The Macroeconomic Consequences of Remittances*

Berrak Bahadir† *Özyeğin University*

Santanu Chatterjee‡ *University of Georgia*

Thomas Lebesmuehlbacher§ *University of Georgia*

Abstract

This paper examines two important channels which influence the dynamic absorption of remittances at the macroeconomic level: (i) the presence of borrowing constraints, and (ii) the distribution of remittances across recipient households. Using an open economy DSGE model with heterogeneous households, we show that remittances accruing to hand-to-mouth households (with no capital ownership or access to credit markets) generate a dynamic response that is inherently contractionary for the recipient economy. On the other hand, credit-constrained households with ownership of capital respond in a way that is inherently expansionary, when they are the principal recipients. The ability of countercyclical remittances to smooth business cycle shocks also depends critically on their distribution across households. We use data for Philippines to calibrate the internal distribution of remittances, and show that this calibrated distribution and the presence of binding credit constraints play an important role in improving the model's fit to the data. The welfare consequences of the distribution of remittances are also analyzed.

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

JEL Classification: F24, F41, O11

*We are grateful to Pablo Acosta, Philip Brock, Julio Garin, Bill Lastrapes, Bento Lobo, Federico Mandelman, and Stephen Turnovsky for constructive comments on an earlier draft. The paper has benefitted from presentations at the Annual Meetings of the Society for Computational Economics (CEF) in Oslo, the Econometric Society European Meetings (ESEM) in Toulouse, the Annnual SEA meeting in Atlanta, the SIDE Workshop at the Federal Reserve Bank of Atlanta, and the University of Georgia. Chatterjee acknowledges financial support from the Terry-Sanford Research Award and the Office of the Provost at the University of Georgia. A part of this paper was completed while Chatterjee was visiting the University of Hamburg in Germany, whose hospitality is gratefully acknowledged.

†Özyeğin University, Çekmeköy Campüs, Istanbul, TURKEY. Email: berrak.bahadir@ozyegin.edu.tr

‡Corresponding author. Department of Economics, University of Georgia. 310 Herty Drive, Athens, GA 30602 USA. Email: schatt@uga.edu

§Department of Economics, University of Georgia. 310 Herty Drive, Athens, GA 30602 USA. Email: lebes@uga.edu

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, 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 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 shows the average share of remittances and private-sector credit in GDP for (i) 73 countries divided into geographical sub-groups, and (ii) the top-15 remittance-recipient countries for the period 1995-2014.[1] Irrespective of geographical sub-division, remittances accounted for a significant proportion of national incomes, with a range between 8-11% of GDP. For the top-15 remittance recipients, however, these flows represented 21% of GDP. On the other hand, the average share of private-sector credit in these countries during this periods was only about 37% (and about 28% for the top-15 remittance recipients). By comparison, the average private credit-to-GDP ratio in high-income countries was almost twice as high, at 71%. The relatively large share of remittances and low share of private-sector credit in GDP underscore the importance of understanding how these variables interact to affect resource allocation decisions.

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 capital accumulation and labor. Further, 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 little or no ownership of capital may react very differently to an inflow of remittances

[1] This group includes countries that received, on average, at least 3 % of their GDP in the form of remittances during 1995-2014. Data Source: The World Bank.

relative to households who own capital or are not credit constrained.

TABLE 1. Remittances and Private-Sector Credit (% of GDP), 1995-2014

	Rem/GDP	**Credit/GDP**
Latin America	7.9	46.1
Sub-Saharan Africa	9.9	16.1
Middle East and North Africa	10.4	49.4
Europe and Central Asia	11.4	31.5
East Asia	10.2	46.4
South Asia	7.8	33.3
Top-15 Remittance Recipients	**21.0**	**27.9**

Given the sheer magnitude of remittance flows to developing countries, their economic impact has naturally become an important area of research.[2] 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 underscores 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. Using a calibrated DSGE model, Durdu and Seyan (2010) show that while remittances dampen economic fluctuations in Mexico, they have the opposite effect in Turkey.[3] These studies seem to indicate that there is significant

[2]The current literature on the macroeconomic impact of remittance inflows is also related to the much broader literature on the effect of international transfers, which dates back to the work of Keynes (1929) and Ohlin (1929) on the "Transfer Problem", and includes a variety of such transfers, such as aid, resource discoveries, FDI, among others; See, for example, Turunen-Red and Woodland (1988), van Wincoop (1993), Brock (1996), and Chatterjee et al. (2003).

[3]Further, while Catrinescu et al. (2009) and Mundaca (2009) find remittances to be beneficial for long-run growth, Chami (2005), Faini (2007), and Barajas et al. (2009) find this relationship to be either

variation in the usage of remittances across recipients (households or countries) which, in turn, may lead to very different macroeconomic outcomes.

We argue in this paper that in the presence of binding borrowing constraints, the distribution of ownership of 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 DSGE model: those that own physical capital (and thereby firms) but have limited access to credit markets, called *entrepreneurs*, and those that have no ownership of capital or access to credit markets, deriving their income solely from supplying labor, called *wage earners* (hand-to-mouth households). We show that with this specification, remittances accruing to entrepreneurs tend to expand aggregate economic activity, by increasing investment and the demand for labor. By contrast, when hand-to-mouth 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: 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. In other words, the larger the remittance-share of wage earners, the more contractionary is the economy's dynamic response (and vice-versa).

The underlying preference structure and the presence of credit constraints are two key drivers of the results described above. First, our baseline model specification assumes that hand-to-mouth wage earners are characterized by Cobb-Douglas preferences over their consumption and labor-leisure choices. As such, this preference structure generates an income effect when this group of agents receive remittance inflows, leading to a decline in labor supply which, in turn, helps propagate the contraction over the business cycle. We examine the importance of this channel by extending the baseline specification to include GHH preferences for wage earners, thereby shutting off the income effect (the marginal rate of substitution between consumption and leisure is zero in the GHH utility specification). Indeed, we find that the presence or absence of the income effect matters: when hand-to-mouth wage earners receive remittances, the absence of an income effect leads to the entire remittance flow to be consumed, with no other aggregate consequences for the economy. On the other hand, when entrepreneurs are the principal recipients, the absence of an income effect for wage earners increases the expansionary effect of remittances relative to the case of Cobb-

neutral or negative. Giuliano and Ruiz-Arranz (2009) and Bettin and Zazzaro (2012) find beneficial effects of remittances conditional on the degree of financial development in the recipient country.

Douglas utility. Second, to emphasize the role played by credit constraints, we examine an alternative specification of the baseline model where these constraints are *absent*, with all agents having unrestricted access to capital markets. We find that the presence of binding credit constraints amplify the effects of remittance inflows relative to when these constraints are absent, irrespective of which group of agents (wage earners or entrepreneurs) receives the remittances. Indeed, as we shall discuss below, the presence of binding credit constraints plays an important role in improving the model's fit to the data. We also consider the case where remittances may be counter-cyclical in nature (with inflows increasing on 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 the two groups of agents.[4]

Given that there are two potential groups of agents in our model that may be recipients of remittance inflows, it is important to consider the welfare consequences of the distribution of remittances. Here, we consider two questions: (i) How is one group affected when the other receives all remittances? In other words, if wage earners are the principal beneficiaries of a remittance inflow, how does that affect the well-being of entrepreneurs (and vice versa)? and (ii) how does the distribution of remittances between wage earners and entrepreneurs affect aggregate welfare for the economy? We find that when entrepreneurs receive remittances, wage earners are better off throughout the transition path. In contrast, when wage earners receive remittances, entrepreneurs are always worse off. With respect to aggregate welfare, when entrepreneurs (wage earners) receive remittances, welfare rises (falls) along the transition path.

The quantitative analysis is conducted by using quarterly data for the period 1993-2011 from Philippines, which serves as a good candidate for a representative remittance-recipient country. For example, during the sample period, it received, on average, about 8% of its GDP in the form of remittances, and had an average private-sector credit-to-GDP ratio of about 32%, which is consistent with the corresponding sample averages presented in Table 1.[5] The

[4] 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.

[5] Mandelman (2013) also uses data for Philippines to examine the link between remittances and monetary and exchange rate policies. Our emphasis, however, is quite different from that paper, with a focus instead on the distribution of remittances and the role played by credit constraints.

numerical evaluation of our model specification is conducted at two levels. First, we establish that the parameterization of our model specifications (with and without credit constraints) yield steady-state equilibrium quantities that are comparable to the corresponding sample averages for Philippines. Second, we 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. Here, we combine data on outward migration patterns from the Philippines with bilateral remittance inflows to calibrate the internal distribution of remittances (i.e., between wage earners and entrepreneurs), and show that the resulting model fit is relatively better than those generated by the two polar cases (where only one group of agents is the principal recipient). We also examine the sensitivity of the model fit to (i) the presence or absence of binding credit constraints, and (ii) the underlying preference structure, i.e., Cobb Douglas or GHH utility. In general, the model specification with binding credit constraints performs significantly better than the one without these constraints when comparing the key moments and correlations from the data. Finally, we provide support for our model's main mechanisms by comparing the trends for remittance flows and growth rates of real GDP and private investment in Philippines and Malaysia during the Asian crisis of 1997-1998 and the Global financial crisis of 2008-2009.

This paper contributes to a growing body of work that links remittances to the aggregate economy. For example, Acosta et al. (2009), Durdu and Seyan (2010), Mandelman and Zlate (2012), and Mandelman (2013), respectively focus on the link between remittances and the Dutch Disease, sudden stops, cross-border migration, and the responses of monetary and exchange rate policies. Our paper adds to this literature by highlighting several determinants of the dynamic absorption of remittances that have not been studied systematically in the literature, namely (i) the internal distribution of remittances between heterogeneous agents (based on their relative ownership of capital and access to credit markets), (ii) the presence of binding credit constraints, and (iii) the underlying preference structure of recipients. Our quantitative results are also consistent with the recent empirical findings of Yang (2008), 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 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 model and a discussion of the steady-state equilibrium. Section 4 presents the simulation of the

effects of unanticipated temporary remittance shocks and a welfare analysis, while Section 5 discusses the case of the countercyclicality of remittances. Section 6 examines the model fit to the data, and Section 7 presents some suggestive evidence to support the main mechanisms of the model. 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, do not own any physical capital, and are *rule-of-thumb* consumers, i.e., they have no access to borrowing or capital markets. As such, these households consume their entire flow of income from wages and remittance receipts every period. 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*. A critical feature characterizing entrepreneurs in this economy is that they are credit-constrained (have limited access to borrowing), but also receive remittance flows from abroad. Therefore, heterogeneity among households is driven by their ownership (or lack) of physical capital and the differential credit constraints they face. For simplicity, we assume that there is no government in this economy.

2.1 Hand-to-Mouth Wage Earners

Households in this category are indexed by h, and being rule-of-thumb consumers, they allocate time between work and leisure, solving a static utility maximization problem every period:

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

subject to

$$C_t^h = w_t l_t + vTR_t \tag{2}$$

where C_t^h is consumption, l_t represents the total allocation of time to work, w_t is the hourly real wage rate, TR_t is the aggregate inflow of remittances from abroad, and $v \in [0,1]$ denotes the share of this inflow received by households in this category. Therefore, when $v = 1$, all remittance inflows into the economy accrue to wage earners. 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.

These households maximize (1), subject to (2), while taking the aggregate remittance inflow and its distribution, v, as given. This leads to the following optimality conditions:

$$U_c\left(C_t^h, l_t\right) = \lambda_t^h \tag{3a}$$

$$-\frac{U_l\left(C_t^h, l_t\right)}{U_c\left(C_t^h, l_t\right)} = w_t \tag{3b}$$

Eq. (3a) equalizes the marginal utility from consumption to that of household income, where λ_t^h is the shadow price associated with the constraint (2). Eq. (3b) expresses the marginal rate of substitution between consumption and the labor-leisure choice.

2.2 Entrepreneurs

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), limited access to credit markets, 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:

$$Y_t = e^{A_t} K_{t-1}^{\mu} l_t^{1-\mu},\ \mu \in (0,1) \tag{4}$$

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. The stock of capital accumulates according to

$$K_t = I_t + (1-\delta) K_{t-1} \tag{5}$$

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:

$$\Phi\left(I_t, K_{t-1}\right) = I_t + \frac{\Psi}{2}\left(\frac{I_t}{K_{t-1}} - \delta\right)^2 K_{t-1},\ \Psi \geq 0 \tag{6}$$

where Ψ is the adjustment cost parameter.

Entrepreneurs maximize utility from consumption over an infinite horizon

$$E_0 \sum_{t=0}^{\infty} (\beta)^t U\left(C_t^e\right),\ \beta \in (0,1) \tag{7}$$

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

$$U\left(C_t^e\right) = \frac{\left(C_t^e\right)^{1-\sigma}}{1-\sigma} \tag{8}$$

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

$$B_t = \left(1+r^*\right) B_{t-1} + C_t^e + w_t l_t + \Phi\left(I_t, K_{t-1}\right) - Y_t - \left(1-v\right) TR_t \tag{9}$$

where B_t is their stock of debt (accumulated through an internationally traded bond), $(1-v)$ represents their share of aggregate remittances, and r^* is the (world) interest rate on borrowing.

We assume that entrepreneurs, even though they own capital and firms, are credit constrained with respect to their borrowing decisions:

$$B_t \leq m_t E_t(q_{t+1} K_t) \tag{10}$$

where q_t is the shadow (market) price of capital, and m_t is the time-varying fraction of the expected market value of capital that defines the upper limit on borrowing for entrepreneurs, i.e., loan-to-capital (LTC).[6]

A representative entrepreneur in this sector maximizes (8), subject to (9) and (10). This leads to the following optimality conditions

$$U_c\left(C_t^e\right) = \left(1+r^*\right)\left[\beta E_t\left\{U_c\left(C_{t+1}^e\right)\right\} + \lambda_t^e\right] \tag{11a}$$

$$\frac{\partial Y_t}{\partial l_t} = w_t \tag{11b}$$

$$q_t = 1 + \Psi\left(\frac{I_t}{K_{t-1}} - \delta\right) \tag{11c}$$

[6] 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. In our specific context, the existence of a binding credit constraint for entrepreneurs is sufficient to impose an upper bound on the accumulation of debt as the model converges to its steady state.

$$q_t = \left[(1-\delta)\,\beta + m_t\lambda_t^e\right] E_t q_{t+1} - \beta E_t\left[\left\{\Phi_K\left(I_{t+1}, K_t\right) - \frac{\partial Y_{t+1}}{\partial K_t}\right\} U_c\left(C_{t+1}^e\right)\right] \tag{11d}$$

where λ_t^e is the shadow price associated with the credit constraint (10). Eq. (11a) represents the Euler equation for consumption of entrepreneurs, while (11b) equates the marginal product of labor (purchased from wage earners) to the real wage rate. Eq. (11c) expresses the instantaneous shadow price of capital, while (11d) describes its evolution over time.

2.3 Remittances

Following Acosta et al. (2009) and Mandelman (2013), we model aggregate remittance flows as

$$TR_t = TR_t^c + TR_t^d. \tag{12}$$

The first term on the right-hand side of (12), TR_t^c, represents the endogenous part of remittances and is countercyclical. The intuition is as follows: we assume that a fraction of the home-born foreign residents have distant ties with their families, and they send resources only if they consider that these households back home are about to face severe economic hardship. Similar to Acosta et al. (2009), we assume that countercyclical remittances are given by $TR_t^c = Y_t^{\xi}$, where $\xi < 0$ is the elasticity of remittances with respect to aggregate output. The second term, TR_t^d is the exogenous component of remittances. Exogenous fluctuations in remittances are independent of economic conditions in the recipient country, and can occur due to productivity improvements or real exchange rate appreciations in the economy where migrants are typically employed.

2.4 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 (9):

$$B_t = (1+r^*)\,B_{t-1} + C_t + \Phi\left(I_t, K_{t-1}\right) - Y_t - TR_t \tag{13}$$

where $C_t = C_t^h + C_t^e$ is aggregate consumption, at time t. According to (13), the economy 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. The model is solved using quarterly data from Philippines for the period 1993Q1-2011Q3. Philippines serves as a representative remittance-recipient country, with the shares of remittances (8.1%) and private credit (32%) in GDP during the sample period that are in line with corresponding global averages for remittance-recipient countries (see Table 1). Quarterly data on output, investment, consumption and the trade balance (net exports) are from the IFS database. The data are denominated in Philippine Pesos and converted to real values using a GDP Deflator (2005=100, Source: IFS). Monthly remittance data are obtained from the Philippines Central Bank, and transformed from U.S. Dollars to Philippine Pesos using the average monthly US-Peso exchange rate (Source: Philippines Central Bank). Subsequently, the data is aggregated to quarterly frequency and converted to real values using the GDP Deflator. Moments are seasonally adjusted using Stata's sax12 command, and detrended using the Hodrick-Prescott (1997) filter. Labor employment data for Philippines are not available after the third quarter of 2011, and this restricts the length of our sample for calibration purposes.

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). Following Mandelman (2013), we set the fraction of time allocated to work in the steady state equal to 1/2, which pins down the value of η at 0.45. The annual world interest rate is set at 4%, and the credit constraint parameter $\bar{m} = 0.125$ yields an equilibrium share of private credit in GDP of about 0.32, which is consistent with the corresponding sample average for Philippines. The capital share in production, μ, is set at the standard value of 0.4 and the quarterly depreciation rate, δ is set at 0.025. The rate of time preference β is set to 0.985 to ensure that $\beta(1 + r^*) < 1$, i.e., the credit constraint is always binding and the model is closed. The adjustment cost parameter Ψ is set to 0.2 to match the investment volatility relative to the volatility of output. The remittance share in GDP is calibrated to equal 8.1%, to match the corresponding sample average in the data.

TABLE 2. Baseline Calibration

Parameter	**Description**	**Value**
σ	Intertemporal elasticity of substitution in consumption	2.25
η	Labor-share in utility	0.48
Ψ	Adjustment cost for investment	0.20
r^*	World interest rate (quarterly)	0.01
μ	Capital share in production	0.4
δ	Depreciation rate for physical capital (quarterly)	0.025
β, β^h	Rate of time preference	0.985
$\bar{m}$	Borrowing constraint parameter (entrepreneurs)	0.125
ρ^A	Persistence of productivity shock (estimated)	0.68
ρ^{TR}	Persistence of remittance shock (estimated)	0.40
ρ^m	Persistence of credit shock (estimated)	0.90
σ^A	Standard deviation of productivity shock	0.0118
σ^{TR}	Standard deviation of remittance shock	0.1257
σ^m	Standard deviation of credit shock	0.0071
Calibrated Variables		
I/Y	Private Investment-GDP ratio	0.25
B/Y	Private credit (debt)-GDP ratio	0.32
TR/Y	Remittance-GDP ratio	0.081

The stochastic processes used in the model are for total factor productivity, the loan-to-capital (LTC) ratio, and the exogenous components of remittance flows.[7] The process for the productivity shock is estimated using the Solow residuals in Philippines for our sample period, according to

$$A_t = \rho^A A_{t-1} + \varepsilon_t^A, \tag{14}$$

where ρ^A denotes the persistence of the productivity shock, and the stochastic term ε_t^A represents normally distributed and serially uncorrelated innovations.

The LTC ratio (credit constraint) is characterized by the following law of motion

$$m_t = \bar{m} \exp(\tilde{m}_t), \tag{15}$$

[7]The Appendix provides additional information on the estimation of the model's underlying stochastic processes.

where $\bar{m}$ is the steady-state LTC ratio, and $\tilde{m}_t$ describes the stochastic process for this ratio:

$$\tilde{m}_t = \rho^m \tilde{m}_{t-1} + \varepsilon_t^m, \tag{15a}$$

where the innovations ε_t^m are normally distributed and serially uncorrelated, and ρ^m denotes the persistence of the credit shock. The persistence of the credit shock is estimated by constructing a series for the real value of business credit relative to the capital stock in Philippines for our sample period.

Finally, recalling (12), the exogenous component of remittances evolves according to

$$TR_t^d = \overline{TR} \exp(\widetilde{TR}_t) \tag{16}$$

where $\overline{TR}$ determines the steady-state level of exogenous remittances. The stochastic part $\widetilde{TR}_t$ follows an AR(1) process:

$$\widetilde{TR}_t = \rho^{TR} \widetilde{TR}_{t-1} + \varepsilon_t^{TR}, \quad \rho^{TR} \in [0, 1) \tag{16a}$$

where ρ^{TR} denotes its persistence and ε_t^{TR} represents an exogenous white-noise shock, which is normally distributed and serially uncorrelated. The persistence parameter for remittances is estimated using the Overseas Cash Remittance data series, obtained from the Philippines Central Bank, and converted to Pesos in units of 2005 prices.[8] The estimated values of ρ^A, ρ^m, and ρ^{TR} as well as the standard deviations for each shock are reported in Table 2.

4 Exogenous Remittance Shock

In this section, we consider a temporary exogenous shock to remittance inflows. Specifically, we consider the economy's dynamic response in two polar cases: when all remittance inflows accrue to (i) wage earners, i.e., $v = 1$, and (ii) entrepreneurs, i.e., $v = 0$. In other words, our objective is to understand how the distribution of remittances affects its dynamic absorption. Further, we conduct this exercise in three different contexts, to examine the sensitivity of the results to different model specifications. To this end, we start with our baseline model specification with hand-to-mouth wage earners and credit-constrained entrepreneurs with Cobb-Douglas preferences (Figure 1), but then extend the framework to (i) GHH preferences

[8] In the model, we assume that total remittances is given by the sum of counter-cyclical and exogenous remittances. In the data, it is not possible to distinguish between the two types of remittances. Therefore we use total remittances to estimate the stochastic process for exogenous remittances. As a robustness check, we include the Solow residual in the AR(1) process to account for the countercyclical part and find very similar estimates for the persistence and the standard deviation.

(Figure 2), and (ii) a comparison to a model specification *without* any credit constraints for either type of agent (Figures 3 and 4). This case underscores the role played by credit constraints in determining the aggregate response to a remittance shock. All figures are plotted as percentage deviations from the steady-state equilibrium and all shocks represent one standard deviation changes from their baseline levels. The unit of time plotted in the figures represent quarters.

4.1 Baseline Model

Figure 1 plots the economy's response for an unanticipated, exogenous, but temporary increase in remittance inflows in the baseline model (hand-to-mouth wage earners, credit-constrained entrepreneurs, and Cobb-Douglas preferences). In the case where wage earners are the principal recipients ($v = 1$, solid line), the economy contracts temporarily, with output, investment and labor supply declining from their pre-shock steady-state levels. Since wage earners are hand-to-mouth and do not own any capital, 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. The decline in labor supply raises the real wage for wage-earners, which further helps supplement the rise in their consumption. This adversely affects entrepreneurs by reducing the marginal product of capital, which consequently results in a lower rate of investment and a decline in output over time. This forces entrepreneurs to absorb the contraction by reducing their own consumption. Overall, aggregate consumption increases in the short run, as the increase in consumption of wage earners more than offsets the decline for entrepreneurs. The decline in output and investment reduces borrowing by entrepreneurs, which in turn improves the current account for the economy.

When entrepreneurs receive the entire temporary remittance inflow ($v = 0$, dashed line), 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 and also relaxes their borrowing constraint. As a result, both investment and borrowing increases on impact of the shock. The increase in investment also increases the demand for labor by raising its marginal product (and thereby the real wage). Since wage earners are not the recipients of the remittance inflow, the income effect from the higher wage rate (which tends to increase leisure) exactly offsets for the substitution effect (increasing labor supply), resulting in no net adjustment in their labor-leisure choice. These effects taken together cause a temporary expansion of aggregate output, which in turn facilitates an increase in consumption for both wage earners

and entrepreneurs.

In summary, Figure 1 indicates that the dynamic effect of remittances depend critically on who the recipient is and their relative ownership of physical capital. Recipients who do not own productive assets and have no access to borrowing tend to respond in a way that is *contractionary* for the aggregate economy, while recipients with ownership of productive assets and (imperfect) access to credit markets tend to respond in a way that is *expansionary* for the economy. In general, the larger the share of remittance flows that accrue to hand-to-mouth wage earners (i.e., as $v \to 1$), the more contractionary the effects will be for the aggregate economy, and vice versa.

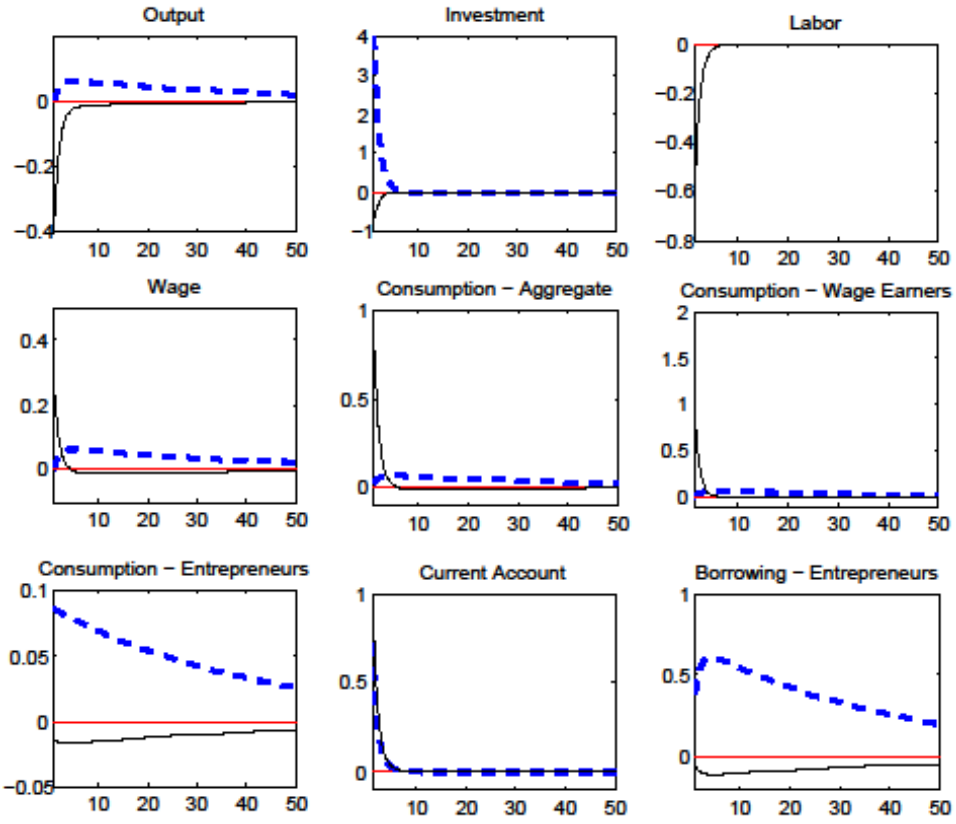


FIGURE 1. Exogenous Remittance Shock (Cobb-Douglas Utility)

- - - - Entrepreneurs —— Wage Earners

4.2 GHH Preferences

In this section, we conduct a robustness check on the dynamic response of the baseline model to an exogenous remittance shock. Since the baseline model is characterized by Cobb-Douglas utility for wage earners, this gives rise to an income effect when this group is the principal recipient of remittance inflows. To examine the role of the income effect we modify the

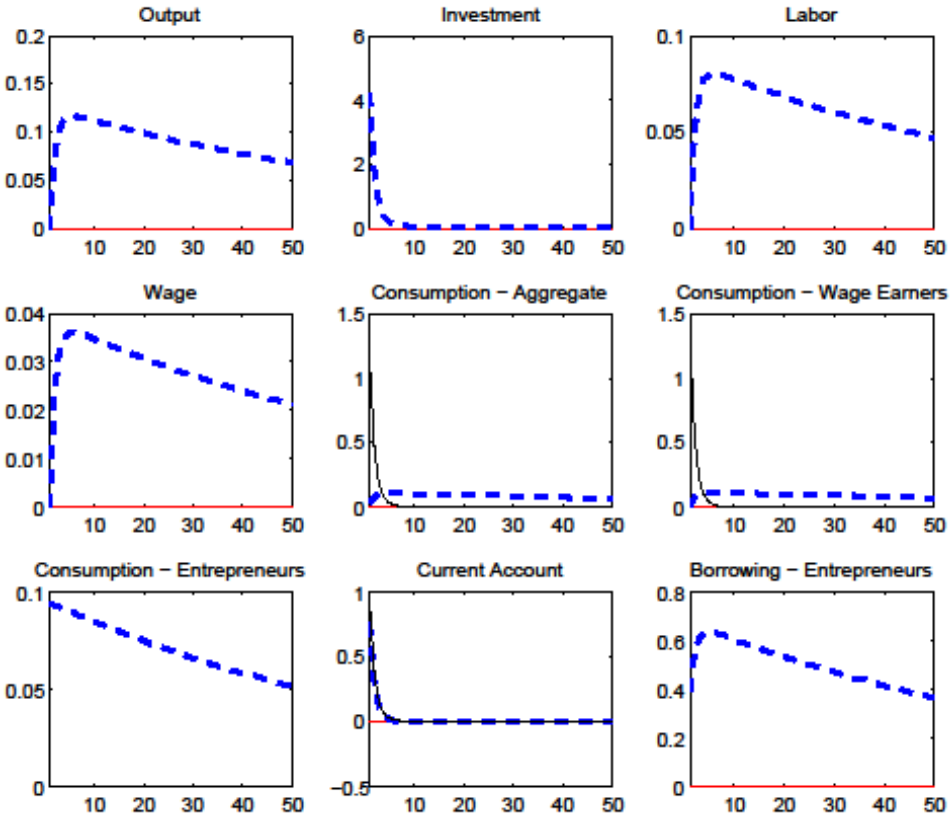
baseline model to introduce GHH preferences for wage earners:

$$U(C_t^h, l_t) = \frac{\left[\left(C_t^h\right) + \psi\left(1 - l_t\right)^{\eta}\right]^{1-\sigma}}{1-\sigma} \tag{17}$$

The main difference between (1) and (17) is the absence of an income effect in the GHH case, since the marginal rate of substitution between consumption and leisure is zero. Under this specification, we set η at 2.2 and ψ at 2.6, so that the fraction of time allocated to labor is the same as in the baseline model with Cobb-Douglas preferences.

Figure 2 depicts the dynamic response of the economy to a temporary, but exogenous remittance shock. As in Figure 1, we plot the dynamic responses in two polar cases, i.e., when wage earners receive the entire remittance inflow ($v = 1$), and when entrepreneurs are the only recipients ($v = 0$). Under GHH preferences, wage earners experience no income effect when remittances accrue to them. As a result, there is no response in their labor supply and the entire remittance inflow is consumed. Consequently, entrepreneurs remain unaffected by this shock and there is no change in the level of output and investment. Aggregate consumption increases as the hand-to-mouth wage earners consume the entire remittance inflow, with no other real consequence for the economy. On the other hand, when entrepreneurs are the principal recipient of remittances, the economy's dynamic response is expansionary and stronger than under the baseline Cobb-Douglas preferences. This is primarily due to the absence of an income effect in the wage earner's GHH utility preferences. Now, as the remittance inflow relaxes the entrepreneur's credit constraint, and increases investment, the higher demand for labor (and the increase in the real wage rate), causes wage earners to increase their labor supply. This, in turn, further increases the marginal product of capital for entrepreneurs, leading to a temporary expansion of output that is larger than in the baseline model with Cobb-Douglas utility. Therefore, the underlying utility specification for wage earners is important in characterizing the impact of remittance inflows. When wage earners receive remittances, the lack of an income effect under GHH preferences lead to a proportionate increase in consumption for this group, with no other macroeconomic consequences. By contrast, under Cobb-Douglas preferences, the economy's dynamic response to the same shock is contractionary. On the other hand, when entrepreneurs receive remittances, the economy expands as in the baseline case, but with the GHH preferences leading to a larger

expansion than under Cobb-Douglas preferences.



FIGUR E 2. Exogenous Remittance Shock (GHH Utility)

- - - - Entrepreneurs —— Wage Earners

4.3 Model 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 upper limit on their borrowing. In other words, we assume that both agents can borrow as much as they want from international capital markets, and then analyze their dynamic response to an underlying remittance shock. In the absence of the binding credit constraint in (10), we use a debt-elastic interest rate specification to close the model, as in Eaton and Gersovitz (1981). Specifically, the instantaneous budget constraint for wage earners is now modified to

$$B_t^h = (1 + r_t^h)B_{t-1}^h + C_t^h - w_t l_t - vTR_t \tag{18}$$

where r_t^h is the net real interest rate on debt for wage earners, which in turn is an increasing function of their group-specific outstanding debt:

$$r_t^h = r^* + F(B_t^h - \overline{B}^h), \quad F'(.) > 0 \tag{18a}$$

where $F(.)$ is an interest rate premium which takes the following form:

$$F(.) = \varphi \left(e^{B_t^h - \overline{B}^h} - 1 \right), \ \varphi \geq 0 \tag{18b}$$

In (18b), $\overline{B}^h$ 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 $F(.)$ goes to zero and the borrowing rate converges to the world interest rate, r^*. Further, since wage earners are no longer rule-of-thumb households in this specification, they maximize intertemporal utility over an infinite horizon:

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t U(C_t^h, l_t), \quad \beta^h \in (0,1) \tag{19}$$

where β^h is the rate of time preference for wage earners, and $U(C_t^h, l_t)$ is given by (1).

For entrepreneurs, the instantaneous budget constraint (9) now takes the form

$$B_t^e = (1 + r_t^e) B_{t-1}^e + C_t^e + w_t l_t + \Phi (I_t, K_{t-1}) - Y_t - (1 - \nu) TR_t \tag{20}$$

where B_t^e is their stock of debt, and r_t^e is their group-specific interest rate on borrowing, given by

$$r_t^e = r^* + H(B_t^e - \overline{B}^e), \quad H'(.) > 0 \tag{21a}$$

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

$$H(.) = \varphi \left(e^{B_t^e - \overline{B}^e} - 1 \right) \tag{21b}$$

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, $B_t^e \to \bar{B}^e$, we have $r_t^h = r_t^e = r^*$. The economy's aggregate stock of private-sector debt is then given by $B_t = B_t^h + B_t^e$. Note that in this specification, there are no credit constraints for either group of agents. The evolution

of the current account under this model specification is then given by

$$B_t = (1 + r_t^h)B_{t-1}^h + (1 + r_t^e)\, B_{t-1}^e + C_t + \Phi\left(I_t, K_{t-1}\right) - Y_t - TR_t \tag{22}$$

We calibrate the equilibrium in the model without credit constraints to ensure that the investment-GDP and remittance-GDP ratios match the equilibrium quantities obtained for the baseline model (with hand-to-mouth wage earners and credit-constrained entrepreneurs). In doing so, we set β^h and β to 0.985 and the interest rate premium parameter φ to 0.00075 to match the trade balance volatility in the data.

Our objective here is to understand better the role played by binding credit constraints in the absorption of remittance inflows. Therefore, we will compare the dynamic response of the recipient economy when there are no credit constraints with the baseline model under the two polar cases: when (i) all remittances accrue to wage earners ($v = 1$, Figure 3), and (ii) all remittances accrue to entrepreneurs ($v = 0$, Figure 4). The dashed line in each figure represents an economy *without* credit constraints for both wage earners and entrepreneurs, and the solid line is the response from the baseline mode, with hand-to-mouth wage earners and credit-constrained entrepreneurs. We retain the baseline assumption of Cobb-Douglas preferences for wage earners in this section.

In general, Figures 3 and 4 indicate that the presence of binding credit constraints in the baseline model works to *amplify* the dynamic response of the economy to an exogenous remittance shock, relative to a model without any borrowing constraints. For example, when wage earners are the principal recipients (Figure 3), the inflow of remittances is a pure lumpsum transfer from abroad, which has a very small income effect in the absence of credit constraints. Consequently, this mutes the response of their labor supply, leading to a much smaller decline in investment and output relative to when these agents are hand-to-mouth (completely shut off from credit markets). When entrepreneurs receive the remittance inflow (Figure 4), the absence of credit constraints imply that remittances substitute for borrowing, which in turn mutes the effect on investment and output relative to when these agents face binding credit constraints. Wage earners, being unconstrained with respect to their borrowing, now reduce their labor supply due to the income effect caused by higher wages. Over all, when entrepreneurs receive remittances but do not face binding credit constraints, the economy's response is still expansionary, albeit much smaller in magnitude than the baseline model with binding credit constraints. Therefore, both Figures 3 and 4 point to the role played by binding credit constraints in amplifying the effects of a remittance shock

to the economy.[9]

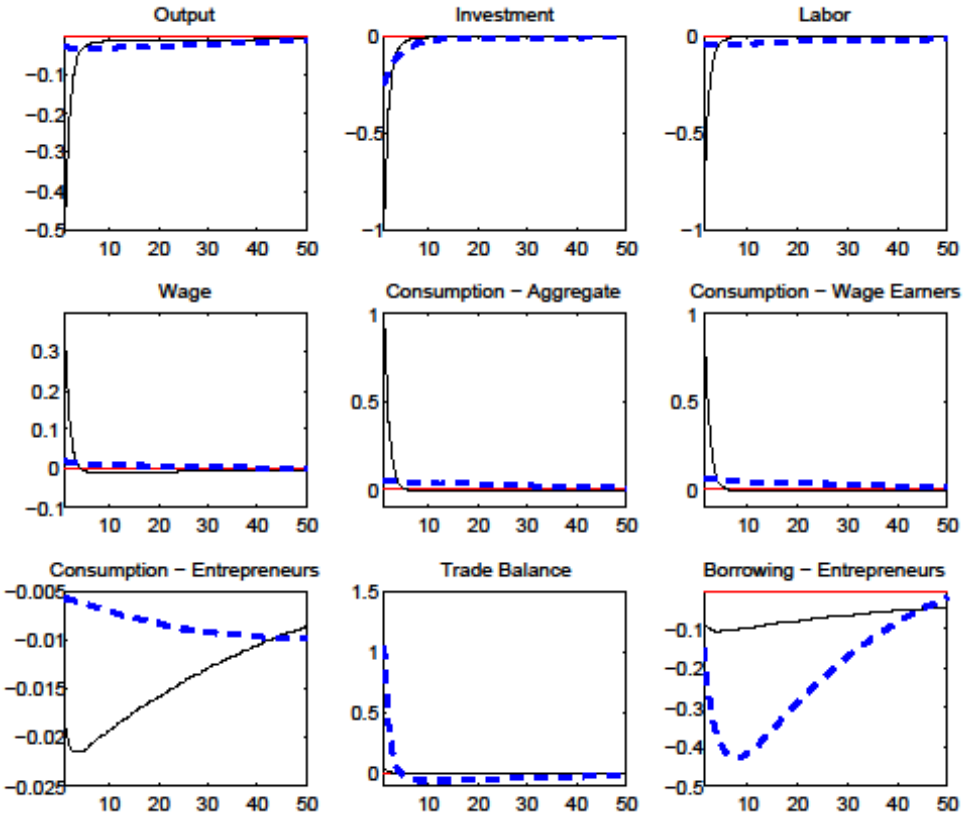


FIGURE 3. Exogenous Shock to Remittances, $v = 1$ (Wage earners, CD Utility)

- - - - Model without credit constraints —— Baseline Model

[9]The result that credit constraints can amplify the dynamic response from an underlying shock has been studied in other contexts; See, for example, a recent contribution by Liu, Wang, and Zha (2013). In the context of remittances, Durdu and Seyan (2010) find that the presence of credit constraints amplify the effects of remittances in the short-run for Turkey.

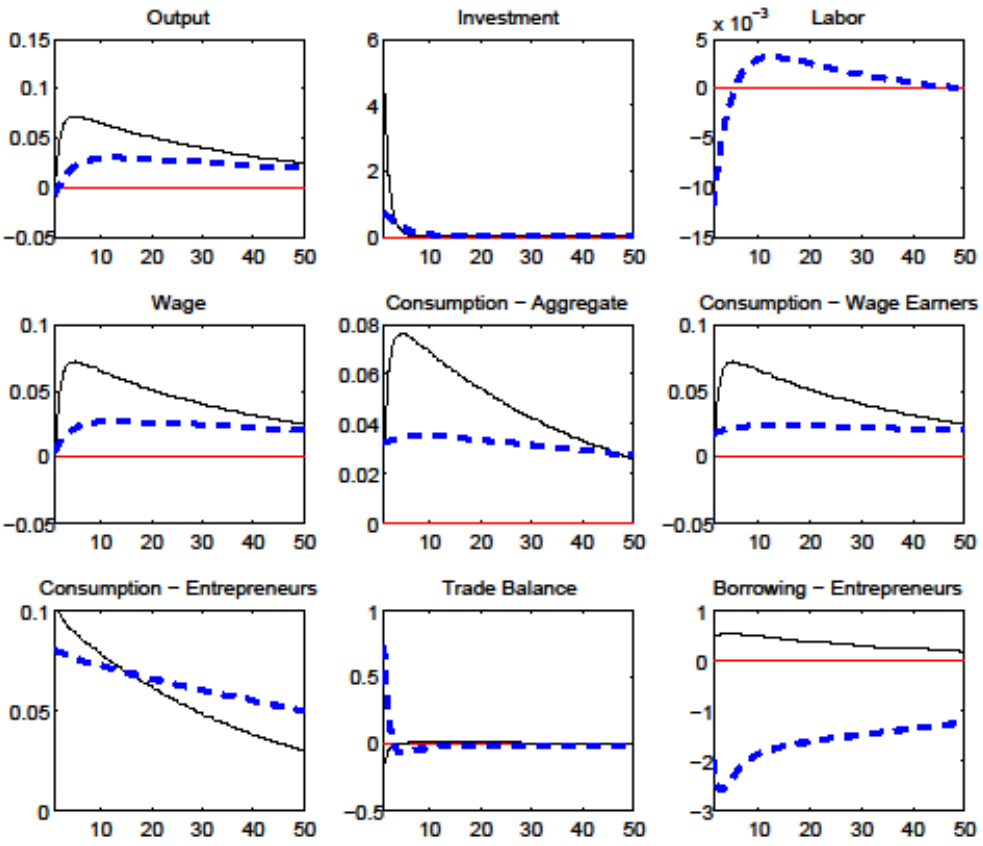


FIGURE 4. Exogenous Shock to Remittances, $v = 0$ (Entrepreneurs, CD Utility)

- - - - Model without credit constraints —— Baseline Model

4.4 Welfare

In this section, we analyze the welfare consequences of remittances, especially taking into account their distribution between entrepreneurs and wage earners. Specifically, we ask the following questions: how is the intertemporal welfare path of entrepreneurs (wage-earners) affected when all remittances accrue to wage earners (entrepreneurs)? In other words, how is the welfare for a group of agents affected when the *other* group receives all remittance inflows? Further, how is total welfare for the economy affected by the distribution of remittances between entrepreneurs and wage earners? We characterize these effects in Figure 5 for the baseline model with credit constraints. The model is simulated with three shocks: productivity, credit, and remittances (exogenous), and the intertemporal welfare paths plotted over time. When entrepreneurs receive all remittance inflows ($v = 0$), wage earners are better off throughout the transition path. This is because of the expansionary effect of remittances when they accrue to entrepreneurs: output and wage income increases, which enables wage earners to increase their consumption in transition. On the other hand, when

all remittances go to wage earners ($v = 1$), entrepreneurs are worse-off throughout the entire transition path. This happens because of the contractionary effect of remittances when wage earners are the principal recipients: output and investment decline, along with the consumption of entrepreneurs. Over all, the distribution of remittances matter for aggregate welfare: when entrepreneurs are the principal recipients, welfare increases in transition, while in the case of wage earners, the aggregate economy is always worse off.

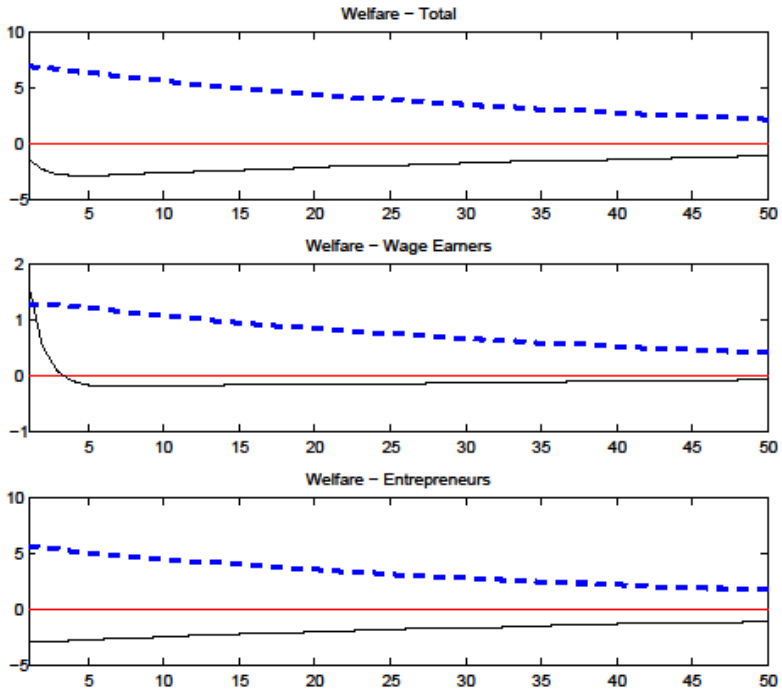


FIGURE 5. Transitional Welfare Paths

- - - - Principal recipients: Entrepreneurs ($v = 0$), —— Principal recipients: Wage Earners ($v = 1$)

5 Countercyclical Remittance Shock

Figure 6 illustrates the economy's response when there is a temporary but countercyclical increase in remittances. Specifically, we consider the case where a negative productivity shock in the recipient country generates an increase in remittance inflows from abroad. Noting (12), countercyclical remittances are given by $TR_t^c = Y_t^{\xi}$, where $\xi < 0$ is the elasticity of remittances with respect to aggregate output. We use the mode value obtained from the Bayesian estimation in Mandelman (2013) for Philippines, and set $\xi = -1.98$.[10] As before,

[10]The specification used by Mandelman (2013) is slightly different in that he defines the elasticity with respect to the real wage rather than output. We choose aggregate output as remittances are received by

we compare the two polar cases regarding the distribution of remittances, i.e., $v = 0$ and $v = 1$: the dashed lines represent the response of the economy when entrepreneurs receive the remittance shock, while the solid lines depict the case where wage earners are the principal recipients. Since the underlying dynamics are being driven by a negative productivity shock, the economy contracts in both cases. When remittances accrue to entrepreneurs, the declines in output, investment, and labor supply are 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. Entrepreneurs in this case are unable to smooth the negative productivity shock, and investment and output decline more and remain below the steady state for longer. Figure 6 underscores the fact that the ability of remittances to smooth business cycle fluctuations depends critically on their distribution across heterogeneous agents.[11]

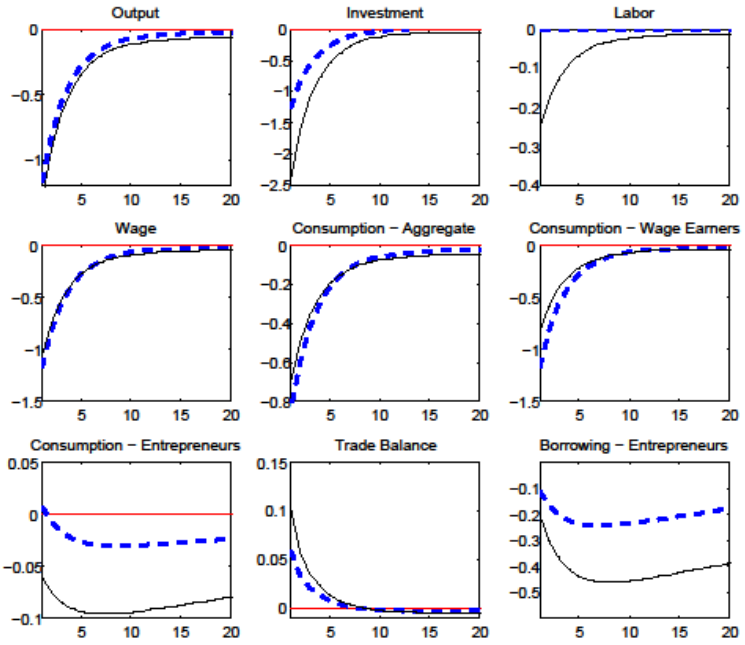


FIGURE 6. Countercyclical Remittances

- - - - Entrepreneurs —— Wage Earners

both wage earners and capital owners in our model.

[11] We have also considered the case of a procyclical shock to remittances, where a positive productivity shock in the recipient economy shock leads to an increase in remittance inflows. The results are a mirror image of the countercyclical case, and hence have not been reported here. They are, however, available from the authors on request.

6 Model Fit

Up to this point, our analysis has focused primarily on highlighting the model's dynamic behavior for two extreme assumptions regarding the distribution of remittances, i.e., when $v = 0$ (all remittances accrue to entrepreneurs), and $v = 1$ (all remittances accrue to wage earners). While this is useful to understand the model's underlying mechanisms, it is clearly not realistic, as remittances may be distributed internally among both group of agents. Given the nature of available data in Philippines, it is not possible to observe directly the internal distribution of remittances among wage earners and entrepreneurs. However, an understanding of the distribution parameter v is crucial to examining the model's fit with the data. We therefore employ an indirect approach to pin down this parameter, by looking at patterns of bilateral remittance inflows and outward migration for Philippines. It has been well documented that migrants with higher levels of education come from wealthy families and also have more inter-regional mobility than those with low educational attainment.[12] Then, a plausible way to start would be with the premise that migrants from Philippines who move to distant countries might come from wealthy families and also likely have high levels of educational attainment. Therefore, the share of remittance inflows into Philippines from these migrants would represent financial flows to their families back home, who in turn, are likely to have ownership of capital and some degree of access to credit markets. (i.e., the entrepreneurs in our model). This approach can then give us indirect information on the internal distribution of remittances in Philippines.

Between 1990-2010, the share of outward migration from Philippines to the US and EU was about 83 percent, with about 68 percent of these migrants reporting a tertiary level of education.[13] During this period, the average share of remittance inflows into Philippines from the US and EU was about 67 percent; See Figure 7.[14] Given our premise that migrants from Philippines to the US and EU are likely to come from wealthy families, we set the remittance distribution parameter, v, to 0.3, implying that 70 percent of remittance inflows in our model accrue to households who own capital, i.e., entrepreneurs. As we will see below,

[12] The relationship between education and mobility has been studied, among others, by Dahl (2002), Hunt (2004), Malamud and Wozniak (2012), Machin et al. (2012); also see Bauernschuster et al. (2014). The link between educational attainment and parental or family wealth in the context of economic development goes back to Galor and Zeira (1993). Black and Devereux (2011) and Kinsler and Pavan (2011) provide comprehensive reviews of the empirical literature on this issue.

[13] A tertiary level of education implies a higher than high-school leaving certificate or equivalent. Source: Institute for Employment Research (2013); See: http://www.iab.de/en/daten/iab-brain-drain-data.aspx

[14] Source: Filipino Central Bank and Institute for Employment Research (2013). The remittance data were transformed from U.S. Dollars to Philippine Pesos using the average monthly US-Peso exchange rate. Subsequently, the data were aggregated to quarterly frequency, converted to real values using a GDP Deflator, and seasonally adjusted using Stata's sax12 command.

$v = 0.3$ provides a much better fit for the model relative to the extreme cases of $v = 0$ or $v = 1$.

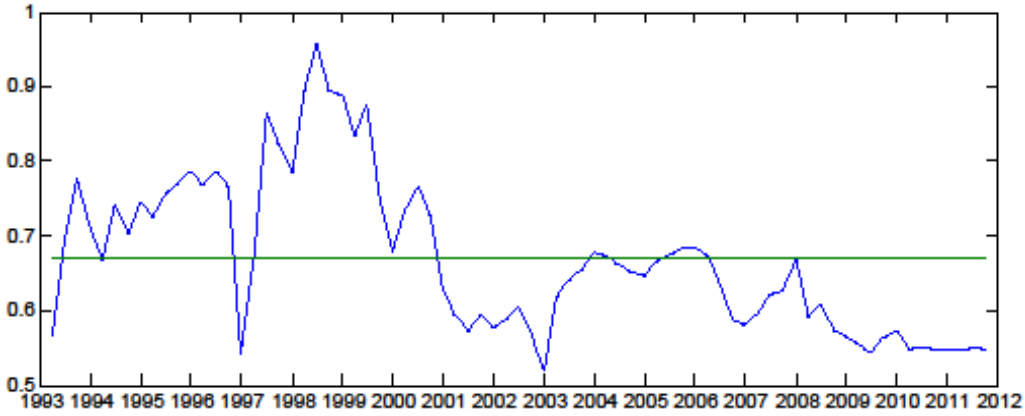


FIGURE 7. Share of Total Remittances from US and EU for Philippines, 1993-2011

Table 3 presents a comparison of the volatility and implied correlations of the key macroeconomic variables under the two model specifications (with and without credit constraints) and for three scenarios for the distribution of the remittance shock, i.e., $v = 0$ (entrepreneurs are the principal recipients), $v = 0.3$ (our calibrated value, with 70 percent of remittances going to entrepreneurs), and $v = 1$ (wage earners are the principal recipients), with those calculated from the data for Philippines for the period 1993Q1 to 2011Q3. The model's moments have been generated from productivity, credit, and remittance shocks. The model is log-linearized around the steady-state and the moments are calculated using de-trended series. Over all, Table 3 suggests that (i) the model specification with binding credit constraints fits the data significantly better than the specification without credit constraints, thereby underscoring the importance of these constraints in understanding the dynamic implications of remittance inflows, and (ii) the calibrated value of $v = 0.3$, with 70 percent of remittance inflows accruing to households with ownership of capital, fits the data relatively better than the polar cases of $v = 0$ and $v = 1$. Moreover, both our model specifications matches well the observed negative correlation between the current account and GDP for Philippines. The countercyclicality between the current account and GDP in emerging markets has been recently documented as an important stylized fact in the open-economy DSGE literature.[15]

[15] See, for example, Chinn and Prasad (2003), Neumeyer and Perri (2005), and Aguiar and Gopinath (2007).

TABLE 3. Model Fit: Standard Deviations and Correlations (CD Utility)

A. Baseline Model with Credit Constraints

	Data	$v = 0$	$v = 0.3$	$v = 1$
$sd(Y)$	1.26	1.32	1.35	1.45
$sd(C)/sd(Y)$	0.78	0.75	0.74	0.83
$sd(I)/sd(Y)$	3.82	4.32	3.82	3.34
$sd(TR)/sd(Y)$	10.82	7.36	7.19	6.64
$sd(NX/Y)$	2.70	1.05	1.04	1.04
$Corr(I, Y)$	0.42	0.36	0.39	0.53
$Corr(TR, Y)$	−0.09	−0.07	−0.15	−0.33
$Corr(TR, C)$	0.14	0.06	0.14	0.54
$Corr(TR, I)$	0.36	0.56	0.40	−0.18
$Corr(NX/Y, Y)$	−0.11	−0.07	−0.07	−0.09

B. Baseline Model without Credit Constraints

	Data	$v = 0$	$v = 0.3$	$v = 1$
$sd(Y)$	1.26	1.74	1.75	1.78
$sd(C)/sd(Y)$	0.78	0.20	0.20	0.20
$sd(I)/sd(Y)$	3.82	3.49	3.49	3.54
$sd(TR)/sd(Y)$	10.82	5.95	5.86	5.65
$sd(NX/Y)$	2.70	0.99	1.04	1.19
$Corr(I, Y)$	0.42	0.87	0.87	0.88
$Corr(TR, Y)$	−0.09	−0.07	−0.07	−0.08
$Corr(TR, C)$	0.14	−0.01	−0.00	0.00
$Corr(TR, I)$	0.36	0.05	0.04	−0.09
$Corr(NX/Y, Y)$	−0.11	−0.09	−0.10	−0.13

Table 4 examines the sensitivity of the model fit to the underlying preference structure of the model, i.e., whether the utility function is characterized by Cobb-Douglas or GHH preferences. The robustness check is performed under the two model specifications, i.e., in the presence and absence of binding credit constraints, and with the distribution of remittances set to its calibrated value of $v = 0.3$. As can be seen from Table 4, the model specification with binding credit constraints again outperforms the one without these constraints, irrespective of the underlying preference structure. A comparison of the two preference specifications suggests that the Cobb-Douglas case fits the data marginally better than the GHH case. Over all, Tables 3 and 4 underscore the importance of binding credit constraints in understanding the absorption of remittance inflows and, at least, in the case of Philippines, suggest that the interior allocation of remittances is skewed towards households who have ownership of capital.

TABLE 4. Model Fit : Sensitivity to Preferences

Cobb-Douglas (CD) vs. GHH Utility Function, $v = 0.3$

	Data	**CD (CC)**	**CD (NC)**	**GHH (CC)**	**GHH (NC)**
$sd(Y)$	1.26	1.35	1.75	1.81	1.86
$sd(C)/sd(Y)$	0.78	0.74	0.20	0.75	0.40
$sd(I)/sd(Y)$	3.82	3.82	3.49	3.15	3.52
$sd(TR)/sd(Y)$	10.82	7.19	5.86	5.62	5.45
$sd(NX/Y)$	2.70	1.04	1.04	1.05	1.15
$Corr(I, Y)$	0.42	0.39	0.87	0.52	0.89
$Corr(TR, Y)$	−0.09	−0.15	−0.07	−0.08	−0.08
$Corr(TR, C)$	0.14	0.14	−0.00	0.15	−0.05
$Corr(TR, I)$	0.36	0.40	0.04	0.41	0.01
$Corr(NX/Y, Y)$	−0.11	−0.07	−0.10	−0.10	−0.40

Note: CC: Model with credit constraints, NC: Model without credit constraints

7 Discussion

The main mechanism suggested by our model specification is that an increase in remittances accruing to hand-to-mouth workers (with no ownership of capital or access to credit markets) has a contractionary effect on the economy, while the reverse holds when owners of capital (with some access to credit markets) are the main recipient. To provide some suggestive

evidence on whether the main channel investigated in this analysis is plausible or not, we compare the behavior of Philippines with Malaysia, a country which is geographically close but receives a very small share of its GDP in the form of remittances (approximately 0.46 percent of GDP, on average) compared to Philippines (8.1 percent of GDP). Specifically, we compare the growth paths of real GDP and private investment in these countries during 1993-2014, and focus on two important events during this period: the 1997-98 Asian financial crisis, and the 2008-2009 Global financial crisis. The idea here is to compare the intertemporal behavior of real GDP and private investment for two countries, one that receives, on average, about 8 percent of its GDP in the form of remittances (Philippines), and the other that receives only about 0.5 percent (Malaysia).

Figures 8 and 9 plot the growth rates of real GDP and private investment, respectively, for Philippines and Malaysia. Recalling Figure 7, we note that remittance inflows from the US and EU to Philippines *increased* dramatically during the 1997-1998 Asian crisis and *decreased* during the 2008-2009 Global financial crisis**.** In contrast, Malaysia did not experience any significant fluctuation in its remittance receipts (not shown, due to scale). It is interesting to note that the contraction of real GDP and private investment was significantly smaller for Philippines compared to Malaysia during the Asian Crisis, when remittance inflows to Philippines from the US and EU went up sharply. On the other hand, when remittance inflows from the US and EU declined during the Global financial crisis of 2008-2009, the differences in the contraction of real GDP and investment between Philippines and Malaysia were not that significant. These trends suggest that remittances indeed might have a business-cycle smoothing effect, given that their level in Philippines is significantly higher than in Malaysia. Further, the fact that the contraction of real GDP and private investment was smaller in Philippines during 1997-98 may also suggest that its internal distribution was skewed towards households who have ownership of capital and access to credit markets. By relaxing binding credit constraints, remittances in Philippines may have enabled recipients to partially offset the contractionary effects of the underlying crisis, as our model predicts. Indeed, Yang (2008) documents a large increase in remittances from overseas Filipinos during the Asian financial crisis (driven by real appreciations in currencies of destination countries like the US), and shows that this increase was associated with higher investments in capital-intensive entrepreneurship, human capital, and labor supply among recipient households in Philippines. While there are surely general equilibrium factors at play in this comparison, we take these facts as suggestive evidence supporting the central mechanism characterized in this paper. Specifically, our results in Sections 4 and 5 that the effect of remittances are more expansionary when entrepreneurs are the principal recipients, and the ability of remittances to smooth the contractionary effects of a negative productivity

shock when its internal distribution is skewed towards entrepreneurs is broadly consistent with the trends in Figures 8 and 9. Further, the pattern of migration and remittance inflows into Philippines discussed in Section 6 also supports the hypothesis that a majority of remittance inflows accrue to households with ownership of capital which, according to our model, would enhance the ability of remittances to smooth business cycle shocks.

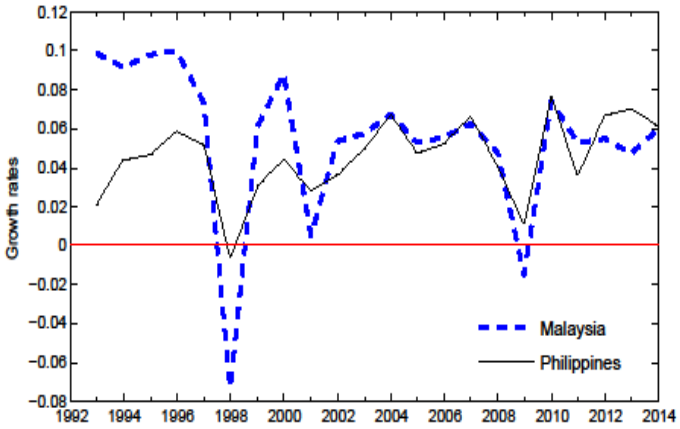


FIGURE 8. Growth Rate of Real GDP, 1993-2014

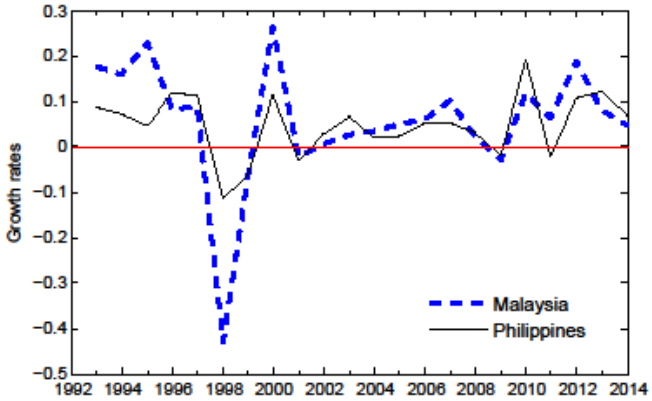


FIGURE 9. Growth Rate of Real Private Investment, 1993-2014

8 Conclusions

This paper analyzes 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: hand-to-mouth wage earners, who have no ownership of capital or access to credit markets, and entrepreneurs, who own capital, but face binding borrowing constraints in credit markets. Given this set up, we show that the dynamic absorption of a temporary in-

crease in remittance inflows depends critically on (i) the internal distribution of remittances between wage earners and entrepreneurs, (ii) the presence or absence of binding credit constraints, and (iii) the underlying preference structure for wage earners, i.e., the presence or absence of an income effect. Specifically, when remittance flows accrue to wage earners, their response tends to be contractionary for the economy. In contrast, when entrepreneurs are the principal recipients, the effects tend to be expansionary. The magnitude of these effects, however, depend on the presence or absence of binding credit constraints and an underlying income effect: the presence of credit constraints works to amplify the effect of remittances relative to when these constraints are absent, while the presence of an income effect tends to mute the effect of remittance inflows, irrespective of their internal distribution among agents. Further, when remittance inflows are countercyclical, their ability to smooth business cycle fluctuations depend on their internal distribution: the larger the share for entrepreneurs, the larger is the smoothing effect of remittances. Using quarterly data from the Philippines for the period 1993 to 2011, we show that the model specification with binding credit constraints compares relatively better with respect to the key moments and correlations in the data, relative to the model without credit constraints. We use data on migration patterns and bilateral remittance inflows to calibrate the internal distribution of remittances, and show that this leads to an improvement in the model's overall fit. Finally, we examine the welfare consequences of the distribution of remittances.

We distinguish our paper from the existing literature by highlighting the quantitative significance of several new channels through which external transfers are absorbed by an emerging economy, namely the internal distribution of remittances among heterogeneous households, the presence of binding credit constraints and an income effect that determines the allocation of time between work and leisure. In contrast, previous studies have generally assumed that households have no access to credit and firms (or households that own them) 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. 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.

Appendix

The nominal GDP, investment, and consumption series are converted into real units by dividing the corresponding nominal series with the GDP deflator for constant 2005 prices.

Capital Stock: The capital stock is generated using a perpetual inventory method. The nominal investment series has been converted into 2005 prices and seasonally adjusted for constructing the capital stock data. For the perpetual inventory method, we use a yearly depreciation rate of 8 percent, as in Meza and Quintin (2007). To set the initial capital stock, we follow Young (1995) and Meza and Quintin (2007) and assume that the growth rate of investment in the first five years of the series is representative of the growth rate of investment in previous years.

Labor Input: We use total employment, general level series from the International Labour Organization.

Remittances: Overseas Filipinos' Cash Remittances in US Dollars converted to Pesos in units of 2005 prices, from the Central Bank of Philippines.

Total Factor Productivity: The data on TFP have been constructed as

$$A_t = \log(y_t) - \alpha \log(k_{t-1}) - (1-\alpha)\log(l_t)$$

where y_t is GDP in 2005 prices, k_t is capital stock in 2005 prices and l_t is total hours worked. The TFP series is then linearly detrended and the residuals are used to estimate the AR(1) process for the productivity shock.

Business Credit: We construct the real value of business credit in 2005 prices by dividing the private credit series with the GDP deflator, obtained from the Central Bank of Philippines. Since the credit constraint on firms takes the form

$$B_t \leq m_t E_t(q_{t+1} K_t),$$

we calculate the series for m_t as the ratio of the real value of private credit divided by the capital stock, where both series are in units of 2005 prices.

References

[1] Acosta, P., P. Fajnzylber, and J.H. Lopez (2008), "Remittances and household behavior: evidence for Latin America," in P. Fajnzylber, and J.H. Lopez (eds.), *Remittances and Development*, The World Bank and IRDB, Washington, DC.

[2] Acosta, P., E. Lartey, and F. Mandelman (2009), "Remittances and the Dutch disease." *Journal of International Economics* 79, 102-116.

[3] Adams, R., and A. Cuecuecha (2010), "Remittances, household expenditure and investment in Guatemala." *World Development* 38, 1626-1641.

[4] Aggarwal, R., A. Demirguc-Kunt, and M. Martinez-Peria (2011), "Do remittances promote financial development?" *Journal of Development Economics* 96, 255-264.

[5] Aguiar, M., and G. Gopinath (2007), "Emerging market buisness cycles: the cycle is the trend." *Journal of Political Economy* 115, 69-102.

[6] Alcaraz, C., D. Chiquiar, and A. Salcedo (2012), "Remittances, schooling, and child labor in Mexico." *Journal of Development Economics* 97, 156-165.

[7] Bansak, C. and B. Chezum (2009), "How do remittances affect human capital formation of school-age boys and girls?" *American Economic Review* 99, 145-148.

[8] Barajas, A., Gapen, M. T., Chami R., Montiel P. and Fullenkamp, C. (2009), "Do workers' remittances promote economic growth?" IMF Working Paper 09/153, Washington, DC: International Monetary Fund.

[9] Bauernschuster, S., O. Falck, S. Heblich, J. Suedekum, and A. Lameli (2014), "Why are educated and risk-loving persons more mobile across regions?" *Journal of Economic Behavior and Organization* 98, 56-69.

[10] Bettin, G. and Zazzaro, A. (2012), "Remittances and financial development: substitutes or complements in economic growth?" *Bulletin of Economic Research* 64, 509-536.

[11] Black, S., and P. Devereux (2011), "Recent developments in intergenerational mobility." *Handbook of Labor Economics*, eds. O. Ashenfelter and D. Card, 1487-1541. Amsterdam: Elsevier.

[12] Brown, R. and D. Ahlburg (1999), "Remittances in the South Pacific." *International Journal of Social Economics* 26, 325-344.

[13] Brock, P. (1996), "International transfers,the relative price of non-traded goods,and the current account." *Canadian Journal of Economics* 29,163–180.

[14] Catrinescu, N., Leon-Ledesma, M., Piracha, M. and Quillin, B. (2009), "Remittances, institutions and economic growth." *World Development*, 37, 81-92.

[15] Chami, R., Fullenkamp, C. and Jahjah, S. (2005), "Are migrant remittance flows a source of capital for development?" *IMF Staff Papers* 52, 55-81.

[16] Chatterjee, S., G. Sakoulis, and S. Turnovsky (2003), "Unilateral capital transfers, public investment, and economic growth." *European Economic Review* 47, 1077-110

[17] Chinn, M., and E. Prasad (2003), "Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration." *Journal of International Economics* 59, 47-76.

[18] Combes, J. and C. Ebeke (2011), "Remittances and household consumption instability in developing countries." *World Development* 39, 1076-1089.

[19] Dahl, G. (2002),"Mobility and the return to education: testing a Roy model with multiple markets." *Econometrica* 70, 2367–2420.

[20] Durand, J., W. Kandel, E. Parrado, and D. Massey (1996), "International migration and development in Mexican communities." *Demography* 33, 249-264.

[21] Durdu, C. and S. Sayan (2010), "Emerging market business cycles with remittance fluctuations." *IMF Staff Papers*, Vol. 57, No. 2, 2010. pp. 303-325.

[22] Eaton, J., and M. Gersovitz (1981), "Debt with Potential Repudiation: Theoretical and Empirical Analysis", *Review of Economic Studies*, 48:289-309.

[23] Faini, R. (2007), "Remittances and the brain drain? Do skilled migrants remit more?" *World Bank Economic Review* 21, 177-191.

[24] Galor, O., and J. Zeira (1993), "Income distribution and macroeconomics." *Review of Economic Studies* 60, 35-52.

[25] Guiliano, P. and M. Ruiz-Arranz (2009), "Remittances, financial development, and growth." *Journal of Development Economics* 90, 144-152.

[26] Guvenen, F., (2006), "Reconciling conflicting evidence on the elasticity of intertemporal substitution: A macroeconomic perspective." *Journal of Monetary Economics* 53, 1451-1472.

[27] Hodrick, R., and E. Prescott (1997), "Postwar US business cycles: an empirical investigation." *Journal of Money, Credit, and Banking* 29, 1-16.

[28] Hunt, J. (2004), "Are migrants more skilled than non-migrants? Repeat, return, and same-employer migrants." *Canadian Journal of Economics* 37, 830–849.

[29] Keynes, J. (1929), "The German transfer problem." *Economic Journal* 39,1–7.

[30] Kinsler, J., and R. Pavan (2011), "Family income and higher education choices: the importance of accounting for college quality." *Journal of Human Capital* 5, 453-477.

[31] Liu, Z., P. Wang, and T. Zha (2013), "Land-price dynamics and macroeconomic fluctuations." *Econometrica* 81, 1147-1184.

[32] Machin, S., P. Panu, and K. Salvanes (2012), "Education and mobility." *Journal of the European Economic Association* 10, 417–450.

[33] Malamud, O., and A. Wozniak (2012), "The impact of college on migration: evidence from the Vietnam generation." *Journal of Human Resources* 47, 913–950.

[34] Mandelman, F. and A. Zlate (2012), "Immigration, remittances, and business cycles." *Journal of Monetary Economics* 59, 196-213.

[35] Mandelman, F. (2013), "Monetary and exchange rate policy under remittance fluctuations." *Journal of Development Economics* 102, 128-147.

[36] Mendoza, E. (1991), "Real business cycles in a small-open economy." *American Economic Review* 81(4), 797-818.

[37] Meza, F., and E. Quintin (2007), "Factor utilization and the real impact of financial crises." *The BE Journal of Macroeconomics* 7.

[38] Mundaca, G. (2009), "Remittances, financial market development, and economic growth: the case of Latin America and the Caribbean." *Review of Development Economics* 13, 288-303.

[39] Neumeyer, P., and F. Perri (2005), "Business cycles in emerging economies: the role of interest rates." *Journal of Monetary Economics* 52, 345-380.

[40] Ohlin, B. (1929), "Transfer difficulties, real and imagined." *Economic Journal* 39,172–178

[41] Ratha, D. and S. Mohapatra (2007), "Increasing the macroeconomic impact of remittances on development." Mimeo, Development Prospects Group, The World Bank.

[42] Saenz, M. (2007), "Framing the debate: use of family remittances for housing finance." Mimeo, Habitat for Humanity International.

[43] Serageldin, M. and E. Guerra (2008), "Migration, remittances, and investment in Sub-Saharan Africa." Mimeo, Institute for International Urban Development.

[44] Turnovsky, S. (1997), *International Macroeconomic Dynamics.* The MIT Press, Cambridge, MA.

[45] Turunen-Red, A., and A. Woodland (1988), "On the multilateral transfer problem: existence of Pareto improving international transfers." *Journal of International Economics* 25,249–269

[46] Uribe, M. and S. Schmitt-Grohe (2003), "Closing small open economy models." *Journal of International Economics* 61, 163-185.

[47] Wincoop, E. (1993), "Structural adjustment and the construction sector." *European Economic Review* 17, 177-201.

[48] Woodruff, C. and R. Zenteno (2007), "Migration networks and microenterprises in Mexico." *Journal of Development Economics, Elsevier* 82(2), 509-528.

[49] Yang, D. (2008), "International migration, remittances and household investment: evidence from Philippine migrants' exchange rate shocks." *Economic Journal* 118, 591-630.

[50] Yang, D. (2011), "Migrant Remittances." *Journal of Economic Perspectives* 25, 129-152.

[51] Young, Alwyn (1995), "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience." *The Quarterly Journal of Economics* 110, 641-680.