county is located in. State level clustered standard errors are in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

for white families in column (8). Moreover, for white families, the positive coefficient of the MSV-score during the boom period more than offsets its negative coefficient during the bust period. Conversely, for the non-white sample, the decrease in fertility during the bust is more pronounced than the increase during the boom, with higher statistical significance. Once again, this aligns with intuition. White couples, being on average more financially well-off and having benefited more from the preceding boom in house prices, need to reduce their fertility less during the bust. Non-white couples, in contrast, lack these buffers and are more exposed to adverse economic conditions (Schneider and Hastings, 2015). The persistence of relatively elevated house prices amid deteriorating economic conditions further reinforces the house-cost channel for groups with low homeownership rates by widening the gap between incomes and house prices.

4.5.2. Fertility rates: Staggered difference-in-differences

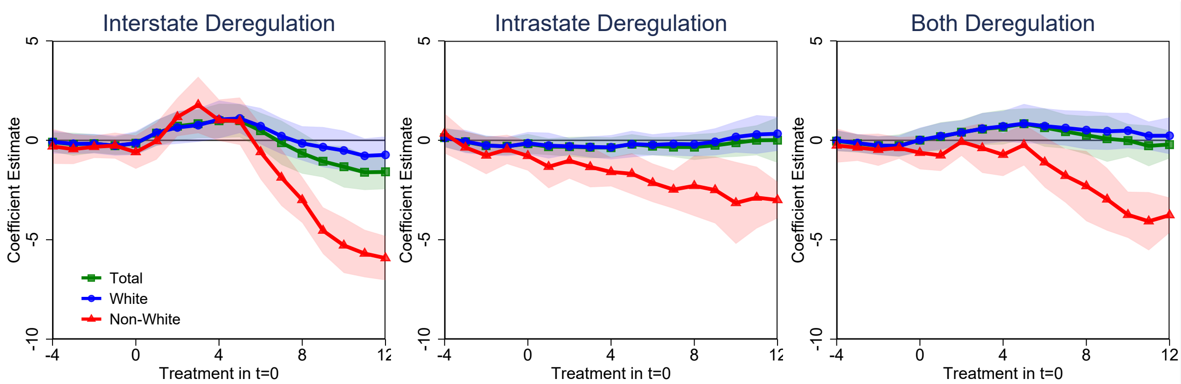
To fully exploit all available observations and estimate the timing of the response to deregulation more precisely, I return to staggered difference-in-differences of the Borusyak et al. (2022) variant. The dependent variable is adjusted to fertility rates disaggregated by race, and the results are presented in Figure 4.11. The left panel illustrates a clear boom-bust pattern for the total, white, and non-white samples.

Notably, the bust is significantly more pronounced for non-white women, whose total fertility has decreased by about 5 points ten years after treatment.[21] The middle panel shows that average fertility does not respond to intrastate banking deregulation, but non-white fertility rates experience a statistically significant decline over longer time horizons. The pattern in the right panel mirrors these findings. Despite the change in the outcome variable, the response to interstate deregulation remains the primary driver of the aggregate results. Conceptually, this aligns with findings suggesting that foreign funds are readily available during boom periods but more volatile and flighty during bust periods (Caballero and Simsek, 2020; Broner et al., 2013). An additional explanation for the pronounced bust in the fertility of non-white families might therefore be their heightened exposure to the reduction in credit availability (the credit channel in the opposite direction) triggered by the withdrawal of out-of-state funds.

These results can be interpreted as further evidence of different segments of the population being exposed in varying degrees to the boom and bust dynamics of house prices and credit, prompted by financial deregulation. For the white population, characterized by high home-ownership rates, the fertility-increasing effects of wealth gains during the boom more than compensate for the postponement effect of the house-cost channel, leading to a net fertility increase over a 5 year time horizon. Following the boom, the subsequent bust affects them less, but fertility rates still decline because no new wealth gains are added, and the previously postponed pregnancies dare insufficient to maintain fertility at a constant level. This is because: i) fertility cannot be postponed indefinitely, leading to lower birth rates in the long run, and ii) high house prices continue to depress the birth rates of prospective home buyers. For non-white families, these downward pressures on fertility are amplified, while the upward dynamics are muted, exacerbated by non-white families being disproportionately affected by a credit crunch during the bust. Any study focusing

[21] For reference, the average fertility rate of non-white women is around 40, compared to around 30 for white women.

Figure 4.11: *Fertility rates and deregulation, by race. BJS-Estimator*



Notes: This figure shows the responses of fertility rates to deregulation by race. Estimates are obtained using the BJS-Estimator. Results in blue are estimated on the full sample. Results in red (green) are estimated on the sub-sample of white (non-white) mothers. The graphs plot the estimated treatment effect p periods before or after treatment. In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. Confidence intervals are plotted at the 90% level.

solely on shorter time horizons or aggregate responses would fail to account for this heterogeneity in effects across population groups over time.

This perspective helps reconcile two seemingly contradictory results from the literature. The initial and short-lived increase in fertility rates during a period of economic growth and rising house prices aligns with the findings of Kim et al. (2022), who report a positive effect of deregulation on fertility over short horizons but do not document the subsequent bust. On the other hand, the bust reported over longer horizons, aligns with the results of Yang (2023), whose study partially overlaps with the end of the sample period considered here. The seemingly contradictory findings from the literature can be reconciled by examining a longer time horizon and considering the trend in total fertility during the period in question. In the period analyzed by Kim et al. (2022), early deregulated states did indeed experience a relative increase in fertility compared to late deregulated states (see Figure A2.38), coinciding with a more pronounced expansion of the business cycle. In contrast, during the period analyzed by Yang (2023), total fertility decreased, with the decrease being more pronounced in early deregulating states.

The timing relative to deregulation shown in Figure 4.11 also supports the hypothesis that these two findings are part of the same long-run trend. The mean deregulation years for intra- and interstate deregulation are 1985 and 1986, respectively, and the estimates in Figure 4.11 turn negative around 6 periods after treatment, precisely corresponding to the beginning of the sample used by Yang (2023) and the turn of the business cycle. Additionally, as discussed, the deregulation measure used by Yang (2023) is highly correlated with the timing of the first wave of deregulation, with states that deregulated early in the first wave also doing so in the second. Assessing the effects of the second wave of deregulation likely also contains long-run effects from the first.

4.5.3. Fertility rates: Robustness

This section addresses the robustness of the previous results along two additional dimensions. Firstly, it elaborates on the argument that the boom and bust in fertility rates are indeed part of one longer cycle, rather than two different phases of deregulation having fertility effects in opposite directions. I argued that the bust in fertility rates observed in Figure 4.11 is a long-run effect of financial deregulation. Yang (2023) instead, finds a negative effect of deregulation on fertility when examining the period from the mid-1990s to the mid-2000s. Given the high correlation between the two waves of deregulation, it is possible that the long-run result partially captures an effect correctly identified by Yang (2023), indicating it's not solely a long-run effect of the first wave but also an independently offsetting effect of the second wave. Figure A4.42 tests this hypothesis by excluding from the sample all county-year observations from within states after the date of the second wave of deregulation. The results barely change, providing additional evidence in support of the argument that the boom and bust in fertility are part of one longer cycle.

The results for fertility rates have proven to be a robust feature of the data across different approaches, including the descriptive section 4.3, the cross-sectional approach in Table 4.4, and the staggered diff-in-diff estimator in the previous section.

Figure A4.43 additionally tests if these results are evident using the conventional 'dynamic' diff-in-diff estimator. I find that while the estimates predictably become less precise when not accounting for heterogeneous effects of deregulation at different points in time, the overall differences in dynamics for different segments of the population can be confirmed. On short- to medium-term horizons, fertility rates increase, but in the long run, the estimated effect of deregulation on fertility rates is consistently lower for the non-white population. A grain of salt, potentially reflecting the more complex interaction of channels driving fertility rates, is that unlike in the staggered case, the absence of pre-trends cannot be fully confirmed. Non-white mothers show a decreasing trend in fertility rates already prior to deregulation across all three panels (with varying degrees of significance), which might indicate that the 'dynamic' estimator is not fully able to separate the strongly decreasing trend in the fertility rates of non-white mothers (see: Figure A1.32) from the effects of deregulation.

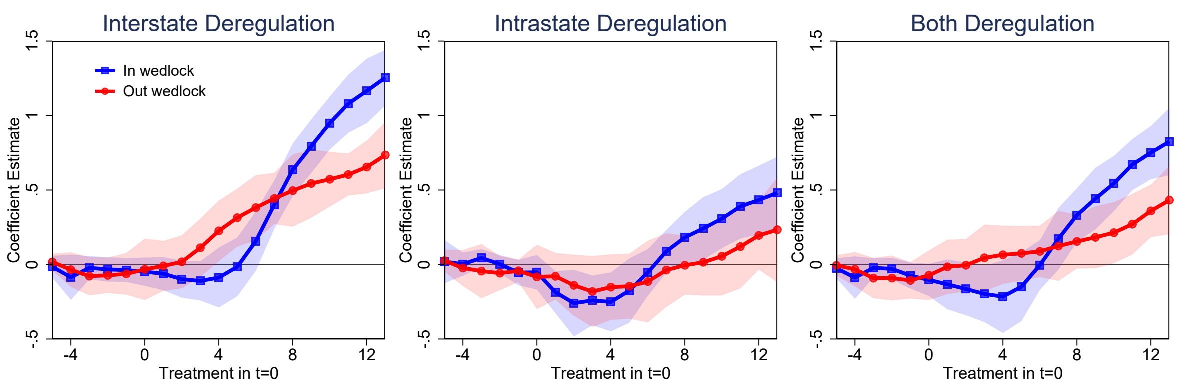
4.5.4. Conscious decision making or spurious result? Exploiting the marital status

The line of reasoning throughout the chapter rests on the tacit assumption that parents are not only aware of changing macroeconomic conditions, but that they consciously adjust their family planning accordingly. But is this a reasonable assumption and can it be confirmed in the data? To answer this question, I exploit an additional feature of the data: the marital status. Arguably, children born within marriage are less likely to result from accidental pregnancies compared to those born outside of it. Their births should, consequently, be more responsive to deregulation through the previously described channels. Additionally, married couples are on average older than non-married couples, which might also affect fertility outcomes via higher financial wealth and likelihood of homeownership. This section devises two tests to address the presumed higher responsiveness of married couples.

Figure 4.12 separately estimates the response of MAFC to deregulation, confirming the previous intuition of different degrees of responsiveness for married and non-married couples. Over short horizons, the rise in MAFC is more pronounced for children born out of wedlock, reflecting the house-cost channel for this younger, more financially constrained subgroup. For children born within wedlock, MAFC does not increase until about six years after treatment. This result can be interpreted as an older sub-sample of the population moving forward its fertility choices due to unexpected wealth gains, which counteracts the postponement channel. Ultimately, however, this short-run effect wears off, and in the long run, the responsiveness of MAFC for married couples outpaces that of non-married couples. This dynamic is visible across all three panels. In Figure A5.44 and Figure A5.45, I disentangle the channels at play further and compute the effects for married white and non-white, as well as for unmarried white and non-white women, respectively. Firstly, this reveals larger peak effects for married than for unmarried mothers, irrespective of race. Secondly, the 'delayed' responsive on MAFC for married women documented in Figure 4.12 is also visible, irrespective of race. Thirdly, regardless of the marital status, the increasing effect on MAFC is stronger for the non-white sample, confirming that the affordability channel continues to play a larger role for the more financially constrained group.

The second exercise follows a similar intuition, but applies to birthrates instead of MAFC. Presumably, teenage pregnancies of unmarried women are least likely to be the result of informed decisions based on macroeconomic conditions, house prices, or credit availability. Consequently, banking deregulation should have no significant impact on them. Figure A5.46 in the appendix plots the response of fertility rates to banking deregulation for the subsample of unmarried teenage mothers and confirms these expectations. The coefficients for interstate and intrastate deregulation trend, for the first time, in opposite directions, showing only spurious statistical significance. The notion of unmarried teenage pregnancies being unplanned is further reflected

Figure 4.12: *Mothers' age at first child and deregulation, by marital status. BJS-Estimator*



Notes: This figure shows results obtained using the BJS-Estimator conditional on mothers' marital status at time of first childbirth. Results in blue (red) are estimated on the sub-sample of married (unmarried) mothers. The graphs plot the cumulative treatment effect *p* periods before or after treatment on Mothers' Age At First childbirth (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment years is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

in them having the widest confidence intervals, relative to the effect size, among all estimations in this chapter. In this case, it is the absence of clear results, which serves as additional validation for my other results being driven by parents consciously adjusting their fertility planning in response to changing macroeconomic conditions.

4.6. Conclusion

I demonstrate that following the first wave of financial deregulation in the USA during the 1980s, the age of mothers at first childbirth increased, contingent upon deregulation. This finding can be explained with the well-documented rise in house prices in early deregulated states (Mian et al., 2020a). Rising house prices affect mothers' age via the house-cost channel, where younger couples delay or reduce fertility, and the house-wealth channel, where older couples increase fertility. The relative strength of these effects depends on the financial constraints and likelihood of homeownership for the affected households. Splitting the sample by race reveals significant heterogeneity between white and non-white households in the US, with the age at childbirth for non-white mothers increasing at a faster rate than for white mothers. I attribute this difference to the non-white population being, on average, more economically constrained and consequently more exposed to the house-cost channel, leading to postponed pregnancies.

These differences across races also extend to fertility rates. While non-white households are more exposed to the house-cost channel, white households benefit more from the house-wealth channel, as they are more likely to own a home. During the economic boom of the 1980s, fertility rates rise for both racial groups, but the increase is more pronounced among white households. The subsequent bust, on the other hand, is more pronounced for non-white households. Over longer horizons, the fertility rates of the white population revert back to a net effect of zero, as the house-cost and house-wealth channels roughly offset each other. For the non-white population, the weaker boom and stronger bust result in decreasing long-run fertility rates.

These findings also help reconcile two contradictory findings from the literature. The initial boom in fertility confirms the findings of Kim et al. (2022) for the early sample period, while the subsequent bust corresponds to the findings of Yang (2023) for the late sample period. Taken together, my results highlight: i) that financial deregulation has important effects beyond the realm of finance, ii) these effects differ across races, depending on their relative economic situation, and iii) the persistent nature of the effects of deregulation, which can only be fully accounted for in a long-run sample.

5. — Conclusions

The global financial crisis of 2008 has reinstated the international dimension of the global financial system on the research agenda, and rightfully so. This thesis has shown how exposure to foreign capital played a pivotal role in both exacerbating and globalizing the Great Depression. It was also foreign capital that enabled households to become the largest group of debtors in advanced economies since the 1970s and the dissolution of the Bretton Woods system. When the United States deregulated its banking system during the 1980s, once again, foreign capital — though predominantly from out-of-state rather than out-of-country sources — was instrumental in amplifying the business cycle in early deregulated states. The response of families to changing economic conditions extended the impact of foreign capital beyond the realm of economics and finance, ultimately even influencing the demographic trajectory of the country.

What sets foreign capital apart, whether from abroad or merely from out-of-state, is its inherent foreignness to local economic conditions. Its availability (or scarcity) aligns with the business cycle of the lender rather than the borrower. In all three described cases, this resulted in disproportionate capital inflows during periods of economic growth. The economic implications of this are a heightened dependence on easily accessible foreign funding, unsustainable surges in credit and housing prices, and, over the long term, vulnerability to capital withdrawals. It is this last point that becomes particularly relevant during economic busts, as domestic capital, by definition, cannot be repatriated. The cycle of booms and busts, driven and magnified by foreign financing, significantly influences the economic well-being and financial stability of our countries, and has done so since at least the Great Depression. Families are sensitive to these changing conditions, especially so, because household (mortgage) credit and house prices appear to be most responsive to the inflow of foreign capital. As a consequence, the implications of capital inflows extend beyond their immediate impact on the economy and into long-term demographic trends.

This thesis has addressed various dimensions of economic policy concerned with the management of capital flows. While the term 'management' might be technically accurate in this context, the more fundamental policy question seems to revolve around how to safeguard against undesirable capital flows. Returning to Robert Solow's introductory quote about the "container full of capital", closed capital accounts and restricted market access for out-of-state banks are measures aimed at ensuring that the container does not overflow, while monetary independence deals with how to react when it does. The presented findings attest some degree of success for each measure.

During the interwar period, countries that abandoned the Gold Standard (or returned to it late or never) experienced lower foreign inflows by having the option to close their capital accounts. Additionally, they had the flexibility to pursue independent economic policies, resulting in less detrimental effects from existing capital flows. In the modern sample of advanced economies, countries with floating exchange rates similarly exhibit a significantly reduced (negative) responsiveness to expansions in household credit financed by foreign sources. Moreover, in the United States during the 1980s, states that delayed the entry of out-of-state institutions into their local markets managed to smooth the boom-bust cycle in credit and house prices evident in early deregulated states. So while these findings demonstrate success in guarding against capital flows, they also highlight the continued necessity to maintain vigilance, closely monitor international capital movements, and conduct further research into the mechanisms through which they influence the economy as well as society at large.

However, neither in Robert Solow's initial quote nor in any part of this thesis does it seem conceivable that the container will ever be empty, regardless of how much capital is spilled. It is also not entirely clear what keeps the container filled to such an extent that as soon as a country opens its capital account or allows out-of-state institutions to operate within its borders, there is always sufficient capital to flow into it. The notion of liberal capital flow regimes with low levels of financial regulation being inconsequential for the inflow of capital is unheard of. So where does the capital come from, why is there so much of it, and why is it flowing abroad?

Some final remarks on this: All three projects involved extensive data collection, which I believe is necessary to answer questions that are ultimately empirical in nature. This data is neither fully exploited yet nor complete in its coverage, and least of all sufficient to satisfactorily answer even the three questions posed above. The simple answers are, of course, that capital comes from other countries, where available capital increases because savings keep rising and investments decline, and it flows to the country offering the highest returns on capital, facilitated by increasing global interconnectedness. But to delve deeper, an additional layer of data is necessary - one that breaks down the concept of 'foreign' capital into the individual bilateral relationships that constitute the total inflow of foreign capital. Fortunately, the magnitude of this task (with 200 countries theoretically allowing for 19,900 bilateral links, not considering different currencies, various forms of investments, or transactions in both directions for the same bilateral pair) has so far prevented its completion. Therefore, I can confidently say that my research on capital flows will not end here.

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Appendix zu

A century of capital flows:
An international perspective, 1920-2020

von

Lukas Maximilian Diebold

A1. Appendix: Golden Fetters or Credit Boom Gone Bust?

A1. The Balance of Payments

Figure A1.1: *Balance of Payments original data example, United States*

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SUMMARY TABLE.

	$ (000,000's)								
	Goods, services and gold					Capital items			All items (¹)
	Merchandise	Interest and dividends	Other services	Gold	Total	Long-term	Short-term	Total	
1919 Balance	+ 3,749	+ 224	— 939	+ 164	+ 3,198	— 2,205	+ 90	— 2,115	+ 1,083
1920 Balance	+ 2,866	+ 56	— 736	+ 50	+ 2,236	— 1,096	+ 100	— 996	+ 1,240
1921 Balance	+ 1,908	+ 119	— 628	— 686	+ 713	— 860	— 100	— 960	— 247
1922 Balance	+ 663	+ 351	— 546	— 235	+ 233	— 687	+ 375	— 312	— 79
1923 Balance	+ 313	+ 417	— 628	— 295	— 193	+ 83	+ 53	+ 136	— 57
1924 Balance	+ 939	+ 464	— 662	— 216	+ 525	— 574	+ 166	— 408	+ 117
1925 Balance	+ 619	+ 515	— 719	+ 102	+ 517	— 488	— 121	— 609	— 92
1926 Balance	+ 139	+ 627	— 564	— 72	+ 130	— 651	+ 310	— 341	— 211
1927 Balance	+ 417	+ 679	— 572	+ 154	+ 678	— 722	+ 845	+ 123	+ 801
1928 Balance	+ 738	+ 680	— 684	+ 272	+ 1,006	— 684	— 228	— 912	+ 94
1929 Balance	+ 382	+ 699	— 681	— 120	+ 280	— 94	— 95	— 189	+ 91
1930 Balance	+ 386	+ 769	— 580	— 278	+ 297	— 224	— 465	— 689	— 392
1931 Credit	2,604	747	559	788	4,698	1,541	—	1,541	6,239
Debit	2,587	126	1,052	612	4,377	1,308	719	2,027	6,404
Balance	+ 17	+ 621	— 493	+ 176	+ 321	+ 233	— 719	— 486	— 165
1932 Credit	1,744	523	250	809	3,326	894	—	894	4,220
Debit	1,594	68	754	820	3,236	647	489	1,136	4,372
Balance	+ 150	+ 455	— 504	— 11	+ 90	+ 247	— 489	— 242	— 152
1933 Credit	1,780	462	271	425	2,938	1,505	34	1,539	4,477
Debit	1,697	63	542	252	2,554	1,457	509	1,966	4,520
Balance	+ 83	+ 399	— 271	+ 173	+ 384	+ 48	— 475	— 427	— 43

Notes: This figure shows a snapshot of a Balance of Payments table for the United States, newly digitized for this dissertation. It is taken from the 1934 publication of the League of Nations (1933-1939). Coverage and quality of data may differ across countries and time.

Table A1.1: *Coverage of Balance of Payments variables*

Country	Balances	CaA Credit & Debit	CuA Credit & Debit	CaA Components	CuA Components
Albania	1926-1933	1926-1933	1926-1933	1926-1933	1926-1933
Argentine	1921-1938	1921-1938	1921-1938	1921-1938	1921-1938
Australia	1922-1936	1922-1936	1922-1936	1922-1936	1922-1936
Austria	1923-1936	1925-1936	1925-1929	1925-1936	1925-1929
Belgium & Luxemburg	1929-1937	1929-1937	1934-1937	1929-1937	1934-1937
Bulgaria	1924-1936	1924-1936	1924-1936	1924-1936	1924-1936
Canada	1920-1938	1925-1938	1920-1938	1925-1938	1920-1938
China	1928-1937	1928-1937	1928-1937	1928-1937	1928-1937
Cyprus	1933-1937	1933-1937	1933-1937	1933-1937	1933-1937
Czechoslovakia	1925-1937	1925-1937	1925-1937	1925-1937	1925-1937
Denmark	1923-1938	1923-1938	1923-1938	1923-1938	1923-1938
Dutch East Indies	1925-1938	1925-1938	1925-1938	1925-1938	1925-1938
Estonia	1925-1938	1925-1938	1925-1938	1925-1938	1925-1938
Finland	1922-1938	1926-1938	1922-1938	1926-1938	1922-1938
France	1921-1938	1921-1938	1927-1938	1921-1938	1927-1938
Germany	1924-1937	1924-1937	1924-1937	1924-1937	1924-1937
Greece	1929-1938	1929-1938	1929-1938	1929-1938	1929-1938
Hungary	1923-1936	1923-1936	1923-1936	1923-1936	1923-1936
India	1923-1938	1923-1938	1923-1938	1923-1938	1923-1938
Ireland	1924-1938	1924-1938	1924-1938	1924-1938	1924-1938
Japan	1924-1936	1924-1936	1924-1936	1924-1936	1924-1936
Latvia	1923-1937	1923-1937	1923-1937	1923-1937	1923-1937
Lithuania	1924-1937	1924-1937	1924-1937	1924-1937	1924-1937
Netherlands	1923-1938	1923-1938	1926-1938	1923-1938	1926-1938
New Zealand	1923-1937	1923-1937	1923-1937	1923-1937	1923-1937
Norway	1923-1938	1923-1938	1923-1938	1923-1938	1923-1938
Poland	1923-1937	1923-1937	1923-1937	1923-1937	1923-1937
Romania	1926-1930	1926-1930	1926-1930	1926-1930	1926-1930
Surinam	1925-1938	1925-1938	1925-1938	1925-1938	1925-1938
Sweden	1923-1938	1923-1937	1923-1937	1923-1937	1923-1937
Thailand	1923-1937	1932-1937	1923-1937	1932-1937	1923-1937
Turkey	1926-1933	1926-1933	1926-1933	1926-1933	1926-1933
Union of South Africa	1923-1937	1923-1937	1923-1937	1923-1937	1923-1937
United Kingdom	1922-1938	1924-1937	1924-1938	1924-1937	1924-1938
United States	1919-1938	1922-1938	1922-1938	1922-1938	1922-1938
Yugoslavia	1926-1935	1926-1935	1926-1935	1926-1935	1926-1935

Notes: This figure shows the availability of BoP Data for each country in the sample. Column (1) refers to capital and current account balances. Columns (2) and (3) refer to individual credit and debit entries within the capital and current account respectively. Columns (4) and (5) show the years where it is possible to further distinguish between the individual components of capital and current account.

Table A1.2: *Financial crises in sample*

Country	Baron, Verner, Xiong	Reinhart, Rogoff	Combined Interwar
Argentina	1930, 1934	1931, 1934	1930, 1934
Australia	1931	1931, 1932	1931
Austria	1929, 1931, 2008, 2011	1929, 1931	1929, 1931
Belgium	1931, 1939, 2008, 2011	1931, 1934, 1939	1931, 1939
Bulgaria			-
Canada	-	-	-
China		1931, 1934, 1937	1931, 1934, 1937
Czech	1931, 1995		1931
Denmark	1931, 2008, 2011	1931	1931
Estonia			1930, 1931
Finland	1931	1931, 1939	1931
France	1930, 1937, 2008	1930, 1931, 1932	1930, 1937
Germany	1929, 1930, 2008	1929, 1930, 1931, 1932	1929, 1930
Greece	1931	1931, 1932	1931
Hungary	1931, 2008	1931, 1932	1931
Iceland	2008		-
India	1929, 1993	1929, 1930, 1931	1929
Indonesia	2007		-
Ireland	2007, 2010		-
Italy	2008, 2011, 2016		N.A.
Japan	1927, 2001	1927	1927
Korea	1997		N.A.
Latvia			-
Lithuania			-
Luxembourg	-		N.A.
Netherlands	1931, 2008		1931
New Zealand	-	-	-
Norway	1927, 1931, 1936, 2008	1927, 1936	1927, 1931, 1936
Poland		1931, 1932, 1934	1931, 1932, 1934
Portugal	2008, 2011, 2014		N.A.
Romania		1931	1931
Russia	1998, 2008		N.A.
South Africa	-		-
Spain	2008, 2010		N.A.
Sweden	1931, 1991, 2008	1931, 1932	1931
Switzerland	1990, 2008		N.A.
Turkey	1930, 1931, 1991, 1994, 2001	1931	1930, 1931
United Kingdom	1973, 1991, 2008	-	-
United States	1929, 1930, 1984, 1990, 2007	1929, 1930, 1931, 1932, 1933	1929, 1930
Yugoslavia			1931, 1932

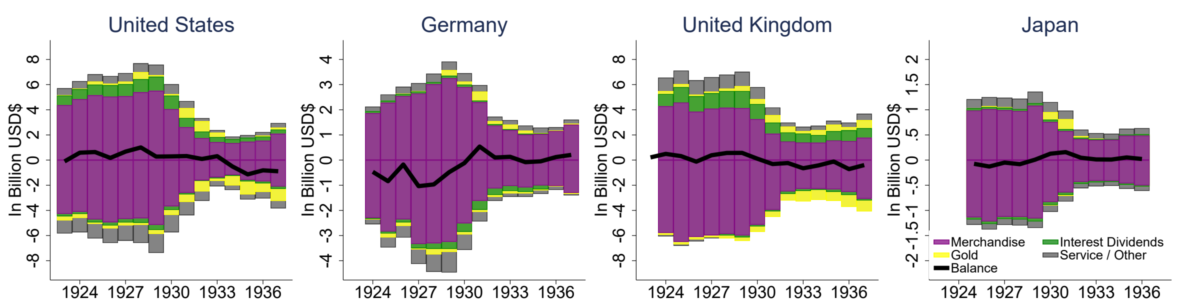
Notes: This table shows the crisis dating from the chronologies of Baron et al. (2021) and Reinhart and Rogoff (2009). Crises are defined as banking crises in Reinhart and Rogoff (2009), but, due to a more detailed breakdown, as either banking crises, banking panics, or narrative crises in Baron et al. (2021). BVX crisis also include dates outside the interwar period, as it is the chronology employed in the chapter on external validity. Despite Canada experiencing large losses in bank equity, no banking failures followed, consequently excluding Canada from conventional crisis-dating (Bordo et al., 2001; Baron et al., 2021; Reinhart and Rogoff, 2009). The third column joins the two crisis chronologies for a more comprehensive country coverage and additionally adds crisis dates from Grossman (1994). A blank space refers to the respective country not being covered by the chronology, a "-" indicates that the country is covered but experienced no crisis, and N.A. refers to countries that are included only in the later OECD data and consequently are not applicable for the combined interwar sample.

Table A1.3: *Summary statistics of main interwar variables*

	Mean	Median	Std. Dev.	Min	Max	Obs	Panels
GDP 1 Year log Growth	0.028	0.028	0.054	-0.185	0.315	681	35
GDP 2 Year log Growth	0.055	0.055	0.084	-0.242	0.440	646	35
GDP 3 Year log Growth	0.082	0.084	0.105	-0.329	0.472	611	35
GDP 4 Year log Growth	0.106	0.109	0.123	-0.364	0.567	576	35
GDP 5 Year log Growth	0.128	0.130	0.137	-0.351	0.690	541	35
GDP 6 Year log Growth	0.147	0.147	0.148	-0.305	0.671	506	35
Capital, Balance	-0.001	0.001	0.207	-2.036	1.036	501	37
Capital, Debit	0.167	0.031	0.404	0.000	3.656	474	37
Capital, Credit	0.174	0.046	0.384	0.000	2.602	474	37
Capital, Balance t to t-2	0.002	0.001	0.512	-3.829	2.483	427	37
Capital, Debit t to t-2	0.532	0.109	1.227	0.000	9.477	400	37
Capital, Credit t to t-2	0.551	0.150	1.152	0.000	7.439	400	37
Combined Interwar Crisis	0.077	0.000	0.266	0.000	1.000	770	37
Gross Exposure Dummy (GED)	0.156	0.000	0.363	0.000	1.000	770	37
Gross Foreign Assets Dummy (GFA)	0.162	0.000	0.369	0.000	1.000	770	37
Crisis × GED	0.016	0.000	0.124	0.000	1.000	770	37
Crisis × GFA	0.022	0.000	0.147	0.000	1.000	770	37
Gold Standard	0.177	0.000	0.382	0.000	1.000	1155	56
Capital Account Openness	67.229	50.000	27.712	12.500	100.000	378	22
Δ Domestic Credit	-0.031	0.005	0.680	-7.210	2.895	381	29

Notes: This table shows summary statistics of the main variables for the interwar sample. Output growth variables are compiled from various sources and jointly expressed in cumulative log differences over the indicated period. Variables from the Balance of Payments are expressed in billion USD. Crises and Gold Standard variables are included as dummy variables, with their mean expressing the unconditional sample frequency of crises. GED and GFA refer to the constructed dummy variables, capturing the accumulation of foreign credit or foreign assets. Their interaction refers to the the respective subset of crisis. The capital account openness measure is based on Quinn (2003) and reports the unconditional capital account openness. During the Gold Standard, the average openness score is 93 versus only 49 outside of it. Reported statistics are the variable mean, median, standard deviation, minimum, maximum, the total number of observations and the number of panels (countries) for which the variable is available.

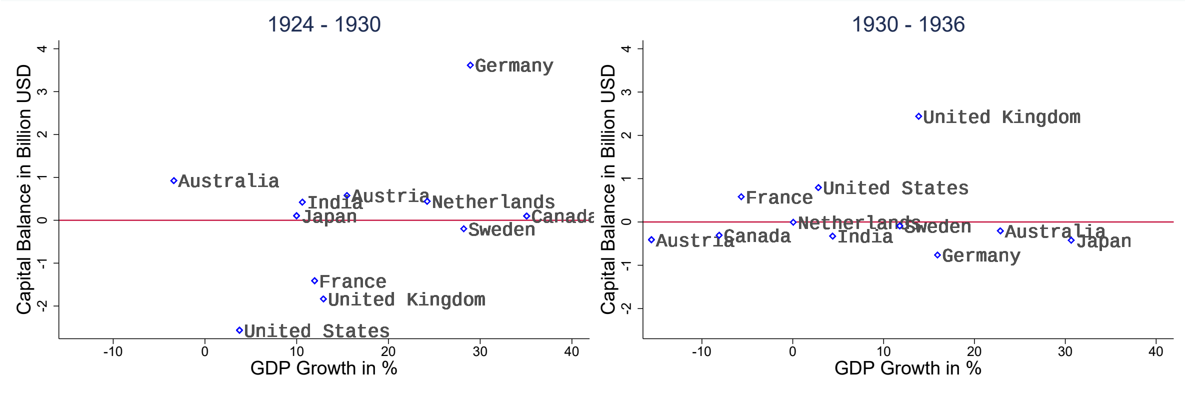
Figure A1.2: *Current account composition*



Notes: This figure shows the annual gross financial flows from the current account side of the balance of payments for the United States, Germany, the United Kingdom and Japan. Figures are in billion US dollars. Purple, green, yellow and gray represent flows in goods, secondary incomes (interest and dividends), gold and services respectively. Black is the current account balance.

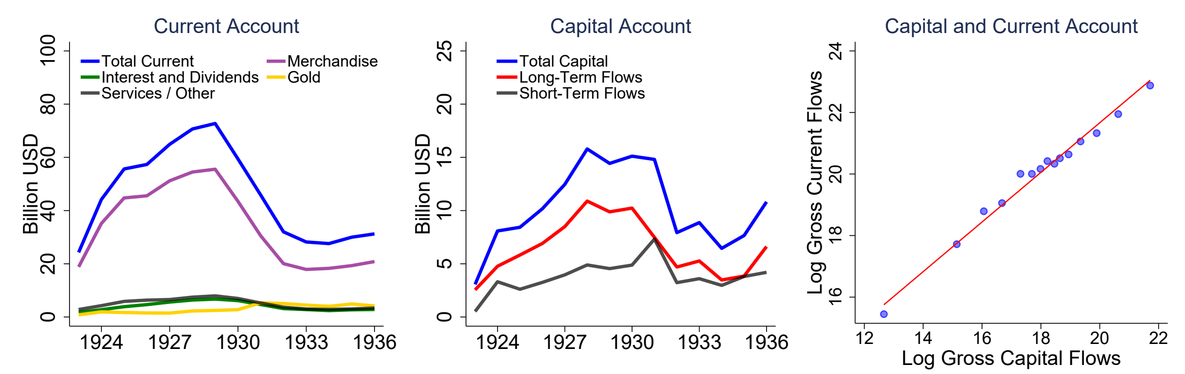
A2. Trends

Figure A2.3: *Net creditors and net borrowers before and after the Great Depression*



Notes: This figure plots the cumulative capital account balance against cumulative GDP growth, covering the periods 1924 to 1930 and 1930 to1936 for the major economies. The two panels show that the two groups of countries swap places, with capital exporters becoming importers and vice versa. A relation between net capital exports and GDP growth is not discernible.

Figure A2.4: *Trends in gross balance of payments flows*



Notes: This figure shows in the left panel the total gross flows (Credit + Debit) for the individual parts of the current account in billion USD. Flows in trade (purple) make up by far the largest part, with secondary incomes (green), services (gray) and gold (gold) making up the remainder. The middle panel shows this decomposition for the capital account. While long-term capital flows (red) generally make up the largest share, short-term flows (gray) make up a sizable portion and gain in importance around the Great Depression. The right panel plots the log gross totals of current and capital account against one another using 15 equal sized bins, confirming the visual impression of a high co-linearity between the two.

A3. Capital flows and business cycle dynamics

Table A3.4: *Capital flows and business cycle dynamics, 5 year cumulative capital flows*

	$\Delta_2 Y_{i,t+2}$			$\Delta_3 Y_{i,t+3}$			$\Delta_4 Y_{i,t+4}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{4} Balance_{i,t-j}$	-0.02***	0.00		-0.03***	-0.00		-0.03***	-0.01	
	(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)	
$\Sigma_{j=0}^{4} Credit_{i,t-j}$		-0.04***	-0.04***		-0.05***	-0.05***		-0.03**	-0.04***
		(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)
$\Sigma_{j=0}^{4} Debit_{i,t-j}$			0.00			0.00			0.00
			(0.01)			(0.01)			(0.01)
R^2	0.208	0.282	0.282	0.369	0.433	0.433	0.616	0.636	0.635
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
p-value, $\beta_{Credit} = \beta_{Balance}$		0.02			0.04			0.21	
p-value, $\beta_{Credit} = \beta_{Debit}$			0.00			0.00			0.01
Observations	291	291	291	263	263	263	234	234	234

Notes: This table regresses log GDP growth over varying time horizons on cumulative capital account flows summed from t to $t-4$. All specifications control for country fixed effects. Adjusting for longer time spans, lagged growth indicates three, four and five year distributed lags of GDP growth, depending on the length of the forecast horizon. The reported p-value refers to a test for the equality of coefficients. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A3.5: *Capital flows and business cycle dynamics, by source of GDP data*

	$\Delta_2 Maddison_{i,t+2}$			$\Delta_2 EAI_{i,t+2}$			$\Delta_2 Y_{i,t+2}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	-0.02***	0.01		-0.03***	-0.00		-0.02***	0.01	
	(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)	
$\Sigma_{j=0}^{2} Credit_{i,t-j}$		-0.04***	-0.04***		-0.05**	-0.05***		-0.04***	-0.04***
		(0.01)	(0.01)		(0.02)	(0.02)		(0.01)	(0.01)
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			-0.00			0.00			0.00
			(0.01)			(0.01)			(0.01)
R^2	0.126	0.246	0.242	0.318	0.421	0.423	0.123	0.232	0.229
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
p-value, $\beta_{Credit} = \beta_{Balance}$		0.00			0.08			0.01	
p-value, $\beta_{Credit} = \beta_{Debit}$			0.00			0.00			0.00
Observations	327	327	327	162	162	162	363	363	363

Notes: This table presents estimation results from Equation 3.2 for different sources of GDP growth separately. The two largest contributes to the total sample are Maddison style GDP estimates from Bolt and van Zanden (2020) and economic activity indicators from Albers (2018). The combined sample also includes growth rates from Baron et al. (2021) and estimates for the Baltic states from Klimantas and Zirgulis (2020); Norkus and Markevičiūtė (2021). The dependent variable is log GDP growth from t to $t+2$. The independent variables are cumulative capital account flows in years $t-2$ to t. All specifications control for country fixed effects and lagged growth indicates a two year distributed lag of GDP growth. The reported p-value refers to a test for the equality of coefficients. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A3.6: *Capital flows and equity returns*

	$\Delta_2 FI - Equity_{i,t+2}$			$\Delta_2 NF - Equity_{i,t+2}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	-0.01	0.05*		-0.07**	0.02	
	(0.02)	(0.03)		(0.03)	(0.03)	
$\Sigma_{j=0}^{2} Credit_{i,t-j}$		-0.10**	-0.06**		-0.14**	-0.13***
		(0.04)	(0.03)		(0.06)	(0.05)
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			-0.03			0.00
			(0.03)			(0.03)
R^2	0.053	0.113	0.110	0.218	0.285	0.284
Country fixed effects	✓	✓	✓	✓	✓	✓
Lagged Returns	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓
p-value, $\beta_{Credit} = \beta_{Balance}$		0.02			0.09	
p-value, $\beta_{Credit} = \beta_{Debit}$			0.41			0.00
Observations	219	219	219	228	228	228

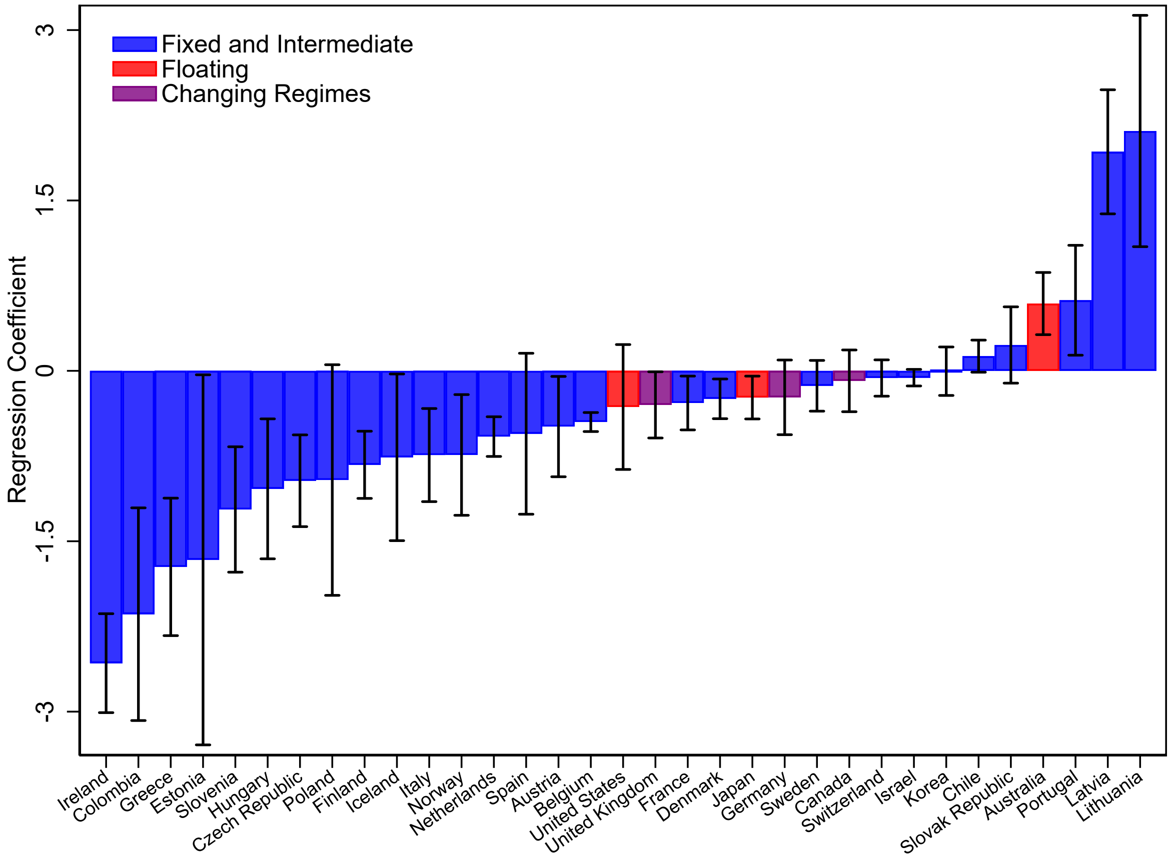
Notes: This table presents estimation results for cumulative equity returns for financial and non-financial corporations between t and $t+2$, using the data from Baron et al. (2021). FI and NF refer to the equity returns of financial and non financial institutions respectively. The independent variables are cumulative capital flows from $t-2$ to t. The reported p-value refers to an equality test of the reported coefficients. All specifications control for country fixed effects and two distributed lags of GDP growth and the respective asset returns. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A3.7: *Capital flows and business cycle dynamics, sample splits, state dependence and linearity*

	$\Delta_2 Y_{i,t+2}$						
	Time Split		Country Split		State Dependence		Linearity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.05***	-0.05***	-0.07***	-0.03***	-0.04***	-0.03***	
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	0.00	0.01	0.03*	-0.00	0.01	0.00	0.01
	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times 1(>0)$							-0.04*
							(0.02)
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times 1(<0)$							-0.04***
							(0.01)
R^2	0.241	0.299	0.438	0.188	0.170	0.160	0.233
Country fixed effects	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓
Sample	pre 1929	post 1929					
Countries			Core	Non-Core			
Current Account					Positive	Negative	
Observations	124	238	73	290	173	187	363

Notes: This table presents estimation results from Equation 3.2, including control variables, sample splits and checks for state dependencies. The dependent variable is log GDP growth from t to $t+2$. The independent variables are cumulative capital account flows in years $t-2$ to t. Core countries are defined as the largest economies in North America and Europe: the United States, the United Kingdom, France, Germany, Canada and the Netherlands. All specifications control for country fixed effects and lagged growth indicates a two year distributed lag of GDP growth. The reported p-value refers to a test for the equality of coefficients. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

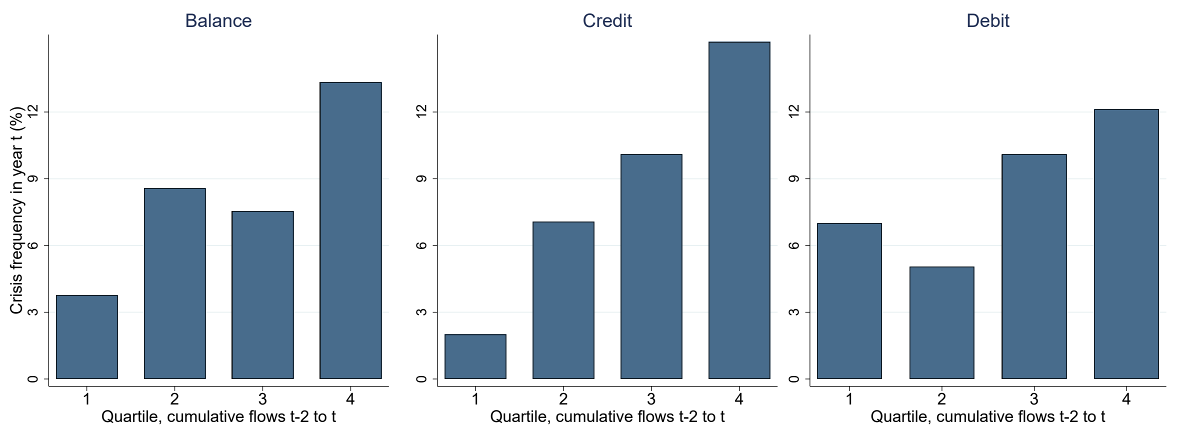
Figure A3.5: *Capital flows and business cycle dynamics, country level regression coefficients*



Notes: This figure plots regression coefficients and 90% confidence intervals, using Newey-West standard errors with a lag length of four, from individual time series regressions of log GDP growth from t to $t+2$ on accumulated credit and debit positions from $t-2$ to t. The shown coefficients are β^C, for capital account credit, with the specification $\Delta_2 y_{i,t+2} = \alpha_i + \beta^C \Sigma_{j=0}^{2} Credit_{i,t-j} + \beta^D \Sigma_{j=0}^{2} Debit_{i,t-j} + u_{i,t+2}$ estimated on individual country sub-samples.

A4. Capital flows and financial fragility

Figure A4.6: *Capital flows and financial crises, conditional probability*



Notes: This figure shows the relationship between cumulative capital flows between $t-2$ and t and financial crisis frequencies for the year t. Observations are sorted into four equal-sized quartiles according to the volume of cumulative capital flows between $t-2$ and t. Vertical bars indicate the frequency of financial crises in year t for each of these bins. The conditional frequency of financial crises can be seen to peak in the highest quartile of gross foreign credit.

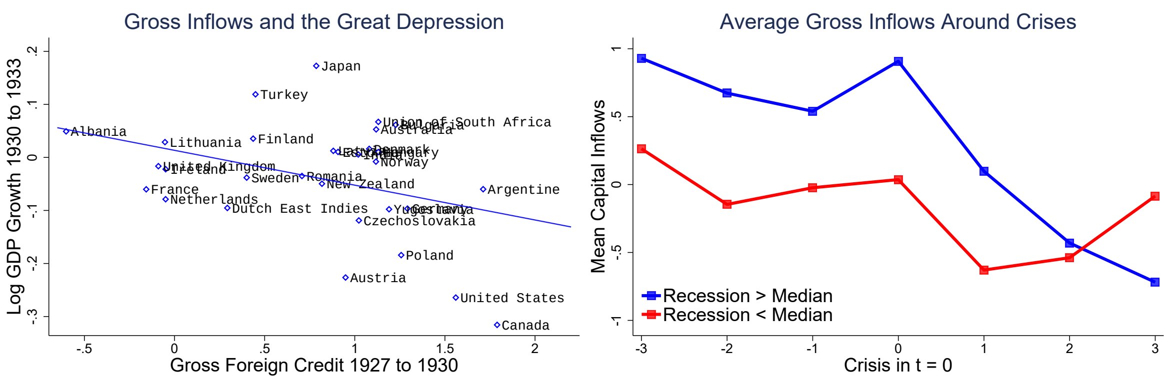
Table A4.8: *Capital flows predicting financial crises, Reinhart and Rogoff crisis dating*

	$RR\ Crisis_{i,t}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	0.01	-0.04*			0.04	-0.02		
	(0.02)	(0.02)			(0.03)	(0.04)		
$\Sigma_{j=0}^{2} Credit_{i,t-j}$		0.08***	0.04**	0.05**		0.09***	0.07**	0.08***
		(0.02)	(0.02)	(0.02)		(0.03)	(0.03)	(0.03)
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			0.04**				0.03	
			(0.02)				(0.02)	
AUC	0.74	0.77	0.77	0.77	0.76	0.79	0.79	0.79
s.e.	0.04	0.05	0.05	0.04	0.05	0.05	0.05	0.04
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Country fixed effects					✓	✓	✓	✓
Observations	301	301	301	301	192	192	192	192

Notes: The table shows estimation results of a probit model for Reinhart and Rogoff (2009) financial crises, reporting mean marginal effects. The independent variables are cumulative flows recorded in the capital account of the BoP in year -2 to t. AUC is the area under the ROC-Curve, below it is its standard error. Standard errors in parentheses are clustered on country level and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

A5. Recession severity: aggravation and moderation

Figure A5.7: *Capital inflows and recession severity*



Notes: This figure relates gross capital inflows to recession severity. The left panel scatters normalized gross capital inflows between 1927 and 1930 against log GDP growth between 1930 and 1933, producing a visibly negative relationship. To account for heterogeneous crisis starting dates, the right panel splits the sample along the median recession severity in the first 3 years after a crisis, using the combined interwar crises chronology. It plots the average gross capital inflows in the 6-year window around crises for both groups, showing that before a crisis, gross inflows are consistently higher in countries with larger than median recessions, but lower three years afterwards.

Table A5.9: *GDP growth, crises and exposure to gross capital inflows, alternative GED2 measure*

	$\Delta_2 Y_{i,t+2}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Crisis_{i,t}$	-0.05**	-0.00	0.03	0.02	-0.05**	-0.01	0.02	0.02
	(0.02)	(0.02)	(0.04)	(0.04)	(0.02)	(0.02)	(0.04)	(0.04)
$GED2_{i,t}$	-0.04**	-0.03**	-0.00	-0.01	-0.04**	-0.04**	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
$Crisis_{i,t} \times GED2_{i,t}$		-0.06**	-0.07**	-0.07*		-0.05**	-0.06*	-0.06*
		(0.02)	(0.04)	(0.04)		(0.02)	(0.04)	(0.04)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$			-0.04***	-0.03**			-0.04***	-0.04***
			(0.01)	(0.01)			(0.01)	(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$			0.00	0.00			0.00	0.00
			(0.01)	(0.01)			(0.01)	(0.01)
$Gold\ Standard_{i,t}$				-0.03*				-0.02
				(0.02)				(0.02)
R^2	0.122	0.126	0.254	0.276	0.164	0.168	0.317	0.321
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Crisis in Sample					✓	✓	✓	✓
Observations	342	342	342	342	241	241	241	241

Notes: This table re-estimates Equation 2.9, with an alternative definition for foreign capital exposure prior to crisis. The alternative *GED*2- dummy is defined as the first lag of the baseline credit variable $\sum_{j=0}^{2} Credit_{i,t-j}$ being in the top 80%. The dependent variable is log GDP growth over the period t to $t+2$. The independent variables are financial crises in year t, the *GED*2-variable capturing exposure to capital inflows, the baseline BoP-variables accumulated over t to $t-2$ and a Gold Standard indicator. All specifications additionally control for country fixed effects and a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A5.10: *GDP growth, crises and exposure to gross capital inflows, Reinhart and Rogoff crisis dating*

	$\Delta_2 Y_{i,t+2}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Crisis_{i,t}$	-0.03*	-0.00	0.02*	0.02*	-0.04*	-0.00	0.02	0.02*
	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
$GED_{i,t}$	0.00	0.01	0.04**	0.04**	-0.00	0.02	0.04*	0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$Crisis_{i,t} \times GED_{i,t}$		-0.12*	-0.11*	-0.11*		-0.12*	-0.11*	-0.11*
		(0.07)	(0.06)	(0.06)		(0.07)	(0.06)	(0.06)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$			-0.04***	-0.04***			-0.04***	-0.04***
			(0.01)	(0.01)			(0.01)	(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$			0.01	0.01			0.01	0.01
			(0.01)	(0.01)			(0.01)	(0.01)
$Gold\ Standard_{i,t}$				-0.04**				-0.03*
				(0.02)				(0.02)
R^2	0.078	0.119	0.273	0.307	0.089	0.145	0.301	0.320
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Crisis in Sample					✓	✓	✓	✓
Observations	252	252	252	252	188	188	188	188

Notes: This table presents estimation results from Equation 2.9. The dependent variable is log GDP growth over the period t to $t+2$. The independent variables are financial crises in year t (using only Reinhart and Rogoff (2009) crisis dating), the GED-variable capturing exposure to large capital inflows, the baseline BoP-variables accumulated over t to $t-2$ and a gold standard dummy variable. All specifications additionally control for country fixed effects and a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

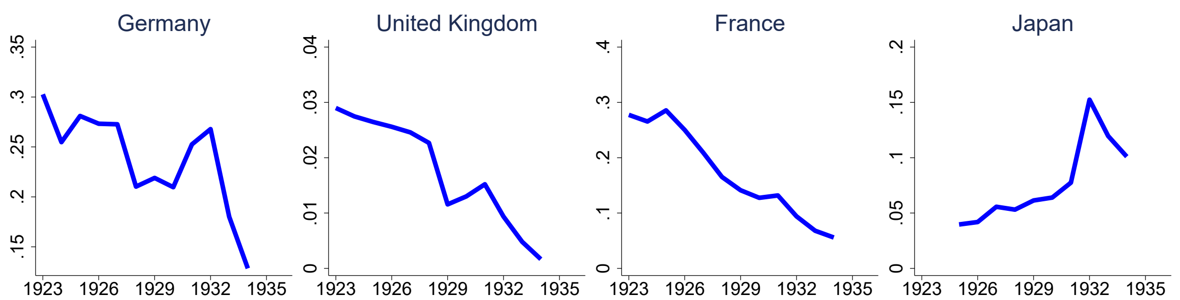
A6. Instrumental Variable Results

Table A6.11: *'Pass through' coefficients of United States portfolio investments*

	Total BBS		*Loans*	*Securities*	*Cash*	*Other*
	(1)	(2)	(3)	(4)	(5)	(6)
$Credit_{i,t}$	0.30^{**} (0.13)					
$\Delta USP_{i,t}$		0.97^{***} (0.34)	0.45^{**} (0.18)	0.35^{**} (0.16)	0.11^{*} (0.06)	0.05^{*} (0.02)
Country fixed effects	✓	✓	✓	✓	✓	✓
Observations	363	325	325	325	325	325

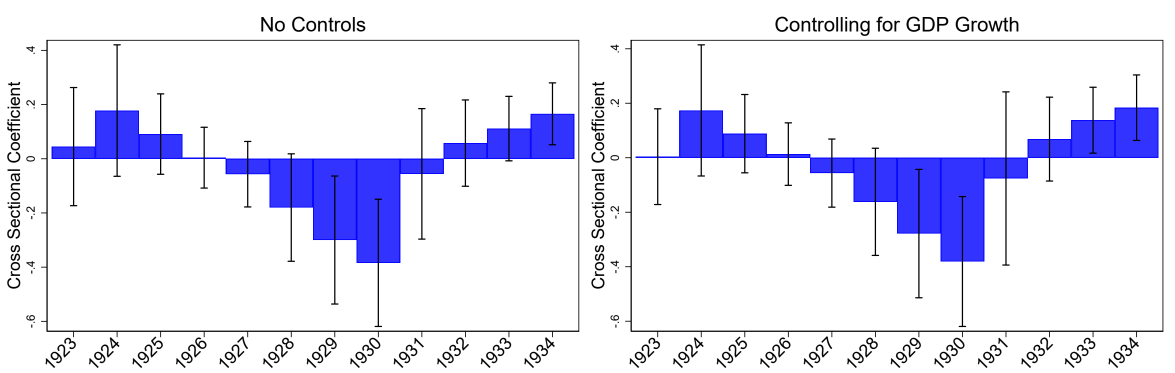
Notes: This table displays 'pass through' coefficients from gross foreign credit and changes in US portfolio investments (USP) to changes in domestic bank balance sheets (BBS). Bank balance sheet changes are further decomposed into the changes in loans, securities, cash and other assets held by domestic banks. Changes are computed based on Eren et al. (2023) with the dependent variable being defined as the change in Bank Balance sheets size (or its separate components), scaled by total balance sheets size in $t-1$ $\frac{BBS_{i,t}-BBS_{i,t-1}}{TotalBBSi,t-1}$. This is regressed on the change in the US portfolio position (or a yearly BoP flow), similarly scaled by total bank balance sheets size in $t-1$ $\frac{USP_{i,t}-USP_{i,t-1}}{TotalBBSi,t-1}$. All specifications include country fixed effects. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Figure A6.8: *US portfolio investment relative to domestic bank balance sheet size*



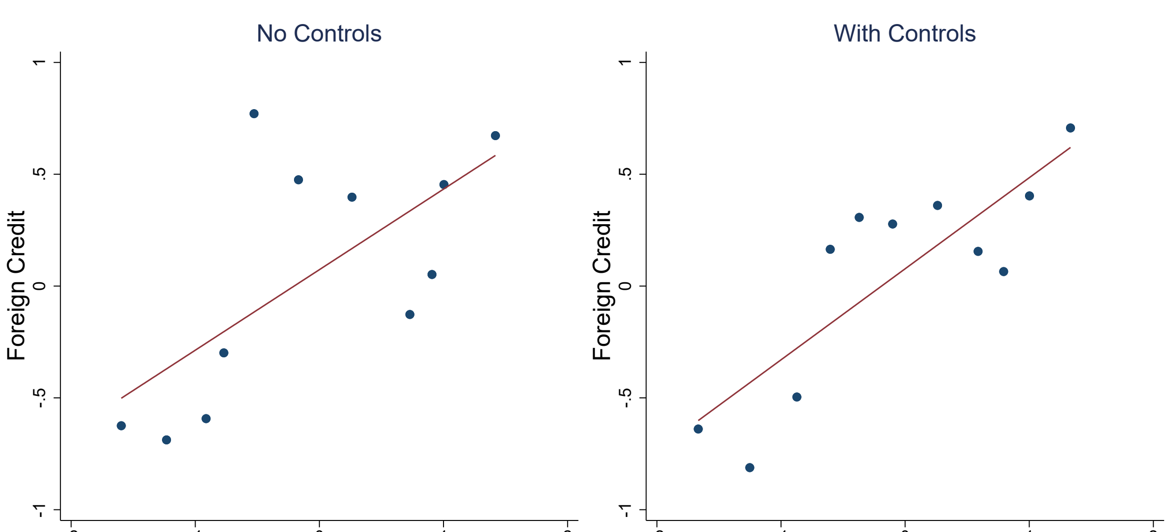
Notes: This figure plots the ratio of the United States portfolio position relative to domestic bank balance sheet size for Germany the United Kingdom, Japan and France over time. Since this ratio is dependent on two time variant variables, changes either in of them might be driving the observed volume and trends. For Example: US portfolio investment volumes in Germany are consistently about 3 to 4 times as large as in the United Kingdom. The balance sheets of commercial banks in the UK, on the other hand, are three to four times as large as the balance sheets of their German counterparts. This results in the ratio of US portfolio investments to domestic bank balance sheets being about 10 times larger in Germany when compared to the United Kingdom.

Figure A6.9: *Capital exposure to the United States, 3 year cross-sectional GDP growth*



Notes: This figure shows coefficients for a cross-sectional regression of three year future GDP growth $\Delta_3 Y_{i,t+3}$ on lagged exposure to US-portfolio investments $\frac{USP_{i,t-1}}{BBS_{i,t-1}}$, for every year between 1923 and 1934. The left panel shows the unconditional relationship, the right panel includes contemporary GDP growth. Black lines represent 90% confidence intervals. The figure shows that a close financial relationship with the United States was positively associated with growth in the early 1920sh, but also that this link turned negative with the onset of the Great Depression, before turning positive again afterwards.

Figure A6.10: *First stage plots of Bartik-style instrument*



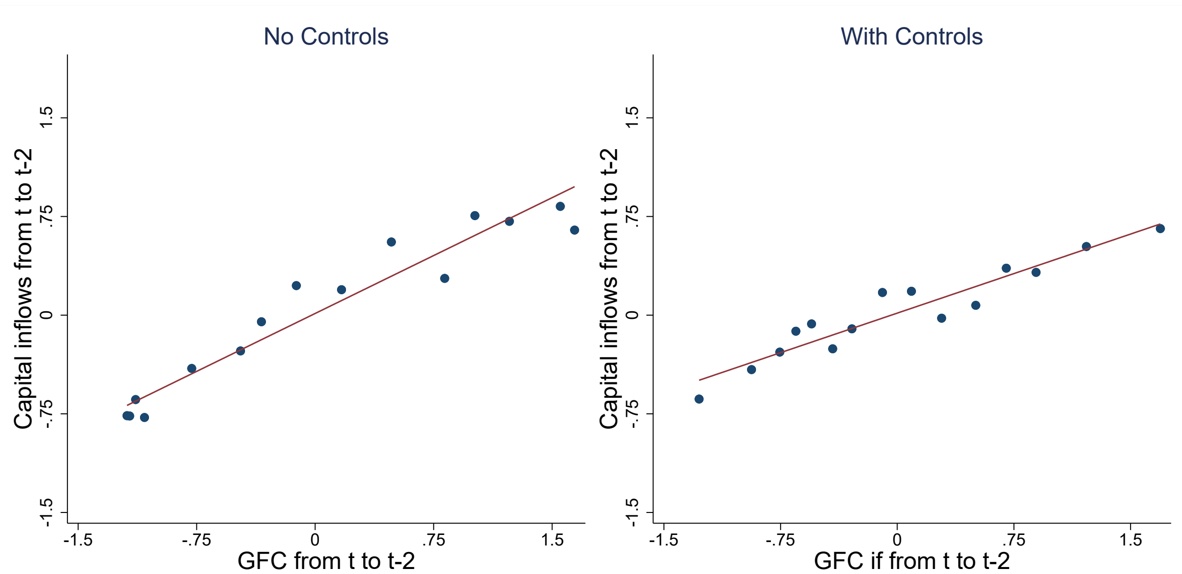
Notes: This figure shows the first stage relationship between the Bartik-style instrument, constructed in Equation 2.10, and the gross yearly inflows at time t. Both variables are normalized and collapsed into equal sized bins. Each point represents the group specific mean.The right panel includes country fixed effects and additionally controls for net capital inflows between $t-2$ and t and GDP growth. Fitted regression lines illustrate the positive correlation.

Table A6.12: *Gross foreign inflows and GDP dynamics, Bartik-style instrument robustness*

	$\Delta_2 Y_{i,t+2}$			$\Delta_3 Y_{i,t+3}$			$\Delta_4 Y_{i,t+4}$		
	OLS (1)	*Reduced* (2)	*IV* (3)	*OLS* (4)	*Reduced* (5)	*IV* (6)	*OLS* (7)	*Reduced* (8)	*IV* (9)
$Credit_{i,t}$	-0.02***		-0.04*	-0.04***		-0.08***	-0.04***		-0.12***
	(0.01)		(0.02)	(0.01)		(0.03)	(0.01)		(0.03)
Interaction IV		-0.02*			-0.04***			-0.05***	
		(0.01)			(0.01)			(0.02)	
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			20.73			20.70			15.89
Observations	254	254	254	254	254	254	245	245	245

Notes: This table presents OLS, reduced form and instrumented coefficients for a regression of log GDP growth between t and $t+h$ on gross foreign inflows at time t. The instrument deviates from the one described in Equation 2.10, as the exposure share to US-portfolio investments is adjusted to be the mean of the previous two years, instead of being fixed to 1927. For the benefits and caveats associated with this change, see text. The instrument is used to instrument gross inflows in columns (3), (6) and (9). Reduced form and instrumented coefficients are larger than OLS-coefficients, suggesting a baseline bias towards zero. All specifications control for country fixed effects, a two year distributed lag of GDP growth and net capital flows. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Figure A6.11: *First stage plots of GFC-measure and capital inflows*



Notes: This figure shows the first stage relationship between the GFC-measure and the baseline gross yearly inflow variable. Both variables are normalized three year sums and collapsed into 15 equal sized bins. Each point represents the group specific mean. The right panel includes country fixed effects and additionally controls for net capital inflows between $t-2$ and t and GDP growth. Fitted regression lines illustrate the positive correlation.

A7. Channels

Table A7.13: *Capital flows, GDP growth and the Gold Standard*

	$\Delta_2 Y_{i,t+2}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.04***	-0.04**	-0.03**	-0.06***	-0.03**	-0.05***		-0.04***	-0.03**
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)		(0.01)	(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	0.01	0.01	0.01	0.02**	0.00	0.02*		0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		(0.01)	(0.01)
$\Sigma_{j=0}^{2} Gold\ Balance_{i,t-j}$	0.01	0.00	0.01	0.01	0.01	-0.01	-0.01	0.01	0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
$Gold\ Standard_{i,t}$								-0.03	-0.03
								(0.02)	(0.02)
R^2	0.243	0.188	0.200	0.296	0.172	0.197	0.034	0.263	0.288
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sample		pre 1933	post 1933			pre 1933	pre 1933		
Goldstandard				Yes	No	Yes	Yes		
Lagged GoldStandard									✓
Observations	329	192	134	146	181	125	125	329	329

Notes: This table links capital and gold flows to GDP growth and Gold Standard theory (see text). The dependent variable is log GDP growth from t to $t+2$. The independent variables are cumulative capital account flows in years $t-2$ to t, net gold flows from $t-2$ to t and a Gold Standard dummy variable. The Gold Standard mechanism, of the outflow of physical gold being related to adverse outcomes, is visible in column (7). All specifications control for country fixed effects and lagged growth indicates a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A7.14: *Capital flows, the Gold Standard and capital account openness, full interaction set*

	$\Delta_2 Y_{i,t+2}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.04***	-0.05***	-0.05***	-0.06***	-0.07***	-0.06***	-0.06***	-0.06***	-0.06***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$No\ Gold_{i,t\to t-2}$	0.04***	0.04***	0.04***						
	(0.02)	(0.02)	(0.02)						
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times No\ Gold_{i,t\to t-2}$	0.03*	0.04*	0.03**						
	(0.02)	(0.02)	(0.02)						
$\Sigma_{j=0}^{2} Balance_{i,t-j}$		0.00			0.01			0.00	
		(0.01)			(0.01)			(0.01)	
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			0.01			-0.01			-0.00
			(0.01)			(0.01)			(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j} \times No\ Gold_{i,t\to t-2}$		-0.01							
		(0.01)							
$\Sigma_{j=0}^{2} Debit_{i,t-j} \times No\ Gold_{i,t\to t-2}$			-0.00						
			(0.01)						
$Closed\ (< 100)_{i,t\to t-2}$				0.05***	0.05***	0.05***			
				(0.02)	(0.02)	(0.02)			
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times Closed\ (< 100)_{i,t\to t-2}$				0.04**	0.05***	0.03*			
				(0.02)	(0.02)	(0.02)			
$\Sigma_{j=0}^{2} Balance_{i,t-j} \times Closed\ (< 100)_{i,t\to t-2}$					-0.01***				
					(0.00)				
$\Sigma_{j=0}^{2} Debit_{i,t-j} \times Closed\ (< 100)_{i,t\to t-2}$						0.02***			
						(0.01)			
$Closed\ (< 67)_{i,t\to t-2}$							0.04***	0.04***	0.04***
							(0.02)	(0.02)	(0.02)
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times Closed\ (< 67)_{i,t\to t-2}$							0.05**	0.05**	0.04**
							(0.02)	(0.02)	(0.02)
$\Sigma_{j=0}^{2} Balance_{i,t-j} \times Closed\ (< 67)_{i,t\to t-2}$								-0.01	
								(0.01)	
$\Sigma_{j=0}^{2} Debit_{i,t-j} \times Closed\ (< 67)_{i,t\to t-2}$									0.01
									(0.01)
R^2	0.274	0.275	0.277	0.409	0.412	0.414	0.383	0.384	0.385
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	342	342	342	234	234	234	234	234	234

Notes: This table presents estimation results from interacting capital inflows with measures for Gold Standard adherence and capital account openness. It shows the full set of interactions for all variables included in Table 2.8. The dependent variable is log GDP growth from t to $t+2$. Columns (1) to (3) interact BoP-flows with a dummy for not being on gold between t and $t-2$. Columns (4) to (6) perform a similar interaction with a dummy for the capital account being less than 100 percent open, based on the Quinn (2003) capital account openness measure. Columns (7) to (9) repeat the specification for capital account openness being in the lower two thirds. All specifications control for country fixed effects and lagged growth refers to a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

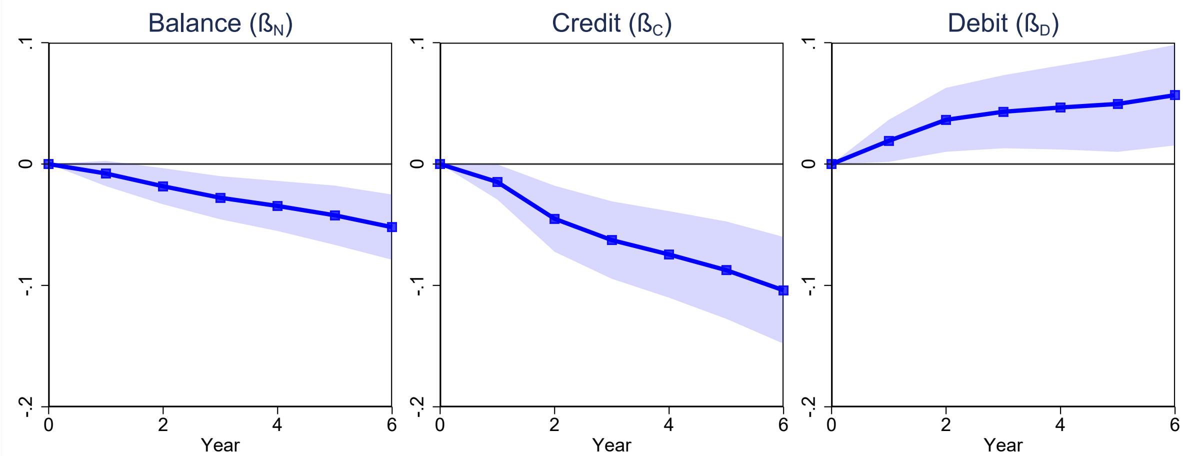
Table A7.15: *The Global Financial Cycle, Output Growth and the Gold Standard, IV Estimates*

	$\Delta_2 Y_{i,t+2}$								
	OLS			*Reduced*			*IV*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$No\ Gold_{i,t\to t-2}$	0.03**	0.04***	0.04***	-0.01	0.00	0.00	-0.06**	-0.01	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$	-0.03***	-0.04***	-0.05***				-0.11***	-0.17***	-0.19***
	(0.01)	(0.02)	(0.02)				(0.02)	(0.03)	(0.03)
$\Sigma_{j=0}^{2} Credit_{i,t-j} \times No\ Gold_{i,t\to t-2}$		0.04**	0.04**					0.16***	0.11***
		(0.02)	(0.02)					(0.03)	(0.02)
$\Sigma_{j=0}^{2} GFC_{i,t-j}$				-0.06***	-0.07***	-0.07***			
				(0.01)	(0.01)	(0.01)			
$\Sigma_{j=0}^{2} GFC_{i,t-j} \times No\ Gold_{i,t\to t-2}$					0.04***	0.04***			
					(0.01)	(0.01)			
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Net Capital Inflows			✓			✓			✓
Kleibergen-Paap Weak ID							36.91	14.34	10.40
Observations	321	321	321	321	321	321	321	321	321

Notes: This tables presents OLS, reduced form and instrumented coefficients for a regression of log GDP growth between t and $t+2$ on BoP variables, summed over the period from $t-2$ to t. Gross inflows (and their reduced and instrumented variants) are interacted with a dummy variable for not being on gold from $t-2$ to t. Again reduced form and instrumented coefficients are larger than OLS-coefficients. All specifications control for country fixed effects, a two year distributed lag of GDP growth and net capital flows when indicated. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

A8. Findings in modern data

Figure A8.12: *Balance of Payments flows and business cycle dynamics, OECD data*



Notes: This figure shows local projection results of log GDP growth over horizons $h = 1, ..., 6$ for the OECD-sample. The left panel plots the response of GDP growth to changes in the capital account balance. The middle and right panel do the same for credit and debit, respectively. Standard errors in parentheses are dually clustered on country and year. Confidence intervals are plotted at the 95% level.

Table A8.16: *Crisis prediction in combined OECD and LoN Data*

	$BVX\ Crisis_{i,t}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$	0.02***	0.01			0.03***	0.02*		
	(0.01)	(0.01)			(0.01)	(0.01)		
$\Sigma_{j=0}^{2} Credit_{i,t-j}$		0.03***	0.03***	0.03***		0.03***	0.04***	0.04***
		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
$\Sigma_{j=0}^{2} Debit_{i,t-j}$			0.00				-0.01	
			(0.01)				(0.01)	
AUC	0.67	0.70	0.70	0.70	0.72	0.75	0.74	0.74
s.e.	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04
Lagged Growth	✓	✓	✓	✓	✓	✓	✓	✓
Country fixed effects					✓	✓	✓	✓
Observations	1101	1101	1101	1101	784	784	784	784

Notes: This table shows estimation results of a probit model for financial crises for the combined sample of OECD and League of Nations data. Crisis dates for the post-war period are added from the Baron et al. (2021) database. The reported coefficients are mean marginal effects. The independent variables are cumulative capital flows from year $t-2$ to t. AUC is the area under the ROC-Curve, below it is its standard error. Standard errors in parentheses clustered on country level and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A8.17: *GDP growth, crises and exposure to gross capital inflows, OECD data*

	$\Delta_2 Y_{i,t+2}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_{i,t}$	-0.06***	-0.03**	-0.02	-0.06***	-0.03**	-0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
$GEDi,t$	-0.01*	-0.01	0.02**	-0.01	-0.00	0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$Crisis_{i,t} \times GED_{i,t}$		-0.05**	-0.04**		-0.06***	-0.05***
		(0.02)	(0.02)		(0.02)	(0.02)
$\Sigma_{j=0}^{2} Credit_{i,t-j}$			-0.03***			-0.02***
			(0.01)			(0.01)
$\Sigma_{j=0}^{2} Balance_{i,t-j}$			-0.00			-0.00
			(0.00)			(0.00)
R^2	0.178	0.183	0.282	0.233	0.243	0.323
Country fixed effects	✓	✓	✓	✓	✓	✓
Lagged Growth	✓	✓	✓	✓	✓	✓
Crisis in Sample				✓	✓	✓
Observations	1018	1018	1018	794	794	794

Notes: This table presents estimation results from Equation 2.9 for the combined sample of OECD and League of Nations data. The dependent variable is log GDP growth over the period t to $t+2$. The independent variables are financial crises in year t (crisis dates for the post-war period are added from the Baron et al. (2021) database.), the *GED*-variable capturing exposure to large capital inflows (defined as gross inflows being above the yearly median for the two consecutive years $t-1$ and $t-2$) and the baseline BoP-variables accumulated over t to $t-2$. All specifications control for country fixed effects and a two year distributed lag of GDP growth. Standard errors in parentheses are dually clustered on country and year and *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

A2. Appendix: When Two Become One

A1. Data

Figure A1.13: *Financial accounts data from golden books, outstanding liabilities of financial institutions, Spain 1981-1988*

SPAIN TABLE 31B/06 *(cont'd)*

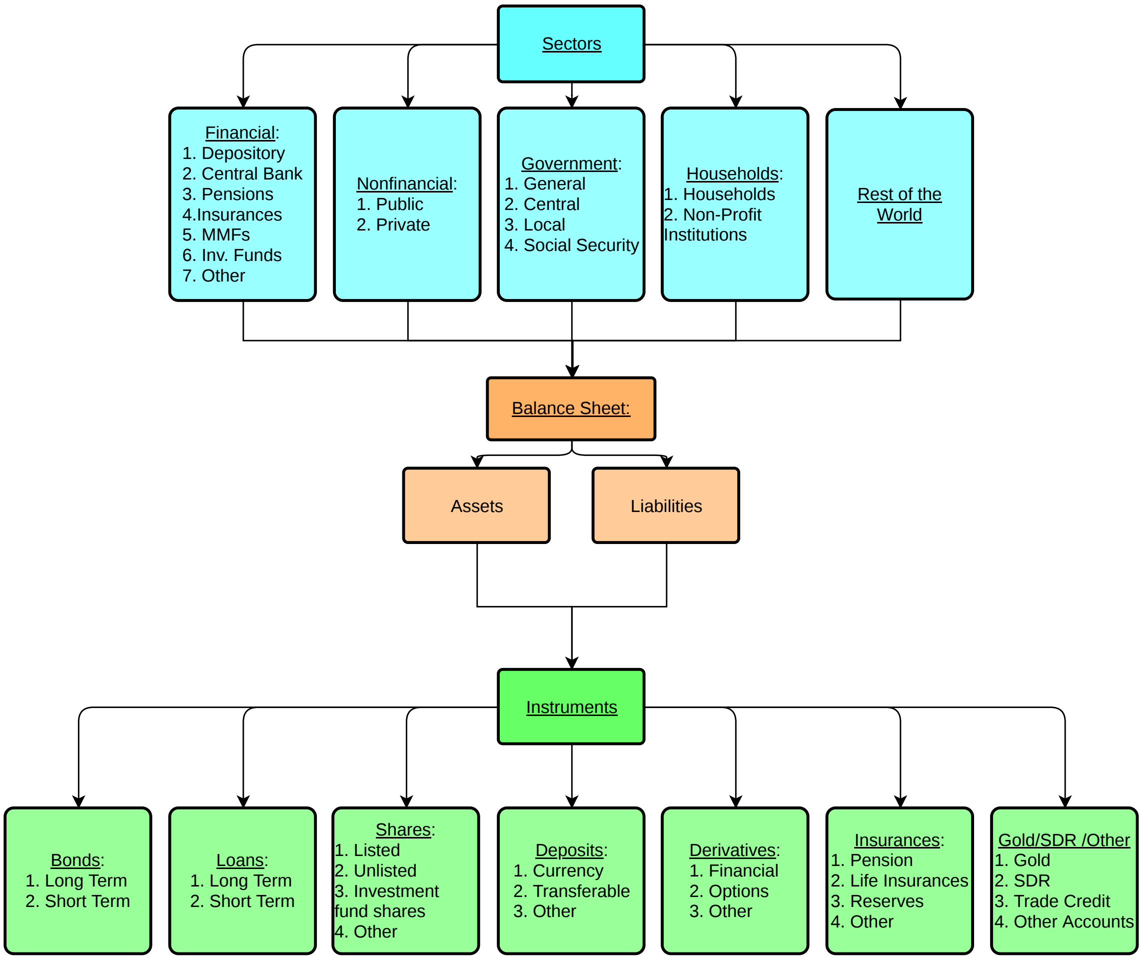
OUTSTANDING FINANCIAL ASSETS AND LIABILITIES OF FINANCIAL INSTITUTIONS

Monetary unit: billion pesetas

	1981	1982	1983	1984	1985	1986	1987	1988
LIABILITIES OF FINANCIAL INSTITUTIONS, to:	26 895.6	32 763.5	39 246.4	46 446.7	51 446.0	57 266.6	66 445.5	76 083.8
a) Institutions of the group	2 065.2	2 850.5	3 163.3	4 031.4	5 060.6	5 163.8	5 193.8	6 129.6
b) Other financial institutions	3 033.4	4 334.6	6 365.3	7 363.6	7 842.3	9 057.1	11 372.3	13 544.0
c) General Government	1 697.9	2 240.9	2 676.3	3 157.7	3 432.8	3 553.1	3 692.9	2 629.9
d) Other domestic sectors	16 183.7	18 831.6	21 601.7	25 019.5	28 287.8	32 470.1	37 998.2	44 566.2
e) Rest of the world	2 893.5	3 054.7	3 482.8	4 138.1	3 679.1	3 897.1	4 254.9	5 072.8
• ***Not allocated***	1 021.9	1 451.2	1 957.0	2 736.4	3 143.4	3 125.4	3 934.4	4 141.3
1. Counterpart of net allocations of SDRs and use of IMF credit, ECUs	41.5	27.1	35.3	42.9	46.8	47.5	45.8	45.6
– Counterpart of net allocations of SDRs	41.5	27.1	35.3	42.9	46.8	47.5	45.8	45.6
2. Cash and other transferable deposits, *assets of:*	5 577.4	6 393.9	7 308.1	9 974.8	11 088.3	12 473.2	14 218.4	16 423.0
b) Other financial institutions	822.0	1 025.3	1 340.1	3 441.0	3 733.8	4 089.3	4 598.1	4 676.8
c) General Government	196.3	363.7	472.9	616.0	715.3	759.2	849.7	1 078.2
d) Other domestic sectors	4 558.1	5 003.0	5 401.3	5 802.2	6 511.9	7 306.4	8 432.7	10 130.3
e) Rest of the world	1.0	1.9	93.8	115.6	127.3	318.3	337.9	537.7
3. Other deposits, *by:*	15 114.4	18 105.9	20 958.8	24 979.7	27 433.2	29 607.5	34 740.6	39 927.6
a) Institutions of the group	1 766.1	2 455.4	2 744.9	3 540.1	4 555.8	4 640.0	4 670.9	5 385.6
b) Other financial institutions	617.4	869.8	1 206.6	1 360.0	1 465.6	1 835.5	3 595.6	4 980.9
c) General Government	42.6	149.2	181.7	242.2	231.1	206.8	196.5	280.4
d) Other domestic sectors	10 039.7	11 889.2	13 829.9	16 167.2	17 980.9	19 802.4	22 933.1	25 510.5
e) Rest of the world	2 648.6	2 742.3	2 995.7	3 670.2	3 199.8	3 122.8	3 343.5	3 770.2
4. Short-term securities, *held by:*	566.3	978.4	1 854.4	–	–	–	–	–
b) Other financial institutions	566.3	978.4	1 854.4	–	–	–	–	–
7. Bonds, *held by:*	479.9	683.6	936.0	1 328.9	1 716.2	2 228.8	2 054.5	2 114.3
a) Institutions of the group	110.0	113.8	84.7	77.0	53.6	66.3	45.6	52.2
b) Other financial institutions	83.7	111.2	121.9	173.7	237.5	298.7	347.9	467.6
c) General Government	0.1	0.6	0.6	0.7	0.7	0.8	0.8	0.9
d) Other domestic sectors	285.5	457.7	728.7	1 076.8	1 424.4	1 863.0	1 647.6	1 579.4
e) Rest of the world	0.6	0.3	0.1	0.7	–	–	12.6	14.2
8. Shares, *held by:*	1 070.0	1 162.3	1 241.2	1 493.7	1 764.4	2 566.6	3 569.9	5 295.2
a) Institutions of the group	87.8	124.9	136.0	146.5	171.8	173.8	221.2	454.5
b) Other financial institutions	66.1	66.1	68.2	72.7	89.6	163.1	219.9	371.0
c) General Government	30.8	33.6	44.4	44.4	48.9	48.9	49.9	160.2
d) Other domestic sectors	834.6	879.5	917.2	1 142.3	1 332.9	1 925.1	2 727.1	3 833.6
e) Rest of the world	50.7	58.2	75.4	87.8	121.2	255.7	352.8	475.9
5+9. Loans, *from:*	2 542.6	3 349.2	4 236.0	5 060.9	5 220.9	5 676.9	5 751.4	4 860.3
a) Institutions of the group	73.1	125.1	166.3	227.6	229.8	212.0	192.8	170.3
b) Other financial institutions	877.9	1 283.8	1 774.1	2 316.2	2 315.8	2 670.5	2 609.8	3 047.7
c) General Government	1 428.1	1 693.8	1 976.7	2 254.4	2 436.8	2 537.4	2 597.0	1 110.2
d) Other domestic sectors	12.4	21.6	36.4	41.8	54.5	104.2	189.5	302.9
e) Rest of the world	151.1	224.9	282.5	220.9	184.0	152.8	162.3	229.2
10. Net equity of household on life insurance reserves and pension funds, *assets of:*	453.4	580.6	688.2	789.2	983.2	844.6	1 309.5	2 326.8
d) Other domestic sectors	453.4	580.6	688.2	789.2	983.2	844.6	1 309.5	2 326.8
11. Others, *to:*	1 050.1	1 482.5	1 988.4	2 776.6	3 193.0	3 821.5	4 756.4	5 091.0
a) Institutions of the group	28.2	31.3	31.4	40.2	49.6	71.7	63.3	67.0
d) Other domestic sectors	–	–	–	–	–	624.4	758.7	882.7
• *Not allocated*	1 021.9	1 451.2	1 957.0	2 736.4	3 143.4	3 125.4	3 934.4	4 141.3

Notes: This figure shows a typical snapshot of the data from 'Golden Books' newly digitized for this thesis. In addition to reporting sectoral accounts by financial instrument, the Golden Books data often includes some counterparty information, i.e. the counterparty sector for an asset or liability position, as can be seen here for the example of Spain between 1981 and 1988.

Figure A1.14: *Structural overview of financial accounts balance sheets*



Notes: This figure gives an overview over the structural composition of the data. It shows, from top to bottom: 1.) the division into the five main sectors, with their respective subsectors, 2.) the split into asset and liability positions and 3.) in which financial instruments these positions are recorded.

Table A1.18: *Year range by country and dataset*

Country	SNA08	SNA93	Golden Books
Austria	1995-2018	1995-2012	
Belgium	1995-2018	1994-2013	1973-1996
Canada	1990-2019	1970-2014	1974-1996
Chile	2003-2018	2002-2015	
Colombia	2015-2018	1996-2015	
Czech Republic	1995-2018	1994-2012	
Denmark	1994-2018	1994-2013	
Estonia	1995-2018	1995-2012	
Finland	1995-2018	1995-2012	1980-1995
France	1995-2018	1995-2012	1977-1997
Germany	1995-2018	1991-2012	1973-1997
Greece	1995-2018	1995-2013	
Hungary	1990-2018	1989-2013	
Iceland	2003-2018	2003-2012	
Ireland	2001-2018	2001-2012	
Israel	2010-2017	2010-2012	
Italy	1995-2018	1995-2012	1979-1997
Japan	1994-2018	1980-2014	1973-1996
Korea	2008-2018	2002-2012	
Latvia	1995-2018		
Lithuania	1995-2018		
Netherlands	1995-2018	1990-2012	1987-1996
Norway	1995-2019	1995-2013	1981-1993
Poland	1995-2018	1995-2012	
Portugal	1995-2018	1995-2013	
Slovak Republic	1995-2018	1995-2012	
Slovenia	1995-2018	2001-2013	
Spain	1995-2018	1980-2012	1973-1996
Sweden	1995-2018	1995-2013	1980-1996
Switzerland	1999-2018	1999-2011	
United Kingdom	1995-2018	1987-2013	
United States	1960-2019	1960-2013	1955-1996

Notes: This table shows the data range for the three separate sources which are used to construct the final dataset. All three are based on non-consolidated financial accounts from the System of National Accounts published by the OECD. Since Australia does not provide non-consolidated data, I instead use consolidated data. For Australia, the SNA08 version covers the years 1989 to 2018 and the SNA93 version the years 1989-2013.

Table A1.19: *Banking crises in sample*

Country	Laeven, Valencia	Baron, Verner, Xiong
Australia		
Austria	2008	2008, 2011
Belgium	2008	2008, 2011
Canada		1982
Chile		
Colombia		
Czech Republic		
Denmark	2008	2008, 2011
Estonia		-
Finland	1991	1990
France	2008	2008
Germany	2008	2008
Greece	2008	2008, 2010
Hungary	2008	1995, 2008
Iceland	2008	2008
Ireland	2008	2007, 2010
Israel		
Italy	2008	1992, 2008, 2011, 2016
Japan	1997	1990, 1997, 2001
Korea		
Latvia	2008	-
Lithuania		-
Netherlands	2008	2008
Norway	1991	1987, 2008
Poland		-
Portugal	2008	2008, 2011, 2014
Slovak Republic	1998	-
Slovenia	2008	-
Spain	2008	2008, 2010
Sweden	1991, 2008	1991, 2008
Switzerland	2008	2008
United Kingdom	2007	1991, 2008
United States	1988, 2007	1984, 1990, 2007

This table gives an overview over the banking crises in the sample. Entries with "-" indicate that the respective country is not included in the source sample. Empty entries indicate no documented crises episodes during the sample period. The left column refers to the crisis-chronology of Valencia and Laeven (2012), the right column to the chronology from Baron et al. (2021).

A2. Unveiling Approaches

This section describes the unveiling methodologies, with different approaches relaxing or altering key assumptions of the baseline. I first describe the baseline 'proportional approach', followed by (ii) the 'counterparty', (iii) the 'subsector' and (iv) the structural approach. In (v) I additional compare the baseline results to the replication kit from Mian et al. (2020b) as well as additional OECD data.

A2-1. Proportional Unveiling (Baseline)

Which counterparty sectors ultimately finance credit to households and firms? This section describes the baseline procedure to answer this question in greater detail. In line with Mian et al. (2020b), I assume that ultimate counterparty sectors (u) can be domestic households, the government or the rest of the world ($u \in \{HH, GG, RoTW\}$). Corporate sectors (c) that cannot be ultimate counterparties and have to be unveiled are non-financial and financial corporations ($c \in \{NF, FI\}$). I use information on sectoral asset and liability composition to allocate loans to the ultimate counterparties providing financing.

Step 1: The proportional unveiling approach relies on the accounting axiom that every liability is another agent's asset. Given the previously described data structure, we always know the liability composition of any given sector, while observing the asset composition of all other sectors. Without detailed counterparty information, I allocate liabilities proportionally to the sectoral distribution in holdings of this instrument on the asset side. For example, I allocate deposits, used by the financial sector to finance loans, to a counterparty sector based on the share this sector has in total deposits holdings in the economy (excluding the financial sector itself). When the household sector holds 70% of all deposits in the economy (excluding deposits held as financial intermediary assets), I assign 70% of the deposit liabilities of the financial sector to the household sector.

More generally, I want to measure the bilateral claims held by financing sector

s against borrowing sector r through financial instrument i, denoted as $\omega_i^{s\to r}$, for each sectoral creditor (holder)-borrower (issuer) pair. This information is observable in counterparty data (for some instruments i), but it is generally not available for the large panel of countries. The key assumption that is needed here, is that for a given financial instrument the mix of financing sectors can be computed based on the proportional asset holdings of all other sectors in that instrument.[1] Using this assumption, I estimate claims in instrument i held by counterparty sector s against recipient sector r as

$$\widehat{\omega}_i^{s\to r} = \frac{A_{i,s}}{\sum_{s\neq r}^{S} A_{i,s}} L_{i,r}, \tag{1}$$

where $(r,s) \in \{HH, GG, RoTW, NF, FI\}$ are the borrowing and the supplying counterparty sectors, and i the instrument through which r has raised and s has provided financing. Instruments (i) can be deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, or other accounts. $A_{i,s}$ and $L_{i,r}$ are assets and liabilities of sectors s and r in instrument i respectively. We can then compute the sum over all financial instruments for directed sectoral pairs $\widehat{\omega}^{s\to r} = \sum_i^I \widehat{\omega}_i^{s\to r}$.

While in principle allowing all possible $s \to r$ relationships, I will set $\widehat{\omega}_i^{RoTW\to HH} = 0$. The reason is that households normally do not directly access international financial markets to borrow. Whenever we observe counterparty information in the data, $\omega_i^{RoTW\to HH}$ is zero or very small. Allowing this direct link based on proportionality would therefore likely overestimate the importance of foreign financing for household credit. While this is a reasonable restriction based on observable data, it is important to note that this approach, if anything, underestimates the rest of the world as a funding source for household debt expansions.

Intuitively, this approach will work best, when instruments are held predomi-

[1]This assumption is also used in Vom Lehn and Winberry (2022) and by the BEA to construct sectoral capital-flows tables.

nantly by one sector. In the example above: if households are the only owner of deposits in the economy, I will allocate deposits correctly. It is therefore an advantage that asset and liability composition differ substantially across sectors. However, all results are validated using several alternative approaches. First, if we can observe $\omega_i^{s\to r}$ directly in the data, the allocation procedure becomes obsolete, allowing us to validate the baseline results for the part of the sample where this information is available. In a second exercise I compare the baseline to estimates using different assumptions in the computation of $\widehat{\omega}^{s\to r}$.

Step 2: We want to determine the ultimate counterparty of household and non-financial corporate credit, i.e. we want to estimate $C^{u\to b}$ with u being the ultimate supplying sector ($u \in \{HH, GG, RoTW\}$) and b the borrowing sector ($b \in \{HH, NF\}$). While we calculated the direct link above, we also need to account for indirect links, which turn out to be very important in the data as most credit is intermediated. These indirect links can take two forms. First, borrowers and u-sectors could be linked via one intermediary, e.g. domestic households holding deposits of financial intermediaries which then lend to other households. Second, there could be more than one intermediation step: e.g., consumer loans to the household sector by the NF sector could be financed with loans from FIs.

To correctly assign credit to the ultimate counterparty, I first estimate the total holdings of u-sectors in intermediary corporate c-sectors ($c \in \{NF, FI\}$), as the sum of direct holdings in the respective c sector, calculated in Equation 1 and indirect holdings channeled through the other c-sector c'. The second part of Equation 2 computes the claims of sector u against sector c channeled through c' via instrument i. Adding up the direct and intermediated (indirect) holdings yields the total assets $\widehat{\Omega}_i^{u\to c}$ in the two intermediary sectors for the three final suppliers of capital:

$$\widehat{\Omega}_i^{u\to c} = \underbrace{\widehat{\omega}_i^{u\to c}}_{direct} + \underbrace{\frac{\widehat{\omega}^{u\to c'}}{\sum_u \widehat{\omega}^{u\to c'}} \widehat{\omega}_i^{c'\to c}}_{indirect}. \tag{2}$$

For loans to the corporate non-financial sector the unveiling ends with this step. For consistency with household credit I denote the special case of $\widehat{\Omega}^{u\rightarrow NF}_{Loans}$, identifying loans to the non-financial corporate sector financed by ultimate sector u, as $C^{u\rightarrow NF}$.

Step 3: To determine the final holders of household debt, one more step is neccessary, distributing credit from the two c-sectors to households between the three u-sectors. The total funds supplied by sector u to the household sector are then calculated as the sum of indirect and direct claims on the household sector[2]

$$C^{u\rightarrow HH} = \sum_c \frac{\widehat{\Omega}^{u\rightarrow c}}{\sum_u \widehat{\Omega}^{u\rightarrow c}} \widehat{\omega}^{c\rightarrow HH} + \widehat{\omega}^{u\rightarrow HH}. \tag{3}$$

Note, that the liabilities of the household sector almost exclusively consist of loans, so that I do not use a subscript for $i = Loans$. Corporates, on the other hand, also borrow using other financial instruments. Here, I want to focus on corporate loans to be able to allow comparisons with other datasets and results in the literature. Consequently, I focus on funds recorded as loans on the liability side of non-financial sector balance sheets and express this as $C^{u\rightarrow NF}$.

A2-2. Counterparty Unveiling

For robustness, I resort to 'counterparty unveiling', using three different sources of data: the historical 'Golden Books' published by the OECD, the 'who-to-whom' matrices of the ECB and data newly made available under the System of National Accounts 2008 (SNA08) provided by the OECD on its website. These data contain counterparty information, i.e. a breakdown of counterparty sectors for a given financial instrument (on the asset or liability side of the balance sheet). Such counterparty data is available for a subset of countries, time periods, and financial instruments. Counterparty data makes step 1 of the baseline procedure obsolete, since we observe $\omega_i^{s\rightarrow r}$ directly in the data and do not have to estimate it. There are two potential ways

[2] Note that the direct link $\widehat{\omega}^{u\rightarrow HH}$ only plays a role for government claims on the household sector as we have set $\widehat{\omega}_i^{RoTW\rightarrow HH} = 0$ and direct loans between households are not recorded in the financial accounts (and likely to be small), i.e. $\omega^{HH\rightarrow HH}_{Loans} = 0$.

to obtain information about $\omega_i^{s \to r}$, where having information on one is sufficient. As an example, assume the domestic financial sector records loans on the asset side by counterparty sector. Even without the household sector reporting counterparties, we know which part of its liabilities was funded by the domestic financial sector through loans. Consequently, we can 'fill' this household counterparty with the information available in the data.

Counterparty information is often available only for a subset of the data, i.e. only for some of the reported sectors or financial instruments. In that case, for the remaining relationships, we can exploit the fact that bilateral claims that are observed in the data, must not be assigned to another counterparty during the unveiling process. The assets held by sector s against r through instrument i, $\omega_i^{s \to r}$ cannot be part of the estimated assets of sector s against any other sector. Using this reasoning, any counterparty information improves the accuracy of the unveiling. To implement this, I subtract the amounts observed in counterparty relationships from the corresponding asset positions of the supplying sector s and the liability position of the receiving sector r.

The remainders are allocated using equation Equation 1 to the remaining positions of other sectors with incomplete counterparty information. When counterparties are complete, this term will simply be zero. We can then use observable counterparty data $\omega_i^{s \to r}$ and pairwise holdings estimated from the unallocated assets and liabilities $\widehat{\omega}_i^{s \to r}$ and follow steps 2. and 3. in the proportional unveiling approach.

The two left panels of Figure 3.3 quantify the results using the ECB 'who-to-whom'-matrices and the historical golden book data for Spain and Sweden respectively, showing foreign-financed household credit relative to GDP using the baseline approach and the results from the counterparty data approaches. In both cases. levels and dynamics are very similar using the baseline and the counterparty data approaches. If anything it seems like the baseline approach in yellow yields more conservative results, with counterparty data showing stronger increases around the

2008 crisis in both countries, and for the crisis in the early 1990s in Sweden. The binned scatterplots in the two right panels show a strong relationship between results using the different approaches in the full sample.

A2-3. Subsector Unveiling

The baseline procedure treats the financial sector as a single entity, where it does not matter through which entity or subsector funds enter and leave the financial system. The data, however, sometimes includes additional breakdowns by subsector within the financial sector. The subsector approach exploits this data by looking at the asset and liability composition of each financial subsector individually. I calculate the weighted average financing of every instrument on the asset side of the total financial sector, given the financing structures of its subsectors. This means that the liability composition of the subsector that holds most loans, now matters most when assigning loans to ultimate holders. In doing so I assume, that funds are not channeled between financial subsectors, but exit the financial sector through the same subsector that raised them. The subsectors included in this approach are: Monetary Financial Institutions (MFI), Investment Funds (IF), Insurances and Pension Funds (IPF) and Other Financial Intermediaries (OFI). These four subsectors together add up to the total financial sector.

To unveil the ultimate holders of funds loaned out to households I start by calculating how much a subsector contributes to the assets of the total financial sector for any instrument i in Equation 4. I use this share as the weight a subsector has in holdings of a given instrument

$$\theta_{s,i} = \frac{A_{s,i}}{\sum_s^S A_{s,i}}, \tag{4}$$

with $\theta_{s,i}$ representing the share a subsector s holds in the total assets of the financial sector in instrument i. Included instruments are deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options. To emphasize the difference between instruments on the asset and liability side of financial subsectors, instruments on the liability side are labeled j in the following equations. In Equation 5 I calculate the share that each instrument contributes to the total funding (i.e. the liabilities) of any subsector

$$\phi_{j,s} = \frac{L_{j,s}}{\sum_j^I L_{j,s}}. \tag{5}$$

$\phi_{j,s}$ now represents the share an instrument j contributes to the total liabilities of a financial subsector s. These two shares allow me to calculate the weighted average financing for each instrument on the asset side of the total financial sector:

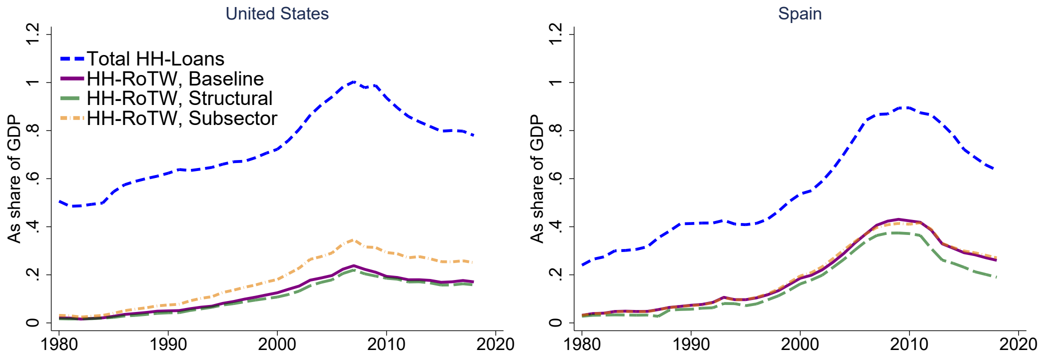
$$\psi_{i,j} = \sum_s^S \theta_{s,i} \times \phi_{j,s}. \tag{6}$$

The left hand side $\psi_{i,j}$ now corresponds the share of instrument i on the asset side that is financed by instrument j. This captures the heterogeneity in financial sector balance sheets, as it is now possible for assets, e.g., loans to be financed by different liability compositions if they are held by different subsectors. These liabilities in turn might then be held by a different set of supplying sectors, leading to a potentially different allocation of household loans to ultimate suppliers of funds. Equation 7 first transforms instrument financing shares $\psi_{i,j,s}$ into nominal values, by multiplying them with the total assets in instrument i by subsector s. Adding up these values over all subsectors delivers the amount of asset i being held by the entire financial sector financed with instrument j

$$\widehat{\Psi}_{i,j} = \psi_{i,j} \sum_s^S A_{s,i}. \tag{7}$$

$\widehat{\Psi}_{i,j}$ consequently refers to the estimated nominal amount of instrument i on the asset side of the financial sector, that is financed by instrument j. From here on, we follow Equation 1 - Equation 3, with the deviation, that wherever the financial sector is concerned, we substitute $\widehat{\Psi}_{i,j}$ for $L_{FI,j}$ (the liabilities of the financial sector in

Figure A2.15: *Alternative unveiling approaches*



Notes This figure shows total household debt and household debt ultimately financed by the foreign sector using three unveiling approaches. The dashed blue line is total household debt relative to GDP. The solid purple line is the share of household debt ultimately financed by the rest of the world, estimated with the baseline approach. The long-dashed green line presents results using the allowed sectoral allocations from Mian et al. (2020b) for unveiling. The yellow (short-dashed) line corresponds to the estimate using the subsectoral unveiling approach. See text.

instrument j are labelled with i in the baseline unveiling). Summing $\widehat{\Psi}_{i,j}$ over j yields the total assets of the financial sector in instrument i, while summing $\widehat{\Psi}_{i,j}$ over i gives the total liabilities of the financial sector in instrument j.

While the subsector unveiling marks the lower bound of financial intermediation, the baseline implicitly assumed that subsector-specific funding differences are irrelevant. It marks, in other words, the upper bound of financial intermediation within the financial sector. Figure A2.15 plots the results of the two approaches together. For the US, the subsector approach delivers a higher estimate for household credit ultimately financed by the foreign sector than the baseline, while for Spain and most other countries the two are almost identical. If anything, this confirms that the baseline is on the conservative end of the spectrum when estimating the importance of foreign credit to households. The left panel of Figure A2.16 quantifies the comparison between subsector and proportional unveiling, showing that on average differences are marginal.

A2-4. Structural Unveiling: imposing the structure of US flow of funds

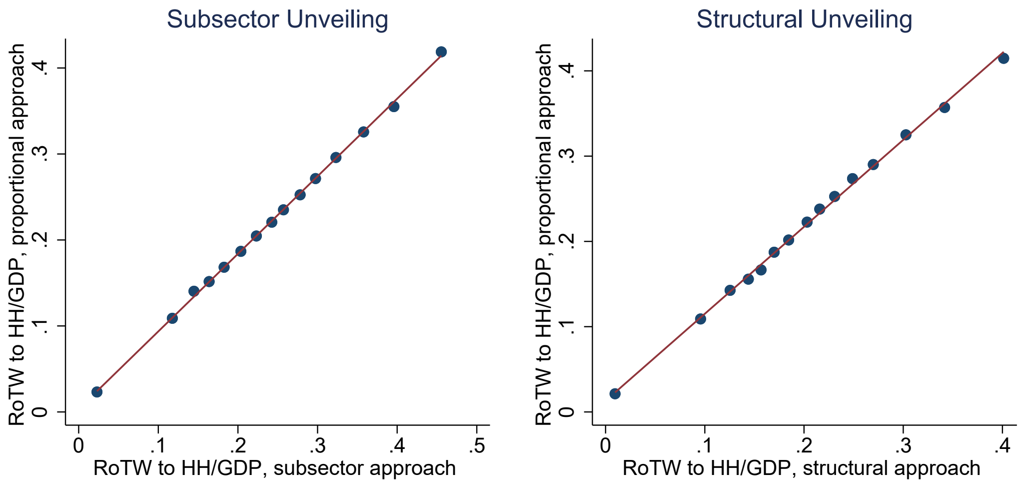
Mian et al. (2020b) use detailed data from US flow of funds to allocate household debt to ultimate holders. While we normally have less information in the panel data, we can impose the structure of the US financial accounts on other countries. In this approach, the financial sector is divided into depository corporations, pensions, insurances, mutual funds, central banks and other financial institutions or pass throughs. The structure changes the assumption of proportional allocation of funds to a hierarchy in which each sector has bilateral relations with only a limited number of other sectors.

In later stages of the unveiling process, any sector s that is not one of the three final sectors (HH, GG, RoTW), will be unveiled itself. In this case the total household debt accumulated by s up to that point is summed and divided between the sectors that are permitted to hold assets in s. Finally, the household debt accumulated by the three ultimate sectors $u \in \{HH, GG, RoTW\}$, i.e. the ones that are not themselves divided between other sectors, is summed up over the allocations made in all different stages. Table A2.20 shows the seven stages of the unveiling with r being the sector being unveiled at a given stage and s being the sectors between which it is distributed.

Table A2.20: *Structural Unveiling Steps*

Stage	r (Receiving- \ Sector being unveiled)	s (permitted supplying sectors)
1	Total Household Debt	Government, Other financial Institutions (Pass-throughs), Depository Corporations
2	Other financial Institutions (Pass-throughs)	Rest of the world, Government, Insurances and Pensions, Central Bank, Money Market Funds, Investment Funds, Depository Corporations, Households
3	Central Bank	Rest of the world, Government, Depository Corporations
4	Money Market funds, Investment Funds	Rest of the world, Government, Insurances and Pensions, Households
5	Depository Corporations	Rest of the world, Government, Insurances and Pensions, Non-financial Institutions, Households
6	Non-financial Institutions	Rest of the world, Government, Insurances and Pensions, Households
7	Insurances and Pensions	Rest of the world, Government, Households

Figure A2.16: *Proportional compared to subsector and structural unveiling*



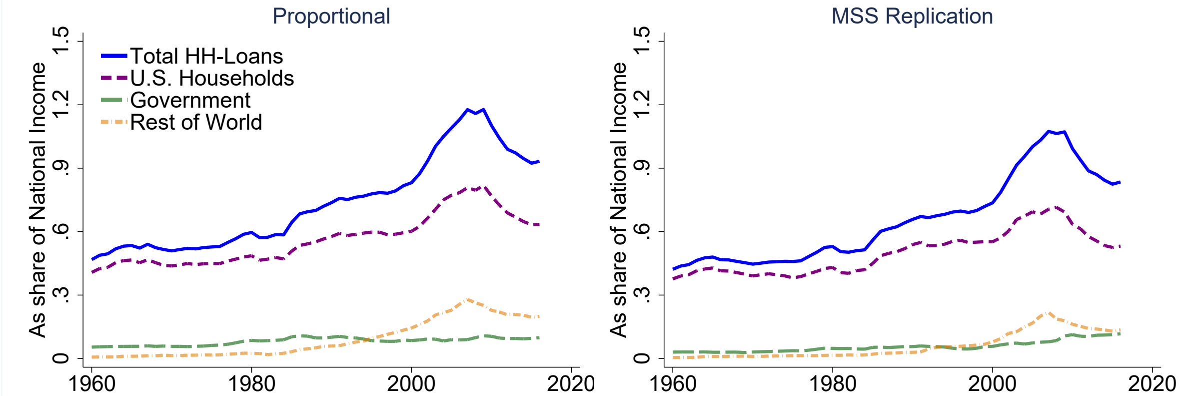
The figure shows the relationship between estimates of household credit funded by the foreign sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using detailed subsector information in recent OECD data. The right panel compares the baseline to results using the structural approach derived from Mian et al. (2020b). Bins are constructed as in Figure 3.3.

Figure A2.15 shows in blue total household debt, in green the estimate imposing the structure described above, in purple the proportional baseline and in yellow the results from subsector unveiling, for the United States and Spain. The difference between proportional and structural unveiling is virtually indistinguishable for the US. This is unsurprising, given that the structure was derived from the US financial sector. For Spain, the results differ marginally, hinting at homogeneous, if not identical structures in advanced OECD economies. The right panel of Figure A2.16 shows this result for all instances where unveiling imposing this structure is possible. Again, differences are marginal on average.

A2-5. Comparison with Mian et al. (2020b) and additional OECD Data: Counterparty and Consolidated

Using detailed information on the counterparties and the flows of funds through the economy, Mian et al. (2020b) impose a structure to the unveiling, which I exploit in the section above. Their results, however, rely on both this structure, as well as information about counterparties, which are accessible using their replication kit. There are some small level differences in the total household credit series, as they

Figure A2.17: *Comparison with Mian et al. (2020b)*



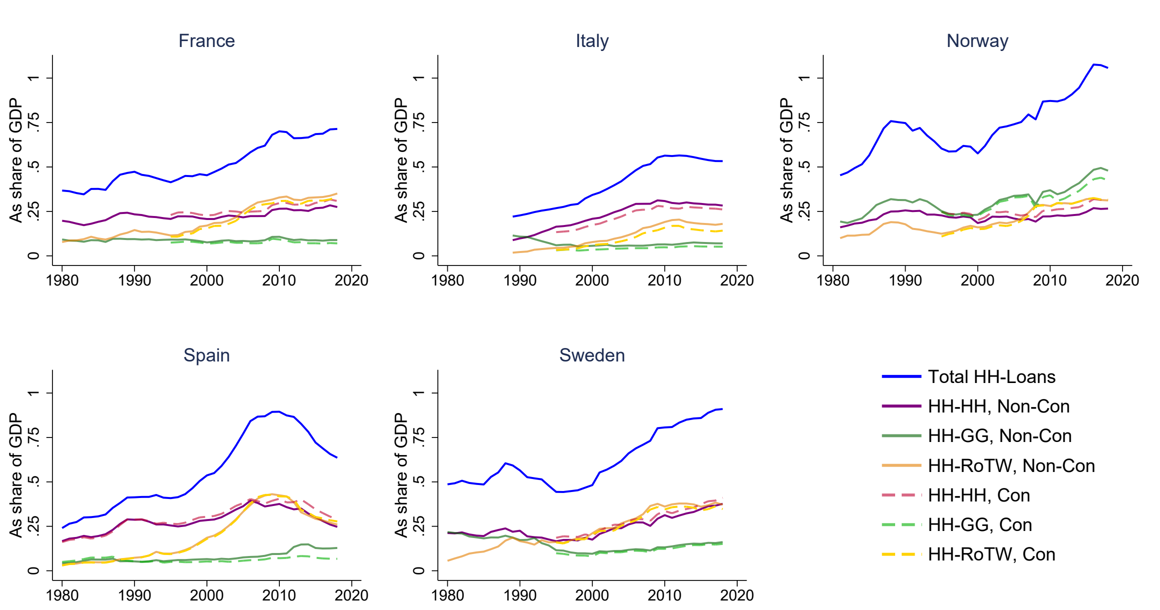
Notes The figure compares the result of the baseline unveiling procedure, using OECD data, to the unveiling methodology employed in Mian et al. (2020b), using US flow of funds data. Since we use total household credit, but Mian et al. (2020b) only mortgages, there are small level differences in the total (blue), which translate into level differences in household credit decomposed by ultimate counterparty. The proportionality and dynamics across graphs however are close to identical.

unveil mortgage and consumer credit only, but Figure A2.17 shows that the unveiled series mirror each other closely in levels and dynamics.

For further verification I replicate the baseline results using the consolidated data series from the OECD System of National Accounts 2008 (SNA08). Using the proportional unveiling with consolidated data, I plot the results against the baseline with non-consolidated data in Figure A2.18, showing that the results are almost identical across datasets. This is quantified in the left panel of Figure A2.19.

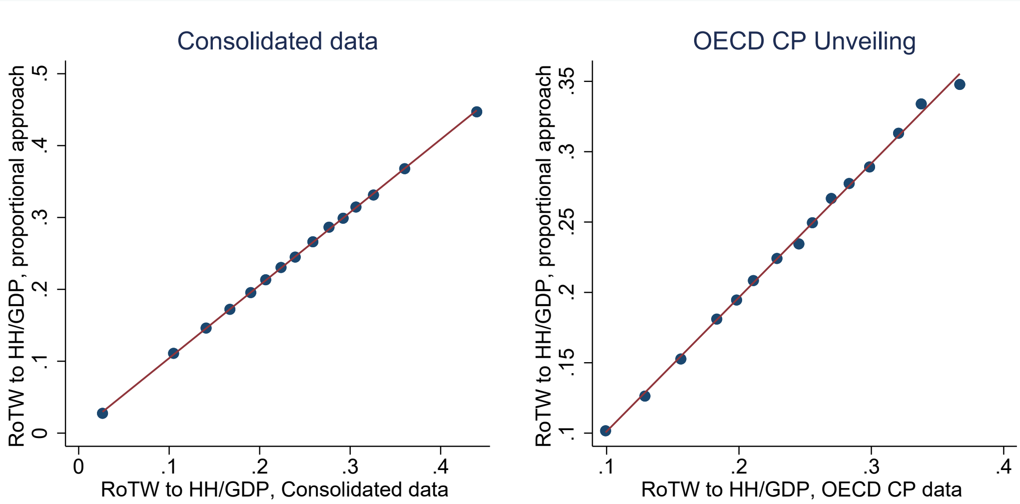
The OECD has also made available a new counterparty dataset under the SNA08 format, but so far, only data for a few countries is available. I employ the previously described counterparty unveiling on this subset of countries and plot them against the baseline in the right panel of Figure A2.19. While the results again confirm the baseline results, this figure is not representative for the majority of the data, as the required information is only available for a very small subset.

Figure A2.18: *Household debt financing sources, non-consolodiated and consolidated data*



Notes: The figure compares sectoral sources of household debt for a number of countries using OECD data and the baseline unveiling approach. The solid lines represent the non-consolidated data used throughout the analysis. The dashed lines represent consolidated data from the same source. Since historical sources report non-consolidated data, the consolidated series generally start at a later point in time.

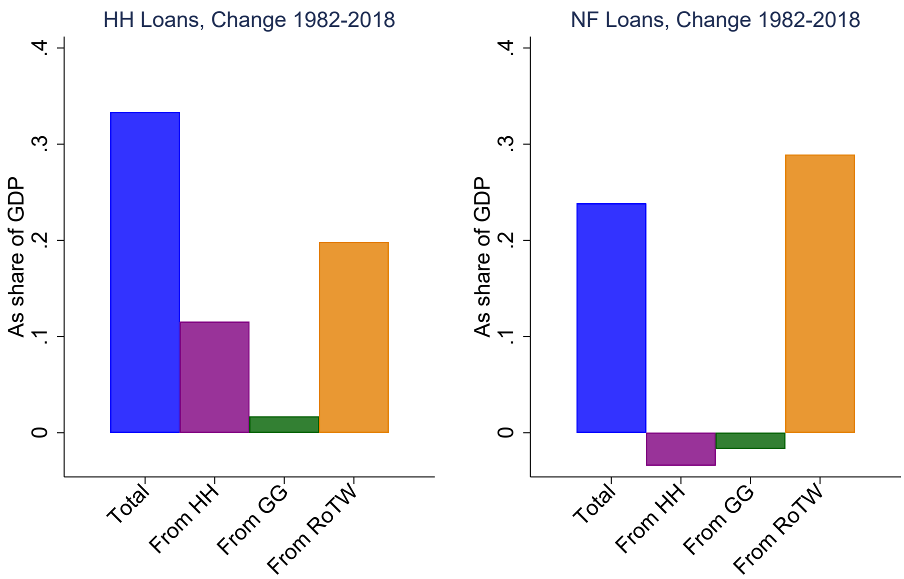
Figure A2.19: *Proportional unveiling compared to consolidated and OECD counterparty unveiling*



The figure shows the relationship between estimates of household credit funded by the foreign sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using the proportional approach on the OECD consolidated Financial Statistics. The right panel compares the baseline to results using recent counterparty information provided by the OECD for selected Countries. Bins are constructed as in Figure 3.3.

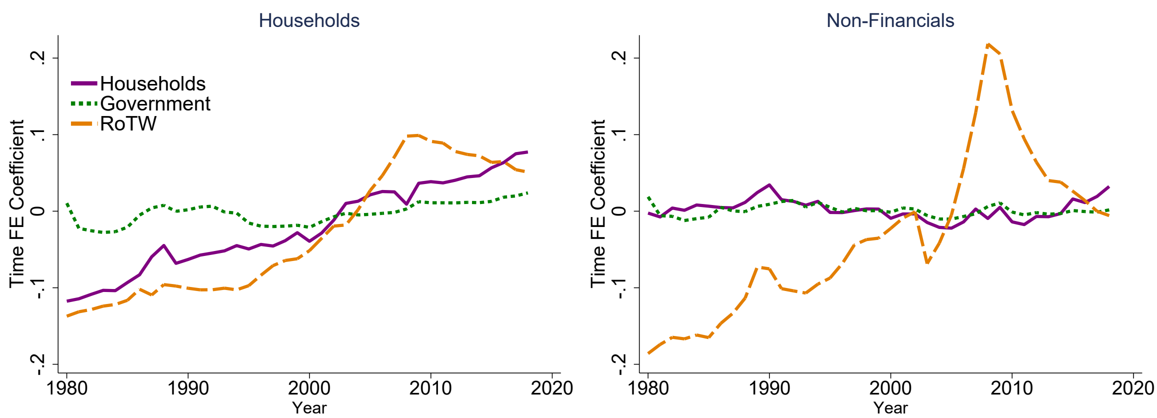
A3. The Changing Nature of Credit Intermediation

Figure A3.20: *Change in credit by source*



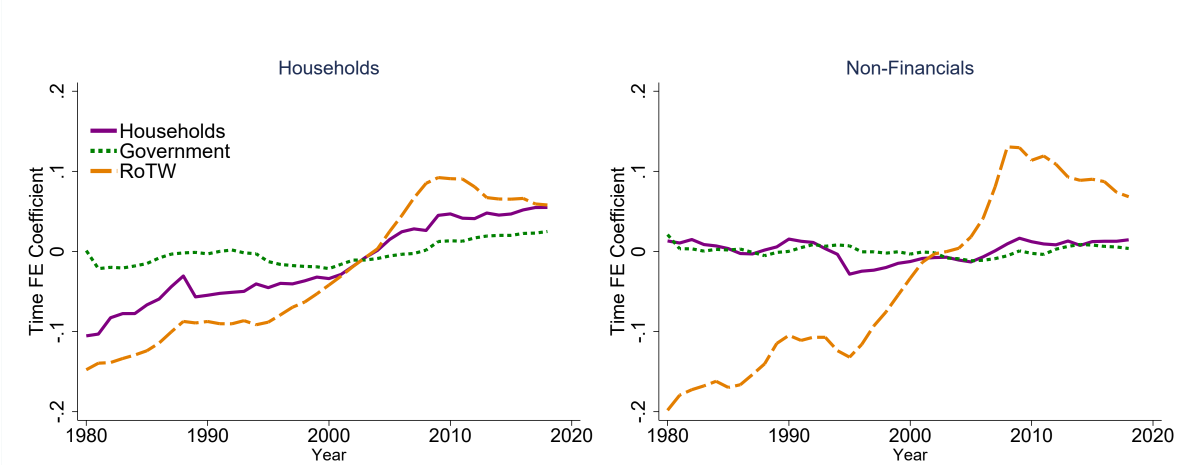
Notes: The figure shows the change in credit-to-GDP by funding source from 1982 to 2018 for a stable sample of countries (Austria, Canada, France, Germany, Japan, Spain, Sweden, and United States). The left panel shows the change in household credit to GDP and how much of this change was financed by the household sector, the government or the rest of the world. The right panel shows the change in loans to the corporate sector relative to GDP and how much of this change was financed by the household sector, the government or the rest of the world.

Figure A3.21: *Fixed Effects of credit by source, excluding Euro-area countries*



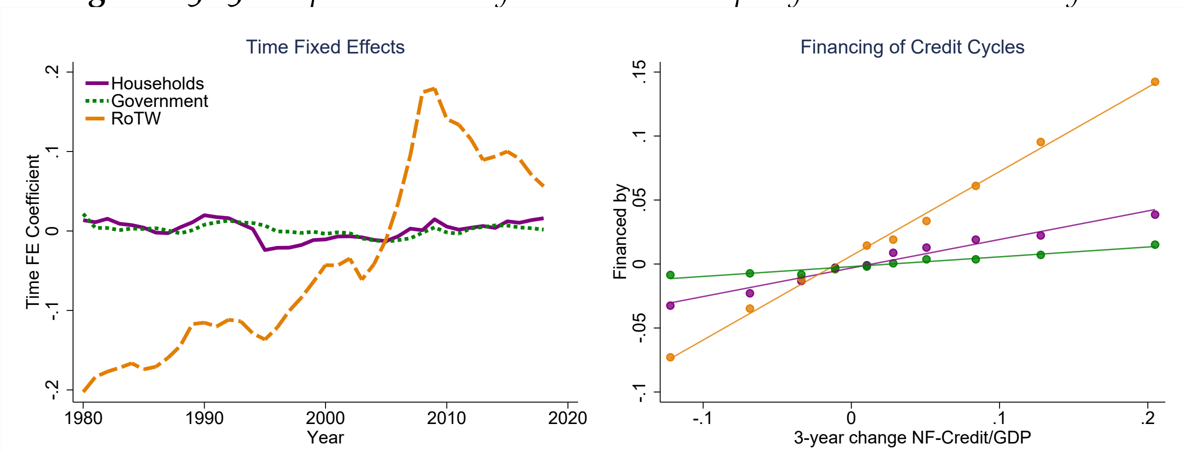
The figure shows time fixed effects for changes in credit by source. Euro area countries are excluded from the sample. The left panel shows the time fixed effects of a regression of household debt-to-GDP by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

Figure A3.22: *Fixed Effects of credit by source, excluding countries with large rest of the world sectors*



The figure shows time fixed effects for changes in credit by source. Countries with large rest of the world positions are excluded from the sample (United Kingdom, Switzerland, Ireland, Iceland and the Netherlands). The left panel shows the time fixed effects of a regression of household debt-to-GDP by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

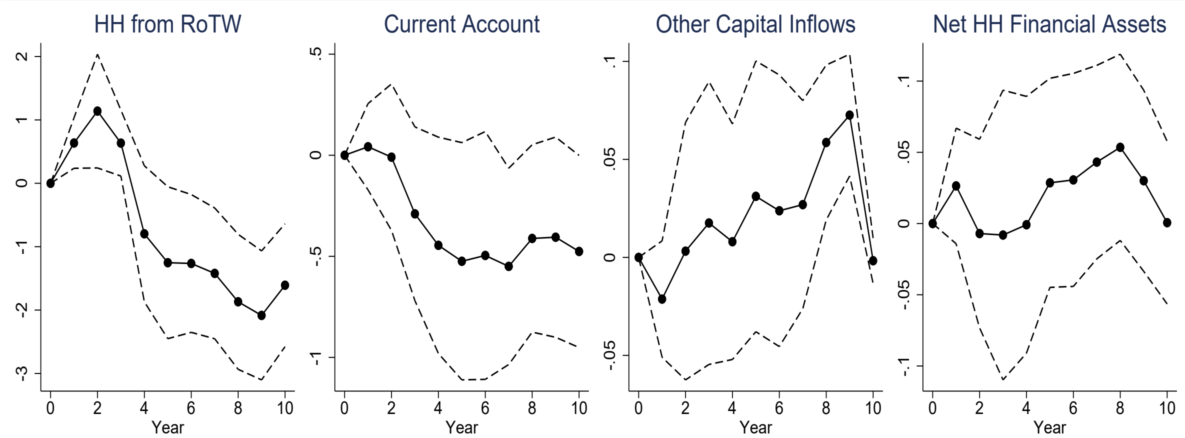
Figure A3.23: *Corporate credit by ultimate counterparty sector: trends and cycles*



Notes: The left panel plots time fixed effects α_t of a regression of non-financial corporate credit by ultimate counterparty sector $C_{i,t}^{u \to NF}$ on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to NF} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government and the foreign sector respectively. The right panel shows the relationship between changes in total non-financial corporate credit and non-financial corporate credit decomposed by ultimate source of funds. Observations are collapsed into 10 equal sized bins based on three-year changes in the ratio of household credit to GDP. Each point represents the group specific means of three-year changes in total non-financial credit and non-financial credit financed by source sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

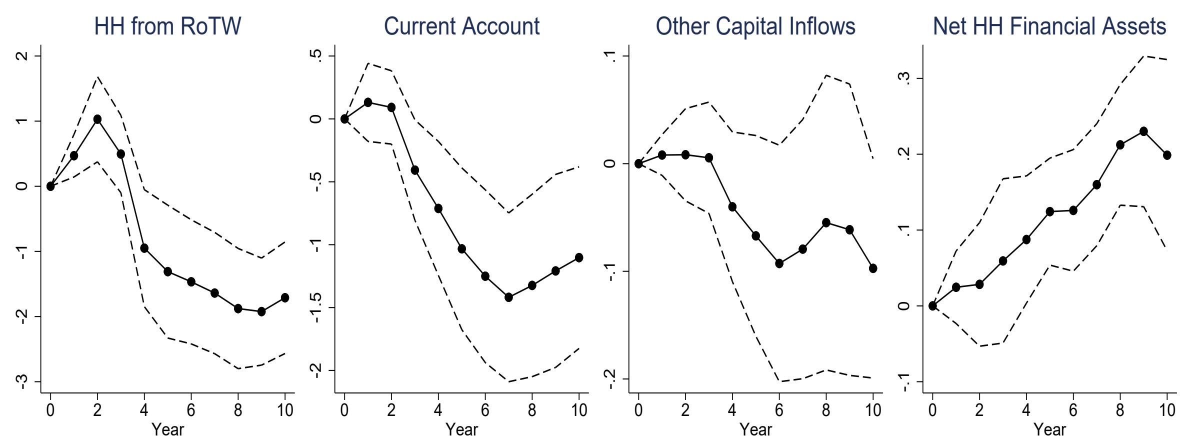
A4. Credit and Business Cycles

Figure A4.24: *GDP responses to changes in foreign financed household credit, the current account, other inflows and net household debt*



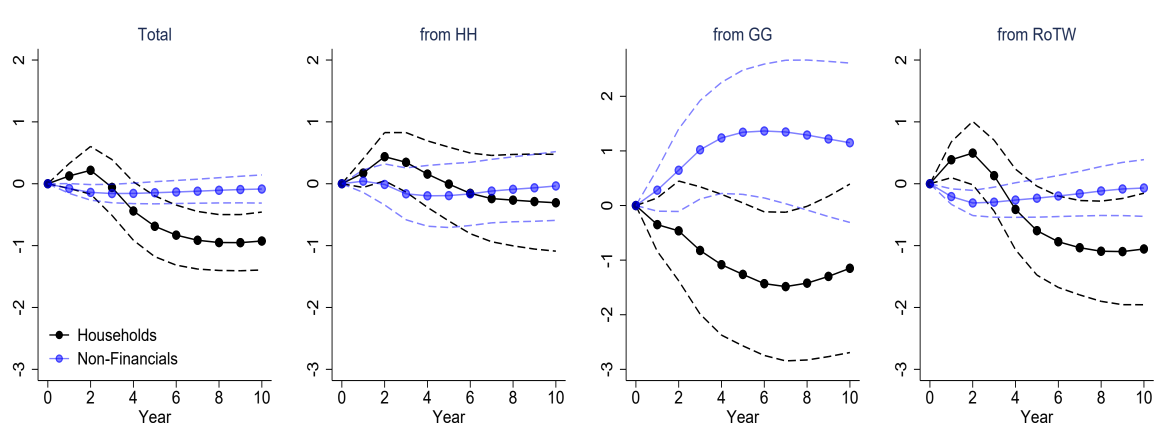
Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household credit financed from abroad, the (inverse) current account, claims of the rest of the world that are financing something else than household credit, and the change in net household financial assets, to GDP. All responses are estimated jointly in the specification with control variables. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Figure A4.25: *GDP responses to changes in foreign financed household credit, the current account, other inflows and net household debt - excluding credit by counterparty data*



Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household credit financed from abroad, the (inverse) current account, claims of the rest of the world that are financing something else than household credit, and the change in net household financial assets, to GDP. Responses are estimated only including contemporanoeus values and five lags of the respective variable and of real GDP growth and short-term interest rates. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Figure A4.26: *GDP responses to increases in credit using a SVAR model*



Notes: This figure shows estimates of impulse responses of log real GDP to innovations in the ratio of household (non-fnancial) credit to lagged GDP. The left panel uses a three variable SVAR model with 5 lags of the ordering $(ln(Y)_{i,t}, NF_{i,t-1}, HH_{i,t-1})$, showing the response to household credit in black and non-financial credit in blue. The right three panels use a six variable SVAR model with 5 lags, where both credit variables are decomposed by financing source (rest of the world, domestic households, government) with the ordering $(ln(Y)_{i,t}, RoTW \rightarrow NF_{i,t-1}, HH \rightarrow NF_{i,t-1}, GG \rightarrow NF_{i,t-1}, RoTW \rightarrow HH_{i,t-1}, HH \rightarrow HH_{i,t-1}, GG \rightarrow HH_{i,t-1})$. Responses to household credit are plotted in black, non-financial in blue. Dashed lines represent 95% confidence intervals computed based on monte carlo simulation draws.

Table A4.21: *GDP responses to increases in household credit, excluding countries with large RoTW sectors*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-1.17***	-0.93***	-0.89***	-0.76***	0.42***	0.37***	0.30***	0.28***
	(0.35)	(0.24)	(0.24)	(0.26)	(0.08)	(0.07)	(0.06)	(0.07)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.18	0.28*	0.28*	0.22	0.02	0.01	0.01	0.01
	(0.17)	(0.14)	(0.14)	(0.14)	(0.07)	(0.07)	(0.07)	(0.06)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.33	-0.31	-0.28	-0.03	-0.13	-0.11	-0.13	-0.23*
	(0.31)	(0.26)	(0.26)	(0.34)	(0.10)	(0.10)	(0.11)	(0.13)
$\Delta_3 CA_{i,t-1}$			0.16	0.09			-0.18***	-0.17***
			(0.11)	(0.12)			(0.04)	(0.04)
R^2	0.330	0.580	0.583	0.601	0.435	0.589	0.613	0.653
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.01
Observations	603	590	589	522	565	552	551	497

Notes: This table presents results from estimating Equation 3.2, excluding countries with large foreign sectors from the estimation. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector and additional controls include changes in household sector net worth, short-term interest rates and foreign capital not financing household credit. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of credit coefficients by counterparty sector. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A4.22: *Credit expansion and output: financial instruments vs. sources*

	$\Delta_3 ln(Y)_{i,t+3}$			
	(1)	(2)	(3)	(4)
$\Delta_3 RW_{Securities} \rightarrow HH_{i,t-1}$	-1.06***	-0.75***	-0.93***	-0.98***
	(0.25)	(0.18)	(0.29)	(0.30)
$\Delta_3 RW_{Intermediated} \rightarrow HH_{i,t-1}$	-0.83***	-0.77***	-0.64***	-0.87***
	(0.21)	(0.19)	(0.21)	(0.25)
$\Delta_3 DM_{Securities} \rightarrow HH_{i,t-1}$	0.51	0.76***	0.46	0.73*
	(0.37)	(0.27)	(0.35)	(0.38)
$\Delta_3 DM_{Intermediated} \rightarrow HH_{i,t-1}$	-0.18	-0.22	-0.14	-0.28
	(0.15)	(0.14)	(0.16)	(0.17)
$\Delta_3 NF_{i,t-1}$	0.03	0.09	0.07	0.05
	(0.07)	(0.06)	(0.08)	(0.06)
r2	0.33	0.60	0.29	0.35
Country fixed effects	✓	✓	✓	✓
LDV	✓	✓	✓	✓
Time fixed effects		✓		
Excluding crises			✓	
Control variables				✓
p-value Securities, $\beta_{RoTW} = \beta_{DM}$	0.01	0.00	0.01	0.01
p-value Intermediated, $\beta_{RoTW} = \beta_{DM}$	0.00	0.00	0.02	0.02
Observations	646	633	576	635

Notes: This table presents results from estimating Equation 3.2. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by source sector of funds. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. Excl. crises excludes a centered three-year window around crisis years. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of coefficients. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A4.23: *Credit expansion and subsequent output, additional results*

	$\Delta_3 ln(Y)_{i,t+3}$							
	Benchmark		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	-0.45***	-0.30**						
	(0.13)	(0.11)						
$\Delta_3 NF_{i,t-1}$	-0.01	-0.01						
	(0.02)	(0.01)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			-0.90***	-0.67***	-0.77***	-0.64***		
			(0.20)	(0.17)	(0.15)	(0.13)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$			0.21	0.13			-0.08	-0.05
			(0.16)	(0.14)			(0.20)	(0.14)
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.45*	-0.10			-0.75**	-0.25
			(0.26)	(0.27)			(0.33)	(0.27)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			0.07*	0.03			-0.09***	-0.07***
			(0.04)	(0.03)			(0.02)	(0.02)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			-0.19**	-0.09			-0.10	-0.05
			(0.09)	(0.09)			(0.08)	(0.07)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.15	0.30			0.67**	0.60***
			(0.32)	(0.23)			(0.32)	(0.20)
$\Delta_3 Net\ HH_{i,t-1}$	0.01	0.06***	-0.03	0.03			0.04	0.09***
	(0.03)	(0.02)	(0.03)	(0.02)			(0.03)	(0.03)
$\Delta_3 Net\ NF_{i,t-1}$	0.00	-0.02	-0.01	-0.03**			0.02	-0.01
	(0.02)	(0.01)	(0.02)	(0.01)			(0.02)	(0.01)
$\Delta_3 CA_{i,t-1}$	0.29**	0.21*	0.24*	0.17			0.33**	0.25**
	(0.13)	(0.11)	(0.12)	(0.11)			(0.12)	(0.11)
R^2	0.311	0.564	0.363	0.599	0.331	0.572	0.251	0.550
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓		✓		✓		✓
Observations	667	663	667	663	678	664	667	663

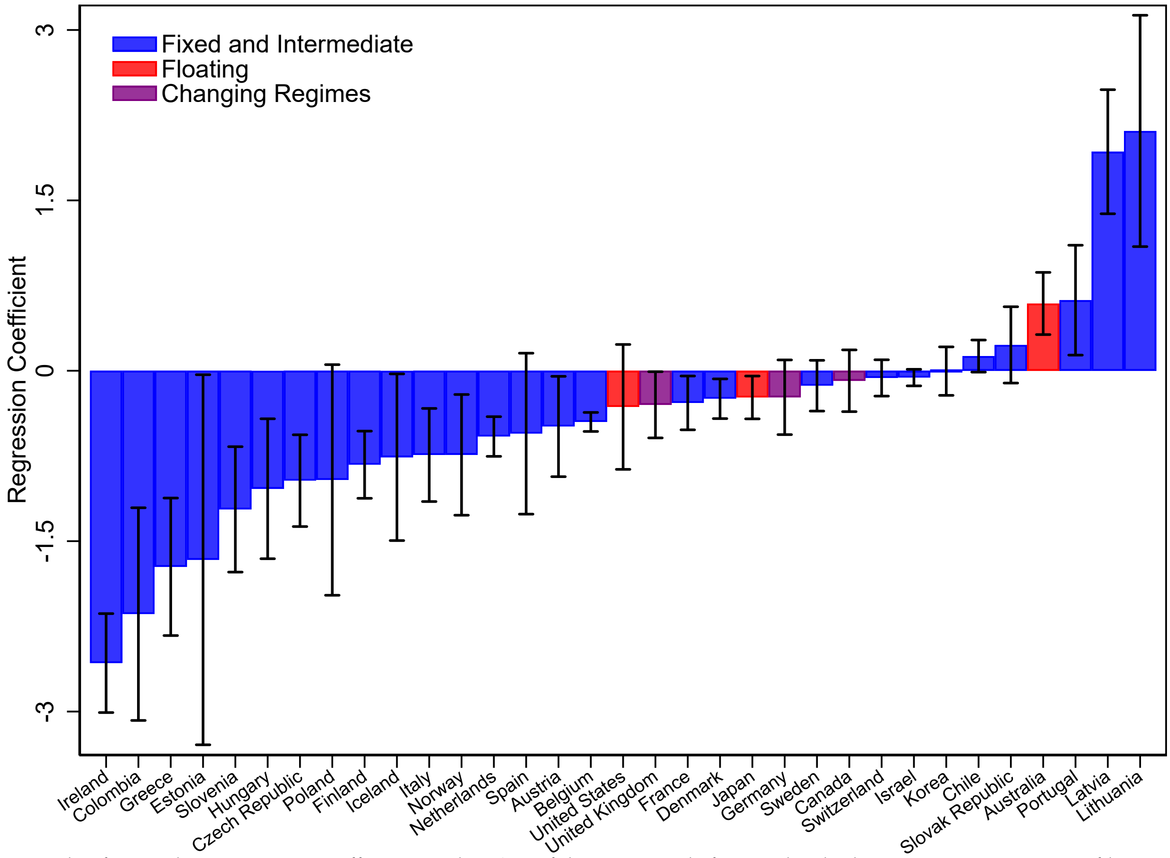
Notes: This table shows predictive regressions of GDP growth on credit expansions. The benchmark specification uses non-decomposed household credit and non-financial credit, as it is standard in the literature. Columns (3) to (4) include credit by counterparty, (5) and (6) only foreign-financed household credit, (7) and (8) exclude foreign-financed household credit. LDV refers to a distributed lag of the dependent variable. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See text.

Table A4.24: *Baseline regressions using different unveiling procedures*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline	Counterparty	Subsector	Structural	Baseline	Counterparty	Subsector	Structural
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.71***	-0.40**	-0.59***	-0.52***	0.19***	0.11***	0.17***	0.14***
	(0.16)	(0.15)	(0.15)	(0.14)	(0.04)	(0.03)	(0.04)	(0.03)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.12	0.05	-0.00	-0.22	0.06	-0.03	0.07	0.14
	(0.13)	(0.07)	(0.16)	(0.16)	(0.06)	(0.03)	(0.11)	(0.09)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	0.10	-0.14	0.13	0.32	-0.12	0.06	-0.08	-0.10
	(0.21)	(0.09)	(0.18)	(0.27)	(0.08)	(0.05)	(0.09)	(0.15)
$\Delta_3 CA_{i,t-1}$	0.21*	0.35**	0.23**	0.20*	-0.14***	-0.30***	-0.15***	-0.15***
	(0.11)	(0.16)	(0.11)	(0.11)	(0.03)	(0.08)	(0.04)	(0.04)
R^2	0.595	0.687	0.598	0.595	0.623	0.645	0.626	0.624
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.07	0.02	0.06	0.00	0.04	0.01	0.23
Observations	663	258	632	632	579	236	548	548

Notes: This table shows the baseline regression of GDP growth and changes in the unemployment rate on decomposed credit growth, including the full set of controls. I compare four different unveiling approaches, including counterparty, subsector level and structural unveiling and find the results to be robust to the choice of method. All specifications control for country fixed effects, a distributed lag of the dependent variable, non-financial credit and year fixed effects. Additional controls include changes in household net worth and inflows not financing household credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See the appendix for detailed descriptions of the unveiling approaches.

Figure A4.27: *Country-level regression coefficients*



Notes: This figure plots regression coefficients and 90% confidence intervals from individual time series regressions of log real GDP growth from t to $t+3$ on Household credit decomposed by funding source $u \in$ (HH, GG, RoTW) and non-financial credit. The shown coefficients are for household credit funded by the rest of the world $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Variables are standardized by country prior to the regression. I use Newey-West Standard Errors with a maximum lag length of 6. The specification $\Delta_3 y_{i,t+3} = \alpha + \sum_{u \in U} \beta^s \Delta_3 C_{i,t-1}^{u \rightarrow HH} + \beta^{NF} \Delta_3 C_{i,t-1}^{NF} + u_{i,t+3}$ is estimated on individual country time series. The bars colored in red indicate countries consistently classified as floating exchange rate regimes by Ilzetzki et al. (2019). Countries in blue are consistently classified as either pegged or intermediate regimes, while purple colored bars indicated countries that switched to or from a floating exchange regime during the sample period.

Table A4.25: *Credit expansion and sectoral reallocation*

	$\Delta_3 ln(\frac{Y_{NT}}{Y_T})_{i,t}$		$\Delta_3 ln(\frac{Emp_{NT}}{Emp_T})_{i,t}$		$\Delta_3 ln(\frac{Inv_{Housing}}{Inv_{Other}})_{i,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \rightarrow HH_{i,t}$	0.56***	0.57***	0.14**	0.20***	1.01***	1.25***
	(0.12)	(0.14)	(0.06)	(0.06)	(0.36)	(0.39)
$\Delta_3 HH \rightarrow HH_{i,t}$	0.08	-0.06	0.36***	0.35***	1.21***	0.98
	(0.21)	(0.22)	(0.10)	(0.12)	(0.41)	(0.69)
$\Delta_3 GG \rightarrow HH_{i,t}$	0.20	0.10	0.59***	0.58***	0.70	0.36
	(0.23)	(0.22)	(0.15)	(0.16)	(0.82)	(0.85)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$	-0.01	0.05	0.06	0.06	-0.09	-0.10
	(0.12)	(0.12)	(0.04)	(0.05)	(0.11)	(0.12)
$\Delta_3 HH \rightarrow NF_{i,t-1}$	0.15	0.06	0.14	0.15*	0.45	0.25
	(0.14)	(0.12)	(0.09)	(0.09)	(0.33)	(0.45)
$\Delta_3 GG \rightarrow NF_{i,t-1}$	-0.11	0.02	-0.33*	-0.36*	-1.46	-1.00
	(0.24)	(0.24)	(0.19)	(0.20)	(1.15)	(1.25)
R^2	0.249	0.283	0.324	0.332	0.234	0.244
Country fixed effects	✓	✓	✓	✓	✓	✓
Additional Controls		✓		✓		✓
p-value, $\beta_{RoTW,HH} = \beta_{GG,HH} = \beta_{HH,HH}$	0.08	0.05	0.02	0.12	0.87	0.58
Observations	620	618	584	582	733	676

Notes: The dependent variables are three-year changes in the log ratio of output (employment, investment) in the non-tradable to tradable sectors between t and $t-3$. For investment, investment in the construction of dwellings (housing) is considered as non-tradable. Credit variables are expressed as contemporaneous three year changes in the ratio of credit to GDP. Additional controls include the current account, changes in household sector net worth and foreign capital not financing household credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

A5. Crisis

Table A5.26: *Predicting financial crises: linear probability models*

	Baseline		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.27^{***}	0.32^{***}						
	(0.08)	(0.09)						
$\Delta_3 NF_{i,t-1}$	0.07^{***}	0.05^{***}						
	(0.02)	(0.02)						
$\Delta_3 RoTW \to HH_{i,t-1}$			0.62^{***}	0.60^{***}	0.62^{***}	0.62^{***}		
			(0.12)	(0.13)	(0.09)	(0.10)		
$\Delta_3 GG \to HH_{i,t-1}$			-0.33	-0.19			-0.04	0.14
			(0.35)	(0.42)			(0.33)	(0.40)
$\Delta_3 HH \to HH_{i,t-1}$			-0.26	-0.17			-0.02	0.07
			(0.34)	(0.40)			(0.33)	(0.38)
$\Delta_3 RoTW \to NF_{i,t-1}$			-0.02	-0.01			0.10^{***}	0.11^{***}
			(0.04)	(0.04)			(0.04)	(0.04)
$\Delta_3 GG \to NF_{i,t-1}$			0.12	-0.08			-0.21	-0.44
			(0.39)	(0.46)			(0.41)	(0.48)
$\Delta_3 HH \to NF_{i,t-1}$			0.16	0.17			0.10	0.11
			(0.22)	(0.25)			(0.22)	(0.26)
$\Delta_3 CA_{i,t-1}$	-0.20	-0.22	-0.15	-0.17			-0.29^{*}	-0.30
	(0.15)	(0.15)	(0.15)	(0.15)			(0.17)	(0.18)
AUC	0.75	0.81	0.80	0.85	0.80	0.85	0.76	0.81
s.e.	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04
Country fixed effects		✓		✓		✓		✓
Observations	739	739	739	739	739	739	739	739

Notes: The table shows linear classification models where the dependent variable is a financial crisis dummy. AUC is the area under the ROC-curve and below is its standard error. Standard errors in parentheses are clustered by country. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A5.27: *Predicting financial crises and banking panics: Baron et al. (2021) crisis chronology*

	Baseline		By counterparty		Only RoTW to HH		All others	
	Crisis	Panic	Crisis	Panic	Crisis	Panic	Crisis	Panic
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.32**	0.27***						
	(0.13)	(0.10)						
$\Delta_3 NF_{i,t-1}$	0.06*	0.04						
	(0.03)	(0.02)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.60***	0.59***	0.60***	0.57***		
			(0.10)	(0.10)	(0.08)	(0.08)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			0.36	-0.24			0.75	0.15
			(0.48)	(0.46)			(0.50)	(0.47)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.32	-0.27			-0.25	-0.20
			(0.30)	(0.22)			(0.31)	(0.25)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.06	-0.10**			0.07	0.04
			(0.06)	(0.04)			(0.05)	(0.04)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.53	0.39			-0.06	-0.20
			(0.52)	(0.40)			(0.49)	(0.43)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.22	0.26			0.25	0.27
			(0.23)	(0.17)			(0.26)	(0.20)
$\Delta_3 CA_{i,t-1}$	-0.28	-0.55**	-0.32	-0.57**			-0.47*	-0.71***
	(0.31)	(0.23)	(0.27)	(0.24)			(0.25)	(0.21)
AUC	0.69	0.77	0.72	0.83	0.69	0.78	0.67	0.74
s.e.	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.04
Observations	631	631	631	631	631	631	631	631

Notes: The table shows probit classification models where the dependent variable is either a dummy for financial crisis or banking panics, classified by Baron et al. (2021). Panics are defined as 'episodes of severe and sudden withdrawals of funding by bank creditors from a significant part of the banking system'. Coefficients are mean marginal effects. AUC is the area under the ROC-curve and below is its standard error. Standard errors in parentheses are clustered by country. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

A6. Channels

Table A6.28: *Credit expansion and subsequent outcomes, non-linearity*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(\geq 0)$	-1.23***	-0.99***	-0.95***	-0.88***	0.35***	0.32***	0.28***	0.24***
	(0.28)	(0.24)	(0.23)	(0.23)	(0.08)	(0.06)	(0.06)	(0.05)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(< 0)$	0.31	0.07	-0.00	-0.11	0.04	0.05	0.08	0.11**
	(0.39)	(0.33)	(0.32)	(0.34)	(0.09)	(0.07)	(0.06)	(0.05)
$\Delta_3 GG \rightarrow HH_{i,t-1} * 1(\geq 0)$	-0.46	-0.27	-0.02	0.24	-0.08	-0.11	-0.21	-0.29*
	(0.56)	(0.46)	(0.46)	(0.44)	(0.16)	(0.15)	(0.14)	(0.16)
$\Delta_3 GG \rightarrow HH_{i,t-1} * 1(< 0)$	-0.47	-0.36	-0.45	-0.11	0.13	0.04	0.07	-0.10
	(0.49)	(0.41)	(0.41)	(0.43)	(0.14)	(0.16)	(0.14)	(0.12)
$\Delta_3 HH \rightarrow HH_{i,t-1} * 1(\geq 0)$	-0.03	0.17	0.25	0.19	0.02	-0.01	-0.05	-0.03
	(0.32)	(0.24)	(0.23)	(0.25)	(0.10)	(0.09)	(0.10)	(0.10)
$\Delta_3 HH \rightarrow HH_{i,t-1} * 1(< 0)$	0.53*	0.23	0.14	0.18	0.02	0.07	0.11	0.10
	(0.28)	(0.28)	(0.30)	(0.33)	(0.09)	(0.10)	(0.09)	(0.10)
$\Delta_3 RotW \rightarrow NF_{i,t-1} * 1(\geq 0)$	0.06	0.09**	0.10**	0.06	-0.03	-0.04**	-0.05***	-0.03*
	(0.06)	(0.04)	(0.04)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta_3 RotW \rightarrow NF_{i,t-1} * 1(< 0)$	-0.02	-0.06	-0.05	-0.04	-0.02	-0.01	-0.02	-0.02
	(0.06)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
$\Delta_3 GG \rightarrow NF_{i,t-1} * 1(\geq 0)$	0.67	0.40	0.34	0.12	-0.05	0.03	0.07	0.13
	(0.55)	(0.38)	(0.35)	(0.35)	(0.18)	(0.13)	(0.11)	(0.11)
$\Delta_3 GG \rightarrow NF_{i,t-1} * 1(< 0)$	-0.05	0.45	0.42	0.05	0.14	0.00	0.02	0.16*
	(0.46)	(0.38)	(0.37)	(0.38)	(0.14)	(0.13)	(0.11)	(0.08)
$\Delta_3 HH \rightarrow NF_{i,t-1} * 1(\geq 0)$	-0.18	-0.03	-0.01	0.04	0.16***	0.09	0.07	0.01
	(0.22)	(0.17)	(0.17)	(0.17)	(0.06)	(0.06)	(0.06)	(0.08)
$\Delta_3 HH \rightarrow NF_{i,t-1} * 1(< 0)$	-0.20	-0.28**	-0.26*	-0.16	0.10	0.13**	0.12**	0.07
	(0.17)	(0.13)	(0.13)	(0.21)	(0.06)	(0.05)	(0.04)	(0.06)
$\Delta_3 CA_{i,t-1} * 1(\geq 0)$			-0.14	-0.27			-0.03	-0.01
			(0.22)	(0.23)			(0.05)	(0.05)
$\Delta_3 CA_{i,t-1} * 1(< 0)$			0.61*	0.68*			-0.35***	-0.37***
			(0.31)	(0.35)			(0.10)	(0.12)
R^2	0.400	0.601	0.612	0.637	0.436	0.591	0.623	0.668
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
Observations	678	664	663	596	688	675	674	604

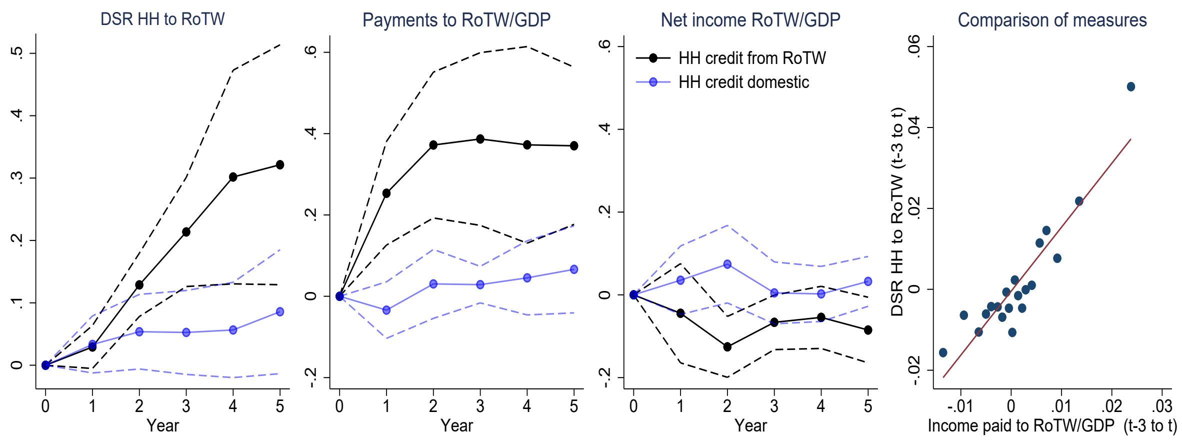
Notes: The dependent variables in this table are real GDP growth and changes in the unemployment rate between t and $t+3$. This table tests for potential non-linearity in the relationship between credit and the business cycle, by estimating separate coefficients for positive and negative changes for household debt for the full set of counterparty sectors. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively

Table A6.29: *Debt service payments to foreigners and gross payable incomes to RoTW increase in foreign financed household credit expansions*

	$DSR^{HH\to RoTW}_{i,t}$		$Pay \to RoTW_{i,t}$			
	DSR Sample		DSR Sample		Full Sample	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \to HH_{i,t-1}$	0.11***	0.12***	0.09**	0.16***	0.16***	0.19***
	(0.01)	(0.01)	(0.04)	(0.03)	(0.02)	(0.03)
$\Delta_3 DM \to HH_{i,t-1}$	0.00	0.00	-0.05	-0.05	-0.09*	-0.10
	(0.01)	(0.01)	(0.06)	(0.05)	(0.05)	(0.06)
$\Delta_3 NF_{i,t-1}$	0.01*	0.01*	0.03	0.03	0.00	-0.00
	(0.01)	(0.00)	(0.03)	(0.02)	(0.01)	(0.01)
Country fixed effects	✓	✓	✓	✓	✓	✓
Lagged GDP Growth	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Additional Controls		✓		✓		✓
p-value, $\beta_{RoTW} = \beta_{DM}$	0.00	0.00	0.06	0.01	0.00	0.00
Observations	218	218	218	218	726	670

Notes: The dependent variables are debt service ratios with foreign counterparties from (1) to (2) and gross payments to the rest of the world in year t from (3) to (6). Samples where both variables are available are reported separately from the full sample for payments to the rest of the world. The independent variables are changes in household credit, decomposed into foreign and domestically financed, and non-financial credit between $t-4$ and $t-1$. Additional controls include changes in the current account and household sector net worth. All specifications control for country fixed effects a distributed lag of GDP growth and the dependent variable in $t-4$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

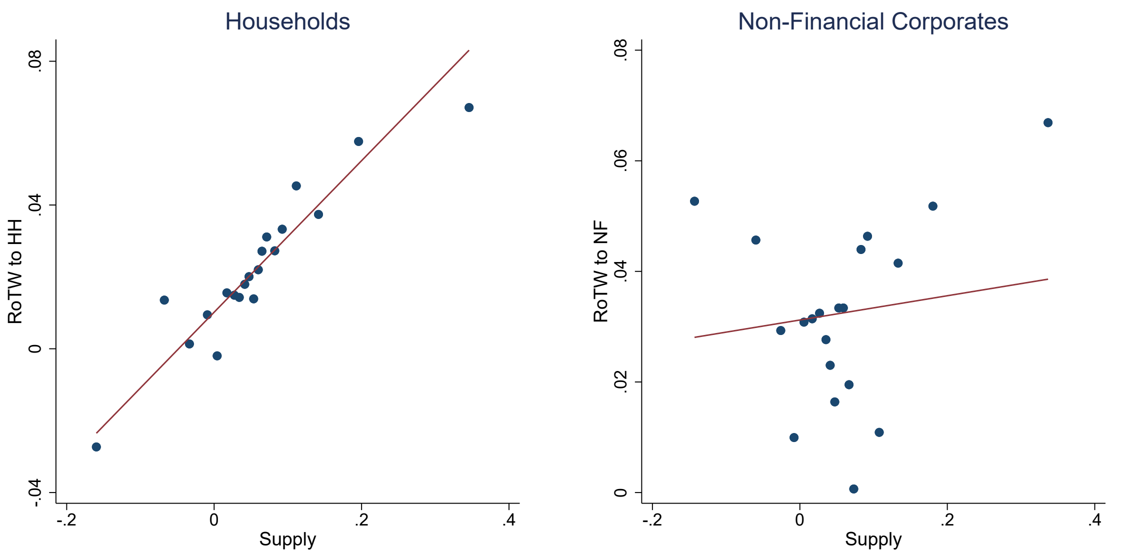
Figure A6.28: *Credit and debt service payments to RoTW*



Notes: The three left panels show the relationships between household credit financed from the RoTW and subsequent payment flows. The left panel shows the response of debt service payments attributed to the RoTW to an increase in household credit financed from the RoTW (black) or from domestic sources (blue). The two middle panels show the response of gross primary incomes payable to RoTW (second panel) and net primary incomes from RoTW (third panel). The right panel shows the relationship between debt service payments attributable to RoTW and gross primary incomes payable to RoTW. See text.

A7. Amiti-Weinstein decomposition and instrumental variable results

Figure A7.29: *Binned scatterplots for first-stage*



Notes: This figure shows the relationship between changes in foreign-financed household credit to GDP and accumulated supply shocks between $t-4$ and $t-1$. Observations are collapsed into 20 equal sized bins, with each point representing the group specific mean. Both panels control for country fixed effects, household credit ultimately funded by domestic counterparties and non-financial credit. Fitted regression lines illustrate the correlation.

Table A7.30: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds - excluding large economies*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline	*Reduced*	*IV*	*IV*	*Baseline*	*Reduced*	*IV*	*IV*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.93***		-2.20***	-2.19***	0.27***		0.33***	0.30***
	(0.19)		(0.79)	(0.80)	(0.04)		(0.08)	(0.08)
$\Delta_3 Supply_{i,t-1}$		-0.25***				0.06***		
		(0.06)				(0.02)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.01	-0.40*	0.48	0.48	0.09	0.23*	0.05	0.05
	(0.20)	(0.21)	(0.40)	(0.40)	(0.09)	(0.12)	(0.09)	(0.09)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.41	-0.48*	-0.18	-0.17	-0.03	-0.06	-0.04	-0.03
	(0.27)	(0.26)	(0.44)	(0.44)	(0.08)	(0.09)	(0.08)	(0.08)
$\Delta_3 CA_{i,t-1}$				0.04				-0.13***
				(0.13)				(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓		✓
Kleibergen-Paap Weak ID	.	.	16.07	17.50	.	.	7.49	8.18
Observations	498	498	498	498	465	465	465	464

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(4) and changes in unemployment between t and $t+3$ in (5)-(8). Columns (1) and (5) are based on Equation 3.2. Columns (2) and (6) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3)-(4) and (7)-(8) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. This specification excludes the United States, Germany, France, Japan and the UK. All specifications control for country fixed effects and a distributed lag of the dependent variable (LDV). NF-credit controls for non-financial credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table A7.31: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds - excluding major suppliers of safe assets*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline (1)	*Reduced* (2)	*IV* (3)	*IV* (4)	*Baseline* (5)	*Reduced* (6)	*IV* (7)	*IV* (8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.88***		-1.89***	-1.85***	0.25***		0.30***	0.28***
	(0.18)		(0.55)	(0.56)	(0.04)		(0.07)	(0.07)
$\Delta_3 Supply_{i,t-1}$		-0.26***				0.06***		
		(0.06)				(0.02)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.02	-0.30	0.26	0.26	0.10	0.20**	0.08	0.07
	(0.16)	(0.19)	(0.27)	(0.26)	(0.08)	(0.10)	(0.08)	(0.08)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.29	-0.37	-0.06	-0.05	-0.02	-0.04	-0.03	-0.03
	(0.26)	(0.27)	(0.36)	(0.36)	(0.07)	(0.08)	(0.07)	(0.07)
$\Delta_3 CA_{i,t-1}$				0.14				-0.14***
				(0.13)				(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID	.	.	22.12	23.00	.	.	11.44	12.29
Observations	590	590	590	590	554	554	554	553

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(4) and changes in unemployment between t and $t+3$ in (5)-(8). Columns (1) and (5) are based on Equation 3.2. Columns (2) and (6) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3)-(4) and (7)-(8) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. This specification excludes the United States and Germany. All specifications control for country fixed effects and a distributed lag of the dependent variable (LDV). NF-credit controls for non-financial credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

A3. Appendix: Financial Deregulation and Fertility Decisions

A1. Data

Figure A1.30: *Deregulation source example, Florida*

FLORIDA

Branching:		Prohibited.
	01/01/77	Any bank may establish up to two *de novo* branches per calendar year and an unlimited number of branches by merger with other banks located within the limits of the county in which its main office is located.
	07/01/80	Branching by merger allowed across county boundaries.
	07/01/81	The restriction of two *de novo* branches per year is eliminated.
	11/18/88	Statewide.
MBHCs:		No limitations affecting BHC formation and expansion.
Inter. Bran.:		None.
Inter. MBHCs:	07/01/85	Regional reciprocal: AL, AR, DC, GA, LA, MD, MS, NC, SC, TN, VA, WV. Acquired banks must be at least two years old. *De novo* entry is prohibited. Acquiring BHCs and any parent companies must have their headquarters and 80 percent of their deposits within the region.
	05/01/95	National reciprocal.
	09/29/95	National.

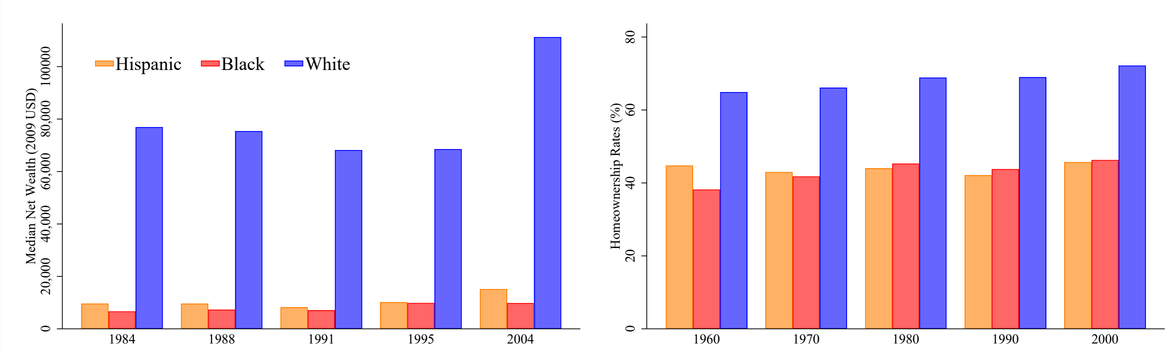
Notes: This figure plots

Table A1.32: *Summary Statistics*

	Mean	Median	Std. Dev.	Min	Max	Obs	Panels
$MAFC$	23.46	23.27	1.78	17.00	30.18	7715	228
$MAFC, W$	23.91	23.72	1.85	17.00	30.39	7715	228
$MAFC, NW$	21.72	21.36	2.02	16.43	30.00	7713	228
$MAFC, Married$	25.02	24.99	2.41	17.00	45.00	7713	228
$MAFC, Non-Married$	20.04	20.00	1.37	12.00	36.50	7700	228
$\Delta MAFC, W$	0.12	0.12	0.18	-2.03	3.96	7487	228
$\Delta MAFC, NW$	0.11	0.10	0.53	-5.13	8.00	7485	228
$\Delta MAFC, Married$	0.17	0.19	0.75	-12.00	21.00	7485	228
$\Delta MAFC, Non-Married$	0.07	0.08	0.59	-9.75	15.00	7472	228
$Fertility, Total$	29.68	29.29	5.35	14.71	59.77	7716	228
$Fertility, W$	28.13	27.56	5.50	12.98	60.19	7716	228
$Fertility, NW$	38.44	37.90	7.67	13.05	80.76	7716	228
$\Delta Fertility, Total$	-0.26	-0.19	1.36	-9.03	12.82	7488	228
$\Delta Fertility, W$	-0.25	-0.17	1.39	-9.21	12.98	7488	228
$\Delta Fertility, NW$	-0.48	-0.45	4.17	-39.03	33.86	7488	228
$HP\ Index, 2000 = 100$	67.33	69.22	23.04	18.07	122.77	6348	228
$Credit\ to\ GDP$	0.36	0.30	0.22	0.05	1.60	6120	228
$Inter\ Dereg\ Year$	1985.89	1986.00	1.72	1982.00	1992.00	7716	228
$Intra\ Dereg\ Year$	1984.79	1987.00	4.63	1976.00	1994.00	7716	228
$Inter\ Dereg, Early$	1984.94	1985.00	1.44	1982.00	1987.00	3407	101
$Intra\ Dereg, Early$	1980.33	1981.00	2.94	1976.00	1985.00	3407	101
$Inter\ Dereg, Late$	1986.64	1986.00	1.55	1984.00	1992.00	4309	127
$Intra\ Dereg, Late$	1988.33	1988.00	1.82	1985.00	1994.00	4309	127
$Inter\ Dereg, 2nd\ Wave$	1997.76	1998.00	1.24	1996.00	2001.00	6902	203

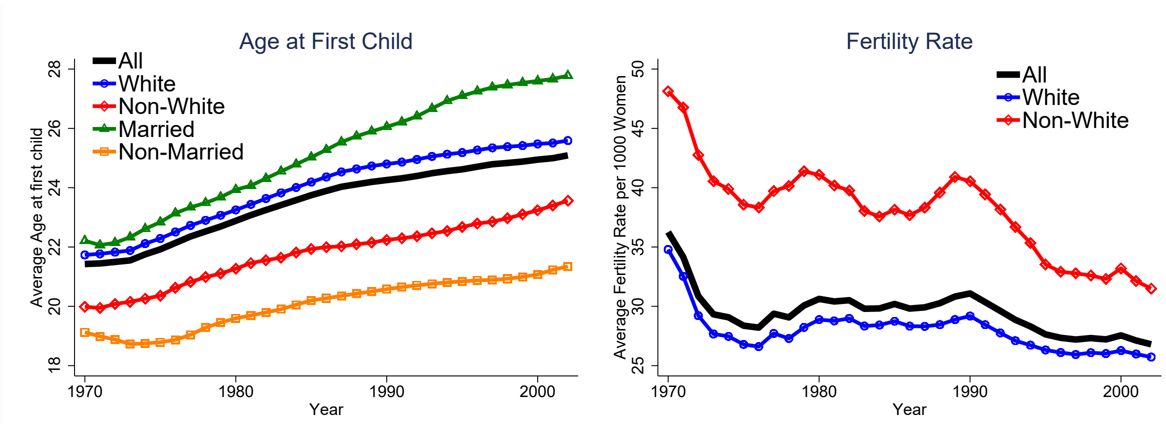
Notes: This table shows summary statistics of the main variables. All demographic variables are collected on the county-level-House prices, credit to GDP and deregulation timing are collected on the state-level. $MAFC$ refers to mothers' age at first childbirth. W and NW refer to the sub-samples of white and non-white mothers respectively. Variable names preceded by δ refer to one year changes in the respective variable.

Figure A1.31: *Homeownership rates and net financial wealth by race*



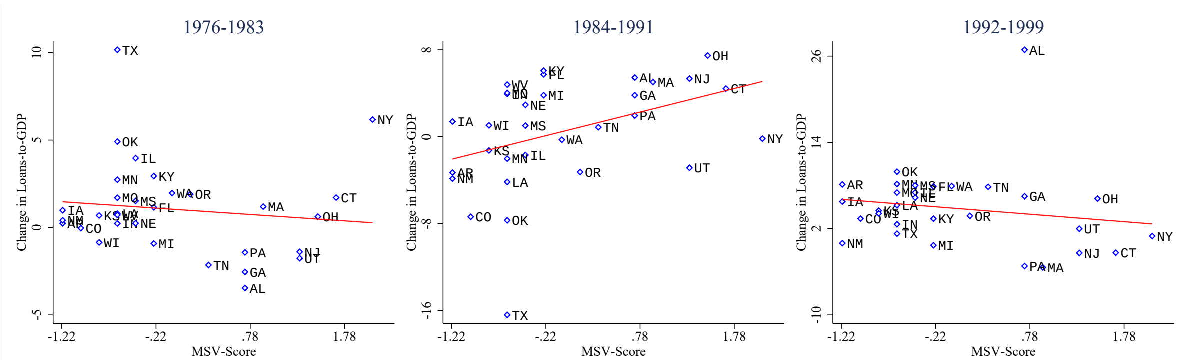
Notes: This figure plots the median net financial wealth (left) and the homeownership rate (right) in the United States by race over time. The source for the median net wealth (in 2009 dollars) is Taylor et al. (2011). The data for homeownership rates is provided by Coulson and Dalton (2010).

Figure A1.32: *Average mothers age at first child (MAFC) and fertility rates*



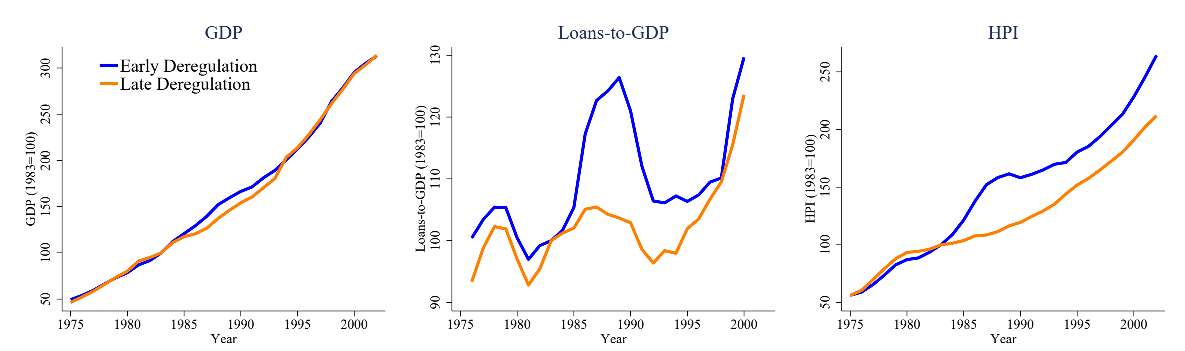
Notes: This graph shows the United States average Mothers' Age at First Childbirth (MAFC) (right) and fertility rates (left) over time, for different sub-samples of the population. Fertility rates are computed as the yearly number of births per 1000 women. The figures are based on the National Vital Statistics System of the National Center for Health Statistics (2023) and the Survey of Epidemiology and End Results, (SEER) (2023).

Figure A1.33: *Loans-to-GDP and the deregulation measure*



Notes: This graph shows scatterplots for the relationship between the change in the Loans-to-GDP ratio and the MSV-deregulation measure over different time periods. The left panel connects the change in the Loans-to-GDP between 1976 and 1983 with the deregulation measure, while the central and right panels, respectively, concern the Loans-to-GDP change between 1984 and 1991, and between 1992 and 1999. Fitted regression lines illustrate the correlation.

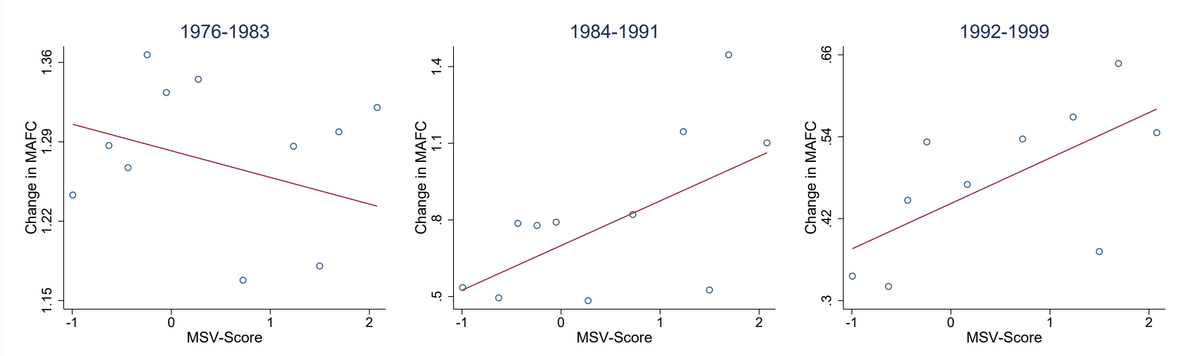
Figure A1.34: *GDP, loans-to-GDP and house prices. Early- vs late-deregulated states*



Notes: This figure shows the average Gross Domestic Product (GDP), Loans-to-GDP and the House Price Index (all normalised to 100 at 1983) across early- and late deregulated states. An early-deregulated (late-deregulated) state is defined as one whose MSV deregulation score is higher (lower) than 0.

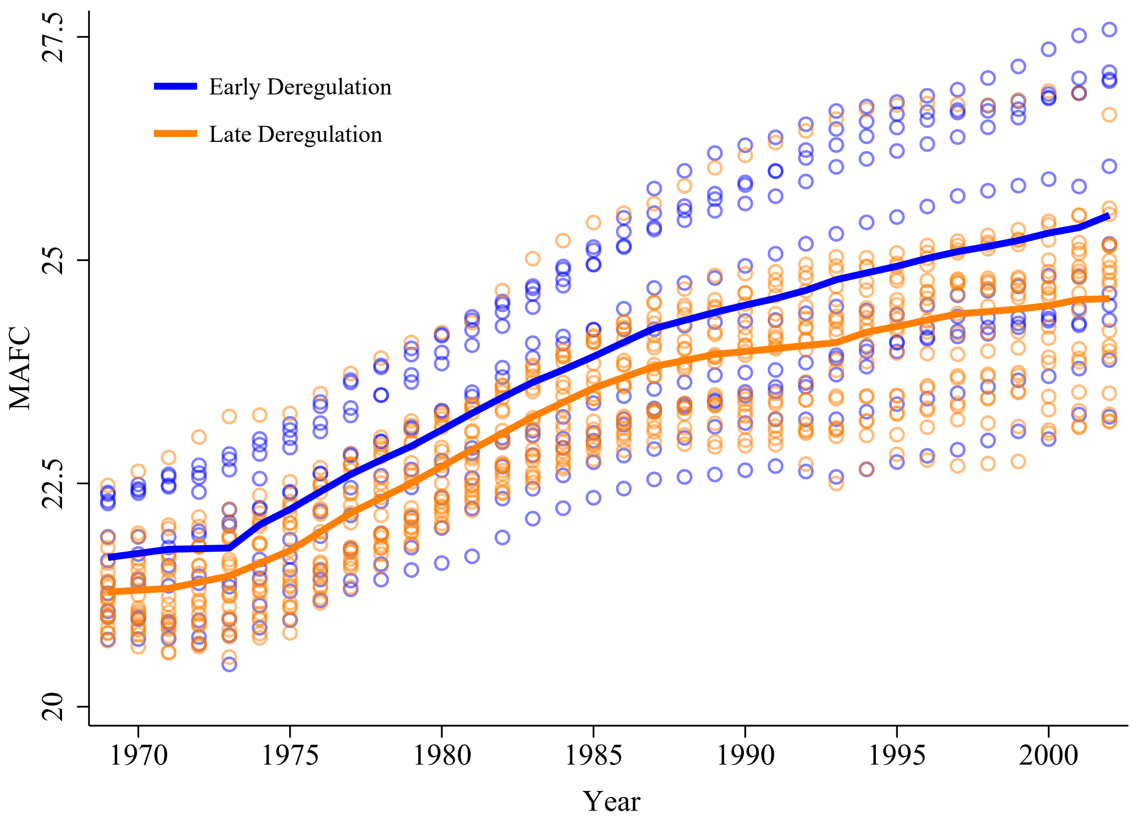
A2. Connecting Financial Deregulation and Fertility

Figure A2.35: *Changes in mothers' age at first childbirth conditional on deregulation*



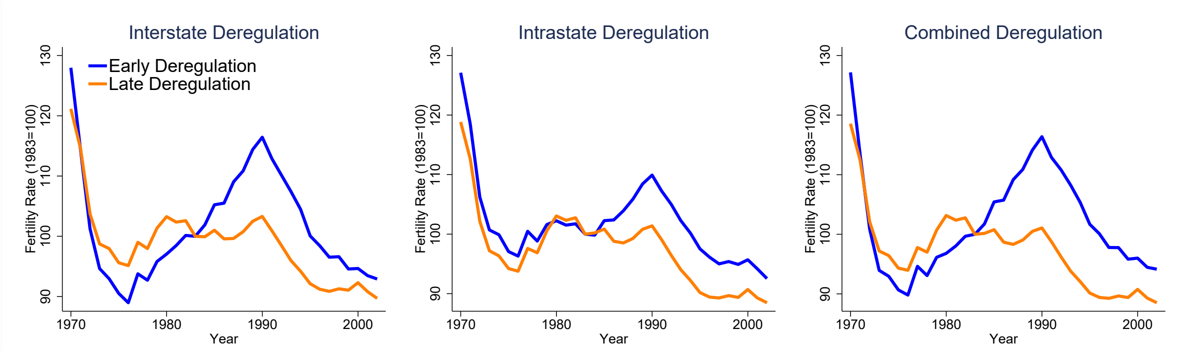
Notes: This graph shows binned scatterplots for the relationship between the change in mothers' age at first childbirth (MAFC) and the deregulation measure over different time periods. The left panel connects the change in MAFC between 1976 and 1983 with the deregulation measure, while the central and right panels, respectively, concern the MAFC change between 1984 and 1991, and between 1992 and 1999. Fitted regression lines illustrate the correlation.

Figure A2.36: *Interstate variance over time, MAFC*



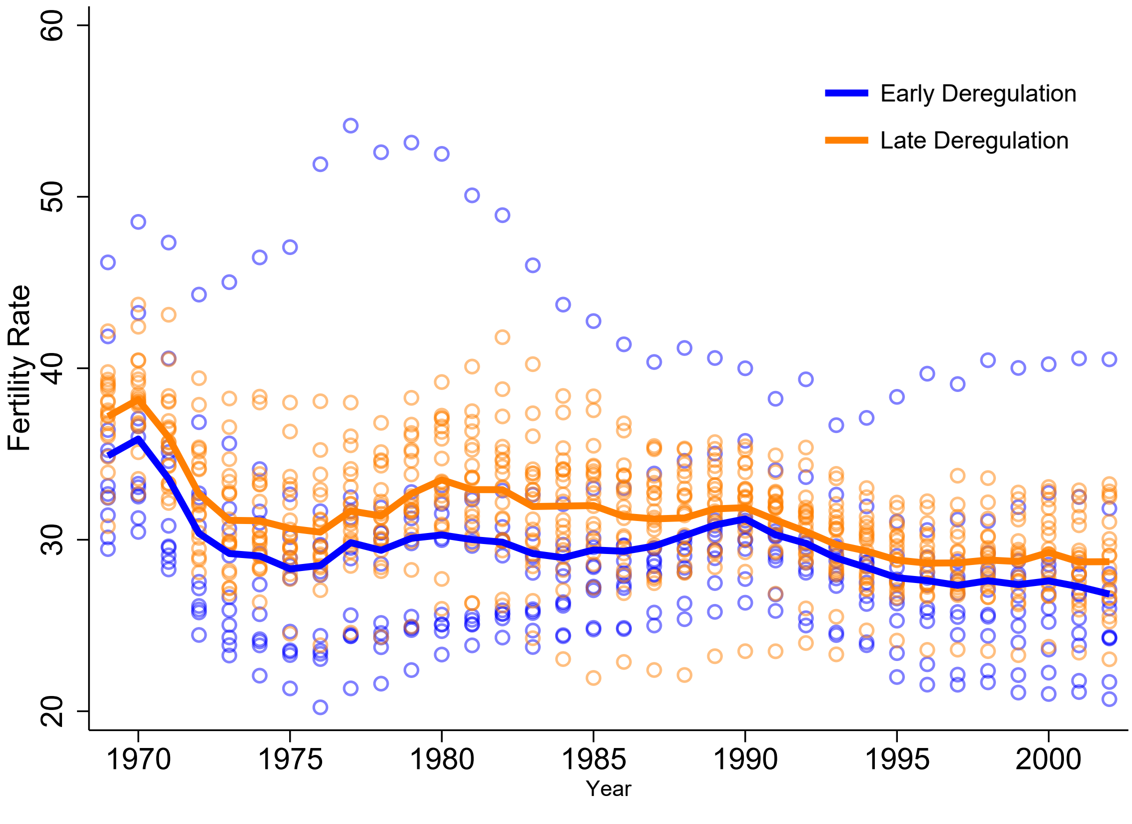
Notes: This graph plots each states' mean mothers' age at first childbirth (MAFC) for every year from 1969 to 2002. The blue (orange) line denotes the average MAFC over all early (late) deregulated states over time. An early-deregulated (late-deregulated) state is defined by its MSV-deregulation score being above (below) 0.

Figure A2.37: *Fertility rates. Early- vs late-deregulated states*



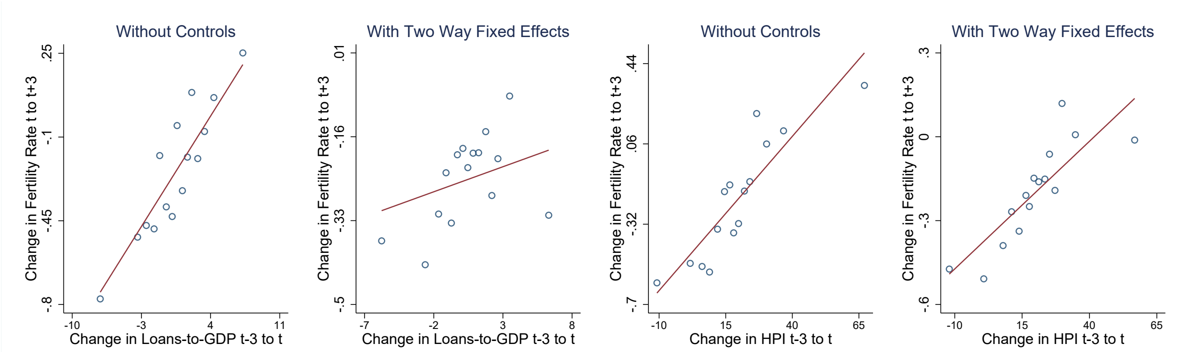
Notes: This figure shows the average fertility rate (normalized to 100 at 1983) across early- and late-deregulated states. The left (central) graph defines a state as early interstate (intrastate) deregulated if it began its interstate (intrastate) deregulation in 1983 or earlier. The graph on the right defines a state as an early deregulated state if it had already began both its intra- and interstate deregulation in 1983 or earlier.

Figure A2.38: *Interstate variance over time, fertility rates*



Notes: This graph's plots each states' fertility rate for every year from 1969 to 2002. The blue (orange) line denotes the average fertility rate of all early (late) deregulated states over time. An early-deregulated (late-deregulated) state is defined by its MSV-deregulation score being above (below) 0. The large positive outlier within early deregulation states is Utah, where fertility rates seem to follow the nationwide pattern only loosely.

Figure A2.39: *Lagged loan and house price growth and forward changes in fertility rates*



Notes: This graph shows binned scatterplots for the correlation between the change in Loans-to-GDP (the House Price Index (HPI)) between $t-3$ and t, and the change in fertility rates between t and $t+3$. The middle left and rightmost panel include county and year fixed effects. Fitted regression lines illustrate the correlation.

A3. Delaying fertility: Results for MAFC

The static diff-in-diff estimator: A standard diff-in-diff setting is a simple 2x2 matrix, consisting of two groups, treated and control, and two time periods, before and after treatment. The 'static' approach to diff-in-diff with heterogeneous treatment periods abstracts from this only slightly, by introducing the distinction between treated and not-yet-treated, instead of treatment and control group. As such, it expands the classic two way fixed effects setting (TWFE) by including a dummy that is 'switched on' when units are in the post treatment period. This is represented in Equation 8.

$$MAFC_{i,t} = \alpha_i + \lambda_t + \beta^{post} D_{i,t}^{post} + \epsilon_{i,t}. \tag{8}$$

Here, in addition to unit α_i and time λ_t fixed effects, $D_{i,t}^{post}$ is an indicator for unit i being already treated in t, whose β^{post} is the coefficient of interest. As this approach treats observations the same regardless of how long they have been within the post-treatment sample it implicitly assumes that the treatment always has the same effect, irrespective of its timing (Roth et al., 2023). Additionally, Roth et al. (2023) explain that *'Longer-run treatment effects will often receive negative weights. Thus, for example, it is possible that the treatment-effect is positive and grows over time since the expansion, and yet β^{post} will be negative'*. Mian et al. (2020a) and Baker et al. (2022) further note that changing the panel length alone can change the weights applied to each group and confound estimates. The Results are shown in Table A3.33, and confirm the 'negative sign problem' of the static diff-in-diff in my analysis.

Table A3.33: *Mothers' age at first child and deregulation. Static Diff-in-Diff*

	Age at First Child$_{i,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Inter Deregulated$_{i,t}$	-0.19***					-0.12*
	(0.06)					(0.06)
Intra Deregulated$_{i,t}$		-0.31**				-0.24*
		(0.12)				(0.13)
Both Deregulated$_{i,t}$			-0.18***			0.02
			(0.04)			(0.09)
HP Index$_{i,t}$				0.02***		0.01***
				(0.00)		(0.00)
HP Credit$_{i,t}$					-0.41**	-0.42**
					(0.19)	(0.20)
R^2	0.948	0.949	0.948	0.951	0.948	0.953
County fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	6347	6347	6347	6347	6119	6119

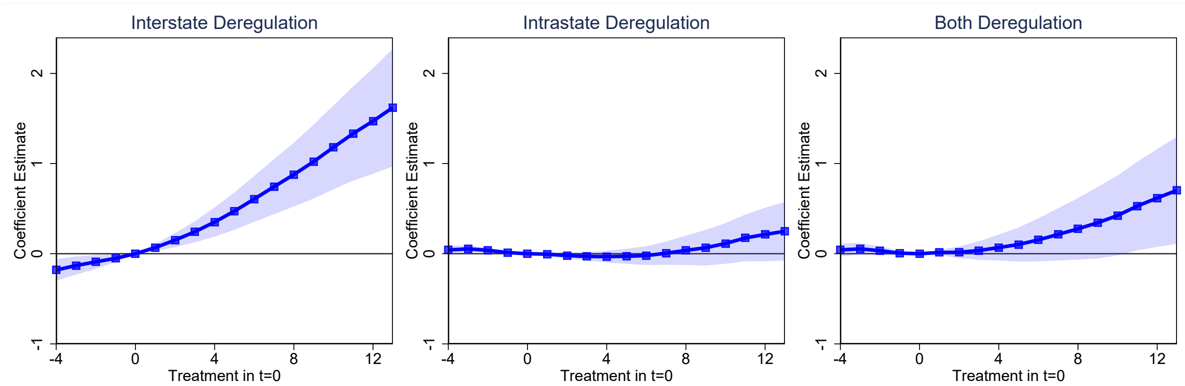
Notes: This table shows estimation results from Equation 8. The dependent variable is mothers' age at first childbirth (MAFC) at the county level. $InterDeregulated_{i,t}$ and $IntraDeregulated_{i,t}$ are indicator variables that take the value '1' in county i from year t onward, in which the respective deregulation began. All specifications include county and year fixed effects. State level clustered standard errors are in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

The dynamic diff-in-diff estimator: partially alleviates this problem by altering the static-specification to include a dummy for each individual period around the treatment (Roth et al., 2023; Sun and Abraham, 2021). Assuming we want to estimate the treatment effect for 5 periods before and after the beginning of treatment, the model would include the familiar TWFE for unit and time, and 10 dummies that are only 'switched on' when the unit is the corresponding amount of periods away from treatment and 0 otherwise. This 'dynamic' diff-in-diff specification can be expressed as follows:

$$MAFC_{i,t} = \alpha_i + \lambda_t + \sum_{p \neq 0} \beta^p \times \mathbf{1}_{[P_{i,t}]=p} + \epsilon_{i,t}, \tag{9}$$

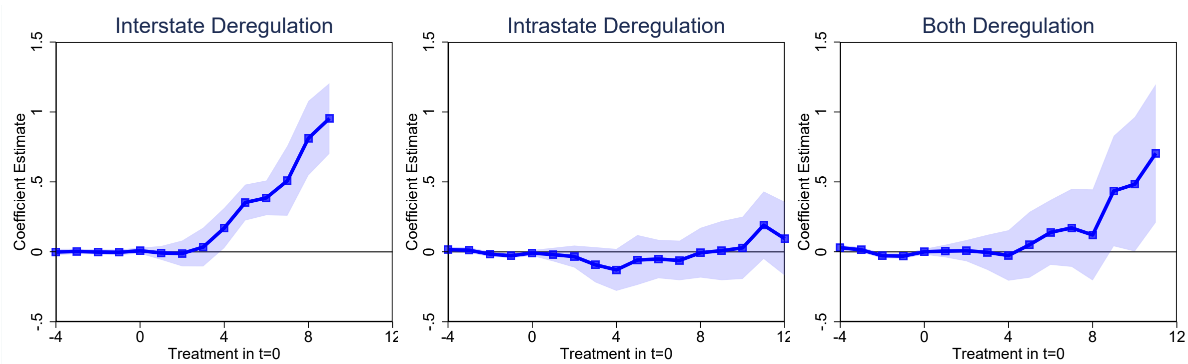
where α_i and λ_t are the familiar unit and time fixed effects. The specification also includes indicator dummies that are only 'switched on' when the observation is $p \neq 0$ periods away from treatment date. $P_{i,t} = t - g_i$ is the time relative to the treatment occurring in $t = g_i$, such that e.g. $P_{i,t} = 1$ in the first period after treatment for unit i. The summation includes all possible values of $P_{i,t}$ except for the treatment period itself at $p = 0$. Results are shown in Figure A3.40

Figure A3.40: *Mothers' age at first child and deregulation. Dynamic Diff-in-Diff*



Notes: This figure shows results from the 'Dynamic' diff-in-diff estimator from Equation 9. Specifically, it plots the estimates of β_p for different values of p. For $p < 0$ ($p > 0$), the coefficient reflects the cumulative effect of deregulation on MAFC p periods before (after) treatment. In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both inter- and intrastate deregulation has taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

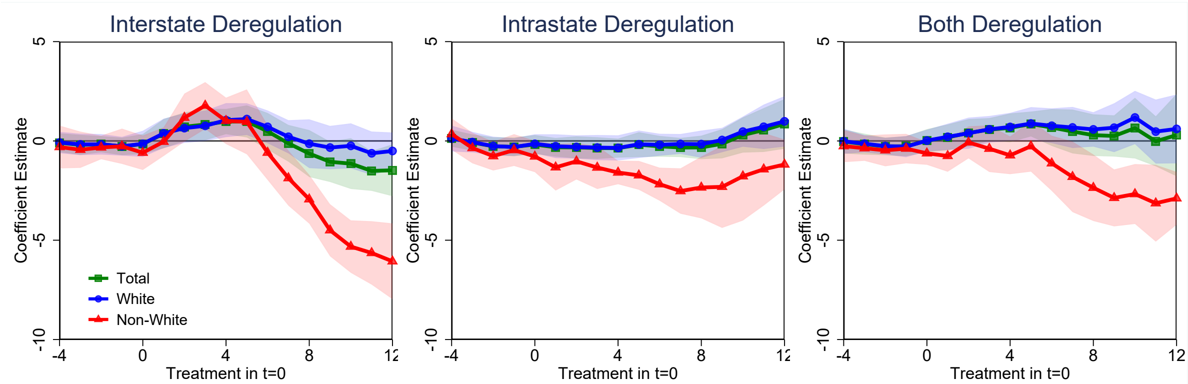
Figure A3.41: *Mothers' age at first child and deregulation. CS-Estimator*



Notes: This figure shows results obtained from the CS-estimator. The graphs plot the estimated treatment effect p periods before or after treatment on mothers' mean age at first child (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

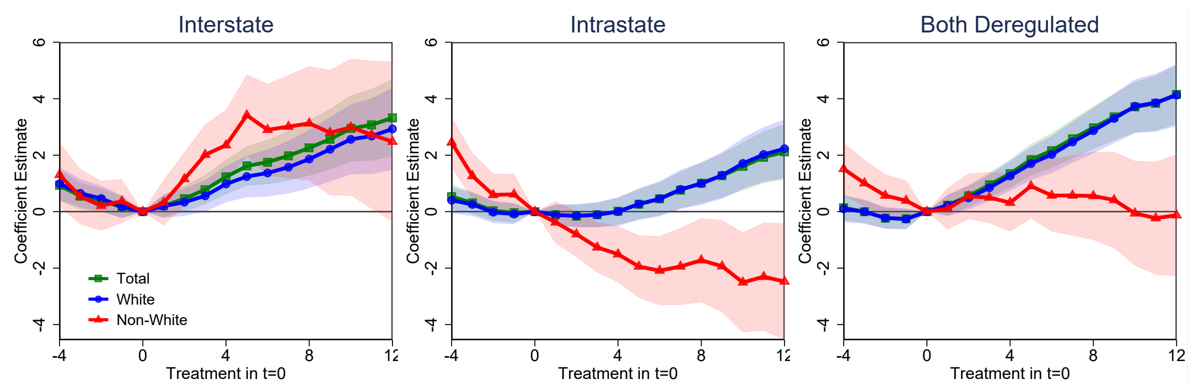
A4. Booms and busts: Results for fertility rates

Figure A4.42: *Fertility rates and deregulation, by race. Excluding periods overlapping with second deregulation wave. BJS-Estimator*



Notes: This figure shows results obtained from the BJS-estimator, excluding county-year observations that overlap with the second wave of deregulation. Specifically, it plots estimates of β_q for different values of p. For $p < 0$ ($p > 0$), the coefficient reflects the cumulative effect of deregulation on MAFC p periods before (after) treatment. In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

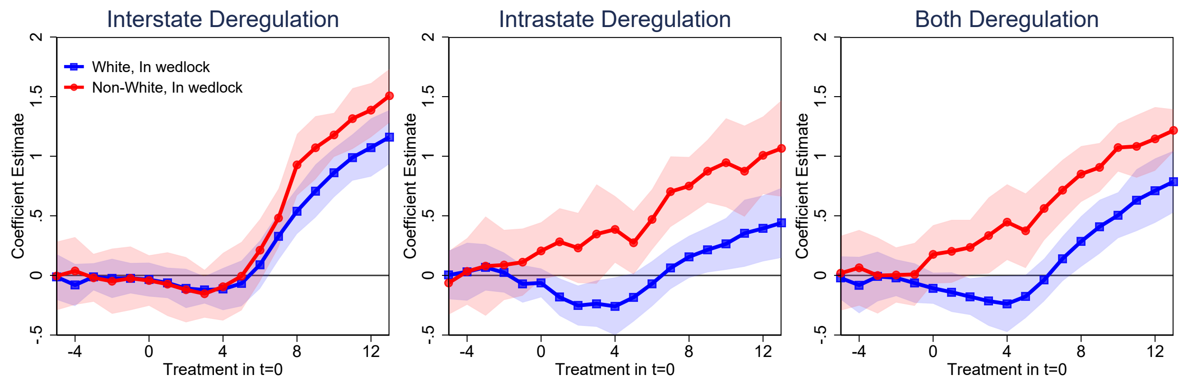
Figure A4.43: *Fertility rates and deregulation, by race. Dynamic estimator*



Notes: This figure shows results for the 'Dynamic' diff-in-diff estimator from Equation 9. Specifically, it plots estimates of β_q for different values of p. For $p < 0$ ($p > 0$), the coefficient reflects the cumulative effect of deregulation on MAFC p periods before (after) treatment. In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

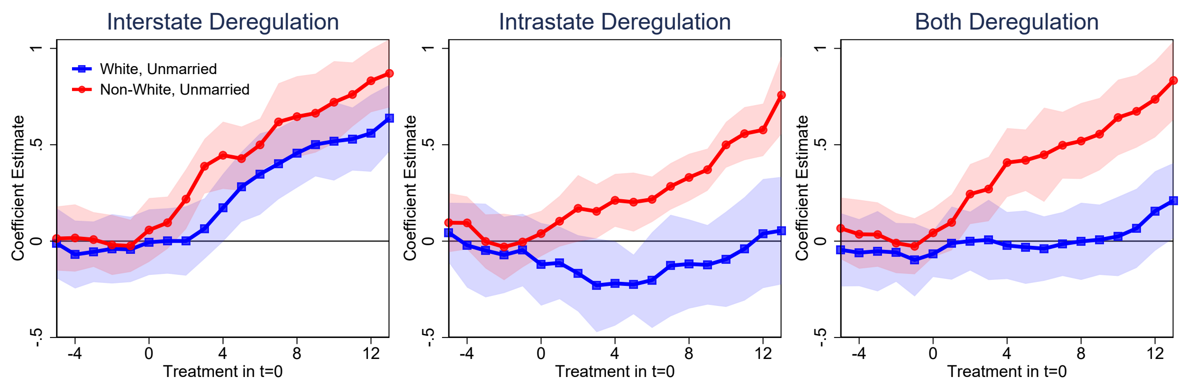
A5. Conscious decision making or spurious result? Exploiting the marital status

Figure A5.44: *Married mothers' age at first child and deregulation, by race of mother. BJS-Estimator*



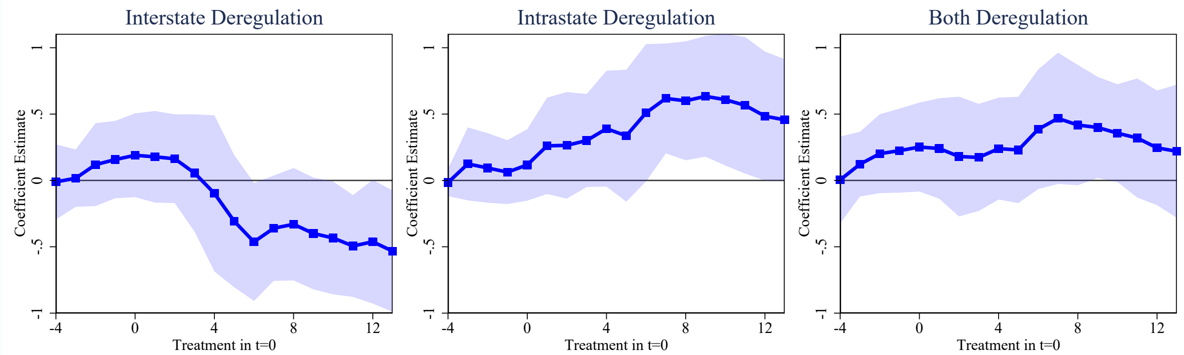
Notes: This figure shows results obtained from the BJS-estimator, conditional on mothers' race and marital status at time of first childbirth. Results in blue (red) are estimated on the sub-sample of married white and non-white mothers. The graphs plot the estimated treatment effect p periods before or after treatment on mothers' mean age at first child (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

Figure A5.45: *Unmarried mothers' age at first child and deregulation, by race of mother. BJS-Estimator*



Notes: This figure shows results obtained from the BJS-estimator, conditional on mothers' race and marital status at time of first childbirth. Results in blue (red) are estimated on the sub-sample of unmarried white and non-white mothers. The graphs plot the estimated treatment effect p periods before or after treatment on mothers' mean age at first child (MAFC). In the left-graph (central-graph), treatment is with respect to interstate (intrastate) deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

Figure A5.46: *Fertility rates and deregulation. Unmarried teenagers. BJS-Estimator*



Notes: This figure shows results obtained from the BJS-estimator. It only considers the subsample of unmarried teenage women. The coefficients reflect the cumulative effect of deregulation on MAFC p periods before (after) treatment. In the left-graph (central-graph), treatment is with respect to interstate (intrastate) banking deregulation. For the graph on the right, the treatment year is the first year in which both interstate and intrastate deregulation had taken place. Standard errors are clustered at the state level. All graphs show 90 percent confidence intervals.

A4. Erklärung zur Autorenschaft

„Ich erkläre hiermit, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet. Insbesondere habe ich nicht die entgeltliche Hilfe von Vermittlungs- bzw. Be- ratungsdiensten in Anspruch genommen.“

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Ort, Datum

____

Unterschrift