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Remittances and Public Finances: Evidence from Oil-Price Shocks

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Abstract

We study the effect of inflowing remittances – a major source of capital for many countries – on tax-revenues and tax-policy. Instrumenting remittances with changes in the oil-price interacted with a country's distance to oil-producing countries, we find that remittances have a large positive effect on VAT revenues but no effect on income-tax revenues. This suggests that remittances often escape the income tax but can be taxed via consumption. We further show that tax policy is responsive to shocks in incoming remittances: remittances make the adoption of VAT-systems more likely, and they lead to lower VAT-rates and higher income-tax rates.

JEL Classification: F24, H20, O23.

Keywords: Remittances, Tax revenue, Tax policy, Value added tax, Personal income tax, Migration, Development.

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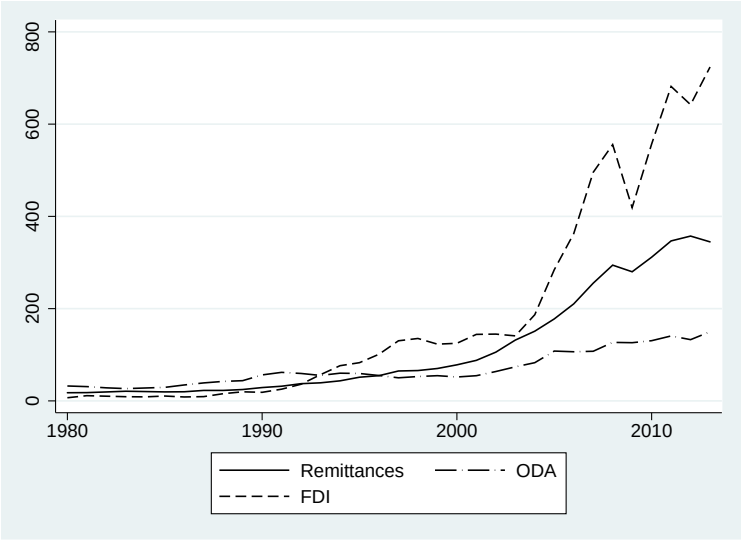
1 Introduction

International migration is a strongly increasing global trend. According to the United Nations, the number of migrants increased from 175 million people in 2000 up to 232 million in 2013. This trend is accompanied by a steady increase of money transfers from these migrants to their home countries, so called remittances. Figure 1 depicts that remittances are of vital economic importance for low and middle income countries and continuously gained importance over the last three decades. In 2013, total remittances flows into low and middle income countries stood at 345 billion USD, which is more than twice the amount of official development aid (ODA) and approximately half the inflow of foreign direct investments (FDI). These large monetary inflows affect micro- and macroeconomic outcomes in the receiving countries. For example, the literature has demonstrated that remittances affect the quality of governance (Ahmed 2012; Ahmed 2013; Berdiev et al. 2013), financial sector development (Giuliano and Ruiz-Arranz 2009; Aggarwal et al. 2011), exchange rate regimes (Singer 2010), international competitiveness (López et al. 2008; Acosta et al. 2009) and schooling decisions (Edwards and Ureta 2003; Alcaraz et al. 2012; Ambler et al. 2015).[1]

Despite their enormous importance, little research exists on the relevance and impact of inflowing remittances for public finances of receiving countries. In this paper, we aim to fill this gap. We study how remittances affect tax revenues and tax policy in receiving countries. In particular, we address two interrelated research questions. First, we estimate the effect of remittances on the level and structure of tax revenues. Figure 2 is indicative that there is a link between inflowing remittances and tax revenue; remittances are positively correlated with the share of VAT/sales-tax revenue and negatively correlated with the share of income-tax revenue. Second, to examine whether such changing patterns of tax revenue also affect tax policy, we investigate how value added (VAT) and/or personal income (PIT) tax rates respond to shocks in the inflow of remittances. We also study if remittances affect the likelihood of VAT adoption and if the progressivity

[1]The net effect of remittances on aggregate output is not clearly established empirically. The economic relevance of remittances and the relevant literature are surveyed in Yang (2011). A more detailed literature review is in section 2.

Figure 1: Remittances flows into low and middle income countries



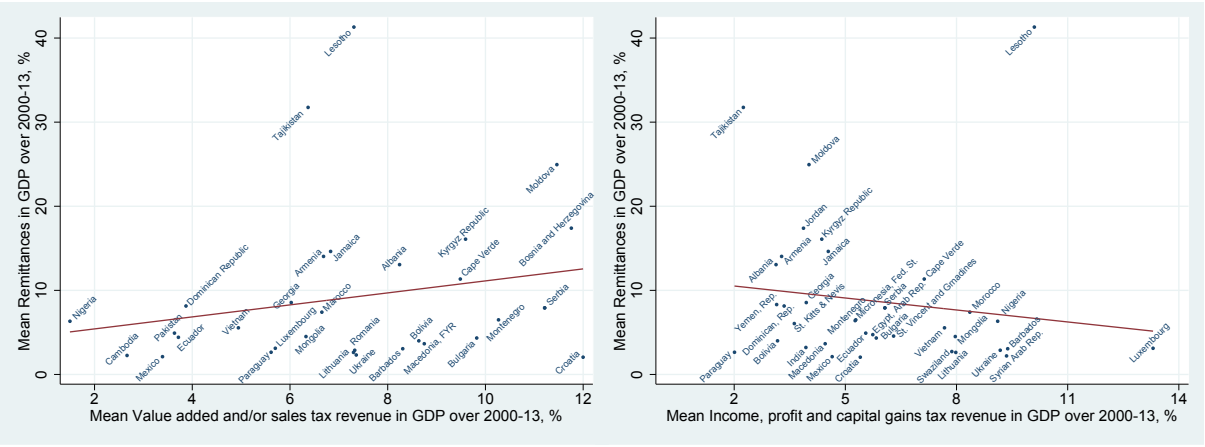
Notes: Remittances inflows to low and middle income countries (according to World Bank definition) compared to FDI inflows as well as official development assistance and official aid. All variables measured in billions of current USD. Source: World Bank.

of the income tax is responsive to variation in inflowing remittances.

Remittances are of particular economic importance for non-developed countries. At the same time, it is well known that a functioning tax system and solid public finances are crucial for the development of countries (Keen 2013; Besley and Persson 2014). Studying the link between public finances and remittances is therefore particularly relevant for non-developed countries and a better understanding of economic development of poorer countries. If remittances foster the power to tax, an attribute at the heart of state development (Besley and Persson 2014), they may help to improve the provision of public goods as well as the tax system. Therefore, one potential implication for development policy might be that sending remittances to the home country should be facilitated and even incentivized. Our research questions are also relevant for the importance of choosing an optimal tax mix and structure. The design of the tax structure can have a positive effect on economic growth even in absence of changes in tax revenues (Arnold et al. 2011; Gordon and Li 2009), and our results shed light on the effects of remittances on the choice of tax structure.

Remittances depend on many factors that also matter for tax revenues and tax

Figure 2: Remittances vs. VAT/sales and income taxes in 2000-13



(a) Value added and sales tax

(b) Income, profit and capital gains taxes

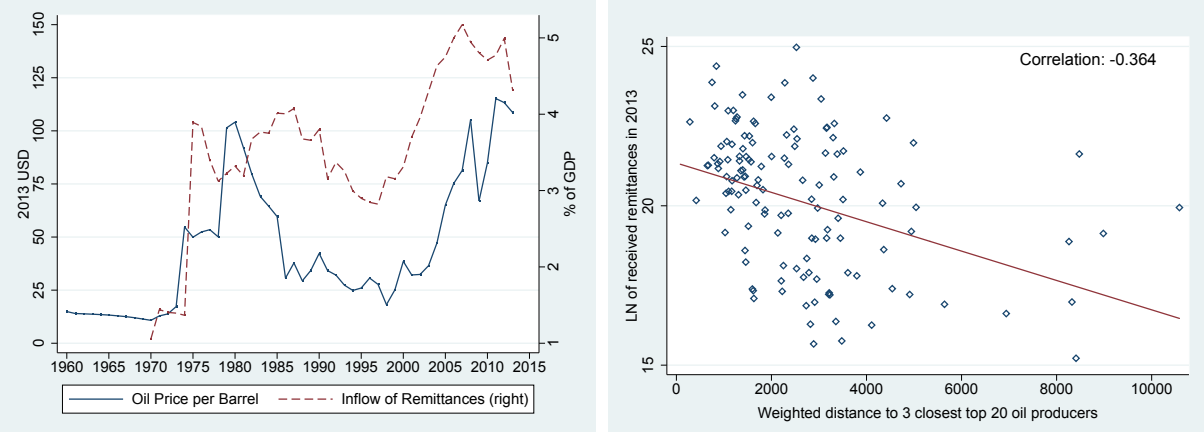
Notes: Data on remittances comes from the World Bank. The source of tax-revenue data is International Center for Tax and Development. Both variables are averaged over the period 2000-13. The sample includes all countries with average inflow of remittances higher than 2% of GDP.

policy. We address this endogeneity and isolate the causal effect of remittances. Our identification strategy exploits the fact that a large share of remittances to developing countries is sent from migrants working abroad in oil-producing countries. According to data from 2013, the top 20 oil producing countries generated about 47% of total outgoing remittances.[2] We instrument remittances with changes in the world-wide price of oil interacted with a country's (weighted) distance to its three nearest oil-producing countries. The rationale behind this instrument is that (i) the oil-price affects wages and employment and, hence, remittances of migrants working in oil-producing countries, and (ii) that remittances are more likely to be affected by the price of oil the closer a receiving country is to an oil-producing country. Figure 3 provides visual evidence of the first-stage correlation; the annual evolution of average incoming remittances indeed closely follows the development of the oil price and received remittances are inversely related to the distance to oil-producing counties. The identifying assumption in our empirical approach is that the oil price has no differential effect on public finances – our dependent variable – on countries that are closer or further away from oil producers; except for the differential

[2]Data on estimated flows of bilateral remittances shows that the geographical distribution of countries receiving remittances from these top 20 oil producers is quite dispersed. In 2013 well over one hundred countries have received at least one hundred million USD in remittances from these countries.

effect through remittances. This instrument generates plausibly exogenous variation in remittances over time and across countries, and overcomes problems of endogeneity.[3]

Figure 3: Evidence for first stage correlation



(a) Remittances and the price of oil

(b) Remittances and distance to oil producers

Notes: Price of oil per barrel in 2013 USD compared to unweighted average of incoming remittances as a share in GDP. The sample includes all countries for which data on remittances is available from the World Bank.

Our empirical findings show that remittances have a large and persistent effect on revenues generated from VAT and sales taxes. A 10%-point increase in the share of remittances in GDP increases the share of VAT/sales-tax revenue in GDP by approximately 3%-points. We do not find a significant effect of remittances on income-tax revenues. The effect on total tax revenues is not significant either. Our findings hence suggest that remittances tend to escape the income tax but can be taxed via consumption. We then go on and examine how governments' tax policy responds to shocks in remittances. The empirical results demonstrate that higher inflows of remittances increase the likelihood of introducing a VAT system. We further find that remittances lead to lower VAT rates, whereas personal-income-tax rates are increased in response to increased remittances. In particular, an increase in remittances/GDP by 10%-points approximately increases the personal-income-tax rate by 13%-points and decreases the standard VAT rate by 6%-points. Our results also show that the level of progressivity of the income-tax system is

[3]This identification strategy is similar to the one used in Ahmed (2013) who explores the effect of remittances on quality of governance. We exclude oil producers from our analysis because their public finances are obviously directly affected by shocks in oil prices. Acemoglu et al. (2013) use the global oil price interacted with local oil reserves as a source of variation to instrument for local-area income.

increased through increasing remittances.

The remainder of the paper is structured as follows: Section 2 describes the possible mechanisms behind the effect of remittances on tax revenues and tax rates, and discusses the related literature. Section 3 explains our empirical strategy. In section 4 we present the results and section 5 concludes.

2 Mechanisms and contribution to the literature

In this section, we first discuss possible mechanisms behind the effects of remittances on tax revenues and tax policy; it therefore provides conceptual guidance to our empirical analysis. The second subsection then presents a detailed literature review with a focus on the most closely related papers.

2.1 Conceptual discussion of mechanisms

Remittances and tax revenues. We expect remittances to have differential effects on income-tax revenue and indirect-tax revenue. It is difficult for governments to enforce the taxation of remittances through income taxes because remittances are hardly reported for income-tax purposes and governments are not able to track received remittances. As a consequence, only few countries tax remittances directly through the income tax.[4] This would suggest that the impact of inflowing remittances on income-tax revenue in the receiving country is small (positive) or zero.

However, remittances might have indirect effects on income-tax revenues. For example, inflowing remittances may facilitate entrepreneurial activities (Yang 2008) and in turn lead to higher (taxable) income-tax revenues (Woodruff and Zenteno 2007). In contrast to this positive effect, "Dutch disease" problems may imply that remittances have a negative effect on revenues from direct taxes. Inflowing remittances, just as any

[4]Remittances are often transmitted in cash (through mailed envelopes) or via untraceable bank transfers. Freund and Spatafora (2005) estimate informal remittances to amount to approximately 35-75% of official flows. A 2005 Worldbank survey demonstrates that only 5 out of 40 developing and transition countries imposed a tax on remittances. While Columbia and Peru did so via a financial transaction tax, Ecuador taxed remittances via the VAT. Poland and Georgia taxed remittances via the income tax (de Luna Martinez 2005).

other inflow of capital, may cause appreciations of the real exchange rate, and therefore a loss of external competitiveness (Amuedo-Dorantes and Pozo 2004; López et al. 2008). This loss of competitiveness, potentially accompanied by negative labor-supply responses (e.g., Jadotte and Ramos 2015), can reduce direct-tax revenues. In light of these different channels, the theoretical total net effect of remittances on direct-tax revenues is ambiguous.

Remittances are likely to be used for consumption purposes; while some received remittances might also be saved, improving living conditions of family and friends at home through providing them with higher consumption possibilities is often the aim of senders of remittances (Abdih et al. 2012). If remittances are channeled into consumption, they should have a positive effect on revenues from indirect taxes.

These theoretical considerations for the effect of inflowing remittances on tax revenues from indirect and direct taxes make us expect that remittances have a larger effect on indirect-tax revenues than on income-tax revenues. Section 4.1 presents the empirical findings with regard to the effect of remittances on tax revenues.

Remittances and tax-policy response. Remittances may trigger a policy response in the form of altered tax rates. This policy response could work through different channels. First, governments may wish to tax migration or remittances directly. Although direct taxation of migration is a longstanding proposal (Bhagwati 1972), administrative obstacles make it very difficult to be implemented in practice; remittances are usually not reported for tax purposes and are therefore difficult to be taxed directly via the income tax. However, because remittances are to a great extent channeled into private consumption, it might be desirable for governments to tax remittances indirectly through consumption taxes. As a result, positive shocks in remittances – which make the existence of remittances more salient to policy makers – may motivate governments to introduce VAT systems or increase existing indirect-tax rates in order to capture more of the pie of remittances.

Second, a possible remittance-induced positive effect on tax revenues may motivate

policy makers to use this improved scope of public finances and reduce tax rates; for example to stimulate the economy. This channel suggests a negative effect of remittances on tax rates. Third, huge inflows of remittances may have "Dutch disease" effects and reduce labor supply, and therefore cause a tax-policy response. In order to restore competitiveness and increase labor supply, governments may want to reduce direct (labor) taxes, such as income, profit or payroll taxes. To keep the direct-tax-rate reduction revenue neutral, this could be accompanied by an increase of indirect taxes (VAT or sales taxes).

Fourth, the effect of inflowing remittances on tax rates has to be considered in the light of large informal sectors in developing countries (see e.g., Schneider et al. 2010).[5] On the one hand, higher inflowing remittances may have a positive effect on indirect-tax revenues. This in turn allows governments to reduce indirect-tax rates in order to reduce the incentives to work in the informal economy. On the other hand, Aggarwal et al. (2011) show that higher inflowing remittances improve financial development, partly because bank accounts are required to receive remittances. This increased presence of bank accounts facilitates the enforcement of income taxes; something which is often very difficult in the cash-based economies of developing countries. Facilitation of income-tax enforcement may allow governments to install a more balanced mixture of indirect and direct tax rates – which is difficult when income taxes cannot be enforced. As a result, more inflowing remittances could increase income-tax rates. To sum up, efforts to reduce the shadow economy and improve the possibilities of enforcing the income tax might imply that inflowing remittances have a negative effect on indirect-tax rates and a positive effect on direct-tax rates.

Finally, if receivers of remittances are clustered in certain parts of the income distribution, governments might want to change the redistributive nature of the tax system. For example, if middle-class families have better possibilities to send out workers to other countries than low-class families, governments could correct for this by increasing the

[5]As discussed in Gordon and Li (2009), large informal sectors are a considerable problem and potentially have a strong effect on the choice of the tax structure in developing countries. This, for example, implies that the VAT, which is usually regarded as efficient, may not be the preferred tax instrument in developing countries (Emran and Stiglitz 2005).

progressivity of the income tax.

The mechanisms described above show that it is eventually an empirical question of whether and how remittances affect tax policy. Our empirical findings in this regard are presented in section 4.2.

2.2 Relevant literature

A large body of literature studies both the micro- and macroeconomic consequences of remittances. Microeconomic research demonstrates that remittances reduce poverty (e.g. Adams and Page 2005), improve education (e.g. Alcaraz et al. 2012; Ambler et al. 2015), and foster financial development (e.g. Aggarwal et al. 2011). Evidence concerning the macroeconomic effects of remittances is inconclusive. While remittances have been considered as a facilitation of external financing constraints and thus a source of investment for developing countries, they might also trigger Dutch disease phenomenons such as real exchange rate appreciation and, eventually, a weakening of international competitiveness (López et al. 2008; Acosta et al. 2009). The evidence on the effect of remittances on output growth is also mixed, with some studies showing a positive influence on growth (Giuliano and Ruiz-Arranz 2009) while others do not find such effects (Yang 2011). Singer (2010) finds that inflowing remittances affect exchange-rate regimes, and hence provides evidence that policy in receiving countries is responsive to incoming remittances. Moreover, recent research demonstrates that remittances also have detrimental effects on the institutional quality of receiving countries (Abdih et al. 2012), as they can weaken governance by increasing levels of corruption (Ahmed 2012; Ahmed 2013; Berdiev et al. 2013) and crowd out public spending on education and health (Ebeke 2012).

Despite this active literature on remittances, to the best of our knowledge there are only a few studies which study the fiscal implications of remittances. Ebeke (2014) studies whether remittances increase the level and the stability of tax revenue ratios (tax revenue divided by country GDP), and whether these effects depend on the presence of a VAT system. The empirical results indicate that inflowing remittances lead to higher and less volatile tax revenue ratios when VAT systems are present. We aim to complement this

paper by exploring the effect of remittances on the tax mix, i.e. on tax revenue generated through direct and indirect taxes, as well as their effect on VAT and PIT rates. In addition, while Ebeke estimates conditional correlation that make a causal interpretation difficult, we use an identification strategy that yields arguably more reliable results.

Abdih et al. (2012) consider the fiscal implications of remittances and study the impact of remittances on government revenue for 17 remittance-dependent countries in the Middle East, North Africa, Central Asia, and the Caucasus. The paper estimates a positive effect of inflowing remittances on different types of tax revenues. In some of their specifications, Abdih et al. (2012) instrument remittances with the level of income in the sending country. However, given that income in sending countries might impact tax revenues in receiving countries not only via remittances, it remains unclear if their results can be attributed a causal meaning. As opposed to our study, Abdih et al. (2012) do not examine the effect of remittances on tax policy and tax rates.

Singer (2012) explores, among other issues, how remittances affect government spending and total tax revenues. His regressions show a positive association between remittances and government expenditures, and his further analyses reveal that this result can partly be explained by a positive effect of remittances on total tax revenues. The latter finding is derived in regressions where remittances are instrumented by the per capita GDP of the ten top remittance-sending countries of the world weighted with the inverse of the distance of each country to the remittance-receiving countries in his sample. In contrast to our paper, Singer (2012) neither studies the effects on different types of tax revenues nor the effects on tax policy.

3 Empirical strategy

Regression equation of interest. We aim to estimate the causal effect of remittances flowing into a country on the country's structure of tax revenue and on the PIT and VAT rates. The regression equation of interest is given by:

$$Y_{i,t} = \beta R_{i,t} + \alpha \mathbf{X}_{i,t} + \lambda_i + \phi_t + \mu_{i,t}, \tag{1}$$

where $R_{i,t}$ is remittances (as a share of GDP) flowing into country i in year t. $Y_{i,t}$ is either one of the following dependent variables: (i) total tax revenue (as a share of GDP), (ii) tax revenue generated from VAT and sales taxes (as a share of GDP), (iii) tax revenue generated from income, profit and capital gains taxes (as a share of GDP), (iv) a dummy variable indicating whether a country i has a VAT system in year t, (v) standard VAT rate, (vi) marginal and average PIT rate, and (vii) a measure for the PIT system's progressivity. $\mathbf{X}_{i,t}$ is a set of control variables to control for economic (logged GDP, GDP growth, logged exchange rate) and demographic (logged population, population growth and share of working age population) conditions. As in e.g. Ahmed (2013), we include a set of country fixed effects, λ_i, and a linear year trend, ϕ_t. $\mu_{i,t}$ is a standard error term. Our coefficient of interest is β, the effect of remittances on the respective dependent variable Y.

Endogeneity. Estimating equation 1 using OLS would likely yield biased results for the effect of remittances. For example, the decision to migrate and send home remittances is often driven by the economic conditions and earnings possibilities in the home country. At the same time, economic conditions and earnings possibilities are likely to have an effect on tax revenue and tax rates, our dependent variables. It is unclear if the country fixed effects and control variables can fully account for these sources of endogeneity. Issues of reverse causality may also play a role if workers decide to migrate because they find the tax system in their country inappropriate (e.g., too high taxes) or unfair. Another source of bias is non-random measurement error; it may be that poorer countries with less tracking capacities are more likely to mis-measure inflows of remittances (Ahmed 2013). Although we collect the most common and most reliable of all existing data (the data are described in detail below) and use country fixed effects, which should partly absorb this bias, it remains unclear if all sources of bias due to measurement error can be eliminated.

Instrument and first stage. Our empirical strategy to mitigate these problems of endogeneity is to exploit sources of variation in remittances that are not related to the error term $\mu_{i,t}$ in equation 1. Motivated by the strategy of Ahmed (2013) and Acemoglu et al. (2013), we instrument for remittances with the interaction of the world-wide price of oil and the weighted distance of a country to the three nearest oil-producing countries.[6] This instrument generates variation over time – via the oil price – and across countries – via the distance to oil producing countries. Our first stage regression reads:

$$R_{i,t} = \delta(p_{t-1} \times d_i) + \alpha^{'}\mathbf{X}_{i,t} + \lambda_i^{'} + \phi_t^{'} + \epsilon_{i,t}, \tag{2}$$

where p_{t-1} is the global oil price in year $t-1$ (varies over time but not across countries), and d_i is population-weighted distance from country i to the three nearest oil-producing countries (varies across countries and not over time). All other variables are as defined in the second-stage equation 1. We use the lag of oil price to account for lagged translation of the oil price to remittances.

The motivation for our instrument is twofold: First, it is observed that many migrants work in oil-exporting countries, and their wages are affected by the global price of oil. Since remittances are likely to be a function of the migrant's wage, we expect the oil price to affect remittances. Figure 3, as well as the supportive evidence documented in Ahmed (2013), shows that remittances received by poor countries closely track the price of oil. Second, remittances to countries close to oil producers are more likely to be affected by oil-price changes than remittances to countries that are further away from oil producers. Migrants are likely to emigrate to countries close to their home country, and if the neighboring countries happen to be oil producers received remittances are more affected by the oil price. This line of argument is supported by figures in Ahmed (2013) as well as Figure 3, which shows that countries receive more remittances if they are located closely to oil producers.[7] To summarize, our instrument exploits the differential impact

[6]We only study the effect of inflowing remittances in countries that are non-oil producers. The top-20 oil-producing countries are as follows: Algeria, Brazil, Canada, China, Indonesia, Islamic Republic of Iran, Iraq, Kazakhstan, Kuwait, Libya, Mexico, Nigeria, Norway, Qatar, Russian Federation, Saudi Arabia, United Arab Emirates, United Kingdom, United States of America, and Venezuela.

[7]Singer (2012) is a further example stating that migrants are more likely to settle in countries closer

of oil prices between countries in which the oil price is a stronger or weaker determinant of inflowing remittances.

The main coefficients of the first-stage regressions are displayed in tables 1 and 2. The estimates for the effect of our instrument, oil-price times distance, on remittances are statistically significant and have the expected sign; an increase in the instrument has a positive effect on inflowing remittances. We can therefore confirm the rationale behind using this instrument. The tables also shows that the F-statistics of excluded instruments are mostly around 7, and therefore sometimes smaller than the benchmark value of 10. However, as discussed in Angrist and Pischke (2008, page 209) and Angrist and Pischke (2009), weak instruments are not a problem in just-identified models: as long as the first-stage coefficient is not zero, a weak instrument does not bias the coefficient of interest in the just-identified case. Any problems with too weak instruments in just-identified models are mirrored in the standard errors of the second-stage but they do not cause the second stage to be biased.

Identifying assumption. The identifying assumption of our empirical strategy is that the instrument – oil price interacted with distance to oil producers – affects our dependent tax-system variables only through remittances. In general, we acknowledge that the oil price is likely to have a direct effect on public finances and tax rates in remittance-receiving countries. However, we argue that it is unlikely that public finances of countries closer or further away from oil producers are differently affected by oil-price shocks. For example, some countries subsidize oil and an increasing oil price might therefore force these countries to increase taxes. Now consider two comparable countries: both subsidize oil in the same way, and one of them is located closely to oil-producing countries and the other one is further away. Our identifying assumption would be violated if an increasing oil price creates different budgetary pressure on these two countries. Since both these countries face the same global oil price and subsidize oil in the same way, we find it implausible that our identifying assumption is violated and that the budgetary effects of

to their home country.

the oil price on these two countries will be different. However, since the country closer to the oil producer is likely to receive more remittances from oil producing countries because more workers migrated from the closer country to oil producers than from the country farther away, it is likely that the increasing oil price has a larger effect on remittances sent to the country located more closely.

We take several additional steps to further back the validity of our instrument and support the identifying assumption: First, we exclude all countries from our empirical analysis which are oil producers because their tax systems are very likely to be directly affected by changes in the oil price. Second, we follow Ahmed (2013, page 1170) and argue that "because the world price of oil is largely determined by supply decisions in oil producers and demand conditions in large (industrialized and rich) economies, it provides a plausibly exogenous source of variation in remittance flows that is unrelated to the economic, political, and social conditions in remittance-receiving countries." Third, we condition on economic conditions and population size. It appears unlikely that, absent any oil prices, our dependent tax-system variables would have developed differently across countries with similar economic conditions and population sizes that are further away or closer to oil producers.

Fourth, we eliminate any time-constant factors that affect both the IV and the dependent variables by including a full set of country fixed effects. That is, we only exploit within-country variation over time and eliminate all potentially confounding factors that are constant over time. For example, countries closer to an oil producer may be more likely to have a trade agreement with oil-producing countries than countries further away. The country fixed effects account for this unless the oil price affects the implementation of new trade agreements differently for countries further or closer away from oil producers during our sample period. However, as trade agreements are subject to long negotiations and they should not be affected by short-run variation in oil prices.

Data and summary statistics. The data on remittances comes from the World Bank and is generally computed by using data on personal transfers and compensation of em-

ployees from balance of payments statistics. The latter is the income earned by workers in economies where they are not resident (or from nonresident employers) and transfers is from residents of one economy to residents of another. Although some cross-country heterogeneity may exist in the quality of data, the general expectation is that these figures are likely to underestimate the true amount of remittances because a good share of these payments are done through informal channels (Freund and Spatafora 2005; Freund and Spatafora 2008). The data on total tax revenue and its structure comes from the International Center for Tax and Development. This is based on harmonized data collected from different sources, including IMF Government Finance Statistics, IMF country reports, OECD tax statistics, African economic outlook, CEPALSTAT, etc., and seems to be the largest available cross-country data on tax revenues. The source of VAT and PIT rates is the World Tax Indicators dataset made available by the Andrew Young School of Policy Studies (Peter et al. 2010). After merging together these different datasets we get an unbalanced panel data of up to 129 countries for a maximum period starting from 1970 to 2013. Table A1 of the appendix presents the summary statistics and sources of the variables used in the paper.

4 Results

4.1 The effect of remittances on tax revenue

Conditional correlations. As a first step, we directly regress remittances on the receiving country's tax revenue controlling for several economic and demographic covariates and including country and year fixed effects as specified in Equation 1. The estimation results are collected in Table A2 of the appendix. Columns 3-4 of Table A2 demonstrate a positive correlation between the inflow of remittances-to-GDP and share of VAT and sales tax revenue in GDP. Symmetrically, columns 5-6 show that remittances are negatively correlated with the share of revenue from income taxes. We find no evidence of a

statistically significant net effect on total tax revenue (columns 1-2).[8]

These results are consistent with our theoretical predictions, however, as described above, these OLS results may be biased due to different sources of endogeneity. Therefore the remainder of this sub-section is devoted to more credibly identifying the causal effects of remittances.

Instrumental variable approach. Table 1 collects the main results from a 2SLS estimation. The first stage is presented in the lower panel of Table 1 which shows that the main instrument – which is constructed from the multiplication of the price of a barrel of crude oil and population-weighted distance to the closest three oil producing countries – is a strong predictor of remittances.

The second-stage estimates presented in the upper panel of Table 1 demonstrate a statistically significant effect of remittances on VAT and sales-tax revenue (columns 3-4). The effect is also economically large with a 10 percentage point increase of remittance to GDP on average increasing VAT and sales tax revenue to GDP by 3 percentage points. Neither the effect on total tax revenues (columns 1-2) nor on revenue generated from the income tax (columns 5-6) are statistically significant.

4.2 The effect of remittances on tax policy

This section reports the results for the effect of remittances on tax policy, i.e., the introduction of VAT system as well as VAT and PIT rates and progressivity. As discussed in Section 2: remittance-dependent countries may directly try to tax remittances, they may indirectly internalize this factor into their decisions related to tax policy and tax administration, or tax policy may respond to the remittance-induced changes in the respective tax bases.

[8]Note that due to the varying data-availability of the dependent variable, the sample sizes of Table A2 vary. We have estimated the regressions of Tables A2 and 1 fixing the sample on the smallest one of column 3, and found robust results.

Table 1: 2SLS estimations: Remittances and the structure of tax revenue in GDP

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Total tax revenue		VAT and sales tax		Income, profit & capital tax	
	t	*t+1*	*t*	*t+1*	*t*	*t+1*
Remittances / GDP	0.350	0.325	0.335**	0.295**	0.202	0.161
	(0.320)	(0.283)	(0.156)	(0.147)	(0.200)	(0.179)
Ln population	-1.739	-2.461	0.759	0.726	7.259**	6.594**
	(4.670)	(4.354)	(3.571)	(3.064)	(3.571)	(3.237)
Population growth	-0.406	-0.727	-0.007	-0.153	-0.541	-0.611
	(0.638)	(0.631)	(0.222)	(0.223)	(0.439)	(0.435)
Working age population	0.196	0.186	-0.269*	-0.240	0.124	0.157
	(0.212)	(0.207)	(0.161)	(0.146)	(0.123)	(0.111)
Ln exchange rate	0.198	0.223	0.319***	0.291***	-0.472**	-0.416**
	(0.403)	(0.369)	(0.093)	(0.081)	(0.203)	(0.185)
Ln GDP	-1.775	-2.114	1.578	1.203	0.167	-0.167
	(1.928)	(1.926)	(1.498)	(1.304)	(1.290)	(1.208)
GDP growth	-0.007	0.005	-0.007	-0.014	-0.013	0.025
	(0.029)	(0.031)	(0.024)	(0.022)	(0.018)	(0.017)
Inflation	-0.000**	-0.000*	-0.001***	-0.000**	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
F	8.110	5.476	14.46	15.78	8.863	10.05
First-stage	Remittances / GDP					
Oil price x distance (t-1)	1.025***	1.061***	1.016**	1.170**	1.112**	1.201***
	(0.374)	(0.379)	(0.428)	(0.486)	(0.436)	(0.461)
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,440	1,417	914	904	1,115	1,095
R-squared	0.107	0.107	0.161	0.154	0.092	0.084
Countries	84	84	64	64	72	72
F excl. instrument	7.38	7.72	5.5	5.64	6.37	6.66

*** p<0.01, ** p<0.05, * p<0.1.

Notes: 2SLS regression results based on empirical strategy described in section 3. The dependent variables are (all as shares of GDP): Total tax revenues (1)-(2), Tax revenue from VAT and sales taxes (3)-(4), Tax revenue from income, profit and capital taxes (5)-(6). The explanatory variable of interest is inflowing remittances as a share of GDP. This explanatory variable of interest is instrumented with *Oil price x distance*, which indicates the population-weighted distance to the closest three oil producing countries times the international price of oil. All regressions include country fixed effects (FE) and a linear time trend (not reported). First-stage regressions include all control variables of the second-stage (not reported). Standard errors are robust to heteroscedasticity and are clustered at the level of countries. Data sources described in section 3.

Conditional correlations. We, again, begin the analysis with simple OLS estimations where we regress tax-policy parameters on remittances controlling for several variables and country and year fixed effects. The results are collected in Table A3 of the appendix, where the dependent variable is a dummy for the introduction of a VAT system (columns 1-2), standard VAT rate (3-4), the average (5, 7) and marginal (6, 8) PIT rates, or the

level of progressivity of the income-tax system (9-10). This exercise shows that the inflow of remittances are correlated with an increased likelihood of introducing a VAT, but does not yield robust evidence on the relation between remittances and receiving country's tax rates.

Instrumental variable approach. In Table 2 we use our main 2SLS specification to test the causal effect of remittances on tax-policy parameters. As before, we see a very robust positive effect of the oil×distance instrument on remittances in the first-stage. In the second stage, we first find evidence that a positive shock in remittances increases the likelihood of having a VAT system (columns 1 and 2). We further observe a negative effect of remittances on (existing) standard VAT rates in column 4 where we control for the share of VAT and sales tax revenue. Given the positive relation between VAT revenue and remittances that we saw before, it seems that the VAT rate is played down (up) when governments realize that revenues from this source are increasing (decreasing). Such additional "windfall" revenues may give a leeway to the government to try, for example, and stimulate the economy by relaxing the tax burden.

The remainder of Table 2 is devoted to PIT rates, which in columns 5 and 7 (6 and 8) is defined as the average (marginal) tax rate for income equivalent to a country's per capita GDP adjusted for the main allowances, deductions, credits, and other main rules of the tax code. In these estimates we consistently find a positive response of income tax rates to increased remittances. Governments also significantly increase the overall level of progressivity of the income-tax system; these results are reported in columns 9-10.

Table 2: 2SLS estimations: Remittances and tax policy response

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	VAT introduction		VAT rate standard		PIT rate average	PIT rate marginal	PIT rate average	PIT rate marginal	Rate progression average	Rate progression marginal
Remittances / GDP	0.291**	0.319**	-0.349	-0.605*	1.134**	1.526*	2.226	3.026*	0.003*	0.005**
	(0.148)	(0.155)	(0.263)	(0.357)	(0.552)	(0.791)	(1.421)	(1.641)	(0.002)	(0.003)
VAT and sales tax		-0.063		0.940***						
		(0.088)		(0.312)						
Income, profit & capital tax							0.206	0.365		
							(0.271)	(0.444)		
Ln population	-1.679	-1.518	3.304	0.749	16.93***	19.07***	7.760	-9.954	0.032	0.031
	(1.681)	(2.059)	(4.704)	(5.091)	(5.165)	(7.218)	(12.513)	(16.729)	(0.021)	(0.035)
Population growth	0.101	0.111	-0.098	-0.275	-0.226	-0.914	-2.282**	-3.916**	-0.003*	-0.001
	(0.089)	(0.098)	(0.282)	(0.337)	(0.328)	(0.579)	(1.038)	(1.628)	(0.002)	(0.002)
Working age population	-0.115	-0.130	0.178	0.299	0.274	0.305	0.235	0.363	0.000	-0.000
	(0.072)	(0.091)	(0.277)	(0.318)	(0.257)	(0.382)	(0.451)	(0.587)	(0.001)	(0.001)
Ln exchange rate	0.041	0.061	0.327	0.148	-0.102	0.061	-0.162	0.469	0.000	0.000
	(0.061)	(0.065)	(0.248)	(0.222)	(0.274)	(0.344)	(0.448)	(0.530)	(0.001)	(0.001)
Ln GDP	1.278	1.378	-3.436*	-3.597	6.396**	9.502**	7.734**	13.253**	0.007	0.007
	(0.879)	(0.999)	(2.033)	(2.448)	(2.582)	(4.183)	(3.738)	(5.652)	(0.010)	(0.019)
GDP growth	-0.021**	-0.023**	0.018	0.020	0.024	0.071	0.061	0.039	0.000	-0.000
	(0.010)	(0.011)	(0.030)	(0.040)	(0.033)	(0.058)	(0.071)	(0.107)	(0.000)	(0.000)
Inflation	-0.000	-0.000	-0.001***	-0.000	-0.002	-0.001	0.005	0.007	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.003)	(0.006)	(0.006)	(0.000)	(0.000)
F	1.300	2.057	48.85	18.72	1.874	2.003	2.976	4.293	3.752	1.692
First-stage	Remittances / GDP									
Oil price x distance (t-1)	0.620*	0.620*	1.031**	0.800**	1.051***	1.051***	0.762***	0.762***	1.051***	1.051***
	(0.317)	(0.317)	(0.442)	(0.338)	(0.228)	(0.228)	(0.252)	(0.252)	(0.228)	(0.228)
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	867	867	836	836	1,653	1,653	744	744	1,653	1,653
R-squared	0.121	0.121	0.169	0.226	0.098	0.098	0.085	0.085	0.098	0.098
Countries	60	60	61	61	116	116	62	62	116	116
F excl. Instrument	3.73	4.26	5.29	5.45	20.88	20.88	8.86	8.86	20.88	20.88

*** p<0.01, ** p<0.05, * p<0.1.

Notes: 2SLS regression results based on empirical strategy described in section 3. The dependent variables are: (1)-(2): a dummy indicating whether a country has a VAT system, (3)-(4): standard VAT rates, (5)-(8): PIT rates, and (9)-(10): a measure for the degree of income-tax progressivity. The explanatory variable of interest is inflowing remittances as a share of GDP. This explanatory variable of interest is instrumented with *Oil price x distance*, which indicates the population-weighted distance to the closest three oil producing countries times the international price of oil. All regressions include country fixed effects (FE) and a linear time trend (not reported). First-stage regressions include all control variables of the second-stage (not reported). Standard errors are robust to heteroscedasticity and are clustered at the level of countries. Data sources described in section 3.

5 Conclusion

In this paper, we study the effect of remittances on tax revenues and tax rates. Instrumenting inflowing remittances with an interaction of the global oil price and a country's

distance to oil producers, we find that remittances increase value-added-tax and sales-tax revenue, and have no significant effect on direct tax revenues. This result is consistent with our prediction that remittances are difficult to tax through income taxation, but can be captured through their effect on consumption. The estimated impact is also sizable with, on average, around a three-to-one effect of remittances on VAT and sales tax revenue. This may help to shed light on the issue of why low and middle income countries are so dependent on indirect taxes, as opposed to high-income countries.

Regarding the effect of remittances on tax policy, we find that increasing remittances are associated with decreasing VAT rates and increasing PIT rates, as well as a slight increase in income-tax progressivity. We also find that inflowing remittances make the adoption of VAT systems more likely. Considering the conceptual discussion in section 2.1, this finding lends support to the interpretation that policy makers in remittances-receiving countries aim at taxing remittances through consumption taxes and use the extra indirect tax revenues from remittances to reduce VAT rates in order to foster participation in the formal economy. In addition, more remittances lead to a more improved financial sector (Aggarwal et al. 2011), hence facilitate the enforcement of income taxes, and give governments the opportunity to increase income-tax rates in order to achieve a more balanced mix of income and indirect tax rates. Our results are therefore in line with recent literature of Gordon and Li (2009), who show in a theoretical framework that non-sufficient financial information is a crucial predictor for the prevailing tax structures in developing countries and the low rates of direct taxes.

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Appendix

Table A1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Source
Dependent variable:						
Remittances / GDP, %	4,883	3.88	7.86	0.00	106.48	WDI
Tax revenues:						
Total tax revenue / GDP, %	2,299	20.49	9.03	0.43	58.73	ICTD
VAT and/or sales tax / GDP, %	1,406	6.63	2.99	0.00	26.93	ICTD
Income, profit and capital gains tax / GDP, %	1,896	9.35	5.93	0.06	31.16	ICTD
Tax rates:						
VAT introduction dummy	7,276	0.39	0.49	0	1	WTI
Standard VAT rate, %	2,616	15.71	5.14	2.00	35.00	WTI
PIT rate, average	2,903	6.86	9.47	0.00	52.29	WTI
PIT rate, marginal	2,903	11.60	14.48	0.00	78.09	WTI
PIT rate progression, average	2,903	0.04	0.03	0.00	0.14	WTI
PIT rate progression, marginal	2,903	0.05	0.04	0.00	0.18	WTI
Controls:						
Log population	11,427	14.79	2.38	8.36	21.03	WDI
Population growth, %	11,419	1.85	1.67	-10.96	19.60	WDI
Share of working age population, %	10,389	58.59	6.86	44.90	85.81	WDI
Log nominal exchange rate to USD	9,183	1.53	4.51	-30.14	10.13	WDI
Log GDP	8,218	23.23	2.39	16.59	30.30	WDI
GDP growth, %	8,259	3.96	6.93	-64.05	189.83	WDI
Inflation, %	8,243	36	447	-65	26,766	WDI
Instrument:						
Log crude oil price per barrel x distance	11,228	11.25	1.03	6.32	14.01	SRWE

Data sources: WDI - World Bank World Development Indicators, ICTD - International Center for Tax and Development, WTI - Andrew Young School World Tax Indicators, SRWE - British petroleum Statistical Review of World Energy, WITS - World Bank World Integrated Trade Solutions, WPP - United Nations World Population Policies

Table A2: OLS estimations: Remittances and the structure of tax revenue in GDP

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Total tax revenue		VAT and sales tax		Income, profit & capital tax	
	t	*t+1*	*t*	*t+1*	*t*	*t+1*
Remittances / GDP	-0.062	-0.030	0.058**	0.058*	-0.049***	-0.034**
	(0.056)	(0.041)	(0.025)	(0.030)	(0.017)	(0.016)
Ln population	-0.707	-1.913	-0.335	-0.278	4.108	2.742
	(3.731)	(3.673)	(2.280)	(2.222)	(3.621)	(3.574)
Population growth	-0.097	-0.349	0.115	-0.033	-0.158	-0.219
	(0.460)	(0.424)	(0.132)	(0.132)	(0.352)	(0.366)
Working age population	0.351**	0.307*	0.058	0.034	0.184	0.195*
	(0.173)	(0.178)	(0.066)	(0.067)	(0.120)	(0.118)
Ln exchange rate	0.102	0.117	0.254***	0.213***	-0.411**	-0.312**
	(0.313)	(0.275)	(0.082)	(0.069)	(0.164)	(0.156)
Ln GDP	-2.657*	-2.841*	0.031	0.025	0.809	0.483
	(1.598)	(1.661)	(0.747)	(0.747)	(1.378)	(1.346)
GDP growth	0.004	0.022	0.018	0.001	0.007	0.026*
	(0.018)	(0.019)	(0.015)	(0.014)	(0.017)	(0.014)
Inflation	-0.000**	-0.000**	-0.000	-0.000	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,670	1,640	1,073	1,056	1,349	1,321
R-squared	0.200	0.200	0.394	0.381	0.156	0.152
Countries	99	99	76	75	87	86
F	20.14	26680	1.925e+06	2238	1190	41.90

*** p<0.01, ** p<0.05, * p<0.1.

Notes: OLS regression results based on Equation 1. The dependent variables are (all as shares of GDP): Total tax revenues (1)-(2), Tax revenue from VAT and sales taxes (3)-(4), Tax revenue from income, profit and capital taxes (5)-(6). The explanatory variable of interest is inflowing remittances as a share of GDP. All regressions include country and year fixed effects (not reported). Standard errors are robust to heteroscedasticity and are clustered at the level of countries.

Table A3: OLS estimations: Remittances and tax policy response

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	VAT introduction		VAT rate standard		PIT rate average		PIT rate marginal		Rate progression average	Rate progression marginal
Remittances / GDP	0.018***	0.017***	-0.006	-0.037	0.082	0.163*	-0.217	-0.133	0.000	0.001
	(0.004)	(0.004)	(0.027)	(0.030)	(0.054)	(0.086)	(0.154)	(0.193)	(0.000)	(0.001)
VAT and sales tax		0.021**		0.382***						
		(0.010)		(0.128)						
Income, profit capital tax							0.199	0.341		
							(0.166)	(0.293)		
Ln population	-2.526***	-2.524***	3.803	3.498	19.57***	24.38***	15.88**	4.332	0.048***	0.052*
	(0.312)	(0.313)	(3.152)	(2.911)	(4.803)	(6.742)	(7.816)	(10.309)	(0.018)	(0.030)
Population growth	0.047	0.045	-0.133	-0.213	-0.049	-0.547	-1.199***	-2.508***	-0.002	-0.001
	(0.043)	(0.042)	(0.179)	(0.194)	(0.225)	(0.448)	(0.434)	(0.786)	(0.001)	(0.002)
Working age population	0.014	0.013	0.018	-0.021	0.287	0.392	0.704**	1.111**	0.000	-0.001
	(0.017)	(0.017)	(0.111)	(0.116)	(0.179)	(0.262)	(0.333)	(0.486)	(0.001)	(0.001)
Ln exchange rate	0.028	0.023	0.349	0.279	0.058	0.057	-0.799*	-0.634	-0.000	-0.000
	(0.019)	(0.018)	(0.269)	(0.264)	(0.114)	(0.202)	(0.450)	(0.669)	(0.001)	(0.001)
Ln GDP	0.407**	0.403**	-2.220*	-1.971	4.312***	6.586**	5.945**	9.005*	0.005	0.005
	(0.195)	(0.190)	(1.204)	(1.241)	(1.501)	(2.681)	(2.804)	(4.619)	(0.008)	(0.015)
GDP growth	-0.001	-0.002	-0.017	-0.024	0.080***	0.149***	0.092**	0.068	0.000***	0.000
	(0.003)	(0.003)	(0.020)	(0.020)	(0.027)	(0.047)	(0.043)	(0.066)	(0.000)	(0.000)
Inflation	0.000	0.000	-0.001**	-0.001**	0.002***	0.004***	0.000	0.002*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,026	1,026	989	989	1,914	1,914	904	904	1,914	1,914
R-squared	0.538	0.542	0.392	0.424	0.277	0.218	0.423	0.404	0.150	0.067
Countries	72	72	73	73	129	129	72	72	129	129
F	1.98e+7	298597	1.78e+9	3.6e+7	4.692	3.768	9.788	12.57	4.100	1.832

*** p<0.01, ** p<0.05, * p<0.1.

Notes: OLS regressions results based on Equation 1. The dependent variables are: (1)-(2): a dummy indicating whether a country has a VAT system, (3)-(4): standard VAT rates, (5)-(8): PIT rates, and (9)-(10): a measure for the degree of income-tax progressivity. The explanatory variable of interest is inflowing remittances as a share of GDP. All regressions include country and year fixed effects (not reported). Standard errors are robust to heteroscedasticity and are clustered at the level of countries.