The Macroeconomic Consequences of Remittances*

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Abstract

This paper examines the importance of borrowing constraints and the distribution of asset ownership in determining the effects of remittance inflows. Using an open economy DSGE model where heterogeneous households face binding credit constraints, we show that the aggregate response of the economy depends critically on the interaction between the distribution of remittances across households and their ownership of capital (or lack of it). An increase in remittances accruing to households with no ownership of capital has a contractionary effect on the economy, while the reverse holds true when households with capital are the principal recipients. The ability of remittances to smooth business cycle shocks depends critically on their distribution across heterogeneous households. When credit constraints are binding, remittances explain a significantly larger fraction of the variation of key macroeconomic variables, relative to when they are not binding. Using data for El Salvador, we show that the model specification with binding credit constraints performs better in matching the key moments and correlations in the data, relative to a specification where they are absent. The welfare consequences of the distribution of remittances and credit constraints are also analyzed.

Keywords: Remittances, credit constraints, labor supply, output investment, consumption, welfare.

JEL Classification: F24, F41, O11

*We are grateful to Bill Lastrapes and Julio Garin for constructive comments on an earlier draft. Chatterjee acknowledges financial support from the Terry-Sanford Research Award and the Office of the Provost at the University of Georgia.

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1 Introduction

Remittances have become an increasingly important channel through which wealth is transferred across the world, as migrant workers and immigrants repatriate portions of their earnings back to their home countries. Over the last two decades these flows have grown remarkably, currently representing the second-largest flow of capital across the world (after FDI), and accounting for almost a third of all international capital flows (Yang, 2011). As such, remittances represent a critical component of both household and national budgets, as they free up scarce domestic resources that can be allocated to consumption, investment, and other expenditures. These inflows assume even more importance in environments where recipients otherwise have limited access to domestic credit markets, or where such markets are not well developed. The objective of this paper therefore is to examine the mechanism through which remittances are absorbed by households that receive them and, how, in turn, these allocation decisions affect the macro-dynamic adjustment of recipient economies.

Table 1 below shows the average share of remittances and private-sector credit in GDP for (i) countries divided into geographical sub-groups and (ii) the top-15 remittance-recipient countries for the period 1995-2010. Irrespective of geographical sub-division, remittances account for a significant proportion of national incomes, with a range between 7-11% of GDP. For the top-15 remittance recipients, however, these flows represent almost 20% of GDP. On the other hand, the average share of private credit in these countries is about 33%. By comparison, the average private credit-to-GDP ratio in high-income countries during this period was about 87%. The relatively large share of remittances and low share of private-sector credit in GDP underscores the importance of understanding how these variables interact to affect resource allocation decisions.

TABLE 1. Remittances and Private Sector Credit (share of GDP), 1995-2010

	Rem/GDP	**Credit/GDP**
Latin America	0.079	0.444
Sub-Saharan Africa	0.093	0.281
Middle East and North Africa	0.108	0.505
Europe and Central Asia	0.109	0.331
East Asia	0.104	0.441
South Asia	0.068	0.281
Top-15 Remittance Recipients	0.197	0.339

Source: The World Bank

A priori, however, the transmission mechanism through which remittances work into household allocation decisions is difficult to predict. On the one hand, remittances, by relaxing borrowing constraints, might lower the marginal utility of wealth and cause an increase in the consumption of all normal goods, including leisure. This may have adverse consequences for investment and capital accumulation. On the other hand, they may alter the relative price of investment goods, causing an increase in labor supply and capital accumulation. More importantly, the relative magnitudes of these effects may depend critically on the distribution of asset-ownership across households. In other words, credit-constrained households who have no ownership of capital may react very differently to an inflow of remittances relative to households who own capital.

Given the sheer magnitude of remittance flows to developing countries, their economic impact has naturally become an important area of research. However, there is little consensus among economists on the usage and absorption of remittances at the household level. While Durand et al. (1996), Brown and Ahlburg (1999), and Combes and Ebeke (2011) find that remittances primarily finance household consumption, Woodruff and Zenteno (2007), Yang (2008), Bansak and Chezum (2009), and Alcaraz et al. (2012) find that remittances are used for financing investments, mainly in education and entrepreneurship. Recent evidence from household survey data collected by the Development Prospects Group of The World Bank further underscore this ambiguity. For example, household survey data from The World Bank's Africa Migration project indicates that between 18-50% of remittances were used for business investment in 2009. On a similar vein, Adams and Cuecuecha (2010) document a reduction in expenditure on non-durables and an increase in expenditures on durables for remittance-receiving families in Guatemala. On the other hand, Acosta et al. (2008) survey a larger group of Latin American countries to find that this pattern shows a lot of variation both across and within countries, especially when one controls for geography (rural versus urban) and distributional issues. These surveys, though limited in their coverage, seem to indicate that there is significant variation in the usage of remittances across recipients (households or countries) which, in turn, might lead to very different macroeconomic outcomes.

We argue in this paper that in the presence of binding borrowing constraints, the distribution of ownership of assets such as capital plays an important role in determining how remittance inflows are channeled into economic activity. Specifically, we consider two types of households facing binding credit constraints in a small open-economy: those that own physical capital (and thereby firms), called *entrepreneurs*, and those that have no ownership of capital, and derive their income solely from supplying labor, called *wage earners*. We show that with this specification, remittances accruing to entrepreneurs expand aggregate

economic activity, by increasing investment and the demand for labor. By contrast, when wage earners are the principal recipient of remittance inflows, aggregate economic activity *contracts*, driven by a decline in labor supply, which in turn lowers the return on investment. In general, the distribution of remittances across households who are either entrepreneurs or wage earners matters for its aggregate effects when credit constraints are binding: the larger the remittance-share of wage earners, the more contractionary is the economy's dynamic response (and vice-versa). This effect holds irrespective of whether the remittance inflow is permanent or temporary in nature. We also consider the case where remittances may be counter-cyclical in nature, with inflows increasing upon the realization of a negative productivity shock in the recipient country. Here, we show that the larger the share of remittances that accrue to entrepreneurs, the more muted are the effects of a negative productivity shock on output, investment, and labor supply. In other words, the ability of remittances to smooth business cycles depends critically on their distribution between entrepreneurs and wage earners.[1]

To emphasize further the role played by credit constraints, we examine an alternative specification of the baseline model where such constraints are absent, with all agents having unrestricted access to capital markets. The dynamic response generated by this specification in response to a remittance shock is in sharp contrast to that generated in our baseline specification with credit constraints. Now, when wage earners receive remittances, there is no change in output, investment, and labor supply. The entire remittance flow is absorbed through an instantaneous increase in consumption of wage earners. When entrepreneurs are the principal recipients, the economy expands, but the responses of consumption and the current account are opposite to those with the presence of credit constraints. The responses of output, investment, and labor supply are also smaller than those generated in the presence of binding credit constraints. In general, we find that when credit constraints are absent, remittances explain a remarkably smaller fraction of the variation in key macroeconomic variables, relative to when these constraints are present. This result holds irrespective of which group of agents (wage earners or entrepreneurs) receives the remittances.

We also examine the welfare effects of remittances by calculating the amount of extra consumption that must be allocated to a specific group of agents (entrepreneurs or wage earners) when they are *not* the principal recipient of a remittance inflow, in order to make

[1] Another potential channel through which remittances might be absorbed is expenditures on housing and real estate. Several studies provide anecdotal evidence on the importance of remittances for local housing markets; see Saenz (2007), Ratha and Mohapatra (2007), and Serageldin and Guerra (2008). However, data on real estate prices, investment, rental rates, etc., in remitance-receiving countries are not systematically available. This prevents a meaningful quantitative analysis of the link between remittances and real estate. An alternative version of this paper with housing included in the model specification is available upon request.

them equally well off compared to when they are the principal recipients. We find that the welfare loss for a group when they are not the principal beneficiary of remittances is higher (i) for wage earners, and (ii) when credit constraints are absent. When remittance inflows are countercyclical, the magnitude of the consumption transfer is smaller relative to when they are exogenous, indicating the importance of remittances in lowering the business cycle cost of adverse productivity shocks.

The quantitative analysis in this paper is conducted at two levels. First, we establish that the parameterization of our baseline specification yields steady-state equilibrium quantities that are representative of a typical remittance-recipient country. To do so, we compare the model's solution for key macro variables both with corresponding sample averages from 77 remittance-recipient countries and for six geographical sub-groups of countries for the period 1960-2010.[2] Second, we use data from El Salvador to examine the model's fit by comparing the implied moments and correlations from the two specifications (with and without credit constraints) to their counterparts in the data. El Salvador serves as a good candidate for a representative remittance-recipient country. For example, between 1976 and 2010 (period for which remittance data is available), it received, on average, about 9.4% of its GDP in the form of remittances, and had an average private-sector credit-to-GDP ratio of about 31%, which is directly in line with the corresponding sample averages presented in Table 1.[3] We show that the model specification with credit constraints performs much better than the one without these constraints in matching the key moments and correlations in the data from El Salvador. This further underscores the importance of borrowing constraints in understanding the aggregate effect of remittance flows.

This paper contributes to a growing body of work that links remittances to the macroeconomy. For example, Acosta et al. (2009), Mandelman and Zlate (2012), Mandelman (2013), and Morshed (2014) respectively focus on the link between remittances and the Dutch Disease, cross-border migration, the responses of monetary and exchange rate policies, and debt sustainability. Our paper adds to this literature by examining an alternative, but previously ignored transmission mechanism, namely the interaction between binding borrowing constraints and the distribution of asset ownership across households. Our quantitative results are also consistent with the recent empirical findings of Guiliano and Ruiz-Arranz (2009) and Aggarwal et al. (2011), who document that remittances affect economic outcomes by relaxing liquidity constraints in countries with less developed financial systems. Finally, by highlighting the conditions under which remittance inflows can generate either

[2] The sample is restricted to countries that received, on average, at least 3% of their GDP in the form of remittances between 1960-2010. See the Appendix for more information on data sources and list of countries.

[3] Acosta et al. (2009) also use data for El Salvador for their study on remittances and the Dutch Disease.

an economic contraction or expansion, we take a step towards reconciling the ambiguity in the literature on the use of remittances.

The rest of the paper is organized as follows. Section 2 outlines the benchmark open-economy DSGE model with heterogeneous households facing binding borrowing constraints and an inflow of remittances from abroad. Section 3 presents the calibration of the benchmark model and a discussion of the steady-state equilibrium. Section 4 presents the simulation of the effects of various remittance shocks (permanent, temporary, and countercyclical). Section 5 presents an alternative specification of the model without credit constraints, Section 6 discusses the welfare analysis, and Section 7 compares the business cycle properties of the two model specifications. Finally, Section 8 concludes.

2 Analytical Framework

We consider a small open economy that produces a single traded good and is populated by two types of households. The first category of households supply labor to the production sector, but do not own any physical capital. We label these households as *wage earners*. The second category of households own physical capital (and firms), and employ labor to produce the economy's final output. These households are referred to as *entrepreneurs*. The critical aspect of the model is that *both* categories of households are (differentially) credit-constrained and receive remittance flows from abroad. Therefore, heterogeneity among households is driven by their ownership (or lack of) physical capital. For simplicity, we assume that there is no government in this economy.

2.1 Wage Earners: Owners of Labor

Households in this category, indexed by h, allocate their time between work and leisure, and choose their rate of consumption to maximize intertemporal utility over an infinite horizon:

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t U(C_t^h, l_t), \quad \beta^h \in (0,1) \tag{1}$$

where β^h is the discount factor, C_t^h is consumption, and l_t represents the total allocation of time to work. Instantaneous utility, $U(C_t^h, l_t)$ is specified as a GHH function with the usual properties:

$$U(C_t^h, l_t) = \frac{\left[\left(C_t^h\right) + \psi\left(1 - l_t\right)^{\eta}\right]^{1-\sigma}}{1-\sigma} \tag{1a}$$

The household finances any excess expenditures over income by accumulating debt through an internationally traded bond:

$$B_t^h = (1 + r_t^h)B_{t-1}^h + C_t^h - w_t l_t - \upsilon TR_t \tag{2}$$

where B_t^h denotes the stock of household debt at time t, r_t^h is the net real interest rate on debt for wage earners, $w_t l_t$ is current household labor income at the hourly real wage rate w_t, TR_t is the aggregate inflow of remittances, and $\nu \in [0, 1]$ denotes the share of this inflow received by households in this category. Wage earners do not own any physical capital and their income is derived solely from employment in the production sector and their share in aggregate remittance inflows.

Aggregate remittance flows from abroad follow an AR(1) process

$$TR_t = \chi Y_t^{-\xi} + \rho^{TR} TR_{t-1} + \varepsilon_t^{TR}, \quad \rho^{TR} \in [0, 1), \ \xi > 0 \tag{3}$$

The specification in (3) nests two possible types of remittances. First, the parameter χ is a binary variable that takes a value of 0 when remittances are purely exogenous and 1 when they are countercyclical. When $\chi = 0$, the remittance inflow is purely exogenous, with ρ^{TR} denoting its persistence and ε_t^{TR} representing an *exogenous* white-noise shock. On the other hand, when $\rho^{TR} = \varepsilon_t^{TR} = 0$ and $\chi = 1$, remittance inflows are *countercyclical* and depend on the cyclical variation in the recipient country's output. The parameter ξ measures the (countercyclical) responsiveness of remittance inflows to a change in GDP driven by a productivity shock.

We assume that the interest rate r_t^h faced by wage earners is an increasing function of their group-specific outstanding debt:

$$r_t^h = r^* + F(B_t^h - \overline{B}^h), \quad F'(.) > 0 \tag{4a}$$

where r^* is the exogenous world interest rate, and $F(.)$ is an interest rate premium which takes the following form:

$$F(.) = \varphi e^{(B_t^h - \overline{B}^h)}, \ \varphi \geq 0 \tag{4b}$$

In (4b), $\overline{B}^h$ denotes the steady-state level of debt for wage earners, and φ is a parameter that measures the sensitivity of the borrowing rate to a deviation of the current stock of debt from its steady-state level. However, in making allocation decisions, wage earners treat their group-specific interest rate, r_t^h, as exogenously given. In the steady state, as B_t^h converges to $\bar{B}^h$, the interest rate premium goes to zero and the borrowing rate converges to the world

interest rate, r^*.[4]

Wage earners also face a borrowing constraint in every period, so that they can only borrow up to a fraction m^h of their current wage income. Since households do not own any capital, and lenders typically require current income statements or collateral in the process of lending money to households, we tie borrowing to current labor income; see, for example, Ludvigson (1999):

$$B_t^h \leq m^h w_t l_t, \ m^h \geq 0 \tag{5}$$

Wage earners maximize (1), subject to (2) and (5), taking (3) and (4) as given. This leads to the following optimality conditions:

$$U_c\left(C_t^h, l_t\right) = \left(1 + r_t^h\right)\left[\beta^h E_t\left\{U_c\left(C_{t+1}^h, l_{t+1}\right)\right\} + \lambda_t^h\right] \tag{6a}$$

$$U_l\left(C_t^h, l_t\right) = -\left[U_c\left(C_t^h, l_t\right) + m^h \lambda_t^h\right] w_t \tag{6b}$$

Eq. (6a) is the Euler equation for household consumption, where λ_t^h is the shadow price associated with the credit constraint (3). When households are not credit constrained, $\lambda_t^h = 0$ and (5) is not binding. Eq. (6b) represents the marginal rate of substitution between consumption and the labor-leisure choice. The right-hand side of (6b) adjusts for the fact that when time is allocated to work, an additional benefit arises from the relaxation of the borrowing constraint, since the higher wage income enables the household to increase borrowing.

2.2 Entrepreneurs: Owners of Capital

This category of households, referred to as entrepreneurs, are indexed by e. In contrast to wage earners, they have ownership of physical capital (and therefore firms), and produce the economy's final good by using their stock of physical capital, employing labor (from wage-earners described in Section 2.1), and a standard neoclassical technology:

$$Y_t = e^{A_t} K_{t-1}^{\mu} l_t^{1-\mu}, \ \mu \in (0,1) \tag{7}$$

[4] One issue with small open economy models with a fixed world interest rate and discount factor is that the marginal utility of wealth is constrained to be a constant along the transition path, with foreign asset holdings approximating infinity. To close these models, the literature has used different strategies, ranging from an endogenous world interest rate that depends on the stock of debt or the debt-GDP ratio (Eaton and Gersovitz, 1981), an endogenous discount factor (Mendoza, 1991), transactions costs for bond-holdings, or a binding borrowing constraint; see also Turnovsky (1997) and Uribe and Schmitt-Grohe (2003). Any one of these features is sufficient to close these models.

where Y_t represents the flow of output at time t, K_{t-1} denotes the stock of physical capital inherited from the previous period, and l_t denotes the current employment of labor-hours that are supplied by wage-earners. A_t represents a stochastic productivity shock that follows an AR(1) process:

$$A_t = \rho^A A_{t-1} + \varepsilon_t^A, \quad \rho^A \in [0, 1) \tag{7a}$$

where ρ^A denotes the persistence of the productivity shock and ε_t^A is a white-noise error term. The stock of physical capital evolves according to

$$K_t = I_t + (1 - \delta) K_{t-1} \tag{8}$$

where δ is the rate of depreciation of physical capital and I_t is the current flow of private investment. We also assume that installing physical capital is a costly activity for entrepreneurs, with these costs represented by a convex adjustment cost function:

$$\Phi (I_t, K_{t-1}) = I_t + \frac{h}{2} \left(\frac{I_t}{K_{t-1}} - \delta \right)^2 K_{t-1}, \ h \geq 0 \tag{9}$$

where h is the adjustment cost parameter.

Entrepreneurs maximize utility from consumption over an infinite horizon

$$E_0 \sum_{t=0}^{\infty} (\beta^e)^t U (C_t^e), \ \beta^e \in (0, 1) \tag{10}$$

where C_t^e represents their consumption and β^e is their discount factor. The instantaneous utility function is specified as

$$U (C_t^e) = \frac{(C_t^e)^{1-\sigma}}{1 - \sigma} \tag{11}$$

Note that entrepreneurs do not face a time-allocation decision between work and leisure like wage-earners. Instead, being final goods producers, they generate a demand for labor employment. The instantaneous budget constraint for entrepreneurs is given by

$$B_t^e = (1 + r_t^e) B_{t-1}^e + C_t^e + w_t l_t + \Phi (I_t, K_{t-1}) - Y_t - (1 - \nu) TR_t \tag{12}$$

where B_t^e is their stock of debt (through the traded bond), $(1 - \nu)$ represents their share of aggregate remittances, and r_t^e is their group-specific interest rate on borrowing, given by

$$r_t^e = r^* + H(B_t^e - \overline{B}^e), \quad H'(.) > 0 \tag{13a}$$

The interest rate premium for entrepreneurs takes a form analogous to that for wage earners:

$$H(.) = \varphi e^{(B_t^e - \overline{B}^e)} \tag{13b}$$

where $\bar{B}^e$ is the steady-state stock of debt for entrepreneurs. Entrepreneurs, in making allocation decisions, treat their group-specific interest rate, r_t^e, as exogenously given. As the economy converges to its steady state equilibrium, $B_t^e \to \bar{B}^e$ and, from (4b), $B_t^h \to \bar{B}^h$, we have $r_t^h = r_t^e = r^*$.

We assume that entrepreneurs, even though they own capital and firms, are also credit constrained:

$$B_t^e \leq m^e E_t(q_{t+1}^e K_t) \tag{14}$$

where q_t^e is the shadow (market) price of capital, and m^e is the fraction of the expected market value of capital that defines the upper limit on borrowing for entrepreneurs.

A representative entrepreneur in this sector maximizes (10), subject to (12) and (14). This leads to the following optimality conditions

$$U_c\left(C_t^e\right) = \left(1 + r_t^e\right)\left[\beta^e E_t\left\{U_c\left(C_{t+1}^e\right)\right\} + \lambda_t^e\right] \tag{15a}$$

$$\frac{\partial Y_t}{\partial l_t} = w_t \tag{15b}$$

$$q_t^e = 1 + h\left(\frac{I_t}{K_{t-1}} - \delta\right) \tag{15c}$$

$$q_t^e = \left[\left(1-\delta\right)\beta^e + m^e\lambda_t^e\right] E_t q_{t+1}^e - \beta^e E_t\left[\left\{\Phi_K\left(I_{t+1}, K_t\right) - \frac{\partial Y_{t+1}}{\partial K_t}\right\} U_c\left(C_{t+1}^e\right)\right] \tag{15d}$$

where λ_t^e is the shadow price associated with the credit constraint (14). The interpretation of (15a) and (15b) is analogous to (6a) and (6b). Eq. (15c) expresses the instantaneous shadow price of capital, while (15d) describes its evolution over time.

2.3 Current Account

The aggregate resource constraint (market-clearing condition) for the economy is derived by combining the budget constraints of wage earners and entrepreneurs, given by (2) and (12):

$$B_t = (1 + r_t^h)B_{t-1}^h + \left(1 + r_t^e\right)B_{t-1}^e + C_t + \Phi\left(I_t, K_{t-1}\right) - Y_t - TR_t \tag{16}$$

where, $B_t = B_t^h + B_t^e$ denotes the aggregate stock of private sector debt, and $C_t = C_t^h + C_t^e$ is aggregate consumption, at time t. According to (16), the private sector (wage earn-

ers and entrepreneurs) accumulates debt to finance any excess expenditures (consumption, investment, and debt-servicing) over income (production and remittance receipts).

3 Calibration

Given the complexity of the baseline specification described in Section 2, we proceed to analyze it numerically. We begin by calibrating the model to derive the benchmark steady-state equilibrium. Table 2 describes the model's parameterization: the intertemporal elasticity of substitution in consumption is given by $1/\sigma$. We set $\sigma = 2.25$ to get an elasticity of 0.4, consistent with the findings of Guvenen (2006). The labor share in utility η and the parameter ψ are calibrated to yield a steady-state time allocation to labor equal to about 0.3. The annual world interest rate is set at 6%, and the credit constraint parameters m^h and m^e are calibrated to yield an aggregate private credit-to-GDP ratio of about 35%, consistent with the sample averages presented in Tables 1 and 2.[5] The capital share in production, μ, is set at 0.4 and the annual depreciation rate, δ is set at 0.1. The rates of time preference β^h and β^e are set equal to each other at 0.92 to ensure that $\beta r^* < 1$, i.e., both the credit constraints are always binding and the model is closed. The persistence parameters (ρ^A and ρ^{TR}) and standard deviations for the productivity and remittance shocks (σ^A and σ^{TR}) are similar to those estimated in Acosta et al. (2009). The benchmark specification considers the case of exogenous remittances, so that $\chi = 0$ in (3). For the specification with a countercyclical remittance shock, we set the elasticity parameter $\xi = 0.75$ in order to calibrate the initial increase in the remittance-GDP ratio to be equal to the case where there is an exogenous increase in remittances.

3.1 Steady-State Equilibrium

The first step in our numerical analysis is to ensure that the steady-state equilibrium generated by the baseline parameterization is representative of a typical remittance-recipient economy. To do this, Table 3 compares the model's implied steady-state equilibrium with the corresponding annual sample averages for 77 remittance-recipient countries, divided into six geographical sub-groups, for the period 1960-2010.[6] As can be seen from Table 3, the

[5] For the model specification with binding credit constraints, we set the interest rate premium, $\varphi = 0$, since the existence of credit constraints is sufficient to close the model. In the specification without binding credit constraints (Section 5), we set $\varphi = 0.09$ to match the equilibrium credit to GDP ratio of 0.35 obtained in the credit-constrained specification .

[6] The sample was restricted to countries that received remittances of at least 3% of GDP during 1960-2010 (on average). Please see the Appendix for more information on the data sources, list of countries in each geographical group, etc.

baseline steady-state equilibrium generated by the model is fairly consistent with the corresponding sample averages for the six remittance-receiving geographical subgroups. The model matches well the investment-output, credit-output, and remittance-output ratios. Both the capital-output and the consumption-output ratios are higher relative to their respective sample-weighted means. One possible reason for this is the absence of government spending in the model specification, which generates a higher level of household consumption and capital stock relative to GDP.[7] The shadow price of debt for both households and firms are positive (not reported), indicating that both the credit constraints are binding in equilibrium.

4 Remittance Shocks

In this section, we consider three types of shocks to remittance inflows: (i) an exogenous permanent increase, (ii) an exogenous temporary increase, and (iii) a countercyclical increase (generated by a temporary negative productivity shock). To analyze these shocks, we parameterize the specification to examine two polar cases: (i) when wage earners are the principal recipients of the remittance inflow, i.e., $v = 1$, and (ii) when entrepreneurs are the principal recipients, i.e., $v = 0$, in (2) and (12). All figures are plotted as percentage deviations from the steady-state equilibrium and all shocks represent one standard deviation changes from their baseline levels.

4.1 Permanent Shock

Figures 1 and 2 depict the dynamic response of the economy on the realization of a permanent exogenous increase in remittances. Figure 1 shows the response when wage earners are the principal recipients, while Figure 2 plots the corresponding responses when entrepreneurs receive all of the remittance inflow. Comparing these responses, we see that who receives the remittances matters: when wage earners are the recipients (Figure 1), the economy contracts permanently, with output, investment and labor supply declining from their pre-shock steady-state levels. Since wage earners do not own any capital but are credit constrained, the permanently higher remittance inflow leads to an instantaneous upward jump in their consumption. The higher consumption level, in turn, lowers the benefit of working, causing wage earners to cut back on their labor supply. This adversely affects entrepreneurs by reducing the marginal product of capital, which consequently results in a lower

[7] The inclusion of government consumption, for example, would tend to crowd out both private consumption and investment, leading to lower consumption-output and capital-output ratios in equilibrium. The results of the model would, however, remain unchanged with this inclusion.

rate of investment and a decline in output over time. This forces entrepreneurs to absorb the contraction by reducing their own consumption. However, aggregate consumption increases almost instantaneously, as the increase in consumption of wage earners strictly dominates the fall in consumption for entrepreneurs. Borrowing for both groups of households decline over time: for wage earners, this is driven by the higher remittances offsetting the need for borrowing, and for entrepreneurs it is driven by the decline in their investment and wage bill. The current account worsens in the short run as aggregate consumption increases and output falls, but over time it improves as borrowing and investment expenditures decline. In sharp contrast, when entrepreneurs receive remittances (Figure 2), the economy expands, with output, investment, and labor supply increasing above their respective steady state levels. Aggregate consumption also increases, with both groups of agents increasing their consumption levels. The higher investment and consumption also increases borrowing for both groups as their respective credit constraints are relaxed, and this worsens the current account over time. In summary, Figures 1 and 2 suggest that the dynamic effects of remittances depend critically on how the distribution of remittances interact with the ownership of capital (wage earners versus entrepreneurs).

4.2 Temporary Shock

Figures 3 and 4 plot the economy's response for an unanticipated, exogenous, but temporary increase in remittance inflows. Similar to the case of a permanent increase, the dynamics responses depend on who receives the remittance inflow. In the case where remittances accrue to wage earners (Figure 3), their consumption and time allocation to leisure increases instantaneously above the baseline steady-state. This leads to a temporary contraction for the economy as both output and investment decline. Entrepreneurs accommodate the fall in output by reducing their consumption. Overall, aggregate consumption increases slightly in the short run, as the increase in consumption of wage earners more than offsets the decline for entrepreneurs. The higher remittances also substitute for wage income, which falls instantaneously (not shown). Finally, the short-run increase in consumption worsens the current account. Eventually, since this is a temporary shock, the economy returns to its pre-shock equilibrium. When entrepreneurs receive the temporary remittance inflow (Figure 4), the economy's short-run adjustment is in sharp contrast to when wage earners are the principal recipients. Since entrepreneurs do not face a labor-leisure trade-off, the inflow of remittances increases the resources available for investment. As a result, investment increases and this, in turn, allows entrepreneurs to borrow more. The increase in investment also increases the demand for labor by raising its marginal product. Wage earners, facing the

demand-driven increase in their wages, reduce their time allocation to leisure and increase labor supply. These effects taken together cause a temporary expansion of aggregate output and wage income, which in turn facilitates an increase in consumption for both wage earners and entrepreneurs. The economic expansion also relaxes the borrowing constraints for both wage earners and entrepreneurs, causing an increase in borrowing for both groups. This leads to a temporary worsening of the current account while the remittance shock is being absorbed by the economy.

In summary, Figures 1-4 indicate that both the long-run and short-run effects of remittances vary critically on who the recipient is and their relative ownership of physical capital. Recipients who do not own productive assets tend to respond in a way that is contractionary for the aggregate economy, while recipients with ownership of productive assets tend to respond in a way that is expansionary for the aggregate economy. Moreover, the magnitude of the changes in the key macroeconomic variables is much larger when entrepreneurs are the principal recipient of remittances, irrespective of whether they are permanent or temporary. In general, even though we have examined two polar cases for the distribution of remittances ($v = 0$ and $v = 1$), the larger the share of remittance flows that accrue to wage earners (i.e., as $v \rightarrow 1$), the more contractionary the effects will be for the aggregate economy, and vice versa.

4.3 Countercyclical Shock

Figure 5 illustrates the economy's response when there is a temporary but countercyclical increase in remittances. As such, the increase in remittance inflows in this case is driven by a negative productivity shock. We compare the two polar cases regarding the distribution of remittances, i.e., $v = 0$ and $v = 1$: the dotted lines represent the dynamic response of the economy when entrepreneurs receive the remittance shock, while the solid lines are the corresponding responses when wage earners are the principal recipients. Since the underlying dynamics are being driven by a negative productivity shock, the economy contracts in both cases. However, when the increase in remittances accrue to entrepreneurs, the magnitude of the contraction is both smaller and the transitional adjustment shorter, as the higher inflow of remittances help partially offset the contractionary effects of a negative productivity shock: the decline in output and labor supply is much smaller relative to when wage earners are the principal recipients. Credit constrained entrepreneurs are able to use the remittances to smooth both investment and consumption, thereby enabling the economy to absorb the negative productivity shock faster. In contrast, when wage earners receive the countercyclical increase in remittance flows, the economy's contraction is larger and the

transition longer. In this case, the higher remittances are absorbed by wage earners increasing their consumption and reducing labor supply. Consequently, entrepreneurs are unable to smooth the negative productivity shock, and investment and output decline more and remain below the steady state for longer. Figure 5 underscores the fact that the ability of remittances to smooth business cycle fluctuations depends critically on their distribution across heterogeneous agents.

5 A Specification Without Credit Constraints

To understand better the role played by credit constraints in the absorption of remittance inflows, we examine in this section a version of the model where wage earners and entrepreneurs do not face an arbitrary upper limit on their borrowing. In other words, we assume $m^h = m^e \to \infty$, so that $\lambda_t^h = \lambda_t^e = 0$ (for all t), i.e., both agents can borrow as much as they want from international capital markets, and then analyze their dynamic response to a remittance shock. To close the model, we retain the debt-elastic interest rate specifications described in (4a) and (13a). As in Section 4, we characterize the dynamic response of the economy without credit constraints to the following remittance shocks: (i) an exogenous permanent increase (ii) an exogenous temporary increase, and (iii) a countercyclical increase. In doing so, we compare these responses to those from our baseline specification with binding credit constraints. The results are reported in Figures 6-11, with the adjustment of the economy without credit constraints depicted by dotted lines and that of the baseline specification with credit constraints depicted by solid lines. In order to evaluate the dynamics of the model without credit constraints, it is parameterized to yield a steady-state equilibrium that is similar to the baseline credit-constrained specification.

5.1 Permanent Shock

When agents do not face any credit constraints (Figure 6), a permanent increase in remittances that accrues to wage earners does not affect labor supply, investment, and output. The remittance inflow is entirely absorbed by an increase in the consumption of wage earners, who also reduce their borrowing. Consequently, entrepreneurs are unaffected by this shock, and there is no change in labor demand and investment (and hence output). This is in sharp contrast to the dynamic response of a credit constrained economy (dotted plots), where a remittance shock to wage earners affects employment, investment, and output, and generates an economic contraction. From Figure 6 we also note that the instantaneous response of consumption for wage earners is larger when they are credit constrained, while

that for borrowing (and hence the current account) is smaller.[8]

Figure 7 plots the dynamic response of the economy to a permanent remittance shock that accrues to entrepreneurs, with the corresponding responses from the baseline specification with borrowing constraints plotted for comparison. As in the case with binding credit constraints, the economy expands on the realization of this shock. Quantitatively, however, the magnitudes of the dynamic responses of the key macroeconomic variables (output, investment, labor supply, and aggregate consumption) are lower relative to when credit constraints are present. In contrast to the case where credit constraints are binding, wage earners reduce their consumption to accommodate the higher labor and investment demand from entrepreneurs. The intuition here is that when entrepreneurs are credit-constrained, their capacity to make productive investments is restricted. An inflow of remittances relaxes their borrowing constraint and enables them to increase investment and realize additional returns that otherwise would not have been possible. By contrast, when credit constraints are absent, investment levels are higher (due to higher borrowing) and expected returns from additional investments financed by remittances are low. This dampens the economy's response relative to the case where borrowing constraints are binding. The responses of borrowing by the two groups are also in contrast with the case where credit constraints are present: both wage earners and entrepreneurs instantaneously reduce their rate of borrowing in the absence of credit constraints. Wage earners do so because they reduce their consumption expenditures and increase labor income, while entrepreneurs use the remittance inflow to reduce their outstanding debt. Consequently, the current account improves (worsens) when credit constraints are absent (present).

5.2 Temporary Shock

As in the case of a permanent shock, an exogenous but temporary increase in remittances that accrue to wage earners has no effect on output, investment, and labor supply when credit constraints are absent, in sharp contrast to the temporary economic contraction that is generated when they are present and binding (Figure 8). Again, we see that the presence of binding credit constraints lead to an amplification of the cyclical response of output, investment, labor supply, consumption, and borrowing relative to when these constraints

[8] The reason the economy does not contract when wage earners receive remittances in the absence of credit constraints is due to the fact that there is no wealth effect for the GHH utility specification. The economic contraction reported for the corresponding shock in the credit constrained model is generated by a wealth effect emanating not from the utility function, but from the existence of a binding borrowing constraint. The wealth effect would, however, be present with a Cobb-Douglas utility function. The resulting economic contraction in the model without credit constraints would then tend to be larger than the one in the model with binding credit constraints. The results with the Cobb-Douglas utility specification are available from the authors upon request.

are absent. Figure 9 plots the dynamic response of the economy to a temporary remittance shock that accrues to entrepreneurs. Aggregate consumption now declines on impact of the shock, in sharp contrast to the case where credit constraints were binding. This decline is driven by a fall in the consumption for wage earners, who reduce the consumption of all normal goods (including leisure) to accommodate the higher labor and investment demand from entrepreneurs. The magnitudes of the dynamic responses are lower relative to when credit constraints are present. As in the case of the permanent shock to remittances, the responses of borrowing by the two groups are also in contrast with the case where credit constraints are present.

In summary, when remittances increase exogenously, its distribution (between wage earners and entrepreneurs) still matters, but the presence or absence of binding credit constraints matters too: the amplitude of the economy's response is larger when credit constraints are present and, in an economy without such constraints, remittances accruing to wage earners have no effect (long run or short run) on output, investment, and labor supply.

5.3 Countercyclical Shock

Figures 10 and 11 plot the economy's adjustment to a countercyclical increase in remittance flows, generated by a temporary negative productivity shock. Irrespective of the distribution of remittances, the qualitative responses of output, investment, and labor supply are similar across both model specifications. However, when credit constraints are present and binding, the magnitude of the cyclical response of the economy is smaller for a negative productivity shock, indicating that remittances can help smooth or absorb negative shocks to productivity. The main differences between the two model specifications arise for the behavior of consumption and borrowing. For example, irrespective of whether wage earners or entrepreneurs receive the higher remittances, the absence of credit constraints leads to a transitional decline in aggregate consumption while the presence of these constraints tends to increase consumption. This underscores the fact that the presence of credit constraints partially helps with consumption smoothing and with the absorption of a negative productivity shock.

6 Welfare

In this section, we analyze the consequences of remittances for welfare, especially taking into account their distribution between entrepreneurs and wage earners, as well as the presence or absence of binding borrowing constraints. Specifically, we calculate the units of extra

consumption (in percentage terms) that would make a specific group of agents indifferent across two steady states: when they are the principal recipients and when they are not. To illustrate this point, let τ^h be the amount of this consumption transfer for wage earners and τ^e be the consumption transfer for entrepreneurs, such that

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t U \left[\left(1+\tau^h\right) C_t^h, l_t \right]_{v=0} = E_0 \sum_{t=0}^{\infty} (\beta^h)^t U (C_t^h, l_t)_{v=1} \tag{17a}$$

$$E_0 \sum_{t=0}^{\infty} (\beta^e)^t U \left[(1+\tau^e) C_t^e \right]_{v=1} = E_0 \sum_{t=0}^{\infty} (\beta^e)^t U (C_t^e)_{v=0} \tag{17b}$$

In (17a), the left-hand side represents the intertemporal utility of wage earners when they are not the principal recipient of remittances ($v = 0$), while the right-hand side represents their utility when all remittances accrue to them ($v = 1$). Then, τ^h is the amount of extra consumption that wage earners would need when remittances accrue to entrepreneurs to make them indifferent to the equilibrium where they are the recipient of all remittances. A similar analogy applies to (17b) for entrepreneurs: τ^e is the extra consumption required to make entrepreneurs equally well-off when wage earners receive remittances ($v = 1$), relative to when they receive all remittances ($v = 0$). For example, in Table 4A, wage earners would need 0.82% extra consumption when they are not the principal recipient of remittances, relative to when they are, for an exogenous temporary increase in remittances. In comparison, entrepreneurs would need about 0.76% more consumption if wage earners were receiving all inflows of remittances, relative to when they are the principal recipients. In general, welfare is higher for the group that is the direct beneficiary of remittances. Tables 4A and 4B present these welfare comparisons for the two model specifications (with and without credit constraints) and for two temporary remittance shocks: (i) exogenous and (ii) countercyclical. We see that for exogenous shocks, the consumption transfer for wage earners is higher than for entrepreneurs, irrespective of whether credit constraints are present or not. The magnitude of these transfers are higher when credit constraints are absent. This implies that the welfare loss for a group of agents when they are not the principal beneficiary of remittances is higher when credit constraints are absent. When remittance inflows are countercyclical, the magnitude of the consumption transfer is smaller relative to when they are exogenous, indicating the ability of remittances to smooth business cycle shocks. Again, the absence of credit constraints requires a larger transfer of consumption across steady states.

Table 4C compares intertemporal welfare for a specific group of agents across the two model specifications. In other words, what is the welfare cost of binding credit constraints? For example, when wage earners are the recipients of an exogenous remittance inflow, the

presence of credit constraints require 0.83% more consumption for this group relative to when these constraints are absent. Here, we see that countercyclical shocks require larger transfers of consumption for each group of agents when credit constraints are binding. In general, entrepreneurs need larger consumption transfers than wage earners in the presence of binding credit constraints.

7 Variance Decomposition and Model Fit

Tables 5A and 5B compare the relative importance of productivity and remittances shocks in driving the variance of key macroeconomic variables for the two model specifications, i.e., when credit constraints are absent or present. The variance decomposition results indicate that (i) the explanatory power of the remittance shock is much higher when entrepreneurs receive remittances, irrespective of whether credit constraints are present or not, and (ii) quantitatively, when credit constraints are present, remittances have significantly higher explanatory power relative to when they are absent. The results in Tables 5A and 5B underscore both the importance of the distribution of remittances among heterogeneous groups of households and the presence of credit constraints in determining the relative importance of remittances in explaining the variation in the major determinants of an economy's business cycle.

We next turn to an examination of the model's fit. Table 6 presents a comparison of the volatility and implied correlations of the key macroeconomic variables under the two model specifications (with and without credit constraints) with those calculated from annual data for El Salvador for the period 1976 to 2010.[9] As explained earlier, El Salvador serves as a representative remittance-recipient country, with the shares of remittances (9%) and private credit (31%) in GDP during the sample period that are in line with corresponding global averages for remittance-recipient countries (see Tables 1 and 3). The model's moments have been generated from productivity and remittance shocks, with the distribution of remittances set at $v = 0.5$, and the magnitude of these shocks set to match the observed sample volatility of GDP and remittances.[10] The model is log-linearized around the steady-state and the

[9] The model specification is evaluated at an annual frequency. This is different from the quarterly frequency used by Acosta et al. (2009) mainly due to the constraints imposed by the data. For example, Acosta et al. (2009) use quarterly data from 1991Q1-2006Q2 for El Salvador for output, remittances, and exchange rates to examine the Dutch Disease phenomenon. We are interested in a broader set of macroeconomic variables that include consumption, investment, hours worked, etc., for which data is available only at the annual frequency from 1976-2010.

[10] The cases where $v = 0$ (all remittances accrue to entrepreneurs) and $v = 1$ (all remittances accrue to wage earners) are illustrative of the two extreme possibilities for the internal distribution of remittances. Since we have no a priori information on how remittances are, in fact, distributed in El Salvador (or in any other country), we set $v = 0.5$ to examine the model's fit. This restriction does not skew the distribution

moments are calculated using a de-trended series.

As can be seen from Table 6, moments implied by the model specification with binding credit constraints perform much better relative to the model without these constraints. For example, the model with credit constraints does quite well to match the dispersion of output and the relative dispersion of remittances. In comparison, the model without credit constraints performs much worse, with the dispersion of output being largely overstated and the relative dispersion of remittances understated. With respect to the relative dispersion of investment, the credit constrained version suggests a lower volatility compared to the data and the model without these constraints suggests a much higher volatility. Quantitatively, however, the model with credit constraints is closer to the corresponding volatility observed in the data. Both models perform poorly in trying to match the relative volatility of consumption, with the credit constrained version slightly outperforming the version without constraints.

When the implied correlations between the key macroeconomic variables for the two model specifications are compared with those from the data, the credit constrained specification performs much better, with the consumption-output, investment-output, consumption-remittances, and investment-remittances correlations being much closer to their counterparts in the data relative to those implied by the model without credit constraints. However, both these specifications generate correlations between output and remittances that are negative, while that in the data is positive.

8 Conclusions

In this paper, we have examined the interaction between credit constraints and the ownership of a productive asset like capital in determining the aggregate effects of remittance inflows. In particular, we model a small open economy which is characterized by two types of households: wage earners, with no ownership of capital, and entrepreneurs, who own capital. Given this set up, the presence of binding borrowing constraints generate sharply contrasting responses of the economy to an underlying exogenous increase in remittance inflows, whether temporary or permanent. When wage earners are the principal recipients, the economy contracts, with most of the remittances being allocated to the consumption of wage earners. By contrast, when entrepreneurs receive remittances, the economy expands. Consumption increases for all households, but is now driven by increases in labor supply and output. In the case where the increase in remittance inflows is countercyclical (driven by a

of remittances towards any particular type of household, so that remittances are equally distributed among wage earners and entrepreneurs.

negative productivity shock), we find that the ability of remittances to smooth business cycle fluctuations depends critically on their distribution: the larger the share of remittances that accrue to entrepreneurs, the larger is the business cycle-smoothing effect. Comparing these results to those from a model specification without credit constraints, we find that the absence of credit constraints leads to remittances having significantly lower explanatory power in the variation of key macroeconomic variables, such as output, investment, consumption, and labor supply, relative to when credit constraints are present. In fact, in the absence of credit constraints, an exogenous increase in remittances accruing to wage earners has no effect on output, investment, and labor supply, in sharp constrast to the responses generated in the model with binding credit constraints. Using data from El Salvador for the period 1976 to 2010, we further show that the model specification with binding credit constraints performs much better in matching the key moments and correlations in the data relative to the model without credit constraints.

Our welfare analysis determines the amount of extra consumption that must be allocated to a specific group of agents (entrepreneurs or wage earners) when they are *not* the principal recipient of a remittance inflow in order to make them equally well off compared to when they are the principal recipients. We find that the welfare loss for a group when they are not the principal beneficiary of remittances is higher (i) for wage earners, and (ii) when credit constraints are absent. When remittance inflows are countercyclical, the magnitude of the consumption transfer is smaller relative to when they are exogenous, indicating the ability of remittances to smooth business cycle fluctuations.

We distinguish our paper from the existing literature by highlighting the quantitative significance of a new channel through which external transfers are absorbed by an emerging economy: the interaction between credit constraints and the distribution of asset ownership. In contrast, previous studies have generally assumed that households have no access to credit and firms are not constrained in their ability to borrow. In taking a more pragmatic approach towards credit constraints and asset ownership, we highlight the importance of these factors in understanding how household allocation decisions are made with respect to remittance receipts. In doing so, we underscore the need for more micro-level evidence for understanding the dynamic implications of remittances. Finally, an important issue from which we abstract is the endogeneity of remittance inflows: one can conceptualize remittances as wage income received from abroad when household labor supply is allocated across national borders. Such an analysis would require a multi-country set-up and the modeling of the costs of migration and the consequences for the composition of skills and human capital in the domestic labor market. While these are interesting and relevant issues, they are beyond the scope of this paper. We look forward to pursuing these ideas in future work.

TABLE 2. Baseline Calibration

Parameter	**Description**	**Value**
σ	Intertemporal elasticity of substitution in consumption	2.25
η	Labor-share in utility	1.7
ψ	Steady-state labor allocation parameter	1.45
r^*	World interest rate (annualized)	0.06
φ	Interest rate premium	0, 0.09
μ	Capital share in production	0.4
δ	Depreciation rate for physical capital (annual)	0.1
β^h	Rate of time preference (wage earners)	0.92
β^e	Rate of time preference (entrepreneurs)	0.92
m^h	Borrowing constraint parameter (wage earners)	0.18
m^e	Borrowing constraint parameter (entrepreneurs)	0.11
ρ^A	Persistence of productivity shock	0.76
ρ^{TR}	Persistence of remittance shock	0.85
σ^A	Standard deviation of productivity shock	0.0127
σ^{TR}	Standard deviation of remittance shock	0.134
ξ	Elasticity of remittances with respect to GDP	0.75

TABLE 3. Baseline Steady-State Equilibrium

	# Countries	C/Y	I/Y	K/Y	B/Y	TR/Y
Model (with credit constraints)	- -	**0.84**	**0.22**	**2.17**	**0.35**	**0.09**
Latin America	17	0.73	0.23	0.57	0.35	0.07
Sub-Saharan Africa	17	0.81	0.21	1.77	0.15	0.09
Middle East and North Africa	10	0.64	0.24	1.69	0.39	0.11
Europe and Central Asia	14	0.71	0.24	2.32	0.46	0.10
East Asia	14	0.66	0.28	2.27	0.39	0.13
South Asia	5	0.81	0.19	2.13	0.18	0.06
Sample Means (weighted)	$N = 77$	**0.73**	**0.23**	**1.80**	**0.32**	**0.09**

TABLE 4. Welfare Analysis

A. Model with Credit Constraints

	Exogenous	Countercyclical
$C^h_{v=0} - C^h_{v=1}$	0.821	0.463
$C^e_{v=1} - C^e_{v=0}$	0.759	0.467

B. Model without Credit Constraints

	Exogenous	Countercyclical
$\hat{C}^h_{v=0} - \hat{C}^h_{v=1}$	1.025	0.671
$\hat{C}^e_{v=1} - \hat{C}^e_{v=0}$	0.856	0.641

C. Credit Constraints vs No Credit Constraints

	Exogenous	Countercyclical
$C^h_{v=1} - \hat{C}^h_{v=1}$	0.834	2.589
$C^e_{v=0} - \hat{C}^e_{v=0}$	1.137	3.473

C^j = Consumption of group j in model with credit constraints

$\hat{C}^j$ = Consumption of group j in model without credit constraints

j = $h,\ e$

TABLE 5. Variance Decomposition

A. $v = 1$

	No Credit Constraint		With Credit Constraint	
	A	TR	A	TR
Output	100	0	99.54	0.46
Investment	100	0	99.65	0.35
Labor	100	0	95.89	4.11
Consumption	97.17	2.83	59.13	40.87

B. $v = 0$

	No Credit Constraint		With Credit Constraint	
	A	TR	A	TR
Output	97.86	2.14	83.86	16.14
Investment	97.24	2.76	40.20	59.80
Labor	97.86	2.14	79.18	20.82
Consumption	88.82	11.18	72.64	27.36

TABLE 6. Model Fit: Standard Deviations and Correlations

	No Credit Constraint	With Credit Constraint	El-Salvador, 1976-2010
$sd(Y)$	3.11	2.27	2.25
$sd(C)/sd(Y)$	0.932	0.965	1.458
$sd(I)/sd(Y)$	5.084	2.242	3.664
$sd(TR)/sd(Y)$	5.630	6.967	6.953
$Corr(C, Y)$	0.949	0.853	0.783
$Corr(I, Y)$	0.379	0.821	0.658
$Corr(TR, Y)$	-0.006	-0.019	0.649
$Corr(TR, C)$	-0.081	0.507	0.629
$Corr(TR, I)$	0.083	0.502	0.674

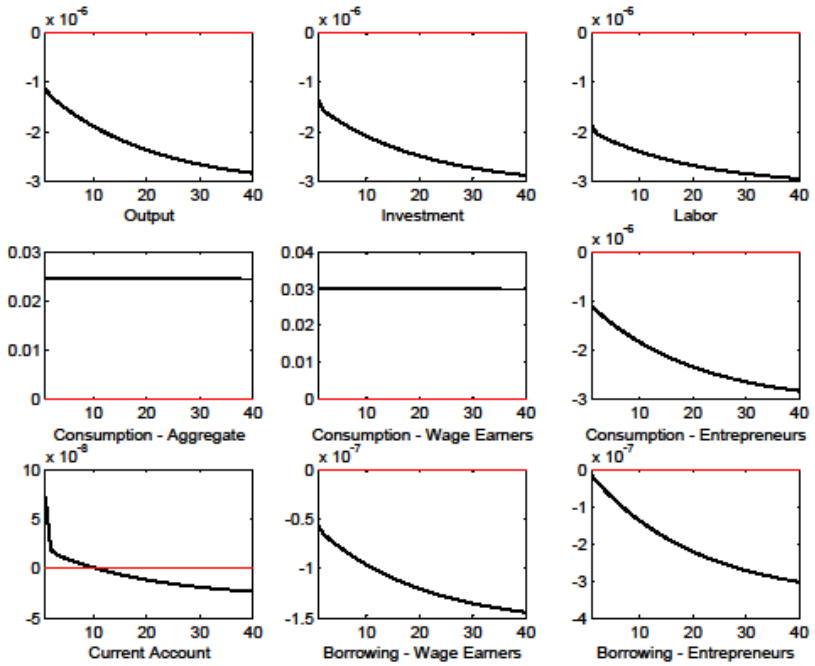

FIGURE 1. Permanent Remittance Shock to Wage Earners

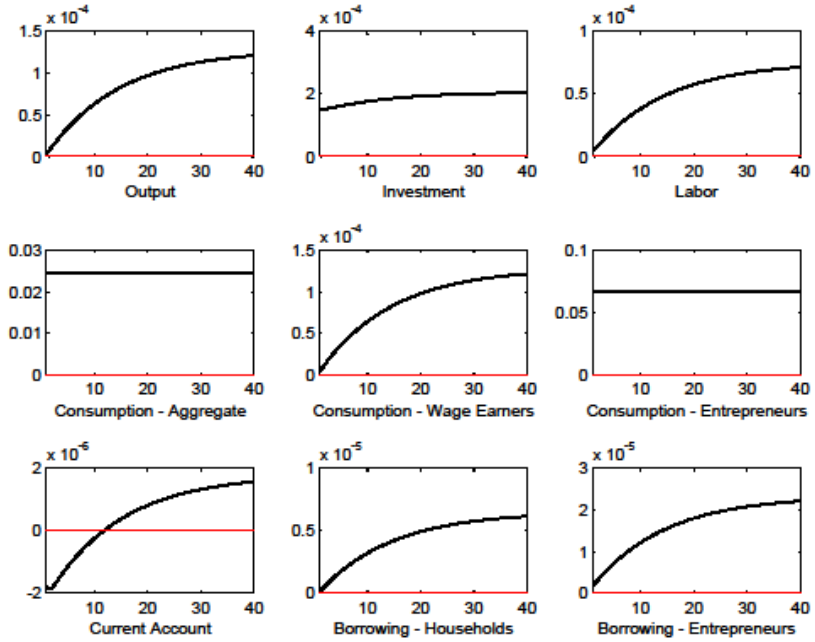

FIGURE 2. Permanent Remittance Shock to Entrepreneurs

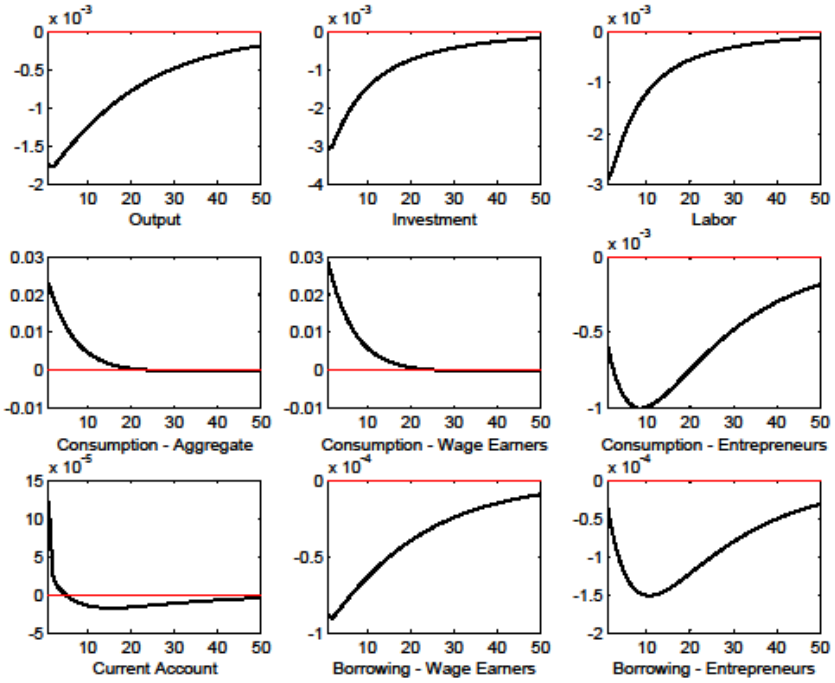

FIGURE 3. Temporary Exogenous Remittance Shock to Wage Earners

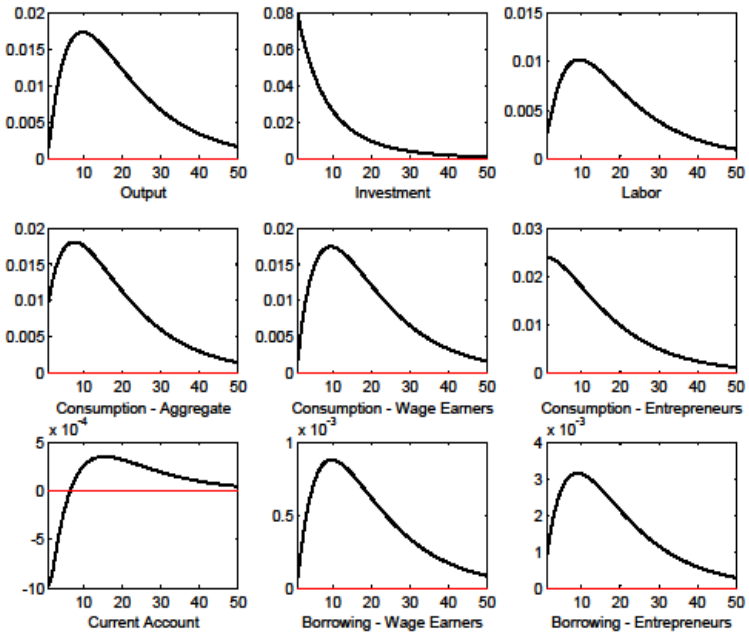

FIGURE 4. Temporary Exogenous Remittance Shock to Entrepreneurs

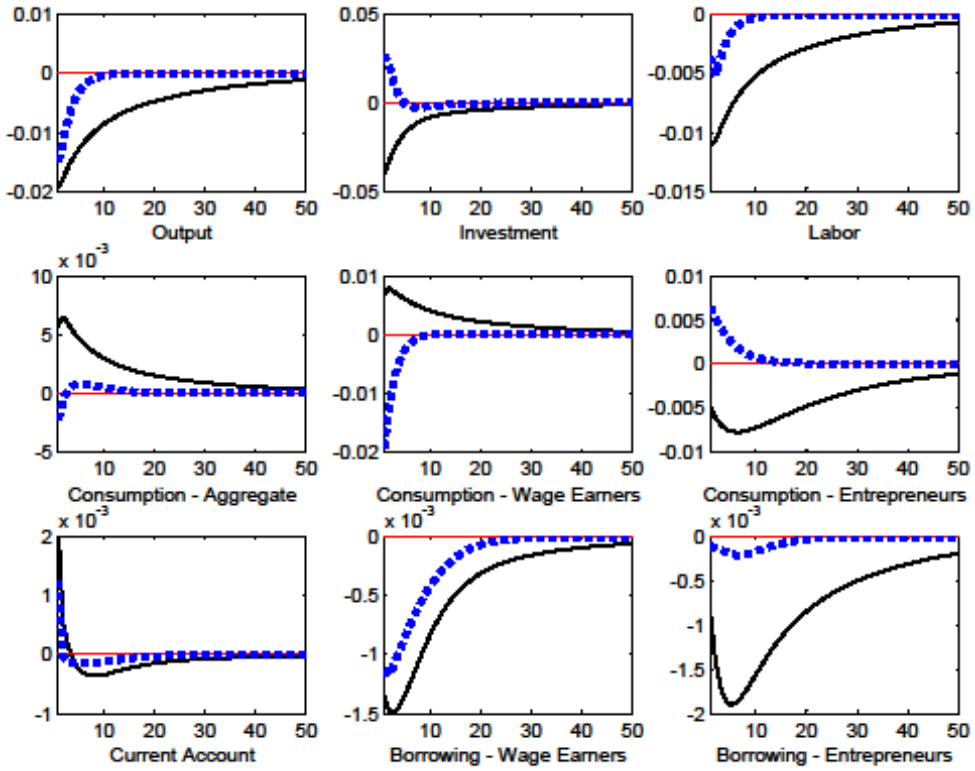

FIGURE 5. Countercyclical Shock to Remittances

- - - - Entrepreneurs —— Wage Earners

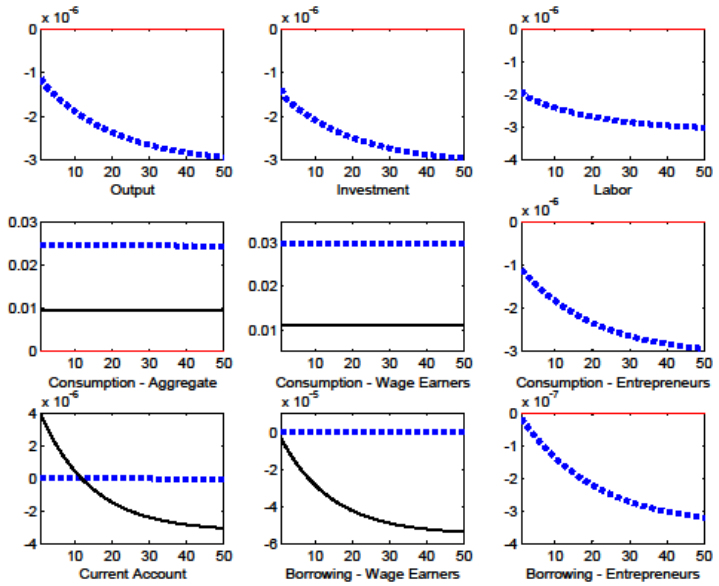

FIGURE 6. Permanent Remittance Shock to Wage Earners

- - - - With credit constraints —— Without credit constraints

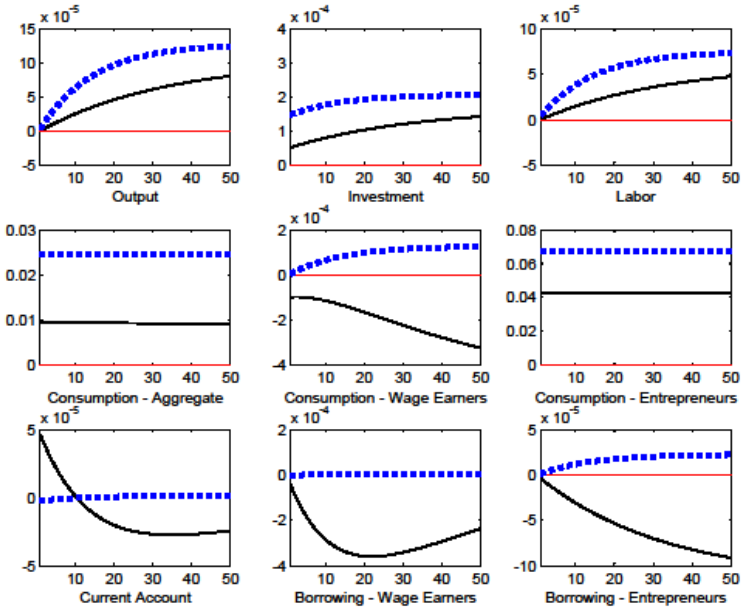

FIGURE 7. Permanent Remittance Shock to Entrepreneurs

- - - - With credit constraints —— Without credit constraints

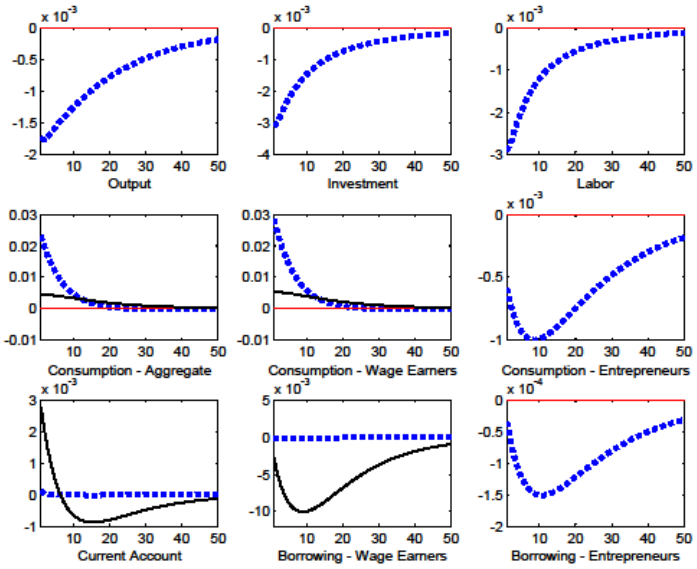

FIGURE 8. Temporary Exogenous Remittance Shock to Wage Earners

- - - - With credit constraints —— Without credit constraints

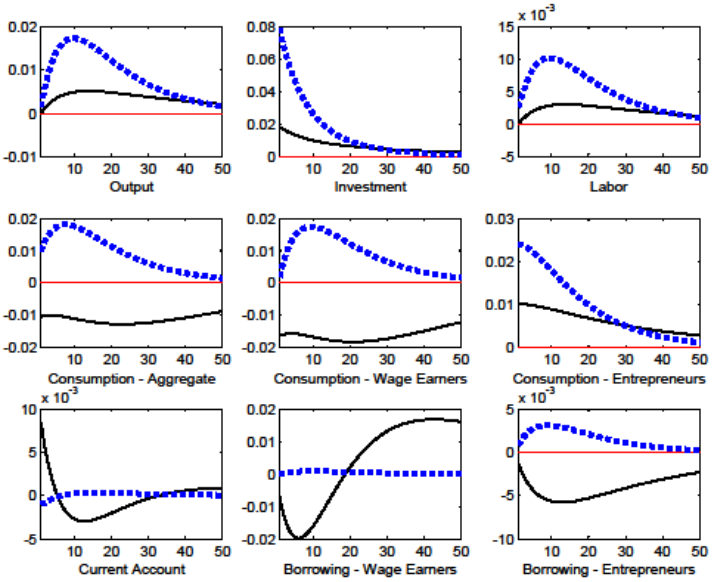

FIGURE 9. Temporary Exogenous Remittance Shock to Entrepreneurs

- - - - With credit constraints – Without credit constraints

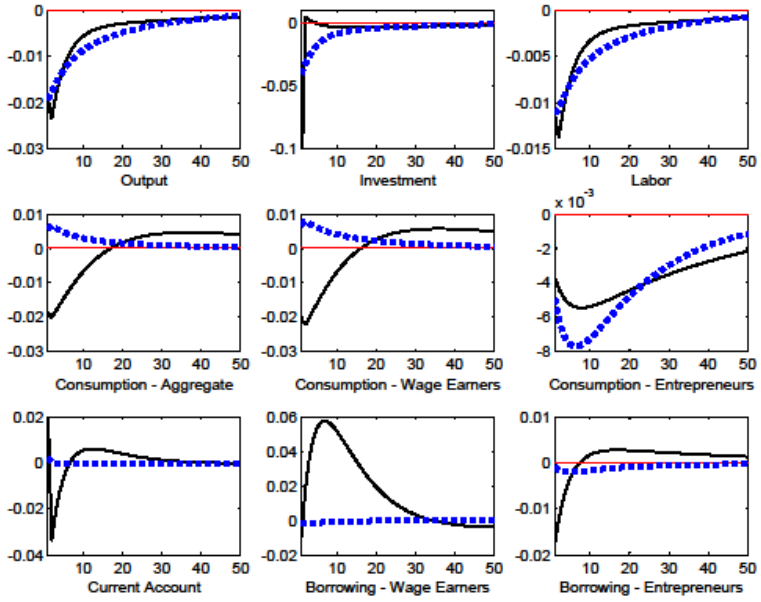

FIGURE 10. Countercyclical Remittance Shock to Wage Earners

- - - - With credit constraints – Without credit constraints

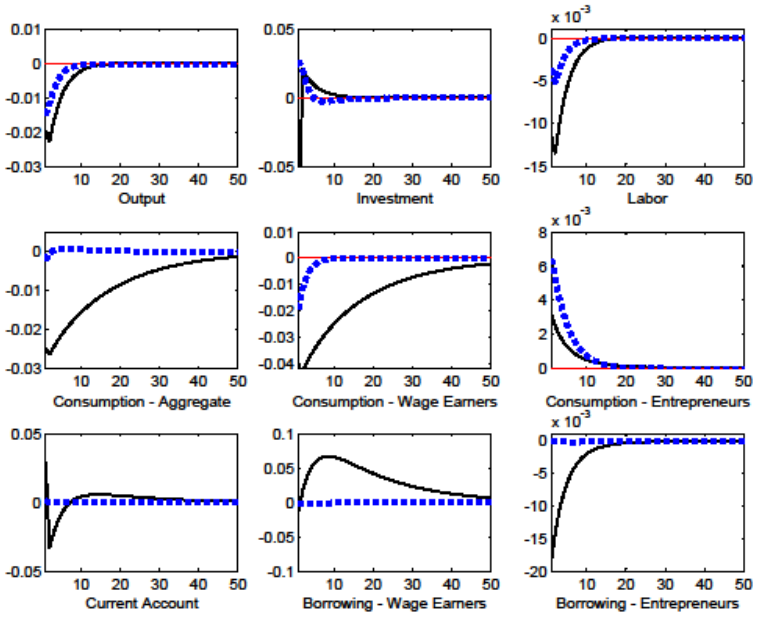

FIGURE 11. Countercyclical Remittance Shock to Entrepreneurs

- - - - With credit constraints —— Without credit constraints

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Data Appendix

The analysis of the Steady-State Equilibrium in Section 3.1 uses sample averages for countries in 6 broad regions with an average Remittance-to-GDP ratio of at least 3% for the period 1960 - 2010. These regions are East Asia, Europe and Central Asia, Latin American, North Africa and Middle East, South Asia, and Sub-Saharan Africa. A list of countries is presented in Table 2

The analyis of Model Fit in Section 5 uses data for El Salvador for the period 1976 - 2010. All variables used for the analysis are expressed in logs and were detrended using the Hodrick-Prescott filter. The sample period is limited by lack of data for El Salvador prior to 1976.

Table 1: Data Source

Name	Definition	Source
Consumption	Household final consumption expenditure, etc. (% of GDP) $\times$ GDP	World Bank
Investment	Gross capital formation (% of GDP) $\times$ GDP	World Bank
Capital	Capital stock at constant 2005 national prices (in mil. 2005US$)	Penn World Table
Credit	Domestic credit to private sector (% of GDP)$\times$ GDP	World Bank
Remittances	Personal remittances, received (% of GDP)$\times$ GDP	World Bank
GDP	GDP (constant 2005 US$)	World Bank

Table 2: List of countries

Latin America		Sub-Saharan Africa	
Bahamas	Haiti	Benin	Mali
Belize	Honduras	Botswana	Nigeria
Cuba	Jamaica	Burkina Faso	Senegal
Dominica	Nicaragua	Cape Verde	Somalia
Dominican Republic	Puerto Rico	Comoros	Sudan
El Salvador	St. Kitts & Nevis	Gambia	Swaziland
Grenada	St. Lucia	Buinea Bissau	Togo
Guatemala	St.Vincent & Grenadines	Lesotho	Uganda
Guyana		Liberia	

East Asia		South Asia
Brunei	Samoa	Afghanistan
Kiribati	Singapore	Bangladesh
Marshall Islands	Taiwan	Nepal
Micronesia	Timor-Leste	Pakistan
Mongolia	Tonga	Sri Lanka
Palau	Vanuatu	
Philippines	Vietnam	

Europe and Central Asia		North Africa and Middle East	
Albania	Macedonia	Bahrain	Morocco
Armenia	Moldova	Egypt	Qatar
Bosnia	Montenegro	Jordan	Tunisia
Bulgaria	Portugal	Kuwait	United Arab Emirates
Georgia	Serbia	Lebanon	Yemen
Kyrgyzstan	Tajikistan		
Luxembourg	Uzbekistan		