mea – Mannheimer Forschungsinstitut Ökonomie und Demographischer Wandel
Gebäude L 13, 17_D-68131 Mannheim_Sekretariat +49 621 181-2773/1862_Telefax +49 621 181-1863_www.mea.uni-mannheim.de

Demographic Change, Foresight and International Capital Flows

Melanie Lührmann

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Melanie Lührmann*
mea, Mannheim University

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Abstract

This paper studies the relationship between demographic change and international capital flows using a large cross-country time-series dataset. The analysis provides empirical evidence of a substantial and twofold demographic effect on international capital flows: First, capital flows are induced by changes in *present* demography. Countries with a large working-age population tend to be net exporters of capital, relatively younger economies importers of capital and extremely aged countries with a major population share of elderly also tend to import capital. In particular, high youth dependency induces current account deficits.
Second, the paper provides evidence that *future* demographic changes are anticipated and affect current net capital flows, too.
This twofold demographic effect on international capital flows can be hampered by capital controls and other capital market frictions. The impact of these frictions is also explored in the paper. The results indicate that they indeed affect capital flows.

Keywords: *international capital flows, capital mobility, anticipation effects, demography, aging*
JEL classifications: E2, F2, G1, J1

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1 Introduction

The next decades will bring about a pronounced aging process, in particular in industrialized countries. This demographic transition which is characterized by falling mortality rates and a subsequent decline in birth rates is much less advanced in developing countries.
There are large cross-region[1] and cross-country differences in the age structure of the population now and in the future (Fig.1).[2] Although the world regions share the common trend of a rising population share of the elderly and a declining share of the young, the differences in levels are large. In order to illustrate the demographic differences across the world, Fig. 2 depicts the total variation in youth and old-age dependency rates across the world using variation coefficients.[3] In particular, not only old age dependency but also its variance is strongly increasing over time until about 2020, and falls afterwards.

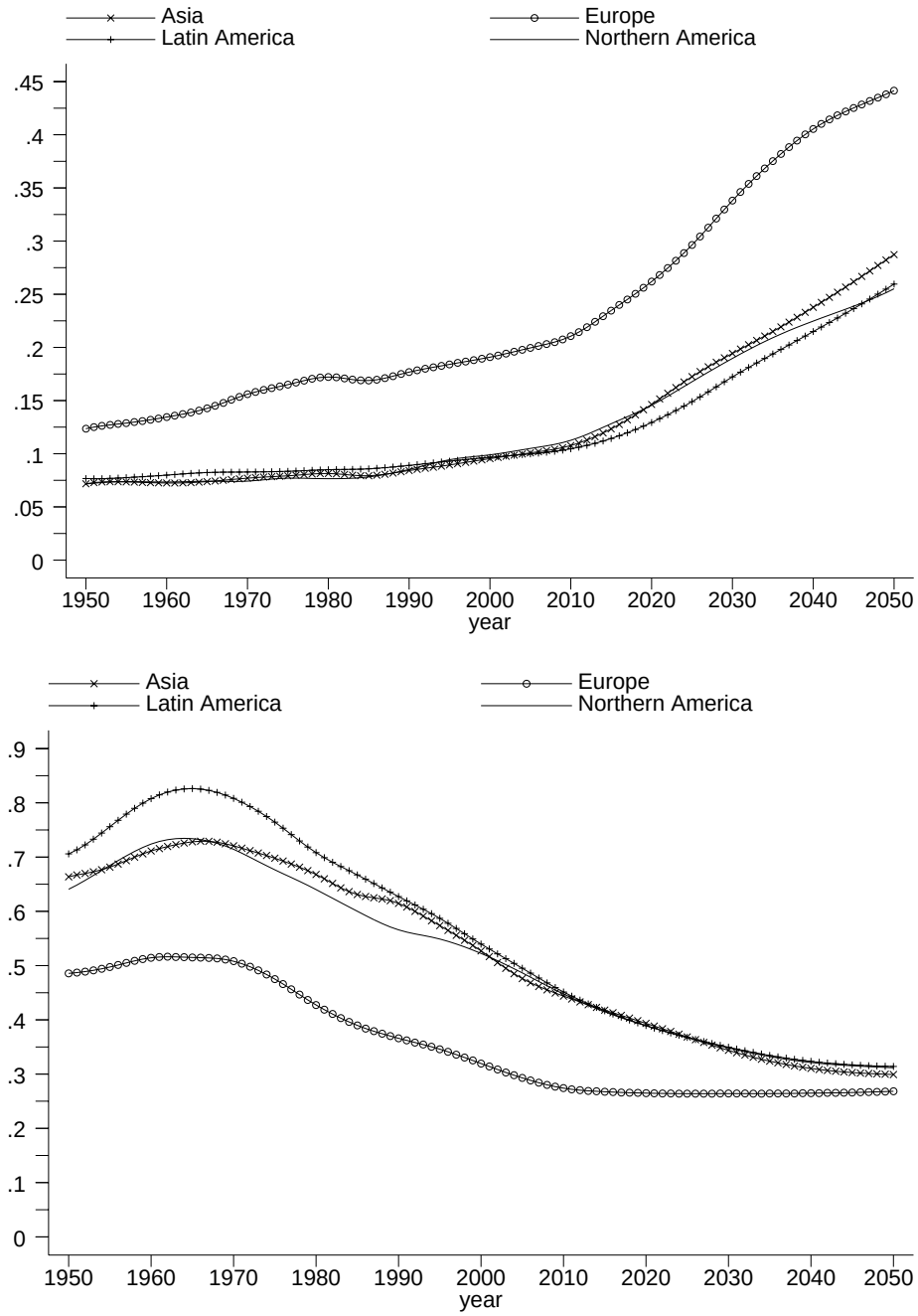
These demographic changes raise questions about their economic implications. There is an ongoing debate about the asset melt-down hypothesis which states that the soon retiring baby boomers will create a massive supply of assets that can be matched by the baby busters' meager demand only at low asset prices (Poterba 2001; Brooks 2000). Thus returns to capital will decline. This discussion is closely related to the focus of this study: international capital flows provide a means of mitigating or even avoiding the expected decline in return rates, since they allow for capital to be placed on the world capital market which channels it to relatively younger countries with higher capital returns. This in turn will reduce the demographic pressure on the domestic rate of return (Börsch-Supan, Ludwig and Winter 2002). Returns to capital also play a key role for the implications of designing partially funded pension systems, since they determine where the additionally accumulated capital will be invested. Understanding the factors driving international capital flows is thus important. This importance is underlined by the remarkable increase of the volume of international capital flows over the 1990s (World Bank 1997) and the observation that capital markets become more and more integrated across national borders.
In this paper, I conduct a reduced-form empirical analysis using an unbalanced panel of 121 countries for the time period from 1970 to 1997. Demographic effects on international capital flows are analyzed taking into account capital market imperfections and limited capital mobility. The main contribution of this paper is the analysis of the role of anticipated demographic changes on international

[1] The world is divided into 18 regions, defined according to the UN classification.

[2] For a detailed description of worldwide demographic differences, see United Nations Population Division (2000) for all world regions, Börsch-Supan (1996) for OECD countries, Bloom and Williamson (1998) for Asia, and Bloom and Sachs (1998) for Africa.

[3] Youth *(old age)* dependency being defined as ratio of the population between 0-14 *(65+)* to the working-age population between ages 15 and 65.

Figure 1: a) Old age and b) youth dependency for selected world regions: 1950-2050

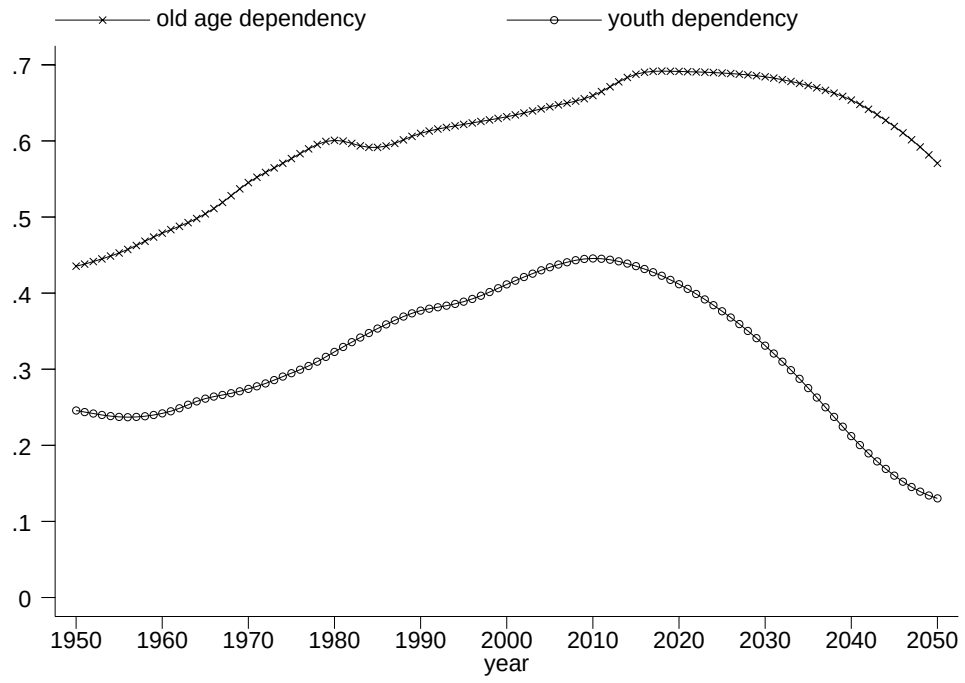


Source: UN Population Prospects and own calculations
Youth (old age) dependency is defined as ratio of the population between 0-14 (65+) to the working-age population between ages 15 and 65.

capital flows. Anticipation affects the timing of the link between demography and international capital flows. Furthermore, this paper relates the reduced-form analysis undertaken here to the growing literature using overlapping generations models which relies on the assumption of forward-looking agents. Forward looking behavior is informally tested here by researching into the relevance of anticipation effects.

The remainder of the paper is organized as follows: Section 2 reviews the theoretical foundations of demographic effects on international capital flows. The role of anticipation effects in this study is described in Section 3. Section 4 contains a description of the data, the regression specifications (4.1), the modeling of present (4.2) and future demography (4.3), and of the financial sector variables and indicators for capital mobility (4.4). Section 5 presents the results. Before I conclude, the demographic effects found in this paper are illustrated by stylized out-of-sample predictions for selected countries (Section 6).

Figure 2: Variation coefficients for youth and old age dependency: 1950-2050



Source: UN Population Prospects and own calculations

2 Literature review

2.1 The dependency debate and life-cycle savings

Whether and how demographic changes affect aggregate savings and growth outcomes is an old question leading back to Malthus (1798) and Coale and Hoover (1958). Coale and Hoover formulated the *dependency hypothesis* of a negative link between an increase in the young population and savings. It is due to the low savings capacity of children and young parents supporting children.
A second strand of studies has its theoretical foundation in the life cycle hypothesis by Ando, Modigliani and Brumberg (Modigliani and Brumberg 1954; Ando and Modigliani 1963). Empirical studies suggest age-specific savings decisions of individuals (Leff 1969; Fry and Mason 1982; Kelley 1988; Mason 1988; Collins 1991; Taylor and Williamson 1994). According to the theory, savings should be low at early stages of life due to low initial incomes and consumption-smoothing. In the course of rising income, savings increase. The age-specific individual savings patterns imply aggregate savings that depend on the national age structure. Thus, the application of the life-cycle model to the national context points to a negative link between youth dependency rates and savings. In contrast, savings are high at later stages of life and thus positively linked to the size of the workforce.
In an empirical analysis, Mason (1988) and Collins (1991) found a negative relationship between youth dependency rates and national savings rates. All these studies however lack a proper incorporation of the capital demand side. In other words: they do not explicitly consider the differences in savings and investment patterns of open versus closed economies. Neglecting the demand for capital leads to biases in the estimated demographic effects on savings. The demographic impact on savings is likely to be negative, but stronger than suggested by this literature. This underestimation is due to the omission of the investment side, so that the demographic coefficients also pick up demographic effects on investment. The nature of the link between savings and investment patterns and the resulting differences in these patterns between open and closed economies will be discussed in more detail in Section 2.3.

2.2 Analyzing savings and investment patterns jointly

In order to analyze the demographic effect on the focus variable net capital flows, and to avoid the biases described in Section 2.1, a joint approach towards savings and investment patterns is needed. In the 1990s, some effort was put into researching demographic effects on capital demand *and* supply by examining the demographic effect on the residual directly (Higgins and Williamson 1996; Higgins and Williamson 1997; Higgins 1998).
Higgins and Williamson (1996) study the demographic effect on savings, invest-

ment and net capital flows in a neoclassical overlapping generations framework with three periods of life. Demographic variation enters their model through cohorts of different size. Fertility and the rate of technological progress are exogenously given, production has constant returns to scale and labor is inelastically supplied. The authors simulate the effect of a stylized demographic transition process. It consists of an increase in fertility over two periods that levels off over three periods afterwards and then falls to a lower steady-state value. The results are that investment is tightly connected with the growth of the labor force which needs to be equipped with capital. Furthermore, the simulations show that savings rates are high for a large work force and decline gradually, as the economy ages.
Countries with a large working population will thus tend to be net capital exporters in a globalized capital market while relatively young economies tend to import capital due to their high investment demand and low national savings. Finally, a country with a majority of retired citizens will tend to be net capital importing.
In an empirical analysis of a large cross section of countries taken from the Penn World Tables (Mark 5.6), Higgins (1998) finds evidence of the savings, investment and net capital flow patterns predicted in the simulation model of Higgins and Williamson (1996). Taylor (1998) also finds a negative link between youth dependency ratios and net capital outflows for Argentina and other Latin American countries in the 20th century (1885-1989).

2.3 Demographic effects and the role of capital mobility

The distinction between closed and open economies is crucial in the analysis of savings patterns, since savings are independent of the demand side in the capital market only under the assumption of perfect capital mobility. In this case, capital is traded at the world capital market which determines the rates of return at the domestic market. If capital is not entirely mobile internationally, domestic savings and investment are jointly determined and can thus not be analyzed separately. This linkage between the degree of capital mobility and savings and investment patterns in the domestic economy is formulated in the well-known Feldstein-Horioka theorem (Feldstein and Horioka 1980). Feldstein and Horioka as well as follow-up studies (Dooley, Frankel and Mathieson 1987; Hussein 1998; Jansen 2000; Shibata and Shintani 1998) found a significantly positive, but decreasing correlation between domestic investment and savings outcomes over time, an indicator for a limited, but increasing degree of international capital mobility.
Studies based on the examination of interest rate parities are in line with these findings of limited capital mobility. Frankel (1992) and Obstfeld (1995) provide surveys on these tests for capital mobility and their (mostly negative) results. French and Poterba (1991) resume that there is considerable home bias in investment decisions and the results of Portes and Rey (1999) suggest that information

asymmetries reduce international capital mobility. Thus, evidence that capital mobility is not perfect is numerous. However, it is equally true that capital controls have been abolished on a large scale during the last decades and that capital has become more mobile at least within the OECD area.
The consensus in the literature is best summarized by Obstfeld (1995): *As far as industrial countries are concerned, capital mobility appears substantial...though it is clear that much of the developing world still stands outside the nexus of industrial-country financial markets.*
Higgins (1998) relates demographic effects and capital mobility, taking into account that incomplete capital mobility can hamper demographically-induced capital flows. Thus, demographic effects on capital flows should be weaker when capital controls or other obstacles to free capital flows are present. Higgins (1998) uses the Sachs and Warner openness measure as an index of financial openness (Sachs and Warner 1995) and obtains the expected results: the less open a country, the weaker the demographic effect on net capital flows. There is a certain flaw to the Sachs and Warner openness measure: it is usually considered as an index of trade and not financial openness. I extend this line of research by applying a broader concept of capital mobility determinants in the empirical analysis.

3 The role of future demography

3.1 How anticipation affects international capital flows

This study is a first step towards evaluating the role of expectations in the analysis of demographic effects on international capital markets. Previous studies found significant demographic effects on international capital flows and capital market returns (Higgins and Williamson 1996; Higgins and Williamson 1997; Taylor 1998; Taylor and Williamson 1994). This paper researches into the effects of *future* demographic developments on *current* international capital flows. This focus stems from the notion that actions taken on the capital market are highly driven by expected returns. Hence, it is not sufficient to look at the present demographic situation only when analyzing demographic effects on net capital flows. To my knowledge, this effect has been not been studied thoroughly in the empirical literature so far.
Poterba (2001) briefly discusses anticipation effects. He notes that forward-looking behavior by agents implies that savings and investment decisions are taken on the basis of present discounted values of the future earnings of investment goods and the value of savings. Poterba resumes that "forward-looking investors should anticipate the decreasing demand for capital and bid down shares prices and the prices for other durable assets before the baby boomers reach their saving years." He however does not incorporate forward-looking behavior into his empirical analysis of demographic effects on asset returns in the U.S. but instead

confines to a steady-state focus.
To clarify how anticipation of demographic changes alters agents' behavior, consider the *closed economy case* in which there is no access to the world capital market: the only way in which individuals can react to the anticipation of a baby boom baby bust cycle is to intertemporally shift their savings: either they save more today in order to ensure a sufficient retirement income, or they start consuming their savings earlier if the substitution effect dominates. Obviously, an intertemporal shift towards earlier consumption would reduce capital returns in the present. However, anticipation can only smoothen the sharp decline of future returns, and it is not clear that individuals really choose to shift their consumption towards earlier stages of their life. Intertemporal substitution does not solve the asset-melt down problem because the individuals' scope for using the information about the future is limited as there is no escape from the (shrinking) domestic financial market.[4]
This closed economy result is found in a study by Brooks (2000). Brooks's stylized Baby Boom-Baby Bust cycle results in an abrupt drop in cohort size between two generations. It can be regarded as a contracted, stylized version of the long-term phenomenon of demographic change. The effect of this demographic shock is analyzed in a simulation model with rational, forward-looking agents. The simulations show that in spite of forward-looking behavior, the transition from baby boom to baby bust will lead to a sharp decline in asset returns. This result is not surprising: the model ignores the ability of investors to hold an internationally diversified portfolio and analyzes demographic effects in a closed economy setup only.
The virtues of integrated capital markets are modeled in Börsch-Supan et al. (2002): Their simulations show that the decline in capital returns induced by the aging process are much smaller when capital is mobile across the EU or OECD, and not bound to be invested in Germany only. The authors find no evidence of an asset melt down effect in an open economy setting. Thus, anticipation effects lead to a much higher extent of smoothing of the return curve over time in an open economy. The pivotal difference to the closed economy case is, that agents can make better use of their knowledge about domestic demographic pressures: they can access the world capital market in order to diversify domestic demographic risks. This mechanism of alleviating domestic demographic pressure generates net capital outflows from industrialized countries to emerging markets in the present. The size of these flows depends on the *relative difference* in the age structure between the home country and the rest of the world (Williamson 2001). Capital will flow between countries such that returns equalize across countries and these returns will depend on the world capital market only.

[4]The effect of the increased volume of savings would further stabilize capital returns if it increased productivity (Börsch-Supan and Winter 2001). A higher capital stock can enhance corporate governance in the capital market and thus raise capital productivity.

In consequence, population aging in the home economy does not necessarily lead to sharp declines in capital returns, since agents can react to demographic pressures by investing their capital in countries where aging is less pronounced.
However, if capital is perfectly mobile and can be reallocated at any point in time, net capital flows will depend on the change of the relative age structure in the next period only. Although individuals anticipate long-term changes in demography, they only need to redirect capital in each period such that the expected change in the relative age structure over the next period is balanced. Thus, one should *not* observe a linkage between net capital flows and *long-term* future demographic change, if capital is perfectly mobile.
In the realistic scenario of imperfect capital markets as supported by empirical evidence (see Section 2.3), however, international capital flows can be affected by expected demographic changes over a longer period as well. It might not be possible to redirect capital flows at any point in time. Furthermore, the allocation of capital across countries might depend on the degree of imperfection of the destination country's domestic capital market. The most obvious deterrent to the redirection of capital in each period is the presence of transaction and information costs. They represent an incentive towards making longer term investment decisions.[5]
Thus, with incomplete capital markets and farsighted agents, present net capital flows should depend on expected relative differences in future demography between countries. The more incomplete the capital markets, the smaller should be the effect of anticipation on international capital flows. Therefore, I construct demographic variables capturing anticipation only, and next, I also introduce interactive effects of these anticipation variables and indicators of capital market imperfections. The variables used in the empirical analysis are described in Section 4.3 and Appendix A.

3.2 The formation of expectations

The studies described in the last section belong to the group of overlapping generations simulation models (see also Börsch-Supan and Winter 2001; Börsch-Supan et al. 2003; Miles 1999; Pemberton 1999; INGENUE 2001). They base on the assumption of rational, forward-looking behavior. This paper means to be the flip side of the coin, since it provides an informal test whether this assumption is warranted, as anticipation effects represent an indicator for forward-looking behavior. By including anticipation effects in the analysis, I test a joint hypothesis: (i) the availability of credible demographic information and (ii) the farsightedness of agents. These two hypotheses cannot be separated in the empirical analysis of this paper.

[5]Another example for capital flows that cannot be redirected each period is foreign direct investment (FDI). FDI often yields positive returns only after a couple of years and is not easy to reverse - if at all.

There is evidence that individuals are aware of the demographic changes ahead, i.e. that they are in possession of reliable and credible demographic information. This awareness is due to the drastic dimension of the aging process in industrialized nations and the resulting widespread problems with financing social security systems in the future (Boeri et al. 2002).
Demographic forecasts like the United Nations projections usually extend over a time-span of 50 years and are considered as relatively reliable, in spite of implausible fertility assumptions used in the past (Birg 2001). Reliability is enhanced by the fact that the elderly of tomorrow are already born today.
In this paper, I chose the UN projections as information source for projections of the aging process. I do so because it is a broadly cited international data source for demographic projections so that public information is mainly based on this data. Projection errors in this database produce errors in the expectations. This is unproblematic here since the goal of this paper is to show that expectations affect the link between demography and international capital flows, regardless of whether individuals have perfect information.
The various editions of UN projections over time differ from each other, mainly due to the rapid spreading of the HIV-virus and revisions of the fertility assumptions. In consequence, every official update produces "news" and thus a change in expectations. I use four UN projections, issued in 1980, 1988, 1992 and 1998, to exploit this variation. Expectations are revised each year on the basis of the latest official projection available. Since data based on forecasts before 1980 is not available, I assume that expectations about the demographic future built before 1980 were correct, i.e. matched the demographic reality. Further details about the construction of the anticipation variables are given in Section 4.3.

4 The econometric model

This paper uses a reduced-form approach to analyze the empirical link between current and future demography and international capital flows. A feasible generalized least squares panel estimator with region fixed-effects is applied to time-series cross-section data for about 120 countries from 1970 to 1997 and to demographic projections that reach out until 2050. The demographic data is provided by the United Nations World Population Prospects, while the economic data of this unbalanced panel is taken from the World Development Indicators by the World Bank. Additional data on capital controls is provided by the IMF (International Monetary Fund 1999). The dependent variable is capital outflows, constructed as the net value of gross domestic savings minus domestic investments as a percentage of GDP.
The next section describes the estimation strategy. Sections 4.2 to 4.4 deal with the explanatory variables used in the analysis and define how they are specified. They can be grouped into four categories: region fixed-effects, present demog-

raphy, expected demographic changes, and last, financial sector variables and capital mobility factors. The regions amount to 18 groups, defined according to the UN classification. The measurement of the present and expected demography is explained in Section 4.2 respectively 4.3 as well as in appendix A. The other covariates are described in detail in Section 4.4.

4.1 The empirical specification

For the moment, consider the regression specification with present demography only:

$$y_{it} = \alpha_{oi} + x_{it}^{'}\beta + \sum_{j}^{J-1} \alpha_j d_{jit} + u_{it} \tag{1}$$

where y_{it} are net capital outflows of country i at time t, α_{oi} represents region fixed effects, x_{it} are other explanatory variables capturing features of the financial sector and of capital mobility. d_{jit} are the population age shares for j age groups in country i at time t and u_{it} is the error term.
I extend the analysis of Higgins (1998) by allowing for heteroskedasticity and first order autocorrelation of the error terms. Heteroskedasticity is introduced into the model by allowing for differences in variances by country, σ_i^2. Second, a first-order autoregressive process AR(1) with country-specific correlation coefficients ρ_i is specified. This leads to a variance-covariance matrix of the following form:

$$E[\epsilon\epsilon'] = \Omega = \begin{pmatrix} {\sigma_1}^2 V_1 & 0 & \dots & 0 \\ 0 & {\sigma_2}^2 V_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & {\sigma_n}^2 V_n \end{pmatrix} \tag{2}$$

where

$$V_i = \begin{pmatrix} 1 & \rho_i & 0 & 0 & \dots & 0 \\ \rho_i & 1 & \rho_i & 0 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \dots & \rho_i & 1 \end{pmatrix} \tag{3}$$

Thus, the feasible generalized least squares estimator is given by:

$$\widehat{\beta}_{FGLS} = (X'\hat{\Omega}^{-1}X)^{-1}X'\hat{\Omega}^{-1}y \tag{4}$$

and the estimated variance by

$$\widehat{Var}(\hat{\beta}_{FGLS}) = (X'\hat{\Omega}^{-1}X)^{-1} \tag{5}$$

where the $\hat{\Omega}$ contains the weights given to each observation according to its country-specific variance and the autocorrelation coefficient.

4.2 Modeling the present age structure of the population

Most of the empirical studies of demographic effects use only two broad measures of the population structure: youth and old age dependency rates. The reason for these coarse measures lies in the high multicollinearity of age-specific population shares and the reduction of degrees of freedom when including population shares for detailed age groups.
This study tries to improve on this by modelling the current demographic situation according to the method proposed by Fair and Dominguez (1991). It allows to use the information on the *entire* age structure while avoiding the identification problem arising from multicollinearity.
Consider the specification introduced in equation (1) in the last section. Now, I constrain the age share coefficients α_j to lie on a fourth-order polynomial[6]:

$$\alpha_j = \sum_{s=0}^{4} \gamma_s j^s \tag{6}$$

where $s \in [0, S]$ and $S = 4$ is the order of the polynomial. A high order polynomial presents a flexible framework for analyzing demographic effects. This restriction is used to reformulate the regression specification by substituting in for the α_j:

$$y_{it} = \alpha_{i0} + x_{it}^{'}\beta + \sum_{s=0}^{4} \left(\gamma_s \sum_{j=1}^{J} j^s \cdot d_{jit} \right) + u_{it} \tag{7}$$

I further restrict the sum of the age share coefficients α_j to zero. This normalization allows for a straightforward interpretation of the age share coefficients as deviations from the average demographic effect on international capital flows.
This yields the following relationship of the γ:

$$\gamma_0 = -\frac{\gamma_1}{J} \sum_{j=1}^{J} j - \frac{\gamma_2}{J} \sum_{j=1}^{J} j^2 - \frac{\gamma_3}{J} \sum_{j=1}^{J} j^3 - \frac{\gamma_4}{J} \sum_{j=1}^{J} j^4 \tag{8}$$

The parameter γ_0 can be recovered from the four estimated coefficients $\gamma_1, ..., \gamma_4$. These coefficients do not have an intuitive interpretation, but they can be used to recover the original age share coefficients α_j in the next step. The transformed regression specification can be written as:

$$y_{it} = \alpha_{i0} + x_{it}^{'}\beta + \sum_{s=1}^{4} \gamma_s \left(\sum_{j=1}^{J} j^s \cdot d_{jit} - \frac{1}{J} \sum_{j=1}^{J} j^s \cdot \sum_{j=1}^{J} d_{jit} \right) + u_{it} \tag{9}$$

[6] I also used higher and lower order polynomials; the results did not change much. For more information, refer to appendix B.

In brief:

$$y_{it} = \alpha_{i0} + x_{it}^{'}\beta + \sum_{s=1}^{4} \gamma_s Ds_{it} + u_{it} \tag{10}$$

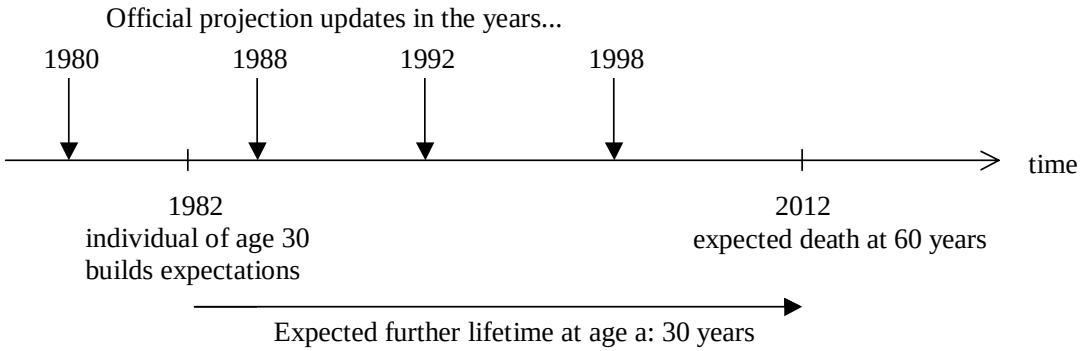
where $Ds = \sum_{j=1}^{J}(j^s \cdot d_{jit}) - \frac{1}{J}\sum_{j=1}^{J} j^s \cdot \sum_{j=1}^{J} d_{jit}$. The $\hat{\alpha_j}$ can be recovered from the $\hat{\gamma}_s$ according to (6).
I use population shares of 17 age groups (0-4,5-9,10-14,...75-79 and 80+) to construct the four demographic measures $D1..D4$. Before applying the method by Fair and Dominguez (1991), I transform the absolute age-specific population shares into shares relative to the rest of the world. It is well-known and often emphasized in the literature that it is *relative* demographic changes that will drive capital flows. However, in empirical studies, this insight is always neglected and only absolute changes are used as measures for demography. The transformation of the variables is described in appendix A and will be applied to the future demography variables in the next section as well.

4.3 Modeling future demographic trends

To analyze expected future demographic changes as a determinant of international capital flows, I develop anticipation measures that reflect expected demographic changes over time (i) relative to the *rest of the world*, (ii) at each point in time and (iii) differing by the age structure of the population.
The effect of future demographic changes on current behavior hinges upon the foresight period over which individuals anticipate demographic changes. Based on the life cycle theory, I assume that individuals plan over their expected further lifetime. Since further lifetime differs by age, the anticipation measures are computed for each age group individually and are then aggregated over age groups to obtain the macroeconomic anticipation measure for each country.
Figure 3 gives an example how the anticipated demographic changes are computed for the 30 year olds in 1982: I determine the expected further life expectancy of the 30 year olds, here 30 years, and calculate the projected demographic changes over their expected further lifetime on the basis of the relevant information, the 1980 projection. The expected demographic change is the difference in the old age respectively youth dependency ratio between 1982 and 30 years later, in 2012. This procedure is performed for each age group. Finally, I obtain the country's composite anticipation measure by aggregating these age-specific anticipated changes over age groups, weighting each age groups' information with its cohort size.

One element of the computation is the expected further lifetime of each age group. It is measurable by age-specific data on further life expectancy. However, due to the bad coverage of data on this variable, the results are most likely to be biased, since many developing countries would be excluded from the sample.

Figure 3: Example of the anticipation effects



Hence, I use the difference between life expectancy at birth and the age at time t instead which both vary over time and by country. This underestimates further life expectancy, especially for elder cohorts who might have a negative further life expectancy in this specification. Their planning horizon will be too short. However, robustness checks reveal that the results are not substantially different from those on the basis of age-specific life expectancies. This specification will be labeled Specification 2 in the following. Specification 1 restricts anticipation effects to zero.

In order to investigate whether anticipation has a long or only a short-term effect on international capital flows, I use an additional specification for the future demography variables, labeled Specification 3: I determine the further lifetime of each age group. Then, I split the age groups into four categories according to their planning horizon: 0 to 10 years, 10 to 20 years, 20 to 30 years and 30 to 50 years. Next, I compute the population shares of these four groups. Finally, I calculate the demographic changes in the short run, i.e. t and $t+10$, in the medium run for $t+20$, and so forth, and weight them by the population shares of the four groups. By doing so, I can identify whether short- or long-term demographic changes have an effect on international capital flows.

I construct these measures for demographic changes in youth and old-age dependency rates seperately. These ratios summarize the broad dimensions of the demographic changes ahead. As in the last section, I transform these ratios into relative dependency ratios. The resulting explanatory variables in Specification 2 are labeled YNG and OLD. Specification 3 contains four variables on the basis of changes in relative youth dependency, $YNG10, 20, 30$ and 50, and four based on old-age dependency ratios, $OLD10, 20, 30$ and 50.

4.4 Capital mobility factors and financial sector influences

Apart from demographic changes, capital flows crucially depend on the degree of capital mobility in a globalized capital market (see Section 2.3). Hence, I include a set of variables that capture some determinants of capital mobility.
The openness of a country towards foreign capital is most directly determined by the existence of capital controls.[7] These controls can prevent capital from flowing between countries. Therefore, I include the dummy variable ($CONTROL$) that takes the value one if restrictions on the current or capital account are in place or if there exist regulations for the surrender of export proceeds.
A second factor are capital gains taxes (TAX). Foreign investors may fear high taxation of their investment returns so that high taxes will discourage foreign investors if taxes have to be paid in the country where the funds are placed. At the same time, high capital gains taxes also discourage investment in the home country by domestic investors. Only a crude measure is available here: taxes on income *and* capital gains. However, income taxes will also affect international capital flows via their depressing effect on savings.
Another tax measure is taxes on international trade ($TRADETAX$). Since capital flows and trade are closely linked through national accounts, I expect that high taxes on international trade will be a disincentive towards capital outflows.
To capture additional non-demographic effects driving capital flows, several variables describing the financial sector in the home country are included. They are the so-called 'pull factors' that capture accessibility, development status and effectiveness of domestic financial markets. The size of the financial sector ($SIZE$) is widely used as a measure of how accessible the capital market is (Levine and Zervos 1993). It is defined as ratio of liquid liabilities to GDP. Next, $PRIVATE$ is private credits as percentage of GDP. Due to limited data coverage, the ratio of private to total domestic credit ratio is not available. Therefore, I use $PRIVATE$ as a proxy for the involvement of private agents in the financial sector.
Next, I include the variable $CIVIL$ from Freedom House (2002) capturing the rule of law and the security of property rights. $CIVIL$ is constructed from survey results in the form of a checklist and takes values from 1 to 7 where 1 represents the highest degree of civil liberties. Recent studies show that especially the security of ownership rights, but also the enforceability of legal claims are vital growth enhancing factors (Knack and Keefer 1995; Barro and Sala-I-Martin 1995). If the rule of law and the security of property rights are weak, then this also comprises capital transactions. Investors planning a new site or production location in a foreign country will certainly be interested in securing their investments. The worse the infrastructure and security to do so, the less they will be prepared to invest in that country. The same argument holds for other types of investment.
Yet another variable from the Freedom House Indicators, $RIGHTS$, is included

[7] A detailed description of capital controls is provided in Cooper (1999) and Montiel and Reinhart (1999).

in the analysis. It reflects the status of political rights and freedom and the voting rights of the public. This variable is taken as a proxy for the political risk that investors face.
Finally, I recognize the role of education in explaining capital flow patterns. The variable $SCHOOL$ captures gross school enrollment in secondary education. It is often argued that omitting human capital when researching the link between demography and international capital flows leads to biased results. This bias would be present, if aging induces a scarcity of labor associated with increased investments in education that will make the scarce factor more productive. Furthermore, schooling might have an effect on net capital flows since increases in schooling trigger a higher labor productivity, raising incomes and thereby savings rates. Higher savings rates will increase net capital outflows. Hence, the demographic effects can be separated from human capital effects. Since the schooling variable is often reported in 5-year-intervals only, I linearly interpolate $SCHOOL$.

5 Results

This section presents the results of the empirical model developed in Section 4.1. Three specifications are estimated. The simple Specification 1 in the second column of table 2 does not account for future demographic changes as a potential determinant of international capital flows, but confines to present demography only. In Specifications 2a and b, I add the future trends in youth and old-age dependency rates, as described in detail in Section 4.3. The future demography variables enter in a continuous way. They contain aggregated information on the demographic changes in relative youth and old-age dependency over the individual planning horizon of each cohort. In order to learn more about the relation between short- and long-term anticipation effects, Specifications 3a and b (table 3) contain the aggregated future demography changes splitted into four variables each for the two dependency ratios. These four variables are lead variables that cover expectations over different time horizons - short-term, medium-term and long-term. Specification b differs from a by the additional interactive term of capital market imperfections, i.e. the size of the domestic financial sector, and the anticipation measures. These variables are supposed to test the hypothesis that anticipative behavior has a larger effect when capital market imperfectionsThe interacted variables are labeled $OLD..i$ and $YNG..i$. Table 1 contains the list of variables.
In the following, I discuss the results of the different specifications, as shown in Figure 2. The discussion is organized along the three groups of explanatory variables: present and future demography and other covariates.

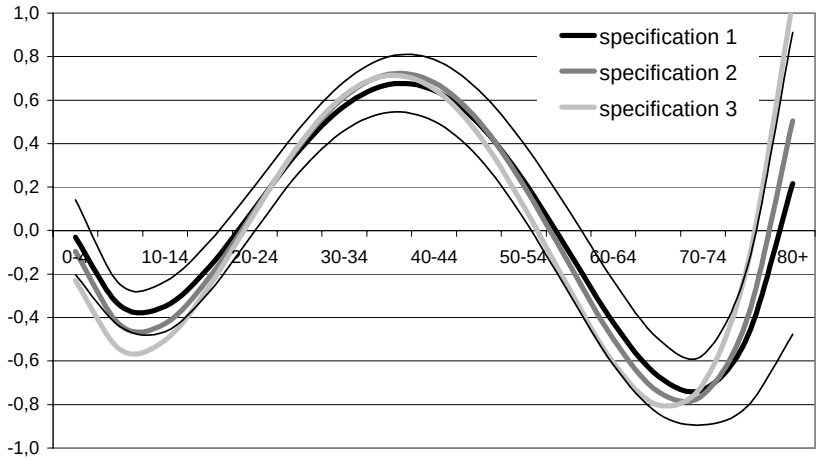
Table 1: List of variables

Dependent variable	
NET	gross domestic savings - gross domestic investment (percent of GDP)
CAPITAL	*Source: World Development Indicators (WDI) 2000 and own calcu-*
OUTFLOWS	*lations*
Present demography variables (see section 4.2)	
D1..D4	Transformed present demographic variables that identify the polynomial
	Source: UN Population Projections (UN)1998 and own calculations
Future demography variables (see section 4.3)	
OLD(YNG)	Change in relative old-age (youth) dependency over the expected further lifetime of each age group, aggregated for each country i at time t
OLD(YNG) 10..50	Change in relative old-age (youth) dependency over the expected further lifetime of each age group, classified into four foresight periods and aggregated for each country i at time t
OLD(YNG)i	interactive terms: anticipation measures OLD(YNG)*SIZE
OLD(YNG) 10..50i	interactive terms: anticipation measures OLD(YNG)10..50*SIZE
	Source: UN 1998 and own calculations
Other explanatory variables (see section 4.4)	
SIZE	Liquid liabilities as percentage of GDP
PRIVATE	Private credit as percentage of GDP
TAX	Taxes on income and capital gains in percent of current revenue
TRADETAX	Taxes on international trade (including import duties, profits of export or import monopolies, exchange profits, and exchange taxes) in percent of current revenue
SCHOOL	Gross school enrollment in secondary education
GROWTH	GDP growth rate, lagged
	Source: WDI 2000
CONTROL	Dummy variable: 1 if capital controls present, otherwise 0 (see *IMF(1999)* for further details)
CIVIL	Indicator capturing the rule of law, security of property rights, human and organizational rights, freedom of expression and belief (ranging from 1 to 7: 1 indicates highest degree of civil liberties, 7 the lowest)
RIGHTS	Political rights indicator (ranging from 1 to 7: 1 indicates highest degree of political rights, 7 the lowest)
	Source: Freedomhouse Indicators

5.1 Present demography

Since the four variables capturing present demography have no direct interpretation, the bold lines in Figure 4 show the implied age share coefficients for Specification 1, surrounded by a 95% confidence interval, and the other two specifications.
In Specification 1 where future demography is not considered, the age share coefficients are significantly negative for ages 5 to 15. Hence, a high youth share tends to draw the economy into a current account deficit. This finding is in line with the theoretical argument that "young" economies have a high investment demand while generating few savings domestically. Even stronger demographic effects are present in the middle of the age distribution: a large working age population in its twenties to mid-fifties generates large net capital outflows. A one percent rise in the relative population share of those between 35 and 40 years induces an increase in net capital outflows of about 0.7 percent. These population groups are in their high savings years. Finally, the results show a reverse effect for the elderly. A high relative share of those aged 65+ is associated with a tendency towards capital inflows. This effect can be explained by declines in savings and the repatriation of capital for consumption in old age. The coefficients for those of age 70 and older cannot be trusted much, since the confidence intervals become very large at the ends of the age distribution.

Figure 4: Age share coefficients by age group for current demography: specifications 1-3



Annotation:
specification 1: present demography effects only
specification 2a: present and future demography, aggregated over age groups
specification 3a: present and future demography, classified into four foresight periods

These results do not change substantially when expected future demographic

change is included in the analysis in Specifications 2 and 3. The shape of the present demographic effect is very similar, as can be seen in Figure 4. The amplitude increases, but the point estimates lie within the confidence interval of the estimated coefficients from Specification 1 except for very young ages. Hence, the estimation results for the present demography variables are robust. I also tried various other specifications of the future demography variables based on further life expectancy instead of life expectancy at birth. Furthermore, I estimated the three specifications without the interpolation of the schooling variable, reducing the sample size by about 30%, and third, I averaged the data in 5 year intervals to see whether autocorrelation effects like business cycles drove the effects. Finally, I included lagged GDP growth in the regressions in order to capture country-specific heterogeneity resulting from different growth patterns (see appendix C). The results do not change much over all these variations of the regression specification.

5.2 Future demography and its interactions with capital market imperfections

The results provide evidence that anticipation of *future* demographic changes does affect international capital flows *today*.
The results for the future demography variables $YNG...$ in Specifications 2 and 3 point to a significant impact of anticipated demographic changes on current net capital flows. A rising youth dependency rate over the further lifetime of the population affects capital outflows negatively. This is in line with the argument from Section 3 that a high expected youth share will induce additional investment in the domestic economy due to the rising labor force in the future. Specification 3 shows that the anticipation effects concerning future youth dependency are stronger for shorter planning horizons. There are a couple of reasons for this: First, capital market frictions are more important for the short and medium-run and will be less important in the long-run. Second, this result might be an indication that individuals do not plan over very long horizons. And third, individuals might have a large discount factor such that in spite of anticipation, long-term demographic changes do not strongly influence their behavior.
An anticipated increase in relative youth dependency signifies that the age structure in the domestic economy will become younger relative to other countries in the future; this leads to rising demand for capital and thus attracts additional capital and keeps domestic capital within the domestic market.
I do not find evidence of anticipation effects in old-age dependency. This is most likely due to little variation in old age dependency over the projections and due to a problem of multicollinearity: if a high share of elderly people is expected for the future, then one observes a high youth dependency ratio in this coun-

Table 2: Regression results for specifications 1 and 2

Dependent variable: NET CAPITAL OUTFLOWS			
	SPEC 1	SPEC 2a	SPEC 3a
Present demography			
D1	-1.057 (5.73)***	-1.171 (6.51)***	-1.193 (5.87)***
D2	0.312 (7.02)***	0.350 (7.95)***	0.372 (7.35)***
D3	-0.030 (7.32)***	-0.034 (8.26)***	-0.037 (7.89)***
D4	0.001 (7.07)***	0.001 (7.99)***	0.001 (7.95)***
Expected future demography			
OLD		-0.010 (0.52)	
YNG		-0.089 (4.75)***	
OLD10			-0.083 (0.88)
OLD20			0.017 (0.11)
OLD30			0.140 (0.98)
OLD50			-0.079 (1.52)
YNG10			-0.240 (4.34)***
YNG20			0.314 (3.47)***
YNG30			-0.208 (2.04)**
YNG50			-0.089 (1.71)*
Other covariates			
SIZE	-0.023 (2.05)**	-0.0248 (2.27)**	-0.0234 (2.08)**
TAX	0.028 (2.35)**	0.0216 (1.88)*	0.0444 (3.71)***
TRADETAX	-0.126 (8.36)***	-0.1198 (8.06)***	-0.1052 (6.66)***
PRIVATE	-0.034 (4.00)***	-0.0317 (3.80)***	-0.0405 (4.93)***
CONTROL	-0.015 (4.34)***	-0.0162 (4.70)***	-0.0152 (4.36)***
RIGHTS	-0.003 (3.53)***	-0.0025 (3.35)***	-0.0020 (2.55)**
CIVIL	0.002 (1.43)	0.0014 (1.42)	0.0022 (2.15)**
SCHOOL	0.036 (3.21)***	0.0332 (3.01)***	0.0271 (2.38)**
CONSTANT	0.031 (2.35)**	0.0415 (3.37)***	0.0439 (2.91)***
Observations	1823	1823	1802

Absolute value of z statistics in parentheses

** significant at 10%; ** significant at 5%; *** significant at 1%*

FGLS estimation with country-specific AR(1)-process and heteroskedasticity.

17 region dummies included.

Table 3: Regression results with interactions of expected future demography*CMI

Dependent variable: NET CAPITAL OUTFLOWS			
	SPEC 2b CMI=SIZE	SPEC 2c CMI=CONTROL	SPEC 3c CMI=SIZE
Present demography			
D1	-1.006 (5.47)***	-1.088 (6.22)***	-1.280 (5.92)***
D2	0.308 (6.79)***	0.334 (7.75)***	0.389 (7.25)***
D3	-0.030 (7.06)***	-0.033 (8.11)***	-0.038 (7.69)***
D4	0.001 (6.80)***	0.001 (7.89)***	0.001 (7.69)***
Expected future demography			
OLD	0.025 (0.47)	-0.057 (2.38)**	
YNG	-0.196 (5.67)***	-0.149 (4.35)***	
OLD10			-0.094 (0.40)
OLD20			-0.231 (0.65)
OLD30			0.284 (0.88)
OLD50			0.0004 (0.00)
YNG10			-0.164 (1.51)
YNG20			0.515 (2.96)***
YNG30			-0.526 (2.64)***
YNG50			0.025 (0.26)
Expected future demography (interacted with CMI)			
OLDi	-0.065 (0.77)	0.080 (2.47)**	
YNGi	0.307 (4.12)***	0.073 (2.16)**	
OLD10i			-0.058 (0.16)
OLD20i			0.745 (1.23)
OLD30i			-0.488 (0.92)
OLD50i			-0.128 (0.71)
YNG10i			-0.088 (0.38)
YNG20i			-0.682 (1.79)*
YNG30i			0.948 (2.03)**
YNG50i			-0.289 (1.38)
Observations	1823	1802	1802

Absolute value of z statistics in parentheses.
** significant at 10%; ** significant at 5%; *** significant at 1%*
FGLS estimation with country-specific AR(1)-process and heteroskedasticity.
17 region dummies, SIZE, TAX, TRADETAX, PRIVATE, CONTROL, RIGHTS, CIVIL, and SCHOOL included (not reported).

try now. Therefore, it is likely that the $OLD...$ variables are highly correlated with the present demography variables. Furthermore, since tomorrow's elderly are already born today, there will not be much news in the projections about their numbers in 30 or 40 years. Variation will mainly stem from improvements in longevity. Thus, it is not surprising that significant effects can be found only for expected changes in relative youth dependency in this study.
In Specifications 2b and 3b, I include the interactive terms of capital market imperfections and anticipation measures in the regressions. I also estimate Specification 2 using the capital control variable in the interactive term (Specification 2c). Fig 3 shows the results: The existence and nature of the capital market imperfections determines how anticipation alters international capital flows. If there are capital controls in place, then the simple anticipation effect is reversed, as can be seen from the reverse sign of YNG and $YNGi$ in Specification 2b. The reason is the argument raised in section 3.1: If the capital market is closed, then anticipation does not help much, since capital cannot be invested abroad. Thus, the $CONTROL$ variable is a discrete indicator, of whether capital markets are open or not.
On the other hand, the size of the domestic variable measures, how well developed the domestic capital market is and *how* open the domestic capital market is. The more developed the market is, the more it will attract foreign, and domestic capital and net capital outflows will decline. At the same time, if the capital market is very well developed and open to foreign investors, then anticipation does not play a large role. If capital were perfectly mobile, then we should not observe anticipation effects, since capital could be reallocated at any point in time. Therefore, anticipation effects become weaker, the more integrated the capital market is. The results for $YNGi...$ in Specifications 2b and 3b show that there is evidence supporting this hypothesis in the data, and again, the effects are significant for (interacted) anticipated changes in youth dependency only.
On the basis of these results, the inclusion of anticipation effects in analyzing the link between demographic change and international capital flows appears to be crucial. The anticipation effects found in this paper are non-negligible and depend upon the degree of capital market imperfections. Even more, the results for present demography become more precise, when anticipation effects are included. Accounting for anticipation effects is necessary to understand the timing of the effects of demographic change. The timing will affect capital returns as well as other economic developments in a complex way.
This analysis provides evidence that savings and investment patterns today adapt not only to present but also to expected future demographic changes. Especially economic forecasts should therefore incorporate these effects into their simulation models, and model capital mobility carefully since it does not only affect international capital flows directly, but also indirectly via its interrelation with anticipative behavior.

5.3 Financial sector and other explanatory variables

An increase in the size of the financial sector leads to a small decrease in net capital outflows which is significant in all specifications. Since *SIZE* is a measure of how developed the financial sector of a country is, a larger size renders the domestic financial market place more attractive for foreign investors and may also absorb a higher share of national capital.
On contrary, high taxes on income and capital gains (relative to total revenues), measured by the TAX variable, make capital outflows more likely. Capital outflows become more attractive since lower taxes are levied upon the returns abroad. The opposite holds for taxes on international trade ($TRADETAX$) which are highly statistically significant: They include import duties, profits of export or import monopolies, exchange profits, and exchange taxes. All these components hamper not only goods, but also capital mobility. The results clearly show that their effect is asymmetric and hampers capital outflows more than inflows.
The same result holds for the capital control variable ($CONTROL$). Explicit restrictions and regulations of capital flows decrease the volume of capital invested abroad.
A final indicator of the intensity of national capital market activities is the variable $PRIVATE$, a proxy for the role of private investors in the national capital market. The hypothesis, that an active involvement of private players in the capital market goes along with less market regulation and more competition and thus more capital imports, is supported by the results, that show a clearly significant negative effect on capital exports.
The two variables $CIVIL$ and $RIGHTS$ coarsely capture general political risk, and the security of property rights as well as the rule of law. The results for $RIGHTS$ confirms the conjectures from section 4.4. The significant negative coefficient for $RIGHTS$ in all specifications implies that the stronger political rights, the higher is the tendency towards being a capital importer. I cannot find robust evidence of a significant relationship between civil rights and net capital flows.
At last, I include $SCHOOL$ in the empirical model. The results show that the demographic effect still exists, even when controlling for changes in human capital, or labor productivity. Furthermore, the better the evolution of human capital, the more capital outflows occur. This effect stems from the labor productivity increasing effect of schooling which translates into higher savings rates and higher net capital outflows.

6 The demographic effect in selected countries

This section is designated to further illustrate the importance of demographic effects on international capital flows. For that purpose, I present in and out

of sample projections of the effect of the demographic variables on net capital outflows. The purpose of this section is not to present a forecast of future net capital flows. I simply calculate the predicted net capital outflows induced by demography only. Thus, all explanatory factors other than present and future demography are neglected for a moment, i.e. all other covariates are set to zero. Thus, this section should be viewed as a thought experiment to illustrate the demographic effects for some selected countries.

Figure 5 illustrates the relative differences in youth and old age dependency rates between 1960 and 2000. The results are surprising: cross country differences in old age dependency were not very large before 2000, but are projected to become substantial afterwards - in some countries, old age dependency will more than double. The differences in the relative age structure before 2000 are mainly driven by large differences in youth dependency. Even after 2000, fertility is projected to play an important role in defining the differences in age structure across countries.

Figure 6 shows the projected demographically induced net capital outflows resulting from Specification 1 with present demography only, and Specification 3a which includes present demography as well as anticipation effects. The comparison of the relative dependency ratios and the predicted net capital outflows illustrates the regression results from Section 5. The cross-country comparison of the levels of demographically induced capital flows shows that in 1960, age differences resulted mainly from differences in youth dependency. Countries with a low relative population share of young people like Canada, Sweden, Argentina and Japan, for example, display demographically induced capital outflows. In 2020, countries with a relatively high share of young people like the US and Sweden will tend to be capital importers.

The demographic effects on capital flows can be illustrated very well over time, too. For example, Argentina's old age dependency will change little relative to the rest of the world, while its relative youth dependency will increase substantially. Hence, Argentina becomes younger in relative terms and will import more and more capital flows over time. The projected demographically induced capital flows in Figure 6 shows exactly this pattern. Brazil's relative youth dependency on contrary will decrease and its old age dependency is roughly flat over time, such that it tends to turn from a net capital importer to an exporter.

In general, the decline in youth dependency in European and other OECD countries like Japan is relatively moderate compared to the decline in less industrialized countries like Brazil, China and India. Hence, in terms of youth dependency the former are aging less than the latter. This demographic counter-movement of the two groups becomes more and more pronounced after 2000, so that capital exports of the European countries tend to shrink since the differences in youth dependency dominate the differences in relative old age.

Figure 5: Relative youth and old age dependency rates, selected countries, 1960-2050

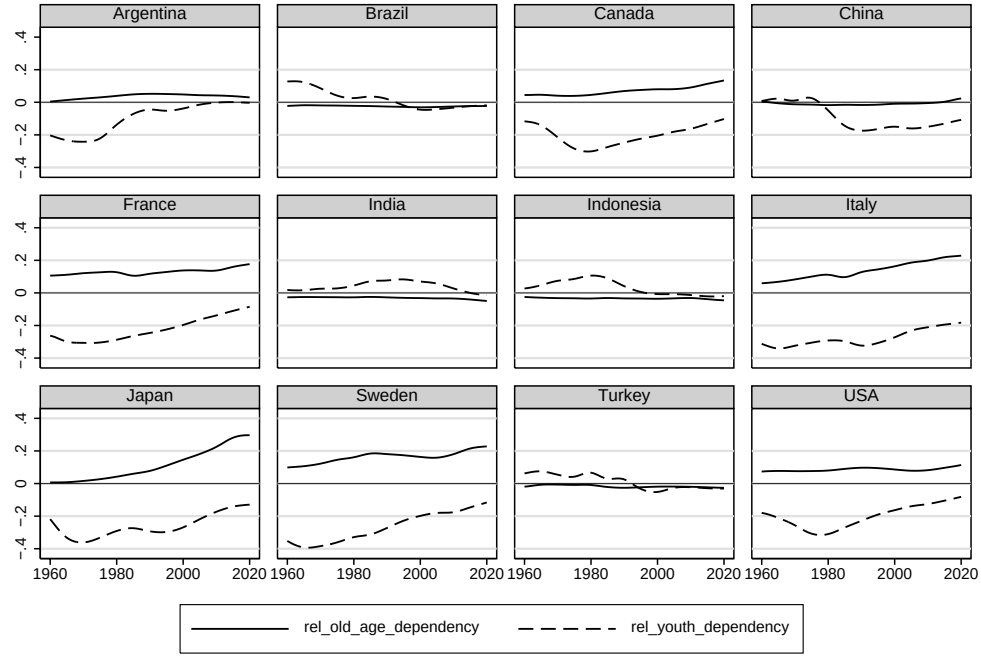
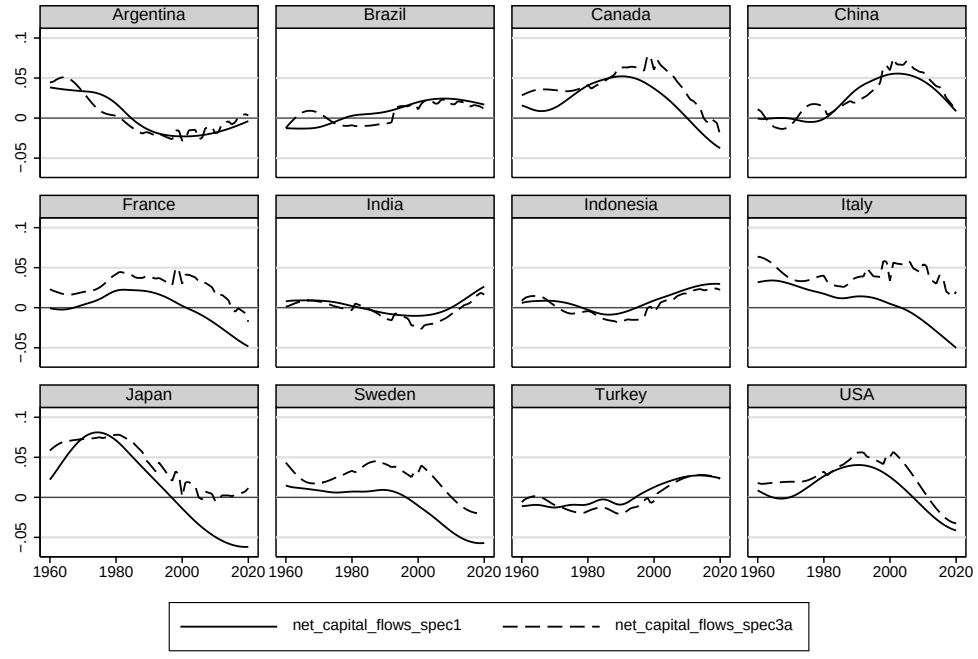


Figure 6: Demographic effects on net capital outflows, predictions of the pure demographic effects, 1960-2020



The effects of future demography are also visible: First, they become obvious when comparing the results of the two different specifications in Figure 6. Second, while relative youth dependency is increasing steadily after 1980, the increase in relative old-age dependency will begin only around 2010. This increase is anticipated and thus, capital exports are already starting to decline around the year 2000, i.e. before 2010.

Table 4 illustrates the quantitative importance of demographic effects. Following the representation of Higgins (1998), I calculate the 'demographic swings': For a given period, the demographic effect on a country's net capital outflows can be calculated as the demographically-induced deviations from the average net capital outflows over this period [8]. The difference between these demographic effects at two points in time is the demographic swing - the demographically induced change in net capital outflows. I calculate the swings between 1996 and 1970 for two specifications: specification 1 which contains present demography only, and specification 2a, which also incorporates anticipation effects.

Table 4: Demographic effects with and without anticipation effects, 1970 vs. 1996, selected countries

	with anticipation specification 2a	without anticipation specification 1
Argentina	-1.63%	-1.87%
Brazil	7.27%	6.17%
Canada	8.60%	7.00%
China	9.07%	7.64%
France	5.52%	4.39%
India	2.60%	2.07%
Indonesia	3.79%	3.04%
Italy	3.16%	1.80%
Japan	-2.47%	-3.33%
Sweden	4.14%	2.87%
Turkey	6.32%	5.30%
USA	8,36%	6,96%

The results show that the effects are quantitatively non-negligible, and that the demographically induced capital flows are larger in many of the selected countries when anticipation is taken into account. As an extreme case, the USA experienced a marked increase of net capital outflows, amounting to 6.96 per cent of GDP in 1996 compared to 1970. When anticipation effects are also accounted for, the demographically induced changes in net capital outflows total to 8.36 per

[8] This is the sum of the product of (i) the deviations of the age shares from their country-specific means, and (ii) the corresponding age share coefficients from the regression.

cent of GDP. However, even in other countries, the difference of the demographic swings between the two specifications is around 1 percentage point.

7 Conclusion

Demographic change has a profound impact on international capital flows. Economies with a relatively young age profile attract foreign capital from the aging countries due to the widening demographic gap. The strongest effect is found for the working age population.

The contribution of this paper is to provide empirical evidence of demographic anticipation effects on international capital flows. Future demographic changes are reflected in capital accumulation and investment outcomes today. In particular, future declines in youth dependency rates are associated with anticipative capital outflows. Additionally, the paper shows that these anticipation effects hinge upon the degree of international capital mobility and the development state of the domestic market. These findings emphasize the dynamic nature of the link between demographic changes and economic outcomes.

Demographic effects are quantitatively non-negligible and will become increasingly important during the next decades due to the unprecedented aging process in the developed world and the large demographic heterogeneity across world regions. It is important to identify demographic and non-demographic determinants of capital flows at times of global capital market integration and an upswing of cross-border transactions. Knowledge about the factors driving these capital flows is also crucial in policy-making. As an example, these factors play a key role in the perspectives of partially funded pension systems, since their design determines where the additionally accumulated capital will be invested. International capital flows also provide a mechanism to dissolve demographic pressure on domestic capital returns in aging economies that shift to a partially funded pension system.

An even more intuitive political field for application are the development and design of capital market structures and the role of institutional investors that can help channel domestic savings to foreign capital markets while providing for diversification of country-specific risks.

This paper shows that international capital flows are able to mitigate the negative economic consequences of the population age mismatch in the developed world by reducing the demographic pressure on capital returns in domestic markets. This mechanism has beneficial impacts on young developing countries as well since it provides them with the additional capital supply that is urgently needed.

In terms of policy implications, this mutual benefit can be strengthened by improvements in the international financial infrastructure, and thus enhancements in international capital mobility.

Appendix

A The construction of the demographic variables

This section describes how the demographic variables are transformed. The basic idea is that demography matters only in terms of relative differences to other countries. This should be reflected in the demographic variables.
First, I calculate the weighted sum of population age shares in the *rest of the world*. The weights are the average population sizes $POPAVG$ between 1960 and 1997 of each country.
In the next step, I calculate the population shares of each age group j in the *rest of the world* from the perspective of country i at time t, $FORPOP_{ijt}$:

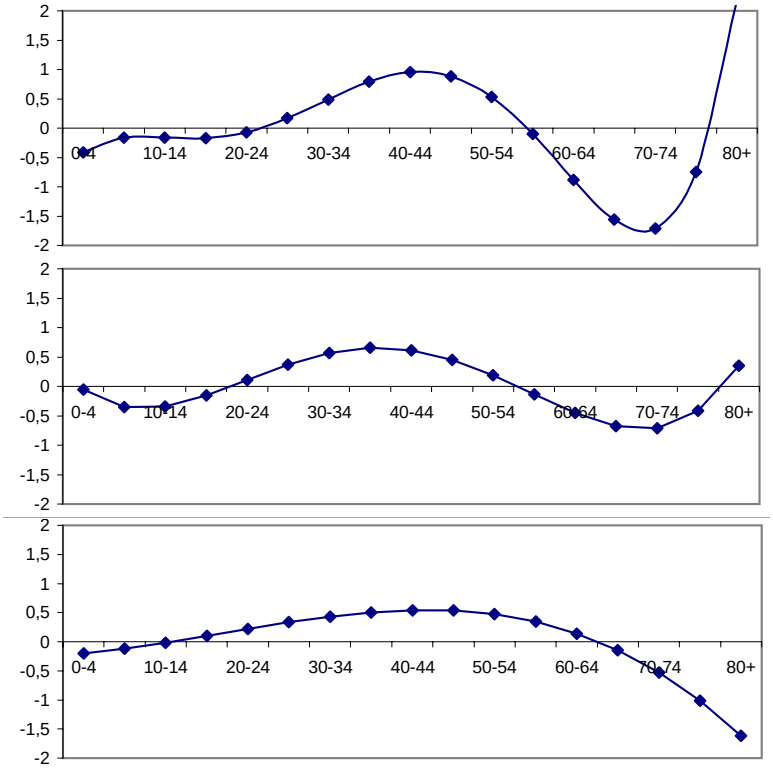
$$FORPOP_{ijt} = \frac{\sum_{k \neq i}^{K} d_{kjt} * POPAVG_{kj} - d_{ijt} * POPAVG_{ij}}{\sum_{k \neq i}^{K} POPAVG_{kj} - POPAVG_{ij}},$$

where d_{ijt} is the share of age group j in the population of country i at time t. The final step consists of taking the difference between the demographic variable in country i and in the rest of the world ($FORPOP_{ijt}$). The resulting variable $RELPOP_{ijt}$ represents the relative difference in the share of age group j between country i and the *rest of the world* at time t. The same procedure is applied to the dependency rates.

B Robustness checks concerning the order of the polynomial

In order to check whether the polynomial of the present demography, described in section 4.2, is properly specified, I also estimate polynomials of third and fifth order. However, generally, choosing a high-order polynomial is unproblematic, because all lower order polynomials are nested in this specification. As can be seen in Figure 7, the third order polynomial is obviously too inflexible and does not model the demographic effects properly. The fifth-order polynomial displays a high sensitivity at the ends of the polynomial function. Thus, the fourth-order specification seems to be most suitable for analyzing demographic effects.

Figure 7: Estimated current age share coefficients: specification using a) a fifth order, b) a fourth order, and c) a third order polynomial structure



C Sensitivity analysis: Including lagged GDP growth in the regressions

Table 5: Regression results for specifications 1 and 2

Dependent variable: NET CAPITAL OUTFLOWS			
	SPEC 1	SPEC 2a	SPEC 2b
Present demography			
D1	-1.026 (5.52)***	-1.173 (6.38)***	-0.999 (5.39)***
D2	0.307 (6.81)***	0.355 (7.80)***	0.312 (6.75)***
D3	-0.029 (7.14)***	-0.034 (8.08)***	-0.030 (7.06)***
D4	0.001 (6.95)***	0.001 (7.82)***	0.001 (6.84)***
Expected future demography			
OLD		-0.009 (0.51)	0.035 (0.65)
YNG		-0.104 (5.26)***	-0.219 (6.65)***
OLD*SIZE			-0.081 (0.99)
YNG*SIZE			0.333 (4.72)***
Other covariates			
SIZE	-0.025 (2.26)**	-0.025 (2.30)**	-0.035 (3.20)***
TAX	0.032 (2.64)***	0.028 (2.35)**	0.024 (2.06)**
TRADETAX	-0.115 (7.26)***	-0.119 (8.06)***	-0.114 (7.29)***
PRIVATE	-0.030 (3.62)***	-0.030 (3.80)***	-0.027 (3.49)***
CONTROL	-0.014 (3.89)***	-0.015 (4.36)***	-0.014 (4.14)***
RIGHTS	-0.003 (3.38)***	-0.003 (3.30)***	-0.002 (2.94)***
CIVIL	0.001 (1.09)	0.001 (0.83)	0.002 (1.53)
SCHOOL	0.035 (3.12)***	0.031 (2.73)***	0.034 (3.06)***
GROWTH(t-1)	-0.053 (3.12)***	-0.056 (4.41)***	-0.056 (4.67)***
CONSTANT	0.026 (1.87)*	0.039 (2.84)***	0.035 (2.48)**
Observations	1804	1804	1804

Absolute value of z statistics in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*
FGLS estimation with country-specific AR(1)-process and heteroskedasticity.
17 region dummies included.

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