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Abstract

A remarkable fact of the mushrooming remittances market is the absence of commercial banks as relevant players. Furthermore, remittances have been identified as a potential catalyst for the financial deepening of receiving countries through higher access to banking services by migrants' families. Building upon these features, this paper sets up a two-period financial model of remittances without uncertainty. The formulation acknowledges, on the one hand, the altruism component of remittances sent by migrants to their families and, on the other hand, the dominant position of Money Transfer Operators (MTO's) due to migrants' mistrust to banks, which hinders the access of banks to the market. Altruism compounded with a non-competitive market allows MTO's to set excessively high remittance fees and to attain monopolistic rents. The model shows that banks can challenge this position thanks to their role as providers of remunerated saving and credit, which enables them to overcome the competitive disadvantage derived by migrants' mistrust. Notwithstanding this, the main positive impact of banks' entry is attained through higher competition, not through the provision of financial services. All in all, the entry of banks reduces the fees and increases the level of remittances, allows an optimal consumption smoothing and improves the welfare of migrants and their families, although it also increases the volatility of remittances.

KEYWORDS: banks, financial development, migrations, remittances.
JEL Classification: G20, J61.

1 Introduction

Worker remittances -monetary transactions between migrants in the host country and their relatives in the origin country- constitute an increasingly important mechanism for the transfer of resources from developed to developing countries (Russell 1992) and are one of the largest sources of external funding for developing countries (Ratha 2003). According to the World Bank, in 2004 the flow of international remittances to developing countries surpassed the 125 billion dollars, and they are growing at rates higher than 10% in most developing regions.

Remittances constitute an essential financial resource for countries with a high incidence of migration, reaching, in cases like most Central American countries, to more than 10% of GDP. Moreover the increase in importance has been dramatic during recent years, as in Guatemala, where this ratio grew from $4,3\%$ in 2002 to $10,3\%$ in 2004 (World Bank, IMF).

The mushrooming market of remittances is overwhelmingly dominated by a small number of Money Transmitters Operators (MTO's, henceforth), with more than 90% share. In spite of the reduction in costs in the last years due to higher competition, these companies charge large fees and exchange rate commissions, which greatly diverge among locations and destination. This suggests that the market has an oligopolistic structure and that it is very segmented. It also underscores that a significant slice of remittances goes to the operators as rents -as highlighted by Orozco (2003)- rather than to the families of the migrants in developing countries. In spite of banks being at the core of the financial system, they have traditionally kept aside of this apparently attractive financial market. In the US for instance they hardly control a 3% of the market for remittances

between this country and Mexico (Orozco, 2004). This situation can be partly explained by the higher effectiveness of MTO's to reach distant receivers, but also to the reluctance that migrants have traditionally shown towards the banks. Notwithstanding this, an increasing interest by banks to occupy the market is being observed. This interest is shared by multilateral and development organizations such as the IADB or the World Bank. Most receiving countries are characterized by scant access to credit by the low income groups -those more prone to receive remittances- and by a low degree of bancarisation. Contrary to banks, MTOs cannot offer financial services attached to their intermediary role. Therefore the bancarisation of remittances is seen as an important lever to promote financial deepening and democratization in the receiving countries.

This paper is -to our knowledge- the first attempt to formally model the entry of banks in the remittances market. The gist of the model conveys the idea of bank entry as fostering financial development, so there is an underlying normative flavour in our approach.

The formal model is framed in a two period setting without uncertainty and it includes two types of agents: migrants and their families who stay at home and get the remittances. Since the characteristics of the migrants are important to determine markets features, we use as a benchmark one migrants profile: the newly arrived migrant with a constant income, although we subsequently consider other migrants' profiles. MTO's and banks are the financial intermediaries. The model conveys the difficulties of banks to enter the market due to reluctance by migrants and network inefficiencies, but it also acknowledges the competitive advantage provided by their potential provision of remunerated saving and credit. An important feature of the model is that these financial services are

provided to the beneficiaries of the remittances, conveying the above mentioned catalyzing role of remittances in financially undeveloped countries and groups of population. We start from a situation in which the MTO's act as monopolist, and we develop the results in several stages, so as to underscore the two different channels through which banks entry impacts the market: competition and financial deepening.

The model shows that the banks' main positive impact is attained through higher competition. The provision of savings and the extension of credit do not, by themselves, generate great quantitative gains, but they are key to allow banks to compete with MTO's and overcome the hindrances to compete profitably in the remittances markets.

There are further insights of this model, such as the increase in overall remittances due to competition induced by banks' entry, which is in contrast by the reduction induced by banks as providers of remuneration for the savings of families. All in all, these results are driven by the positive influence of banks in the management of remittances, in particular to improved consumption smoothing, the return attained by remittances when they are saved and the ability to anticipate consumption through borrowing. This rich set of results, some of them counterintuitive -as the higher volatility of remittances when banks allow to save- encourage further research taking this model as reference and relaxing some of the assumptions of this basic setup.

The paper is organized as follows. Section 2 presents the main features of the remittances markets which are relevant for the setup of the model. This is described, presented and calibrated in section 3, where its main insights are also displayed. Section 4 presents the results in a sequential way. First, we

let MTO's act as monopolist and then banks enter the market. At this point, the differential effect of competition and financial innovation is emphasised. Section 5 considers two extensions: the case of settled migrants emphasizes the role played by altruism in the model and the case of migrants with increasing incomes opens the possibility for banks to extend credit to the receivers of remittances. Section 6 wraps up the results, hints several extensions and derives some possible policy implications.

2 Main relevant features of the market for remittances

In order to set up the model, it is convenient to describe some of the most relevant features of the current context. In particular, the motivation behind migrants' remittances and the current configuration of the market, emphasizing the limited role played by banks.

2.1 Why Do Migrants Remit?

The literature on remittances has come up with several theories to explain the motives behind migrants' decisions to remit. Solimano (2003) distinguishes four motives: (*i*)The Altruistic Motive, (*ii*)Loan Repayment, (*iii*)Coinsurance and (*iv*)The Self-Interest Motive. In practice, all the four get entangled in the effective decision to remit part of their income to the country of origin, but for our purposes here the most relevant is the altruistic motive, with some ingredients of loan repayment.

Remittances based on altruism are sent out of affection and responsibility towards the family. It has been argued in the poverty literature that the major reason why people migrate to other countries is due to poverty. According to

the altruistic model, then sending remittances yields a satisfaction and utility to the migrant out of a concern for the welfare of his family[1].

Altruism can also be mixed up with elements of loan repayment and coinsurance, both of which arise when considering remmitances as the outcome of a implicit family contract, among those staying and those leaving (the migrants). This implies approaching the issue from the family rather than the individual perspective and it has two dimensions. The first is considering remmitances as a loan repayment. According to this view, the family invest in the education of the migrant and usually finances the costs of migration (travel and subsistence costs in the host country). After the migrant settles in the foreign country, his income profile starts rising over time and he is in a condition to start repaying the loan back to the family in the form of remittances. The coinsurance dimension is linked to the notion of risk diversification, since economic risks between the sending and foreign country are not positively correlated. The migrant, can help to support his family in bad times at home and conversely, for the migrant, having a family in the home country is insurance as bad times can also occur in the foreign country. In these cases, as in any contract, there is a potential problem of enforcement. However, we can expect enforcement to be simpler, in principle, due to the fact that these are implicit family contracts, helped by considerations of family trust and altruism.

This altruistic cum implicit contract dimension of remmittances will be conveyed in our model. For completeness, let us add that the self-interest motive is based on the idea that the migrant sends remmittances as a way to save and invest in the origin country. These assets may earn a higher rate of return

[1] Unilateral altruism has been recently tested by Chami, Fullenkamp and Jahjah (2005). See also Rapoport and Docquier (2003).

than assets in the host country although their risk profile canalso be greater. In turn, the family can administer, during the emigration period, those assets for the migrant, thus acting as a trusted agent. Note that the profile of the migrant determines the effective propensity to remit and it will be a central consideration of the analysis. Newly arrived migrants tend to be more attached to the leftover families, which translates into a higher level of altruism and, as a consequence, to a higher share of income devoted to remittances, relative to long settled remittances. Also other characteristics, such as the mistrust to the banking channel tends to decrease with the time of stay in the host country.

2.2 The financial intermediation of remittances

The market of remittances is dominated by Money Transmitters Operators (MTO's, henceforth), while the participation of banks is strikingly small (Suro 2002, Orozco 2004). It is important to stress that, by their nature and contrary to banks, MTO's do not offer financial services attached to the remittance, they act as mere money transmitters.

MTO's charge an explicit fee that can be a percentage of the amount remitted or a fixed amount (often in dollars). The fee usually depends on the services offered (speed of delivery, home delivery, etc.). The exchange rate spread is the difference between the exchange rate applied by the money transmitter company to convert dollars into local currency and the market (e.g. inter-bank) exchange rate. Money transfer companies usually offer a less favorable exchange rate to the sender than the market rate. In spite of narrowing in the last decade, the cost of remittances remains high and large differences are observed among different destinations. According to sendingmoneyhome.org, the average cost of sending £100 though MTO's in 2001 for a sample of 40 countries was

between 8% and 40% without including the exchange rate charged on money transfers located in local currency. Therefore, currently a significant slice of remittances goes to the operators as rents rather than to the families of the migrants in developing countries. Furthermore, most of the migration countries are characterized by low financial development. In this context, it is rather striking that the main financial intermediaries, commercial banks in both the source and recipient countries, have a low share of the global remittances market (Orozco, 2004) and, until recently, they have shied away from this apparently attractive business. Thus there is a clear case to increase competition in the remittances markets through banks entry. Furthermore, the outstanding role of banks in promoting financial deepening underscores such role.

Why have then banks been unable to capture a substantial part of the remittances markets? On the one hand, the branching distribution system of banks seems ill-suited to reach fast the recipients in remote areas in countries with low financial development where bancarization is scarce. This contrasts with capillarity of MTO (non-proprietary) network, which has given them a comparative advantage. Also, behavioral evidence suggests that many remittances senders take a skeptical view of banks and other financial institutions (See Suro et.al. 2003). Some other studies found that many immigrants fail to understand and are suspicious of bank pricing structures. In many cases this mistrust is linked to the dismal performance of banking systems in the origin countries of migrants, characterized by financial crises, appropriation of savings or depletion of their value. Finally, the requirements of documentation and transparency in banking transactions tend to be higher than on MTO's; the large share of informality in the migrants' job market and their irregular legal situation act

as strong deterrents of both access to and use of the banking channel. Given these obstacles, banks, in order to be competitive in the remittances market, are developing several initiatives to increase financial literacy and build confidence. The initiatives take different forms, such as targeting the migrants market at the host countries and it is many cases complemented by a variety of strategies at the origin country of migrants, either through joint ventures with local financial and non-financial institutions or even with MTO's. Note that, only a part of the strategies developed so far convey the possibility of banks directly playing its natural role of inter-temporal allocation of financial resources in the origin countries, which is opening savings accounts and giving credit to remittances recipients contemplating such resources as collateral. But some of the initiatives imply indirectly the use of the remittances to promote individual or community investments. These direct or indirect initiatives, as well as some others with less intrinsic financial content will contribute to generate more trust and customer linkages which will broaden the scope of banking activities in this market. Furthermore, if the use of the banking channel has positive effects on savings, then banks would have strong incentives to create lasting banking relationships with migrants who use remittance products.

Remittances could also serve as collateral for future credits as they have proved to be more stable when compared to other private capital flows (Solimano 2003). At the same time, remittances are less affected by economic downturn; on the contrary, they are known to rise during periods of downturns or crises in the migrants country of origin (Bush and Kuckulenz 2003). This counter-cyclical behavior is an attractive feature for banks during recession periods in emerging economies. Finally, a positive effect of the use of the banking channel on savings

will boost both, the social and the economic impact of remittances on emerging economies. Regarding the nation of origin of remittances, they can become the levers to lure migrants into the banking system; migrant's consumers can also benefit from the use of financial products attached to the remittances business. In any case, the largest expected benefit from banks' entry is to increase the competition in a market in which large rent-appropriation is perceived on behalf of MTO's.

After what has been said in this subsection, there is little doubt about the benefits that the introduction of banks in the remittances market may entail for both, remittances senders and receivers.

3 The Model

Remittances constitute monetary transactions between migrants in the host country and their relatives who stay in the origin country, which is intermediated by a financial intermediary (MTO's or banks in our model). The model has two periods and there is perfect information. Two different decision processes are entailed in the model, one concerning the families and one concerning the financial intermediary(ies).

There are various possible ways to model the family decision making. Recent research suggests that in the case of remittances, the migrant workers likely to decide how much to send to their families in the host country taking into account their welfare -they are altruistic- but the decision about the level of remittances is still made by the migrant. Also, the allocation of the money received by the families back home appear to be a decision made without the participation of

the sender[2]. Thus, in this paper we will use a non-cooperative solution, in which both the remitter and his family maximize their utility unilaterally taking the other's actions as given.

We consider two types of financial intermediaries (see Table 1): the MTO's which act as just transmitters of money, and the banks, which can also allow for saving with a return r^b and extend credit. MTO's and banks charge a fee for sending the money, which may be different (c^{mto}, c^b, respectively). This fee includes the explicit fee plus the exchange rate premium. Furthermore, our model has to capture the apparent disutility in which families incur when using banks compared to MTO's due to familiarity, convenience, and simplicity. This is captured by the disutility parameter ε which is positive for banks, reflecting the reluctance to use this channel, and null for MTO's.

TABLE 1

Differences between Banks and MTO´s

Type	Transfer Costs	Return on Savings	Negative Savings	Disutility Factor
Banks	c^b	r^b	Yes	ε
MTO´s	c^{mto}	0	No	0

3.1 Migrants and their Families

3.1.1 The optimization problem

As mentioned above, there are two agents involved in this part of the decision process, the prospective migrant (m) and his family back home (f). Each of the agents wants to maximize his own utility function conditional on the migrant (m) sending remittances to his family (f). We suppose that families back home derive utility solely from their consumption of goods, while migrants also derive

[2] "Latino, Immigrants, Remittances and Banking, Billions in Motion" produced in cooperation between The Pew Hispanic Center and The Multilateral Investment Fund. 2003.

utility from sending money back to their families since they are altruistic. The migrant decides the level of remittances in both periods at the beginning of period one, taking into account the transfer costs. Subsequently, the family makes its decision on consumption and saving in the first period.

More precisely, both agents maximize their utility to the following exponential utility function[3].

$$U^f = -\frac{1}{\theta}e^{-\theta z_1^f} - \frac{1}{1+\rho}\frac{1}{\theta}e^{-\theta z_2^f} \tag{1}$$

$$U^{m,j} = -\frac{1}{\theta}e^{-\theta z_1^m} - \frac{1}{1+\rho}\frac{1}{\theta}e^{-\theta z_2^m} - \gamma\left[\frac{1}{\theta}e^{-\theta z_1^f} + \frac{1}{1+\rho}\frac{1}{\theta}e^{-\theta z_2^f}\right] - \varepsilon^j \tag{2}$$

where z_t^i indicates consumption of agent i in period t ($t = 1, 2$; $i = f, m$ with $f = family\ back\ home$, $m = migrants$), ρ is the intertemporal discount rate and θ is a parameter that captures the intensity of consumption smoothing. γ is the weight attached by the migrant to the utility of the family and it captures the level of altruism. Finally, ε^j is the utility differential migrants lose when they send money through banks rather than through MTO's. Note that the superscript j in what follows refer to the financial intermediary of reference ($j = b, mto$ with $b = banks$, $mto = money\ tranfer\ operator$). Thus, as explained above $\varepsilon^j = 0\ \forall j = mto$; $\varepsilon^j \geqslant 0\ \forall j = b$

As a migrant, the migrant's full income budget constraints for periods one and two are

$$y_1^m = z_1^m + (1 + c^j)R_1^j \tag{3}$$

$$y_2^m = z_2^m + (1 + c^j)R_2^j \tag{4}$$

[3] Following the relevant literature (Nordblom, K. (1998)) about altruism, $U(c_1, c_2)$ is strictly increasing, concave, and twice continuously differentiable and make possible to facilitate the derivation of closed form solutions, at least for some variables such as R_1, R_2 and s.

where y_t represents the earnings of the migrant in the foreign country in period t, R_t^j is the value of transfers he makes to his family as a migrant in period t when using the $j-$ type of financial intermediary and c^j is the cost, in percentage, of sending money to his family through the $j-$ type of financial intermediary.

In order to keep things simple, in this paper we are going to assumme that family income in both periods rely only on remittances ($y_1^f = y_2^f = 0$), therefore the families' full income constraints are

$$R_1^j = s^j + z_1^j \tag{5}$$

$$R_2^j + s^j(1 + r^j) = z_2^j \tag{6}$$

where s^j and r^j are, respectively, the level of savings families hold and the return families can get from those savings when the migrant uses the $j-$type of financial intermediary to send his money.

It is important to recall, as indicated in Table 1, that $\forall j = mto$; $s^j \geqslant 0$ *and* $r^j = 0$.

3.1.2 Solution

Using (1); (5) and (6) and assuming for simplicity that $y_1^f = y_2^f = 0$, the family problem can be expressed as

$$max_{s^j}\ U^f = -\tfrac{1}{\theta}e^{-\theta(R_1^j - s^j)} - \tfrac{1}{\theta}e^{-\theta\frac{R_2^j + s^j(1+r^j)}{1+\rho}}$$

where s^j and r^j are, respectively, the level of savings families hold and the return families can get from those savings when the migrant uses the $j-$type of financial intermediary to send his money ($j = b, mto$; $b = banks$, $mto = money\ tranfer\ operator$).

The resulting Euler condition can be reformulated as an expression for savings:

$$s^j = \frac{1}{\theta}\frac{1}{2+r^j}\left[\ln\left[\frac{1+r^j}{1+\rho}\right] + \theta(R_1^j - R_2^j)\right] \tag{7}$$

With this result, we can proceed to solve the sender's problem, which, using (2); (3); (4) and (7) can be expressed as

$$\begin{aligned}
max_{R_1^j, R_2^j}\ U^m &= -\frac{1}{\theta}e^{-\theta\frac{y_1^m-(1+c^j)R_1^j}{1}} - \frac{1}{\theta}e^{-\theta\frac{y_2^m-(1+c^j)R_2^j}{1+\rho}} - \\
&\quad -\gamma\left[\frac{1}{\theta}e^{-\theta\frac{R_1^j-s^j}{1}} + \frac{1}{\theta}e^{-\theta\frac{R_2^j+s^j(1+r^j)}{1+\rho}}\right] - \varepsilon_j \\
s.t.\ (i)\ s^j &= \frac{1}{\theta}\frac{1}{2+r^j}\left[\ln\left[\frac{1+r^j}{1+\rho}\right] + \theta(R_1^j - R_2^j)\right] \\
(ii)\ R_1^j &\geqslant 0 \\
(iii)\ R_2^j &\geqslant 0 \\
(iv)\ R_1^j + R_2^j &\geqslant 0
\end{aligned}$$

From the F.O.C's we can obtain the following system of two equations with two unknowns

$$R_1^j = \frac{1}{\theta}\frac{2+r^j}{(1+r^j)+(2+r^j)(1+c^j)}\left[\ln\frac{\gamma(1+r^j)}{(2+r)(1+c)} + \theta y_1^m + \ln[\Omega] - \theta R_2^j\frac{1}{2+r^j}\right] \tag{8}$$

$$R_2^j = \frac{1}{\theta}\frac{\left(2+r^j\right)}{1+(2+r^j)(1+c^j)}\left[\ln\frac{\gamma}{(2+r^j)(1+c^j)} + \theta y_2^m + \ln[\Omega] - \theta R_1^j\frac{1+r^j}{2+r^j}\right] \tag{9}$$

where $\Omega = e^{\frac{1}{2+r^j}\ln\left[\frac{1+r^j}{1+\rho}\right]} + \frac{1}{1+\rho}e^{-\frac{(1+r^j)}{2+r^j}\ln\left[\frac{1+r^j}{1+\rho}\right]}$.

Solving the system we get the corresponding expressions for R_1^j and R_2^j

$$R_1^j = c^j\left[\frac{1}{\theta}\frac{2+r^j}{(1+r^j)+b}\left[\begin{array}{l}\ln\frac{\gamma(1+r^j)}{b} + \theta y_1^m + \ln[\Omega] - \\ -\frac{1}{1+b}\left(\theta y_2^m + \ln\frac{\gamma}{b} + \ln[\Omega]\right)\end{array}\right]\right] \tag{10}$$

$$R_2^j = \frac{1}{\theta}\frac{2+r^j}{1+b}\left[\ln\frac{\gamma}{b} + \theta y_2^m + \ln[\Omega] - \theta\frac{1+r^j}{2+r^j}\left[c^j\frac{1}{\theta}\frac{2+r^j}{(1+r^j)+b}\left[\begin{array}{l}\ln\frac{\gamma(1+r^j)}{b} + \theta y_1^m + \ln[\Omega] - \\ -\frac{1}{1+b}\left(\theta y_2^m + \ln\frac{\gamma}{b} + \ln[\Omega]\right)\end{array}\right]\right]\right] \tag{11}$$

where $b = (2 + r^j)(1 + c^j)$ and $c = \frac{\left(1+r^j\right)+b\left(1+r^j\right)+b+b^2}{b(1+r^j)+b+b^2}$.

Even if the solution yields a closed form for the optimal level of remittances, the expression is quite complex. To obtain better insights, it is convenient to display the solution when migrants use MTO´s because the solution substantially simplifies. In this case, the sender's problem should be re-calculated adding the restriction $s^{mto} \geqslant 0$ with $r^j = r^{mto} = 0$. If we do this, we can obtain the corresponding expressions for R_1^{mto} and R_2^{mto} for the case in which the restriction $s^{mto} \geqslant 0$ is binding. This will be the more general case in the paper, since without uncertainty and with a strictly positive discount factor ρ, families would be eager to anticipate consumption by disaving. With MTO's they can't.

$$R_1^{mto} = \frac{1}{\theta}\frac{1}{(2 + c^{mto})}\left[\ln\left(\frac{\gamma}{1 + c^{mto}}\right) + \theta y_1^m\right] \tag{12}$$

$$R_2^{mto} = \frac{1}{\theta}\frac{1}{(2 + c^{mto})}\left[\ln\left(\frac{\gamma}{1 + c^{mto}}\right) + \theta y_2^m\right] \tag{13}$$

Even when corresponding expressions for R_1^j and R_2^j are quite complicated, it is immediate to see that there is not intertemporal linkages among them (the remittances depend only the contemporaneous value of income). Also, this expression allows to observe the effects of the different parameters of the model on both variables are quite intuitive. For instance, it is straightforward to see that remittances increase with the level of altruism (γ), the income level (y_i) and are reduced by higher remittances costs (c^{mto}).

3.2 Financial Intermediaries

When entering the financial intermediaries, we consider both separately: MTO's and banks. It is useful to anticipate here that in order to capture the current behavior of the remittances market, in the presentation of the results we will first assume that there is only one MTO and that banks enter sequentially.

3.2.1 MTOs

We will consider a two-period model. The MTO will choose the total charges for remittances (c^{mto}) in order to maximize its profits taking into account sender's reaction. The problem for a representative MTO can be then expressed as:

$$max\Pi_{c^{mto}} = (c^{mto} - k^{mto})R_1 + \frac{(c^{mto} - k^{mto})R_2}{1+\rho}$$

$$s.t. \;\; (i) \; R_1 = R_1^{mto}$$

$$(ii) \; R_2 = R_2^{mto}$$

Where k^{mto} is the (constant) marginal cost of Remittances for the MTO (in percent). In Appendix A we solve this problem analytically and show why, given the form of the utility functions, there is no closed form solution for c^{mto}. We solve this problem by numerical methods[4]

3.2.2 Banks

The difference and therefore the possible surplus for both, migrants and family, that may arise from choosing the banking channel is related to the impact on their utility of a change in the transfer costs and to the impact of the rate of return offered by banks to families for their savings. At the same time, the banking channel will give consumers the possibility of transferring consumption from period one and two in a optimal way.

The problem for a representative bank entering first can be expressed as:

$$max\Pi_{c_b,r} = (c^b - k^b)R_1 + \frac{(r^b - r)s + (c^b - k^b)R_2}{1+\rho}$$

$$s.t. \quad (i) \; U^{m,b} \geqslant U^{m,mto}$$

$$(ii) \; R_1 = R_1^b$$

[4] To solve this problem we use the Reduced Gradient (GRG2) nonlinear optimization code developed by Leon Lasdon, University of Texas and Allan Waren, Cleveland State University.

$$(iii)\ R_2 = R_2^b$$

$$(iv)\ s = s^b$$

Where r^b is the return banks obtain in the financial market for the money in the savings accounts.

Note that there are three qualitative differences when comparing this expression with the previous MTO's problem The first is the potential for families to save some of the remittances in a (remunerated) bank account and also to disave, since banks are allowed to extend credit (in this case $s^b < 0$). This comes out in the profit function of the banks. Second, and related to this, in the second period the bank is paying a return r^b for the share of saved remittances but it is able in turn to obtain a yield r for them. This gives banks a competitive advantage over MTO's. The third difference operates on the contrary direction, since banks suffer a behavioral disadvantage indicated by ε^b included in $U^{m,b}$ -see Equation (2) above.

The problem for banks will be to choose c^b and r^b to maximize their benefits taking into account that they must be competitive respect to money transfer operators and conditional to families utilities. Given the form of the utility functions, there is no closed form solution for c^b and r^b (the nature of the problem is the same as in the case of MTO´s, albeit more complexs), so the problem, again, must be solved by numerical methods.

3.3 Calibration and effects

The calibration of the model is rather standard except for two central parameters. The level of altruism γ and the disutility associated with using the bank instead of the MTO´s as channel for remittances, ε.

Table 2 summarizes the values taken by the main parameters of the model

referred to our benchmark case of temporal migrants with constant income[5]

Let us first briefly comment on the rest of parameters of the model, for the case of newly arrived migrant (N) with a constant income, which is our benchmark case. These parameters appear in Table 2. The value of ρ was chosen following standard criterion. θ was chosen to match the data about reasonable values of care for a smooth consumption. In order to keep things simple, we normalize to obtain $y_1 = y_2 = 1$. Finally, the value of k^{mto} was chosen to leave a margin equal to the mark up observed in the data. As mentioned above, for simplicity we set $k^b = k^{mto} = k$.

TABLE 2

Model´s Parameters

Parameter	Value
$y_1 = y_2$	1
k	$0,02$
ρ	$0,01$
θ	$0,5$
γ_N	$1,080$
ε_N	$0,009$

The calibration of the level of altruism requires, under our model specification, to know the share of income sent as remittances R_1. Furthermore, that share is expected to depend on the costs of remittances, it is necessary to have data on both at least at a point in time. As we showed in Section 2, data on the costs of remittances are rich but extremely disperse, depending on the characteristics on the markets and the profile of the families. For the year 2002 survey data by Orozco (2003) establish that the cost of sending USD 200 to Mexico from the United States trough MTO's is $6,343\%$. Interestingly, a recent paper

[5] The other considered cases difer from the table as follows. Settled migrants with constant income (S) have a lower level of altruism, that is $\gamma_S = 0.753$ and also a lower level of disutility associated with using banks instead of MTO´s ($\varepsilon_S = 0.00235$).

by Sorensen (2003) provides quite detailed information of the average share of income sent by migrants for the same period, according to their characteristics. Newly arrived migrants -identified as temporary- send around 50% and long settled migrants (permanent) contribute with a significant smaller share of around 15%.

We link this divergence a higher level of altruism of the former, although other factors like higher expected incomes of settled migrants may also play a role. Given the rest of parameters, we calibrate the value for γ so as to match in the solution the share of remittances on income R_1. The corresponding calibrated value for new migrants is $\gamma_N = 1,08$, as shown in Table 2. Note that this calibration implies that new migrants attach a higher utility to their families consumption than to their owns. For the sake of completeness, the calibrated value for settled migrants (S), derived from the lower share of remittances is also lower: $\gamma_N > \gamma_S = 0.753$. Finally, the disutility factor arising when banks are used is computed taking advantage of the wedge between the known cost of sending remittances through banks or MTO's, which is also provided by Orozco (2003). He states that the remittances fee for banks is around 1% lower than the fee charged by MTO's ($5,233\%\ Vs\ 6,343\%$). Interestingly, this banks' fee is not attached to the existence of saving account, that is, the bank is effectively behaving as an MTO's, and therefore the differences are related to subjective preferences. Therefore, the calibrated value of $\varepsilon_N = 0,009$ is obtained by solving the bank's problem (when they do not offer a saving account to migrant's families) in order to obtain a full transfer cost for banks of $5,233\%$. Settled migrants have a lower value of ε ($\varepsilon_S = 0,002$) indicating that the disutility produced by the lower speed of delivery or by the other aspects in which banks

are worse than MTO's, is lower for permanent than for temporary migrants.

3.4 Main effects

It is quite useful at this point to derive the impact of the changes in some of the model parameters and values on the most relevant variables, the level of remittances, the levels of consumption both of families and migrants, and on families' savings.

All the results presented in this subsection hold for migrants with constant and growing income pattern[6] and for the parameters around the values in Table 2.

TABLE 3

Main Effects

	Changing Variable				
Effect on	y_1	y_2	c^j	γ	r
R_1	+	−	−	+	+
R_2	−	+	−	+	−
z_1^m	+	+	+	−	−
z_2^m	+	+	+	−	+
z_1^f	+	+	−	+	−
z_2^f	+	+	−	+	+
s	+	−	+	−	+

3.4.1 Income effects

A higher y_1 increases R_1 which means that according with an altruistic behavior, migrants destinates part of the increment in y_1 to his family. The magnitude of the impact will depend on the level of the migrant's altruism, the value of θ and the difference between r and ρ. In order to smooth consumption part of the increase in R_1 is saved (s increases). This allows R_2 to decrease. On the

[6] We believe that it is not relevant in the context of this model to study the case of migrants with decreasing income.

other hand, an increase in y_2 lowers R_1 and increases R_2 which reflects agains ordinary consumption smoothing. It is important to note that, if the increase in y_2 is big enough, savings can be negative which is another consequence of ordinary consumption smoothing. This can only happen in a context of banks allowing for families to hold negative savings[7].

3.4.2 Costs effects

An increase in the total transfer cost of remittances lowers remittances in both periods. When the transfer costs increase, migrants decide to lower the level of remittances due to substitution effect. The reason is that the increase in migrants utility from lowering remittances more than offsets the decrease given through the altruistic channel. This decision increases migrant's consumption in both periods and causes a decrease in families consumption in both periods even when families increase savings as an attempt to offset the effects of a lower remittances level.

It is interesting to underline the savings' positive reaction to increases in the transfer costs of banks, since this would imply that a cost reduction due, for instance, to higher competition would induce a fall in savings.

3.4.3 Gamma effects

As expected, an increase in the migrant's level of altruism increases the remittances in both periods, increasing families' consumption and causing migrant's consumption to decrease in both periods.

The reaction of savings is also as expected, a higher γ lowers families' savings reflecting income effect. On the other hand, a lower level of altruism increases

[7] In the case of constrained disaving, that is, when migrants use MTO's, the impact of non-contemporaneous variations in income on remittances is zero, as explained in the previous section.

the level of savings since the rate of return offered by banks allow families to offset some of the negative income effect produced by a lower level of remittances[8].

3.4.4 Interest rate effects

Interest rate effects are only relevant when remittances are sent through the banking channel and they may be different if families save or borrow.

There are several channels through which interest rates affect remittances. It will first help to consider the various ways that an increase in interest rate affects families' consumption and migrant's utility. First, an increase in the interest rate increases the interest income of families when they save. The opposite applies when they borrow[9] (income effect); second, delaying consumption becomes more attractive and this induces more saving (substitution effect). If families save, both effects operate in the same direction in period one. When they borrow, given the parameters of the model, the substitution effect dominates in any case: there is an increase in savings so that families' consumption decreases in period 1 and increases in period 2; the net effect on families' aggregate consumption of an increase in r is positive.

Through the altruistic channel, changes in r also affect the level of remittances by migrants. Migrants know they can induce their families to save -and obtain higher returns- by increasing the difference between R_1 and R_2 (with $R_1 > R_2$) and this lowers their consumption in period 1 while increases their consumption in period 2[10].As a result, through the saving and altruistic chan-

[8] In case we have migrants with growing income, a decrease in the level of altruism also decreases savings (s becomes more begative) as the effect in the level of remittances is stronger for R_1.

[9] In the context of this model, this happens when migrants have an increasing income pattern.

[10] Note that an increase in R_1 and a decrease in R_2 increases the transaction costs paid by

nels, an increase in interest rate has a positive effect on R_1 and a negative effect on R_2

3.4.5 Sensitivity analysis and the characteristics of the migrants

The magnitudes of the responses depend mainly on the size of the estimated coefficients of γ and on the values of $y_1$and y_2 as θ is set equal to 0.5. For those migrants with a lower gamma (settled), the impact of a raise in costs will be higher than for those with a higher one (new migrants). Also the importance of the altruistic channel will be higher for newly arrived migrants.

4 Results

The solution of the model implies that MTO's and banks maximize their profits and that families maximize their respective utilities. In equilibrium, migrants must attain the same level of utility regardless of the channel through which they send the money.

Our benchmark case is new migrants with constant income. First, we will show the monopolistic case, where only MTO's are present in the market and then we will show the competitive equilibrium with banks, which will only be able to compete for a certain level of interest rates. However, it is particularly useful to introduce an intermediate step -section 4.2.1- which is allow banks to enter the market without offering additional financial services, that is, letting banks compete as if they were MTO's. This is NOT an equilibrium solution -since banks incur in losses due to the disutility migrants attach to them- but

remitters in period 1 and decreases the transaction costs paid by remitters in period 2. In this case, the positive "altruistic" effect from a raise in families' consumption in period 1 and 2 and the positive income effect from a fall in the transaction costs paid for remittances in period 2 offset more of the negative income effect from a raise in the transaction costs paid in period 1.

it is very useful to highlight the gains from perfect competition. When in the last step banks enter the market providing their inherent financial services we will be able to discriminate between the two expected effects from bank's entry: competition and financial innovation.

TABLE 4

Model's Output for New Migrants with Constant Income

Scenario	Only MTO´s	Banks as MTO´s		Banks are Banks	
Channel	MTO's	Banks	MTO's	Banks	MTO's
c^j	0.345	0.010	0,020	0.018	0.020
r^b	–	–	–	0.111	–
r	–	–	–	0.122	–
$cons^m$	1.345	0.856	0.869	0.886	0.869
$cons^f$	0.480	1.122	1.098	1.102	1.098
$cons^*$	1.825	1.978	1.968	1.989	1.968
$R_1/y_1(\%)$	23.940	56.411	55.201	64.815	55.201
$R_2/y_2(\%)$	23.940	56.411	55.201	43.988	55.201
R^{**}	23.940	56.411	55.201	54.453	55.201
$s/R_1(\%)$	0.000	0.000	0.000	29.200	0.000
Π (%)	32.528	−0.994	0.0000	0.000	0.000

*cons=cons^m+cons^f, where cons^m= $c_1^m + \frac{c_2^m}{1+\rho}$ and cons^f= $c_1^f + \frac{c_2^f}{1+\rho}$

**R= $\frac{R_1+R_2/(1+\rho)}{y_1+y_2/(1+\rho)}$

4.1 Model with MTO´s

In the solution for the MTO as only agent, it just maximizes profits as a monopolist and take advantage of the high level of altruism of new migrants. The lack of competitive or regulatory restraints in its behaviour implies a quite high remittance fee: $c^{mto} = 34,5\%$. This figure is indeed much larger than that the fee used for the calibration, but it falls within the range mentioned in Section 2 $(8 - 40\%)$,[11] which did not include exchange rate fee.

[11] Recall that our calibration was based in the US-mexican market which is probably one of the most competitive.

The results also show that, as expected, the share of remittances is halved relative to the calibrated case (24% in average, as opposed to 50%) due to the higher transfer costs. There are no savings since, given the discount rate and the lack of return -$r = 0$ for MTO´s, see Table 1- families would be eager to disave but this is not possible since there are no banks. The profit rate for MTO's is large: 35.5%.

Finally, the consumption -computed at its present value- is dented by the very high remittances fee. The value of $1,825$ is $8,3\%$ less than that which would be obtained by migrants, if there where no remittances[12]. Furthermore, the consumption in this case displays a large divergence in favor of migrants (almost three times as much) derived from the relatively low rate of remittances.

4.2 Banks enter the Market

When banks operate they can potentially offer saving account and offer a return for clients (migrants' families in this case). These savings are in turn invested by banks in the market and they earn a return, the interest rate r, so that they may make a profit through savings. The higher attractive of banks -and for banks-of the market may compensate the hindrance attached to mistrust and make profitable their entry into the market.

More precisely, there is a trade-off between the return the bank can earn from the families' savings (r) and the disutility parameter ε. Recall that the latter is calibrated and the former is arbitrarily set in our model. Note that the return to migrants' families from savings r^b also plays a role, but this parameter is endogenous to the model and it is dragged or pulled by the other two parameters

[12] The potential consumption is computed just by the present value of consumption derived from income, that is $c_1^m + c_2^m/(1+\rho) = 1.99$.

as we will elaborate below.

Graph 1 displays the trade off, conveyed in the upward slope of the mapping between r and the disutility level ε. On this line profits are zero. Higher disutility levels require a higher interest rate for banks to become competitive. Note that points to the left are unattainable, since banks enter to achieve perfect competition into the market. Points to the right indicate the area where the banks attain negative profits. Finally, the line passes through the vortex of the figure since with zero disutility, banks are identical to MTO's and the perfect competition equilibrium would be achived with $r = 0$ and no profits.

4.2.1 Banks behave as MTO's

Introducing first banks just acting as MTO's is useful to obtain insights on the perfect competition induced by the entry of an indeterminate number of banks, although it is clearly a non equilibrium solution, given the characteristics of the model. To see why recall that the only difference between banks and MTO's if the former are deprived from offering saving accounts is the disutility derived from bank mistrust, the parameter ε. In order to compensate for this and deliver the same utility than MTO's to migrants, the bank will have to offer a lower fee $c^b = 1\% < c^{mto}$. But this in turn implies losses to banks (0.99%) and MTO's profits are driven to zero. The bank in this case is located in a point like A_N in Graph 1. Banks might decide to operate in this area (with negative profits) as a way to generate trust or develop better skills, that is, on the expectation that the ε moves to the left in the graph and the equilibrium points goes back to the vortex of the graph. Alternatively, the bank may decide to offer savings accounts, that is, moving up the graph when the return on and from saving hits in. In any case, point A_N is not an equilibrium.

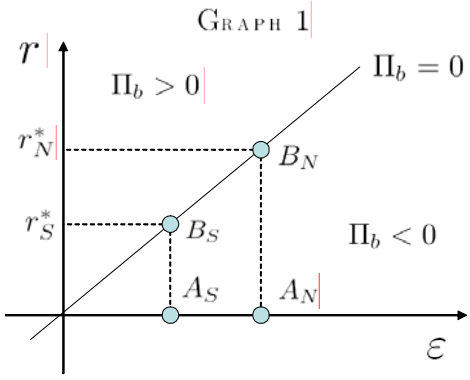
In spite of this, it is remarkable to see the gains from this "virtual" competition [13]. The share of remittances now jumps to $55,9\%$ and the gap between migrants and families' consumption greatly narrows to around 22%. The gains for the families can be roughly grasped by adding the total consumption of both families back home and migrants. Now the loss in consumption relative to potential is reduced to 0.6%.

4.2.2 Banks behave as proper Banks

In Table 4 we show, for the parameterization of the model, the results, which correspond to point B_N in Graph 1. Given the parameters of the model, this is the minimum value for which it starts to be profitable for banks to enter the market when facing the value of ε showed in Table 2. For the segment AB, wich corresponds to values of r between zero and r^b, the profits are negative.

It is important to stress that banks have two control variables at their disposal: the fee for remittances c^b and the return to the families' savings r^b. The optimal combination of both for the given parameters is an outcome of the numerical solution problem. Under the considered parametrisation, the transfer fee is set below the level of MTO's $(0,018\ Vs\ 0,020)$ and the return to savings is slightly below the market rate $r^b < r$ $(11,19\%\ Vs\ 12,20\%)$.This rate of interest is the minimum market return that drive banks into the remittances market. Higher values for r would allow profit for banks and in the end would drive MTO's out of the market. Under perfect competition assumption (profits are zero for both banks and MTO's) banks will do not make any profit either from the savings or from the transfer fees.

[13] The relevant column in this case is the MTO's, since banks would not effectively enter this market.



What about the behaviour of the families?. The results do not change if MTO's are used relative to the previous case (recall that then MTO's profits were also zero). But now the solution for banks is an equilibrium and it can be compared with the MTO's. As before overall remittances grow relative to the non-competitive case. Overall, and relative to MTOs, remittances are higher in the first period but fall in the second because now remunerated savings ($29,2\%$ of the received remittances) allows for this discrepancy. Furthermore, the average total remittances decrease with the banks ($54,4\%$ $Vs.$ $55,2\%$ of average income), due to the income effect: the resources provided by remunerated savings allow for an overall reduction in remittances.

Actually, banks allows higher to increase overall consumption by 1.1% ($1,989$ Vs $1,968$) and now consumption is very close to potential (a $0,05\%$ difference). Notwithstanding this migrants utility is the same, since the higher consumption makes up for the disutility attached to the use of banks.

5 Extensions

In this section we consider two alternative migrants' profiles. The case of settled migrants highlights the importance of the disutility parameter in driving the results and the relative gains for financial intermediaries, while considering the case of increasing income lets the banks become providers of credit to the migrants' families.

5.1 The case of settled migrants.

TABLE 5

Model's Output for Settled Migrants with Constant Income

Scenario	Only MTO´s	Banks as MTO´s		Banks are Banks	
Channel	MTO's	Banks	MTO's	Banks	MTO's
c^j	0.125	0.012	0.020	0.018	0.020
r^b	–	–	–	0.056	–
r	–	–	–	0.063	–
$cons^m$	1.782	1.582	1.595	1.604	1.595
$cons^f$	0.184	0.402	0.387	0.383	0.387
$cons^*$	1.967	1.985	1.982	1.987	1.982
$R_1/y_1(\%)$	9.256	20.227	19.456	24.399	19.456
$R_2/y_2(\%)$	9.256	20.227	19.456	13.619	19.456
R^{**}	9.256	20.227	19.456	19.035	19.456
$s/R_1(\%)$	0.000	0.000	0.000	9.612	0.000
Π (%)	10.519	−0.717	0.000	0.000	0.000

$^*\text{cons}=\text{cons}^m+\text{cons}^f$, where $\text{cons}^m = \text{c}_1^m + \frac{c_2^m}{1+\rho}$ and $\text{cons}^f = \text{c}_1^f + \frac{c_2^f}{1+\rho}$

$^{**}\text{R} = \frac{R_1+R_2/(1+\rho)}{y_1+y_2/(1+\rho)}$

Table 5 displays the results obtained in the case of settled migrants, which are characterized by a lower altruism and also by a lower disutility attached to banks. Points A_s, B_S convey this case in graph 1. The differences in the results allow to highlight some of the features of the model. The first thing to note is that now the level of remittances is much lower across the board. This is an

obvious consequence of the lower level of altruism. But this allows for lower rents for the monopolist MTO: the remittance fee is now only $12,5\%$, compared to $34,3\%$ in the new migrants' case, and profits fall almost than 20 *p.p*, to $10,51\%$. Consequently, now the consumption is just reduced $1,2\%$ relative to potential in the monopolistic case.

When banks enter the market under perfect competition (third column, point B_S) remittances grow, as expected, but now the rate of saving is 9.6%, almost 1/3 relative to the new migrants' case. This is partly due to the lower return than migrants now achieve from their savings, $5,6\%$, since the lower relative competitive advantage of MTOs due to the lower altruism and banks' disutility allows bank to enter the market with a much lower interest rate.

Finally, the marginal impact of banks on consumption is lower than previously, which confirms that the positive impact of higher competence and banks entry into the remittances market is inversely proportional to the level of altruism.

5.1.1 The case of New Migrants with increasing Income

Table 6

Calibration and Other Parameters

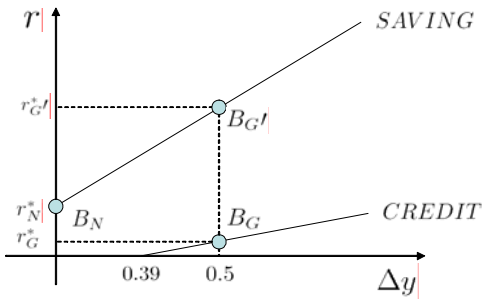
Type of Migrant	θ	y_1	y_2	k^{mto}	ρ	γ	ε
Transitory / Growing Income	0.5	1	1.5	$0,02$	$0,01$	$1,080$	$0,01$

When dealing with growing income migrants, the role of banks as credit providers may become relevant. As we have seen in Section 3.5, a higher y_2 raises the amount of remittances sent in the second period, creating incentives for families to disave in order to smooth consumption. The outcome, however, will depend on the level of interest rate (r) in the economy.

Graph 2 shows the relation between r and the increase in income between periods $\Delta y = y_2 - y_1$.We start from the equilibrium point when income is equal, B_N, corresponding to the same situation as in graph 1. Increases in Δy reduce the wish to save by families back home and this has to be compensated by a higher remuneration of saving along the curve labelled $SAVING$, where banks' profits are zero. Therefore, as long as the remuneration of savings is high enough, migrants families will be eager to go on saving even with increasing income. For instance, the point $B_{G'}$ represents the equilibrium point for an increase of 50% in the second period income. The required interest rate, at that point, $r^*_{G'}$ is $27,34\%$.

More interesting is the case is the case where interest is not high enough to induce families to save. Rather, they prefer to disave -ask for credit- as long as there is an agent eager to do so. The banks can play now a role that MTO's can not play, namely, the ability to satisfy the demand for credit. In this case, they charge an interest rate r^b to their clients (in this case migrants' families) while raising funds at a cost r. The lower curve labelled $CREDIT$ in Graph 2 displays the situation in which the bank becomes a creditor. The graph shows that, when the difference of income is around 40% between periods or higher, a positive interest rate allows bank to enter the market by extending credit to the families at a cost r^b. The case for a increase in the second period income of 50% is shown in Table 7 . The results correspond to the point $B_{G'}$. The market interest rate r is the price at which the banks finance themselves. The migrant's families back home can anticipate their consumption. The utility derived from this consumption smoothing allow the migrants' familiest to overcome the disutility attached to the use of the banking channel embedded in the model. Note that

GRAPH 2



the banks fee is now slightly higher than the cost, while the credit spread $r^b - r$ is negative, that is, under this parametrisation banks lend at a loss, which then recover through a higher fee, so that profits are zero.

Regarding the implication for migrants, note that when banks offer credits to migrants families, the remittances are much higher in the second period relative to income (that is even much higher in absolute terms). This is because an important part of families' consumption -around 16%- in the first period is financed through credit[14]. Also note that total consumption is lower under banks although utility is the same than when using MTOs. The reason is that the ability to smooth consumption thorugh borrowing compensates for this less consumption in the case of banks.

[14] As seen in the Table 7, (disaving) is 21% of remittances in period one, and they are $44,7\%$ of the kids income in that period. This means that families' consumption in period one is $(0,44 + 0,21 * 0,44)y_1 = 0,55y_1$ and that $0,09y_1$is borrowed.

TABLE 7

Model's Output for New Migrants with Growing Income

Scenario	Only MTO´s	Banks as MTO´s		Banks are Banks	
Channel	MTO's	Banks	MTO's	Banks	MTO's
c^j	0.412	0.011	0.020	0.021	0.020
r^b	–	–	–	0.019	–
r	–	–	–	0.026	–
$cons^m$	1.654	1.104	1.114	1.124	1.114
$cons^f$	0.588	1.365	1.343	1.330	1.343
$cons^*$	2.242	2.469	2.458	2.455	2.458
$R_1/y_1(\%)$	19.253	56.226	55.201	44.702	55.201
$R_2/y_2(\%)$	26.654	54.055	53.302	59.657	53.302
R^{**}	23.676	54.928	54.066	53.638	54.066
$s/R_1(\%)$	0.000	0.000	0.000	−21.017	0.000
Π (%)	39.216	−0.848	0.000	0.000	0.000

*cons=cons^m+cons^f, where cons^m= c$_1^m$ + $\frac{c_2^m}{1+\rho}$ and cons^f= c$_1^f$ + $\frac{c_2^f}{1+\rho}$

**R= $\frac{R_1+R_2/(1+\rho)}{y_1+y_2/(1+\rho)}$

6 Conclusions

In this paper we have developed from scratch a very basic model to obtain some insights on the impact that the entry of banks in the remittances market can have. There are two key elements in this model which enables to address the issue. First, it is the idea that remittances is a special kind of financial and personal transfer, since it is based, at least partly on altruism on behalf of the migrants. Second, the specification of the model has to come to terms with the fact that the importance of banks in the market for remittances has been lower than their condition of main financial intermediaries would imply. Several studies explain this on the basis of reluctance of migrants to use banks to send their money. Both factors are translated into migrants' utility function which convey altruism on the one hand and disutility from using the banking channel on the

other. Upon this basis we develop the model which has two kinds of agents: families (composed of migrants and their families back home) and financial intermediaries of two types: the incumbent MTO's which are mere transmitters of money and banks which have the possibility of offering remunerated saving accounts and extend credit so as to overcome the competitive drug of being mistrusted by migrants.

The implications of the model are rather intuitive. Remittances depend positively on the level of altruism and negatively on the costs of remittances, but the possibility of banks entering the markets add quite deeper insights to the results.

When MTO's act as a monopolist they set large remittance fees, so that they are able to derive large rents from the market, which increase with the level of altruism of the migrant. As a consequence, they depress remittances and the level of consumption to migrants their families back home alike. Furthermore, since in the benchmark case of new migrants with constant incomes families would save but with MTO's this is not economically feasible, the allocation of remittances through time is suboptimal, generating an additional inefficiency in the market.

The entry of banks has two different although intertwined consequences. First, they move the market from a situation of monopoly to one of perfect competition. This reduces the transfer costs to around the levels of the operation costs, and increases the remittances and the consumption of families back home. Second, allowing for savings improves the inter-temporal allocation of remittances and consumption, increasing welfare further. The return from savings also increases the consumption possibilities of the family but this gain is

of minor order. In other words, for the family, the gains from the banks entry are mostly related to the higher competition. However, in this model, for banks to compete they have to offer remunerated savings accounts, even if they do not attain any profit from intermediating savings. Why? Because, if banks could only compete through lower remittances fees than MTO's to make up for their disutility drag, they would have permanent losses. By offering a return of savings banks actually overcome such competitive disadvantage through other means and this allows them to set the remittance fee equal or close to the operation costs and to eliminate the losses. All in all, then although the main benefit from banks is to increase competition, it is their financial technology what allows them to be competitive in the market, in this simplified model.

Furthermore, the results of the model with banks suggest other interesting implications. For instance, it is interesting to note the possibility of saving may increase the volatility of remittances, since consumption smoothing can be achieved through alternative means. Also, the level of remittances may marginally recede thanks to savings, given the additional return they deliver to the families back home.

Even in this very basic framework, thus, the model provides some interesting insights. This invites to extending the model to account for other relevant facts that have been disregarded. One line of extension is the introduction of uncertainty, which can be of different types: uncertainty on income or on debtors' (be it banks or families back home who save). Another possible extension is the impact of families back home to use the remittances as co-lateral to ask for credit. It would also be useful to try to embed into the model the recent strategies used by banks to lure migrants into using the banking channel. The efforts have

been intense in the last years and two developments are worth mentioning. The first has been to turn migrants into banking customers and offering remittances services within the pack of financial services provided. The second has been the association to of banks to MTO's in the host or origin countries, as well as to other institutions widely settled in the origin countries -such as cooperatives, charities or other institutions. Note that in terms of our model some of these initiatives are equivalent to attempts to either reduce the reluctance of migrants to use the banking channel, either by increasing the capillarity and efficiency of the network, or by reducing the mistrusts of migrants. The use of migrants of banks accounts in the host countries also suggest to introduce in the model the possibility of saving in the host countries, since this is the strategy that banks are lately pursuing.

Given the policy relevance that the issue of remittances is attaining, some final words on the policy implications of our results are in order. The obvious one is that any measure which increases competition will be positive to increase the welfare of families, migrants and their families back home. Notwithstanding this, we have also show that the implications of the model are different depending on the migrant's characteristics, so the design of policies must take into consideration this. We have noted that the entry of banks may have side effects which are not necessarily positive, like the increase in the volatility of remittances. The potential reduction in remittances when banks offer saving accounts may have different interesting policy implications from the perspective of the host and migration countries. Since remittances is a drag on the current account of host countries, and, reversely, it is an addition of external resources to receiving countries, the former may favor the banking channel of remittances

more than the later. However, given the additional impact of the development of the financial system that the banking channel is expected to engineer in the receiving countries, both countries should be interested in developing this channel.

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A Analytical solution of the MTO's problem

We start from the MTO's problem

$$max\Pi_{c^{mto}} = (c^{mto} - k^{mto})R_1 + \frac{(c^{mto} - k^{mto})R_2}{1+\rho} \tag{A1}$$

$$s.t.\ (i)\ R_1 = R_1^{mto}$$

$$(ii)\ R_2 = R_2^{mto}$$

Where, from (12) and (13)

$$R_1^{mto} = \frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_1^m\right]$$

$$R_2^{mto} = \frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_2^m\right] \tag{A3}$$

Replacing (A2) and (A3) in (A1),

$$\begin{aligned}\Pi_{c^{mto}} &= (c^{mto} - k^{mto})\left[\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_1^m\right]\right] + \\ &+\frac{c^{mto} - k^{mto}}{1+\rho}\left[\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_2^m\right]\right]\end{aligned}$$

In roder to keep things simple, we call

$$A = (c^{mto} - k^{mto})\left[\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_1^m\right]\right] \tag{A4}$$

$$B = \frac{c^{mto} - k^{mto}}{1+\rho}\left[\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_2^m\right]\right] \tag{A5}$$

Therefore,

$$\begin{aligned}\frac{\partial A}{\partial c^{mto}} &= \left[\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_1^m\right]\right] - \\ &-(c^{mto} - k^{mto})\left[\begin{array}{c}\frac{1}{\theta}\frac{1}{(2+c^{mto})^2}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right) + \theta y_1^m\right] - \\ \frac{1}{\theta}\frac{1}{(2+c^{mto})}\left(\frac{1+c^{mto}}{\gamma}\right)\end{array}\right]\end{aligned} \tag{A6}$$

$$\frac{\partial B}{\partial c^{mto}} = \frac{1}{1+\rho}\left[\begin{array}{c} \left[\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right)+\theta y_2^m\right]\right]- \\ -(c^{mto}-k^{mto})\left[\begin{array}{c}\frac{1}{\theta}\frac{1}{(2+c^{mto})^2}\left[\ln\left(\frac{\gamma}{1+c^{mto}}\right)+\theta y_2^m\right]- \\ -\frac{1}{\theta}\frac{1}{2+c^{mto}}\left(\frac{1+c^{mto}}{\gamma}\right)\end{array}\right]\end{array}\right] \tag{A7}$$

and

$$\begin{aligned}\frac{\partial(A+B)}{\partial c^{mto}} &= \frac{1}{\theta}\frac{1}{(2+c^{mto})}\ln\left(\frac{\gamma}{1+c^{mto}}\right)\left[\frac{2+\rho}{1+\rho}\right]+\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right]+\\ &+(c^{mto}-k^{mto})\frac{1}{\theta}\frac{1}{(2+c^{mto})^2}\left(\frac{1+c^{mto}}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]-\\ &-(c^{mto}-k^{mto})\frac{1}{\theta}\frac{1}{(2+c^{mto})^2}\ln\left(\frac{\gamma}{1+c^{mto}}\right)\left[\frac{2+\rho}{1+\rho}\right]-\\ &-(c^{mto}-k^{mto})\frac{1}{\theta}\frac{1}{(2+c^{mto})}\left[\theta y_1^k+\frac{\theta y_2^m}{1+\rho}\right]\end{aligned}$$

$$\begin{aligned}\Rightarrow\quad \frac{\partial(A+B)}{\partial c^{mto}} &= \ln\left(\frac{\gamma}{1+c^{mto}}\right)\left[\frac{2+\rho}{1+\rho}\right]+\left[\theta y_1^k+\frac{\theta y_2^m}{1+\rho}\right]+\\ &+(c^{mto}-k^{mto})\frac{1}{(2+c^{mto})}\left(\frac{1+c^{mto}}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]-\\ &-(c^{mto}-k^{mto})\frac{1}{(2+c^{mto})}\ln\left(\frac{\gamma}{1+c^{mto}}\right)\left[\frac{2+\rho}{1+\rho}\right]-\\ &-(c^{mto}-k^{mto})\left[\theta y_1^k+\frac{\theta y_2^k}{1+\rho}\right]\end{aligned}$$

If $c^{mto}=c$ and $k^{mto}=k$, then

$$\begin{aligned}\frac{\partial(A+B)}{\partial c^{mto}} &= \ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]+\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right]+(c-k)\frac{1}{(2+c)}\left(\frac{1+c}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]-\\ &-(c-k)\frac{1}{(2+c)}\ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]-(c-k)\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right]\end{aligned}$$

$$\begin{aligned}\Rightarrow\quad &\ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]+\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](1-c+k)+\\ &+(c-k)\frac{1}{(2+c)}\left(\frac{1+c}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]-(c-k)\frac{1}{(2+c)}\ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]\end{aligned}$$

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]\left[1-\frac{c-k}{2+c}\right]+\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](1-c+k)+\frac{c-k}{2+c}\left(\frac{1+c}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]$$

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]\left[\frac{2+k}{2+c}\right]+\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](1-c+k)+\frac{c-k}{2+c}\left(\frac{1+c}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]$$

Now, we make $\dfrac{\partial(A+B)}{\partial c^{mto}}=0$ in order to get an expression for c,

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]\left[\frac{2+k}{2+c}\right]+\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](1-c+k)+\frac{c-k}{2+c}\left(\frac{1+c}{\gamma}\right)\left[\frac{2+\rho}{1+\rho}\right]=0$$

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)\left[\frac{2+\rho}{1+\rho}\right]\left[\frac{2+k}{2+c}\right]+\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](1-c+k)+\frac{c^2+c(1-k)-k}{\gamma(2+c)}\left[\frac{2+\rho}{1+\rho}\right]=0$$

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)=\left[\frac{1+\rho}{2+\rho}\right]\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](c-(1+k))\left[\frac{2+c}{2+k}\right]-\frac{c^2+c(1-k)-k}{\gamma}\left[\frac{1}{2+k}\right]$$

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)=\left[\frac{1}{2+k}\right]\left[\left[\frac{1+\rho}{2+\rho}\right]\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](c-(1+k))(2+c)-\frac{c^2+c(1-k)-k}{\gamma}\right]$$

$$\Rightarrow \ln\left(\frac{\gamma}{1+c}\right)=\left[\frac{1}{2+k}\right]\left[\left[\frac{1+\rho}{2+\rho}\right]\left[\theta y_1^m+\frac{\theta y_2^m}{1+\rho}\right](c^2+(c-2)(1+k))-\frac{c^2+c(1-k)-k}{\gamma}\right] \quad \text{(A8)}$$

The form of (A8) implies that there is no closed form solution for c.

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