**Modeling the Impact of Overseas Filipino Workers Remittances on the Philippine Economy: An Inter-Regional and Economy-Wide Approach**

*by Cristela Goce-Dakila and Francisco G. Dakila, Jr.*

**ABSTRACT**

Remittance inflows to the Philippines have increased substantially as the stock of overseas workers has grown and shifted towards more skilled jobs. Thus, second to exports of goods and services, remittances have become the largest foreign exchange source for the Philippines. Past studies of the impact of remittances on the economy have relied either on econometric estimations, which yield partial equilibrium estimates, or survey approaches. This paper uses an economy-wide (general equilibrium) approach that allows for interactions between all major sectors in the economy, while ensuring consistency of results. A major feature of the paper is its inter-regional approach, which gives a spatial dimension to the analysis.

The basis of the approach is the social accounting matrix (SAM). A three-level production function, is specified - Cobb-Douglas between labor and capital to produce value added, then Leontief between non-transport inputs and value added to produce output net of transport, which is then combined with transport inputs finally using a Cobb-Douglas production function. Capital and labor incomes accrue to households, which then goes to consumption and saving, with a constant marginal propensity to consume. Overseas remittances enter as transfer payments to households. Consumption is divided among different commodities using a Cobb-Douglas utility function. Final demand is then built up in a standard way.

Empirical results indicate that, in absolute terms, the main beneficiaries of remittance increases are the middle-income classes across all regions. The second major beneficiaries are the low income households, again for all regions, with the notable exception of the National Capital Region, where the high-income households are the second highest beneficiary of remittances. The paper highlights the data requirements for the modeling approach, which is instructive for emerging economies in similar situations.

Key words: social accounting matrix, remittances, CGE modeling.

# Modeling the Impact of Overseas Filipino Workers Remittances on the Philippine Economy

*By Cristela Goce-Dakila and Francisco G. Dakila, Jr.*[1]

## I. Introduction

Remittance inflows to a number of emerging market economies have increased substantially as the stock of overseas workers has grown and shifted towards more skilled jobs. The subject has, therefore, received much recent attention, with several studies focusing on the interplay between remittances and growth in emerging economies.[2] For instance, using panel data on 113 countries for the period 1970-1998, Chami, et al. examined the role of remittances in economic development relative to that of foreign direct investment and other capital flows. They found empirical support for the premise that remittances are not profit-driven but are compensatory in nature, and hence have a strong negative correlation with growth. The authors concluded that remittances "do not appear to be intended to serve as capital for economic development, but as compensation for poor economic performance".

In the Philippines in particular, second to exports of goods and services, remittances have become the largest foreign exchange source.[3] This prompted some researchers to look specifically at the Philippines.[4] An important issue is the extent to which the Philippines' experience is in line with that of other emerging economies. In order to validate the main findings of the Chami, et al. study and gauge their applicability to the Philippine situation, BSP staff attempted to re-estimate the main equations of the study using Philippine data. The BSP study noted that while a negative relationship between remittances and growth appears in OLS estimates for the Philippines, this relationship vanishes when the appropriate correction is made for serial correlation. Thus, there may be a need to re-examine the applicability of the Chami et al. conclusion to the Philippine case. In summary, the estimation results for the Philippines supported the notion of a positive contribution from overseas Filipino workers (OFWs) remittances to GDP growth, rather than the premise that remittances are compensatory in nature. These results may indicate a need to exercise greater care in applying the results from a panel estimation of different countries to all the countries included in the panel, because of possible heterogeneity in the characteristics of the sample included in the study.[5]

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[1] An earlier version of this paper was presented at the International Conference on Policy Modeling (EcoMod2006), 28-30 June 2006, Hong Kong Convention and Exhibition Center. C. Dakila is Associate Professor, De La Salle University, Manila while F. Dakila, Jr. is Officer-in-Charge, Center for Monetary and Financial Policy, and concurrent Head, Economic and Financial Forecasting Group, Department of Economic Research, Bangko Sentral ng Pilipinas. The views expressed are those of the authors and do not necessarily reflect the official stance of the BSP.

[2] One of the latest comprehensive studies is World Bank, Global Economic Prospects 2006: Economic Implications of Remittances and Migration (World Bank, 2006). Chami, Fullenkamp and Jahjah (2003 and 2005) use data from a panel of countries to examine the relationship between remittances and growth.

[3] Annex 1 presents data on recent trends in remittances.

[4] Studies of the impact of OFW remittances in the Philippines include Burgess and Haksar (2005), and Asian Development Bank (2004).

[5] BSP Department of Economic Research Validation Exercises for Chami, et al., "Are Immigrant Flows a Source of Capital for Development?" unpublished memo (5 December 2003)

Burgess and Haksar (2005) have also re-examined the link between remittances and growth, using Philippine data specifically. As with the BSP study, they did not find empirical support for the hypothesis that remittance flows exert a short-term stabilizing effect on consumption. In contrast to the finding by Chami, et al. for their panel of countries, Burgess and Haksar do not find strong evidence that remittances lead to lower growth in the Philippine case. These results are, therefore, in line with the previous caution on generalizing the results obtained from a panel of countries. Moreover, the authors noted that measurement issues, as well as endogeneity of regressors and the resulting problem of finding adequate instruments, can complicate the estimation of the remittances-growth relationship using macroeconomic data. Given this, Burgess and Haksar encourage looking at micro-level data to help shed light on the issue.

An Asian Development Bank (ADB) study provides an excellent example of how survey data can help provide additional information on the potential for remittances as a source of funds for capital accumulation and development.[6] The ADB commissioned several surveys meant as aid to policy formulation, especially with respect to the issue of how the remittances can be channeled to strategic areas and sectors of the economy. Among the constraints reported by survey respondents were difficulty experienced by OFWs in accessing remittance services of host country banks. However, the gap was addressed by Philippine banks, courier services, and informal channels of transmission.

A distinction must be made between banks serving as remittance channels as against functioning as intermediaries between OFW remitters and the production sector of the economy. The ADB survey indicated that 80 percent of respondents regularly remit through banks and other regulated channels; 90 percent were able to save some money; but only 45 percent of Philippine respondents had a savings account. Thus, a large potential still exists for channeling such funds into investment.[7]

All previous studies of the impact of remittances on the economy have relied either on econometric estimation, which yield partial equilibrium estimates, or survey approaches. This paper uses an economy-wide (general equilibrium) approach that allows for interactions between all major sectors in economy, while ensuring consistency of results. A major feature of the paper is its inter-regional approach, which gives a spatial dimension to the analysis. The basis of the approach is the social accounting matrix, a version of which, covering the year 1994, was especially constructed for several papers authored by C. Dakila.

This paper uses the applied general equilibrium (AGE) as its theoretical framework. A general equilibrium is described, which consists of a set of 'economic agents' (such as consumers and producers) each of which demands and supplies goods or services, with each agent aiming to solve its own optimization problem. Agents are assumed to be price takers. Equilibrium is defined as a state of the economy in which the actions of all agents are mutually consistent and can be executed simultaneously. [8] In the model, adjustment to equilibrium is implemented by specifying that markets adjust to minimize the sum of (squared) excess

[6] Asian Development Bank, Enhancing the Efficiency of Filipino Overseas Workers Remittances, Final Report (2004)

[7] In this respect, it is worth noting that the BSP is implementing a number of initiatives to encourage greater intermediation of OFW remittances, including allowing rural banks to be granted foreign currency deposit unit (FCDU) license (Circular No. 522 dated 23 March 2006); requiring banking institutions to post the charges for their various remittance products within the banks' premises and in their websites, with hyperlinks in the BSP website (Circular No. 534 dated 26 June 2006); and continuing a financial literacy program targeted towards OFWs. Likewise, an ad hoc working group has been formed by the BSP to study possible guidelines by the BSP on securitization of future flows of remittances with credit guarantee by the ADB.

supplies.[9] It can be noted that although several AGE models have been estimated for the Philippines, all previous models were national in scope.[10] This is thus the first spatial computable general equilibrium (SCGE) model for the Philippines, i.e. the first model to offer a spatial dimension to the analysis. It is also the first attempt to analyze the impact of remittances in the Philippines using an economy-wide approach.

We specify a three-level production function. In order to allow for substitutability between capital and labor, we introduce, at the first stage, a Cobb-Douglas production function which combines labor and capital to produce value added. At the second stage, a Leontief production function transforms non-transport inputs and value added to produce output net of transport, which is then, at the third production stage, combined with transport inputs using a Cobb-Douglas production function. Capital and labor income accrue to households, who then allocate this between consumption and saving, with a constant marginal propensity to consume. Overseas remittances enter as transfer payments to households. Consumption is divided between different commodities using a Cobb-Douglas utility function. Final demand is then built up in a standard way.

Empirical results indicate that the main beneficiary (measured in peso terms) of remittance increases are the middle income classes across all regions. The second best beneficiaries are the low-income households, again for all regions, with the notable exception of the National Capital Region and Mindanao, where the high-income households are the second highest beneficiaries of remittances. The paper highlights the data requirements for the modeling approach, which is instructive for emerging economies in similar situations.

## II. A Five-Region Social Accounting Matrix (SAM) for the Philippines

The calibration of the SCGE model required the construction of a specialized five-region social accounting matrix (SAM) that was used as the benchmark for deriving the baseline values for the SCGE model. A SAM represents transactions in a complete economic system during an accounting period, usually one year. It integrates, within a macroeconomic framework, several detailed accounts for factors of production and institutions—especially households—so as to focus on the living standards of different groups in society. Round (2003) elaborated on the main features of a SAM, which are threefold: (1) The accounts are in a SAM are represented as a square matrix, in which the incomings and outgoings for each account are shown in corresponding matrix rows and columns. The transactions are shown in the cells, so the matrix displays the interconnections between agents in an explicit way. The corresponding row and column totals in the SAM must be equal to each other. (2) The SAM is comprehensive: it portrays all the economic activities of the system (consumption, production, accumulation and distribution), although not necessarily in equivalent detail. (3) The SAM is flexible, in that, although it is usually set up in a standard, basic framework, there is a large measure of discretion both in the degree of disaggregation and in the emphasis placed on different parts of the economic system.

[8] See Shoven and Whalley (1992) or Ginsburgh and Keyzer (1997) for more details on applied general equilibrium models.

[9] Quantities adjust in the model; prices follow to equate the notional and effective demands for labor. The excess supply quantities are squared to prevent negative and positive values from cancelling each other.

[10] The AGE models that have so far been constructed are described in Agricultural Policy Experiment (APEX) model (1992); Bautista, C. (1987 and 1992); Bautista, R. (1986); Clarete (1984 & 1991); Cororaton (1989); Gaspay (1993); Go (1988); Habito (1984 & 1989), Jemio and Vos (1993) and Cororaton (2000).

When a national SAM is split into regional SAMs (RSAM), the flow of income from production units to consuming units is given a spatial dimension. In line with this objective, a five-region SAM was constructed in order to analyze ripple effects of particular shocks, particularly on regional income disparity and other aspects of the regional economies. This RSAM is presented in detail in Dakila, C. and Mizokami, S. (2006). The methodological issues in constructing the RSAM are discussed in detail in Dakila, C. and Dakila, F (2004).

The main data source for the study is the 1994 five-region Philippine inter-regional input-output (PIRIO) table, which regrouped the 15 administrative regions of the country in 1994 (now 17) into five greater regions according to geographic proximity (Secretario, 2002). This regional classification is carried over to the present paper.

As described in Dakila and Mizokami (2006), there were three major activities undertaken to derive the RSAM. First, the coverage of the 1994 PIRIO was expanded. In particular, the personal consumption expenditures component in the final demands columns was further disaggregated according to income class; greater attention was paid to the components of value added across sectors, and import transactions were broken down into CIF values and tariffs and import taxes.

Second, the PIRIO was transformed from an open-type input-output model (i.e., one with an exogenous household sector) into a closed input-output model, with the household sector endogenized within the production system of regional economies. This closed I-O framework accounted for the balance between the different sources of incomes for households, on the For this, the Philippine Family Income Expenditures Survey (FIES) was the primary data source. Finally, the multi-region SAM was compiled based on the expanded PIRIO.

## III. Theoretical Framework

The model accounts for the interregional linkages of the Philippine economy. The model was originally developed to address the issue of the spatial impact of transportation; thus the transport component of the production sector of the model is relatively well-developed. Table 1 summarizes the sectoral structure of the model. The model distinguishes between seven main production sectors, which are further differentiated according to the five regions of origin. These five regions are an agglomeration of the 17 administrative regions in the Philippines. Since the National Capital Region does not have an agricultural sector, there are therefore 34 production sectors. For each region, households are differentiated into three income classes. There are, therefore, a total of 15 household categories. To ensure consistency with official standards, low income households are defined as comprising all households that earn below the regional poverty thresholds as determined by the National Statistical Coordination Board.[11] The high income households are those who earn ₱250,000 and above annually, which is the income bracket in the FIES. All the households with incomes between the regional poverty threshold and the highest income bracket in the Family Income and Expenditure Survey are classified as middle income households. Mizokami, S. and Dakila, C. (2005a) contain a detailed description of the database utilized in the model. Annex 3 contains a partial list of the main endogenous and exogenous variables of the model.

**Table 1. Major Sectors in the Multi-Regional Model for the Philippines**

[11] The poverty thresholds were taken to be the average of those for the administrative regions falling within each of the five “super”-regions in the model. Details of the thresholds are show in Annex 2.

| PRODUCTION SECTORS | REGIONS | HOUSEHOLDS |
|---|---|---|
| Agriculture | National Capital Region | Low income |
| Industry | Northern Luzon | Middle income |
| Water transport | Southern Luzon | High income |
| Land transport | Visayas | |
| Air transport | Mindanao | |
| Other services | | |
| Government | | |

## A. HOUSEHOLD SECTOR

The model distinguishes between 15 representative households, with 3 household types (representing the low, middle, and high income classes) for each of the six regional groupings distinguished in this paper. The preferences of each household type are summarized by a corresponding Cobb-Douglas utility function:

$$U_h = \prod_i C_{ih}^{\delta_{ih}} \quad (1)$$

where $\delta_{ih}$ is the elasticity of the utility of the $h^{th}$ household with respect to consumption of the $i^{th}$ good. Each representative household maximizes its utility subject to its income constraint, which we describe below.

For each region, household labor income is assumed to be equal to the sum of the labor incomes that each household income group earns from supplying labor within the region. The endowments of labor of different income classes within a region are taken to be a constant; this then determines how labor income is distributed within each region.

Since capital is fixed, then each household income group is assumed to own a fixed share of total capital, and this ratio is maintained through the policy experiments. Household income is calculated as the sum of labor income ( $w_i L_i$ ) plus that portion of capital income that accrues to the households ( $\lambda_h \Sigma_i r_i K_i$ ), plus transfers from government and from the rest of the world. The latter two are exogenously determined. Thus, if we partition the indices h and i so that the $r^{th}$ partition belongs to the rth region, then we obtain total income per household type as:

$$Y_{h,r} = \omega_{h,r} \sum_{i \in r} w_i L_i + \lambda_{h,r} \sum_i r_i K_i + Tr_{GOV,h,r} + Tr_{ROW,h,r} \quad (2)$$

where the ω's are the labor income distribution parameters, and, as indicated, the summation is for industries belonging to the rth region. Total disposable income is found by subtracting direct taxes imposed on the household from the foregoing quantity:

$$Yd_h = Y_h (1 - \tau_h) \quad (3)$$

where $Y_d$ is disposable income and $\tau_h$ is the direct tax rate imposed on household h. Note that the summation now runs within each household type, so that we have dropped the subscript r referring to the partitioning across regions.

Each household type is assumed to consume a constant proportion of its disposable income. Thus, households maximize utility subject to the budget constraint

$$\sum_i pd_i C_{ih} = c_h Yd_h \quad (4)$$

where $pd_i$ is the domestic price of the good and $c_h$ is the average propensity to consume of household h. Given the Cobb-Douglas utility function, the first order conditions yield the following consumption demands for each commodity by each household type in each region:

$$C_{i,h,r} = \delta_i c_{h,r} \left[ \omega_{h,r} \sum_{i \in r} w_i L_i + \lambda_{h,r} \sum_i r_i K_i + Tr_{GOV,h,r} + Tr_{ROW,h,r} \right] \left(1 - \tau_{h,r}\right) / p_i \quad (5)$$

## B. PRODUCTION SECTOR

Production is modeled assuming a three-stage production function. At the first stage, capital and labor are combined to produce value-added, using a Cobb-Douglas production technology.

$$V_i = A_i K_i^{\alpha_i} L_i^{1-\alpha_i} \quad (6)$$

where for sector i and region r, V = value added, K = capital, L = labor, $\alpha$ = share of capital in value-added, and 1-$\alpha$ = share of labor in value-added. This specification of the Cobb-Douglas function assumes constant returns to scale. Capital is assumed to be immobile across sectors while labor is mobile.

In stage 2 of the production process, value-added is combined with non-transport intermediate inputs under a Leontief technology, to produce a composite good, which is output net of transport.

$$X_i^{NT} = \min\left[ X_{1i} / a_{1i}, X_{2i} / a_{2i}, \ldots, X_{NTi} / a_{NTi}, V_i / a_{V,i} \right] \quad (7)$$

Finally, stage 3 combines output net of transport with transport intermediate inputs under a Cobb-Douglas production function to yield total output gross of transport of commodity i ($X_{T,i}$).

$$X_{T,i} = B_i \left( X_i^{NT} \right)^{\beta_{1i}} W_i^{\beta_{2i}} A_i^{\beta_{3i}} La_i^{\beta_{4i}} \quad (8)$$

where W, A and La represent the different transport intermediate inputs that go into sector i, namely, water, air and land transport. This specification allows substitutability between the various transport modes. Total output of sector i ($X_i$) is found by summing together total output gross of transport of commodity i ($X_{T,i}$), indirect taxes on i ($T_{indirect,i}$), direct taxes imposed on firms in sector i ($T_{direct,i}$), imports of i ($M_i$), tariffs imposed on i ($Tar_i$), and net dividends from the foreign sector into sector i ($Div_{For,i}$).

$$X_i = X_{T,i} + T_{Indirect,i} + T_{Direct,i} + M_i + Tar_i + Div_{For,i} \quad (9)$$

The firm is assumed to maximize profits. Because of the nature of the production function, profit maximization can be described in three stages. The bottom stage entails choosing the optimum levels of capital and labor so as to maximize the contribution of value added to profits. At the second stage, as noted above, value-added is combined with other intermediate non-transport inputs in a fixed coefficients (Leontief) technology to produce output net of transport. Finally, the top stage determines the optimal combination of transport inputs to deliver output to the region of destination. Then for commodity j, the optimization problem is

Maximize

$$\Pi_j = pd_j X_j - \sum_i pd_j Mat_{i,j} - pva_j V_j \quad (10)$$

subject to

$$X_j = B_j X_j^{NT\,\beta_{1j}} W_j^{\beta_{2j}} A_j^{\beta_{3j}} La_j^{\beta_{4j}}$$

$$X_j^{NT} = \min\left[ X_{1j}/a_{1j}, \ldots X_{NTj}/a_{NTj}, V_j/a_{V,j} \right] \tag{11}$$

$$V_j = A_j K_j^{\alpha_j} L_j^{1-\alpha_j}$$

where $\Pi$ is total profits, $Mat_{ij}$ is the matrix of intermediate inputs of each commodity into commodity j, V represents value added, and pva is its corresponding price.

At the top production level, the corresponding first order conditions (FOCs) for profit maximization are

$$pd_i * \frac{\partial X_i}{\partial X^{NT}_i} = p_{NT} \text{ or } pd_i \beta_{1i} \frac{X_i}{X^{NT}_i} = p_{NT} \tag{12}$$

$$pd_i * \frac{\partial X_i}{\partial W_i} = p_w \text{ or } pd_i \beta_{2i} \frac{X_i}{W_i} = p_W$$

$$pd_i * \frac{\partial X_i}{\partial A_i} = p_A \text{ or } pd_i \beta_{3i} \frac{X_i}{A_i} = p_A$$

$$pd_i * \frac{\partial X_i}{\partial La_i} = p_L \text{ or } pd_i \beta_{4i} \frac{X_i}{La_i} = p_{La}$$

There are no corresponding FOCs for the second level production stage, since this is characterized by fixed coefficients technology, and marginal conditions are not defined. However, once output net of transport is determined, the different non-transport inputs as well as total value added can be derived using the fixed coefficients technology (7).

At the bottom level, profit maximization entails choosing the least cost combination of labor and capital to produce the required value-added. Since capital is immobile, of particular interest is the first-order condition for labor, which is

$$pva_i * \frac{\partial V_i}{\partial L_i} = w_i$$

$$pva_i (1 - \alpha_i) \frac{V_i}{L_i} = w_i \tag{13}$$

## C. Government and the External Sector

The model incorporates a national government sector, i.e., the behavior of local government units is not considered. Government enters the economy in several ways: it purchases output from each sector, imposes indirect taxes on production and tariffs on imported goods, and direct taxes on income of each household type. Government expenditures on each commodity are taken as exogenous in the model, while taxes are endogenous.

Tariff revenues per commodity equal the product of the tariff rates and import values:

$$Tar_i = tar_i (m_i) \tag{14}$$

where $Tar_i$ and $tar_i$ are total tariff collections from i and the tariff rate on commodity i, respectively. Indirect tax collections are given by the product of the indirect tax rate imposed on domestic production and the rate imposed on imports of the product:

$$T_{Indirect,i} = tind_i \left( d_i + m_i \left( 1 + tar_i \right) \right) \quad (15)$$

Direct tax collections per household type in the model are computed as:

$$T_{Direct,h} = Y_h - Yd_h \quad (16)$$

At this stage of model specification, imports and exports are taken as exogenous.

## D. Investment-Saving Balance

Total household savings in the model are given by the aggregate difference between household disposable income and consumption expenditures:

$$S_h = \Sigma_h \left( Yd_h - C_h \right) \quad (17)$$

One complication is that some of the measured consumption expenditures are of the nature of investments, including pension premia, pre-need plans and stock investments. Thus, we introduce a balancing factor ($\phi$) to account for any discrepancies between measured savings and investments.

Total government savings are the sum of the various revenue sources minus total government purchases of the outputs of the various sectors, total government transfers to households, and total net transfers of the government to the foreign sector:

$$S_G = \Sigma_i Tar_i + \Sigma_i T_{Indirect,i} + \Sigma_h T_{Direct,h} - \Sigma_i G_i - \Sigma_h Tr_{GOV,h} - Tr_{GOV,FOR} \quad (18)$$

Total foreign savings, $S_{FOR}$, are given by the current account deficit minus net dividends to foreigners. Therefore, total savings are

$$S_{TOTAL} = S_h + S_{GOV} + S_{FOR} \quad (19)$$

Conceptually, total savings should equal total investment. As noted previously, our framework allows for statistical discrepancy by introducing a factor $\phi$ which transforms savings to investments. Investment distribution per sector is then modeled as constant proportion of total investment, with the distribution coefficients $\gamma_i$ calibrated according to the sectoral distribution of investment in 1994:

$$I_i = \gamma_i \phi \left( S_{TOTAL} \right) \quad (20)$$

## A. Demand

Total intermediate demand for commodities by the firm arises from its maximization of profits subject to the three-level production function. At the first level, the first order condition for profit maximization entails equating the marginal product to the marginal cost of labor.

$$pva_i * \frac{\partial V_i}{\partial L_i} = w_i$$

$$pva_i \left( 1 - \alpha_i \right) \frac{V_i}{L_i} = w_i \quad (11)$$

where the marginal product of labor for each production sector is evaluated assuming that capital is immobile across sectors. For any given employment, equilibrium entails that the corresponding level of production equal the demand forthcoming at the employment level. Similar equations hold for the choice between output net of transport and the various transport

inputs, at the third level of the production function. This equilibrium condition together with (11) determines pva. We turn to this in greater detail in the section on prices.

At the second level, each production sector combines value-added and every non-transport intermediate input according to a fixed proportions technology:

$$Mat_{i,j} = a_{ij}X_j^{NT} \tag{21}$$

where i runs through all the non-transport intermediate inputs and value added for each sector, j runs through all the production sectors in the economy, $Mat_{ij}$ is the matrix of interindustry flows in the economy, $a_{ij}$ represents the fixed coefficients technology, and, as before $X_j^{NT}$ is output net of transport for the jth sector.

Final demand in the economy originates from households (consumption demand), firms (investment demand), government spending, and the foreign sector (export demand). Consumption demand by households originates from the maximization of the utility function, as described previously in section IIIA. Although, for simplicity, firms' investment demand are not described explicitly in terms of optimization, the level of investment is determined by the transformation of savings into such, as described in section IIID. Government and export expenditures are taken to be exogenously determined.

The domestic demand for commodity i consists of the total intermediate demand, plus the total final demands for consumption, investment, and government purchases, while the total composite demand, represented by $Q_i$, is the sum of the domestic demand and exports:

$$Q_i = \sum_j Mat_{i,j} + \sum_h C_{h,i} + I_i + G_i + Exports_i \tag{22}$$

## B. Prices and Equilibrium

For any given employment level, equilibrium entails that the corresponding level of production should equal the demand forthcoming at the employment level. This requirement, together with the first order conditions for profit maximization by the firms, determines the price levels in the economy, relative to the price of labor. The labor price is assumed to be the numeraire, and is thus taken to be fixed. Since capital is a fixed factor, we take returns to capital as a residual determined by the identity:

$$r_i = \frac{\left(pva_i * V_i - w_i^0 L_i\right)}{k_i^0} \tag{23}$$

The total product cost can then be built up from the components in a standard way. Thus, average cost per unit is

$$AC_i = \frac{\Sigma_j pd_j Mat_{j,i} + pva_i V_i}{X_i} \tag{24}$$

where $pd_i$ is the domestic (tax-inclusive) price of i. In equilibrium, the average cost equals the composite price $pq_i$ of the commodity (the composite price is the peso price of both domestically produced and imported commodities).

The excess supply for each commodity is given by:

$$ES_i = X_i - Q_i \tag{24}$$

The model treats all the foregoing relationships as constraints in a nonlinear programming problem. Markets are assumed to operate so as to minimize the value of sum of squared excess supplies for all commodities; i.e., the objective of the programming problem is to minimize the quantity

$$\Omega = \Sigma_i \left( pq_i * ES_i^2 \right) \tag{25}$$

In equilibrium, therefore, the unit cost is divisible into three parts: (1) $\frac{\sum_j pd_j q_{ji}}{X_i}$, where the j's are the non-transport inputs give the cost of non transport intermediate inputs per unit of X; (2) the same formula with the j's taken to be the transport inputs yields the transport margin; and $\frac{w_i L_i + r_i K_i}{X_i}$ is the cost of value added per unit of X.

## IV. Empirical Results: Regional Impact of Overseas Workers Remittances

With overseas remittances accounting for a significant portion of foreign exchange inflows, the sensitivity of economic activity to any disruption in such flows becomes a relevant policy question. It can, for instance, be argued that export receipts could be more controllable from a policy standpoint, compared to remittances, since the former can be stabilized by programs to diversify export industries, while the latter is essentially dependent on external developments. It is also noteworthy that since 2002, while the growth of remittances has outstripped that of exports, such growth has likewise been more volatile.[12] Remittances from overseas workers are the most important component of transfers from abroad, and it is thus the latter variable that we subject to a shock in our simulations.

In this section, we present the results from the model simulations following a fall in transfers from abroad in the magnitude of 5 percent that of 1994 levels. Such magnitude is within one standard deviation of the variability in growth of remittances, and is therefore within the bounds of experience. We apply this evenly across household types. The incidence of the shock depends upon household dependence on foreign income. This absolute incidence is summarized in Figure 1 (in M₱), and the relative incidence, in terms of the percentage fall in income, in Figure 2. Note that all the household data come from the 1994 Family Income and Expenditure Survey (FIES).

In absolute terms, N. Luzon middle-income households are the most vulnerable, although a greater concentration of the impact of reduced transfers falls on NCR households, particularly the high and middle income classes. N. Luzon households, in particular the low and middle income groups, generally bear the highest percentage reductions in incomes. The results generally validate the characterization of N. Luzon households as being most prone to migrate or transfer residence in pursuit of work opportunities. On the other hand, Mindanao households are the least vulnerable. As can be seen in Table 2, receipts from abroad in cash or in kind account for only 4.2 percent of total household income in Mindanao; this compares to a figure of 13.4 percent and 14.5 percent for NCR and N. Luzon households, respectively.

[12] Using quarterly data for the period 2002-2005, the average year-on-year growth of remittances was 15.8 percent, compared with 6.6 percent for goods exports. The standard deviation of the growth rate was 9.6 percent for remittances, compared to 6.1 percent for exports.

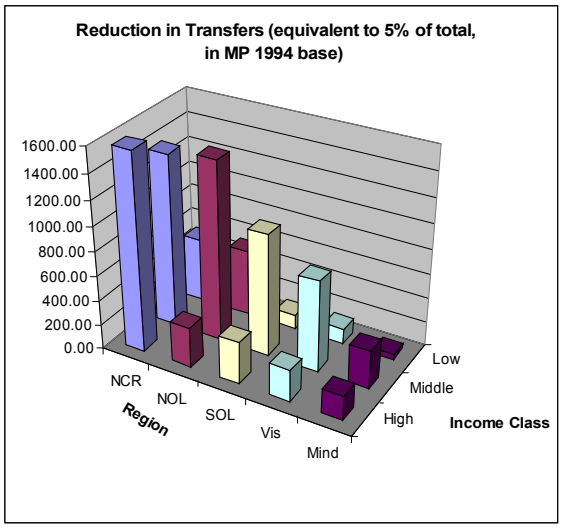


Fig. 1

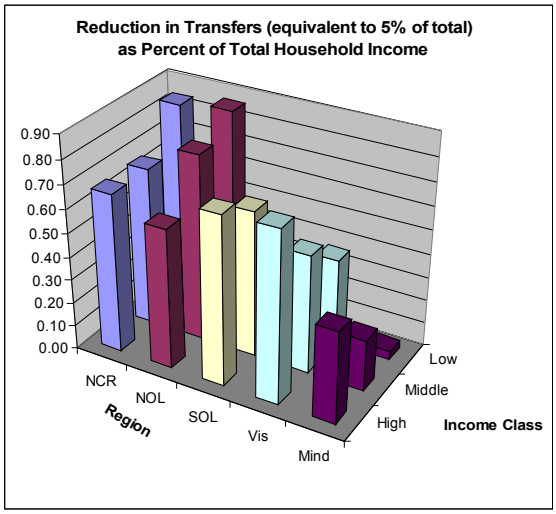


Fig. 2

Lower income levels will induce a reduction in consumption, and therefore on output, which then leads to second round impacts on the foregoing variables in a multiplier process. The final impacts will depend on the initial incidence of the income reductions across the different household groups, the consumption patterns of such households, and the linkages between the different sectors of production (i.e., the transactions matrix, in an input-output analysis). Changes in production levels impact on the demands for the various factors of production, and the incidence of such production changes depends on the distribution of ownership of the inputs to production. Table 2 provides an idea of the regional disparity in income sources. Wages and salaries account for the greatest proportion of total income in the NCR. Relative to total income, entrepreneurial activities show the largest share in Mindanao. As can be expected, most of such income comes from agricultural activities.

**Table 2. Distribution of Family Income by Source, Philippines, 1994**

| Source of Income | NCR | | N. Luzon | | S. Luzon | | Visayas | | Mindanao | | Philippines | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1/ | 2/ | 1/ | 2/ | 1/ | 2/ | 1/ | 2/ | 1/ | 2/ | 1/ | 2/ |
| 1. Wages and Salaries | 56.4 | 100 | 45.9 | 100 | 54.1 | 100 | 49.6 | 100 | 47.0 | 100 | 51.2 | 100 |
| Agricultural | | 0.2 | | 8.9 | | 8.0 | | 16.3 | | 18.6 | | 8.5 |
| Nonagricultural | | 99.8 | | 91.1 | | 92.0 | | 83.7 | | 81.4 | | 91.5 |
| 2. Entrepreneurial Activities | 25.6 | 100 | 33.3 | 100 | 30.2 | 100 | 33.8 | 100 | 43.7 | 100 | 32.3 | 100 |
| Agriculture, Fishery & Forestry | | 1.7 | | 52.7 | | 43.0 | | 49.4 | | 62.6 | | 41.0 |
| Industry | | 8.3 | | 7.3 | | 8.0 | | 6.2 | | 4.8 | | 7.0 |
| Transportation | | 7.1 | | 7.5 | | 6.0 | | 3.7 | | 4.1 | | 5.9 |
| Other Services | | 82.8 | | 32.5 | | 42.0 | | 40.8 | | 28.5 | | 46.2 |
| 3. Other Sources of Income | 18.0 | 100 | 20.7 | 100 | 15.7 | 100 | 16.5 | 100 | 9.3 | 100 | 16.5 | 100 |
| Receipts from Abroad (Cash/Kind) | | 74.7 | | 70.2 | | 66.0 | | 53.3 | | 45.0 | | 66.0 |
| Pensions, Social Security Benefits | | 8.9 | | 11.4 | | 8.0 | | 14.1 | | 20.6 | | 11.3 |
| Investment Income | | 2.3 | | 0.2 | | 0.0 | | 0.9 | | 0.6 | | 1.0 |
| Other Transfer Incomes | | 14.1 | | 18.3 | | 25.0 | | 31.7 | | 33.9 | | 21.7 |
| Total Family Income (P Billions) | 306.51 | | 220.66 | | 199.27 | | 162.08 | | 172.18 | | 1060.71 | |

Notes:
1/ Denotes percent of total family incomes for the region
2/ Denotes percent of income for category in the region
Source of basic data: 1994 Family Income and Expenditure Survey, National Statistics Office

Figures 3 and 4 show the final reductions in output, both in absolute and percentage terms. In peso terms, it can be seen that the impacts are largest for industry and for services other than transport in NCR, followed by industry in S. Luzon. The pattern follows that of the expected inter-regional linkage between the NCR and S. Luzon. Percentage-wise, however, we see that the impact is more broad-based, and more evenly distributed across regions, with Mindanao being least vulnerable. The impact is also more diffuse, with the output reductions being all less than half a percentage point. The concentration of impact is on the services sector in general and on agriculture.

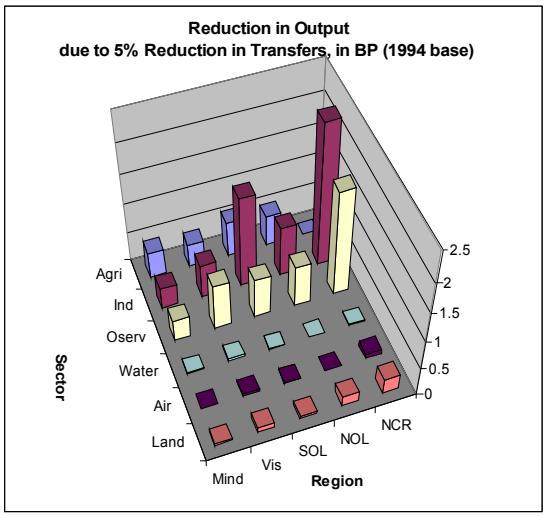


Fig. 3

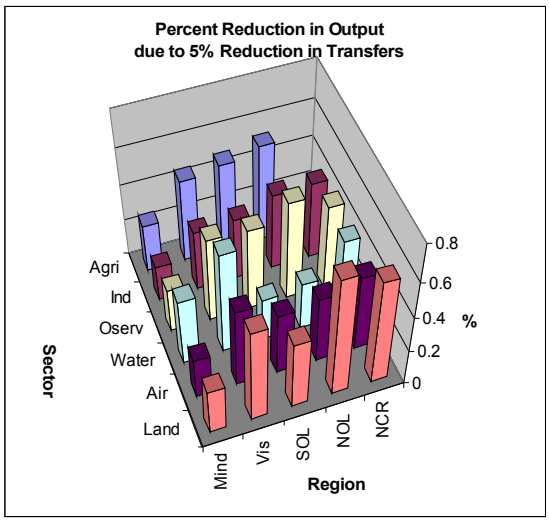


Fig. 4

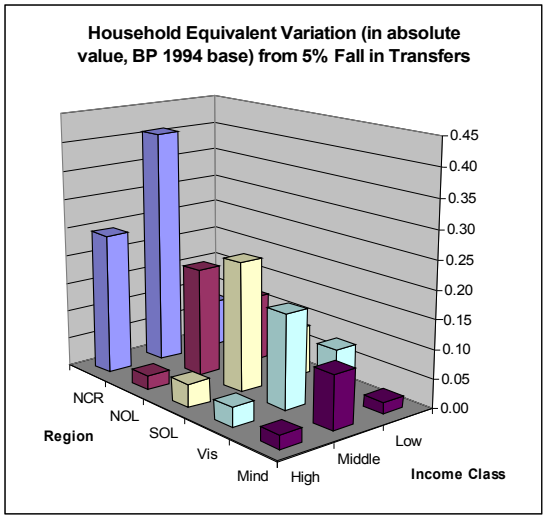


Fig. 5

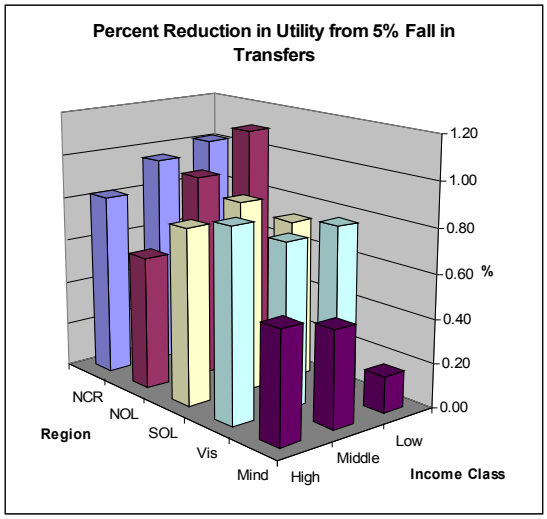


Fig. 6

Although Figures 1 and 2 show the initial incidence of the fall in transfers, the final impact on utility can be quite different, and in general will be further influenced by the successive round effects on regional output, plus the successive impacts on incomes and consumption patterns. Figure 6 shows that the impact is especially hard on low income classes in the NCR and N. Luzon. The incidence is more evenly distributed in S. Luzon and the Visayas, while Mindanao low income families are least affected. The latter result agrees with the finding shown in Fig. 2 that foreign transfers are a comparatively insignificant source of support for the poorest families in Mindanao; moreover, the impact of reduced remittances on their real incomes are mitigated by the reduction in the price level induced by lower demand. Alternatively, one can look at the absolute welfare reduction across household categories. One

measure of this is equivalent variation, defined as the amount of money a household would have to be compensated for in order to bring it to the original level of utility before the shock being considered. Using this measure, results (Figure 5) indicate that the burden of decline in remittances is borne mainly by the middle income classes across all regions. The second highest incidence falls on low income households, with the notable exception of the NCR. This reflects the greater disparity in earnings across income classes in the NCR.

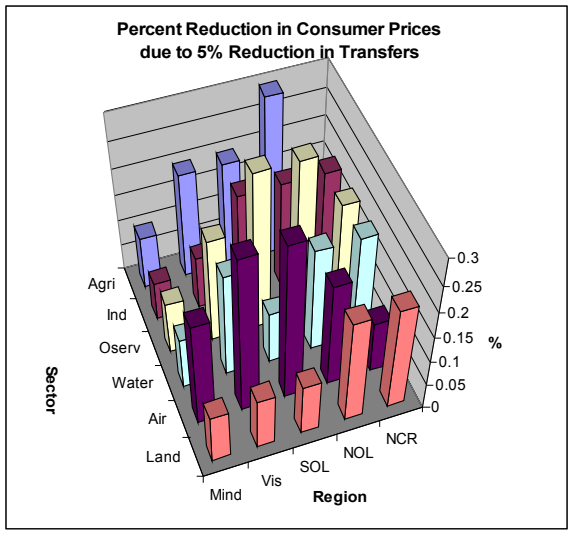


Fig.7

Simulations also indicate some induced lowering of prices, ranging from about 0.1-0.25 percent relative to the baseline (Figure 7), with the overall consumer price index lower by about 0.2 percent. The largest price reductions are for other services in the N. Luzon and S. Luzon areas, and agriculture in N. Luzon. There are likewise significant reductions in the price of air transport services in S. Luzon and the Visayas.

## V. Conclusion

In summary, empirical results indicate that, in absolute terms, the main beneficiaries of remittance increases are the middle-income classes across all regions. The second major beneficiaries are the low income households, again for all regions, with the notable exception of the National Capital Region, where the high-income households are the second highest beneficiary of remittances. Conversely, these distributions provide us an idea of the vulnerability of the different regional income classes, should there be disruption in remittance flows. Percentage-wise, for example, the simulations indicate that the impact of such disruption would be especially hard on low income classes in the NCR and N. Luzon. The incidence is more evenly distributed in S. Luzon and the Visayas, while Mindanao low income families would be less affected.

Assessing household vulnerability to shocks is an important aspect of policy design. An applied general equilibrium framework can be an important tool in quantifying the spatial dimension of such shocks. In view of the increasing importance of remittances as a source of foreign exchange, this work can be seen as a first attempt to fill a void in our knowledge of the impact of instability in such flows on the various sectors of the economy. It should be emphasized that the quantitative results presented in this paper can be subject to further refinement. Specification of a sectoral model for the year 2000 is high on our agenda. In this regard, we would like to highlight the importance of timely, detailed and consistent information on resource flows in the economy, especially an updated transactions matrix, which is essential for an updated input-output table, survey of family income and expenditures, and flow of funds in the economy.

**Annex 1.**

**Value of OFW Remittances**

| | | | Remittances as % of: | | | | |
|---|---|---|---|---|---|---|---|
| | **Level (in US$ Bil) [1/]** | **Growth Rate (%)** | **GNP** | **XGS** | **FDI** | **GIR** | **DSB** |
| 1996 | 4.3 | 11.3 | 5.0 | 15.6 | 656.4 | 36.6 | 85.7 |
| 1997 | 5.7 | 33.3 | 6.7 | 16.7 | 469.9 | 65.3 | 102.6 |
| 1998 | 7.4 | 28.3 | 10.8 | 21.3 | 324.9 | 68.0 | 144.6 |
| 1999 | 6.8 | -7.8 | 8.5 | 18.0 | 544.8 | 45.1 | 103.2 |
| 2000 | 6.1 | -11.0 | 7.5 | 14.9 | 270.1 | 40.2 | 96.6 |
| 2001 | 6.0 | -0.3 | 7.9 | 17.5 | 3092.8 | 38.4 | 92.4 |
| 2002 | 6.9 | 14.2 | 8.4 | 18.2 | 446.6 | 42.1 | 88.7 |
| 2003 | 7.6 | 10.1 | 8.9 | 19.6 | 1543.4 | 44.4 | 95.3 |
| 2004 | 8.6 | 12.8 | 9.2 | 20.0 | 1242.7 | 51.7 | 118.5 |
| 2005 | 10.7 | 25.0 | 10.0 | 23.9 | 944.3 | 57.8 | 142.2 |
| 2006 | 4.9 (Jan-May) | 14.8 | 9.8 (J-Mar) | 23.3 (J-Mar) | 742.6 (J-Apr) | 23.2 (J-May) | 145.4 (J-Mar) |

Source: Bangko Sentral ng Pilipinas

[1/] Cash remittances passing through the banking system

GNP - gross national product

XGS - Exports of goods and services; Note that the ratios to XGS before and after 1999 may not be comparable due to the shift in the BOP concept

FDI - Foreign Direct Investment

GIR - Gross International Reserves

DSB - Debt Service Burden

## ANNEX 2: DISTRIBUTION OF NUMBER & ESTIMATED INCOME OF FAMILES BY INCOME GROUP, BY REGION: PHILIPPINES, 1994

| I-O REGIONS | | ADMINISTRATIVE REGIONS | 1994 DISTRIBUTION OF FAMILIES | | | | | | ESTIMATED INCOME IN 1994 | | | | | | 1994 Poverty Threshold [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BI-REG | S-REG | | All-Income Groups | | Low-Income Group [1] | | High-Income Group | | Total Income | | Low-Income Group [1] | | High-Income Group | | |
| | | | (Number) | % Dist'n | (Number) | % Share | (Number) | % Share | (P000) | % Dist'n | (P000) | % Share | (P000) | % Share | (PESOS) |
| | | TOTAL PHILS | 12,754,944 | 100.0 | 6,530,352 | 51.2 | 6,224,592 | 48.8 | 1,060,709,853 | 100.0 | 227,064,942 | 21.4 | 833,644,911 | 78.6 | 53,310 |
| I | 1 | N.C.R | 1,765,644 | 13.8 | 415,022 | 23.5 | 1,350,622 | 76.5 | 306,514,234 | 28.9 | 25,411,146 | 8.3 | 281,103,088 | 91.7 | 67,380 |
| II | | R.O.P | 10,989,300 | 86.2 | 6,115,330 | 55.6 | 4,873,970 | 44.4 | 754,195,619 | 71.1 | 201,653,796 | 26.7 | 552,541,823 | 73.3 | 50,852 |
| | 2 | NORTH LUZON | 2,745,211 | 21.5 | 1,447,463 | 52.7 | 1,297,748 | 47.3 | 220,662,278 | 20.8 | 57,931,268 | 26.3 | 162,731,010 | 73.7 | 58,422 |
| | | CAR | 241,204 | 1.9 | 172,906 | 71.7 | 68,298 | 28.3 | 18,010,523 | 1.7 | 7,536,149 | 41.8 | 10,474,374 | 58.2 | 65,118 |
| | | I - ILOCOS | 706,263 | 5.5 | 525,742 | 74.4 | 180,521 | 25.6 | 46,701,861 | 4.4 | 22,053,232 | 47.2 | 24,648,629 | 52.8 | 60,132 |
| | | II - CAGAYAN | 523,098 | 4.1 | 271,011 | 51.8 | 252,087 | 48.2 | 36,016,040 | 3.4 | 8,710,635 | 24.2 | 27,305,405 | 75.8 | 49,896 |
| | | III - C. LUZON | 1,274,646 | 10.0 | 477,804 | 37.5 | 796,842 | 62.5 | 119,933,854 | 11.3 | 19,631,251 | 16.4 | 100,302,603 | 83.6 | 58,542 |
| | 3 | SOUTH LUZON | 2,609,291 | 20.5 | 1,358,810 | 52.1 | 1,250,481 | 47.9 | 199,269,085 | 18.8 | 46,035,495 | 23.1 | 153,233,590 | 76.9 | 53,568 |
| | | IV - S. TAGALOG | 1,731,396 | 13.6 | 798,940 | 46.1 | 932,456 | 53.9 | 151,716,292 | 14.3 | 30,026,503 | 19.8 | 121,689,789 | 80.2 | 57,222 |
| | | V - BICOL | 877,895 | 6.9 | 559,870 | 63.8 | 318,025 | 36.2 | 47,552,793 | 4.5 | 16,008,992 | 33.7 | 31,543,801 | 66.3 | 49,914 |
| | 4 | VISAYAS | 2,779,431 | 21.8 | 1,555,759 | 56.0 | 1,223,672 | 44.0 | 162,084,537 | 15.3 | 42,675,846 | 26.3 | 119,408,691 | 73.7 | 42,132 |
| | | VI - W. VISAYAS | 1,133,399 | 8.9 | 656,197 | 57.9 | 477,202 | 42.1 | 72,625,996 | 6.8 | 20,818,933 | 28.7 | 51,807,063 | 71.3 | 49,182 |
| | | VII - C. VISAYAS | 952,353 | 7.5 | 491,744 | 51.6 | 460,609 | 48.4 | 54,835,627 | 5.2 | 11,905,392 | 21.7 | 42,930,235 | 78.3 | 38,550 |
| | | VIII - E. VISAYAS | 693,679 | 5.4 | 407,818 | 58.8 | 285,861 | 41.2 | 34,622,914 | 3.3 | 9,951,521 | 28.7 | 24,671,393 | 71.3 | 38,664 |
| | 5 | MINDANAO | 2,855,367 | 22.4 | 1,753,298 | 61.4 | 1,102,069 | 38.6 | 172,179,719 | 16.2 | 55,011,188 | 31.9 | 117,168,531 | 68.1 | 49,288 |
| | | IX - W. MINDANAO | 508,768 | 4.0 | 332,941 | 65.4 | 175,827 | 34.6 | 25,837,416 | 2.4 | 9,486,554 | 36.7 | 16,350,862 | 63.3 | 42,444 |
| | | X - N. MINDANAO | 734,195 | 5.8 | 451,211 | 61.5 | 282,984 | 38.5 | 42,459,008 | 4.0 | 13,065,299 | 30.8 | 29,393,709 | 69.2 | 47,628 |
| | | XI - S. MINDANAO | 887,145 | 7.0 | 436,971 | 49.3 | 450,174 | 50.7 | 62,730,628 | 5.9 | 13,756,652 | 21.9 | 48,973,976 | 78.1 | 49,206 |
| | | XII - C. MINDANAO | 395,243 | 3.1 | 265,040 | 67.1 | 130,203 | 32.9 | 24,221,379 | 2.3 | 8,424,232 | 34.8 | 15,797,147 | 65.2 | 53,826 |
| | | A.R.M.M. | 330,016 | 2.6 | 267,135 | 80.9 | 62,881 | 19.1 | 16,931,288 | 1.6 | 10,278,450 | 60.7 | 6,652,838 | 39.3 | 53,334 |

[1] Low-income families are defined to include families with incomes falling within the predetermined poverty income class range and below.

[2] Estimated annual threshold for a family of 6. (Data Source: 1997 Philippine Poverty Statistics, NSCB)

**Annex 3. List of Model Variables**

| **Endogenous variables** | | |
|---|---|---|
| **Variable name** | **Description** | **Size** |
| | **Production sector** | |
| $\mathbf{mat_{ij}}$ | Intermediate inputs flow from industry i to industry j | 34X34 |
| $\mathbf{intp_i}$ | Total intermediate inputs into industry i | 34 |
| $\mathbf{V_i}$ | Total value added in i | 34 |
| $\mathbf{X^{NT}_i}$ | Output (net of transport) in industry i | 34 |
| $\mathbf{X^{T}_i}$ | Output (gross of transport) in industry i | 34 |
| $\mathbf{X_i}$ | Total output in industry i | 34 |
| $\mathbf{ES_i}$ | Excess supply of commodity i | 34 |
| **GDP** | Gross domestic product | 1 |
| **Ω** | Sum of squared excess supplies in economy | 1 |
| | **Inputs** | |
| $\mathbf{L_i}$ | Labor demand in industry i | 34 |
| $\mathbf{K_i}$ | Value of capital inputs in industry i | 34 |
| | **Incomes** | |
| $\mathbf{Y_{LH}}$ | Labor income of household h | 3X5 |
| $\mathbf{Y_{LR}}$ | Total labor income for the region | 5 |
| $\mathbf{Y_L}$ | Total labor income | 1 |
| $\mathbf{Y_K}$ | Total capital income | 1 |
| $\mathbf{HHOS_i}$ | Total household share in capital income of industry i | 34 |
| **HHOS** | Total household share in capital income | 1 |
| $\mathbf{YD_H}$ | Total disposable income of household h | 3X5 |
| $\mathbf{Y_H}$ | Total income of household h | 3X5 |
| | **Demand** | |
| $\mathbf{C_{H,i}}$ | Consumption by household h of commodity i | 3X5X34 |
| $\mathbf{C_H}$ | Total consumption by household h | 3X5 |
| $\mathbf{U_H}$ | Utility of household h | 3X5 |
| $\mathbf{EV_H}$ | Equivalent variation for household h | 3X5 |
| $\mathbf{D_i}$ | Domestic demand for commodity i | 34 |
| $\mathbf{Q_i}$ | Composite (domestic + foreign) demand for commodity i | 34 |
| | **Prices** | |
| $\mathbf{P_{VA,i}}$ | Price of value added of commodity i | 34 |
| $\mathbf{P_{L,i}}$ | Local (domestic) price of commodity i excluding tax | 34 |
| $\mathbf{P_{D,i}}$ | Local (domestic) price of commodity i including tax | 34 |
| $\mathbf{P_{M,i}}$ | Domestic price of imports of commodity i | 34 |
| $\mathbf{P_{Q,i}}$ | Composite (domestic + export) price of commodity i | 34 |
| $\mathbf{P_{X,i}}$ | Price of output of commodity i | 34 |
| $\mathbf{r_i}$ | Return on capital in industry i | 34 |
| **CPI** | Consumer price index | 1 |
| | **Government** | |
| $\mathbf{T_{Direct,H}}$ | Direct tax collections from household h | 3X5 |
| $\mathbf{T_{Direct}}$ | Total direct tax collections | 1 |
| $\mathbf{T_{Indirect,\ i}}$ | Total indirect tax collections from industry i | 34 |
| $\mathbf{T_{Indirect}}$ | Total indirect tax collections | 1 |
| $\mathbf{Tar_i}$ | Tariff collections from inputs into i | 34 |
| **Tar** | Total tariff revenue of government | 1 |
| $\mathbf{Y_G}$ | Total income of government | 1 |
| | **Savings** | |
| $\mathbf{S_h}$ | Savings of household h | 3X5 |
| $\mathbf{S_H}$ | Total savings of households | 1 |

| | | |
|---|---|---|
| $S_G$ | Savings of government | 1 |
| $S_F$ | Foreign savings | 1 |
| $S_T$ | Total savings | 1 |
| | **Total endogenous variables** | **2,485** |
| | | |
| **Exogenous variables and parameters** | | |
| | **Production sector** | |
| $a_{ij}$ | Input-output coefficient | 34X34 |
| $a_{Vi}$ | Coefficient of value-added in input-output matrix | 34 |
| $A_i$ | Scale parameter in 1st level Cobb-Douglas production function | 34 |
| $\alpha_i$ | Coefficient of inputs in 1st level Cobb-Douglas production function for i | 34X2 |
| $\beta_i$ | Coefficient of inputs in 2nd level Cobb-Douglas production function for i | 34X4 |
| | **Inputs** | |
| $KR_i$ | Real capital in industry i | 34 |
| | **Demand** | |
| $M_i$ | Imports of commodity i | 34 |
| $Exports_i$ | Exports of commodity i | 34 |
| $c_h$ | Marginal propensity to consume for household h | 3X5 |
| $\delta_{ih}$ | Parameter in Cobb-Douglas utility function for household h | 34X15 |
| | **Prices** | |
| $w_i$ | Wage rate in industry i | 34 |
| $P_{E,i}$ | World price of exports of i | 34 |
| $P_{M,i}$ | World price of imports of i | 34 |
| $CPEW_i$ | Weight in commodity i in price index for private consumption expenditures | 34 |
| | **Incomes** | |
| $HHOS_H$ | Total household operating surplus from informal transactions | 3X5 |
| $YFOR_H$ | Household transfer receipts from foreign sources | 3X5 |
| $\lambda_i$ | Capital income distribution to households | 34 |
| | **Government** | |
| $Tr_{Direct,H}$ | Direct tax rate on household h | 3X5 |
| $Tr_{Indirect,\ i}$ | Indirect tax rate on industry i | 34 |
| $Tarr_i$ | Tariff rate on imports of i | 34 |
| $Y_{GOV,H,R}$ | Total government transfers to household h | 3X5 |
| | **Total exogenous variables and parameters** | **2,353** |

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