

## Assessment of Two Modes of Financing Land Transport Investment in the Philippines

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**Abstract:** This paper introduces a system-wide spatial impact analysis of two modes of financing of land transport infrastructure in the Philippines with opposite reallocative effects – (1) foreign transfers as in official development assistance funds and (2) value-added tax on transport services. These two financing modes are alternatively used to finance an equal amount of land transport infrastructure improvement across five different Philippine regions. The effect of each financing scheme will be analyzed per regional transport mode, per regional production sector; and per regional household income group. A spatial computable general equilibrium model is used to estimate the values of production and welfare after an exogenous financing shock is introduced. Results show that value-added tax has slightly greater impact on regional output and regional welfare than foreign transfers.

**Key Words :** *financing, transport infrastructure, value-added tax, foreign transfers*

### 1. INTRODUCTION

For developing countries with twin problems of huge budget deficit and trade deficit, sourcing funds for transport infrastructure investment is a major concern among policy makers. Constraints of tight fiscal position have forced governments in developing Asian economies like the Philippines to seek foreign aid, impose higher consumption taxes like value-added tax and encourage private sector participation in funding transport projects.

This study seeks to look into the impact on gross output and relative welfare of two types of financing with seemingly opposite reallocative effects. The first one, an indirect tax, has distortionary effects on prices since it takes the form of a value-added tax on land transport services. Its main purpose is revenue enhancement and is mainly characterized by relative ease in collection. The second has minimal distortionary effect on prices since it involves foreign transfers or official development assistance funds (ODA). This study identifies spatial distribution of benefits of transport financing policy in terms of its welfare effects among fifteen household income groups and output effects across thirty-four regional production sectors in a spatial computable general equilibrium model. This distinction is necessary because the paper aims to determine whether the mode of financing affects the level and patterns of spatial distribution of micro effects of macro transport financing policy. Two traditional sources of transport infrastructure funding, with diverse resource reallocation effects were adopted to test the previous hypothesis –namely VAT and ODA. Hopefully, this will provide some benchmarks

in resource allocation of indirect taxes and foreign transfer for transport infrastructure in developing economies in Asia.

The succeeding section presents a quick overview of studies on transport infrastructure financing. The next section gives brief situationer of current transport infrastructure financing in the Philippines. The theoretical part presents a spatial computable general equilibrium model with a five region social accounting matrix as database. The empirical part presents the simulation results of alternative modes of financing urban transport infrastructure investment in the Philippines. The paper concludes with some insights for policy makers regarding choice of financing mode for land transport infrastructure of developing economies like the Philippines.

## **2. OVERVIEW OF STUDIES ON TRANSPORT INFRASTRUCTURE FINANCING IN DEVELOPING COUNTRIES**

This section elaborates on current issues involved in transport infrastructure financing in developing countries. This will put in place the previously mentioned objective of this paper.

During the 1990s two traditional sources of funding are government tax revenues and foreign transfers like official development assistance. For many low income and middle income countries, government revenues provide 70% of funding, whereas the private sector provide 20-25% and official development assistance (ODA) filled in 5%-10% of total financing. (UK Department for International Development : 2002) ; (Briceno et al :(2004) .However ,at the onset of the 21<sup>st</sup> century, it seems the private sector now provides more funds than foreign sources. .The International Monetary Fund estimated that around 2.1% of GDP in upper-middle income countries to 3.2% in low-income countries goes to infrastructure spending.

As far as foreign transfers are concerned, an interesting finding by Chatterjee et al (2003) showed that pure transfers for infrastructure investment have no growth or dynamic consequences but always resulted to increases in welfare. In other words, transfers are quite short-term. They contrasted the effects of a transfer tied to investment in public infrastructure with those of a traditional pure transfer. Chatterjee et al showed that a temporary pure transfer has only modest short-run growth effects and leads to a permanent deterioration in the current account. On the other hand, a productive infrastructure-related transfer has significant impacts on short-run growth, which redounds to permanent improvement in key economic variables. Estache (2004) argued that welfare and output effects take place when transfers are tied to infrastructure. He believes that long-run growth welfare effects depend on the initial stock of infrastructure as well as co-financing arrangements. These findings highlight the usage of economic and not political criteria in determining optimal allocation of scarce international aid funds for developing countries. A study by Acharya in 2003 contended that ODA funds going to transport infrastructure can have a strong impact on poverty reduction in developing countries and social objectives such as equity, sustainability and social development. Among his recommendations relevant to ODA financing is that emphasis on fund utilization should shift from micro to macro management like policy dialogue, sectoral and donor coordination. Moving on to the relationship between fiscal position of developing countries and transport infrastructure funding, belt-tightening measures adopted by foreign-debt strapped, developing countries, have limited the extent of public funding of transport infrastructure. Easterly &

Serven (2003) argue that macroeconomic policies which adopt intensive fiscal adjustment programs, must not suppress implementation of infrastructure projects and avoid wasteful, unnecessary construction of useless structures.. Standard IMF adjustment programs advocate short-term aggregate balance, medium-term debt sustainability, cutting down excessive and inefficient public expenditures and the promotion of private participation in infrastructure.

In the end, Estache & Pinglo (2004) identified four major directions where the literature on infrastructure financing is heading : (1) technical literature on the desirability and conditions of efficient public-private partnerships; (2) need to develop financial markets in developing countries; (3) search for new and improved risk mitigation products that will help strengthen the connection between infrastructure development and private financial markets; and (4) subsovereign issues or capability of local governments in attracting funds for transport infrastructure development.

### **3. CURRENT INFRASTRUCTURE DEVELOPMENT PLAN OF PHILIPPINE GOVERNMENT AND ITS FINANCING**

To put into context the financing issues discussed within Philippine setting, a concise situationer on the infrastructure development plan of the Philippines is presented together with its funding scheme.

The current administration under President Gloria Macapagal-Arroyo has embarked on the implementation of a comprehensive infrastructure development plan with transport projects as a major component. This is included in a Medium Term Development Plan (MTDP) which is a six year plan which coincides with the term of the incumbent president. It defines the macroeconomic and sectoral targets and the general thrust of economic policies in the Philippines. Part of the Plan is a Medium Term Public Investment Plan (MTPIP) .This contains the projects that must be undertaken to achieve the numerical targets. The current administration has identified strategically important transport infrastructure projects in the so-called “ super-regions “. In 2006, the National Economic Development Authority (NEDA), the economic planning body, has put forth a super-region scheme which aims to connect major islands in the Philippines through an intermodal transport infrastructure scheme. Emphasis was placed on those transport infrastructure projects which enhance connectivity and spatial cohesiveness among the Philippine regions The five regions are; (1) Luzon Urban Beltway – heartland of industry, trade and commerce and contributes the most to national economy, (2) Central Philippines – envisioned to be the premier tourist destination with its beautiful and scenic spots, (3) North Luzon Agribusiness Quadrangle – has comparative advantage in agricultural and food productivity, (4) Mindanao Agribusiness Region – has competitive edge in agribusiness and (5) Cyber Corridor – an ICT channel running from Northern to Southern Philippines. The priority given to transport infrastructure is manifested in 27% increase in budget allocation to the Department of Transportation & Communication and the 20.2% increase to funds given to the Department of Public Works and Highways last fiscal year of 2008. The spatial distribution of transport infrastructure funds across the country is depicted in the table below. A striking feature is that the bigger allocation goes to the socio-economic-political center region ,National Capital Region, and its adjacent regions namely Northern Luzon and Southern Luzon. These fall under the category of Luzon Urban Beltway, with the nearby regions falling under the category of Central Philippines. The regional disaggregation used in this paper was based on administrative

categories and data availability; but has some striking overlap with the government's delineation of regional grouping. The regional groupings in this paper can be aligned with the super-region disaggregation of the National Economic Development Authority which is the economic planning agency of the Philippines. It must also be noted that one of major fiscal reforms instituted by the Arroyo administration to solve the fiscal problem is the imposition of twelve percent VAT on sales of goods and services. The proceeds from this indirect tax is a major source of government revenues used for the country's infrastructure projects. Whereas ODA remains a major source of infrastructure funds in the Philippines. Hence, the focus on these two financing schemes.

Table 1 Allocation of Funds Across Super Regions

Super Region	No. of Projects	Amount (Billion Pesos)	Percentage Share (%)
Luzon Urban Beltway	283	826.50	40.79 %
Central Philippines	361	412.39	20.35 %
North Luzon Agribusiness Quadrangle	207	368.82	18.21 %
Agribusiness Mindanao	316	325.91	16.09 %
Cyber Corridor	30	63.07	3.11 %
Across All Super Regions	31	29.45	1.45 %

Source : National Economic Development Authority, Public Information Division, 2008

Prior to world-wide increase in the price of oil and global shortage in rice supply, it was planned that the budget would be balanced by this end of this year 2008. To achieve this goal, domestic sources will be tapped which is around 64% and the residual from foreign sources. However, the reverse seems to happen, based on the current sourcing of funds as reported by NEDA. Maybe the reason is that ODA or foreign-funded projects cut across political boundaries within domestic economy. Revenue growth for 2008 was projected to be 10.5% and total revenues are estimated to be 17% of GDP. It was also forecasted that national government debt will drop to 54% of GDP. (Dept of Finance : 2007). Briefly, the plan aims to spend around 1.904 trillion pesos over the remaining years of the Arroyo administration from 2007 to 2010 on infrastructure projects; 37% of which will go to the transport sector. This magnifies the importance given to higher mobility of persons and commodities across regions in the Philippines and strong linkage with the rest-of-the world

.Table 2 Updated Comprehensive and Integrated Infrastructure Program for Fiscal Years 2007-2010

Type of Infrastructure	Billion Pesos	Percent Share (%)
Transport	753.24	37.1
Power	527.05	26.01
Water	425.66	21.01
Social Infrastructure	203.97	10.07
Communication	63.07	3.11
Relending	27.73	1.37
Support for CARP ( Comprehensive Agrarian Reform Program )	25.47	1.36

Source : National Economic Development Authority, Public Information Division, 2008

The profile of source of funding shows that more than half of funding infrastructure projects will come from national government funds and one third will come from the private sector.

Table 3 Source of Financing of Infrastructure -- Years 2007-2010

	Percentage Share (%)
National Government	53.86
Private Sector	31.68
GOCCs (Government-Owned & Controlled Corporations )	5.68
GFI ( Government Financial Institutions)	1.33
LGUs ( Local Government Units )	1.12
Other Sources	6.33

Within the national government funds, 76% comes from foreign transfers in the form of official development assistance and the rest from local sources. This seems to reflect a coping strategy as the government aims to balance the budget and improve its fiscal position through higher tax collection . It looks to the foreign sector as a potential source of financial resources while it puts its fiscal house in order.

Table 4 Source of Infrastructure Funds of National Government

	Million Pesos	Percentage Share(%)
Local Financing	261.17	23.93
Official Development Assistance (ODA)	830.17	76.07

Source : National Economic Development Authority, Public Information Division, 2008

The midyear economic briefing in September 2008 by then recently appointed Economic Planning Minister Ralph Recto showed that the aforementioned infrastructure funding profile has not changed substantially. Emphasis of the current government is still on transport infrastructure in the midst of the global financial crisis.

#### 4. PRESENTATION OF FIVE-REGION MODEL

This next section elaborates on the theoretical framework used to compare relative impact of different financing mechanisms of land transport infrastructure in the Philippines.

This is the first spatial computable general equilibrium model with a disaggregated transport sector for the Philippines. Policy simulations are undertaken using data from a five-region social accounting matrix constructed by the author , using secondary data, as basis. A social accounting matrix shows the linkage among production and consumption sectors in an economy and captures their interaction among institutions in the macroeconomy as in households, firms, government sector and, foreign sector.

The main limitation of this model is that it is a static model and hence captures only the short-run impact of different financing modes. While it is recognized that financing has intertemporal component, a system-wide simulation of policy impact is undertaken to assess the short-run gains and costs . These can be compared with a dynamic general equilibrium model which captures long-run benefits and costs. However dynamic SCGE imposes huge data requirements and investments in time and resources. This will be done in future studies Moreover, availability of secondary data for dynamic spatial general equilibrium modeling is fairly limited for the Philippines at this stage.

As a pioneering undertaking for the Philippines, the study adopts the simplest assumption for

market structure of product and factor markets in the Philippines ,i.e. perfect competition. The accounting period used which is 1994 is justified by the availability of consistent and reliable data for the tremendously large data requirements of a five-region social accounting matrix. (SAM). It must be pointed out though that the direction and magnitude of interregional flows in the constructed multi-regional SAM were verified and checked against primary data collected by an origin-destination (O-D) freight and passenger flow survey conducted by the Philippines Department of Transportation & Communication (DOTC) and Japan International Cooperation Agency (JICA).

The simulation of the impact of alternative financing scenarios used in this study is an extension of the basic model used in a previous paper by Dakila and Mizokami ( 2007). In this previous application, land transport infrastructure in NCR –the Skyway Project was identified as the investment with maximum impact, but the financing aspect was not investigated.

**4.1 Database**

The benchmark data are taken from a five-region social accounting matrix constructed by the authors for the Philippines, using 1994 Philippine interregional input-output data. ( Mizokami & Dakila :2005). The delineation of regions is based on the archipelagic geography of the Philippines. This differs slightly from that of the government’s “super-region” categories since primary consideration was given to the availability of secondary data, which are compiled based on administrative groupings of provinces into regions. Moreover, the regional delineation adopted in this study is based on concept of regions as “centers of economic interest “ which is different from that of the government’s super region scheme. This regional disaggregation preceded the “super-region” infrastructure plan of the current government. The disaggregation into seven sectors ( with three transport sectors – water, air, and land mode ) is done to enable the researcher to look into the impact of a change in transport capacity on alternative modes of transport and non-transport sectors. Households are divided into three income groups; namely low-income households, middle-income households and high-income households. Low income households are all those who earn below the regional poverty threshold as determined by the National Statistical Coordination Board. The high income households are those who earn 250,000 pesos and above annually. All the households earning income between the regional poverty threshold and the highest income bracket in the Family Income and Expenditure Survey (250,000 pesos and above ) are classified as middle income households.

Table 5 : Sectoral Disaggregation of Model

Production sectors	Regions	Households
Agriculture (AG)	National Capital Region (NCR)	Low income (Low)
Industry (IND )	NorthernLuzon (NOL)	Middle Income(Mid)
Water transport (WTRSRV)	Southern Luzon (SOL )	High income (High)
Land transport (LNDTR)	Visayas (VIS)	
Air transport (AIRTR)	Mindanao (MIN)	
Other services (OTSRV)		
Government (GOV)		

The calibration of the SCGE model utilized a special five-region social accounting matrix (SAM) that was used as the benchmark for deriving the baseline values of 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. 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 spatial effects of particular shocks, particularly on regional income and output disparity and other aspects of the regional economies. This RSAM is presented in detail in Dakila, C. and Mizokami, S. (2006). The main data source for the RSAM 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.

#### 4.2 Assumptions

(1) All product and factor markets operate under perfectly competitive conditions. (2) Economic agents like households and firms maximize an objective function subject to constraints. Households maximize utility whereas firms maximize profit. (3) Equilibrium is defined as a state where the actions of all agents are mutually consistent and can be executed simultaneously. Quantities adjust in the model and prices follow to equate the notional and effective demand for labor. (4) In this model, adjustment to equilibrium is implemented by specifying that markets adjust to minimize the sum of excess supplies. (5) Among the seven production sectors, three belong to the transport sector, namely, water transport services sector, air transport services sector, land transport services sector. The demand for services of each type of transport mode is a derived demand associated with the demand of intermediate goods. (5) Between the two factors of production, capital is immobile and labor is mobile among the five regions. (6) The economy has thirty-four product markets. This is composed of thirty-four product markets within the five regions, one capital market and one labor market. NCR has an insignificant agricultural sector. (7) The exogenous shock in the model takes the form of a technological improvement which is capital enhancement of land transport infrastructure services sector across all delineated regions in the Philippines. (8) The national government finances the technological improvement. (9) Government funds for this purpose are derived from alternative sources namely – (9a) indirect taxes like value-added tax (VAT) on land transport services sector ; (9b) foreign transfers in the form of official development assistance (ODA) (10) The magnitude of government spending on capital enhancement exactly equals the amount of taxes or foreign transfers used to finance the exogenous shock.

#### 4.3 Description of the Model

##### 4.3.1. 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  $h^{\text{th}}$  household with respect to consumption of the  $i^{\text{th}}$

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 ( $\lambda_h \sum_i r_i K_i$ ), 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  $r^{th}$  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  $\omega$ 's are the labor income distribution parameters, and, as indicated, the summation is for industries belonging to the  $r^{th}$  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

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

where  $p_i$  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:

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

#### 4.3.2. 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.

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

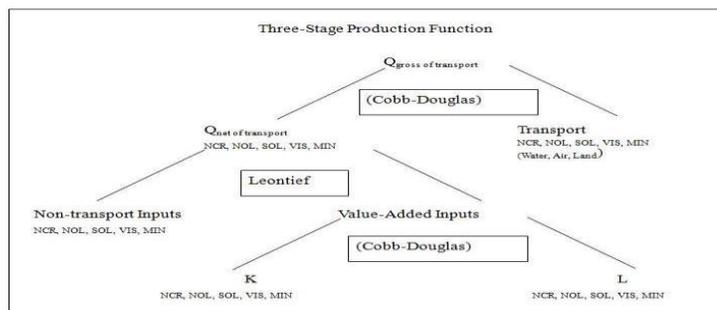


Figure 1 Three Stage Production Function

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.

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

where  $X_{ji}$  = non-transport intermediate input coming from sector  $j$  in origin to sector  $i$  in destination region, with corresponding Leontief coefficient  $a_{ji}$  in the second level production function;  $V_i$  represents value-added of output in destination region.

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. The usage of Cobb-Douglas production function at the top level of the nested production function is appropriate because of the aggregative nature of data used in the model. The perception that substitution is low maybe due to this aggregative nature; but at the more disaggregative micro level; significant substitution among transport modes occur. 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

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

$$X_j^{NT} = \min \left[ \frac{X_{1j}}{a_{1j}}, \dots, \frac{X_{NTj}}{a_{NTj}}, \frac{V_j}{a_{V,j}} \right] \quad (11)$$

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

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

$$pd_i * \frac{\partial X_i}{\partial X_i^{NT}} = p_{NT} \quad \text{Or} \quad pd_i \beta_{li} \frac{X_i}{X_i^{NT}} = p_{NT} \quad (12)$$

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

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

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

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 in Eqn (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

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

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

#### 4.3.3 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:

$$Tar_i = tar_i (m_i) \quad (14)$$

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:

$$T_{\text{Indirect},i} = \text{tind}_i (d_i + m_i (1 + \text{tar}_i)) \quad (15)$$

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

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

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

#### 4.3.4 .Investment-Saving Balance

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

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

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:

$$S_G = \Sigma_i \text{Tar}_i + \Sigma_i T_{\text{Indirect},i} + \Sigma_h T_{\text{Direct},h} - \Sigma_i G_i - \Sigma_h \text{Tr}_{\text{GOV},h} - \text{Tr}_{\text{GOV},\text{FOR}} \quad (18)$$

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

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

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:

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

#### 4.3.4. 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.

$$\begin{aligned} \text{pva}_i * \frac{\partial V_i}{\partial L_i} &= w_i \\ \text{pva}_i (1 - \alpha_i) \frac{V_i}{L_i} &= w_i \end{aligned} \quad (11)$$

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:

$$\text{Mat}_{i,j} = a_{ij} X_j^{\text{NT}} \quad (21)$$

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,  $\text{Mat}_{ij}$  is the matrix of interindustry flows in the economy,  $a_{ij}$  represents the fixed coefficients technology, and, as before  $X_j^{\text{NT}}$  is output net of transport for the  $j$ th 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. 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 earlier section. 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:

$$Q_i = \sum_j \text{Mat}_{i,j} + \sum_h C_{h,i} + I_i + G_i + \text{Exports}_i \quad (22)$$

#### 4.3.5. 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:

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

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

$$AC_i = \frac{\sum_j pd_j \text{Mat}_{j,i} + pva_i V_i}{X_i} \quad (24)$$

where  $pd_i$  is the domestic (tax-inclusive) price of  $i$ . In equilibrium, the average cost equals the composite price  $pqi$  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:

$$ES_i = X_i - Q_i \quad (25)$$

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

$$\Omega = \sum_i (pq_i * ES_i^2) \quad (26)$$

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 (3)  $\frac{w_i L_i + r_i K_i}{X_i}$  is the cost of value added per unit of X.

Equilibrium Condition:

$$Y = C + I + G + X - M \quad (27)$$

Where Y: aggregate supply

C: total consumption expenditures of the national economy

I: total investment expenditures of the national economy

G: total government expenditures of the national economy

X: total purchases of locally made goods by foreign sector

M: total purchases of foreign-made goods by domestic residents of nation

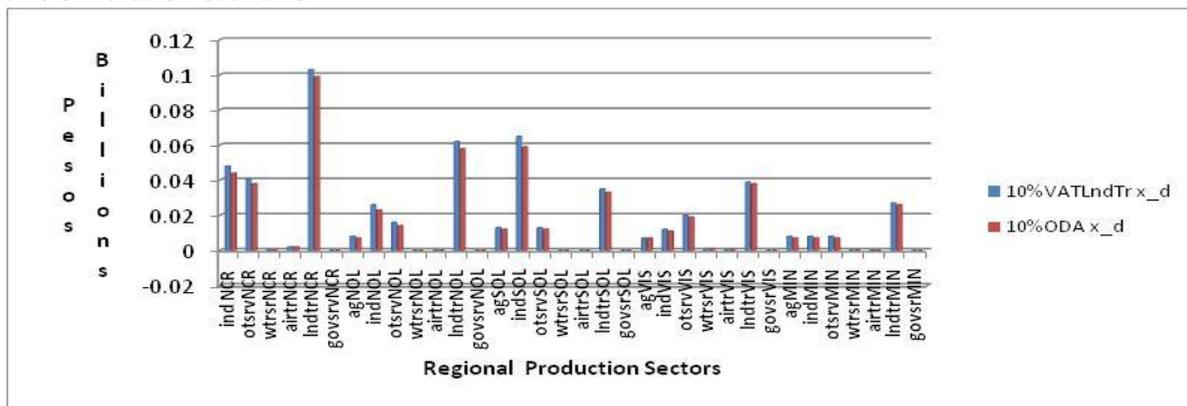
## 5. EMPIRICAL RESULTS

An exogenous shock in the form of national government-revenue financed capital improvement in land transport infrastructure is introduced across all five regions. The impact on regional gross output and welfare levels of regional household income groups is estimated under different types of financing schemes: (1) indirect taxes like value added tax on land transport services disaggregated across regions (2) foreign transfers like official development assistance to the national government. The amount of government expenditures in each scenario is equal to the amount of funds raised under these alternative funding schemes. The exogenous shock in the model takes the form of a technological improvement which is capital enhancement of land transport infrastructure services sector across all delineated regions in the Philippines. The national government finances the capital infusion from two alternative sources namely – value-added tax (VAT) on land transport services sector and official development assistance (ODA). The magnitude of government spending on capital enhancement exactly equals the amount of indirect taxes collected in one simulation scenario and in the alternative simulation scenario equals the amount of foreign transfers. This is to standardize comparison of effects. Land transport capacity improvement is chosen over water and air transport modes due to a previous study's finding that land transport infrastructure investment relative to other modes in the Philippines has the maximum impact on the economy. On the other hand, it emits negative externalities like pollution and cause congestion which are the basis of indirect taxation.. (Dakila & Mizokami : 2007)

### 5.1 COMPARATIVE ANALYSIS OF IMPACT ON GROSS REGIONAL OUTPUT – VAT VS. ODA

A VAT-financed increase in capital of land transport services across the Philippines generated an increase in output across all the five regions. The highest increment was experienced in the National Capital Region (NCR) better known as MetroManila. The industrial sector in adjacent regions namely, Southern Luzon and Northern Luzon also benefited from this capital expansion policy in land transport sector. Southern Luzon is where the CALABARZON – a booming industrial zone and population center adjacent to MetroManila or NCR, is located. Northern Luzon in this study is where a logistic hub – Clark-Subic area is being developed by the government. The NCR’s industrial sector had the third biggest increase in output. Complementary to all these is the boom in other services sector of the National Capital Region, Northern Luzon and the Visayas. Interregional flow of people and commodities due to enhanced land transport infrastructure contributed to the output effects in the services sector. However, regions other than Luzon, namely Visayas and Mindanao, did not register as much significant gains.

On the other hand, the effect of capital improvement in land transport services funded by foreign transfers indicate that the industrial sector of adjacent regions to the center region, NCR, experienced the next highest increment in output; namely, those of Southern Luzon (SOL) and Northern Luzon (NOL). The biggest output increment went to the land transport services sector of NCR and Northern Luzon. The other services sector and industrial sector of this prime region, NCR, are in the top ten sectors with highest output increase. This indicates the spatial bias in terms of distribution of benefits in favor of the most affluent region, namely, NCR. However, spillover effects in the peripheral regions of Southern and Northern Luzon are also registered in this simulation scenario.



of measuring change in utility since it is directly measurable and related welfare measurements like equivalent or compensating variation are expressed also as changes in income. Moreover, from the practical viewpoint, changes in income are more comprehensible to policymakers rather than technical terms such as those previously mentioned.

In this scenario, the middle income classes across all regions, specially of the NCR, had the highest welfare gains. However, an important income redistributive effect is that the low income groups in four regions excluding NCR had the next highest welfare gain. In other words, while land transport infrastructure improvement benefits the middle income groups, the low income groups do not lag far behind.

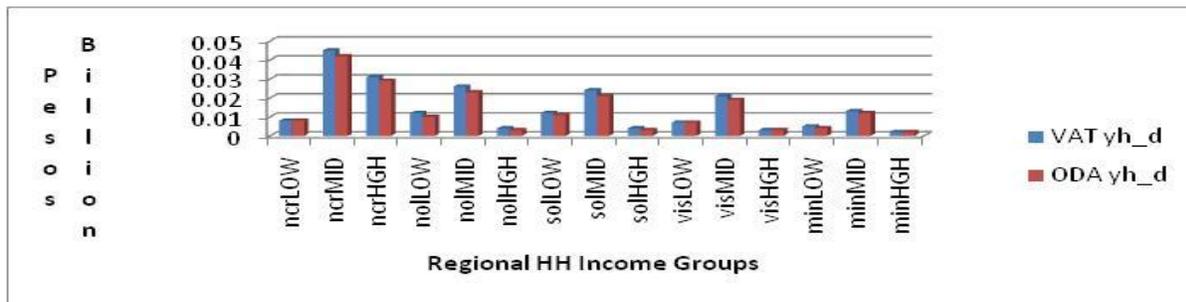


Figure 3 Change in Regional Household Welfare Levels – VAT vs ODA Financing

## 6. CONCLUSION

The foregoing discussion indicates the role of financing in influencing the spatial distribution of microeconomic benefits of a macroeconomic transport policy as in capital enhancement of land transport infrastructure investment. The SCGE model shows how developing economies with available SAM database, can use system-wide approach in assessing the impact of different financing modes on efficiency and equity.

While it may seem counterintuitive that an indirect tax like VAT has greater impact on output and welfare compared to an equivalent amount of foreign transfers like ODA, because of deadweight loss due to taxes, a key assumption in the simulation is that the capital enhancement is greatest in the region where VAT collections are highest; namely the National Capital Region (NCR). Hence, the increase in capacity brought about by capital infusion is highest in the transport sector with the highest output, namely, land transport services in NCR. In contrast, the distribution of ODA follows that implied in the five-region SAM which provides greater weight to areas outside of NCR. Since one key result of the model is that transport capacity in NCR has the highest multiplier effect; then this difference in distribution in transport capacity accounts for the difference in distribution of impact of VAT versus ODA.

A comparative analysis of the effects of land transport infrastructure financing via foreign transfers and via indirect taxes indicates that in terms of direction, both financing modes affect gross regional output and income level of households across regions in the same direction. However, a critical and controversial finding is that in terms of magnitude, the impact of an

indirect tax like value-added tax is greater than that of ODA funds. It must also be pointed out that the greater positive impact on output and welfare of VAT is just slightly higher than ODA. This maybe explained by the fact that while an indirect tax creates deadweight loss in terms of price distortions, this loss in social welfare is far outstripped by the multiplier effects generated by capital enhancement of land transport infrastructure across regions. In other words , the usage of indirect tax revenues to finance transport infrastructure mitigate the possible social losses associated with indirect taxes, This also means that the negative political impact of higher value added tax may be offset by the tangible output multiplier effects of transport infrastructure projects due to more job creation and greater benefits to those belonging to low income brackets. Imposition of additional indirect tax also leads to positive redistributive effects across space in favor of the middle and low income classes across regions .So while foreign transfers like ODA, generate similar positive impact like VAT, policy-makers of developing countries like the Philippines , should not hesitate in generating infrastructure funds from indirect taxes. In the long-run, attaining a healthy fiscal balance domestically with less reliance on foreign transfers for infrastructure would be better for both developing economies and developed economies . Foreign transfers could instead be diverted to subsidy of social infrastructure like schools, hospitals and housing in the disadvantaged regions. This will keep them at par with the lead region as far as equity considerations are concerned. Instead of emphasizing homogeneity in structure of each region in terms of economic performance, regions are meant to complement each other in terms of resource availability and comparative advantage. In the end, the choice of financing mode affects not only the magnitude , but also the distribution of output and welfare gains of transport infrastructure improvement across all Philippine regions

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