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# MIGRATION AND REMITTANCES:
## A New Approach with Endogenous Exchange Rates and the Possibility of Multiple Equilibria

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**Abstract**

A commonly accepted notion in the literature on migration is that migration occurs in response to higher real wages in the host or destination country or region. However, this paper argues that people may voluntarily choose migration to accept wages lower than those in one's own country without being triggered by misinformation or misperception. This is due to the fact that if the remittances sent back home for the family translate into amount of consumption favorable enough to compensate the low standards of living that she faces abroad, a migrant would have an incentive to tolerate extremely low real wages in the host country. When remittances serve as the channel through which consumption is allocated between a migrant and her family left behind, prevailing exchange rate shifts around the worker's utility gain from migration, thus the decision to migrate. On the other hand, the number of migrants and the amount of hard currencies they send home could in turn affect the exchange rates. Incorporating this two-way interaction, the model endogenously determines the exchange rates with the number of migrants. It contributes to understanding 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.

**Keywords**: Foreign exchange, migration, real wage, remittances, multiple equilibria

**JEL classification numbers**: F20, F30, O10, R20

## 1. Introduction

Among the many causes that trigger people to migrate, geographic disparities in income or economic opportunities undoubtedly occupy one of the major positions.[1] As is implied by Samuelson (1948, 1949) and Harris and Todaro (1970), unless opportunities for the improvement of real wages are completely exhausted across markets, people will have the tendency to move from country to country or from region to region seeking better economic opportunities. The mass migration of people from Europe to America during the first wave of globalization between 1850 and 1913 will be a good example and the era of "constrained" mass migration of the last fifty years provides additional evidence on how strongly people respond to market signals. [Hatton and Williamson (1998), Chiswick and Hatton (2001)] In 2002, the United States had an inflow of 1,063,700 immigrants and Germany accepted 658,300 foreigners.[2] Once we add the number of illegal immigrants, the above figures would radically change. According to the estimates of the Immigration and Naturalization Service (INS), there were 7 million illegal aliens living in the United States in 2000 while the Census Bureau estimates the number to be 8 million for the same year.[3]

According to standard theory, an immigrant who travels to another country or a rural dweller who migrates to a city should experience at least as great a real wage as she could have enjoyed by staying in her home country or rural region. Otherwise, why would she have bothered to go to all the trouble and bear the risk to move to a new

[1] The history of international migration is well summarized in http://www.let.leidenuniv.nl/history/migration/.
[2] Mexico, India, and China were the major source countries of the immigrants to the Unites States while Poland, Turkey, and the Russian Federation were to Germany. [OECD (2004)]
[3] http://www.cis.org/topics/illegalimmigration/html

place?[4] However, in reality, not all the 8 million or so people entering the United States each year seem to be experiencing substantial improvement in their standards of living or real wages. Let us look at the 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 in 2004 while the minimum wage requirement was $5.15 an hour.[5] Given the enormous living costs in Metropolitan New York, it is not hard to imagine that the quality of living 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. Sometimes, however, the nominal wage paid to the worker looks just too small relative to the high price level 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), Greenwood (1985), and Stark (1991) suggest 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

[4] Here I am abstracting away from non-economically motivated migration such as migration of refugees to seek asylums.
[5] "Rewards of a 90-Hour Week: Poverty and Dirty Laundry" by Steven Greenhouse, the NYT, May 31, 2004.

too short to realize potentially high income stream over time.[6] It is quite bewildering to observe migrants accepting wages lower than their own country's real wages. However, once the migrant's family is taken into consideration, this puzzle becomes easy to understand.

To a migrant from a poor household, her spouse and children's consumption would be as integral a part of her utility function as her own consumption. Therefore, if the nominal wage in the host or destination country is much higher than in the home country, an individual might find it worthwhile to migrate even if the real wage in the host country happens to be less than what she makes at home because the prices in the host country are disproportionately high. This is due to the following: Suppose the remittances payment made to family translates into amount of consumption favorable enough to more than compensate the low level of consumption the migrant enjoys abroad. Then she would have an incentive to accept wages that are considered to be extremely low in the host country.[7]

This paper is not the first to point out the need to distinguish nominal and real wage differentials for a migrant worker. In a model where guest workers maximize lifetime utility under fixed wages and prices, Djajić (1998) showed 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 between host and

[6] Chiswick (1978) suggests that immigrants may narrow the income gap with the natives over time as they assimilate into the host country society. However, based on the Public Use Microdata Samples (PUMS) of the U.S. Census, Borjas (2000) finds that between 1980 and 1990, the rate of wage convergence with U.S. natives of immigrants originating in Mexico was negative implying income divergence over time.

[7] The migrant juggles between own consumption and consumption of her family depending on utility functions. Note that her consumption should be purchased in the host country while consumption of family is purchased in the source country. Therefore, depending on the prevailing exchange rates and price levels, the migration decision will be adjusted.

source countries. 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 with Djajić (1989), this paper focuses on the concurrent remittances made to the family as the main motivation to migrate rather than inter-temporal optimization of individual utility. According to a survey conducted by Inter-American Development Bank in 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.[8] These 10 million immigrants remit on average 12.6 times a year, typically $100/$150/$200 each time. While the amount of remittances in dollars may look small, remittances range depending on country from 50 to 80 percent of recipient household income.[9] For Mexico, annual flow of remittances from the US is estimated to be $2 billion, making it one of the country's leading sources of foreign exchange. [Durand, Parrado, and Massey (1996)]

The motivation to remit money home may be driven by reasons other than altruistic concern, e.g. aspirations to inherit family wealth, spatial diversification of investment through the trustworthy family, etc. [Lucas and Stark (1985), Subramaniam(1999)] However, household utility maximization or migrant's utility maximization with some degree of altruism for spouse and kids embedded in the preference seems to be a reasonable starting point. Stark (1991) supports this view of family as the decision-making unit of migration. Chen, Chiang, and Leung (2003) also demonstrated that migration can take place even when migrants earn less income abroad, and this is as part of optimal risk diversification scheme of a family whose members have

[8] At least four times a year
[9] "Sending Money Home: Remittances to Latin America from the United States" (2004), IDB/MIF

heterogeneous productivities.[10] This paper shows the same phenomenon can arise even if no country or individual risk is imposed in the model.

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 exchange rate and the level of migration. It is easy to see that the 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 number of migrants and the remittances they send home could in turn affect the exchange rates. For some developing economies, remittances from abroad amount to quite a substantial fraction of GDP. Remittance payment was 29.4 percent of GDP in Nicaragua, 24.2 for Haiti, and 15.1 for El Salvador in 2002.[11] When a large amount of foreign currencies flows in as remittances, the exchange rate between the host and source countries will no longer be exogenous to the level of migration. The Philippines, with nearly seven million workers or 10 percent of its population abroad, has arguably benefited from the large inflow of foreign currencies as remittances amidst the Asian financial crisis in 1997.[12] Behavioral responses of migrants to different economic conditions in combination with endogenous determination of exchange rates could not

[10] See Stark (1991), Stark and Levhari (1982), Rosenzweig and Stark (1989), and Daveri and Faini (1999) for the literature on migration with risk diversification motive.
[11] "Sending Money Home: An International Comparison of Remittance Markets" (2003), IDB/MIF
[12] Of the 7 million, 4.2 million are classified as overseas contract workers (OCWs) who work on fixed terms of six months to two years. [Philippine Overseas Employment Administration (POEA)] POEA Report on Key Performance Indicators cited OFW remittances for 1997 at USD 5.7 billion. This amount would easily double to about USD 10 million once the remittances through non-banking and informal channels are taken into account. This amounts to about 18 percent of the Gross National Product (GNP) of the Philippines.

only predict drastically different migration equilibria but also shed some light on understanding migration in relation with important macroeconomic issues.[13]

The rest of the paper is structured as follows. Section 2 presents the baseline model where household utility maximization drives migration decision. Section 3 loosens the assumption of exogenous exchange rates in the model and endogenizes the exchange rate. Section 4 modifies the utility function to specifically deal with the problem of households with income near poverty line. Section 5 concludes the paper by commenting on some policy implications.

## 2. Migration with Exogenous Exchange Rates

Consider a model in which there is a source country—henceforth *South*, and 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 $w^*$.[14] These countries have their own currencies, say, peso in the South and dollar in the North. The exchange rate between the currencies is denoted by e where one dollar exchanges with $e$ pesos.[15] Though the story is told in terms of international migration, it is easy to adapt the analysis to the context of rural-urban migration, where exchange rate $e$ will be set to unity.

Let us suppose that each household in the South consists of two members, a potential migrant and her spouse who is sedentary. The household wants to maximize the utility, $U(C_1, C_2)$, where $C_1$ and $C_2$ refer to the consumption level of the migrant and spouse respectively. The function $U(C_1, C_2)$ satisfies the following property: $U_i > 0$, i = 1,

[13] Borjas and Fisher (2001) is an example showing how a macroeconomic variable can affect migration. They consider dollarization and its effects on Mexican labor market and show that it causes illegal immigration flows from Mexico to the U.S. more volatile.
[14] Here w and w* are the total earnings that a migrant can make, not an hourly wage.
[15] Therefore, rise in e implies depreciation of peso.

2. 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.[16] Here, costs involved in migration are suppressed.

The household is assumed to maximize the family utility function, $U(C_1, C_2)$, in the sense of unitary model.[17] The unitary model of household encompasses several different models of family structure that predict a family in aggregate behaves "as if" it is maximizing a family utility function. Transferable utilities in the spirit of Gorman (1953), family utility function in the form of Bergson-Samuelson social welfare function, and Becker's "Rotten Kid Theorem" (1974, 1981) can justify the unitary approach. 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.

If the household is a more realistic one 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 (2005), migrant's wages at home and abroad may have different impacts on how much say the migrant will get in the household. The dynamics between the power balance and the decisions made by the household may predict a multiplicity of migration equilibria. 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.

The household will send the migrating member to the North only if the utility level achievable by doing so exceeds what it would get when both members stay in the

[16] For simplicity, it is assumed that the migrant can always find a job thus unemployment is not an issue here.
[17] See Bergstrom (1995) for a survey of theories of the family including unitary approach.

South. Formally, the decision process runs as follows. With no migration, the household chooses $C_1$ and $C_2$ to maximize

$$U(C_1, C_2), \qquad (1)$$

subject to the budget constraint

$$pC_1 + pC_2 \leq w. \qquad (2)$$

I shall denote the maximized value 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

$$p^*C_1 + R \leq w^*, \qquad (3)$$

$$pC_2 \leq eR, \qquad (4)$$

where R is the remittances paid to the spouse left behind in the South.[18] Let $U^N$ be the utility achieved by this household. If $U^N \geq U^S$ at the optimal level under each scenario, the household will decide to send the potential migrant to the North and enjoys $U^N$. On the other hand, if $U^N < U^S$, the worker won't migrate, and the household will enjoy the utility level $U^S$.

To actually make comparison between $U^S$ and $U^N$ and get an idea of how the migration equilibrium would look, let us assume $U(C_1, C_2) = C_1C_2$. This functional form implies $U^S = (¼)(w/p)^2$ with $C_1 = C_2 = (½)(w/p)$ for the no migration scenario and $U^N = (¼)(w^*/p^*)(ew^*/p)$ with $C_1 = (½)(w^*/p^*)$, $C_2 = (½)(ew^*/p)$ and $R = (½)w^*$ for the scenario involving migration. Therefore $U^N \geq U^S$ if

$$(¼)(w^*/p^*)(ew^*/p) \geq (¼)(w/p)^2, \qquad (5)$$

[18] The model abstracts away from the transaction costs involved in remittances transfer. In reality sending remittances home is costly. Fees paid to banks or wire transfer companies are significant and the differential between official and commercial exchange rates also cause loss because remittances are only allowed to be converted to local currency at official rates upon arrival. Reflecting this reality, during the recent G8 summit, leaders called for reducing the transaction fee for remittances by half by 2008.

or

$$(w^*/p^*)ew^* \geq (w/p)w. \qquad (6)$$

As long as (6) is true, workers from the South have an incentive to move to the North. Although we have treated $w$ and $w^*$ as exogenous so far, both wages will adjust to the level of labor supply in each country.[19] Let us denote the number of immigrants to the North or emigrants from the South by $n$. In the North the wage $w^*$ will be subject to downward pressure with the inflow of workers from the South. Therefore, it will be natural to look at $w^*$ as a function of $n$ with $\partial w^*(n)/\partial n < 0$. Analogously, the wage in the South will rise with the outflow of workers implying $\partial w(n)/\partial n > 0$. When price levels and exchange rate are not responsive to the level of migrants, the equilibrium number of migrants will be determined in the following condition:

$$\{w^*(n)/p^*\}ew^*(n) = \{w(n)/p\}w(n) \qquad (7)$$

When (8) holds, there no longer exists the urge to migrate. Notice that in equilibrium, greater nominal wage in the North, namely, $ew^*(n) > w(n)$ implies smaller real wage in the North, i.e. $w^*(n)/p^* < w(n)/p$. On the other hand, when the nominal wage in the North is smaller, $ew^*(n) < w(n)$, the real wage offered in the North will be greater, i.e. $w^*(n)/p^* > w/p$. Therefore, depending on which situation the equilibrium is in, immigrants themselves may be accepting lower than home country real wage in the North. This does not imply their utility is lower because 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. Therefore, when

[19] The measured impact of immigrants on native workers' wages has seemed to be negligible. [Greenwood and McDowell (1986), Butcher and Card (1991) and Friedberg and Hunt (1995)] However, Borjas (2003), using new methodology, finds that there has been sizable adverse impact on local wages due to influx of immigrants in the United States.

household utility maximization is the motive rather than maximization of individual utility, a migrant's voluntary acceptance of lower than home real wage can make perfect sense. Requiring Northern employers to pay higher compensation to immigrant workers may be psychologically relieving for a Northerner, this well-intended policy might generate an adverse outcome: as hiring extra immigrant becomes more costly, the employers may hire fewer workers than before, potentially reducing the welfare of migrants' households altogether.

## 3. Migration with Endogenous Exchange Rates

Although we have so far treated exchange rate as exogenously given, it will no longer be the case for countries that send many workers abroad and receive substantial amount of remittances, which brings about large inflow of hard currencies. In a recent empirical study by Amuedo-Dorantes and Pozo (2004), it is shown that doubling of remittances results in real exchange rate appreciation of about 22 percent in a panel of 13 Latin American and Caribbean nations. This study is in parallel with other works such as Burnside and Dollar (2000), Cassen (1994), White (1992), and Funkhouser (1992) in that it examines the macroeconomic impacts of large financial inflows in the form of foreign aid or remittances in the context of Dutch Disease or Resource Boom models.

One important observation is that exchange rate is not only the outcome of remittance inflows but also a factor that potentially triggers worker outflows from the South and their remittances, as is clear from condition (7). To explore this two-way relation between exchange rates and remittances, we loosen the assumption of

exogenously given exchange rates from previous section and derive both the equilibrium migration level and the exchange rate within the model.

Let us first look at the way the prevailing exchange rate affects the level of migration. With varying exchange rates, condition (7) can be rewritten as

$$\{w^*(n)/p^*\}e(n)w^*(n) = \{w(n)/p\}w(n), \qquad (8)$$

where exchange rate $e$ in (7) is now replaced by $e(n)$. With $\partial w^*(n)/\partial n < 0$ and $\partial w(n)/\partial n > 0$, it is easy to see from (7) that $e(n)$ is an increasing function of $n$.[20] This is quite intuitive because as e rises or the dollar appreciates, the expected utility from migrating, $U^N$, becomes higher relative to $U^S$, attracting more migrants to the North. The positive relation between the exchange rate and the migration level, $\partial e(n)/\partial n > 0$, can be denoted as

$$e = \xi(n) \quad \text{with } \partial\, \xi(n)/\partial n > 0. \qquad (9)$$

Now, let us consider the other side of the picture, i.e. how migration level and remittances in turn affect exchange rate. We already know from the previous section that optimal remittance payment by each migrant is $R = (\frac{1}{2})w^*(n)$ with Cobb-Douglas utility function, $U(C_1, C_2) = C_1C_2$. When there are n migrants, the total flow of remittances to the South will then amount to $nR = (\frac{1}{2})nw^*(n)$. While there can be many factors that influence exchange rates in reality, we focus on the effects of remittances and government fiscal policy in the South. Specifically, we introduce the government spending variable, G, into the model so that imprudent fiscal policies and increased budget deficit adversely affect exchange rate. Formally, exchange rate is expressed as

$$e = f(nR, G) = f((\tfrac{1}{2})nw^*(n), G) \qquad \text{with } f_1 < 0 \text{ and } f_2 > 0.$$

[20] In fact it is more correct to say that number of migrants n(e) is an increasing function of e since we are looking at how workers in the South are triggered to migrate by the depreciation of its currency. However, we can interpret e(n) as an inverse function of n(e).

As the total inflow of remittances to the South goes up and dollar-supply increases in the foreign exchange market, the peso will appreciate, thus $f_1 < 0$.[21] On the other hand, as government spending in the South increases, the peso will depreciate, thus $f_2 > 0$.

Before moving on to derive the precise relationship between the exchange rate and the level of migration, we make the following assumption.

**Assumption 1**: $w^*(n) + n\partial w^*(n)/\partial n > 0$

What it says is quite intuitive: total remittances sent to the South, $n$R, increase as more workers from the South migrate to the North, i.e. $\partial(n\mathrm{R}(n))/\partial n > 0$. This will be true as long as the rate of wage decline in the North is mild enough as labor supply goes up due to the inflow of immigrants. Under Assumption 1, increased number of migrants, $n$, implies larger amount of total remittances, and thus appreciation of peso or decline in $e$. This relation can be written as follows:

$$e = \pi(n, \mathrm{G}) \text{ with } \pi_1 < 0 \text{ and } \pi_2 > 0 \qquad (10)$$

Now, the equilibrium level of migration and exchange rate can be determined by (9) and (10). Figure 1 depicts the endogenous determination of exchange rate with the number of migrants.

[21] Recall that e was defined as pesos per dollar.

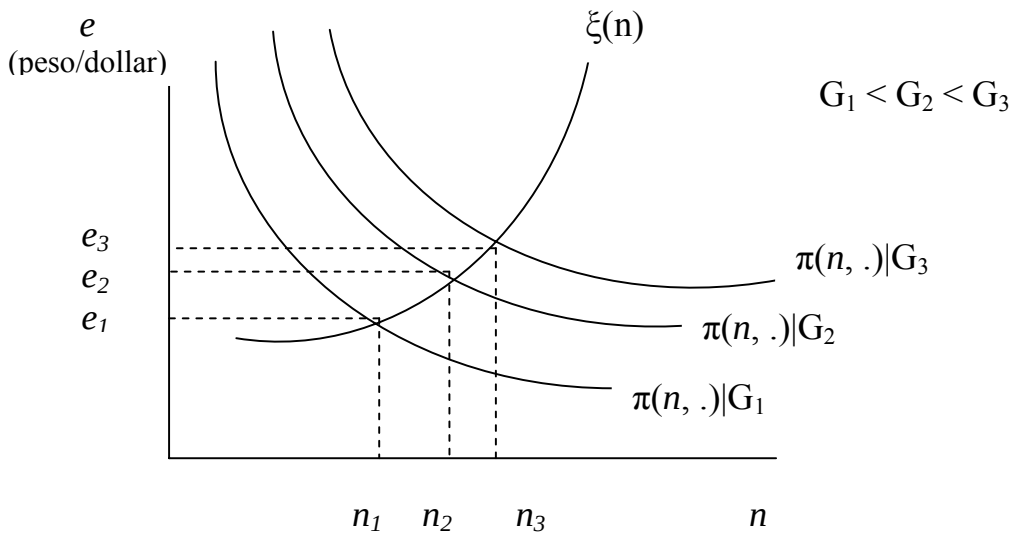


Figure 1

Equilibrium exchange rate and migration level are uniquely determined in the model for a given level of government policy. However, as the government budget stance worsens in the South, its currency depreciates by construction. More interestingly, bad government policy in the South drives workers out of the country.[22] This is because bad government policy in the South weakens the value of the peso against the dollar, pushing up the utility gain expected from earning a Northern wage. Being aware of this, workers from the South will be motivated to seek a better lot in the North as their own government deficit rises.

## 4. Poverty-sensitive Utilities and Multiple Equilibria

[22] In the diagram, higher G is associated with larger size of migrants, n.

In this section the utility function of Southern households is modified so as to reflect the realities that poor families may face in developing countries.[23] Let us denote the subsistence level of consumption, or the poverty line, by $z$. The utility function of a poor household is defined as follows:

$$U = U(C_1, C_2) = \begin{cases} C_1 & \text{if } C_1 \le z \text{ and } C_2 > z \\ C_2 & \text{if } C_1 > z \text{ and } C_2 \le z \\ C_1C_2 & \text{if } C_1, C_2 < z \\ (C_1 - z)(C_2 - z) & \text{if } C_1, C_2 > z \end{cases} \qquad (11)$$

If either member of the household is below subsistence level, the household will still suffer no matter how much consumption the other member enjoys above $z$. When both members are below subsistence level, each member's consumption is equally important for household utility and they would like to share whatever resources they have if small. In the good situation where both members can transcend the poverty line, the consumption of each member equally contributes to household utility. The indifference curves for this utility function are drawn in Figure 2.

[23] For an anecdotal example of situations where poor families end up sending their beloved members abroad due to poverty, see "Sri Lankan Maids Pay Dearly for Perilous Jobs Overseas," by Amy Waldman, May 8, 2005, NYT.

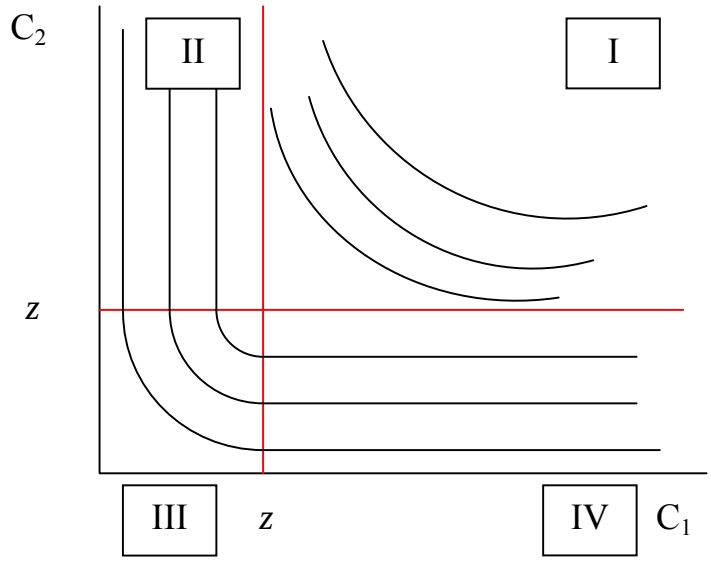


Figure 2

With this utility function, the household will never pick a bundle in the interior of quadrants II or IV because they can always do better by taking away the excess consumption of the member who is above poverty line *z* and redistribute this amount among the two and enjoy higher utility level than before. Therefore, the equilibrium choice of consumption bundle will always fall in either quadrant I or III depending on the budget.

Let us first examine the no migration case. There are four different possibilities of wage level in the South such that with the given wage (i) worker's consumption falls below *z* while the spouse can consume an amount above *z*; (ii) worker consumes above *z* while spouse's consumption is less than *z*; (iii) both members consume below *z*; (iv) both members consume above *z*. Diagrammatically, this is indicated in Figure 3.

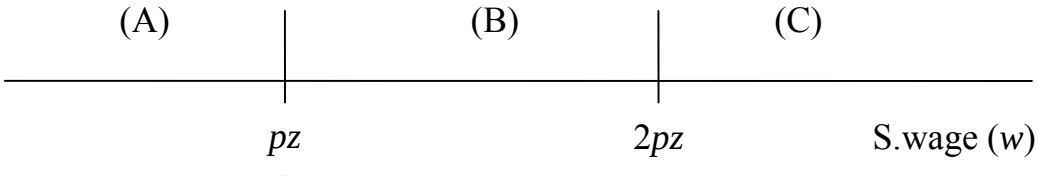


Figure 3

If wage level falls in the interval (B) so that (i) or (ii) is the case, the optimal choice of consumption will be such that $C_1 = C_2$, and the location of the bundle will be in quadrant III. On the other hand, if wage level is in interval (A) or (C) so that (iii) or (iv) is true, the optimal allocation rule will be to equally distribute wage, w, between the two members. This is because these initial situations correspond to quadrant I or III, where the utility function follows Cobb-Douglas format. However, with both members residing in the South and facing the same price level *p*, equal resource sharing directly implies $C_1 = C_2$. Therefore, without migration, all four cases give rise to an equilibrium where $C_1 = C_2 = (1/2)(w/p)$. The equilibrium utility level will be

$$U^S = (1/4)(w/p)^2 \qquad \text{for cases (i), (ii) and (iii)} \qquad (12)$$

while

$$U^S = (w/2p - z)^2 \qquad \text{for case (iv).} \qquad (13)$$

Case (iv) is the only one where both members cross the poverty line and fall to quadrant I.

Now let us look at the equilibrium utilities when the worker migrated. Analogously to the no migration case, the wage in the North can be classified into different levels: (a) it makes the worker residing in the North consume less than *z* while it can buy consumption goods above z for the spouse in the South; (b) it is enough to buy *z* for the worker in the North while insufficient to also buy z for the spouse in the South; (c)

the wage is so low that neither of the members can cross the poverty line; (d) the wage is enough to buy $z$ for both members. Diagrammatically this is shown in Figure 4.

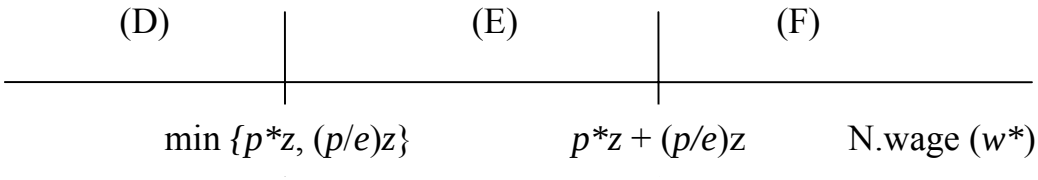


Figure 4

It is important to note that to buy the same amount of consumption good $z$, it costs $p^*z$ dollars in the North while the cost is $pz$ pesos or $(p/e)z$ dollars in the South. If Purchasing Power Parity (PPP) holds, these two would amount to the same costs. However, we allow more flexibility and do not impose PPP in the model. Therefore, the costs of buying $z$ in each country can differ and either $p^*z > (p/e)z$ or $p^*z < (p/e)z$.

If wage level $w^*$ falls in the interval (E) so that (a) or (b) is the case, the household will choose a consumption bundle in quadrant III. If PPP holds and $p^* = p/e$, it will be optimal for the household to choose $C_1 = C_2$ given the properties of Cobb-Douglas utility. On the other hand, if PPP does not hold, we have to consider two different possibilities. First, when costs of buying goods are more expensive in the North so that $p^* > p/e$ holds and the budget constraint is steeper than the equal price case, the optimal choice will fall in the corner such as point N in Figure 5. On the other hand, if the costs of buying goods are higher in the South so that $p^* < p/e$, then the optimal choice will look like the point S in Figure 5.

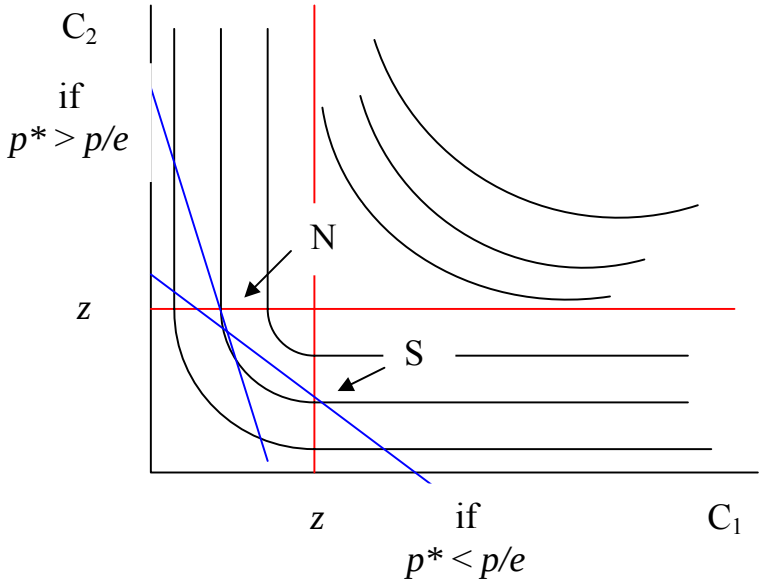


Figure 5

Formally, points such as N can be described as $C_1 = (w^* - pz/e)/p^*$, $C_2 = z$, and $R = pz/e$. The utility associated with equilibrium is $U^N = C_1C_2 = (w^* - pz/e)z/p^*$. On the other hand points such as S imply $C_1 = z$, $C_2 = (w^* - p^*z)e/p$ and $R = w^* - p^*z$ with $U^N = C_1C_2 = (w^* - p^*z)ze/p$.

If w* falls in the strict interior of the interval (D) or (F) so that (c) or (d) is true, the household had better equally split the wage earning.[24] This implies $R = w^*/2$. Equal split of nominal resources does not imply the equalization of consumption-level between the two members. The member who resides in the country where it is less costly to buy the consumption good will get to consume more.[25] With equal sharing of nominal resources, $C_1 = (1/2)(w^*/p^*)$ and $C_2 = (1/2)(ew^*/p)$ can be reached. The utility level achieved with optimal choice of bundles under the migration scenario can be summarized as follows:

[24] This result relies on the functional form of the utility function in the quadrants I and III.
[25] Again the consumption level of each member will equalize if PPP holds.

$$U^N = (w^* - pz/e)z/p^* \quad \text{for case (a); } p^* > p/e, \qquad (14)$$

$$U^N = (w^* - p^*z)ze/p \quad \text{for case (b); } p^* < p/e, \qquad (15)$$

$$U^N = (1/4)(w^*/p^*)(ew^*/p) \quad \text{for case (c),} \qquad (16)$$

and

$$U^N = (w^*/2p^* - z)(ew^*/2p - z) \quad \text{for case (d).} \qquad (17)$$

Now we are left with the task of comparing the utility levels reached in no-migration and migration equilibrium respectively. If $U^N \geq U^S$, there will be the pressure to migrate to the North. The equilibrium utilities, $U^S$, from cases under no migration scenario are shown in (12) and (13). The equilibrium utilities with migration, $U^N$, are given in (14) through (17).

If the wage in the South is such as the case in (iv) so that the consumption bundle chosen by the household falls in quadrant I, there is not much urge to migrate since this equilibrium is already good enough. The only way migration becomes a consideration is that the wage in the North is such as (d) so that the optimal bundle achievable from migration also falls in quadrant I. Direct comparison of utilities in each scenario gives rise to the migration equilibrium already discussed in section 3. The equilibrium condition is given by (8). The juggle between cases (i), (ii), or (iii) under no migration scenario and case (c) under migration scenario also leads to migration equilibrium described by (8).

Interesting possibilities arise when the Southern wage level, (i), (ii), or (iii), from no-migration competes with the Northern wage level, (a), from migration. Workers in the South would be motivated to move if $U^N \geq U^S$. Using (12) and (14), this condition can be formalized as

$$(w^* - pz/e)z/p^* \geq (1/4)(w/p)^2. \qquad (18)$$

Incorporating the number of migrants, migration equilibrium now looks as follows:

$$\{w^*(n) - pz/e(n)\}z/p^* = (1/4)\{w(n)/p\}^2 \qquad (19)$$

where $w^*(n)$ and $w(n)$ are such that $\partial w^*(n)/\partial n < 0$ and $\partial w(n)/\partial n > 0$. By differentiating (19), we can easily see that number of migrants, $n$, is increasing in exchange rate, $e$. Formally the effect of exchange rate on the level of migration can be stated as

$$e = \xi(n) \qquad \text{with } \partial\, \xi(n)/\partial n > 0. \qquad (20)$$

Continuing with wage level (i), (ii), or (iii) from no-migration and wage level (a) from migration, let us now look at the other side of the story, namely, how remittances in turn affect exchange rates. Since each migrant will remit R = pz/e in case (a), total remittances arriving in the South will amount to nR = npz/e(n) dollars. Similarly to section 3, the exchange rate is defined as a function of foreign currency inflows through remittances and government policy, G:

$$e = f(nR, G) = f(npz/e(n), G) \quad \text{with } f_1 < 0 \text{ and } f_2 > 0$$

Differentiating e with respect to $n$, we get

$$\partial e(n)/\partial n = \{f_1(.)pz/e(n)\} * 1/[1 + f_1(.)pzn/\{e(n)\}^2] \qquad (21)$$

With $f_1 < 0$, we can see that the sign of $\partial e(n)/\partial n$ depends on the sign of the following term:

$$1 + f_1(.)pzn/\{e(n)\}^2 \qquad (22)$$

Specifically,

$$\textbf{Case I}: \partial e(n)/\partial n > 0 \quad \text{if } 1 + f_1(.)pzn/\{e(n)\}^2 < 0 \quad (23)$$

and

$$\textbf{Case II}: \partial e(n)/\partial n < 0 \quad \text{if } 1 + f_1(.)pzn/\{e(n)\}^2 > 0. \quad (24)$$

Case I will arise if the exchange rate is very responsive to the inflow of foreign currencies, so that $| f_1 |$ is large. On the other hand, if the responsiveness of the exchange rate to the inflow of foreign currencies is relatively mild, i.e. if $| f_1 |$ is small, Case II will arise. Using (23) and (24), adjustment of exchange rates to the level of migration can be stated as

**Case I**: $e = \pi(n, G)$ with $\pi_1 > 0$ and $\pi_2 > 0$ if $| f_1 |$ is large (25)

**Case II**: $e = \pi(n, G)$ with $\pi_1 < 0$ and $\pi_2 > 0$ if $| f_1 |$ is small . (26)

Putting (20) together with (25) or (26), depending on the case at hand, we can derive the equilibrium exchange rate and migration level. This is shown in Figure 6.

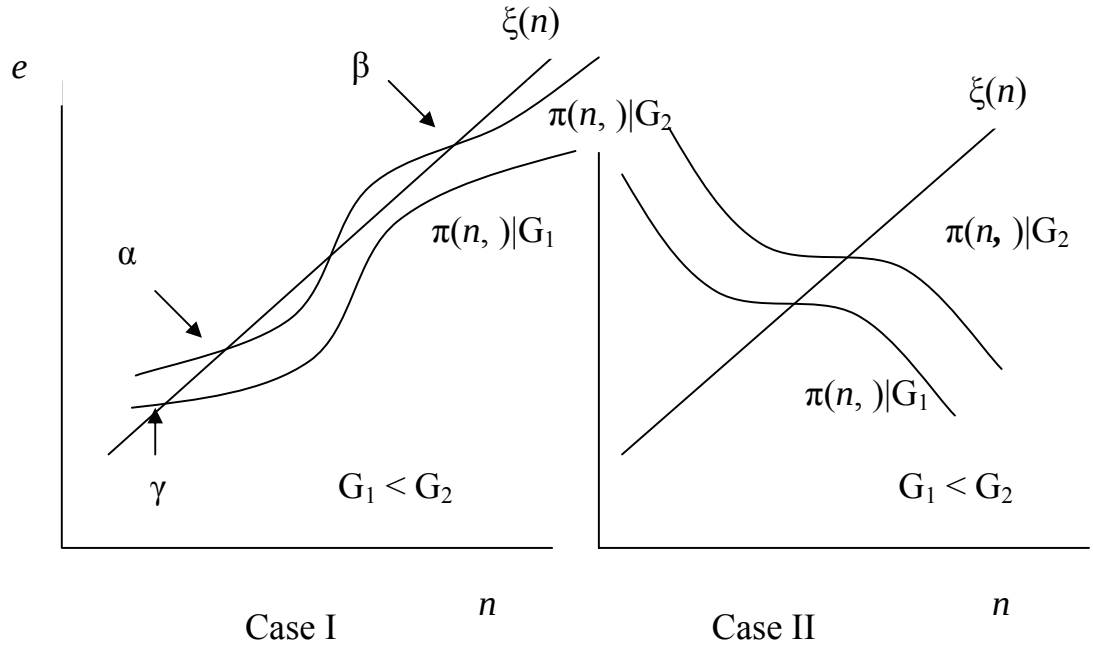


Figure 6

Finally, when the Southern wage level is (i), (ii), or (iii) and the Northern wage level is such as (b), the analysis becomes straightforward. Comparing (12) and (15), the worker will decide to migrate to the North if

$$U^N = (w^* - p^*z)ze/p \geq (1/4)(w/p)^2 = U^S \qquad (27)$$

At the equilibrium, the condition will look as follows:

$$\{w^*(n) - p^*z\}ze(n)/p = (1/4)\{w(n)/p\}^2, \qquad (28)$$

implying

$$e = \xi(n) \qquad \text{with } \partial\, \xi(n)/\partial n > 0. \qquad (29)$$

With $R = w^* - p^*z$, the effect of remittances on exchange rate is now stated as

$$e(n) = f(nR, G) = f(nw^*(n) - p^*z, G) \quad \text{with } f_1 < 0 \text{ and } f_2 > 0.$$

Differentiating $e(n)$ with respect to $n$ and utilize the Assumption 1 from section 3, we see the following relation holds:

$$e = \pi(n, G) \qquad \text{with } \pi_1 < 0 \text{ and } \pi_2 > 0 \qquad (30)$$

Combining (29) and (30) we necessarily get a unique equilibrium as in the second picture in Figure 6.

Going back to the story of Southern wage level, (i), (ii), or (iii) and a Northern wage level of (a), let us take a look at the equilibrium more carefully. In Figure 6, Case II shows the unique equilibrium which arises when the impact of remittances on exchange rate is relatively mild, so that the expression in (22) is positive. On the other hand, when the exchange rate is very vulnerable to external shocks and fluctuates much with the inflow of hard currencies, an equilibrium like Case I arises and the equilibrium may not be unique. The points $\alpha$ and $\beta$ indicate the two stable migration equilibria that arise when the government in the South is in relatively bad fiscal shape, namely, with higher G. However, when the government in the South adjusts its debt properly and uses more prudent fiscal policies, the multiple equilibria may disappear, leaving the country in a unique equilibrium point such as $\gamma$.

Getting multiple equilibria by this route actually stems from Basu and Van (1998). Though that model deals with a totally different problem, namely, child labor, if one thinks carefully, the multiple equilibria result is obtained because of target-based behavior. Children will work as long as their households fail to reach minimum subsistence income. This same idea can be used here. Targeted behavior, i.e. trying to achieve some minimal consumption, is natural for poor migrants. This objective is embedded in the utility function, (11), with $z$ being the target consumption level.

## 5. Policy Implications and Comments

The tragic circumstances that poor migrants face at home and abroad are cause for concern not only from a humanistic point of view but also to the economists. An explanation is called for as to why migrants who get paid so little in terms of real wages would still want to work in the host country or region. This paper tries to address the problem of migrants who face a seemingly two-fold suffering: first, they were so poor at home that they had to resort to migration as a way to escape from poverty; second, the low real wages paid in the host country are possibly lower than those in their own country. The puzzling migration behavior of workers can be resolved once the family is taken into consideration. One implication of this paper is that policies motivated by philanthropic ideas without proper analyses of the actual circumstances faced by migrants and their families may bring about unintended, or sometimes perfectly opposite, results.

For instance, suppose the host country initiates a law requiring equal compensation for immigrants and domestic workers with the intention of improving the real wages of immigrant workers. If unemployment pressure is present in the market and

the migrants happen to lose jobs because they are disadvantaged compared to domestic workers—perhaps due to language problems, etc.—then the situation is exacerbated for not only the workers, but their families awaiting remittances in the source country.

Another point addressed in this paper is the two-way relation between exchange rate and migration. People from developing countries make the decision to migrate based on wage differentials between countries *and* the prevailing exchange rate, since exchange rates will influence the effectiveness of remittances sent home to the family. On the other hand, the number of migrants determines the size of total remittances. A large inflow of hard currency in the form of remittances, in turn, affects the exchange rate. Equilibrium is determined when this exchange rate equalizes to the initial level, completing the endogenous exchange rate and migration story.

This possible linkage between exchange rate and migration has largely been neglected while separate discussions on the problem of migration and exchange rates abound in the host and source countries. This paper suggests another possible route through which migration level can be affected. As shown in section 4, for countries where exchange rate is vulnerable to external financial flows, multiple equilibria could result. In Figure 6, low migration with strong domestic currency, namely $\alpha$, is a perfectly possible equilibrium for a country where the current emigration rate is very high but domestic currency is weak, i.e. $\beta$. Supposing the latter equilibrium is undesirable for both the source and host countries, and the governments want to reduce the level of migration, what policies can be used for this purpose?

One way to achieve this would be to improve the fiscal stance of the Southern government. When the deficit decreases from $G_2$ to $G_1$, one of the equilibrium conditions,

namely, the $\pi(n, G)$ curve, shifts down leading to unique equilibrium results. Under the new circumstances, only the low migration equilibrium, $\gamma$, can be reached and an extremely high migration point like $\beta$ 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 government debt reduction policy is not sustainable in the long run for a developing country, once the equilibrium $\gamma$ is achieved in the short run, the economy may shift to a low migration equilibrium $\alpha$ rather than an undesirable outcome like $\beta$ even if the government debt level goes back to $G_2$ after the short run intervention ends.

This paper explored the dynamics of migration addressing the significance of remittances to developing countries. The interaction between migration and exchange rate will have to be understood in the broader context of immiserization (see Bhagwati (1958), Srinivasan and Bhagwati (1983)) and the ensuing welfare analysis.

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