A Model of International Migration, Remittances, and Real Exchange Rates*

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Abstract

This paper investigates the linkage between international migration and real exchange rates using remittances as a medium. It demonstrates that due to cost of living differences between countries, if remittances sent back home for the family translate into a favorable enough amount of consumption, a migrant may voluntarily accept real wages or standards of living in the host country that are lower than those in one's own country. This paper contributes to an understanding of international migration in relation with important macroeconomic variables. Moreover, the possibility of multiple equilibria arising in the model suggests an unusual route through which migration can be regulated. (JEL classification codes: F22, F24, O15, O24; Key words: international migration, remittances, real exchange rate, purchasing power parity, multiple equilibria)

1 Introduction

According to the New York Times (2004), there are thousands of Mexican women working as "wash and fold" workers in New York City. They handle the unpleasant chore of shoveling clothes in and out of washers and dryers, matching socks and folding hundreds of undergarments in noisy and humid laundries around the city. The hourly wages paid for this job ranged from $2.45 to $3.19

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in 2004 while the minimum wage requirement was $5.15 an hour. Given the enormous living costs in Metropolitan New York, it is not hard to imagine that the quality of living (the real wage) for the women would be poor and, maybe, even worse than what they would have had in their home country.

To the extent that migrant workers are used to being poor in their home countries, the meager compensation they receive in the host country might still be considered as an improvement in their standard of living. Sometimes, however, the nominal wage paid to the worker simply appears too small relative to the high cost of living of the host country, especially when one takes housing prices into account. The *real wage* does not seem to live up to what she could have earned back in her home country. Sjaastad (1962) suggests viewing migration as profitable investment when the expected stream of income from the host country exceeds that of the source country after taking the moving costs into account. However, it cannot explain why some outrageously low real wages are willingly accepted by *temporary* migrants whose horizon of stay in the host country is too short to realize a potentially high income stream over time.

This paper investigates the puzzling behavior sometimes observed in migrants from low to high income countries, namely the migration to accept a real wage (or migrant's own standard of living) that is lower than that of the source country. It demonstrates that if the real exchange rate between the host and source countries is such that the wage of the host country, when transferred to the family in the source country, translates into large enough purchasing power, such migration behavior may be rationalized. The argument is motivated by three stylized facts: (1) Temporary migration from low- to high- income countries is prevalent; (2) The real price level in the source country tends to be lower than that in the host country; (3) Migrant workers optimize their consumption mix across borders by sending remittances to their families left behind.

That real exchange rates tend to deviate from purchasing power parity (Rogoff, 1996, Taylor and Taylor, 2004) and the real price levels in poor countries tend to be lower than in rich ones (Balassa, 1964, Samuelson, 1964) is a well-known empirical regularity in international economics. As of 2008, the same basket of goods and services, including rent, costs 49.1 in Mexico City when the price level of New York is normalized to 100 (Union Bank of Switzerland, 2008). This means that a U.S. dollar, if converted to pesos at the market exchange rate and spent in Mexico City, can buy twice as much as what it affords in New York City. Therefore, a Mexican worker in New York may accept wages that are extremely poor by U.S. standards to the extent that she supports her family left behind in Mexico by sending remittances. Here, it is not the real wage per se that

a migrant seeks to maximize. Rather, it is the joint utility of the family that is being optimized through migration and remittances.[1] According to the Inter-American Development Bank (2004), more than 60 percent of the 16.5 million Latin American-born adults residing in the U.S. send money home on a regular basis. These 10 million immigrants remit on average 12.6 times a year, typically 100 to 200 dollars each time. This suggests that the majority of migrants are remotely supporting their families via remittances.

The issue of geographic real price differentials in migration was addressed, though indirectly, in an earlier study by Djajic (1989). In a model where guest workers maximize lifetime utility under fixed wages and prices, he shows that a guest worker's decision to migrate depends on both the real and nominal wage differentials while a permanent migrant is primarily interested in the real wage differential. This is because a guest worker is able to choose the country in which to spend her labor income independently of where she earns it. While similar in spirit to Djajic (1989), this paper focuses on the concurrent remittances made to the family as the main motivation for migration, rather than intertemporal optimization of individual utility. More importantly, this paper explicitly deals with the issue of geographic real price differentials, represented by the real exchange rate between the host and source countries, and its role in guiding the migration decision of workers.

Many studies have previously sought to understand why some immigrants earn lower wages than natives or fellow immigrants from other countries. Typically, the explanation is found in their possession of different levels of human capital such as the language proficiency and educational attainment of natives (Trejo, 1997) or immigrants from different countries of origin (Chiswick, 1978, Borjas, 1982). This paper points out the fact that a variable that is not at all intrinsic to the migrant's ability to perform on the job, namely real price differences between the host and source countries, may influence her labor market outcome by changing her reservation wage. For example, to the extent that the peso is undervalued against the dollar, a Mexican worker who has a remittances motive in mind may become more likely to travel to the U.S. and work for a low paying job there (Ku, 2008). This in turn implies that, ceteris paribus, if the Mexican peso achieved purchasing power parity with the U.S. dollar, the Mexico-U.S. migration pressure would be lower

[1] Hoddinot (1994), in his study of rural-urban migration in Western Kenya, also takes this view of remittances, namely as a channel through which household utility is being maximized. This is in line with the new economics of migration (Stark, 1991), which views migration as the outcome of the collective decisions made by families or household members to overcome a variety of market failures.

than what appears to be the case currently with the peso having about half the purchasing power of the dollar.

Another interesting result demonstrated in this paper, and one that is a natural concomitant of the migration theory posited in this paper, is the possibility of multiple equilibria in the real exchange rate and the level of migration. It is easy to see that the real exchange rate is a factor affecting the migration decision, as remittances play a significant role in determining the worker's utility gain from migration. However, the total number of migrants and the amount of hard currency they send home can in turn affect the real exchange rates. A recent study by Amuedo-Dorantes and Pozo (2004) indeed finds that the doubling of remittances results in a real exchange rate appreciation of about 22 percent based on a panel of 13 Latin American and Caribbean nations. Incorporating this feedback effect of remittances to the real exchange rate, this paper derives migration equilibrium where the real exchange rate and the aggregate level of migration are both endogenously determined. Behavioral responses of migrants to different economic conditions in combination with endogenous determination of real exchange rates can predict drastically different migration equilibria.

The possibility of multiple equilibria is interesting in that it suggests that two countries with identical environment may end up reaching completely different types of equilibrium, one with strong domestic currency and low level of migration and another with weak domestic currency and the need to export lots of labor. The result also sheds light on evaluating the active labor-exporting policies that countries like the Philippines are currently engaged in to promote the inflow of remittances.[2] In particular, the paper shows that the inflow of remittances to the labor-exporting country may have non-monotonic relation with the level of migration.

In a separate study, McCormic and Wahba (2000) also derive migration equilibrium with endogenous real exchange rate and demonstrates the possibility of multiple equilibria. In that paper, multiple equilibria may arise if remittances per migrant exceed their foregone productivity in the source country because this situation reinforces the high price level of the domestic nontradables, which drove the original emigration. This paper goes beyond McCormic and Wahba (2000) by

[2]The government of the Philippines, a country which received 6.4 billion dollars, or 8.9 percent of its GDP, as remittances in 2001, deliberately promotes and assists labor emigration. The government operates agencies such as the Philippines Overseas Employment Administration (POEA) domestically and Philippine Overseas Labor Office (POLO) in popular destination countries to assist migrant workers in everything from the pre-departure job search to post-migration financial transactions. To see the services these government agencies provide, visit http://www.poea.gov.ph/.

suggesting an alternative route by which multiple equilibria are reached. Specifically, this paper deals with the migration and remittances behavior of households whose income levels are near the poverty line. Here, multiple equilibria are attained due to the behavior of migrants who aim to meet a target consumption level for the family such as a poverty line by sending remittances, and the interaction between such behavior and the real exchange rate.

The rest of the paper is organized as follows: section 2 presents the baseline model in which household utility maximization drives the migration decision of workers; section 3 relaxes the assumption of exogenous exchange rates and modifies the utility function to specifically deal with the issue of households whose income is near the poverty line; section 4 concludes.

2 The Model

2.1 Environment

Consider a model in which there is a source country - henceforth South, and the rest of the world (a host "country") - henceforth North. The price level and nominal wage offered in the South are P and W respectively, while the North offers P^* and W^*. Then, the real wages in the South and the North are $W/P \equiv w$, and $W^*/P^* \equiv w^*$, respectively. These countries have their own currencies: peso in the South and dollar in the North. The exchange rate between the currencies is denoted by e, where one dollar purchases e pesos.[3] Then, the real exchange rate between the countries is eP^*/P, which is denoted by Q. If the dollar and the peso are at purchasing power parity, $Q = 1$. If the peso is undervalued against the dollar, $Q > 1$. If the peso is overvalued against the dollar, $Q < 1$. This paper will assume throughout that $1 < Q < \overline{Q}$ for some $\overline{Q} > 1$, making the South a country where the real price level is relatively low.

2.2 Household Preferences

There exists a mass 1 of workers in the South who contemplate migrating to the North. Suppose that each household in the South consists of two members; a potential migrant and her spouse (or dependent) who will not migrate. The household wants to maximize its utility,

$$U(C_1, C_2) = C_1 C_2, \tag{1}$$

[3] Though the set-up is in terms of international migration, it is easy to adapt the analysis to the context of rural-urban migration, where the exchange rate e will be set to unity.

where C_1 and C_2 refer to the consumption level of the migrant and spouse respectively.[4] To focus on the relevant issues, it is assumed that the migrant always works and earns either W or W^* depending on where she works, and the spouse always makes zero earnings. Also, for ease of exposition, costs involved in migration are suppressed.[5]

The household is assumed to maximize the family utility function in the sense of the unitary model (Becker, 1981). The unitary model of household encompasses several different models of family structure in which a family in aggregate behaves as if it is maximizing a family utility function.[6] Alternatively, we may think of $U(C_1, C_2)$ as the individual utility function of the worker or potential migrant who cares about her partner's consumption for altruistic reasons.[7]

The household will send the worker to the North only if the family utility level achievable by doing so exceeds what it would get if both members stayed in the South. Formally, the decision-making process runs as follows. With no migration, the household chooses C_1 and C_2 to maximize (1) subject to the budget constraint $C_1 + C_2 \leq w$.[8] Denote the maximand by U^S. If one member migrates to the North, the household now maximizes (1) with location-specific wage and price indices in the budget constraints

$$\begin{aligned} C_1 + R &\leq w^*, \\ C_2 &\leq QR, \end{aligned}$$

where R represents the remittances (expressed in terms of the Northern real wage) paid to the

[4] This is a special case of a unitary household or an altruistic migrant's utility function of the form, $C_1^{\alpha} C_2^{1-\alpha}$, where $\alpha \in (0, 1)$. Although the case of $\alpha = 1/2$ is being used here for expositional simplicity, the qualitative results presented in this paper do not hinge on this particular choice of α.

[5] For discussions on migration costs, see for instance Carrington et al (1996) and Chau (1997).

[6] See Bergstrom (1995) for a survey of theories of the family including the unitary approach.

[7] If the household is modeled more realistically with the balance of power varying between the partners, as in Browning et al (1994), this could lead to interesting possibilities. In particular, if we follow the approach in Basu (2006) where a decision variable of a household can in turn affect the balance of power that guides the process of decision making, multiplicity of migration equilibria may be predicted: initial bargaining power in the household influences whether a worker would migrate or not; but at the same time, the wages that she earns at home and abroad can have different levels of impact on how much say she will get within the household. This idea may be explored in a separate paper. To focus on the issues addressed in this paper, the household will be assumed to behave as in the unitary model.

[8] In nominal terms, the budget constraint corresponds to

$$PC_1 + PC_2 \leq W.$$

spouse left behind in the South.[9] The migrant spends part of her wage, w^*, on own-consumption in the North and sends the rest to her dependent in the South. The real exchange rate, Q, determines how R is translated into the level of consumption in the South. Let U^N be the maximum post-migration utility achievable by this household. If $U^N \geq U^S$, the household will send the worker to the North and enjoy U^N. On the other hand, if $U^N < U^S$, the worker won't migrate, and the household will enjoy the utility level U^S. We can show that $U^S = (w/2)^2$ with $C_1 = C_2 = w/2$ for the no-migration scenario, and $U^N = (w^*/2)^2 Q$ with $C_1 = w^*/2$, $C_2 = (w^*/2)Q$, and $R = w^*/2$ for the scenario involving migration. Therefore, $U^N \geq U^S$ if

$$(w^*)^2 Q \geq (w)^2. \tag{2}$$

As long as (2) is true, workers from the South have an incentive to move to the North.

2.3 Labor Market

Denote the fraction of Southern workers who migrate to the North by n. Suppose there is only one price-taking firm in each economy.[10] Each firm produces according to the following technology:

$$x^N = f(l),\ f^{'} > 0,\ f^{''} < 0,$$

$$x^S = g(l),\ g^{'} > 0,\ g^{''} < 0.$$

A Northern firm produces x^N units of Northern goods hiring l migrant workers. A Southern firm produces x^S units of Southern goods employing l workers. The Northern labor market clears if

$$f'(n) = w^* \tag{3}$$

since the firm is a wage taker. In the South, as n fraction of the workforce exits the labor market,

$$g'(1-n) = w. \tag{4}$$

[9] These constraints can be stated in nominal terms as

$$\begin{aligned} P^*C_1 + P^*R &\leq W^*, \\ PC_2 &\leq eP^*R, \end{aligned}$$

using that $Q = eP^*/P$.

[10] This is an innocuous way to model a competitive labor market; introducing many firms will not change the analytical results (Basu 2002).

Here, the real wage levels, w^* and w, can be viewed as functions of n.[11] Denote the wage functions by $w^*(n)$ and $w(n)$ respectively. Then, it follows from $f'' < 0$ and $g'' < 0$ that

$$\frac{dw^*(n)}{dn} < 0 \tag{5}$$

and

$$\frac{dw(n)}{dn} > 0. \tag{6}$$

Intuitively, as more workers move to the North, the real wage rises in the South and falls in the North.

2.4 Migration Equilibrium

Although individual workers make the decision to migrate taking market wages as given, the wage in each country responds to the aggregate labor supply, hence the collective decision of the potential migrants. Specifically, as Southern workers start to migrate and the level of migration n increases, the Northern real wage w^* declines while the Southern real wage w rises. This adjustment in wages reduces the utility differential between migration and no-migration scenarios. When the wages are fully adjusted so that $U^N = U^S$, the urge to migrate no longer exists and equilibrium is reached.

Definition 1 *With exogenous real exchange rate Q, the North and the South are at migration equilibrium if the level of migration, n, satisfies the following condition:*

$$\{w^*(n)\}^2 Q = \{w(n)\}^2, \tag{7}$$

where $w^*(n)$ and $w(n)$ are the labor market-clearing wage functions satisfying (3) and (4), respectively.

This notion of equilibrium resembles that of Harris and Todaro (1970), though not exactly. In Harris and Todaro (1970) there is no concern for family left behind and migration equilibrium is defined as the point at which an individual's expected wages in the urban and rural sectors

[11] In nominal terms, the conditions above correspond to

$$f'(n) = \frac{W^*}{P^*}$$

and

$$g'(n) = \frac{W}{P}.$$

are equated. In this paper, household, instead of individual migrant, utility maximization is the objective; therefore, equilibrium exists where the expected household utilities in the North and the South are equated.

Proposition 1 *At the migration equilibrium, the real wage in the North is smaller than that in the South to the extent that the dollar has greater purchasing power against the peso.*

Proof. Rearranging the terms in (7), we obtain

$$\{\frac{w(n)}{w^*(n)}\}^2 = Q. \tag{8}$$

From (8) it follows that $w^* = w$ if the dollar and the peso are at purchasing power parity ($Q = 1$). If the peso is undervalued against the dollar ($Q > 1$), it must be that $w^* < w$ to make the equality in (8) hold. ■

The proposition above demonstrates that for migrants who are engaged in sending remittances back home, their Northern real wage may actually be lower than that which is available to them in the South, to the extent that the dollar has relatively greater purchasing power against the peso. This does not imply their utility is lower since the low real wage in the North will be compensated by high nominal wage and high nominal remittances, which in turn will translate into favorable consumption for the spouse in the South. In reality, the situation that migrants face will be more complex than we presented here due to moving costs, possibility of unemployement, etc., and the quantitative prediction about the North-South real wage gap will have to be adjusted accordingly. However, the goal here is to demonstrate in the starkest form how the deviation of market real exchange rate from purchasing power parity can motivate people to seek South-North migration when the channel of remittances is available.

3 Poverty-sensitive Utilities and Migration with Endogenous Real Exchange Rates

We have so far treated real exchange rate as an exogenous factor that can trigger migration. However, as Amuedo-Dorantes and Pozo (2004) show, the real exchange rate itself can be responsive to the inflow of remittances. But again what drives the aggregate remittances is the number of migrants who are sending them, among many other factors.[12] To investigate the two-way inter-

[12] Aggarwal and Spatafora (2005) find that policies such as multiple exchange rates, restrictions on holding foreign exchange deposits, and a large black-market premium have sizable and statistically significant negative impacts on

action between migration and real exchange rates, we relax the assumption of exogenously given real exchange rates and derive both the equilibrium migration level and the real exchange rate within the model. In a richer model than presented here, McCormic and Wahba (2000) also derive migration equilibrium with endogenous real exchange rate and demonstrate the possibility of multiple equilibria under plausible assumptions. This paper goes beyond McCormic and Wahba (2000) by considering the migration and remittances behavior of households whose income levels are near the poverty line. To reflect the realities that poor households face in developing countries and specifically deal with the issues pertaining to them, this section modifies the household utility. It then demonstrates that target-based remittances behavior of migrants can serve as an additional mechanism by which multiple migration equilibria arise.

3.1 Poverty-sensitive Utilities and Target-based Remittances Behavior

Denote by z a target level of consumption or standard of living that the household wishes to attain for each of its members. The subsistence level of consumption, or poverty line, is an example of z, but z can also refer to varying degrees of luxury that a person desires. The preference of the household is such that if both members are below or above the target, the consumption of each member equally contributes to household utility. However, if only one member of the household is below the target, regardless of how much consumption the other member enjoys above z, the household will still suffer from the "poverty" of one member. Formally, this preference is represented in the following household utility function

$$U(C_1, C_2) = \begin{cases} C_1 C_2 & \text{if } C_1, C_2 < z \\ (C_2)^2 & \text{if } C_1 \geq z,\ C_2 < z \\ (C_1)^2 & \text{if } C_1 < z,\ C_2 \geq z \\ (C_1 - z)(C_2 - z) + z^2 & \text{if } C_1, C_2 > z \end{cases} \tag{9}$$

and the indifference curves for this utility function are depicted in Figure 1.

[Insert Figure 1 here]

To focus on the situation in which the target consumption motive of the household has a binding impact, assume that the wage level in neither country is high enough to allow both members of the

remittances. Freund and Spatafora (2005) also find that high transaction costs such as money transfer fees and dual exchange rates reduce official remittances.

household to transcend the target consumption level, z. A sufficient condition for such a situation appears below and we maintain that the assumption holds throughout.[13]

Assumption 1: $f^{'}(0) < z(1 + 1/\overline{Q})$ and $g^{'}(0) < 2z$

The decision-making process of the household runs similar to that in the baseline model we discussed earlier. With no migration, the household maximizes (9) subject to the budget constraint, $C_1 + C_2 \leq w$. The solution to this problem is $C_1 = C_2 = w/2$. Hence, $U^S = (w/2)^2$. If the worker migrates to the North, the appropriate budget constraints become:

$$\begin{aligned} C_1 + R &\leq w^*, \\ C_2 &\leq QR, \end{aligned}$$

where R is the remittances (expressed in terms of the Northern real wage) sent back to the South. To the extent that the real price level in the South is lower ($Q > 1$), the family will try to allocate more consumption to the dependent there. However, with Assumption 1 and preferences in (9), the dependent's consumption in excess of z does not contribute any extra utility to the household due to its aversion to intrahousehold inequality around the poverty line. Therefore, the household will settle at a point like S in Figure 2, where the dependent consumes exactly z while the migrant spends her wage net of transfer to the spouse. Points like S are characterized by $C_1 = w^* - z/Q$, $C_2 = z$, and $R = z/Q$. Therefore, the maximized value of utility in the event of migration is $U^N = (w^* - z/Q)z$.

[Insert Figure 2 here]

Workers in the South have an incentive to move to the North if $U^S \leq U^N$, or

$$(\frac{w}{2})^2 \leq (w^* - \frac{z}{Q})z.$$

Therefore, any equilibrium level of migration, n, will have to satisfy

$$mm : \{\frac{w(n)}{2}\}^2 = \{w^*(n) - \frac{z}{Q}\}z, \tag{10}$$

where gains from further migration are fully exhausted due to the adjustment in wage levels.

[13] In the event the worker migrates to the North, the real price of her own consumption (with respect to the Northern real wage) is 1 whereas the real price of her dependent's (Southern) consumption is $1/Q$. The first condition indicates that even at the most favorable real exchange rate, $\overline{Q}$, the Northern wage is not enough to buy z for both of migrant and her dependent left behind. If both members stay in the South, they face the real price level of 1 with respect to the Southern real wage; hence, the second condition.

3.2 The Feedback of Migration and Remittances on Real Exchange Rates

The outcome of household utility maximization shows that a worker, once she migrates to the North, desires to send $R = z/Q$ to her dependent in the South. If n fraction of the Southern workforce migrates, then the aggregate remittances to the Southern economy amounts to $nR = nz/Q$, which is denoted by A.

Consider the following (reduced-form) equation of North-South real exchange rate determination:

$$rr : Q = h(A, B),\ h_1 < 0, h_2 > 0, \tag{11}$$

where B represents the budget deficit of the Southern government. That $h_1 < 0$ stems from the empirical observation that a large inflow of remittances into the South, which is a small open economy, leads to a real appreciation of the peso against the dollar (Amuedo-Dorantes and Pozo, 2004).[14] That $h_2 > 0$ is also intuitive. If the budget deficit is large and the fiscal stance is not sustainable in the long-run, the government may opt to inflate the peso to take advantage of the senorage revenue, for example. This expected inflation would impose downward pressure on the value of the peso against the dollar, leading to a real depreciation of the peso against the dollar. Although B is called the budget deficit here to illustrate the argument, it really represents macroeconomic policy measures besides remittances that may adversely impact the real exchange rate.

Lemma 1 *If the level of South-North migration exogenously goes up, the North-South real exchange rate, Q, rises (falls) if the response of Q to the North-South remittances is elastic (inelastic).*

Proof. Let $\sigma \equiv \frac{\partial Q}{Q} / \frac{\partial A}{A}$ (i.e. elasticity of the North-South real exchange rate with respect to the aggregate remittances to the South). Plugging $A = nz/Q$ into (11) and taking partial derivatives with respect to n, we obtain

$$\frac{\partial Q}{\partial n} = \frac{(\frac{Q}{n})\sigma}{1+\sigma}. \tag{12}$$

That $h_1 < 0$ implies $\sigma < 0$. Since the numerator in (12) is always negative, the sign of $\partial Q/\partial n$ is negative if $-1 < \sigma$; positive if $\sigma < -1$. When $\sigma = -1$, the sign of $\partial Q/\partial n$ is positive because

$$\lim_{\sigma \to -1} \frac{(\frac{Q}{n})\sigma}{1+\sigma} = \lim_{\sigma \to -1} \frac{Q}{2n} = \frac{Q}{2n},$$

[14] See McCormic and Wahba (2000) for a theoretical explanation of real exchange rate determination with remittances. In fact, $h_1 < 0$ corresponds to the circumstances in which unique equilibrium is reached in their paper. This makes it clear that the multiple equilibria result presented in the current paper arises for reasons other than what McCormic and Wahba showed; yet is consistent with their paper.

by l'Hôpital's rule. To summarize,

$$\frac{\partial Q}{\partial n} \begin{cases} < 0 \text{ if } |\sigma| < 1, \\ > 0 \text{ if } |\sigma| \geq 1, \end{cases} \tag{13}$$

where $|\sigma| < 1$ means the response of Q to the inflow of remittances is inelastic and $|\sigma| \geq 1$ means it is elastic. ■

3.3 Migration-Real Exchange Rate Equilibrium

So far we have separately examined how a change in the real exchange rate influences the level of migration and how the latter affects the former. This section incorporates the two-way interaction between the variables and endogenously determines their equilibrium values.

Definition 2 *A migration equilibrium with endogenous real exchange rate is vector, (n, Q), which simultaneously satisfies (10) and (11).*

Proposition 2 *The migration-real exchange rate equilibrium is unique if the response of real exchange rate to remittances is inelastic. The equilibrium may not be unique if the response of real exchange rate to remittances is elastic.*

Proof. The equilibrium can be represented diagrammatically in the (n, Q)-space. Consider Figure 3. The horizontal axis represents the space of n and the vertical axis represents the space of Q. A migration-real exchange rate equilibrium is where the mm and rr curves intersect (see (10) and (11)). The mm curve shows how Q influences n and it is an upward-sloping curve in this space. To see this, take the partial derivative of (10). We obtain

$$\frac{\partial n}{\partial Q} = \frac{\frac{2z^2}{Q^2}}{w(n)\frac{\partial w(n)}{\partial n} - 2z\frac{\partial w^*(n)}{\partial n}} > 0,$$

using (5) and (6). The rr curve shows how n affects Q and it can be either upward- or downward-sloping in this space depending on the magnitude of σ (see (13)). The left panel depicts a situation where the elasticity is small ($|\sigma| < 1$). The right panel represents a case where the elasticity is large ($|\sigma| \geq 1$). The mm and rr curves can intersect only once if one is upward-sloping and the other is downward-sloping (unique equilibrium). The curves may intersect at more than one place if both of them are upward-sloping (unique or multiple equilibria). ■

[Insert Figure 3 here]

The result suggests that policies to regulate South-North migration should be sensitive to the elasticity of real exchange to the inflow of remittances. Suppose that the government of the South were to lower the rate of emigration. If $|\sigma| < 1$, then lowering the budget deficit from B_H to B_L will bring the country to an equilibrium with a lower level of migration. This is because when $|\sigma| < 1$, (11) implies

$$\frac{\partial Q}{\partial B} = \frac{h_2}{1+\sigma} > 0,$$

shifting down the rr curve with a smaller B on the left panel of Figure 3.

If $|\sigma| > 1$, different policy measures emerge. On the right panel of Figure 3, we see that low migration with strong domestic currency, namely α, is a perfectly possible equilibrium for a country where the current emigration rate is very high and the domestic currency is weak, i.e. β. Suppose the latter equilibrium is undesirable for both the source and host countries and the governments want to reduce the level of migration. One way to achieve this is to impose a quota on the number of people who can move from the South to the North. However, in the presence of multiple equilibria, migration can be regulated by a channel that does not interfere with people's freedom to move, namely B. Suppose the Southern government increases spending or lowers taxes. If the budget deficit rises from B_L to B_H due to this policy, the rr curve shifts down, leading to unique equilibrium results.[15] Under the new circumstances, only the low migration equilibrium, γ, can be reached and an extremely high migration point like β ceases to be an equilibrium. This is analogous to what Basu and Van (1998) called "benign intervention" since the policy suggested above does not constrain people's freedom to migrate, but still achieves the desired outcome by simply changing the initial condition in the presence of multiple equilibria. Even if the expansionary fiscal policy is not sustainable in the long run for a developing country, once the equilibrium γ is achieved in the short run, the economy may shift to a low migration equilibrium α rather than jumping to a point like β even if the government debt level goes back to B_L after the short run intervention ends. If $\sigma = -1$, the policy depends on the sensitivity of h_2 to the change in σ.[16]

[15] If $|\sigma| > 1$, (11) implies

$$\frac{\partial Q}{\partial B} = \frac{h_2}{1+\sigma} < 0.$$

[16] Using l'Hôpital's rule,

$$\lim_{\sigma \to -1} \frac{h_2}{1+\sigma} = \frac{\partial^2 Q / \partial B \partial \sigma}{2},$$

where $h_2 = \partial Q / \partial B$ from (11).

The multiple equilibria result also sheds light on understanding migration in relation with other macroeconomic issues such as foreign reserves. If maximizing the remittances revenue were the goal of the Southern government, would it necessarily want to encourage more of its citizens to migrate to the North? The following proposition provides an answer:

Proposition 3 *If there exist multiple migration-real exchange rate equilibria, the relation between the level of migration and the remittances revenue may be non-monotonic.*

Proof. When n fraction of the Southern labor force migrates, the revenue from remittances is equal to nz/Q. Let (n_1, Q_1) and (n_2, Q_2) be two equilibria corresponding to points α and β in Figure 3, respectively. Therefore, $n_1 < n_2$ and $Q_1 < Q_2$. This is consistent with either $n_1 z/Q_1 \leq n_2 z/Q_2$ or $n_1 z/Q_1 > n_2 z/Q_2$. If the former, the remittances revenue is lower at the low migration equilibrium; if the latter, the remittances revenue is actually higher at the low migration equilibrium; hence the non-monotonicity in the relation between the level of migration and aggregate remittances. ■

Although the example drawn in Figure 3 has only two stable equilibria, there may exist somewhere environments in which more than two equilibria are embedded. If the welfare criterion of the Southern government were the aggregate remittances flowing into the country, the government won't necessarily rank equilibria with more migration over equilibria with low levels of migration.

4 Conclusion

The tragic circumstances that poor migrants face at home and abroad are a cause for concern not only from a humanistic point of view but also to economists. An explanation is called for as to why migrants who get paid so little in terms of real wage (a migrant's own standards of living) would still want to work in the host country or region. This paper showed that if the real exchange rate between the host and source countries is such that the wage of the host country, when transferred to the family in the source country, translates into large enough purchasing power, such migration behavior may be rationalized. The findings of this paper suggest that migration policies, if implemented without proper analyses of the actual circumstances faced by migrants and their families, may bring about unintended, or sometimes perfectly opposite, results. Suppose the host country initiates a law requiring employers to provide adequate living conditions, such as housing, for migrant workers. If the demand for immigrant labor goes down as a result of this change in effective real wage, some migrants who would have otherwise gained in terms of household utility through migration may now lose their jobs altogether.

Another point addressed in this paper is the two-way relation between migration and real exchange rates. For workers who seek migration in order to send remittances to their family, not only the real wage differential but the real price differential (real exchange rates) matters in making the migration decision since the latter influences the effectiveness of remittances sent back home. On the other hand, the level of migration guides the aggregate remittance inflows to the source country, which in turn affects the real exchange rate. Therefore, both the level of migration and the real exchange rate are understood as endogenous variables. This new approach can predict multiple migration-real exchange equilibria suggesting unusual policy routes through which migration can be regulated. It also enabled us to see that more emigration of workers does not necessarily bring more hard currency into the source country. This suggests that labor export is not the panacea for a developing country seeking to replenish its foreign currency reserves through remittances.

This paper focused on the dynamics of labor migration and remittances, abstracting away from commodity and capital market issues. However, the problem of large-scale migration and remittances will have to be understood in the broader context of immiserization (Bhagwati, 1958, Srinivasan and Bhagwati, 1983) and the ensuring welfare analysis, and this is one to be pursued in future research.

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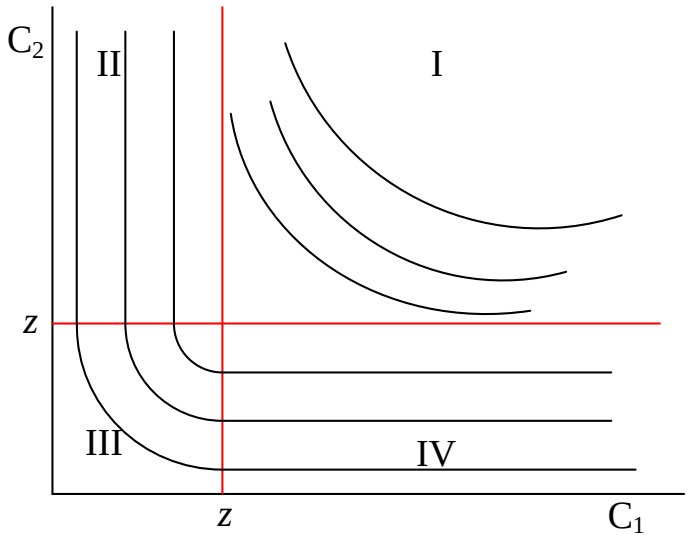

Figure 1: Household utility with target consumption

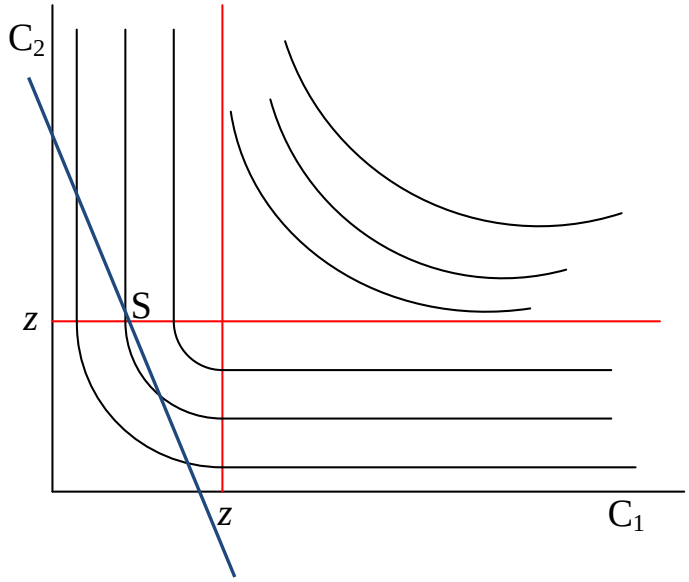

Figure 2: Optimal remittance behavior of a migrant

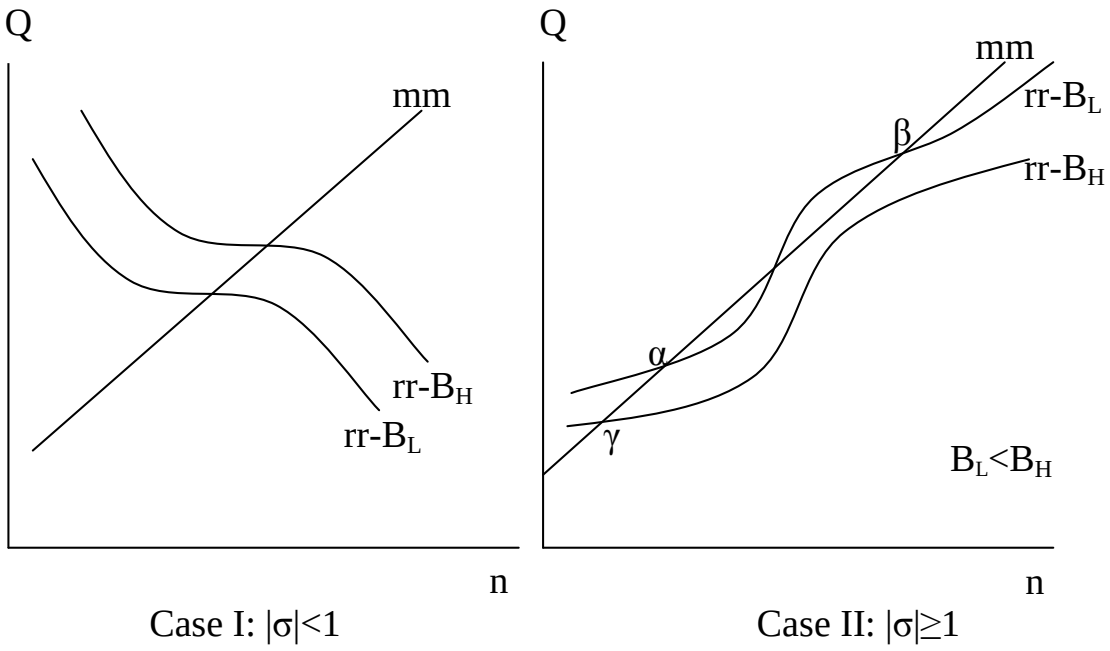

Figure 3: Migration and real exchange rate equilibria