THE IMPACT OF WESTERN UNION® AGENT LOCATIONS:

A CASE STUDY OF REMITTANCES IN THE PHILIPPINES

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January 2015

Abstract

The purpose of this study is to estimate how Western Union remittances have impacted the economy and household welfare for recipient countries. The report uses quantitative economic techniques, such as Input-Output and CGE modeling, to quantify and characterize how remittance transfers alter incomes, wages, and employment. The Philippines is used as an example case for this exercise.

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BACKGROUND

How remittances impact a country, and whether all members of the country benefit from remittances, has become a highly debated subject since the early 2000s. At that time, foreign transfers from migrant workers to their families back home began to grow rapidly to eventually become a substantial source of hard currency for some developing countries.

While it is undeniable that remittance transfers help alleviate poverty and that they smooth household consumption among the recipients, some studies suggest that, on average, remittances do not promote economic growth and in some situations can even cause economic growth to decline.

The underlying theory behind this claim is that the transfers contribute to the "Dutch disease," where foreign currency inflows cause currency appreciation, thereby placing export-intensive businesses at a disadvantage. Additionally, detractors suggest that outside funds serve to weaken the incentive to work, which effectively shrinks the labor pool and shifts the nation's production possibilities frontier inward.

Despite the worrisome academic findings, most recipient nations behave in a way that suggests there are benefits from remittance inflows. Our analysis shows that there exist both positive and negative externalities related to foreign workers abroad who remit funds back to their home country. An important distinction of this study is that we *quantify* the relative magnitude of each effect, both positive and negative, as it occurs within the economy. This is done using a customized general equilibrium model that has been calibrated to represent the Philippines' economy.

We find that the benefits related to remittances are larger than the costs, at least in the short and medium term. In the long term, economic growth is a function of government policies more than external conditions. Good policies that encourage capital accumulation and labor productivity will leverage the potential benefits of rtable emittances, whereas poor policymaking can have the opposite effect, allowing remittances to increase prices and discouraging capital accumulation.

REMITTANCE LITERATURE

The role that remittances and household transfers play in poverty alleviation, economic growth and development receives considerable attention among development economists and international research agencies. The size and depth of remittances has grown eight times faster than the world economy since 2000, a clear sign that migration and international money transfers have become a clear manifestation of globalization.

However, there is significant controversy among researchers about how these remittances have impacted the families who receive them and how they impact the overall economy. Few people contest the fact that money transfers help to smooth consumption for families who receive them and that these transfers have helped to alleviate poverty among the poorest recipients.

The overall effect is less clear from a macroeconomic standpoint. For small and poor countries, these transfers represent a welcome inflow of hard currency. In Tajikistan, for example, remittances represent 50 percent of the nation's GDP and 90 percent of their foreign reserves. This stabilizes the country's currency and helps the government to maintain lower interest rates—both of which are essential elements to promote business investment.

Economics researchers are becoming more skeptical about the size of benefits over time as cross-sectional data have shown a weak relationship between the size of international remittances and the rate of economic growth for a developing economy. A study from 2009 by Barajas et al. collected data for a large cross section of developing countries, then compared their GDP performance against the size of remittances into the country. They find that remittances cannot be linked to the rate of growth and that often the long-term rate of growth is lower for countries with larger remittances. Importantly, the researchers acknowledge the fact that worker migration is larger for those countries that are growing slowly, simply because ambitious workers will seek out the highest returns for their time and effort. This creates an important endogeneity between remittances and slow growth. It is unclear whether remittances lead to slower growth, or if slow growth has encouraged emigration, causing larger remittances.

METHODOLOGY

This study aims to provide a more concrete, quantified example of how remittances impact a recipient economy when considering both the recipients, as well as the welfare of nonrecipients. To do this, we employ two types of quantitative analysis: input-output modeling, and general equilibrium modeling.

Input-Output Modeling[1]

Input-output (I-O) modeling is a simple and convenient way to describe how external spending flows through an economy. Those flows are then tied to employment/output ratios in order to provide a number for the total employment effects generated by external spending. I-O modeling has been used for more than 50 years to characterize spending impacts, and it is well documented.

In an I-O framework, a national input-output table is used to show where household spending flows. This spending will be split between local services, locally produced goods, imported goods, and savings. The input-output table reveals how much each category receives. Spending on local goods and services contributes to local output and employment; this is called the "direct effect" of household spending. But in addition, there is an indirect effect caused by follow-on spending by the recipients and employees.

[1]A full technical description of input-output modeling is provided in Annex B.

Local shop owners and factory employees receive a portion of the original spending, and they go on to spend money as well, leading to a follow-on effect called the "indirect effect." When combined, the direct and indirect effect represent the total effect of how an external source of funds is spent by households in the recipient economy. Output to employment ratios are then used to calculate the number of jobs that would be created by the additional production in the economy.

This I-O approach is a convenient and simple method to estimate the basic employment and output effects that would be created by remittances flowing into a country. But for many important facets of economic life, such as wages, real incomes, consumer prices and household welfare, a more sophisticated approach is needed.

CGE Modeling

Computable general equilibrium (CGE) modeling is more difficult and more complicated than I-O modeling, but in return for the added complexity, CGE models provide information about key economic behavioral impacts. The most obvious is price impacts that cannot be determined using I-O models.

A CGE model is used in this report to determine the effect of remittances upon wages and household welfare. As discussed in the literature section, remittances tend to reduce labor force participation among recipients. A pessimistic view is that potential workers decide to simply remain home rather than work. A more realistic view is that remittance recipients who are young use the funds to stop working and attend school, or to spend more time raising their children. Older workers may stop working and instead depend upon remittances as a supplement to their pensions. In either case, this reduces the total labor supply and exerts upward pressure on wages for the entire market. Higher wages are good for workers, but also make production more costly and will make some exporters less competitive, on the margin. Complex interactions such as these can only be determined using a general equilibrium model.

CGE models are also the best tool for tax and policy analysis. In this case, the model is used to assess the impact of government taxation of remittances. Because they are a steady source of foreign exchange, foreign remittances are an attractive potential tax revenue source. However, because several alternatives to formal remittance channels exist, even a small tax can potentially lead the remittance market into informal channels that are untaxed. The CGE model is used to assess how large the diversion would be and the likely tax-yield that governments may expect from such a tax.

Finally, the CGE model can be used to assess how remittances ultimately impact household welfare—both for recipient households and nonrecipient households. Welfare, or consumption, is ultimately the benchmark that should be used to measure how government policies and global trends impact a country's people. GDP and employment are useful but incomplete indicators of household welfare itself. The welfare impact of Western Union remittances in the Philippines is computed using the Remittance-CGE (R-CGE) model developed specifically for this purpose.

Complete documentation of the CGE model and of the input-output coefficients used for this report are both included as annexes at the end of the report.

OVERVIEW: REMITTANCES AND THE PHILIPPINES

Any interested reader of this report would know that global migration, and the corresponding global remittance flows, have grown dramatically since the 1990s.

Figure 1 : Personal Remittances Compared to Foreign Direct Investment (FDI) and Net Official Devlopment Assistance to Low and Middle Income Countries

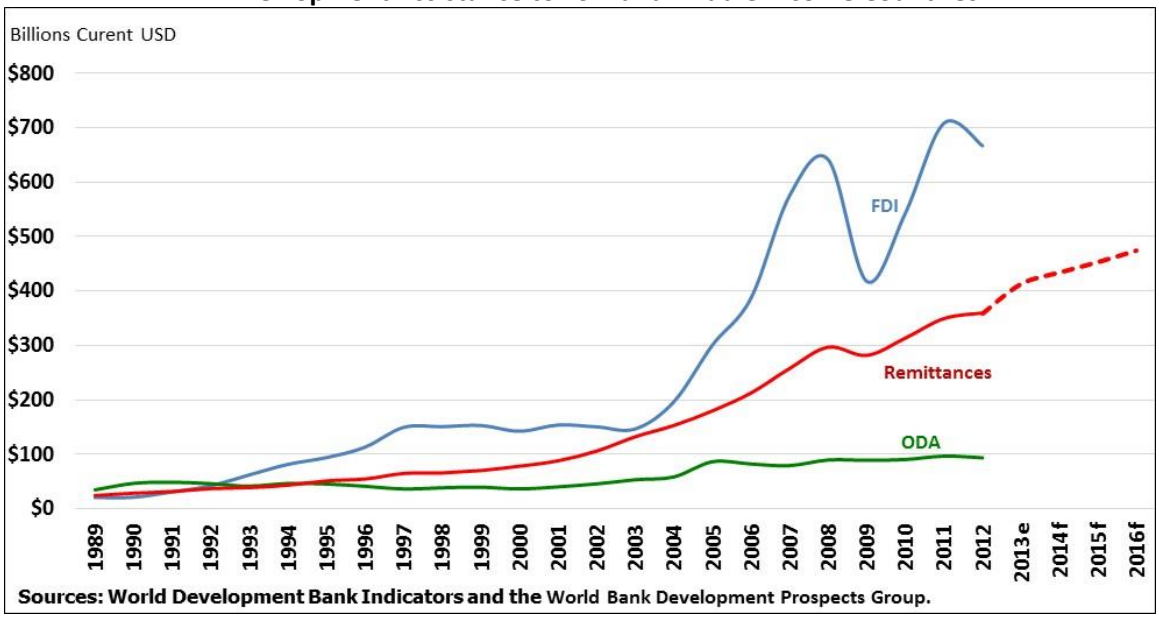
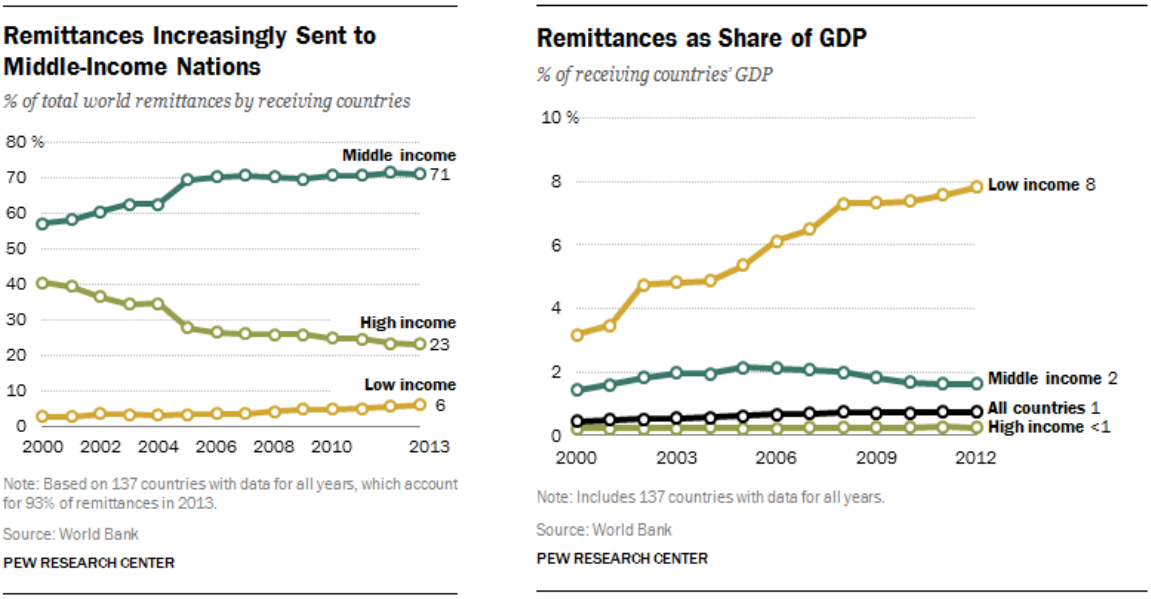


Figure 1 shows how remittance flows have become the second-largest, and most stable, source of foreign currency and development assistance worldwide. This is different from the world in 1990, when international development funds were the world's largest source of aid. Official development assistance was twice as large as either remittances or foreign direct investment (FDI) at that time.

However, as trade, the Internet and globalization evolved, development assistance was quickly outpaced by FDI flows and remittances. While FDI flows are large, they are also volatile. FDI inflows can grow or decline sharply year to year based upon financial markets. Remittances are shown to be far more stable. While they can grow or shrink, the rate of change is less volatile than for FDI.

Figure 2: Recipients of Remittance Flows: 2000–2013



By tracing the source and destination of remittances worldwide, the PEW Research Center found that most remittances flow to middle-income countries, defined as countries with per capita national income between $1,036 and $12,615 in 2012 dollars. Seventy-one percent of funds flow to middle-income countries compared to 23 percent for high-income countries and just 6 percent for low-income countries.

Although only 6 percent of remittances flow to low-income countries, these remittances often represent a large share of GDP for those countries. Overall, remittances were equal to 8 percent of total GDP for low-income countries compared to only 2 percent for middle-income and less than 1 percent for high-income countries. Remittances grew from just 3 percent of GDP for low-income countries in 2000 to 8 percent in 2012.

Remittance Service Prices

The World Bank notes in its September 2014 *Remittance Prices Worldwide* issue[2] that the general trend worldwide is toward lower official transmission rates. The global average transmission rate fell below 8 percent for the first time in Q4 2014, to 7.9 percent. This compares to a rate of 8.93 percent in Q3 2013. As the rate of formal services declines, senders will increasingly utilize formal mechanisms, due to higher convenience and security, compared to informal channels.

[2]See http://remittanceprices.worldbank.org/ for the latest issue of the World Bank publication.

Figure 3: Weighted Average Cost of Remittances: Worldwide and for East Asia (2008–2014)

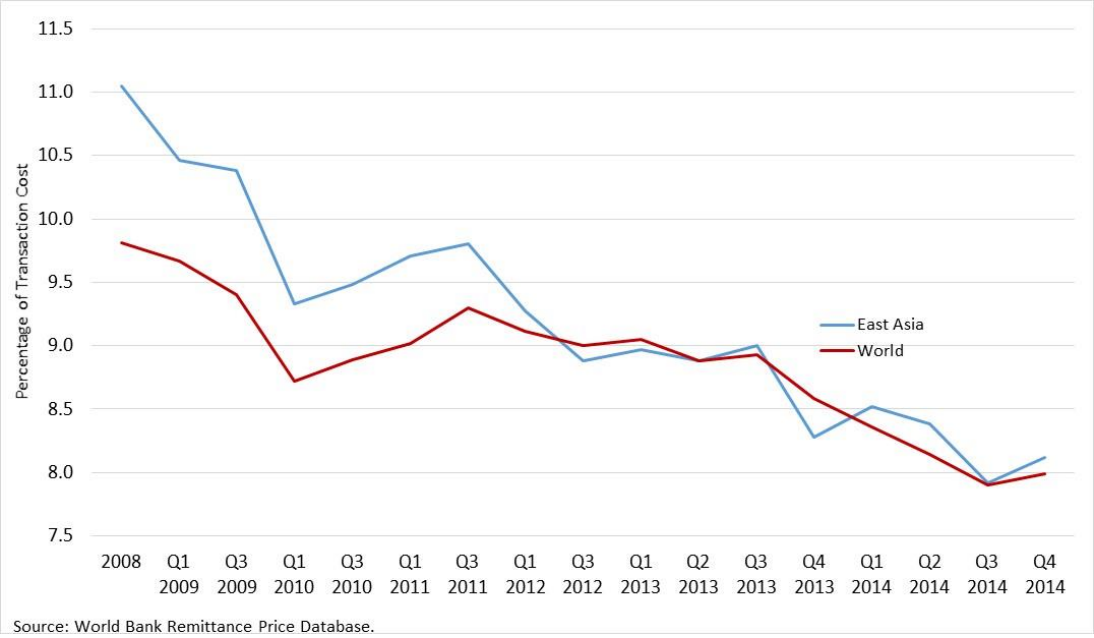


Figure 3 highlights the rapid decline in average remittance prices. The chart shows the world average remittance price as it declines from 9.8 percent of the transaction cost to less than 8 percent. The average remittance cost has declined more dramatically specifically for East Asia, where the Philippines is located. In this region, average formal remittance prices were above 11 percent in 2008 before falling to below 8 percent in 2014. This is a reduction of 3 percent, or about 27 percent over six years.

Remittances to the Philippines

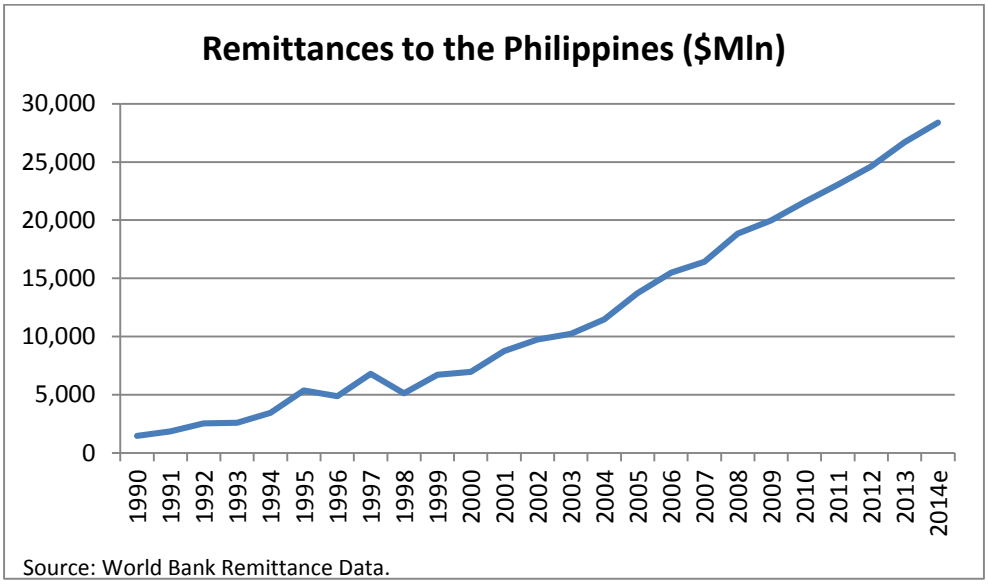
Remittance inflows to the Philippines have grown from $1.46 billion in 1990 to $26.7 billion in 2013, and are expected to be $28.4 billion in 2014.[3] Remittances were equal to 9.3 percent of national GDP in 2013. The Philippines registered the third-highest total remittances in the world in 2012 according to the IMF. Total official remittances (classified by the IMF as BPM6) were $26 billion. Only China and India, with much larger populations, had higher total remittance levels.

Remittances are well known to be a key component of the Philippine's economy. The country actively encourages international migratory work, and the government has a national agency dedicated to the support and facilitation of international migratory work and incomes.[4]

[3]Source: World Bank Remittance Data – Inflows, published October 2014, http://go.worldbank.org/092X1CHHD0.

[4]The office is called the Overseas Employment Administration.

Figure 4: Remittances Inflows to the Philippines - Growing from US$1.4 Billion in 1990 to US$28.4 Billion in 2014.



These figures represent officially transmitted remittances only. According to a report by the Asian Bankers Association and the Central Bank of the Philippines, informal remittances may contribute another 30–40 percent of foreign currency flows into the country, above the level of official transfers.

The Central Bank and other bankers dislike any proliferation of informal remittance agents who transfer funds through informal channels for lower fees than formal banks and transmission services can charge. However, informal transmissions may begin to slow as the cost of formal remittance costs declines.

Western Union Facilitated Remittances in the Philippines

Western Union is one of the largest single remittance entities in the Philippines. There are approximately 8,500 Western Union® Agent locations across the country.

THE ECONOMIC IMPACT OF REMITTANCES IN THE PHILIPPINES

The complex interaction between remittances and economic welfare can be sorted out using I-O and CGE modeling techniques. In this section, we quantify the impact of remittances, particularly Western Union remittances, on employment, wages, incomes, and welfare for the Philippines. The estimates are made at the national level.[5] The CGE model is also used to calculate what would happen if the Philippine government decided to apply a tax on formal remittance transmissions. First, the section begins by calculating the employment impacts.

Employment Impacts

The most straightforward effect to estimate is the employment effect. Economic "multiplier analysis," which is based upon national I-O tables, is used for this purpose. The Philippines National Economic and Development Authority (NEDA) has developed an I-O table and the corresponding output multipliers that can be used to establish an estimate of employment generated by a typical household's spending in the Philippines.

Using the I-O multipliers from the NEDA analysis, it is shown that every ₱100 spent by households generates ₱223 of additional output. Next, we use the average output to employment ratio for each category of spending by households. The typical household spending pattern is shown in Annex B, Table 6. For each sector that receives additional remittance spending, the labor share of output for that sector is used to compute how many new jobs are created.

Next, the level of remittances flowing through Western Union offices is used to compute the additional spending that occurs by the households that receive the remittance funds. On average, each Western Union affiliate office transmits ₱23.2 million in remittances ($552,941 USD). Using multiplier analysis, this ₱23.2 million in additional spending creates an additional ₱51.7 million in national output. This level of additional output is sufficient to support an additional 85 full-time jobs; most of these jobs are created in the area where the office is located.

[5]Regional and local level effects are possible in some cases, provided sufficient local area data is available.

Table 1: Spending Pattern for Average Households and the Related Employment Associated with Spending within each Sector

Sectoral Share of Household expenditures*	Share (%)	Employment by Sector**	Weighted Employment
Agriculture, Fishery and Forestry	8%	115,136	9,211
Mining and Quarrying	0%	227,861	0
Manufacturing	8%	430,785	34,463
Construction	9%	286,088	25,748
Electricity, Gas and Water	11%	186,005	20,461
Transportation, Storage and Communication	7%	348,762	24,413
Wholesale and Retail Trade	19%	504,821	95,916
Finance	0%	338,807	0
Real Estate	14%	387,000	54,180
Private Services	16%	572,637	91,622
Government Services	8%	114,325	9,146
Total Spending:	100%		365,159

Source: 2006 Social Accounting Matrix of Philippines.
**Employment by Sector source: Dumaua (2010), National Economic and Development Authority. See Table #7: Employment Multiplier Effect.

The average contribution of 85 jobs by each Western Union affiliate can be combined to find the total contribution of Western Union remittances for employment nationwide. At the end of 2012, approximately 8,500 affiliate offices were operating in the Philippines, which transmitted almost 25 percent of all remittances for the country and for which the subsequent spending by recipients generated approximately 720,825 full-time jobs in the country.

Table 2: Employment Effects of Western Union Affiliate Remittances for the Philippines (2012)

On average, ONE Western Union Affiliate finances the employment for:	**85**	*Full-time jobs in the local area*
There are	**8,500**	*Affiliate Offices in Philippines*
Combined, Western Union based remittances finance	**720,825**	*Full-time jobs in the Philippines*

Source: Based upon I-O derived employment multipliers derived by the National Economic and Development Authority (NEDA). See report for calculations.

Income and Welfare Effects

Although total economic growth and employment are often the focus of most policymakers, economists are more concerned with welfare, income, and how this income is distributed. Remittances are sometimes highlighted as something that is good for the recipients only and that are harmful to nonrecipients. While there is cause for concern, the net impact upon nonrecipients depends upon multiple impacts. The size and importance of each impact depends upon the specific economy and upon national economic policies. The R-CGE model provides an excellent tool to identify these impacts and to combine them simultaneously so that a net effect can be found.

In theory, remittances may be harmful to nonrecipients because the remittance spending exerts upward pressure upon prices (inflation). The nonrecipients would be unhappy in this case, because they did not receive any additional funds yet they face higher prices.

The next impact occurs if the funds are denominated in a foreign currency. In this case, economic theory suggests that the inflation effect would be mitigated somewhat, because the local currency will become slightly stronger, thereby lowering the cost of imported goods and services for all families. The exchange-rate effect is good for households who purchase imported goods, but it is also harmful to local companies that export their goods and services abroad. For those companies, their products will become slightly more expensive when denominated in foreign currency, making them less competitive on world markets.

Finally, there is a third effect: recipients of foreign remittances typically reduce their work hours, or they leave the workforce altogether in order to attend school or care for their families. The reduction in labor supply pushes up wages. This is good for nonrecipient workers because they will enjoy larger paychecks and more money, but the labor effect is less beneficial to capital owners who must now pay more to employ the same workers as wages increase. The labor supply effect also contributes to domestic “cost-push” inflation, because the cost of an input (labor) has become more expensive due to the remittance effect. Clearly, the overall impact of these forces is not obvious, a priori, and this is the reason that a comprehensive method is needed to quantify the net impact upon different households, as well as the economy overall.

The net impact, as computed by the R-CGE model, is shown in Table 3. The first column shows the average change in household income caused by the remittances. Remittances represent a large share of incomes for low-income deciles, even if the total remittance amount for these households is not large since base incomes are small to begin with.

Table 3: Household Income and Welfare Effects for Remittance Recipients and Nonrecipients in the Philippines, (Western Union Remittances Only)

Household Income Decile	Income Change (%)	Welfare Change (%)	Labor Supply (%)
1	20.1%	17.7%	-3.5%
2	17.0%	15.2%	-2.9%
3	21.0%	18.2%	-3.9%
4	14.4%	13.1%	-2.4%
5	11.5%	10.7%	-1.5%
6	3.2%	3.9%	0.6%
7	1.7%	2.1%	1.3%
8	-	0.2%	1.9%
9	-	0.0%	2.1%
10	-	-1.1%	2.5%
Average (1-6)	14.5%	13.1%	-2.3%
Average (7-10)	0.4%	0.3%	2.0%

Source: Author's estimates.
Labor Supply Elasticity 2.0

However, welfare for these low-income deciles increases by less than the change in incomes; this is because prices have increased, and many recipients have shifted away from working into home-production, school, or other nonmarket activities. In decile 2, for example, average income has increased by 17.0 percent, but welfare has only increased by 15.2 percent. This reflects the price impact as the change in income is offset by slightly higher prices. At the same time, recipient households choose to work less as their income rises, further reducing real incomes and consumption.

Welfare gains grow compared to remittance income gains in middle and upper income deciles. Wage growth, as shown in
Table 4 below, is larger than price increases, so that welfare can increase, even for households who receive little or no remittance incomes. The net benefit for the middle classes (deciles 6, 7, 8) lies between 0.2 percent and 3.9 percent. Only a small fraction of these gains are related to remittance income (1.7 percent to 3.2 percent) and most of the gains come from the higher wage. This higher wage entices nonremittance workers to supply slightly more labor (because wages are higher) and therefore enjoy higher incomes and welfare as a result.

The highest income decile is a net loser from national remittances. This cohort is the primary owner of capital in the country and also the owner of most factories that ship products overseas. The return to capital decreases slightly (by about 0.1 percent), caused by higher wage rates and by a stronger domestic currency, which makes Filipino exports slightly more expensive at world prices. The net impact is a 1.1 percent reduction in household welfare for the richest 10 percent of the population.

Labor Market and Wage Effects

It was noted in the literature review that remittances discourage labor force participation. These studies do not elaborate about why recipient households choose to reduce working hours or to leave the labor force altogether. The omission of detail leaves the reader to assume that remittances suddenly cause recipients to become lazy, staying at home and watching television.

On the contrary, most surveys of recipients conducted by private firms or research agencies suggest that households choose to exit the labor force for good reason. A survey of recipients in 2012, conducted by the Nielsen Company found that among survey respondents, 27 percent indicated the remittance funds would be used for education, either for themselves or their children. Six percent indicated the funds were used for home renovations, investment, or business purposes, and 67 percent indicated that the funds were used for daily expenses and that it allowed them to provide home-care services for children or the elderly.

Regardless of the reason, the exit of these recipients from the labor force reduces the supply of workers and therefore increases wages. In the R-CGE model, a basic "wage curve" model is adopted to reflect that households can choose how much leisure to sell as labor. The choice in the model is based upon relative wages, the household's income level, and the cost of goods and services (the CPI). Using this approach, households that receive remittance funds will shift toward leisure, effectively "buying" some of their time and spending it outside of the workforce. The model computes the net change in market wages as recipient households choose to reduce labor force participation.

Impact of Western Union Transfers Only We find that within recipient deciles the labor supply declines between 3.9 percent and 1.5 percent, depending upon the income decile and the level of remittances received. The change in labor supply was presented in

Table **3**. Many of the recipients are in the lower income deciles, which is correlated with lower-skilled work. This is seen in the market wage rate as unskilled wages increase the most. Table 4 shows how wages are impacted by Western Union facilitated remittances.

Table 4 : Labor Market Impacts of Western Union Remittances in the Philippines

Labor Market	Change (%)
Unskilled Labor	5.2%
Semi-Skilled Labor	3.8%
Skilled Labor	4.9%

Source: Author estimates.

Labor supply elasticity: 2.0

Surprisingly, skilled labor wages increase slightly more than semi-skilled wages, possibly reflecting the fact that middle-income households may still have skilled labor supplies. Regardless of skill level, the clear impact is that wages increase. Higher wages are good for workers, raising household earnings for both remittance recipients and nonrecipients alike. However, as mentioned previously, the higher wages eventually increase the cost of goods and services in the economy. Finally, producers and factory owners will face higher costs as wages rise; this makes their goods less competitive on the world markets if they are exporters.

In the end, the benefits of higher incomes, increased output, and higher wages outweigh the inflationary pressures and the foreign-exchange disadvantage caused by the foreign currency inflows. This report shows that while there will always be downside risk associated with remittances, that at least for the case of the Philippines, the benefits are quantified and are found to be higher than the costs.

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ANNEX A: A REMITTANCE-BASED CGE MODEL FOR THE PHILIPPINES

Many of the economic results in this report were derived using an economic equilibrium model developed at the University of Colorado, called the "R-CGE" model. This is a computable general equilibrium (CGE) model that has been calibrated to represent the economy of the Philippines using the country's latest published social accounting information (2006)[6]. The R-CGE model has then been customized to analyze the specific issues related to the effects of remittances upon a recipient country.

This section provides the modeling details required for the interested reader to replicate or review the results that were found when using this model.

The R-CGE is a modified general equilibrium model that has been extended to include a careful depiction of national remittances and how those remittances are spent or invested in local markets. The national economy is characterized using standard Arrow-Debreu equilibrium conditions. These conditions reflect each economic sector's production structure, as well as the demand for labor and capital inputs. General equilibrium models are considered to portray the impacts more accurately than other methods (I-O, simultaneous equations, etc.).

The R-CGE model is written using the Generalized Algebraic Modeling System (GAMS), and the mathematical problem is formulated and solved as a Mixed-Complementarity Problem (MCP). The MCP formulation has been found to be convenient when solving multiple optimization problems simultaneously. Special software is used to define the mathematical derivations automatically using a high-level shorthand. This is a subsystem of the GAMS software, called Mathematical Programming System for General Equilibrium (MPSGE). The algebraic description of both the accounting conditions, as well as the production and consumption functions, are presented next.

[6]The social accounts have been adapted from officially published statistics by the United Nations Development Policy and Analysis Division (DESA). In particular, the dataset was disaggregated in order to emphasize sectors that were related to the Millennium Development Goals (MDG), such as education and social services.

Mathematical Description: Accounting, Production and Consumption

Symbols

Table 5: Symbol Lookup Table

Set Label	***Elements***
i	Sectors
g	Goods
f	Factor types (labor, capital)
m	Margin types (wholesale, retail)
Symbol	***Description***
Y_i	Production of good i
x_{ij}	Intermediate input: level of A_i used in sector j production
L_{Fi}	Formal labor input into sector i
K_i	Capital input into sector i
A_i	Armington aggregate good (imports plus domestic production)
E_i	Export output of good i
D_i	Domestic output of good i
M_i	Imports of good i
I_i	Investment demand i
G_i	Government demand
C_i	Household final demand
a_{ij}	Share parameter for factor inputs
Taxes	***Description***
t_y, t_k, t_l	Production, capital and labor taxes, respectively
vat_i	Value-added tax / Consumption Tax
t_m	Import duties
t_xs	Remittance Taxes
Prices	***Description***
p_i	Output price of the Armington aggregate, A_i
w_i	Wage for formal labor
rk	Single-period (rental) price of capital
pfx	Price of foreign exchange

General Accounting Conditions

Resource Balance

For each producer in the economy, we define the following conditions for producer profits and for market equilibrium[7]. First, the total sales value must equal the total cost of production:

$$Y_i = \sum_j ID_{ji} + L_i + K_i + T_i \quad (1)$$

Total output or sales for good i (Y_i), at producer prices, must be large enough to cover the cost of production. This includes the purchase of intermediate inputs (ID_{ji}), value-added (L_i, K_i) and taxes (T_i).

Market Balance

Total supply must equal demand for all commodity markets:

$$Y_i + M_i \geq \sum_j ID_{ij} + G_i + FD_i + INV_i + X_i \quad (2)$$

where total supply in this framework equals total output (Y_i) plus imports (M_i) and demand is comprised of intermediate demand by firms, ID_{ij}, government demand, G_i, final consumer demand, FD_i, investment demand, INV_i and demand by the rest of the world, X_i.

The same condition holds for factor markets. Supply of labor and capital must be sufficient to satisfy producer demand:

$$\sum_h \omega_h^L \geq \sum_i D_i^L \quad (3)$$

$$\sum_h \omega_h^K \geq \sum_i D_i^K \quad (4)$$

where ω_h^L is each household (h)'s endowment (or supply) of labor, ω_h^K is each household's capital endowment and D_i^L is the demand for labor by sector i. So, total factor supply equals factor demand.

Income Balance

Finally, the total income for households and government must be sufficient to cover current year purchases. This condition is:

$$\Omega + TRN + BOP = \sum_g (C_g + INV_g) \quad (5)$$

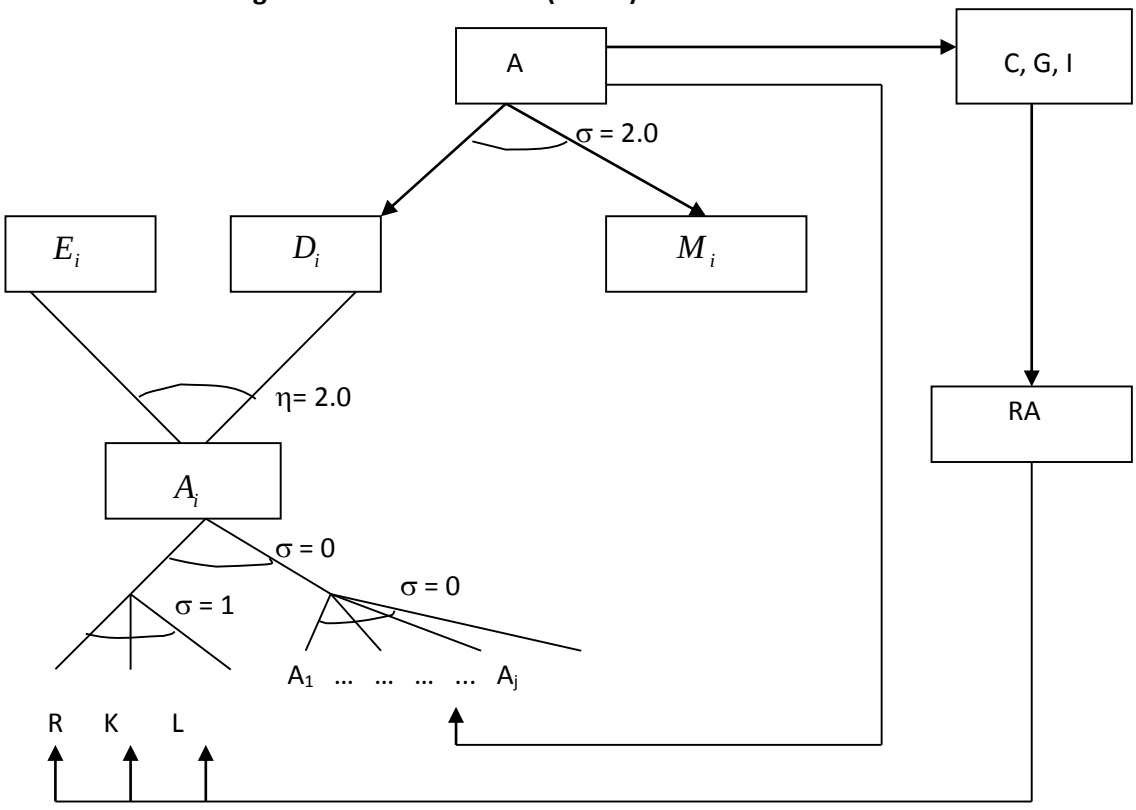
[7]Table 5 contains descriptions for each symbol.

In equation 5, total factor earnings, Ω plus net transfers from the government (TRN), plus net transfers from the rest of world (BOP) must provide sufficient income to purchase all household consumption and private investment goods.

Formulation of the R-CGE Model

The general model structure is presented graphically in Figure 5, where sigma (σ) represents the elasticity of substitution between inputs and eta (η) represents the elasticity of transformation between outputs.

Figure 5: Remittance CGE (R-CGE) Model Production Structure



Production Inputs: Goods and services are produced according to a nested Leontief-Cobb Douglas technology. In this framework, intermediate inputs must be used in fixed proportions. Aggregate value-added enters at the top level with intermediate inputs, but labor and capital can be substituted, usually assuming an elasticity of substitution equal to unity.

Elasticities

The elasticity choices for the R-CGE model are shown in Figure 5. We use σ to denote the elasticity of substitution for production inputs and η as the elasticity of transformation for outputs. In the model, any choice for σ and η in each sector can be used in order to reflect local expertise related to

particular sectors. For example, we typically assume a lower demand elasticity for goods facing excise taxes (tobacco, alcohol and petroleum), than for other goods in consumption.

Production Functions

The R-CGE model is based on constant elasticity of substitution (CES) functions. CES functions are widely applied because they are globally regular and can be defined by their zeroth, first, and second order properties. This means that the location (price and quantity), slope (marginal rate of substitution), and curvature (or convexity) completely characterize a CES production or consumption function. This permits a high-level approach to the representation of production technology and consumer preferences.

Goods are produced according to a nested Leontief-Cobb-Douglas technology. Intermediate inputs and aggregate value-added enter at the top level:

$$Y_{gi} = \min\left[\min_{g}\left(\frac{x_{gi}}{a_{gi}}\right), \frac{v_i}{b_i}\right]$$

In this expression, x_{gi} represents intermediate inputs of good g from the local market. Value-added is represented using a Cobb-Douglas aggregation of labor and capital:[8]

$$v_i = L_{Fi}^{\alpha_F} K_i^{\beta}.$$

Constant returns to scale requires that $\alpha_F + \beta = 1$.

Production Outputs

Each production sector Y produces two types of commodities: domestic goods D_g and goods for sale outside of the country, E_g. These goods are assumed to be imperfect substitutes, and they have a constant elasticity of transformation. An algebraic formulation of export transformation is written as:

$$Y_i = g(D_i, E_i) = \left[\alpha_i^D D_i^{1+\eta} + (1-\alpha_i^D) E_i^{1+\eta}\right]^{1/1+\eta}$$

where α_i^D is the benchmark value share of domestic sales in total output for sector i and η corresponds to the elasticity of transformation for output.

[8]The numerical model permits the more general CES functional form for the valued-added component of production based on the model input parameter,
`esubkl`. When `esubkl` is one, the value-added aggregates are Cobb-Douglas as shown here.

Imports

The model adopts an Armington representation of external demand. Armington goods, A_g, are produced by combining local goods (D) with external goods (M) from the same sector. These goods are treated as close but imperfect substitutes (e.g., U.S. brands versus Japanese brands). We use σ_{DM} as the Armington elasticity, which corresponds to `esubdm` in the computer code.

$$M_i = \left[\alpha_i^M M_i^{1-\sigma} + \left(1-\alpha_i^M\right)E_i^{1-\sigma}\right]^{1/1-\sigma}$$

Some confusion can arise trying to distinguish between production, Y_i, output (D_g, E_g) and the consumption good (A_g). The Armington aggregate good, A_g combines domestic output, D_g, with imports, M_g. A_g is the good used as an intermediate input and also for final demand.

Trade Balance

The real exchange rate, rho (ρ) is determined by supply and demand for imports and exports, which is determined in units of foreign currency.

$$\sum_i \bar{p}_i^E \; E_i + B = \sum_i \bar{p}_i^M \; M_i \qquad (10)$$

Holding all else equal, rising import demand will exert pressure to increase ρ, which reflects increased demand for external currency. The fixed parameter *B* denotes the exogenously specified current account balance.[9] Because this is a small, open economy, import and export prices $\left(\bar{p}_i^E, \bar{p}_i^M\right)$ are assumed to be exogenous. By the same token, the country can buy and sell any quantity of tradable goods or services at fixed international prices. The price of foreign exchange, ρ, adjusts to reflect relative supply and demand for both imports and exports. Because this is a static model, the current-account deficit (or surplus) is held constant, and ρ adjusts balance international trade levels. Different models hold ρ constant, and allow the current-account balance to change.

Household Consumption and Welfare

While most CGE models represent households using a single representative agent (RA), the R-CGE model has separated this RA into 10 distinct households based upon income. Each household is

[9]This parameter is fixed in real terms.

endowed with a different level and mix of primary factor earnings: unskilled labor, semi- and high-skilled labor, and capital. Each household demands final goods for consumption. Each household saves a portion of their income through a fixed Investment function. The government is characterized in the model as an agent, who also demands final goods and services, but the level of government demand depends purely upon the level of tax revenues and borrowing. While at the same time, household demand is endogenously determined by utility-maximizing behavior. Each households' utility function is Cobb-Douglas as shown below:

$$U(A_g) = \prod_g A_g^{\alpha g} \quad \text{where} \sum_g \alpha_g = 1$$

Each household, A, maximizes utility, subject to a budget constraint:

$$A_g \max U(A_g)$$

s.t.

$$\sum_g p_g A_g \leq p_K K + p_L L + p_O O + trn - I - B$$

In this problem, the household A_g, maximizes the utility function, subject to a budget constraint. Each household budget constraint is equal to the total value of factor endowments (K, L_I, L_F), plus any transfers from the government or from relatives (remittances), minus the cost of investment, plus the net current-account balance. This partially reflects the ratio of cash remittances to total trade volume. Finally, remittances are explicitly modeled using a separate transfer account, Rg, where remittance are a source of foreign exchange (ρ), that the household receives directly and spends on consumption and savings.

Investment

Investments are aggregated into a single investment pool, then distributed among production and government sectors according to base-year accounts. Investment funds come from households and government. In some cases, it is possible to alter the level of investment to represent the long-run change in output. This is called "steady-state" analysis, and it not included in the current version of the model, but can be included into subsequent revisions.

Government

The government spends money on the purchase of government services and investment. Purchases are supported with tax revenue, capital rents, and net foreign exchange transfers. The national tax system and total tax revenues are collected by the government agent.

Incorporating Remittances into the R-CGE Model

In terms of the model mechanics, remittances are considered to be a direct transfer of foreign exchange into the domestic economy through households. This will have several different effects, which occur simultaneously. First, the influx of foreign exchange causes the domestic currency to

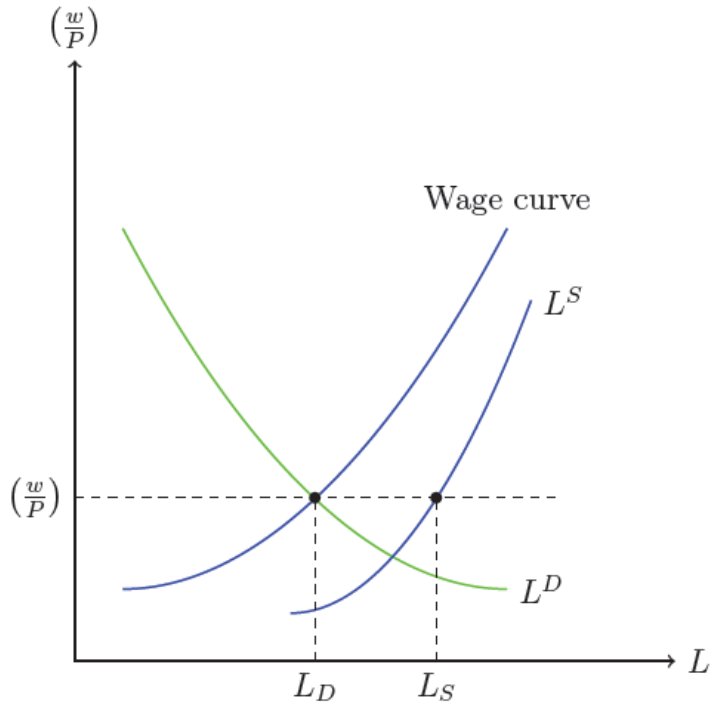
appreciate. At the same time, some households—those receiving the funds—have more disposable income than they would without the remittance. This increased income is either spent or saved according to the propensity to save by each household.[10] In the Philippines, approximately 90 percent of remittances are used for current expenses, and 10 percent are used for savings and investments.

Other facets of remittances are captured in the model and can be described as follows:

- Higher incomes lead to increased expenditures and higher prices, and lower labor supply.
- Increased production to satisfy higher spending contributes to increased employment and higher wages. Higher wages are caused by two factors:
    - First, higher aggregate expenditures call for more production, thereby increasing demand for labor (as well as for capital and intermediate inputs). The amount of the increase depends upon the size of the remittances and also upon the share of goods and services that are domestically supplied versus imported.
    - Second, wages increase because the remittance recipients will, almost certainly, work less than without remittances. Those recipients may choose to increase their leisure time, they may choose not to work in favor of increased education, or they may leave the workforce in order to spend more time providing child care or elder care. The exit of these workers from the labor force reduces overall labor supply, pushing wages higher, on average, for the entire labor force, and especially for the low-skilled portion of the labor force.
    - The wage-impact is captured in the R-CGE model by including a labor-leisure choice for households. This labor-leisure choice can be combined with a "wage curve" in order to describe the relationship between wages, prices and the equilibrium unemployment rate. So far, the wage-curve has not been implemented; see Blanchflower and Oswald (1990) for details related to this employment model.

[10]Note that low-income households typically spend a higher share of their income compared to high-income households. The relative share of savings by household was not available, so the national average was applied to all households.

Figure 6: Graphical depiction of wage curve connecting labor supply, real wages, and the equilibrium unemployment rate.



Formal and Informal Remittance Choice

The choice of remittance method is characterized using two constant elasticity functions. Formal remittance channels (R_F) are demanded based upon the net of tax (t) price for those remittance services:

$$R_F = R_F^0[1+t]^{-\sigma}$$

Likewise, informal remittances (R_I) are based upon benchmark informal use, adjusted by the inverse of the tax rate on formal remittances:

$$R_I = R_I^0[1+t]^{\sigma}$$

The impact of a tax on remittances adversely impacts demand for formal remittance channels, and similarly, it increases the demand for informal channels, as they are a close substitute. The elasticity of substitution between formal and informal remittances, σ, lies between two and eight: $\sigma \in \{2,8\}$, with a central estimate for sigma of four.

ANNEX B: ECONOMIC MULTIPLIER ANALYSIS

Some of the results in this analysis were determined using I-O analysis, sometimes called "multiplier analysis." This section briefly describes the economic logic behind the use of multipliers for local area and small-scale economic impact analysis.

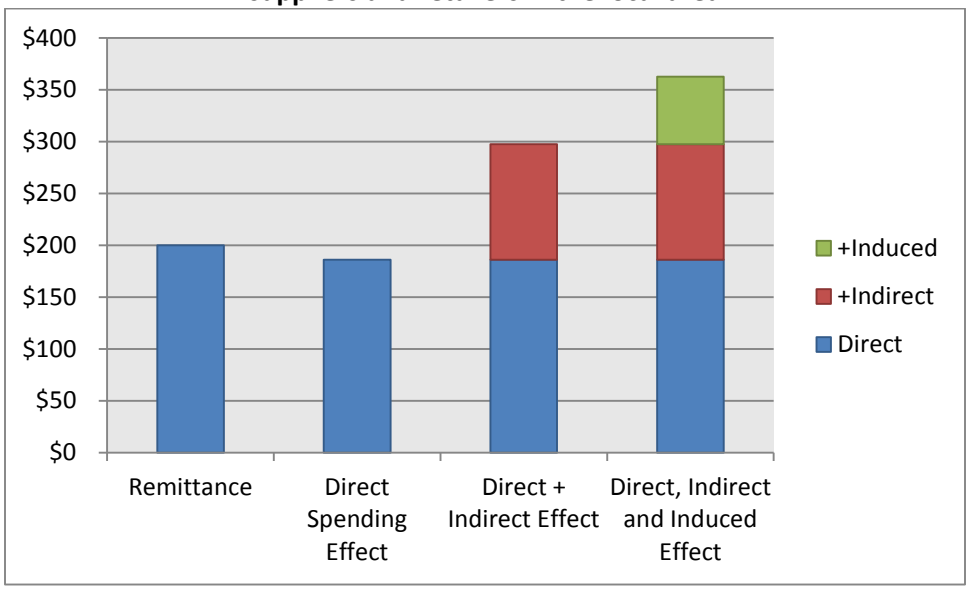
Input-output (I-O) models are designed to trace effects of an economy that has been represented through an Input-Output table. The idea is to understand how the flows of money circulate within the different sectors of the economy. The shocks applied to I-O models can be classified as demand shocks; structural changes refer to modifications on the needs of inputs between sectors; final demand changes refer to changes in the value of output demanded from a specific sector.

The results determined from the I-O model rely upon an assumption that there are no structural changes in the economy during the period of analysis. This assumption is reasonable for local area effects and for small changes in spending patterns. Some impacts are structural in nature, and for those types of impacts, we utilize the R-CGE model in order to capture the impact of those structural changes upon the macroeconomy.

The I-O table used for this part of the study was published for year 2006, and unfortunately, is the most recent "official" input output table published by the Philippine government. The old age of this table may not capture some of the recent spending patterns that exist in a modern economy. For example, spending on communications, computers and information technology makes up a larger portion of typical budgets in 2014 compared to 2006. However, we believe that the 2006 I-O table is applicable for the purpose of constructing a general estimate of employment and labor demand for most industries in the economy. The I-O table used here describes the economy using seven different economic sectors. We use the I-O model to track the effect of a change in household income on overall employment. Recipients of overseas remittances tend to spend these funds in a manner that is similar to typical household expenditures, although the savings rate from remittances is slightly higher than for households who are cash-constrained and must spend all funds to meet basic subsistence needs.

I-O tables are not directly useful for local area impact analysis. Instead, these tables are used to identify the intermediate use and employment that is related to expenditures for each sector. The I-O tables are then used to trace out the subsequent spending on suppliers and intermediate inputs through the economy. The result of this exercise is called the final economic "multiplier." This is described next.

Figure 7: Aggregate Impact of Remittance Spending for Recipient Region or Country. Multiplier analysis combines the impact of direct spending, indirect spending and induced spending by suppliers and retailers in the local area



Calculation of Output Multipliers

The starting point is the matrix of intermediate purchases that shows the direct, indirect and induced changes in industry outputs required for a specific level of output. The overall impact is computed by inverting the I-O table in a way that generates economic *multipliers*, which combine all of the spending iterations into a final multiplicative number. This is done by noting that "T" above is the sum of an infinite series, and as such, it can be summarized as:

$$T = [I - A]^{-1}X$$

Where $[I - A]^{-1}$ (or the Leontief inverse) is the intermediate purchases matrix and X defines the additional spending by households due to remittances. Using this transformation, we estimate that the change in aggregate (national) Philippine output corresponding to an additional ₱100 of remittance spending services equals ₱223. This reflects the ₱100 of direct sales to suppliers of food, clothing, retailers and construction sectors, plus an additional ₱123 of additional spending on secondary producers and suppliers as the money circulated through the economy.

The multiplier effects that result from the input output data have multiple intrinsic assumptions. The analysis is based on the idea that the economy has unlimited unused resources that can be employed to increase output in response to additional intermediate demand for inputs from other sectors and from consumers.

The model also assumes that goods produced in the economy are homogenous, and therefore can be used as an input in other sectors, and that demand is satiated by the population for consumption.

The national accounts level of aggregation impedes to determine the exact impact that remittance spending has on different sectors; arguably, the multiplying effect for this spending should use a combination of the multipliers of direct current spending sectors, as well as complementary investment services, such as construction and transportation. This issue is solved in the analysis by assuming that households save a fixed proportion of their total income, leading to the shares of household purchases shown below.

Table 6: Expenditure Shares for Households in the Philippines - Used for Output and Employment Multiplier Analysis

Sectoral Share of Household expenditures	Share (%)
Agriculture, Fishery and Forestry	8%
Mining and Quarrying	0%
Manufacturing	8%
Construction	9%
Electricity, Gas and Water	11%
Transportation, Storage and Communication	7%
Wholesale and Retail Trade	19%
Finance	0%
Real Estate	14%
Private Services	16%
Government Services	8%
Total Spending:	100%

Source: 2006 Social Accounting Matrix of Philippines.

Similarly, in the absence of regional data to understand the interdependencies of the economic sectors across different rural and urban regions of the country, it is difficult to derive regional economic effects via I-O models. An alternative to estimate regional effects would be the use of the origin destination matrix for spending that flows through the local area and to determine the regional impact based on these flows and the regional participation in national GDP. At present time this level of detail is not available for the analysis.

ANNEX C: NATIONAL ACCOUNTS, REMITTANCE SHARES, AND INCOMES IN PHILIPPINES

This section reviews national accounts data from the Philippines and then uses income and remittance data to allocate remittances among different income deciles within the model.

The Philippine Statistics Authority regularly conducts a nationwide household income and expenditure survey. This survey is used to identify household incomes (and expenditures) by region and by type of household. Summary statistics for the country as a whole were used in this analysis to allocate labor and capital endowments among 10 household types.

Each household type is distinguished by income level. The same number of households exist in each cohort, effectively one-tenth of the population. Unsurprisingly, the poorest decile has almost no labor or capital endowments, and the richest decile is endowed with almost half of the country's labor and capital earnings. This is not unusual, and in fact, the income and wealth shares in the Philippines are slightly more egalitarian than the United States. In the United States, for example, the top decile owns 77 percent of total household wealth[11] and earned approximately 50.4 percent of total pre-tax income in 2012.

Table 7: Household Income by Decile and Estimated Share of Remittances

		Income ('000 PhP)		Expenditure ('000 PhP)		Income per Family	Share of Remittances
		Value	Percent	Value	Percent		
National Total:		**5,026,798**	**100**	**4,125,312**	**100**	**('000 PHP)**	**(%)**
First	Decile	146,984	2.9	156,081	3.8	68.6	14
Second	Decile	197,980	3.9	195,477	4.7	92.4	16
Third	Decile	231,134	4.6	219,078	5.3	107.9	23
Fourth	Decile	277,621	5.5	258,953	6.3	129.6	19
Fifth	Decile	328,517	6.5	296,986	7.2	153.3	18
Sixth	Decile	390,886	7.8	344,582	8.4	182.4	6
Seventh	Decile	490,002	9.7	420,732	10.2	228.7	4
Eighth	Decile	613,665	12.2	508,442	12.3	286.4	-
Ninth	Decile	817,204	16.3	647,624	15.7	381.4	-
Tenth	Decile	1,532,805	30.5	1,077,357	26.1	715.4	-

Source: Philippine Statistics Authority.
Household income based upon total household count of 21.426 million.

The assignment of remittances to individuals or households is not simple. On the one hand, most individuals who receive remittances have no earned income at all. Fifty-one percent of respondents to a Western Union survey indicated that they did not earn any income, thus implying that most recipients lie within the first decile of incomes. However, this would be misleading, because the same recipients indicated that they came from households with much higher total household incomes. Sixty-nine percent of respondents indicated that, based on their household income, they resided

[11]See Saez and Zucman (2014) listed in references.

within the 3rd–8th income deciles nationwide. Although no individual recipients indicated that their incomes were above the 8th decile, some household incomes were in the 10th deciles.

This presents a challenge—whether to assume that the recipients are truly "poor" as most of them are from middle-class families, but they themselves do not earn much income. To assign the remittances, a hybrid between the responses in the "family" category and the "individual" category was used to categorize recipients into respective income deciles. The last column of Table 7 shows the assumed share of remittances by national income decile. These assignments are based on responses take from the 2011 Western Union survey of Filipino remittance recipients conducted by Nielsen International. Responses from this survey are shown in Table 8.

Table 8: Recipients of Remittances in the Philippines and their Stated Income Levels: Individual and Household (2011)

Monthly Income	Annual Income (PHP)		Income Decile	Recipient Household Income Share (%)	Recipient Individual Income Share (%)
Lower - Upper	Lower	Upper			
4000 PHP or below		48,000	1	1	**5**
4001 - 8000 PHP	48,012	96,000	2	4	**16**
8001 - 12000 PHP	96,012	144,000	3	9	**11**
12001 - 16000 PHP	144,012	192,000	4,5	14	**8**
16001 - 20000 PHP	192,012	240,000	6	18	**6**
20001 - 24000 PHP	240,012	288,000	7	8	**1**
24001 - 28000 PHP	288,012	336,000	8	9	**1**
28001 - 32000 PHP	336,012	384,000	8	11	**1**
32001 - 36000 PHP	384,012	432,000	9	4	**0**
36001 - 40000 PHP	432,012	480,000	9	8	**0**
40001 - 50000 PHP	480,012	600,000	10	5	**0**
50001 - 60000 PHP	600,012	720,000	10	3	**-**
60001 - 70000 PHP	720,012	840,000	10	2	**0**
70001 - 80000 PHP	840,012	960,000	10	1	**-**
80001 - 100000 PHP	960,012	1,200,000	10	2	**-**
100001 - 120000 PHP	1,200,012	1,440,000	10	1	**-**
120001 - 160000 PHP	1,440,012	1,920,000	10	0	**-**
160001 - 200000 PHP	1,920,012	2,400,000	10	-	**-**
200001 PHP or above	2,400,012			0	**-**
No Income				0	**51**
Average monthly income (+)				**27,649**	**5,615**

Source: 2011 Western Union survey of recipients, conducted by Nielsen.

National Accounts and the Philippines Social Accounting Matrix (SAM)

The core dataset that was used for the R-CGE model of the Philippines was developed by the UN Division of Economic and Social Affairs (UN-DESA). The UN-DESA SAM was developed as an initiative to assess whether countries were moving closer or further from its Millennium Development Goals. The original SAM was constructed by Roehlano Briones and Francis Quimba from the Philippine Institute for Development Studies. The SAM reflects transactions for the year 2006, but the totals

were scaled up to match production and remittance data for the year 2012. A summary table for the original SAM is too large to display as a table here. The full SAM can be downloaded directly from the United Nations website, using the following link:
http://www.un.org/en/development/desa/policy/capacity/output_sam.shtml

Labor and Capital Endowments by Household Type

Another challenging detail related to a multi-household CGE model is the assignment of endowment types between income deciles. The 2012 Household Income and Expenditure Survey has total incomes and general income categories, such as salary, own-income and rents, but it does not specify the share of labor by skill type between income decile cohorts. Thus, the challenge of skill assignment was left to the researchers. This assignment was made based on similar country experience. The main factor is that low-skilled income is endowed primarily by lower-middle income deciles, while high-skill labor is endowed to the middle and upper income households. Similarly, capital earnings, a reflection of accumulated wealth, is concentrated primarily among the highest income categories.

These allocations of labor types and capital must match the total market demand for each type. In addition, the share of each labor and capital earning type among cohorts must sum to their respective aggregate incomes. Thus, there is a programming problem, where total incomes must be allocated by skill type, holding total decile incomes constant, and ensuring that total supply among households for each endowment type matches the total demand by firms.

A nonlinear programming program was used to identify the shares of these endowments, based upon target levels that reflect traditional endowments elsewhere. The program ensures that each constraint is met, while minimizing the difference between share targets and share outcomes. The results are displayed in Table 9.

Table 9: Share Allocation for Endowments Used in the R-CGE Model

Decile	Unskilled	Semi-Skilled	High-Skill	Capital
1	11.8%	2.9%	1.3%	2.2%
2	19.2%	5.6%	2.8%	2.0%
3	19.1%	8.8%	4.4%	2.0%
4	16.9%	15.3%	5.2%	2.4%
5	12.4%	10.0%	9.0%	4.6%
6	10.3%	15.2%	10.8%	5.4%
7	6.2%	11.6%	14.4%	8.8%
8	2.0%	14.2%	15.0%	12.5%
9	1.0%	8.7%	22.5%	18.0%
10	1.0%	7.7%	14.6%	42.1%
Total:	100%	100%	100%	100%

Source: Author estimates.