

A Technical Note on the Decision of Sending Remittances: An Overlapping Generations Model on the Self-Interest Motive of Remittances¹

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The motivations to remit may be summarized into altruism and self-interest, which is composed of exchange, strategic, insurance and investment motives. Under self-interest, migrants remit so as to maximize income across time. By devising an unconventional overlapping generations model elaborating on the migrant's decision to remit, this paper draws three key findings. The amount a migrant remits increases with his level of income, given that he has a positive time preference. The level of remittances increases with the gross rate of return if the migrant is risk neutral or relatively less risk averse. Lastly, the level of remittances decreases with the depreciation of exchange rates.

Keywords: Motivations to Remit, Remittance Decisions, Self-interest, Overlapping Generations Model, Remittance Function

INTRODUCTION

There are several reasons to remit. Stark (2009) presented very specific reasons wherein remittances are sent: to diversify the migrant's income portfolio, to reduce precautionary savings of the family as well as providing them insurance in anticipation in negative economic shocks, to increase the migrant's bequest/inheritance from his parents (wherein remittances are sent to "purchase" the parents' gratitude), altruism, and to enhance the status and living standard of the family. Rapoport and Docquier (2005), as well as Tullao and Cabuay (2011b), summarized these

motivations as altruism, exchange, strategic, insurance, and investment. Although, in general, remittances are sent because of either mutual concern (hence altruism) or self-interest (all the other motivations).

The model presented in this study is based only on the motive of investment which is a motive of self-interest (as opposed to the altruistic motive). Families send migrants in order to increase their wealth in the long run (Alba & Sugui, n.d., as cited in Tullao & Cabuay, 2011b) as well as to make use of interspatial differences in purchasing power so as to maximize income and spread out risk by sending remittances, which may be considered an

action of diversifying the household's portfolio (Stark, 2009; Rapoport & Docquier, 2005). The cost of migration itself is considered part of the investment and the objective therefore of remittances according to the investment motive is (1) to repay the loan that was given to finance the migration (transportation, lodging and intermediary costs) (Tullao & Cabuay, 2011a), and (2) eventually serve as the avenue of increasing the migrant's income in the long run (Tullao & Cabuay, 2011b) should he choose to return to the home country. The first objective entails that the migrant provides a transfer for his family in order to repay the costs of migration or its prerequisites: educational attainment, experience in occupations, and credentials that increases the employability of the individual (Tullao & Cabuay, 2011a). The family may use the transfer for their own ends such as smoothen their own consumption or raise their standard of living (Jongwanich, 2007; Yang & Martinez, 2005).

This study investigates three interesting propositions regarding:

1. The mechanism as to how and why the *time preference* of the migrant can *increase* his remittance transfer given an *increase in his income*.
2. The mechanism as to how and why the *relative risk aversion* of the migrant can determine how his remittance decision will *respond* to a change in the *rate of return*.
3. The mechanism as to how and why a *depreciation* in the *exchange rate* can *decrease* the amount remitted by the migrant.

THE OVERLAPPING GENERATIONS MODEL

There are two countries: country h and country f which represent the home and foreign country

respectively. There are two periods in the lifetime of the migrant. In the first period, the migrant, who is still young, is sent to work in the foreign country and is given an exogenous income y_t^f (read as the income at time t in country f), which is the prevailing wage in f . Upon receiving his payment, the migrant is faced with the decision of how much will be allocated for his present consumption at time period c_t^f and how much to send back to country h as transfers \bar{T} (as repayment for the cost of migration that his family initially shouldered) and the remaining amount: the exchange rate and price-adjusted remittance $e \frac{M_t}{P_t^h}$, that will be invested in certain financial assets with rate of return r_t which the migrant is supposed to receive in the future if he chooses to go home. Notice that the remittance transfer is divided by P_t^h , the price index of goods in country h at time t which represents the opportunity cost of the migrant's remittances in terms of goods in country h . In the second period, the migrant is now old and the amount he remitted in the first period will be expressed as $e \frac{M_t}{P_{t+1}^h}$ wherein P_{t+1}^h is the price index of goods in country h at time $t+1$. His future consumption therefore depends on the exchange rate-adjusted remittance he sends, the rate of return of his investment and the probabilistic nature of his choice to go home or stay in the foreign country. Should he choose to go home, the migrant avails of the entire amount of his investment, but should he choose to stay, the amount of his investment is charged a fee for remittance transfer.

The following assumptions are further imposed:

1. There is a given probability π , such that $0 \leq \pi \leq 1$, that the migrant will return to country h to reap the full benefit of his investment, which implies that $1 - \pi$ is the probability that he will stay in f where he must pay the cost of remittance transfer again to get back his investment. The probability is considered a parameter and

- does not require a specific distribution.
2. The initial cost of migration is not taken into account in this model, however, the migrant will repay the initial investment through a lump-sum transfer T_t , which is assumed to be equal to the initial cost of migration and will then be used by the migrant's family to smoothen consumption or for whatever purpose they assign the transfer to serve. It is further assumed and strictly imposed that $\bar{T} < y_t^f$, or that the transfer cannot be larger than income of the individual.
 3. There is a cost of remittance transfer λ , such that $0 \leq \lambda \leq 1$, which is a proportion of the exchange-rate-adjusted amount that the migrant is going to send eM_t .
 4. Labor supply is exogenous which implies that the nature of service the migrant renders is homogenous. For simplicity, the model assumes that the migrant inelastically supplies one unit of labor to country f given an exogenously determined wage w , so $y_t^f = lw$, wherein $y_t^f = w$, hence income is exogenous.
 5. Exchange rates and interest rates are exogenous and are not subject to any shock or fluctuation. Furthermore, the economy is running on a fixed exchange rate regime (hence the e term), and that there is perfect capital mobility (hence $r_t = r_{t+1}$). This implies that only intertemporal choices are considered, and interspatial differences are ruled out.
 6. The migrant is now old and retires in the second period so there is no income in this period (y_{t+1}^f), and all the migrant's consumption depends on the returns of his investment in the first period.

The utility of the migrant therefore follows the overlapping generations form:

$$U_t = U(C_t) + \frac{1}{1+\rho} \left(\pi U(C_{t+1}^h) + (1-\pi)U(C_{t+1}^f) \right) \quad (1)$$

$$U_t = \frac{1}{1-\theta} C_t^{1-\theta} + \frac{1}{1+\rho} \left[\pi \left(\frac{1}{1-\theta} C_{t+1}^{h,1-\theta} \right) + (1-\pi) \left(\frac{1}{1-\theta} C_{t+1}^{f,1-\theta} \right) \right] \quad (2)$$

$$\theta \geq 0 \quad \rho > -1 \quad 0 \leq \pi \leq 1$$

wherein the periodical utility functions take CRRA form. The parameter θ represents the reciprocal of the elasticity of intertemporal substitution which measures the curvature of the indifference curve. If θ is equal to zero, the indifference curves are straight lines and there is no form of consumption smoothening. This also implies that the current period utility is linear and that the migrant is risk neutral. As θ approaches infinity, the indifference curves become right angles and the consumption at the two time periods become perfect complements. This also implies that the consumer is risk averse. Generally, if θ is smaller, the more the migrant is willing to vary his consumption over time (Romer, 2001) since this implies that the marginal rate of substitution diminishes slower.

The parameter ρ represents the discount factor and reveals the preference of the migrant with regard to the timing of his consumption. In a way, it serves as the impatience parameter wherein if $\rho > 0$ and increasing, the value of his future consumption to his lifetime utility is smaller, and it is said that he prefers present over future consumption. If $\rho < 0$ but $\rho > -1$, then the value of his future consumption to his lifetime utility is larger and increasing, and it is said that he prefers future over present consumption.

This is subject to a three-part budget constraint: one part when the migrant is young and is working in country f in the first period, and two parts in the second period where there is the possibility of going back to h and the possibility of staying in f , given by the following:

$$\text{when young:} \quad y_t^f = C_t^f + (1-\lambda) e \frac{M_t}{P_t^h} + \bar{T} \quad (3)$$

$$\text{when old and returning to } h, \quad C_{t+1}^h = (1+r_{t+1}) e \frac{M_t}{P_{t+1}^h} \quad (4)$$

given $\pi > 0$:

$$\text{when old and staying in } f, \quad C_{t+1}^f = (1-\lambda)(1+r_{t+1}) e \frac{M_t}{P_{t+1}^h} \quad (5)$$

given $1 - \pi > 0$

where y_t^f is the income of the migrant in payment of his services in country f . In the first period (3), he allocates his income between his current consumption c_t^f , the amount he remits subject to the cost of remittance transfer $(1-\lambda)e \frac{M_t}{P_t^h}$, and his transfer \bar{T} to his family in repayment of the initial cost of migration.

In the second period, the migrant retires and will either go back to h or stay in f depending on π . If he goes home (4), his consumption C_{t+1}^h will be financed by his realized return $(1+r_{t+1})e \frac{M_t}{P_{t+1}^h}$. If he decides to stay (5), he will need to recall his period 1 investment and will be subject again to the cost of remittance transfer λ , and hence his net realizable amount will be $(1-\lambda)(1+r_{t+1})e \frac{M_t}{P_{t+1}^h}$ which will finance his consumption C_{t+1}^f . For simplicity in solving the model, R_{t+1} will represent the gross interest rate, $1+r_{t+1}$. By isolating c_t^f , C_{t+1}^h , and C_{t+1}^f in the budget constraints, and substituting them into the utility function of the migration turns the problem into an unconstrained optimization given by:

$$\begin{aligned} \text{Max}_{M_t} (M_t) = & \frac{1}{1-\theta} \left[y_t^f - (1-\lambda) e \frac{M_t}{P_t^h} - \bar{T} \right]^{1-\theta} + \frac{1}{1+\rho} \frac{\pi}{1-\theta} \left[R_{t+1} e \frac{M_t}{P_{t+1}^h} \right]^{1-\theta} \\ & + \frac{1}{1+\rho} \frac{1-\pi}{1-\theta} \left[(1-\lambda) R_{t+1} e \frac{M_t}{P_{t+1}^h} \right]^{1-\theta} \end{aligned} \quad (6)$$

wherein the utility function is no longer a function of the migrant's consumption, but is implicitly determined by the amount he remits M_t . This gives an interesting implication that in his quest for utility maximization, the migrant ultimately chooses the amount he remits which is then the basis of his consumption, that is, he chooses the amount he remits first depending on his intertemporal consumption preference (which will be larger if he prefers future over present consumption and vice versa) and adjusts his present consumption accordingly.

KEY RESULTS AND SOME USEFUL CONCLUSIONS

Taking the first order derivative of the migrant's utility function with respect to M_t :

$$\begin{aligned} \frac{dU}{dM_t} = & \left[y_t^f - (1-\lambda) e \frac{M_t}{P_t^h} - \bar{T} \right]^{-\theta} \left(-(1-\lambda) \frac{e}{P_t^h} \right) + \frac{\pi}{1+\rho} \left[R_{t+1} e \frac{M_t}{P_{t+1}^h} \right]^{-\theta} \left(R_{t+1} \frac{e}{P_{t+1}^h} \right) \\ & + \frac{1-\pi}{1+\rho} \left[(1-\lambda) R_{t+1} e \frac{M_t}{P_{t+1}^h} \right]^{-\theta} \left((1-\lambda) R_{t+1} \frac{e}{P_{t+1}^h} \right) = 0 \end{aligned} \quad (7)$$

and the second order derivative to show that the solution is a maximum is found in the appendix.

Deriving M_t from (7) gives the Euler equation of remittance decision:

$$M_t^* = \frac{\left((1-\lambda) \frac{e}{P_t^h} \right)^{-\frac{1}{\theta}} (y_t^f - \bar{T})}{\left[\frac{\pi}{1+\rho} \left(R_{t+1} \frac{e}{P_{t+1}^h} \right)^{1-\theta} + \frac{1-\pi}{1-\rho} \left((1-\lambda) R_{t+1} \frac{e}{P_{t+1}^h} \right)^{1-\theta} \right]^{\frac{1}{\theta}} + \left((1-\lambda) \frac{e}{P_t^h} \right)^{\frac{\theta-1}{\theta}}} > 0 \quad (8)$$

which is a function of the migrant's income y_t^f , the lump-sum transfer \bar{T} , the gross interest rate R_{t+1} , the price indices of goods in country h for the first period P_t^h and the second period P_{t+1}^h , and the exchange rate e , and is positive given that all exogenous variables are positive, and that $y_t^f > \bar{T}$, $\theta \geq 0$, $\rho > -1$, $0 \leq \pi \leq 1$, and $0 \leq \lambda \leq 1$.

Proposition 1. *Given a migrant's time preference and holding all other factors constant, the remittance a migrant sends increases with the income he earns (proof in Appendix).*

The remittance a migrant sends increases with his earnings given that his time preference is intertemporally consistent such that he prefers future over present consumption, because if his future consumption contributes more utility, then being able to consume more in the future will yield higher utility, so he will choose to save and invest more in the present so he can consume more in the future.

Proposition 2. *Given a migrant's time preference and holding all other factors constant, a risk-neutral (or less risk-averse) migrant's remittances increase with the gross rate of return, whereas a more risk-averse migrant's remittances decrease with the gross rate of return (proof in Appendix).*

The remittance a migrant sends increases with the rate of return given that he exhibits relative risk neutrality and intertemporally consistent time preference such that he prefers future over present consumption, because in order to derive higher utility, future consumption must be higher, and so a higher rate of return will yield a higher realizable return so a migrant will increase his remittance but only if he is willing to take risks in his investment, although in the model, there are no shocks in the interest rate that will make migrants think twice. Furthermore, the transmission mechanism of how an increase in the rate of return enhances the migrant's utility level may be attributed still to consumption. Given these factors, a migrant will need to choose how much to remit, depending on his given time preference and risk aversion, but he will simultaneously choose the level of his consumption, which will then directly affect his utility for any given time period.

Proposition 3. *Holding all other factors constant, a larger exchange rate (i.e. the ratio of h currency equivalent to a unit of f currency) will constitute a lower level of remittances (proof in Appendix).*

The depreciation of exchange rates, or rather the larger the value of the foreign currency in terms of the home currency, will induce the migrant to remit less because given particular specifications about his risk aversion and time preference, he could afford to remit less in order to cater to his time preference of consumption because foreign currency is now valued more in terms of the home currency. He is free to decrease his remittance just to reach the value eM_t which requires more M_t given a lower/appreciated e .

APPENDIX

Second-order Derivative of (6)

Taking the second-order derivative of (6):

$$\begin{aligned} \frac{d^2U}{dM_t^2} = & (-\theta) \left[y_t^f - (1-\lambda)e \frac{M_t}{P_t^h} - \bar{T} \right]^{-\theta-1} \left(-(1-\lambda) \frac{e}{P_t^h} \right)^2 \\ & + (-\theta) \left(\frac{\pi}{1+\rho} \right) \left[R_{t+1} e \frac{M_t}{P_{t+1}^h} \right]^{-\theta-1} \left(R_{t+1} \frac{e}{P_{t+1}^h} \right)^2 \\ & + (-\theta) \left(\frac{1+\pi}{1+\rho} \right) \left[(1-\lambda) R_{t+1} e \frac{M_t}{P_{t+1}^h} \right]^{-\theta-1} \left((1-\lambda) R_{t+1} \frac{e}{P_{t+1}^h} \right)^2 < 0 \end{aligned}$$

Note that the second order derivative is negative given that all exogenous variables (y_t^f , T_t , e , R_{t+1} , P_t^h , P_{t+1}^h) are positive, and that $y_t^f - (1-\lambda)e \frac{M_t}{P_t^h} - T_t$ is positive because $y_t^f > (1-\lambda)e \frac{M_t}{P_t^h} + T_t$ due to the fact that the remittance and the transfer are part of the migrant's income he allocates; therefore, the solution is a maxima.

Proof of Proposition 1

First, note that the remittance sent by the migrant increases if his time preference leans toward future consumption $\frac{\partial M_t}{\partial \rho} < 0$ given by $\frac{\partial M_t}{\partial \rho} =$

$$\frac{P_t^{h^2} (\bar{T} - y_t^f) \left(\frac{(1-\lambda)}{P_t^h} \right)^{\frac{1}{\theta}} \left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)^{\frac{1}{\theta}}}{P_{t+1}^h (1+\rho)}}{\theta(1+\rho) \left(P_t^h \left(\frac{(1-\lambda)e}{P_t^h} \right)^{\frac{1}{\theta}} + e(1-\lambda) \left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)^{\frac{1}{\theta}}}{P_{t+1}^h (1+\rho)}} \right)^2 \right)^2}$$

which is negative because $(\bar{T} - y_t^f) < 0$, and all other terms are positive. This implies, therefore, that when ρ increases, remittances decrease because the tendency of the migrant is to favour present over future consumption, hence favouring present consumption over remitting and investing. The opposite is true if ρ is decreasing such that $\rho < 0$ but $\rho > -1$, which implies that the migrant prefers future over present consumption, hence favouring remitting and investing over present consumption.

Given this relationship, should the migrant have a lower ρ (future consumption has a larger value to his utility) such that $\rho < 0$ but $\rho > -1$, analyzing the comparative statics of how M_t responds to a change in y_t^f given by $\frac{\partial M_t}{\partial y_t^f}$:

$$= \frac{\left((1-\lambda) \frac{e}{P_t^h} \right)^{\frac{1}{\theta}}}{\left[\frac{\pi}{1+\rho} \left(R_{t+1} \frac{e}{P_{t+1}^h} \right)^{1-\theta} + \frac{1-\pi}{1-\rho} \left((1-\lambda) R_{t+1} \frac{e}{P_{t+1}^h} \right)^{1-\theta} \right]^{\frac{1}{\theta}} + \left((1-\lambda) \frac{e}{P_t^h} \right)^{\frac{\theta-1}{\theta}}}$$

which is *positive* because all exogenous variables are strictly positive, indicating that there is a positive relationship between remittance transfers and income. Therefore, remittances increase alongside income.

Proof of Proposition 2

Note that the remittance sent by the migrant increases if his time preference leans toward future consumption $\frac{\partial M_t}{\partial \rho} < 0$ (As proven previously). Given a lower ρ , analyzing the comparative statics of how M_t responds to a change in R_{t+1} given by $\frac{\partial M_t}{\partial R_{t+1}}$:

$$P_t^{h^2} (\bar{T} - y_t^f) (-1 + \theta) \left(\frac{(1-\lambda)e}{P_t^h} \right)^{\frac{1}{\theta}} \left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)}{P_{t+1}^h (1+\rho)} \right)^{\frac{1}{\theta}}$$

$$= \frac{\theta R_{t+1} \left(P_t^h \left(\frac{(1-\lambda)e}{P_t^h} \right)^{\frac{1}{\theta}} + e(1-\lambda) \left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)}{P_{t+1}^h (1+\rho)} \right)^{\frac{1}{\theta}} \right)^2}{\left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)}{P_{t+1}^h (1+\rho)} \right)^{\frac{1}{\theta}}}$$

will only be positive for all exogenous variables are positive and if the $(\bar{T} - y_t^f) (-1 + \theta)$ terms in the numerator are positive. Notice that $(\bar{T} - y_t^f) < 0$ since $y_t^f > \bar{T}$, and $(-1 + \theta)$ will only be negative if $0 \leq \theta < 1$ and so $(\bar{T} - y_t^f) (-1 + \theta)$ will be positive resulting to $\frac{\partial M_t}{\partial R_{t+1}} > 0$. If it is not the case that $0 \leq \theta < 1$, or that $\theta > 1$, then $(-1 + \theta)$ will be positive, $(\bar{T} - y_t^f) (-1 + \theta)$ will be negative, resulting to $\frac{\partial M_t}{\partial R_{t+1}} < 0$. But it is known that when the value of θ approaches 0, the migrant is willing to let his consumption vary over time and is said to be relatively risk neutral; and if θ approaches ∞^+ , the migrant is said to be risk averse. This implies therefore, that only when the migrant is relatively risk neutral, such that $0 \leq \theta < 1$, can $\frac{\partial M_t}{\partial R_{t+1}} > 0$, otherwise, when he is risk averse, such that $\theta > 1$, $\frac{\partial M_t}{\partial R_{t+1}} < 0$.

Proof of Proposition 3

The proof for this is straightforward and does not need any supporting statements or conditions. Analyzing the comparative statics of how M_t responds to a change in e given by $\frac{\partial M_t}{\partial e}$:

$$\begin{aligned}
 & - \left[P_t^h (\bar{T} - y_t^f) \left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)^{\frac{1}{\theta}}}{P_{t+1}^h (1+\rho)} \right) \right] \\
 = & \left(e(-P_t^h) \left(\frac{(1-\lambda)e}{P_t^h} \right)^{\frac{1}{\theta}} - e(1-\lambda) \left(\frac{eR_{t+1} \left(\pi \left(\frac{eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} + (1-\pi)(1-\lambda) \left(\frac{(1-\lambda)eR_{t+1}}{P_{t+1}^h} \right)^{-\theta} \right)^{\frac{1}{\theta}}}{P_{t+1}^h (1+\rho)} \right) \right)
 \end{aligned}$$

which is negative for all exogenous variables are strictly positive. Notice in the numerator that the term $(\bar{T} - y_t^f) < 0$ since $y_t^f > \bar{T}$, which means that the numerator is positive. Notice however that the denominator is comprised of all negative values. This implies that remittances and the exchange rate have an inverse relation: as the exchange rate (the ratio of h currency to f currency) increases (depreciates), remittances from f to h will decrease.

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