Remittances, Entrepreneurship and Employment Dynamics over the Business Cycle*

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Abstract

We build a small open economy business cycle model with frictional labor markets that incorporates several facts from the micro literature on remittances into a general equilibrium environment. Specifically, remittances can (1) support household consumption, (2) affect households' labor force participation decisions, and (3) contribute to microenterprise development. We calibrate the model to Mexico and show that it is consistent with several facts about labor market dynamics and business cycles in emerging economies. Then, we study how differences in the cyclicality of remittances affect labor market and aggregate dynamics. We find that, while countercyclical remittances smooth fluctuations in consumption, investment, and individual labor earnings, they can generate sharper output and unemployment movements by generating changes in labor force participation and the cyclical composition of employment. Finally, we show that the model is consistent with the behavior of output, investment, and unemployment in Mexico during the 2008-2009 global financial crisis.

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1 Introduction

It is well known that remittances represent an important source of income for many developing countries. For example, these resources account for anywhere between 2.5 percent of GDP in Mexico and Turkey to more than 20 percent of GDP in other Latin American economies, and almost one third of GDP in certain African countries (Sirkeci, Cohen, and Ratha, 2012). Despite recent improvements in data availability, we still lack a solid grasp of the aggregate impact of remittances in remittance-recipient economies. More importantly, we lack a comprehensive practical framework that can guide policymakers in assessing the key channels and mechanisms through which cyclical movements in remittances can affect individual welfare and aggregate economic activity when countries face adverse shocks. This has become more evident during the recent financial crisis, which was accompanied by a decline in remittance flows for the first time in recent history (Sirkeci, Cohen, and Ratha, 2012). Thus, recent events have rekindled interest in delving deeper into the individual and aggregate consequences of remittance fluctuations.

The macroeconomic literature on remittances has largely focused on exploring how cyclical movements in remittance income affect consumption smoothing and aggregate volatility (Chami, Cosimano, and Gapen, 2007; Durdu and Sayan, 2008; Chami, Hakura, and Montiel, 2012). Conversely, the microeconomic literature has placed more attention on the impact of remittances on individual labor supply and labor force participation (Amuedo-Dorantes and Pozo, 2006), human and physical capital investment – including the creation of microenterprises in recipient countries (Woodruff, 2001; Woodruff and Zenteno, 2007) – and more generally, on the allocation of remittance income between saving, consumption, and investment at the individual level (Sirkeci, Cohen, and Ratha, 2012). While the macroeconomic literature has analyzed how total hours worked respond to remittance movements, the extensive margin of employment – including changes in the composition of employment between salaried work and self-employment, as well as the behavior of unemployment – have generally been absent in discussions of the aggregate implications of remittance fluctuations. Given the breadth of self-employment in many remittance recipient economies, it is possible for cyclical changes in remittances to have an additional

impact on the labor market over and above the one arising from changes in hours worked and salaried labor supply through the decision to become self-employed and start a microenterprise. This is particularly the case since self-employment exhibits different cyclical dynamics relative to salaried employment (Bosch and Maloney, 2008; Loayza and Rigolini, 2011). This suggests that remittance fluctuations not only have the potential to alter participation decisions, but also the cyclical composition of employment between salaried and non-salaried work depending on the cyclicality of remittances. In turn, changes in the response of salaried and self-employment can have wider implications for unemployment dynamics and aggregate fluctuations such that the benefits of remittance inflows during downturns may not be as clear cut. Moreover, to the extent that the cyclicality of remittance inflows changes during downturns and alters labor market dynamics in recipient economies, the effectiveness of active labor market policies in these economies may be affected in important ways. To the best of our knowledge, these issues have not been addressed in a comprehensive environment that takes into account the different margins through which remittances affect household behavior, where the latter have been a recurring theme in the micro literature.

We build a small open economy business cycle model with frictional labor markets to analyze the impact of remittance fluctuations and their cyclicality on employment and aggregate dynamics. Our framework captures various margins that have been studied separately in the literature, and does so in a comprehensive way. First, remittances are allowed to affect consumption. This allows us to study the consumption smoothing role of remittances. Second, the model incorporates a labor force participation margin. This allows us to determine whether remittances affects participation in a meaningful way. Third, the model introduces endogenous and frictional self-employment entry. This allows us to study the extent to which remittances are used for microenterprise development as documented in the literature (Woodruff, 2001; Woodruff and Zenteno, 2007), and how self-employment interacts with the participation and consumption decisions of private agents. Fourth, we merge all these margins in a search environment, which allows us to study the impact of remittances on labor market and unemployment dynamics. To

the best of our knowledge, none of these margins have been simultaneously studied in a business cycle environment.

First, we show that the model is in line with salient stylized facts about the cyclical dynamics of labor markets and investment, output, and the current account. In particular, the model can generate the countercyclicality of self-employment, entry into self-employment from unemployment, and unemployment, as well as the volatility of unemployment in a way that is qualitatively consistent with the data despite the presence of a labor force participation margin and the absence of on-the-job search. Furthermore, we show that the interaction between self-employment and labor force participation are key to obtaining the cyclical behavior of the labor market in the presence of remittance fluctuations. In particular, alternative models that abstract from either of those margins yield counterfactual unemployment dynamics or substantially lower unemployment volatility compared to the data. Second, using the model as a laboratory, we analyze the consequences of differences in the cyclicality of remittance inflows for aggregate dynamics. We find that, while countercyclical remittances limit the contraction in consumption, investment, and individual labor earnings after a recession, they also generate sharper fluctuations in output and unemployment. The interaction between the response of consumption, the change in labor force participation, and the entry decisions of the self-employed in response to remittance inflows play a key role in explaining the sharper contraction in output as well as the response of unemployment. Importantly, we interpret our results as suggesting that, while countercyclical remittance inflows can yield several benefits at the individual level – lower consumption and labor earnings volatility – they can also have adverse effects at the aggregate level, including larger output and unemployment fluctuations. As an additional test to determine the validity of the model, we explore whether the model is consistent with the response of the Mexican economy after the 2008-2009 financial crisis. We find that the model is in line with the behavior of output, investment, participation, and more remarkably, both the unemployment level and the unemployment rate after 2007.

Finkelstein Shapiro (2014) introduces endogenous and frictional self-employment as a search process

for capital into a business cycle model with labor market frictions. In particular, salaried firms act as capital suppliers by allocating part of their accumulated capital to the self-employed via frictional capital markets. The model is consistent with the presence of capital constraints among small firms, the reliance of small firms on input credit relationships, and the cyclical dynamics of self-employment and self-employment entry in the data. We build upon his framework so as to analyze the impact of remittances on microenterprise development (self-employment ventures) in an environment that can capture the cyclical dynamics of developing country labor markets. We modify this model by introducing a labor force participation margin in an open economy setting, where changes in labor supply and participation have been a common theme in the micro literature on remittances. Importantly, also consistent with the micro literature, we allow households to freely allocate remittance income between various uses, including consumption, the financing of startup costs for self-employment ventures, and saving via the purchase of foreign assets.

The intuition behind the effects of countercyclical remittances on aggregate fluctuations is as follows. A remittance inflow triggered by an adverse shock to the economy reduces the contraction in consumption relative to an economy with acyclical remittances, which in turn affects the cost of searching for salaried employment and self-employment. In particular, search for salaried work falls by more when remittances are countercyclical. Simultaneously, a fraction of the inflow of external resources can be used to finance the startup (search) costs of unemployed individuals who need capital to enter the microenterprise sector. Thus, at the onset of the downturn, the number of individuals searching for self-employment opportunities (or capital for those ventures) rises. Given the inflow of remittances, the contraction in individuals searching for salaried work is larger than the increase in self-employed searchers, which generates a fall in labor force participation relative to an economy with acyclical remittances. However, the larger rise in the number of individuals searching for capital for self-employment initially reduces the measure of unemployed in the economy.

Simultaneously, the exogenous fall in productivity in the economy reduces the marginal product of

inputs and causes a reduction in capital usage and vacancy postings among salaried firms. The reduction in vacancies is larger when remittances rise in response to the downturn. This takes place because the higher number of individuals searching for capital to enter self-employment makes it more likely for salaried firms to match their unused capital with the self-employed, so that the contraction in capital usage and hence the incentive to reduce vacancy postings among salaried firms are larger. Coupled with the larger reduction in labor force participation and salaried vacancies, this leads to a larger contraction in salaried output, and in turn, in total output. While unemployment initially fell due to the change in labor force participation, the large reduction in vacancies leads to a sharper rebound in unemployment in the aftermath of the shock, thereby amplifying the response of unemployment. Finally, since countercyclical remittance inflows cushion the contraction in consumption, the opportunity cost of investment increases by less, thereby leading to a smaller fall in investment in response to the shock. As these results suggest, the interaction of remittance fluctuations with both self-employment and labor force participation play a key role in explaining the differential response of the economy to a recessions depending on the cyclicality of remittances. These findings are consistent with the main conclusions in Chami, Cosimano, and Gapen (2007) and suggest that the impact of the cyclicality of remittances on aggregate dynamics through cyclical changes in the labor market offer one way to reconcile particular conflicting findings in the literature (discussed below), where certain studies find that remittances can smooth aggregate fluctuations, while others find that these flows can exacerbate the business cycle.

Chami, Hakura, and Montiel (2012) find that remittances tend to stabilize aggregate fluctuations and reduce volatility in the economy. Neagu and Schiff (2009) explore the role of remittances as automatic stabilizers and argue that countercyclical remittances may not necessarily be stabilizing. Chami, Cosimano, and Gapen (2007) argue that remittance inflows can have positive and negative effects on recipient economies. On the one hand, these inflows can reduce the contraction in consumption during a downturn, but the same flows can affect labor supply decisions and increase the correlation between labor and output, which in turn increases aggregate volatility. Our results are in line with theirs in a richer context

with employment heterogeneity and frictional unemployment. Magnusson Bernard (2010) also claims that remittances can increase macroeconomic volatility in recipient countries. Durdu and Sayan (2008) use a standard open economy business cycle model and contrast the case of Turkey, which exhibits procyclical remittances, to the case of Mexico, which has generally experienced countercyclical remittances. They focus specifically on sudden stops and find that remittances stabilize aggregate fluctuations in Mexico and act as an amplification mechanism in Turkey. Mandelman and Zlate (2012) present a two-country model with Walrasian labor markets where labor supply and participation are endogenous through immigration flows. The most important difference of our work relative to these papers is that we can explicitly explore the role of microenterprise development and employment dynamics.

The paper is organized as follows. Section 2 presents the model. Section 3 gives an overview of the calibration. Section 4 presents the main quantitative experiments and discusses a series of robustness tests. Section 5 concludes.

2 The Model

We modify a standard small open economy real business cycle model with a single tradable good along four fronts: first, we incorporate remittance flows that affect the household's budget constraint. Second, we introduce search and matching frictions in salaried employment. Third, following Finkelstein Shapiro (2014), we introduce endogenous and frictional entry from unemployment into self-employment as a search process for capital. This allows us to to study the impact of remittances on microenterprise creation as well as the influence of remittances on the cyclical composition of employment in a setup consistent with the cyclical dynamics of employment in developing countries. Finally, we include an explicit labor force participation margin to study the influence of remittances on household participation and labor supply decisions.

Salaried firms use salaried labor and capital to produce. They accumulate capital and post vacancies to attract salaried workers. In addition, they decide how much capital is used within the firm. The re-

maining, unused capital is supplied as input credit through frictional capital markets to individuals who wish to become self-employed. Thus, salaried firms act as capital suppliers. The household spends resources to find capital suppliers and send household members currently searching for self-employment opportunities to the microenterprise sector. Since remittances enter the household's budget constraint as an additional source of income and the decisions to enter self-employment take place at the household level, remittances can affect the startup (capital search) costs of self-employed firms. In addition, the household decides on the measure of members looking for salaried employment, so that labor force participation decisions are endogenous.

Frictional entry into self-employment is motivated by the presence of capital constraints among small (new and existing) firms in many developing countries. Recent empirical evidence has highlighted the relevance of input credit from other firms as one of the most important sources of external financing for self-employment ventures and microenterprise development (Kantis et al., 2002; IDB, 2005; Demirgüç-Kunt, and Maksimovic, 2008; Farazi, 2014).[1] Given the relationship-based nature of input credit, capital search frictions are a natural way to capture transitions from unemployment to self-employment. For simplicity, we assume that each self-employed individual uses one unit of matched capital to produce once a capital relationship between a salaried firm supplying capital and a potential self-employed individual searching for capital materializes (Finkelstein Shapiro, 2014).

2.1 Households

Following the literature, we assume a representative household with a large number of members. Family members perfectly insure each other against variation in labor income as they pool their income. Individuals can be out of the labor force, searching for salaried employment, searching for self-employment opportunities, or working in any of these two occupations. The labor force is thus given by $lfp_t =$

[1] Note that it is still the case the the household requires internal resources to finance the cost of searching for an input supplier, where we interpret these costs as startup costs. Thus, the model is consistent with the idea that self-employment ventures are often financed with household resources and resources from friends and family. However, spending these resources is a necessary but not sufficient condition to become a successful self-employed individual since other inputs (obtained from other firms) are needed to produce.

$n^h_{S,t} + n^h_{SE,t} + s_{S,t} + s_{SE,t}$, where n^h_{SE} and n^h_S are the self-employed and salaried workers and $s_{S,t}$ and $s_{SE,t}$ account for those searching for employment in any of the these occupations, respectively. By definition, the total measure of unemployment is $s_t \equiv s_{S,t} + s_{SE,t}$, while total employment is defined as: $n^h_t \equiv n^h_{S,t} + n^h_{SE,t}$. We normalize the total population to one, so that $\mathbf{lfp}_t$ is also the labor force participation rate and $\mathbf{olf}_t \equiv 1 - \mathbf{lfp}_t$ corresponds to the population outside the labor force. The unemployment rate is defined as $\mathbf{u}_t \equiv \frac{s_{S,t}+s_{SE,t}}{\mathbf{lfp}_t}$.

The problem of the household is:

$$\max_{\left\{c_t, s_{SE,t}, s_{S,t}, n^h_{SE,t+1}, n^h_{S,t+1}, b^*_t\right\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) - h(s_{S,t} + n^h_{S,t}) - g(s_{SE,t} + n^h_{SE,t}) \right], \tag{1}$$

subject to the budget constraint: [2]

$$c_t + \kappa\left(s_{SE,t}\right) + R^*_{t-1} b^*_{t-1} = b^*_t + w_{S,t} n^h_{S,t} + (z_{SE,t} - r_{SE,t}) n^h_{SE,t} + \Pi_{S,t} + rem_t, \tag{2}$$

where $u'(\cdot) > 0$, $u''(\cdot) < 0$, $h'(\cdot) > 0$, $h''(\cdot) < 0$, $g'(\cdot) > 0$, $g''(\cdot) < 0$, $\kappa'(\cdot) > 0$ and $\kappa''(\cdot) > 0$. c_t is household consumption, $w_{S,t}$ is the wage of salaried workers, b^*_t are holdings foreing bonds, and $R^*_t = R^* \Phi\left(b^*_t - b^*\right)$ is the gross interest rate- where $\phi(\cdot)$, $\phi'(\cdot) < 0$, is a standard portfolio adjustment cost needed to avoid non-stationarity in the stock of foreign liabilities.[3] $\kappa(\cdot)$ captures the entrepreneurs' searching cost for capital suppliers, which may be interpreted as a start-up cost for self-employment projects. Each successful self-employed individual earns $(z_{SE,t} - r_{SE,t})$ where $z_{SE,t}$ is a sectoral productivity shock and $r_{SE,t}$ is the rental rate of capital. $\Pi_{S,t}$ are lump-sum profits from firm ownership in the salaried sector. Finally, rem_t represents the remittance income households receive from emigrants residing abroad.

[2] We assume that the contemporaneous value of unemployment that searchers receive consists solely of unemployment benefits. Since most developing countries do not have national unemployment insurance schemes, we abstract from including this benefit in the budget constraint for expositional purposes.

[3] See Schmitt-Grohé and Uribe (2003) for details.

The perceived law of motion for self- and salaried employment are respectively:

$$n^h_{SE,t+1} = (1-\rho^{SE})(n^h_{SE,t} + s_{SE,t}p(\theta_{SE,t})), \quad n^h_{S,t+1} = (1-\rho^{S})(n^h_{S,t} + s_{S,t}p(\theta_{S,t})), \tag{3}$$

The exogenous separation rates for self-employed and salaried workers are given by ρ^{SE} and ρ^{S}, respectively. We define the probability of finding a capital supplier as $p(\theta_{SE,t}) = \frac{m(s_{SE,t},(1-\omega_t)k_{S,t})}{s_{SE,t}}$, where $m(s_{SE,t},(1-\omega_t)k_{S,t})$ is a matching function that brings together the total measure of searchers looking for self-employment opportunities $s_{SE,t}$ and unused capital by salaried firms $(1-\omega_t)k_{S,t}$ (defined in detail in the next subsection). Capital market tightness is defined as $\theta_{SE,t} = \frac{s_{SE,t}}{(1-\omega_t)k_{S,t}}$. An analogous matching function $m(s_{S,t}, v_{S,t})$ combines searchers in the salaried sector $s_{S,t}$ with salaried sector vacancies $v_{S,t}$. The job-finding probability for a salaried searcher is $p(\theta_{S,t}) = \frac{m(s_{S,t},v_{S,t})}{s_{S,t}}$, and the labor market tightness is defined as $\theta_{S,t} = \frac{v_{S,t}}{s_{S,t}}$. We assume that wages and rental rates for capital are determined via Nash bargaining. The value functions needed to characterize the optimal Nash wage and capital rental rate are defined further below.

Optimality Conditions The household's optimality conditions are characterized by a standard Euler equation:

$$u'(c_t) = \beta \mathbb{E}_t R^*_t u'(c_{t+1}), \tag{4}$$

and two participation decisions, one for salaried workers:

$$\frac{\frac{h'_t}{u'(c_t)}}{p(\theta_{S,t})} = (1-\rho^S)\mathbb{E}_t \left\{ \left(\frac{u'(c_{t+1})}{u'(c_t)} \right) \left(w_{S,t+1} - \frac{h'_{t+1}}{u'(c_{t+1})} + \frac{\frac{h'_{t+1}}{u'(c_{t+1})}}{p(\theta_{S,t+1})} \right) \right\}, \tag{5}$$

and one for self-employed individuals:

$$\frac{\frac{g'_t}{u'(c_t)} + \kappa'_t}{p(\theta_{SE,t})} = (1-\rho^{SE})\mathbb{E}_t \left\{ \left(\frac{u'(c_{t+1})}{u'(c_t)} \right) \left(z_{SE,t+1} - r_{SE,t+1} - \frac{g'_{t+1}}{u'(c_{t+1})} + \frac{\frac{g'_{t+1}}{u'(c_{t+1})} - b + \kappa'_{t+1}}{p(\theta_{SE,t+1})} \right) \right\}. \tag{6}$$

The first participation decision equates the expected marginal cost of searching for a salaried job to the expected marginal benefit, where individuals take into account the disutility cost from searching. The second participation decision characterizes the decision to become self-employed. The left-hand side equates the expected marginal cost of searching for self-employment (which includes the resource and utility costs of searching for a capital supplier) to the expected marginal benefit, given by individual self-employment earnings net of the disutility from labor force participation, as well as the continuation value.

2.2 Salaried Production

Salaried firms post salaried vacancies, $v_{S,t}$, accumulate capital, $k_{S,t}$,and decide on the desired level salaried employment, $n^f_{S,t+1}$, as well as on the share of capital used in-house, ω_t. As explained above, the remaining unused share, $1-\omega_t$, which we label input credit, is rented to the self-employment sector, $n^f_{SE,t+1}$, through frictional capital markets. Salaried firms' maximization problem is:

$$\max_{\left\{v_{S,t},n^f_{S,t+1},k_{S,t+1},\omega_t,n^f_{SE,t+1}\right\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \Xi_{t|0} \left\{ z_{S,t} f(n^f_{S,t}, \omega_t k_{S,t}) - w_{S,t} n^f_{S,t} - \psi_S v_{S,t} - i_t + r_{SE,t} n^f_{SE,t} - \frac{\varphi_{k_S}}{2} \left(\frac{k_{S,t+1}}{k_{S,t}} - 1 \right)^2 k_{S,t} \right\}, \tag{7}$$

where $\Xi_{t|0} = \beta(u'(c_{t+1})/u'(c_0))$ is the stochastic discount factor, $z_{S,t}$ is a sectoral productivity shock and $f(.)$ is a standard constant-returns production function. ψ_S is the cost of posting vacancies, i_t is investment, and $\frac{\varphi_{k_S}}{2}\left(\frac{k_{S,t+1}}{k_{S,t}}-1\right)^2 k_{S,t}$ is a convex capital adjustment cost. The perceived law of motion for salaried employment and self-employment are, respectively:

$$n^f_{S,t+1} = \left(1-\rho^S\right)\left(n^f_{S,t} + q\left(\theta_{S,t}\right) v_{S,t}\right), \quad n^f_{SE,t+1} = \left(1-\rho^{SE}\right)\left(n^f_{SE,t} + q\left(\theta_{SE,t}\right)\left(1-\omega_t\right) k_{S,t}\right), \tag{8}$$

where $q(\theta_{S,t}) = \frac{m(s_{S,t},v_{S,t})}{v_{S,t}}$ the job-filling probability for posted vacancies and $q(\theta_{SE,t}) = \frac{m(s_{SE,t},(1-\omega_t)k_{S,t})}{(1-\omega_t)k_{S,t}}$ is the probability of finding a self-employed individual for the unused capital.

Finally, capital accumulation evolves as follows:

$$k_{S,t+1} = (1-\delta)\, k_{S,t} + i_t + \left(\rho^{SE} - \delta\right) n^f_{SE,t} - \left(1-\rho^{SE}\right) q\left(\theta_{SE,t}\right)\left(1-\omega_t\right) k_{S,t}.$$

Notice that the standard law of motion for capital incorporates two extra terms in its right-hand side. The first adds the (deppreciated) capital from failing self-employed enterprises, while the second substract succesfully matched capital that new self-employment projects will use in the subsequent period.[4]

Optimality Conditions Combining first-order conditions yields a standard job creation condition:

$$\frac{\psi_S}{q\left(\theta_{S,t}\right)} = \left(1-\rho^S\right) \mathbb{E}_t \Xi_{t+1|t} \left\{ z_{S,t+1} f_{n^f_S}(n^f_{S,t+1}, \omega_{t+1} k_{S,t+1}) - w_{S,t+1} + \frac{\psi_S}{q\left(\theta_{S,t+1}\right)} \right\}, \tag{9}$$

a standard capital Euler equation (with capital adjustment costs):

$$\left[1 + \varphi_{k_S}\left(\frac{k_{S,t+1}}{k_{S,t}} - 1\right)\right] = \mathbb{E}_t \Xi_{t+1|t} \left\{ \begin{array}{l} z_{S,t+1} f_{\omega k_S}(n^f_{S,t+1}, \omega_{t+1} k_{S,t+1}) + (1-\delta) \\ \\ -\frac{\varphi_{k_S}}{2}\left(\frac{k_{S,t+2}}{k_{S,t+1}} - 1\right)^2 + \varphi_{k_S}\left(\frac{k_{S,t+2}}{k_{S,t+1}} - 1\right)\frac{k_{S,t+2}}{k_{S,t+1}} \end{array} \right\}, \tag{10}$$

and a self-employment capital supply condition:

$$\begin{aligned} &\frac{z_{S,t} f_{\omega k_S}(n^f_{S,t}, \omega_t k_{S,t}) + \left(1-\rho^{SE}\right) q\left(\theta_{SE,t}\right)}{q\left(\theta_{SE,t}\right)} \\ &= \left(1-\rho^{SE}\right) \mathbb{E}_t \Xi_{t+1|t} \left\{ r_{SE,t+1} + \left(\rho^{SE} - \delta\right) + \frac{z_{S,t+1} f_{\omega k_S}(n^f_{S,t+1}, \omega_{t+1} k_{S,t+1}) + \left(1-\rho^{SE}\right) q\left(\theta_{SE,t+1}\right)}{q\left(\theta_{SE,t+1}\right)} \right\}, \end{aligned} \tag{11}$$

The job creation condition simply equates the expected marginal cost of posting a vacancy to the expected marginal benefit, where the latter is comprised of the marginal product of salaried labor net of wages plus the continuation value of the salaried employment relationship. The capital Euler equation

[4] Notice that new matches are also subject to the separation rate shock ρ^{SE} before they start to produce in the next period.

similarly equates the marginal cost of accumulating a unit of capital to the marginal benefit of doing so. Finally, the capital supply condition equates the expected marginal cost of devoting an additional unit of capital to matching – given by the marginal product of capital in the salaried sector as well as a term that captures the fact that matched capital remains in the firm until it becomes productive next period – to the expected marginal benefit. The latter is given by the rental rate that the salaried firm would obtain next period, the net benefit of recovering a separated unit of capital from the self-employment sector next period, and the continuation value of the capital relationship.

2.3 Wage and Rental Rate Determination

The values to the household of having a household member in salaried employment, $\mathbb{W}_{S,t}$, and self-employment, $\mathbb{W}_{SE,t}$, are

$$\mathbb{W}_{S,t} = w_{S,t} - \frac{h'_t}{u_{c,t}} + \mathbb{E}_t \Xi_{t+1|t} \left\{ \left(1 - \rho^S\right) \mathbb{W}_{S,t+1} \right\}, \tag{12}$$

$$\mathbb{W}_{SE,t} = z_{SE,t} - r_{SE,t} - \frac{g'_t}{u_{c,t}} + \mathbb{E}_t \Xi_{t+1|t} \left\{ \left(1 - \rho^{SE}\right) \mathbb{W}_{SE,t+1} \right\}, \tag{13}$$

Similarly, the values to a salaried firm of having an additional salaried worker and an additional capital relationship with a self-employed individual are

$$\mathbb{J}_{S,t} = z_{S,t} f_{n_S^f}(n^f_{S,t}, \omega_t k_{S,t}) - w_{S,t} + \mathbb{E}_t \Xi_{t+1|t} \left\{ \left(1 - \rho^S\right) \mathbb{J}_{S,t+1} \right\}, \tag{14}$$

and

$$\mathbb{J}_{SE,t} = r_{SE,t} + \left(\rho^{SE} - \delta\right) + \mathbb{E}_t \Xi_{t+1|t} \left\{ \left(1 - \rho^{SE}\right) \mathbb{J}_{SE,t+1} \right\}. \tag{15}$$

We assume free entry such that the value of salaried vacancies is zero in equilibrium. Following the literature, the wage and the rental rate of capital used in self-employment are determined via Nash bargaining.

Thus, the Nash bargaining problems for the wage and the rental rate can be expressed as

$$\max_{w_{S,t}} \left\{ \left(\mathbb{W}_{S,t} \right)^{v_S} \left(\mathbb{J}_{S,t} \right)^{1-v_S} \right\}, \qquad \max_{r_{SE,t}} \left\{ \left(\mathbb{W}_{SE,t} \right)^{v_{SE}} \left(\mathbb{J}_{SE,t} - \mathbb{J}_{U,t} \right)^{1-v_{SE}} \right\}, \tag{16}$$

where v_S and v_{SE} are the bargaining powers for salaried the and self-employed workers. the threat point for salaried firms in the negotiation of the rental rate is the value of idle capital, $\mathbf{J}_{U,t} = (1-\delta)$. The first-order conditions yield implicit functions for the Nash wage and rental rate:

$$\mathbb{W}_{S,t} = \frac{v_S}{1-v_S} \mathbb{J}_{S,t}, \qquad \mathbb{W}_{SE,t} = \frac{v_{SE}}{1-v_{SE}} \left(\mathbb{J}_{SE,t} - \mathbb{J}_{U,t} \right). \tag{17}$$

Using the value equations for salaried workers and self-employed individuals as well as the salaried firm's value equations of having an additional salaried worker and an additional capital relationship, the resulting Nash wage and capital rental rate are given by:

$$w_{S,t} = v_S z_{S,t} f_{n_S}(n_{S,t}, \omega_t k_{S,t}) + (1-v_S) \frac{h'_t}{u_c(c_t)}, \tag{18}$$

and

$$r_{SE,t} = (1-v_{SE}) \left(z_{SE,t} - \frac{g'_t}{u_c(c_t)} \right) - v_{SE}(\rho^{SE} - \delta). \tag{19}$$

Intuitively, the Nash wage depends on a combination of the marginal product of salaried labor and the disutility cost from participating in the labor market. In particular, an increase in salaried searchers puts upward pressure on wages to partly offset the rise in the utility search cost. Similarly, the Nash capital rental rate increases with sectoral productivity and decreases with a rise in self-employment searchers to partly offset the rise in the utility search cost. In addition, a rise in the capital depreciation rate puts upward pressure on the rental rate to compensate firms for the fact that, if a unit of capital is matched, it remains idle within the firm until the match becomes productive next period.

2.4 Resource Constraint and Shock Processes

Total output is given by the sum of salaried output and output in self-employment, $y_t = y_{S,t} + y_{SE,t}$.[5] The resource constraint of the economy is:

$$y_t = c_t + \kappa\left(s_{SE,t}\right) + \psi_S v_{S,t} + i_t + b^*_{t-1}R^*_{t-1} - b^*_t - rem_t + \frac{\varphi_{k_S}}{2}\left(\frac{k_{S,t+1}}{k_{S,t}} - 1\right)^2 k_{S,t}, \tag{20}$$

The sectoral productivity shocks $z_{S,t}$ and $z_{SE,t}$ follow standard AR(1) processes:

$$\ln z_{S,t} = \rho_{z_S} \ln z_{S,t-1} + \varepsilon^{z_S}_t, \qquad \ln z_{SE,t} = \rho_{z_{SE}} \ln z_{SE,t-1} + \varepsilon^{z_{SE}}_t, \tag{21}$$

where $\varepsilon^{z_j}_t \sim N(0, \sigma_{z_j})$, $j = S, SE$, and steady-state sectoral productivities are normalized to one. We assume that remittances are driven by exogenous shocks while also responding to deviations of total output from steady-state:

$$rem_t = rem_{ss} \exp\left[\eta_r\left(1 - \frac{y_t}{y_{ss}}\right)\right] + \varepsilon^r_t, \tag{22}$$

where rem_{ss} and y_{ss} denote steady-state remittances and total output, respectively. Thus, remittances are affected by an exogenous i.i.d component $\varepsilon^r_t \sim N(0, \sigma^2_r)$, $\eta_r > (<) 0$ implies that remittances are countercyclical (procyclical), and $\eta_r = 0$ implies that remittances are acyclical. The exogenous innovations may reflect developments in the country in which emigrants reside, which we take as given in this framework.

2.5 Competitive Equilibrium

Definition *(Competitive Equilibrium) Taking the set of exogenous processes* $\varepsilon^{i\{i=z_S,z_{SE},r\}}_t$ *as given, the allocations* $\{c_t, n_{S,t}, n_{SE,t}, \theta_{S,t}, \theta_{SE,t}, k_{S,t}, \omega_t, lfp_t, s_{S,t}, s_{SE,t}, y_t, b^*_t, rem_t\}$ *as well as prices* $\{w_{S,t}, r_{SE,t}\}$ *satisfy the law of motion for self-employment, the definition of the unemployment rate, the definition of labor force participation, the self-employed's participation decision, the salaried workers' participation decision, the law of motion for salaried*

[5] For an overview of the contribution of informality to aggregate economic activity as well as the different ways in which countries include estimates of self-employment into their national accounts, see ILO (2013).

employment, the salaried firms' salaried job creation condition, the Euler equation for capital, the household's bond Euler equation, the salaried firms' capital supply of self-employed capital, the implicit equations for the Nash wage and the Nash rental rate, the definition of total output, and the economy's resource constraint.

3 Calibration

The time period is a quarter. We use Mexico as our benchmark economy since it has quality data on remittances and labor flows (inluding self-employment), which we use to assess the empirical fit of the model.

Functional Forms The salaried production function is Cobb-Douglas, $y_{S,t} = z_{S,t} \left(n_{S,t}\right)^{1-\alpha_S} \left(\omega_t k_{S,t}\right)^{\alpha_S}$, $0 < \alpha_S < 1$. The disutility of salaried employment and self-employment are given by

$$h(n_{S,t} + s_{S,t}) = \varsigma \frac{\left(n_{S,t} + s_{S,t}\right)^{\frac{1+\phi}{\phi}}}{\frac{1+\phi}{\phi}}, \qquad g(n_{SE,t} + s_{SE,t}) = \varsigma \frac{\left(n_{SE,t} + s_{SE,t}\right)^{\frac{1+\phi}{\phi}}}{\frac{1+\phi}{\phi}}, \tag{23}$$

where $\varsigma, \phi > 0$. We assume Cobb-Douglas matching in both the labor and capital markets, so that $m_{S,t} = M_S \left(s_{S,t}\right)^{\xi_S} \left(v_{S,t}\right)^{1-\xi_S}$ and $m_{SE,t} = M_{SE} \left(s_{SE,t}\right)^{\xi_{SE}} \left(\left(1-\omega_t\right) k_{S,t}\right)^{1-\xi_{SE}}$, where $0 < \xi_S, \xi_{SE} < 1$. M_S, M_{SE} are the matching efficiency parameters. Total capital search expenditures are $\kappa(s_{SE,t}) = \psi_{SE} \left(s_{SE,t}\right)^{\eta_{SE}}$, with $\psi_{SE} > 0$ and $\eta_{SE} \geq 1$.

Parameters from Literature As it is standard in the literature, the capital share in salaried production, α_S, is set at 0.32, the subjective discount factor, β, at 0.985, and the capital depreciation rate, δ, at 0.025. The bargaining powers for salaried, v_S, and self-employed individuals, v_{SE}, and associated matching elasticities, ξ_S, ξ_{SE}, are set to 0.5 (Hosios condition).[6] The adjustment cost of debt holdings, Φ, is set to 0.05. This value is small enough to not affect the aggregate dynamics, while guaranteeing debt stationarity. Using evidence from Bosch and Maloney (2008) for Mexico, the separation rates for salaried workers, ρ^S,

[6]The results remain qualitatively the same if we assume that salaried workers have a higher bargaining power than the self-employed.

and self-employed individuals, ρ^{SE}, are 0.06 and 0.02, respectively. We assume linear capital search costs (i.e. $\eta_{SE} = 1$) .[7] The persistence of the sectoral productivity shocks, $\rho_{z_j\{j=S,SE\}}$, is set to 0.92.

Calibrated Parameters The remaining parameters are calibrated to match specific targets for Mexico. The matching efficiency parameter for salaried employment, M_S, is set to capture a quarterly job-finding probability of 0.90.[8] The corresponding matching efficiency parameter for self-employment, M_{SE}, is set to capture a self-employment share of 0.23. The common search disutility parameter, ς, is chosen to obtain a labor force participation rate of 0.60. ψ_S is set at 1.67 to obtain a cost of posting vacancies equal to 3.5 percent of quarterly wages (Levy, 2007). We fix ψ_{SE} to obtain a cost of searching for capital suppliers equals to 3 months of wages, which the estimated average startup costs of microenterprises in Mexico (See McKenzie and Woodruff, 2006). Steady-state remittances are set to capture a remittance-to-output ratio of 2.4 percent (Mandelman and Zlate, 2012). We jointly calibrate the sensitivity of remittances to output fluctuations, η_r, the capital adjustment cost parameter, φ_{k_S}, the labor supply elasticity, ϕ, the standard deviation of the sectoral productivity shocks, σ_{z_S}, $\sigma_{z_{SE}}$, and the standard deviation of the remittance shock, σ_r, to match the cyclical correlation between remittances and output (-0.38), the relative volatility of investment (2.78), the cyclical correlation between output and the population outside of the labor force (-0.157), the volatility of output (2.39), the persistence of output (0.846), and the cyclical correlation of output and the current-account-output ratio (-0.47).[9]

[7] The results do not change if we assume convex search costs.

[8] While this value is higher than in the data, it yields a salaried employment share close to 0.72 in the data without allowing the job-finding rate to go above one. This target also implies that the steady-state unemployment rate is slightly higher than in the data. Importantly, the unemployment rate in the model is between the official unemployment rate of 5 percent and the "partial employment" and unemployment rate of 10.5 percent, while the steady-state transition rate for the self-employed in consistent with the evidence in Bosch and Maloney (2008). The results with a lower job-finding probability are broadly in line with those presented below. Finally, we note that recalibrating the model to bring the steady-state unemployment rate to exactly match a 5 percent rate implies that the volatility of unemployment becomes implausibly high.

[9] The resulting parameter values are: $\{\eta_r, \varphi_{k_S}, \phi, \sigma_{z_S}, \sigma_{z_{SE}}, \sigma_r = 20,\ 3.3, 0.55, 0.138, 0.02, 0.032\}$. The targets using output and investment are obtained using data for 1993Q1 through 2007Q4 from the FRED database. The cyclical correlations between output and remittances and output and the current-account-output ratio are from Durdu and Sayan (2008). The cyclical correlation of output with the population outside the labor force is from Bosch and Maloney (2008).

4 Results

4.1 Moments

Table 1 presents some selected business cycle statistics produced by the benchmark model with countercyclical remittances (as documented for Mexico).[10] The model performs remarkable well along several margins. The model qualitatively captures the cyclicality of aggregate employment, self-employment, unemployment, and entry into self-employment from unemployment. The presence of a participation margin along with an explicit decision to enter self-employment makes this good fit to the data particularly noteworthy. [11] Furthermore, the model is able to generate a relative volatility of the unemployment rate higher than one, while preserving its intrinsic countercyclicality at the same time–which is very difficult to obtain in standard search models (see Shimer, 2005, and Tüzemen, 2013, for a discussion). The most important shortcoming of the model lies in the relative volatility of consumption generated by the model, which is well below its empirical counterpart. This is in line with the results in other studies (see, for example, Durdu and Sayan, 2008) and stems partly from the countercyclicality of remittances. As previously discussed, many microeconomic studies show that countercyclical remittances serve as an insurance mechanism which ultimately smmoths households' consumption over the cycle. However, in this parsimonius model, we abstract from other channels that increase the volatility of consumption instead (e.g. financial frictions and trend growth shocks, among others.) [12]

To highlight the importance of including both self-employment and labor force participation, we compare the benchmark model to three alternatives: (1) a model with no self-employment and no labor force participation, (2) a model with labor force participation but no self-employment, and (3) a model with self-employment but no labor force participation. As shown in Table 1, these alternative specifications

[10] We log-linearize the model around the non-stochastic steady-state and use a first-order approximation to the equilibrium conditions. The model is simulated for 2100 periods. We discard the first 100 periods and apply the Hodrick-Prescott (HP) filter with smoothing parameter 1600 to extract the cyclical component of the series and compute second moments.

[11] This is important to highlight since the countercyclicality of self-employment tends to put downward pressure on the cyclical correlation of the unemployment rate and makes the unemployment rate less countercyclical relative to a model with no countercyclical self-employment.

[12] See Aguiar and Gopinath (2007) and Garcia-Cicco et al (2010) for a discussion. Restrepo-Echavarria (2013) studies the case of an informal economy that is poorly measured in the national accounts. She shows that, in such scenario, the model artificially generates very high volatility in measured consumption (significantly different than its actual value).

perform worse than the benchmark model. In particular, while the model with labor force participation and no self-employment does generate a relative volatility of unemployment higher than one, as in the data, it fails to generate countercyclical unemployment.[13] The versions of the benchmark model without a labor force participation margin generate substantially lower unemployment volatility and more importantly, under the presence of remittance fluctuations, they generate procyclical unemployment. In contrast, the benchmark model is able to generate a cyclicality of unemployment, labor force participation, and self-employment which are consonant with the data. In addition, the benchmark model captures relatively well the cyclicality of aggregate employment, outperforming all the alternative specifications. Thus, the combination of self-employment and labor force participation are key for generating the correct cyclical behavior of unemployment.

Remittances are also play an decisive role in the model's empirical fit. Table 2 compares the benchmark model to the same model under alternative calibrations: (1) the parameters that determine the behavior of TFP and remittances are estimated outside of the model (column 4), (2) remittance fluctuations are only determined by an i.i.d. shock, $\eta_r = 0, \sigma_r > 0$ (column 5), and (3) remittances are constant, $\eta_r = 0, \sigma_r = 0$ (column 6).[14] As the results illustrate, assuming either stochastic remittances or constant remittances yields counterfactual correlations for aggregate employment, unemployment rate, labor force participation and the current-account-output ratio.[15] For robustness, in the last column, we show that the results remain qualitatively identical if we assume a higher share of remittances (10 percent of output versus 2.4 percent calibration).[16] Finally, in the appendix, we show that all these results hold when we assume that both the salaried and self-employment sectors are subject to the same productivity shocks.

[13] Importantly, no reasonable values for the elasticity of labor supply can generate the cyclical correlation between output and the population out of the labor force in the data.

[14] Specifically, for the calibration in Column 3, we regress HP-filtered log TFP on its lag, and regress HP-filtered log remittances on HP-filtered log real GDP. This yields the shock processes for TFP and remittances, as well as the parameters that determine the persistence of TFP and the response of remittances to output movements. Naturally, this calibration assumes a single aggregate productivity shock.

[15] We note that these alternative calibrations cannot capture the cyclicality of out-of-the-labor-force without running into convergence problems.

[16] Increasing the steady-state remittance-to-output ratio while keeping all other parameters constant keeps the employment shares constant, increases consumption and reduces the labor force participation and total output in the stationary equilibrium.

4.2 Impulse Response Functions

Negative Salaried Productivity Shock Fig. 1 shows the impulse response functions to a negative shock to salaried productivity in the benchmark model with countercyclical remittances and an alternative scenario with acyclical remittances that do not vary throughout the experiment.[17] Consider first this last scenario (refer to the thin-blue line). The decrease in productivity reduces wages, which in turn leads to a fall in the value of salaried employment. Firms post fewer vacancies, which leads to a reduction in hiring and an increase in unemployment. As households' disposable income decreases, consumption demand falls. In this adverse scenario, firms confront an excess of capacity that induces them to sharply decrease in invesment and reduce its capital utilization. The labor force participation increases despite the lower wages. Households are induced to search for employment to compensate for the fall in disposable income that is enhanced by the lack of unemployment insurance. In other words, the negative income effect dominate the substitution effect arising from lower salaries. As the economy enters in a recessive phase, the opportunity cost of searching for entreprenurial ventures decreases and household devote more resources to self-employment. Entrepreneurs further benefit from cheap input credit as the firms' excess of capacity puts downward pressure on capital rental rates. In sum, an expansion of self-employment in recessions serves as a cushion during a recession.

Countercylical remittances play an important insurance role in our benchmark model (refer to the red thick line). These remittance inflows reduce the contraction in consumption that takes place at the onset of the downturn. While these foreign transfers widen the trade deficit, they actually translate into a current account surplus as these inflows are categorizes a positive current transfers in the balance of payments (See Acosta et al, 2009, for details). Remittances relax households' budget constraint, inducing them to reduce their participation in a labor market that offers lower wages. Put it differently, the substitution effect dominates the income effect when remittances are countercyclical. The contraction in the labor supply, dampens the decrease in wages, forcing firms to adjust to the bad productivity shock by

[17] The model with $\eta_r = 0$ and $\sigma_{rem} > 0$ is not recalibrated. We simply take the benchmark model and shut down the effect of output deviations on remittance movements.

reducing hiring more sharply. On impact, the employment in salaried sector result on a deeper contraction of output on impact.[18] However, the economy recovers faster afterwards thanks to the performance of the self employment sector. Consistent with the empirical evidence, remittances allow households to devote more resources to fund their entrepreneurial start-up outlays (i.e. search cost for capital suppliers). Countercyclical remittances also dampen the fall in investment. As the self-employment sector explands, firms can rent out more of their capital to the entrepreneurs. In addition, as the labor force participation declines and more individuals select into self-employment, firms substitute away from labor towards capital further abating the recession. To conclude, while countercyclical remittances cushion the contraction in consumption and investment during downturns, they generate sharper falls in total output and larger fluctuations in unemployment. Consistent with the documented evidence that highlights both the insurance mechnism of remittances and the instability they exert on output and aggregate economic performance.[19]

Negative Productivity Shock to the Self-Employment sector Fig. 2 shows a alternative sectoral productivity shocks in our the benchmark model with countercyclical model. The thin-blue line depicts a negative salaried shock (as described above). The red-solid line depicts a negative shock to the self-employment sector. The dashed line depicts a symmetric negative shock affecting both employment sectors. It is worth noting that the impulse response to a symmetric productivity shock are remarkable similar to the ones derived from innovations only affecting the salaried sector. This the result of much sizable salaried sector which accounts for most of the aggregate output. This also explains why productivity innovations in the self-employment have, instead, limited impact on the main macro aggregates. However, the self-employent sector plays a more decisive role in the margin of participation in the labor market, significantly impacting households' employment outcomes. The expected profitability of the en-

[18] This behavior of the labor force participation leads to fall in unemployment on the immediate impact. This is consistent with existing search models that introduce a participation margin (see, for example, Tüzemen, 2012).

[19] In the appendix, we extend the impulse response analysis to show how the combination of (a) endogenous self-employment, and (b) labor force participation, are important to account for various stylized facts about the business cycle in the presence of remittance fluctuations. Noticeably, an alternative specification without (a) and (b) generates less variability in output and unemployment fluctuations.

trepreneurial ventures' decrease when their productivity falls. As a result, households stop looking for capital suppliers for new start-ups, effectively dropping out of the labor force. The substantial decrease in the participation margin, mechanically results in a decrease in the unemployment rate. Overall, these results are consistent with the empirical evidence: salaried account for most of the aggregate activity, while micro-enterprises play a more relevant role on the employment margin.

Impulse Response Functions: Positive Remittance Shock Fig. 3 shows the impulse response functions to an exogenous innovations remittance that relax households' budget constraints. As before, remittances inflows are partly used boost household consumption and also to finance the start-up costs of the entrepreneurs. On impact, some household members abandon the salaried sector to start searching for entrepreneurship opportunities. This transition results in a production disruption that leads to a temporary decrease in aggregate output. Similarly, there is a temporary increase in frictional unemployment as individuals transitioning from one job to another. Nonetheless, as self-employment expands, the economy gains traction and output expands more robustly. Remittances foster firms' investment expenditures. Two factors explain. First, as individuals move away from salaried employment towards self-employment they put pressure on wages, inducing firms to substitute away from labor toward capital. Second, as micro-enterprises increase in numbers, so does the demand for capital suppliers. This pushes up the rental rates for capital, further incentivizing the investment expenditures. This increase in rental rates is of particular importance in this context. As seen in Fig 1, in response to a negative productivity shock, firms post fewer vacancies, lower salaries and confront excess of capacity in capital. Some households members' are thus "pushed" into self-employment. Even though some of the new entrepreneurs have relatively low productivity, the poor prospects in the salaried sector and the cheap capital rental rates persuade them to become self-employed. A "pull" factor is what better describe the micro-enterprises arising from this exogenous remittances shock, as the increase in entrepreneuship occurs in tandem with increasing wages and rental rates.

4.3 Data and Model Comparison: 2008-2009 Financial Crisis in Mexico

As an additional validity test, we explore whether the model can capture the response of the Mexican economy in the aftermath of the global financial crisis of 2008-2009. Importantly, recall that the model is calibrated using data from 1995 to 2007. To see how the model performs after 2007 – in the aftermath of of the crisis – we first estimate an AR(1) process using HP-filtered TFP, and use the residuals from this regression as the TFP shocks that we feed the model.[20] Similarly, the residuals obtained from regressing HP-filtered log remittances on HP-filtered log real GDP yield the remittance shocks that we use in the simulations.[21]

As Figure 3 shows, the model naturally mimics the dynamics of remittances and TFP and is successful in capturing the overall behavior of output and investment after 2007.[22] While the model cannot capture the sharper movements in consumption (a result that was already apparent in Table 1), labor force participation in the model is qualitatively consistent with the data (even though participation in the model is not quite as volatile as in the data). More importantly, the model does particularly well in capturing the behavior of both the unemployment rate and the unemployment level after 2008. This is worth highlighting since our framework abstracted from endogenous separations and demand shocks.

We perform two robustness checks. First, we consider the same experiment but instead assume that TFP and remittances follow independent AR(1) processes (as opposed to having remittances respond to output deviations). For the second test, we use the estimated parameters for the persistence of the TFP shock and the estimated parameter for the response of remittances to output obtained from the regressions that we used to initially extract the TFP and remittance shocks. We then use these parameters in the simulation of the model after 2007. The shock series we use for both robustness checks are the same as the ones used in the main experiment. The results, presented in the Appendix, show that the model

[20] Since we cannot obtain sectoral TFP series from the data, we allow for a single aggregate productivity shock that affects both self-employed and salaried firms in the model.

[21] We thank Carlos Urrutia for sharing his TFP series for Mexico.

[22] The empirical counterparts in Figure 5 are obtained from the Federal Reserve Bank of Saint Louis FRED database for Mexico, except for the labor force participation rate and TFP. The labor force participation rate is obtained from Mexico's National Survey on Occupation and Employment (ENOE). The TFP series is from Carlos Urrutia.

is broadly in line with the data. Notably, using the estimated parameters for the exogenous processes capture the behavior of output, investment and labor force participation very well. Thus, the model is generally consistent with the response of the Mexican economy to the 2008-2009 global financial crisis (with the exception of consumption).

5 Conclusion

Remittances represent an important source of revenue for many developing countries. The disruption in remittance flows caused by the recent financial crisis has rekindled interest in the aggregate consequences of cyclical fluctuations in remittance inflows. The microeconomic literature has highlighted the role of remittances in labor supply decisions, including participation in the labor market, and in investment decisions, including investment in microenterprise development. The macroeconomic literature has focused mainly on the smoothing role of remittances.

We build a business cycle model with frictional labor markets that combines several features highlighted in both the macro and micro literature to analyze the implications of remittance fluctuations for labor market and aggregate dynamics. We offer a novel environment that incorporates a participation margin as well as endogenous and frictional entry into self-employment, both of which capture important margins at the micro level, and allows us to study unemployment dynamics in a tractable way.

First, we show that the model captures various salient business cycle and labor market facts very well, including the countercyclicality of self-employment, entry into self-employment from unemployment, unemployment, and the current account. The model can also generate much higher unemployment volatility relative to standard search models while maintaining the countercycical behavior of unemployment. Importantly, similar models without labor force participation or self-employment either yield counterfactual unemployment dynamics or cannot replicate the higher relative volatility of unemployment in the data. Second, we find that, while countercyclical remittances limit the contraction in consumption and investment after a downturn and initially reduce unemployment, they also generate sharper output

and unemployment fluctuations. The participation margin, combined with the behavior of consumption and the response of self-employment, play a key role for explaining these results. A positive shock to remittances causes an expansion in consumption and investment, but a contraction in output as capital is reallocated from the salaried sector towards the self-employment sector. The cyclicality of remittances have a negligible impact on the response of these variables, even though labor force participation is more responsive when remittances are countercyclical. Finally, we show that the model performs well in capturing the behavior of investment, output, participation, and unemployment in Mexico during the 2008-2009 global financial crisis. From a broader perspective, this paper offers a comprehensive and tractable environment that captures stylized facts from both the micro and macro literatures, and that allows us to explore the implications of remittance fluctuations for employment dynamics. This is a topic that has received scant attention in the business cycle literature, but has gained recent traction during the latest financial crisis.

Given the scarcity of models that explicitly study the general equilibrium effects of remittances on labor market dynamics, we abstracted from several relevant issues to offer the simplest environment possible that is consistent with the stylized facts. Some of these issues include the effect of remittances on the real exchange rate (and hence on the reallocation of resources between the tradable and nontradable sectors), the impact of monetary policy on remittances and the cyclical composition of employment, and the effect of remittances on financial development and the structure of labor markets in developing countries. We plan to address these and other extensions in future work.

References

[1] **Acosta, Pablo, Emmanuel Lartey and Federico Mandelman. 2009.** "Remittances and the Dutch Disease," *Journal of International Economics*, vol. 79(1), ppp 102-116.

[2] **Aguiar, Mark, and Gita Gopinath. 2007.** "Emerging Market Business Cycles: The Cycle is the Trend," *Journal of Political Economy*, Vol. 115, No. 1, pp. 69-102.

[3] **Amuedo-Dorantes, Catalina, and Susan Pozo. 2006.** "Migration, Remittances, and Male and Female Employment Patterns," *American Economic Review Papers & Proceedings,* pp. 222-226.

[4] **Beck, Thorsten, Alsi Demirgüç-Kunt, and Vojislav Maksimovic. 2008.** "Financing Patterns around the World: Are Small Firms Different?" *Journal of Financial Economics* 89 (3), pp. 467–487.

[5] **Bosch, Mariano, and William Maloney. 2008.** "Cyclical Movements in Unemployment and Informality in Developing Countries," *World Bank Policy Research Working Paper 4648.*

[6] **Chami, Ralph, Thomas F. Cosimano, and Michael T. Gapen. 2007.** "Beware of Emigrants Bearing Gifts: Optimal Fiscal and Monetary Policy in the Presence of Remittances," *mimeo.*

[7] **Chami, Ralph, Dalia S. Hakura, and Peter Montiel. 2012.** "Do Worker Remittances Reduce Output Volatility in Developing Countries?," *Journal of Globalization and Development,* Volume 3, Issue 1.

[8] **Durdu, Bora, and Serdar Sayan. 2008.** "Emerging Market Business Cycles and Remittance Fluctuations," *International Finance Discussion Papers Number 946,* Board of Governors of the Federal Reserve System.

[9] **Farazi, Subika. 2014.** "Informal Firms and Financial Inclusion: Status and Determinants," *World Bank Policy Research Working Paper No. WPS 6778.*

[10] **Finkelstein Shapiro, Alan. 2014.** "Self-Employment and Business Cycle Persistence: Does the Composition of Employment Matter for Economic Recoveries?" *Journal of Economic Dynamics and Control*, forthcoming.

[11] **Garcia-Cicco, Javier, Roberto Pancrazi and Martin Uribe. 2010.** "Real Business Cycles in Emerging Countries?," *American Economic Review*, vol. 100(5), pp. 2510-31.

[12] **Gertler, Mark, Simon Gilchrist, and Fabio M. Natalucci. 2007.** "External Constraints on Monetary Policy and the Financial Accelerator," *Journal of Money, Credit and Banking*, Vol. 39, Issue 2-3, pp. 295-330.

[13] **ILO. 2013.** "Women and Men in the Informal Economy: A Statistical Picture," *Second Edition*, International Labour Office: Geneva, Switzerland.

[14] **Kantis, Hugo, Masahiko Ishida, and Masahiko Komori. 2002.** "Entrepreneurship in Emerging Economies: The Creation and Development of New Firms in Latin America and East Asia," Inter-American Development Bank: Washington D.C.

[15] **Levy, Santiago. 2007.** "Can Social Programs Reduce Productivity and Growth? A Hypothesis for Mexico," IPC Working Paper Series Number 37, Gerald R. Ford School of Public Policy, University of Michigan.

[16] **Magnusson Bernard, Kristin. 2010.** "Business Cycle Properties of Remittance Flows and Macroeconomic Volatility," *mimeo.*

[17] **Mandelman, Federico, and Gabriel Montes-Rojas. 2009.** "Is Self-employment and Micro-entrepreneurship a Desired Outcome?," *World Development,* Vol. 37, pp. 1914-1925.

[18] **Mandelman, Federico, and Andrei Zlate. 2012.** "Immigration, Remittances and Business Cycles," *Journal of Monetary Economics*, Vol. 59, Issue 2, pp. 193-213.

[19] **McKenzie, David J., and Christopher Woodruff. 2006.** "Do Entry Costs Provide an Empirical Basis for Poverty Traps? Evidence from Mexican Microenterprises,"*Economic Development and Cultural Change*, Vol. 55, No. 1, pp. 3-42.

[20] **Neagu, Ileana C., and Maurice Schiff. 2009.** "Remittances Stability, Cyclicality and Stabilizing Impact in Developing Countries," *World Bank Policy Research Working Paper 5077.*

[21] **Orozco, Manuel. 2004.** "Remittances to Latin America and the Caribbean: Issues and Perspectives on Development," Report Commissioned by the Organization of American States, Washington D.C.

[22] **Restrepo-Echavarria, Paulina. 2011.** "Macroeconomic Volatility: The Role of the Informal Economy," *European Economic Review,* forthcoming.

[23] **Shimer, Robert. 2005.** "The Cyclical Behavior of Equilibrium Unemployment and Vacancies," American Economic Review, vol. 95(1), pp 25-49.

[24] **Tüzemen, Didem. 2012.** "Labor Market Dynamics with Endogenous Labor Force Participation and On-the-Job Search,"*Federal Reserve Bank of Kansas City Working Paper RWP 12-07*.

[25] **Sirkeci, Ibrahim, Jeffrey H. Cohen, and Dilip Ratha. 2012.** "Migration and Remittances during the Global Financial Crisis and Beyond, " The World Bank Group: Washington D.C.

[26] **Woodruff, Christopher. 2001.** "Firm Finance from the Bottom Up: Microenterprises in Mexico," *Center for Research on Economic Development and Policy Reform Working Paper No. 112*, Stanford University.

[27] **Woodruff, Christopher, and Rene Zenteno. 2007.** "Migration Networks and Microenterprises in Mexico," *Journal of Development Economics,* Vol. 82, pp. 509-528.

[28] **Yang, Dean. 2008.** "International Migration, Remittances and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks," Economic Journal, vol. 118(528), pages 591-630, 04.

6 Appendix

6.1 Model with No Self-Employment and No Participation Margin

Figure 4 shows the impulse responses to a salaried productivity shock in a model with no self-employment and no participation margin.

6.2 Alternative Parameterization with Acyclical Remittances

Table 7 compares the benchmark model (third column), which assumes countercyclical remittances, to two versions of the same model that instead assume that remittances do not respond to output fluctuations (which effectively yields acyclical remittances). The fourth column assumes the same steady state as the benchmark case. While this alternative parameterization of the model improves the cyclical correlation of unemployment, the model generates a lower relative volatility of unemployment as well as a counterfactual correlation between output and the population out of the labor force. The fifth column recalibrates the model when remittances once again do not respond to output fluctuations. The model is unable to capture the cyclical correlation between output and the population out of the labor force without running into convergence problems. Furthermore, the cyclical correlation between output and the unemployment rate and between output and the current account-output ratio are counterfactual.

6.3 Data and Model Comparison: 2008-2009 Financial Crisis in Mexico with AR Process for Remittances

As described in the main text, we estimate an AR(1) process using HP-filtered TFP, and use the residuals from this regression as the TFP shocks that we feed the model with. We use a similar procedure to obtain the shock series for remittances. One caveat: this last procedure for obtaining the remittance shocks from

the data is not strictly correct since we assumed that the remittances in the model partly respond to output deviations from trend. The results are broadly consistent with those in the main text. We also note that using an AR process for remittances captures better the behavior of labor force participation, but is less successful in capturing the behavior of unemployment. Figure 5 shows the results from this exercise.

6.4 Data and Model Comparison: 2008-2009 Financial Crisis in Mexico with Estimated TFP and Remittance Process Parameters

As a robustness check, we use the coefficient estimates for the autocorrelation of TFP and the elasticity parameter for the response of remittances to output deviations in the data as opposed to the calibrated values used in the benchmark experiment. More specifically, the estimated values we use are $\rho_z = 0.735$ and $\eta_r = 1.01423$. The shock series for TFP and remittances remain the same. As in Figure 6, the model is very successful in capturing the behavior of output, investment, and labor force participation, and also does well at capturing the response of unemployment.

Remittances, Entrepreneurship, and Employment Dynamics over the Business Cycle: Figures and Tables

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Table 1: Parametrization for Benchmark Economy

Parameter	Value	Parameter Description	Parameter Source
α_S	0.32	Salaried Capital Share	DSGE Lit.
β	0.985	Discount Factor	DSGE Lit.
δ	0.025	Capital Depreciation Rate	DSGE Lit.
ν_S	0.50	Salaried Bargaining Power	Search Lit.
ν_{SE}	0.50	SE Bargaining Power	Search Lit.
ξ_S	0.50	Matching Elasticity, Labor	Search Lit.
ξ_{SE}	0.50	Matching Elasticity, Capital	Search Lit.
ϕ	0.05	Adjustment Cost, Bond Holdings	Assumption
ρ^S	0.06	Salaried Separation Rate	Bosch, Maloney (2008)
ρ^{SE}	0.02	SE Separation Rate	Bosch, Maloney (2008)
η_{SE}	1.00	Curvature, SE Search Cost	Assumption
ρ_{z_S}	0.92	Autocorr. of Salaried Productivity	DSGE Lit.
$\rho_{z_{SE}}$	0.92	Autocorr. of SE Productivity	DSGE Lit.

Table 2: Calibrated Parameters and Targets, Benchmark Economy

Parameter	Value	Parameter Description	Target
M_S	0.176	Salaried Matching Efficiency	$p(\theta_S) = 0.90$
M_{SE}	0.021	SE Matching Efficiency	$n_{SE} = 0.23$
ψ	20.31	Labor, Search Disutility Parameter	$lfp = 0.60$
ψ_S	0.059	Salaried Vacancy Cost	3.5 percent of wages
ψ_{SE}	1.673	Capital Search Cost	3 months of wages
rem_{ss}	0.0299	Steady State Remittances	2.4 percent of output
η_r	20	Sensitivity of Remittances to Output	See Text
φ_{k_S}	3.3	Capital Adjustment Cost Parameter	See Text
ϕ_S	0.550	Elasticity Parameter, Salaried Empl.	See Text
ϕ_{SE}	0.550	Elasticity Parameter, SE	Same value as ϕ_S
σ_{z_S}	0.0138	SD Salaried Productivity Shock	See Text
$\sigma_{z_{SE}}$	0.0200	SD SE Productivity Shock	See Text
σ_r	0.032	SD Remittance Shock	See Text

Table 3: Business Cycle Statistics, Data vs. Model

Second Moments	Data	Benchmark Model	Benchmark, Single Agg. TFP Shock	Model with no LFP, no SE	Model with LFP, no SE	Model with SE, no LFP
σ_{y_t}	2.39	2.39	2.39	2.39	2.39	2.39
$\sigma_{c_t}/\sigma_{y_t}$	1.13	0.17	1.20	0.27	0.13	0.585
$\sigma_{i_t}/\sigma_{y_t}$	2.78	2.79	2.79	2.79	2.79	2.79
$\sigma_{u_t}/\sigma_{y_t}$	6.28	3.42	2.74	0.447	3.63	0.799
$\rho(u_t, y_t)$	-0.889	-0.582	-0.486	-0.731	0.120	0.221
$\rho(olf_t, y_t)$	-0.157	-0.154	-0.158	-	-0.961	-
$\rho(n_t, y_t)$	0.530	0.762	0.768	0.995	0.978	-0.221
$\rho(n_{SE,t}, y_t)$	-0.450	-0.386	-0.380	-	-	-0.433
$\rho(p(\theta_{SE,t}), y_t)$	-0.433	-0.922	-0.844	-	-	-0.945
$\rho(y_t, y_{t-1})$	0.846	0.793	0.785	0.739	0.812	0.574
$\rho(rem_t, y_t)$	-0.380	-0.480	-0.390	-0.467	-0.498	-0.365
$\rho(ca_t/y_t, y_t)$	-0.470	-0.309	-0.257	-0.350	-0.369	-0.140

Table 4: Business Cycle Statistics – Benchmark, Estimated Shock Parameters, Stochastic Remittances, and Acyclical Remittances

Second Moments	Data	Benchmark Model	Estim. TFP, Rem. Param.	Stoch. Rem. $\eta_r = 0, \sigma_{rem} > 0$	Acycl. Rem. $\eta_r, \sigma_{rem} = 0$	Higher SS Rem. $rem = 0.10 * y$
σ_{y_t}	2.39	2.39	2.06	2.39	2.39	3.17
$\sigma_{c_t}/\sigma_{y_t}$	1.13	0.17	0.52	0.47	0.44	0.13
$\sigma_{i_t}/\sigma_{y_t}$	2.78	2.79	2.78	2.79	2.78	1.01
$\sigma_{u_t}/\sigma_{y_t}$	6.28	3.42	3.74	5.43	3.14	5.68
$\rho(u_t, y_t)$	-0.889	-0.582	-0.413	0.235	0.258	-0.254
$\rho(olf_t, y_t)$	-0.157	-0.154	-0.158	0.021	0.100	-0.744
$\rho(n_t, y_t)$	0.530	0.762	0.535	-0.179	-0.238	0.899
$\rho(n_{SE,t}, y_t)$	-0.450	-0.386	-0.344	-0.583	-0.632	-0.327
$\rho(p(\theta_{SE,t}), y_t)$	-0.433	-0.922	-0.761	-0.112	-0.716	-0.925
$\rho(y_t, y_{t-1})$	0.846	0.793	0.634	0.715	0.692	0.83
$\rho(rem_t, y_t)$	-0.380	-0.480	-0.157	-0.019	0.033	-0.879
$\rho(ca_t/y_t, y_t)$	-0.470	-0.309	-0.043	0.050	0.522	-0.734

Figure 1: Response to a Negative Salaried Productivity Shock

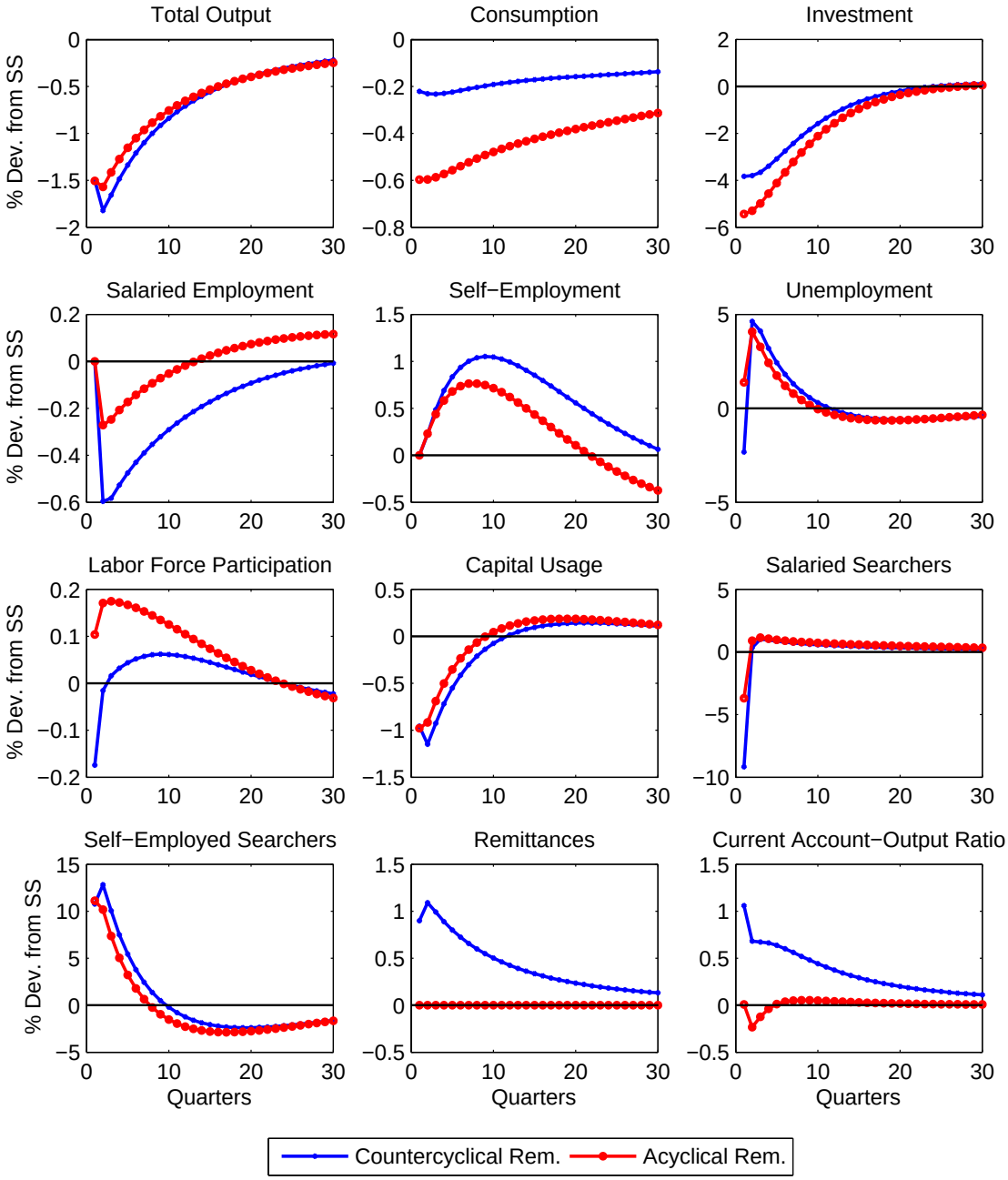

Figure 2: Response to a Positive Remittance Shock

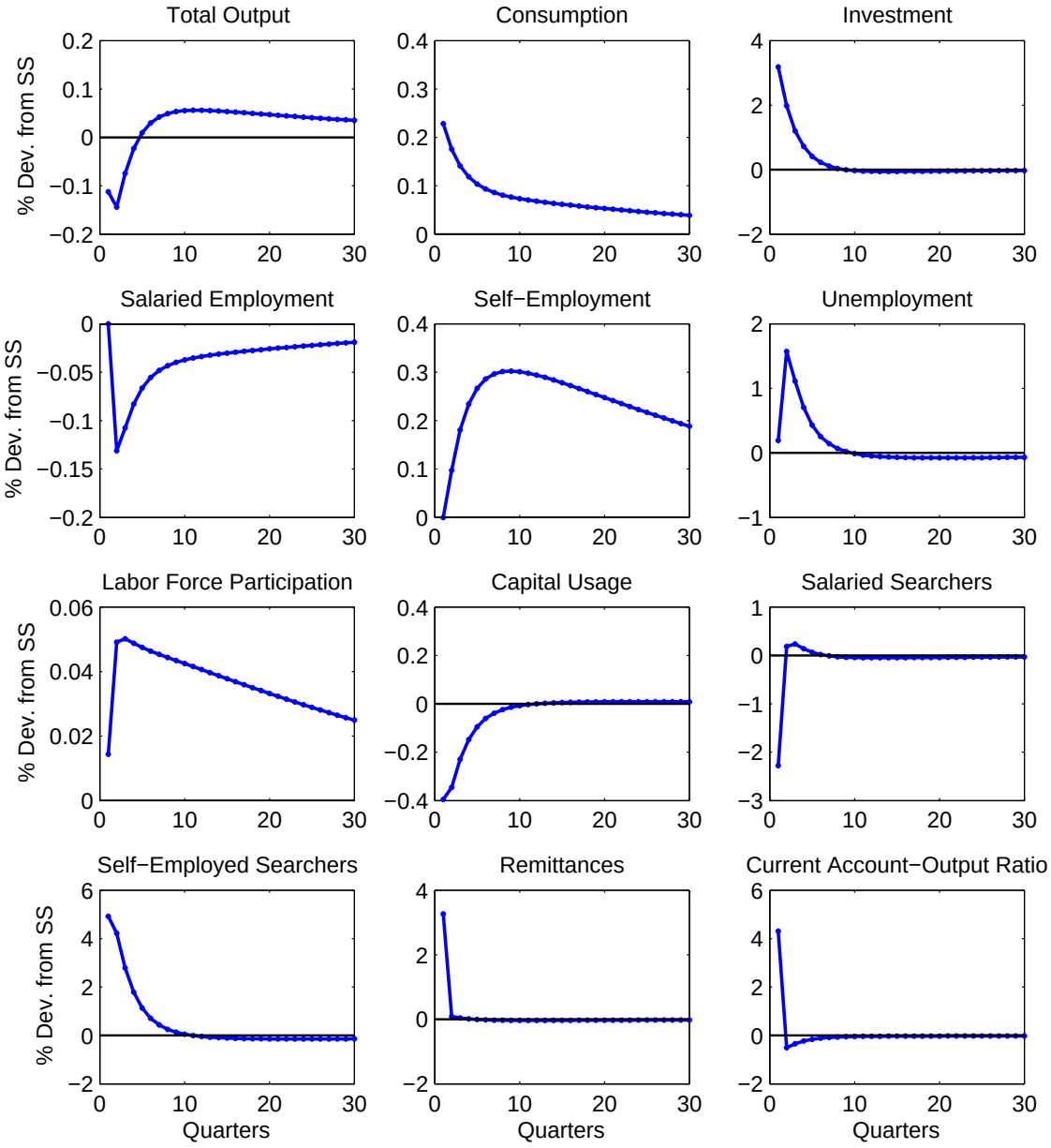

Figure 3: Data and Model Comparison: 2008-2009 Global Financial Crisis

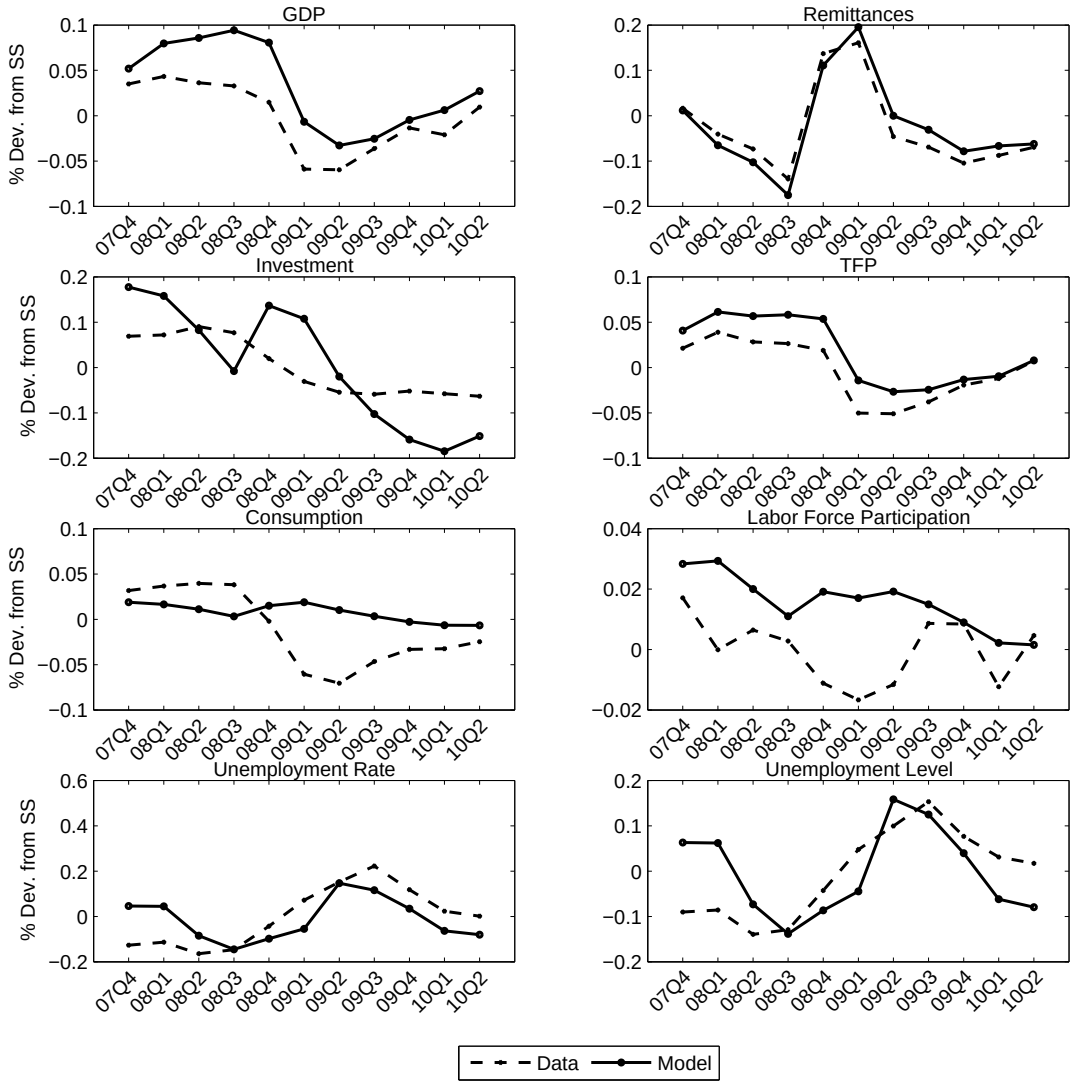

Figure 4: Response to a Negative Productivity Shock – Benchmark Model vs. Model with No Self-Employment and No Participation Margin

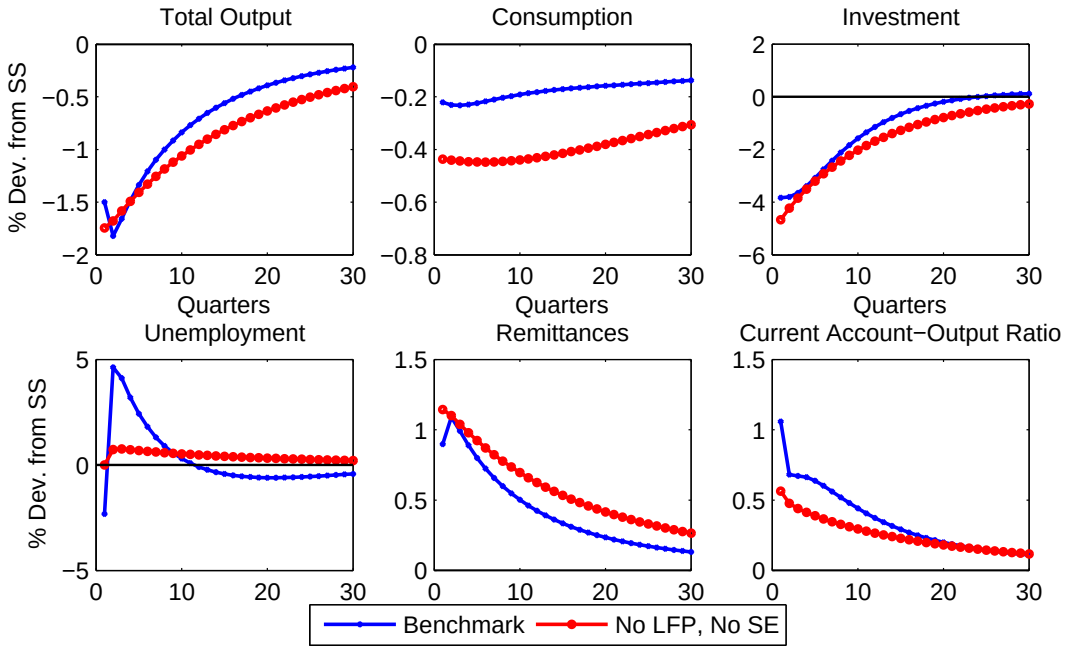

Figure 5: Response to a Negative Shock: Salaried Productivity, Self-Employment Productivity, and Aggregate Productivity Shocks

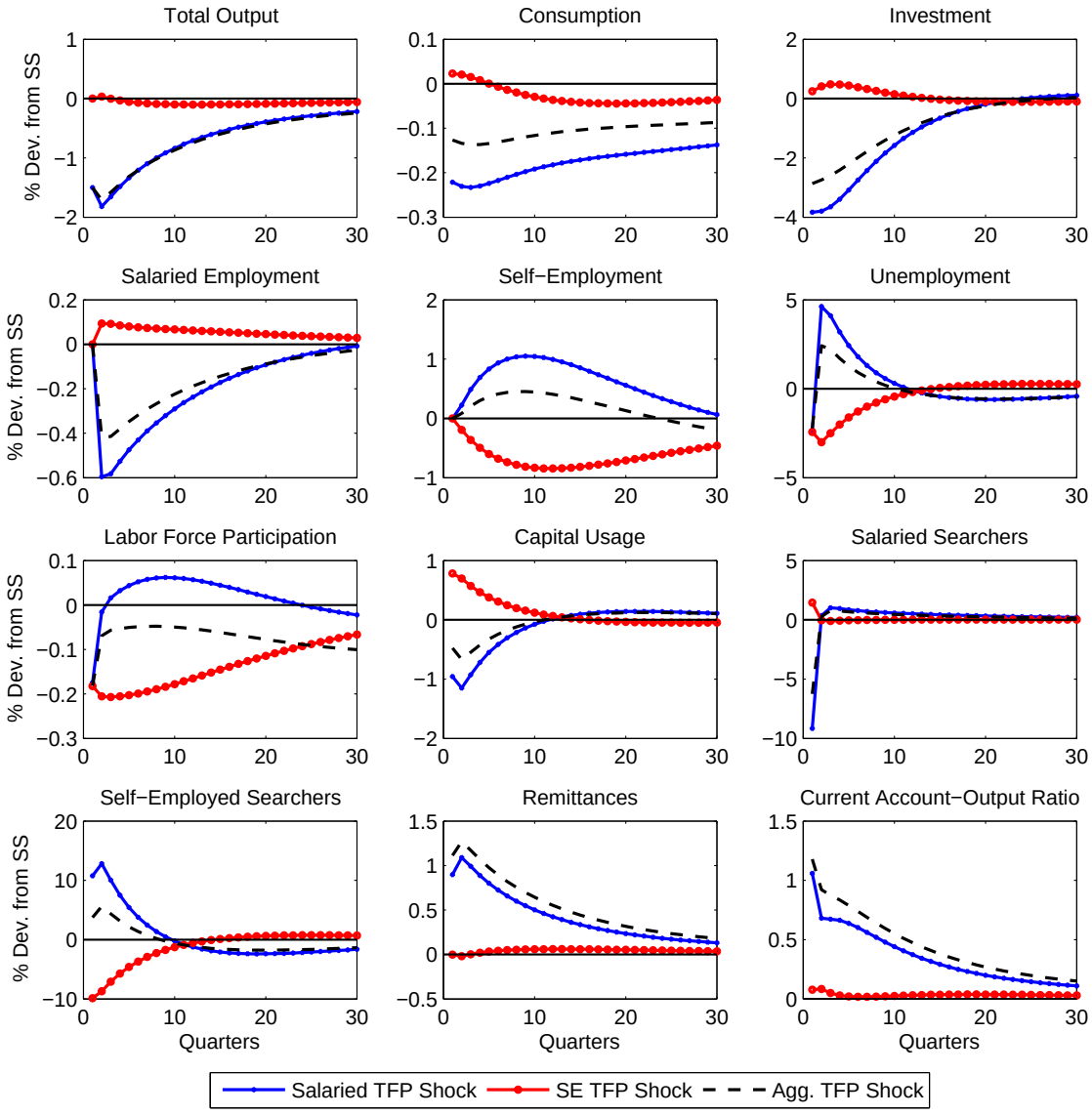

Figure 6: Data and Model Comparison: 2008-2009 Global Financial Crisis (Alternative Remittance Shock Process)

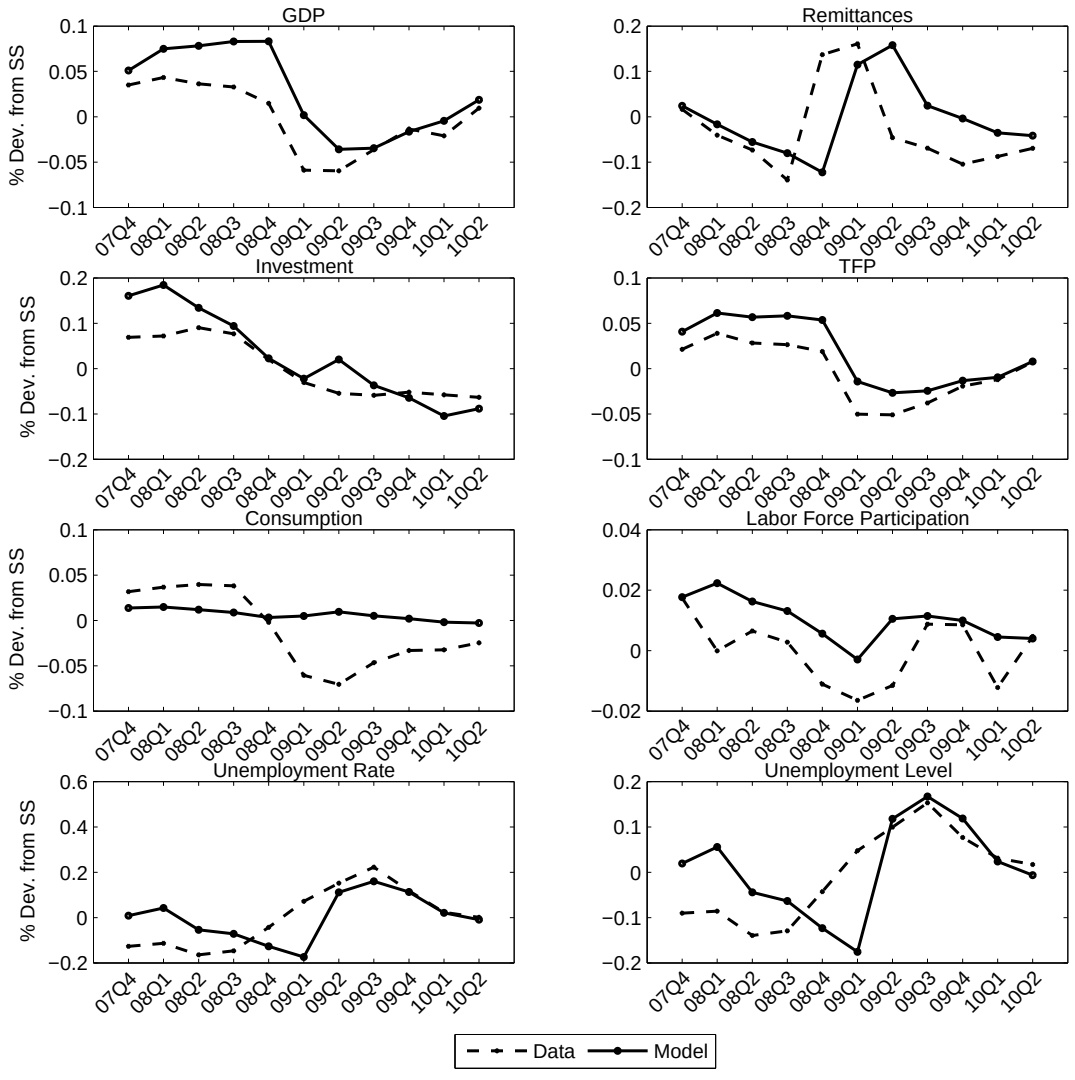

Figure 7: Data and Model Comparison: 2008-2009 Global Financial Crisis (Estimated Parameters for TFP and Remittance Processes)