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Incidence and Economic Impacts of Property Taxes in Developing and Transitional Countries[1]

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1. Introduction

The property tax has long been held as a good local tax worthy of significant development in countries around the world. In developing and transition countries, the use of the property tax at the subnational level still lags behind that of the developed countries. There are a number of likely reasons for this—the property tax involves an investment of time and money to develop an appropriate cadastre and collection system, the property tax is not a popular tax and may therefore bear the brunt of constituent complaints, and the property tax can be tough to administer and developing countries have a particularly tough time with tax administration.

[1] Paper prepared for the conference: "Making the Property Tax Work in Developing and Transitional Countries" Andrew Young School of Policy Studies and Lincoln Institute of Land Policy October 15-17, 2006

While the theory of the incidence and burden effects of the property tax and the resulting implications for the equity of the tax are still being debated, the impacts in developing and transition countries are even less sure. Well-working capital markets, access to information, defined property rights, etc., are typically assumed in the stories of tax incidence in developed economies. These "givens" that underlie the tax system should not be taken for granted in any incidence analysis, but in the case of developing and transition countries, they can't be taken for granted as they may be completely missing in these countries. The implications of institutions, economic base, and political systems may have an important impact on the theoretical impact of taxes on returns to capital, labor, and land.

In this paper, we will revisit the theory of property tax incidence in light of the conditions in developing and transition countries by modifying the traditional property tax incidence model for at least some of the specific conditions of these countries that affect property tax incidence. The rest of the paper proceeds as follows. First, we summarize the current thinking on the incidence of the property tax. Second, we develop a computational equilibrium model and test the impact of various assumptions regarding those specific issues that reflect the reality of property taxes in transition and developing countries. We conclude with some suggestions for further research.

2. Modeling Property Tax Incidence

To make clear our focus we define tax incidence to refer to how the prices of factors of production and final goods and services change as a result of a tax and tax equity as the resulting tax burden across income classes. In tax equity studies,

researchers generally adopt a set of assumptions regarding the incidence of the tax. Bahl and Lin (1992) provide a list of property tax equity studies conducted in developing and transition countries, all of which were conducted prior to 1977.

The breadth of the incidence assumptions that are found in tax equity studies is quite large. For example, the tax on land is alternatively assumed to be borne by property owners, by capital owners, and by occupants. The tax on industrial and commercial property is alternatively assumed to be borne by consumers of nonfood items, by consumers of non-housing items, and by shareholders. Turning to property tax incidence, there is still much debate among the alternative "views" of the property tax. The fact that the "new view" of property tax incidence is over 25 years old speaks to the longevity of the debate. The view of incidence boils down, roughly, into three different views of the incidence of the property tax—and these are not necessarily mutually exclusive or completely separate views. These are: the Old or Traditional View, the New View, and the Benefits View. Each of these views asks "who bears the burden of a property tax?"

The traditional view of the property tax identifies the property tax as a tax on mobile capital and a tax on land. In the traditional view the capital portion of the property tax is regressive in nature because capital is mobile. Capital owners (relatively high income individuals) can move their assets in response to the property tax. Capital owners bear no burden of the property tax on capital and the tax must be shifted to renters, consumers, or to labor—or those at the lower end of the income distribution (in a relative sense). Under the traditional view of property tax incidence, the land portion of the property tax is progressive. Land is immobile and therefore cannot move to avoid the

tax. As landowners tend to be higher income individuals, the tax burden is distributed higher in the income distribution.

The new view of the property tax (see Mieszkowski 1972 and Mieszkowski and Zodrow 1989) treats the capital portion of the property tax as two pieces: a basic, or average tax rate applied to all capital, plus a local differential that may vary by jurisdiction. The average tax is levied on a fixed supply of capital, and thus capital can't escape the tax—so the tax is borne by capital owners. The differentials around the average encourage capital to move among jurisdictions. The cost of capital in the higher taxed jurisdiction increases, encouraging migration capital away from that sector to lower taxed sectors, a la Harberger. The net rate of return to capital falls as a result but how much it falls depends on what happens to land and labor. Thus, under the new view the property tax will tend to be a progressive tax as property/capital are owned by higher income individuals. In the long-run (new, new view), capital might respond to changes in interest rates, international capital flows, etc. so long-run the elasticity is not as extreme as perfectly inelastic.

Finally, the benefits view of property tax incidence views the property tax as a payment for benefits received. Under this view, individuals search for jurisdictions that meet their demands for public goods and the property tax is the payment for local public goods. As long as there are choices, individuals will seek to match their demand for public goods with the appropriate jurisdiction. In this case, the tax is a user charge of sorts—and there is an inherent fairness to the tax.

A healthy debate regarding these views continues. As summarized by Zodrow (2001), the various views of property tax incidence rely on acceptable theoretical

economic models. Zodrow also notes that it is difficult to disentangle and identify the impacts of the property tax at the national level versus local level, and changes in the property tax. The assumptions of the underlying models—Tiebout in the case of the benefits view, and Harberger in the case of the new view—may be more or less applicable to any one particular government. Critiquing these assumptions is particularly crucial when we analyze the equity of a property tax in developing and transition countries. It is very unlikely that a number of assumptions like mobility, good information, and accountability hold in countries that are new to market-based economic systems. However, even in these countries, it is likely that certain aspects of both views have an influence on the distribution of the property tax burden. Below, we provide a matrix of some of the important assumptions for the various incidence views and note their reality in the case of developing and transition countries:

Assumption	"View"	Reality?
Capital is mobile among jurisdictions	Traditional and new view	In both developing and transition countries this may be true in theory, but a lack of available capital or an unwillingness to invest in many areas of the country may effectively negate the value of this assumption. In some countries, regulations prevent the legal movement of capital outside the country.
Households are mobile and able to vote with their hands and feet	Benefits view	In many developing countries, individuals are mobile, but are not necessarily able to vote in local elections. In some transition countries, like Russia, individuals are not legally allowed to migrate freely, which may prevent them from voting if they do migrate illegally.

Jurisdictions are allowed to impose different tax rates	New view and benefit view	Not true in law in all countries; but might be true in fact if tax administration varies.
Total capital is fixed in supply	New view (not relevant in the benefits view)	In the short run this may be valid, but porous borders may increase elasticity of capital.
Non-monopoly markets for land and capital	All views	In some transition countries (e.g., China and Romania), state ownership of land may have confounding effects on incidence.

It is hard to think that a pure benefit view of property tax incidence currently applies to developing and transitional countries. For most developing and transitional countries, property tax plays a relatively minor role in financing local public services (Bahl and Martinez, 2006). In addition, fiscal zoning does not apply to these countries, the Tiebout conditions of a large number of local governments and residential mobility normally does not exist in developing countries.

But it is also the case that the conditions specified in the new view of property tax incidence do not apply. Bird (1974), McLure (1979), Linn (1979), Strasma et al. (1987), and Bahl and Linn (1992) present extensive discussions of how conditions in developing and transitional countries differ from those required in order to apply the Mieszkowski (1972) property tax incidence model. We summarize these conditions here, but for a full discussion, the reader should refer to the references listed above.

One of the basic assumptions of the new view is that the factors of production are fixed in supply nationwide. But most less developed countries are small open economies. To the extent that capital is perfectly mobile, the assumption of fixed capital supply is inappropriate. However, as the author's cited above suggest, the international supply of capital is not perfectly elastic. Capital flows depend upon risk and that increasing debt

reduces the elasticity. Thus, it seems appropriate to assume that the capital stock is not fixed, but that the elasticity of supply is less than perfectly elastic.

A second major assumption is that capital is perfectly mobile across space and that labor and capital are mobile across sectors. (Models of national taxes assume that labor is mobile across space, but models of the new view assume immobile labor.) But it is argued that capital is not perfectly mobile geographically in less developed countries, particularly with respect to tax rate differentials. Several reasons are given for this argument, including the lack of information regarding tax rate differentials, the large variation in effective tax rates within jurisdictions due to poor assessment practices and weak tax enforcement, and that some areas of the country will not attract firms regardless of the level of tax differential.

It is also argued that capital is not perfectly mobile across sectors in developing and transitional countries. For example, capital may not flow to the informal sector, which may have no access to capital markets. Such a sector may expand capital through saving, for example, expanding the housing as the occupant is able to. Thus, it may be appropriate to assume that the stock of capital is fixed in the informal sector, but that perhaps the stock of capital can shift between housing and small enterprises within the informal sector.

The common assumption in the new view is that land is fixed in supply within every jurisdiction. But if jurisdictions can expand into the existing agricultural land, land is not in fixed supply in each jurisdiction. This is an issue if the tax on agricultural land differs from that in urban areas.

Another way that less developed countries differ from the assumptions of the new view is that there are submarkets that serve different segments of the population and there is no mobility across these submarkets. Some producers may be able to sell to only certain segments of the country. As noted above, the supply of housing for low-income households (the informal sector) may be fixed and not a substitute for housing for the middle and upper-income households.

In addition to these market conditions, the authors listed above also list a set of government policies that result in market imperfections. These include price restrictions, including rent control, crop prices set by the government, maximum legal interest rates, subsidized prices for farm inputs, and exchange rate policies. Government enterprises may constitute a large segment of the economy, and may not behave as profit maximizing firms. In addition, there are many ways that markets may fail to work in less developed countries, for example, custom may drive how wages are set and may limit the mobility of labor across sectors, or land may be held for prestige or social standing and not for economic reasons. Finally, some sectors may be controlled by monopolists.

The incidence of the property tax also depends on administrative aspects of the tax. While not restricted to less developed countries, exemptions from the property tax for owner occupied housing and agricultural land and capital affects the incidence of the property tax. Several less developed countries also use progressive rate structures.

As McLure (1979, 70) states, in reference to determining the incidence of property tax in less developed countries, that, “the proper approach is likely to be far different from anything done in the past, and it is theoretically more difficult and empirically more demanding.”

With the exception of these authors we have found no one who discusses how the conditions of developing and transitional countries might affect the incidence of the property tax. And, while these authors point out that it is not appropriate to apply the traditional new view model to developing and transitional countries, no one has attempted to formally model property tax incidence in developing and transitional countries. Our objective is to fill this void. Thus, we incorporate several, but not all, of the conditions discussed above into our model.

Our approach is to specify a model of property tax incidence under conditions that are likely to exist in a developing country, as suggested by Bird (1974), McLure (1979), Linn (1979), Strasma et al. (1987), and Bahl and Linn (1992). In particular, we specify a Computable General Equilibrium (CGE) model of a hypothetical country.

CGE models have been used to explore the implications of fiscal policy in many developing countries.[2] But none of the CGE models of which we are aware incorporate the types of market imperfections that we discussed above. The first CGE model of a property tax in a developing country of which we are aware was prepared by Follain and Miyake (1986) in order to study the effects of substituting the Jamaican land value tax with capital value property tax or an income tax. The model is a static national level CGE model that consists of three production factors—land, capital, labor—an intermediate good, housing, and a non-housing composite final good. They assume perfect competition in factor and product markets and analyze both open and closed economy cases.

[2] Dervis, de Melo and Robinson (1982) provide some of the earliest application of CGE models to developing countries.

More recently, Light (2004) used a CGE model to explore the effects of various possible tax reform options for Jamaica.[3] The model represents a small open economy with 48 production sectors, a single, representative agent, and three factors of production. He assumes constant returns-to-scale and perfect competition. Other than the existing taxes, no imperfections in the economy are assumed. One of the taxes is the land value tax, which in Jamaica is imposed at a constant national rate; he does not consider any policy change with respect to the land value tax. Light acknowledges the existence of an informal sector that is not taxed, but because of the lack of data on the size of the informal sector, it is not included in the model.

Corsetti and Schmidt-Hebbel (1995) use numerical simulations of an overlapping generations (OLG) growth model to study pension reforms in Chile. They allow for two sectors. The first sector, i.e., the formal sector, employs both labor and capital and is subject to social security regulations. The second sector, i.e., the informal sector, is less efficient, employs only labor, and it unregulated. They allow the pension program to determine the size of the two sectors.

Enoh, Enoh, and Koffi (2000) developed a standard CGE model of Côte d'Ivoire in which they assume four classes of labor, only two of which are perfectly mobile, where as the other two are restricted to non-agricultural use and agricultural use, respectively. The restriction on the mobility of the two classes of labor is imposed to assure that there is a minimum amount of labor in those two sectors. They adopt a similar assumption of a sector-specific form of capital in the production of the

[3] Light's CGE model is similar to the model Rutherford, Light, and Barrera (2005) use to consider equity and efficiency of raising taxes in Columbia.

agricultural good. They consider various types of value added tax and import tax reforms.

Lora and Herrera (2000) present a CGE model for Columbia to study the incidence of the value added tax, import tariffs, a capital flat tax, and corporate and income taxes. The capital tax would be equivalent to a property tax that excluded land. They allow for different degrees of factor mobility across sectors, wage and price rigidities, and supply constraints in specific sectors. These restrictions on mobility are similar to the ones we incorporate into our model.

Their model allows for five factors of production. These include two types of capital, rural and urban, and three types of labor, rural, skilled urban, and unskilled urban. Skilled and unskilled urban labor are combined in the urban sector. However, in the rural sector only rural labor is used. However, rural labor can migrate to the urban sector, where the degree of migration is based on expected wages and an elasticity of migration parameter. The two types of capital are split between the rural and urban sectors through a constant elasticity of transformation function, with the elasticity determining the degree of mobility. They also allow for an informal and a formal urban sector.

Lora and Herrera also consider wage, quantity and price rigidities. They allow for rigidity of real wage of unskilled workers in the formal sector. Thus, in the absence of migration, the change in demand for this type of worker results in a change in the number of such workers who are unemployed. Quantity rigidities are imposed on the production of such products as oil due to limitations on the pipeline network. Finally, they allow mark-up pricing as a way of modeling oligopolistic practices.

These important nuances of the developing and transition countries make it quite difficult to determine the net impact of these various factors on the incidence and economic effects of property taxes. To aid us in that analysis, we turned to a computational general equilibrium model in which we set up conditions that we believe are closer to the realities of developing and developed countries. We simulate alternative baseline conditions in order to determine an order of magnitude and/or sign effect of these unique conditions of the developing and transition countries.

3. Computational Model: Static Computational General Equilibrium (CGE) Model

Computational models have increasingly become a standard tool in the welfare analysis of tax systems. A CGE model is a computer-solved model that mimics the economy by using a series of mathematical expressions that represent important relationships in the economy. The most basic of CGE models captures a production sector and a consumption (household) sector, imposing equilibrium or market clearing conditions often from an export or international sector. For tax incidence analysis, it is important to be able to model different types of households so that the welfare effects of changes in tax policy can be analyzed. In this section, we use a CGE model to analyze the distribution of tax burdens under assumptions that we believe are more applicable to developing and transition countries.

The model presented depicts a small open economy with three broadly defined formal sectors and two informal sectors and is drawn from Sennoga (2006). The formal sectors are trade and industry, farming, and housing while the informal sectors include a

service and/or housing sector and a farm sector. The model reflects consumption choices of three "domestic" consumers or households (poor, middle income, and wealthy) and endowments of a representative foreign consumer. Three primary factors and three intermediate inputs are used in production.

Our model is consistent with an Arrow-Debreu economy that is characterized by constant returns to scale and perfect competition across all forms of production. Producers maximize profits taking prices as given, while consumers maximize utility subject to a budget constraint that depends on the value of their endowments. The small open economy assumption implies that relative prices of imports and exports are fixed. Taken together, these assumptions imply that no producer earns above-normal profits and that consumers cannot increase the consumption of all goods.

The model is formulated and solved as a complementary problem with three types of equilibrium conditions: market clearance, zero profit, and income balance (Mathiesen, 1985). Production technology and consumer choices are characterized using nested, constant elasticity of substitution (CES) functions. The numerical equations are based on data that is constructed to depict a developing small open economy, but does not represent any actual country at this point in time. The current version of the model distinguishes five (5) production sectors, and four different types of consumers, including a single, representative foreign consumer. No taxes are included in the benchmark data and thus, the government is introduced in the counterfactuals as an agent that collects tax revenues to produce a public good (public administration). We assume that the government is the only consumer of this good and therefore the public good does not enter into the consumers' utility function. However, consumers can earn wages, capital

rental income and land rents from supplying labor, capital, and land, respectively to the government.

3.1 Economic Flows

Production technology in sector *i* combines three primary factors: capital, labor, and land. Intermediate inputs (which comprise intermediate or final output from other sectors in the economy) are combined with the primary factors to produce output that can either be consumed domestically or exported. An "Armington good" which is a combination of domestic and imported goods is the basic consumption commodity. Armington composite goods are consumed by industry as intermediate inputs, and are also goods for final consumption (by consumers) and government consumption. Consumers use their endowments of labor, land, and capital to purchase the aggregate Armington good or to finance government services (via paying taxes). Our model assumes that production takes place through formal and "informal" channels. The formal and informal sectors are assumed to produce nearly identical goods but the informal sectors are assumed to be characterized by inefficient and small scale production. Informal sector activities include street vending, subsistence farming, and other small volume activities. We assume that informal sector goods are consumed by all domestic consumers and are used as intermediate inputs only in the informal sector.

3.2 Functional forms

Our model adopts Constant Elasticity of Substitution (CES) functions. CES functions are widely used because they are globally regular, and can be defined by their

zero, first, and second order properties. This implies that the location (price and quantity), slope (marginal rate of substitution), and curvature (convexity) completely characterize a CES production or consumption function (Light, 2004). The use of CES functions consequently allows us to adopt a higher level approach to the representation of production technology and consumer preferences in our static model.

3.2.1 Production Functions

Production inputs. Goods have production functions that combine intermediate inputs in fixed proportions and labor (L), capital (K), and land (R) with substitution possibilities governed by a Cobb-Douglas production function. Stated differently, goods are produced according to a nested Leontief–Cobb Douglas technology, where intermediate inputs and aggregate value-added enter at the top level. Value-added represents a Cobb-Douglas aggregation of formal and informal sector labor, capital, and land. The general form of the total production function is;

$$Y_i = \min\left[\min_j \left(\frac{x_{ji}}{a_{ji}} \right), \frac{v_i}{b_i} \right],$$

where x_{ji} represents intermediate inputs of good *j* from the domestic market,

$a_{ji} = x_{ji}/Y_i$, $b_i = v_i/Y_i$, and v_i is value-added:

$$v_i = L_{Fi}^{\alpha_F} L_{Ii}^{\alpha_I} K_i^{\beta} R_i^{\gamma}.$$

Constant returns to scale imply that $\sigma = \alpha_F + \alpha_I + \beta + \gamma = 1$. Our numerical model can accommodate more general functional forms for value-added. When the elasticity of

substitution for production inputs σ is unity, value-added totals are Cobb-Douglas as represented here.

Production outputs. Each of the three formal production sectors presented in this model produces both a domestic good D_i and an export good E_i. We assume that these goods are imperfect substitutes and that they are characterized by a constant elasticity of transformation η. The transformation function can be written as follows:

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

In this expression, θ_i^D represents the benchmark value share of domestic sales in total output for sector *i*. The informal sector is assumed to produce only for the domestic market.

Imports. Following Light (2004) our model adopts an Armington representation of import demand. The Armington good A_i is produced by aggregating domestic goods with imports from the same sector. Domestic goods D_i and import goods M_i are treated as imperfect substitutes (for instance tea from Kenya vs. Uganda). The Armington elasticity is represented by σ_A.

$$A_i = \left(\theta_i^M M_i^{1-1/\sigma_A} + (1-\theta_i^M) D_i^{1-1/\sigma_A}\right)^{1/(1-1/\sigma_A)}$$

To summarize, the Armington aggregate good A_i is the main commodity used in production Y_i and for final consumption (D_i, E_i). The Armington good combines domestic output D_i with imports M_i.

Trade Balance. The small open economy assumption adopted by our model implies that export $\overline{P}_i^E$ and import $\overline{P}_i^M$ prices are fixed exogenously. Further, the real exchange rate is market determined by the supply of exports and demand for imports. The real exchange rate is determined in units of foreign currency. Trade balance is shown by the equality of the following expression:

$$\sum_i \overline{P}_i^E E_i + B = \sum \overline{P}_i^M M_i ,$$

where B is an exogenously specified current account balance.

3.2.2 Consumption

Each of the three consumers considered in our model (poor, middle income, and wealthy) are endowed with primary factors of production: labor, capital, and land. Each of these consumers demands final goods for consumption and uses his/her respective endowment to purchase these final goods. The government also demands final goods though their level is exogenously determined.

Private consumer demand is endogenously determined via utility maximization. Consumer *j*'s utility maximization problem can be specified using a Cobb-Douglas utility function as follows:

$$\underset{A_i}{Max} U = U^j(A_i) = \prod_i A_i^{\alpha_i}; \sum_i \alpha_i = 1$$

subject to

$$\sum_i P_i A_i \le p_K K + p_L(L_F + L_I) + p_R R$$

3.2.3 Informal Labor Supply

Our model assumes that labor supply is fixed. Further, we assume that the poor consumer's labor endowment is entirely allocated to the informal sector while the labor endowment of the middle income and wealthy consumers can be allocated either to formal labor supply (L_F) on which taxes are imposed and informal labor (L_I) which is not taxed. The middle income and wealthy consumers choose how much of each type of labor to supply based on relative wages. Following Rutherford and Miles (2001), we specific the labor-supply unit revenue function as follows:

$$w = \left[\alpha^L \left(\frac{w_F}{w^F} \right)^{1+\eta L} + \left(1 - \alpha^L\right) \left(\frac{w_I}{w_I} \right)^{1+\eta L} \right]^{1/(1+\eta L)}$$

In this expression, η^L is the labor supply elasticity. We assume that the production technology in our model combines formal and informal labor supply with substitution possibilities governed by a Cobb-Douglas production function. In other words, the elasticity of substitution between formal and informal labor in production is unity.

3.2.4 Capital

Since our model represents an open economy, we allow for international capital flows or trade in capital. One way of capturing this feature in a static model is by introducing a market for "foreign" capital which is rented from or to foreigners. The country (small open economy) is assumed to be a price taker and we adopt three alternative assumptions regarding the supply of capital: fixed capital supply; capital can be acquired internationally at a fixed price; and capital can be acquired internationally at

an increasing price. Foreign capital is one of the import goods and is paid for using the proceeds from exports.

Capital used in the informal sector is assumed to be sector-specific and fixed in supply. Since the informal sector mostly comprises street vending, subsistence farming, and other small volume activities, it is practical to assume that informal sector capital is largely "rudimentary" and commands a lower rate of return than formal sector capital.

4. Equilibrium Conditions

Mathiesen (1985) demonstrates that an Arrow-Debreu general economic equilibrium model can be formulated and solved as a complementarity problem. The Arrow-Debreu equilibrium is defined by a system of three classes of nonlinear inequalities: zero profit, market clearance, and income balance.

4.1 Zero profit

The first class of constraints requires that in equilibrium no producer earns an "excess" profit; that is, the value of inputs per unit activity must be equal to or greater than the value of outputs. This can be written in compact form as:

$$Cost_i(p) \geq \text{Re}venue_i(p) \qquad \perp y_i$$

The corresponding complementary variable for a zero profit condition is output y_i. All else constant, if output prices increase for commodity *i*, production activity increases until marginal cost equals marginal revenue.

4.2 Market Clearance

The second class of equilibrium conditions is that, at equilibrium prices and activity levels, the supply of any commodity must balance or exceed excess demand by consumers and producers. This condition can be expressed as:

$$D_i + M_i \geq \sum_j A_{ij} + E_i + Consumer_i + Government_i \qquad \perp p_i$$

The above inequality refers to produced commodities, and a similar constraint holds for endowed goods such as labor, capital, and land.

The corresponding dual or complementary variable is the price p_i (price of both commodities and factors of production). Prices adjust until supply equals demand for a given commodity or factor.

4.3 Income Balance

The third condition is that in equilibrium the value of each agent's income must equal the value of factor endowments:

$$\sum_i p_i A_i \geq w\bar{L} + p_K \bar{K} + p_R \bar{R} \qquad \text{for (poor, middle, wealthy, and government)}$$

Since we always work with utility functions that exhibit non-satiation, Walras' law will always hold.

5. Data and Model Calibration

This sub-section describes the Social Accounting Matrix (SAM) constructed under the assumption that the consumers and/or producers in the formal sector meet their tax obligations while their counterparts in the informal sector fully evade taxes. Table 1 presents a list of variable definitions, the salient feature of our data are presented in Table

2, while Table 3 shows the data for the five-good, three-factor, and four-consumer small open economy model considered in this paper.

5.1 Salient features of the SAM

Table 2 summaries the salient features of the SAM used in this study. The SAM is constructed based on the assumptions we make about the structure and size of both the formal and informal sectors and the poor, middle income, and wealthy households. The formal sector is comprised of trade and industry, agriculture, and housing sectors while the informal sectors are broadly categorized into services and subsistence agriculture. We assume that the formal sector is more capital-intensive compared to the informal sector. We also assume that the formal sector is more efficient relative to the informal sector and that the informal sector utilizes part of the formal sector output (in addition to inputs of labor, capital, and land) as an intermediate input in its production process. The formal sector is assumed to utilize only formal labor, capital, land, and imported inputs in production. In other words, we assume that informal sector products and labor are not used as inputs in formal sector production.

The small open economy represented here is assumed to have two jurisdictions: urban and rural. The trade and industry and the housing sectors are assumed to be situated in the urban jurisdiction while the (formal sector) farming sector and both informal sectors are located in the rural area. Finally, we assume that the poor households' endowment is 43 and 33 percent of the endowment enjoyed by the middle income and wealthy households, respectively. It is important to note that though it is feasible to use various parameters to reflect the input and output choices that are consistent with these

assumptions, the choice of our input and output values is dictated by the need to maintain the internal consistency of our social accounting matrices or to preserve the zero profit, market clearing, and income balance conditions. Table 3 presents the data for the five-good, three-factor, and four-consumer small open economy model used in this study. We now turn to a description of these data.

5.2 Taxes

In the economy represented in Table 3, we assume that no taxes are levied in the benchmark. Four "tax-treatments" are introduced as counterfactual exercises. The first counterfactual exercise introduces "uniform" national tax rates on land and capital; the second simulation exempts land and capital inputs used in the agricultural sectors, while the third counterfactual levies differential tax rates on land and capital in the urban and rural jurisdictions. The fourth counterfactual exercise sets the tax on informal sector inputs equal to zero (that is, complete tax evasion in the informal sector).

5.3 Input/output Data

The input data are presented in the form of a balanced matrix, in which the entries represent the value of economic transactions in a given period (typically one year). The rectangular SAM format adopted follows a sign convention wherein supplies or receipts are represented by positive numbers and demands or payments are represented by negative numbers. Internal consistency of a rectangular SAM implies that row sums and column sums are zero. With this interpretation, a row sum is zero if the total amount of commodity flowing into the economy equals the total amount of commodity flowing out

of the economy. This is market clearance, and one such condition applies for each commodity in the model. Columns in this matrix correspond to production sectors or consumers. A production sector column sum is zero if the value of outputs equals the cost of inputs. A consumer column is balanced if the sum of primary factor sales equals the value of final demands. Zero column sums thus indicate zero profits (product exhaustion) or consumer income balance.

It is important to emphasize that the numbers in the SAM are values or prices multiplied by quantities. The modeler has flexibility in interpreting these values as prices or quantities. A commonly followed practice is to choose units so that the prices of as many activities as possible are equal to unity initially. Prices can be chosen to be unity, and "representative quantities" for activities can be chosen such that activity levels are also equal to one (for instance, formal agricultural activity run at level one produces 150 units of the formal agricultural good). However, in the presence of taxes, both consumer and producer prices generally cannot equal one. In a rectangular SAM, we have one row for every market (traded commodity). In the present model, there are eight markets, for goods 1-5 and for factors L, K, and R.

There are two types of columns in a rectangular SAM, corresponding to production sectors and consumers. In the current model, there are five production sectors (1-5) and four "domestic" consumers (poor, middle income, wealthy, and government). Table 3 presents the rectangular SAM used in this study.

5.3.1 Production Sectors

We assume that each of the three formal sectors produces 150 units of output. Positive column entries designate production or output while the column entries with a negative sign are production inputs. For instance, Trade and industry output of 150 units is produced using 45 units of labor, 55 units of capital, 35 units of land, 5 and 10 units of intermediate inputs from the farming and housing sectors, respectively (see Table 3). Column entries for the other four production sectors have a similar interpretation. These units are chosen to reflect the fact that formal sector production is more efficient and capital-intensive relative to production in the informal sector. We also assume that the formal sector does not utilize intermediate inputs from the informal sector.

5.3.2 Consumers' Endowments and Labor Supply

Table 3 also shows the capital, labor, and land endowments of the three "domestic" consumers: poor, middle income and wealthy. We assume that the poor consumer is endowed with 40 units of labor, 10 units of capital, and 15 units of land while the endowments of middle income consumer are 50, 45, and 55 units, respectively. The wealthy consumer is endowed with 60 units of labor, 75 units of capital, and 65 units of land. Consequently, we assume that the poor consumers' total endowment is 43 and 33 percent of the middle income and wealthy consumers' total endowments.

Labor supply choices of the three consumers can also be inferred from Table 3. For instance, the poor consumer supplies 50 percent of his/her labor to the informal services sector and the remaining 50 percent is supplied to the informal agriculture or subsistence sector. We assume that informal sector activity is largely a small scale

operation and as such, the poor consumer is equally likely to undertake any informal sector activity. The middle income and wealthy consumers are assumed to supply the bulk of their labor to formal sector production. In particular, we assume that the middle income and wealthy consumers supply only 10 and 8 percent of their labor to the informal sector, respectively. Our model accommodates different elasticities of labor supply, allowing formal and informal sector labor to respond to relative wage differentials across sectors and jurisdictions.

5.3.3 Government

The government (GOVT) is also considered as a separate consumer, which collects or demands tax revenues to provide a government good referred to as "public administration." Since no taxes are imposed and/or collected in the benchmark, the level of government activity is thus implicitly assumed to be zero in the benchmark. We assume that the government is the only consumer of this good, and consequently the poor, middle income, and wealthy households do not enjoy any welfare from "public administration." Stated differently, the government good does not enter the households' utility functions, but the households earn wages, capital, and land rents working for the government. Therefore, increased government activity (or increased provision of the government good) increases the demand for labor, capital, and land. We assume here that production of the government good is labor-intensive.

5.3.4 Consumers' Utility Functions

The consumer's utility function is represented as a production activity. In other words, utility is a good that is produced from commodity inputs, including factor inputs such as leisure. Table 3 depicts a utility function W in which utility (goods PWp, PWm, and PWw) is produced from inputs of both formal and informal sector output. The activity level in sectors Wp, Wm, and Ww (utility functions of poor, middle income, and wealthy consumers, respectively) can also be interpreted as a Hicksian welfare index. For instance, utility for the poor consumer (Wp=65 units) is produced using 10 units of the trade and industry good, 5 units of the formal sector farming good, 10 units of the housing good, 15 units of the informal sector services good, and 25 units of the informal sector farming good. Utility functions for the middle income and wealthy consumers (Wm and Ww, respectively) have similar interpretations.

The utility goods (PWp, PWm, and PWw) are purchased using the consumers' endowments, which also reflect their income constraint. In other words, the consumer demands utility good PW, and receives income from endowments of labor, capital, and land. For instance, the middle income consumer demands 150 units of utility good PWm, and receives 50, 45, and 55 units of income from his/her endowments of labor, capital, and land, respectively, to make this purchase. Table 3 assumes that the poor consumer's utility is intensive in the informal sector goods while the middle income and wealthy consumers' utility is intensive in the formal sector goods. Further, we assume that the middle income consumer consumes 30 percent of the imported goods, with the residual being consumed by the wealthy consumer. Import goods are assumed to be close but

imperfect substitutes in consumption, with an Armington elasticity of substitution in final demand of 5.

5.3.4 Capital Flows

To accommodate capital flows or trade in capital, we introduce a market for a factor which is rented from or to foreign consumers. One way of modeling capital flows is by creating a "fictitious" factor Kr (price PKr) which is a fixed factor in a function (KM) transforming foreign exchange into capital. We assume that this "fictitious" factor is owned by the representative foreign consumer. Our benchmark data shows that 20 units of capital are imported initially.

6. Elasticity Choices

Another data requirement is to specify the curvature in various CES and Cobb-Douglas functions for production, consumption, and labor supply. The elasticities used in this study are chosen based on past studies as well as conventional wisdom. Table 4 lists the default elasticity choice for each parameter. Economists often make decisions based upon judgment and experience. Choosing appropriate parameter values for various elasticities is one of these exercises. We use values that have been previously accepted in other models in the literature (see Light, 2004).

Value-added in production represents a Cobb-Douglas aggregation of labor, capital, and land, hence the labor/capital/land elasticity in value-added of 1. The choice for the Leontieff intermediate input demand is standard in CGE modeling (Light, 2004). It is reasonable to assume that two industries are poor substitutes than a domestic and

foreign good in the same industry. Therefore, the elasticity of substitution in final demand (1) and the Armignton elasticity of substitution between domestic and import goods (5) are chosen to emphasize this feature. The elasticity of transformation between domestic and export goods (4) reflects the fact that output from the same industry is highly substitutable between domestic and foreign markets.

The Cobb-Douglas structure for value-added (in final demand) taken here has received some criticism especially in the development literature, with some economists arguing that the elasticity of substitution parameter is closer to zero for some goods. More elaborate formulations for consumption could include Stone-Geary preferences, especially if the focus is on poverty effects.[4] Finally, the default elasticity of labor supply for all consumers is chosen to be 4. CGE models typically contain some form of sensitivity analysis especially since some parameter choices have a sizable impact on the counterfactual results. Sensitivity analyses are conducted to verify the consistency of our results.

7. Counterfactuals and Simulations

Analysis of the impact of a change in government policy with a static CGE model proceeds via the comparative statics methodology. The model is constructed so that its equilibrium replicates the benchmark data. Simulation of the policy change then follows by altering the relevant policy parameters (for instance a change in the ad-valorem tax rate on land or a property tax exemption on land and capital used in agriculture) and

[4] Stone-Geary utility functions are simply Cobb-Douglas utility functions with the origin displaced from zero. These displacements, when positive, are typically referred to as "minimum consumption requirements", indicating that the consumer gets no positive utility until these needs are met.

calculating the new equilibrium. In the base case equilibrium, commodity prices p_i, the wage *w,* capital rental rate p_k and the return to land p_r are all calibrated to equal one. The model is then used to evaluate the impact of changes in government policy on the welfare of the poor, middle income, and wealthy households, on consumption, as well as on prices of produced goods and factors of production.

The purpose of our counterfactual exercises is to compare the incidence of property taxes under different tax "systems." We carry out simulations for each of the four tax "regimes" considered in this paper: a uniform national property tax regime, (property tax) exemption of land and capital used in agriculture, local property tax rate differentials, and tax evasion in the informal sector. Our analysis focuses mainly on the welfare of the poor, middle income, and wealthy consumers, production, and on the prices of produced goods and factors of production. In particular, for each of the four tax regimes considered here, we compute percentage changes in pre and post-tax: welfare, production, and prices of consumer goods and factors of production. Since the primary focus of this paper is the incidence of property taxes, other types of taxes such as individual income taxes, import tariffs, and sales and excise taxes and their effects are assumed to remain constant.

7.1 Uniform National Property Tax

In this counterfactual exercise, we levy a uniform ad-valorem tax rate of 25 percent on land and capital. The second column of Table 5 shows that when labor is mobile between the urban and rural jurisdictions and when capital supply is fixed, the incidence of a uniform national property tax is on the owners of land and capital. The net-

of-tax return to formal sector capital falls by 25.3 percent while the net-of-tax price of land drops by 21 percent. The return to informal sector-specific capital declines by 26.9 percent. The return to imported capital falls by 1.1 percent indicating that a small portion of the property tax is exported to the foreign capitalist. Further, Table 5 reveals that the incidence of a uniform national property tax is progressive with the middle income and wealthy consumers bearing a proportionately higher burden of the tax. The poor consumer's welfare falls by 4.6 percent, while the welfare of the middle income and wealthy consumers declines by 12.2 and 15.9 percent, respectively.

McLure (1979) argues that in the absence of international mobility of capital, the burden of a national property tax would be borne by capital. Mieszkowski (1972) also points out that when capital is in fixed supply to the taxing nation, a national tax on improvements (capital) is on average borne by owners of capital. Our findings differ from these two studies only to the extent that the burden of a national property tax falls on both land and capital.

A national property tax produces "excise" effects as well. Prices of formal sector manufacturing, farming, and housing goods, which are intensive in primary factors of land and capital, decline by 0.2, 0.5, and 1.1 percent respectively. The fall in prices of formal sector goods is due to both decreased production (as a result of the increased factor prices due to the tax) and decreased demand (due to "domestic" consumers' preference for the relatively cheaper imported goods) of these goods. Since the primary factors used in the production of the informal sector goods are assumed to be both intranationally and internationally immobile, the burden of a national property tax is borne by both the owners of land and capital in the informal sector (via reduced returns to

land and sector-specific capital) and consumers of the informal sector goods (via increased prices).

7.2 Local Tax Differentials.

Incidence patterns from property tax rate differentials between urban and rural areas are presented in column 3 of Table 5. McLure (1979) points out that it is not uncommon for capital cities to levy higher property tax rates than those allowed in other areas. However, to the extent that capital cities are also allowed to levy other types of taxes, reduced reliance on property tax revenues may actually translate into lower property tax rates in capital cities than in other cities or rural areas. The results presented in column three of Table 5 are based on the assumption that property tax rates are higher in urban areas than in rural areas. In particular, we impose a 35 percent ad-valorem tax on land and capital in the urban jurisdiction and a 25 percent ad-valorem tax on land and capital in the rural areas. We assume that capital is intranationally immobile and fixed in supply.

Simulation results in the third column of Table 5 reveal that the middle income and wealthy consumers shoulder a bigger burden of taxes on land and capital compared to the poor consumer. The poor consumer's welfare falls by 4.1 percent compared to the 14.4 and 18.6 percent drop in the middle income and wealthy consumers' welfare. These findings are consistent with McLure (1979) who argues that differentials in land and capital taxes are largely expected to increase the progressivity of taxation. He argues that local tax differentials would be reflected in land rents, wages of locally immobile labor, and prices of local goods (goods produced in a particular jurisdiction). To the extent that

the richest land owners might be expected to own land in capital cities or urban areas, higher tax rates on land in such areas is likely to increase progressivity or reduce regressivity. Our model assumes that the formal sector farming activity is located in the rural jurisdiction and is undertaken by the middle income and wealthy consumers. This therefore suggests that the middle and wealthy consumers can also benefit from lower property tax rates imposed in the rural areas. McLure (1979) points out that the latter result is unlikely to counter the effects of higher property tax rates in big cities or urban areas on progressivity, a conclusion that is in line with our findings.

Further, local differentials cause prices of local goods to rise where incomes are highest (urban areas). The third column of Table 5 reveals that the price of the formal sector manufacturing good increases by 1.3 percent. Given that the middle income and wealthy households consume more formal sector manufacturing goods than the poor consumers, the differential effects on prices of local goods also increase progressivity.

Finally, our simulation results indicate that the incidence of local differentials in property tax rates falls on capital and land. The returns to formal sector capital, imported capital and land rents fall by 29.3, 2.6, and 27.8 percent, respectively. The return to informal sector capital falls by 27.9 percent.

7.3 Exemption of Land and Capital Used in Agriculture

In this counterfactual exercise, we exempt land and capital used in agriculture from property taxes. Land and capital in other sectors are taxed at an ad-valorem rate of 25 percent. The simulation results are presented in column 4 of Table 5. These results indicate that the poor consumer's welfare which is intensive in the informal sector

farming good falls by 3.5 percent compared to the 9.1 and 11 percent reduction in the middle income and wealthy consumers' welfare. Further, prices of both formal and informal sector farming goods decline by 5.8 and 0.5 percent respectively. Prices of all other goods increase. As in the case of the two sets of results discussed earlier, the incidence of property taxation falls on both capital and land, with some of the burden being exported to the foreign capitalist. Consumers of both national and local goods bear some of the burden via increased prices of the non-farming goods.

7.4 Evasion in the Informal Sector

Here, we set taxes on land and capital in the informal sector equal to zero as would be the case with full tax evasion. Primary factors of production used in the formal sector are taxed at an ad-valorem rate of 25 percent. Simulation results from this counterfactual exercise are presented in column 5 of Table 5. Perhaps the most noteworthy finding from this counterfactual exercise is that even with tax evasion in the informal sector, the poor consumer's welfare declines; albeit by a small magnitude compared to the other counterfactuals discussed earlier. This outcome can be explained by the fact that in our model, the poor consumer's consumption "basket" comprises over 38 percent of formal sector goods, which are produced using primary factors of land and capital on which taxes are imposed. Further, production of the informal sector services and farming goods uses intermediate inputs from the formal sector. In our model, 30 and 36 percent of the inputs used to produce the informal sector services and housing goods, respectively, are intermediate inputs from the formal sector. To the extent that the prices of the formal sector intermediate inputs are inclusive of taxes, use of these inputs in

informal sector production leads to an increase in the cost of production in the informal sector. The increase in the cost of production in the informal sector is passed onto the informal sector inputs of land and capital which are immobile and fixed in supply. The fifth column of Table 5 shows that the rate of return to informal sector capital falls by 9.5 percent and the return to land declines by 18.6 percent.

8. Relaxing the Assumptions

Tables 6-8 show simulation results from our counterfactuals in which the intranational and international mobility assumptions are adjusted. Tax treatments similar to those discussed in the preceding sections are considered.

8.1 Immobility between Urban and Rural Jurisdictions (Fixed Supply of Capital)

Table 6 shows that intra-national immobility of capital does not alter the incidence results of property taxes discussed in the preceding section. The simulation results shown in Table 6 indicate that the incidence of the property tax on land and capital falls on the owners of land and capital under all four tax-treatments: uniform national property tax, local differentials in property tax rates, property tax exemption on land and capital used in agriculture, and tax evasion in the informal sector. In all four of these tax treatments, we maintain the assumption that capital is fixed in supply.

The major difference between the simulation results shown in Tables 5 and 6 is that for Table 5 we allow for intra-national labor and capital mobility across urban (formal manufacturing and housing sectors) and rural (formal farming, informal services, and informal farming sectors) jurisdictions. For the simulation results shown in Table 6,

labor and capital are immobile between the urban and rural areas. Our model assumes that informal sector capital is sector-specific and therefore, capital is not mobile between the formal sectors (which constitute the bulk of sectors in the urban jurisdiction) and the informal sectors (which constitute the majority of sectors in the rural jurisdiction). This therefore implies that even with the assumption of intra-national mobility, capital can only move from the formal manufacturing and housing sectors (urban area) to the formal farming sector (located in the rural area.) It is important to note however that capital used in the farming sector could be highly specialized and may not easily be adaptable to manufacturing and housing sectors (for instance a combine harvester may not be easily adapted to move dirt on a construction site being cleared for a housing project).

Therefore, in the current set-up of our model, it is plausible to assume that capital is not very mobile between the urban and rural areas. This consequently implies that intra-national mobility should not be expected to influence the incidence patterns of property taxes on land and capital.

8.2 Elastic Capital Supply

Here, the counterfactual exercises assume that capital can be acquired internationally at an increasing price, or elasticity of the supply of capital is positive. All other assumptions are similar to those made for the simulation results presented in section 5. Table 7 presents simulation results based on the assumption that capital and labor are mobile across jurisdictions while the results presented in Table 8 assume intranational mobility.

On average, Tables 7 and 8 indicate that the elastic supply of international capital to the taxing small open economy does not alter the incidence of the property tax in any significant way. One explanation for this result is that our model assumes that capital imports are financed by foreign exchange proceeds from exports. To the extent that the value of exports for most developing countries does not vary much from time to time, it is reasonable to assume that the amount of capital imported is also stable or fixed to the small open economy.

9. Sensitivity Analysis

Since the choice of our parameters and factor intensities in the benchmark data can affect the simulation results, sensitivity analyses are necessary to verify the robustness of our results. A typical CGE sensitivity analysis compares simulation results across a range of elasticity values and factor intensities. As such, we alter the consumer endowments in our benchmark data and adjust the other values in the SAM accordingly while preserving the internal consistency (that is, maintaining the market clearing, income balance, and zero profit conditions) of the SAM. The SAM used in the sensitivity analysis is presented in Table 9.

In "constructing" the data for our sensitivity analysis, we assume that there is a wider divergence in consumer endowments between the poor and the higher income groups. Consequently, we assume that the poor consumer's endowment is 33 and 20 percent of the middle income and wealthy consumers' endowments, respectively (down from 43 and 33 percent, respectively, in the initial benchmark data.) Further, it is plausible to assume that the informal sector in developing countries will reflect a sizeable

presence of wealthy consumers (as they try to avoid high marginal income tax rates in the formal sector say, by moon-lighting and/or working off the "books" in the informal sector). We therefore increase the amount of labor supplied to the informal sector by wealthy consumers to 20 percent of their total labor endowment, up from 8.3 percent in the initial SAM shown in Table 3. In our formulation, the trade and industry sector is assumed to comprise the formal manufacturing, commerce, and service sub-sectors; we therefore increase the size of this sector from 150 units of output to 160 units to reflect its presumably higher GDP share. Finally, we adjust the poor and wealthy consumers' welfare functions (or utility) to accommodate the reduction and increase in their respective endowments. The poor consumer now consumes only 50 units of output while the wealthy consumer purchases 250 units of output. We assume that the benchmark value of the export and import goods is unchanged.

Results from our sensitivity analysis are presented in Tables 10-13 and are consistent with the findings discussed in sections 5 and 6 above. These results confirm that the burden of a property tax on land and capital falls on land and capital owners, with the middle income and wealthy consumers bearing a proportionately bigger fraction of this burden. Further, intra-national and international mobility of capital does not affect these incidence patterns in any significant way.

10. Conclusions

The "new" view of property tax incidence attributable to Mieszkowski (1972) is based on a general equilibrium model in which capital is fixed in supply but perfectly mobile across sectors and geography. Several authors have suggested that the conditions

in developing and transition countries do not correspond to those in developed countries and therefore the new view does not directly apply. To date no one has formally modeled property tax incidence under the conditions that exist in developing and transition countries. Thus, we develop a CGE model that addresses this gap in the literature.

Simulation results from our simple CGE model indicate that the burden of property taxes imposed on capital and land is borne by the capitalists (owners of land and capital.) The property tax burden is progressive with the middle income and wealthy consumers bearing a heavier burden compared to the poor consumers. Further, the incidence patterns are largely unaffected by the different assumptions regarding the intranational and international mobility of capital. These findings are robust to alternative distributions of consumer incomes or factor endowments and factor intensities.

However, our analysis does not incorporate other taxes, such as individual income taxes, import tariffs, and sales and excise taxes. To the extent that property taxes are imposed concurrently with other taxes, assuming away the effects of such taxes could potentially bias our results.

Table 1. *List of Variable Definitions*

T&I (1)	Activity level for Formal Trade & Industry sector
Farm (2)	Activity level for Formal Farm sector
Hsg (3)	Activity level for Formal Housing sector
Scvs (4)	Activity level for Informal Service & Housing sector
Farm (5)	Activity level for Informal Farm sector
E	Export index or activity level
M	Import index or activity level
KM	Capital Imports
Wp	Hicksian welfare function for Informal (poor) household
Wm	Hicksian welfare function for Formal (middle) household
Ww	Hicksian welfare function for Formal (wealthy) household
LIs	Labor supply for poor household to informal services sector
LIf	Labor supply for poor household to informal farming sector
LSp	Labor supply for poor household
LFm	Activity level for formal labor supply (middle income household)
LIm	Activity level for informal labor supply (middle income consumer)
LSm	Labor supply for middle income household
LFw	Activity level for formal labor supply (wealthy household)
LIw	Activity level for formal labor supply (wealthy household)
LSw	Labor supply for wealthy household
poor	Informal sector household
mdle	Middle income formal sector household
wlthy	Wealthy formal sector household
frgn	Representative foreign agent
P1	Price index for formal sector trade and industry good
P2	Price index for formal sector farm good
P3	Price index for formal sector housing good
P4	Price index for informal sector “services” good
P5	Price index for informal sector farm good
PWp	Price index for poor household welfare
PWm	Price index for middle income household welfare
PWw	Price index for wealthy household welfare
PLIs	Price index for poor household labor supplied to firms (svcs (4))
PLIf	Price index for poor household labor supplied to firms (farm)
PLSIs	Price index for poor household labor supplied to market (svcs (4))
PLSIf	Price index for poor household labor supplied to market (farm)
PLFm	Price index for formal labor supplied to firms (mdle)
PLIm	Price index for informal labor supplied to firms (mdle)
PLSFm	Price index for formal labor supplied to market (mdle)
PLSIm	Price index for informal labor supplied to market (mdle)
PLFw	Price index for formal labor supplied to firms (wlthy)
PLIw	Price index for informal labor supplied to firms (wlthy)
PLSFw	Price index for formal labor supplied to market (wlthy)
PLSIw	Price index for informal labor supplied to market (wlthy)
PL	Price index for primary factor labor

PK	Price index for mobile capital
PR	Price index of resources (land)
PK4-5	Price index for informal sector-specific capital input (svcs & farming)
PFX	Exchange rate index
PKm	Rent due to imported capital

Table 2. Social Accounting Matrix: Summary of Salient Features

Markets	Production Sectors Formal Sectors (F) Informal Sectors (I)	Consumers' Endowment poor middle wealthy foreign
Good 1 Good 2 Good 3 Good 4 Good 5 Capital (K) Labor (L) Land (R)	○ Goods 1-3 are produced in F & 4-5 are produced in I ○ F is more capital-intensive ○ I is more labor-intensive F only uses inputs of capital, labor, and land ○ I uses capital, labor, and land inputs plus intermediate inputs from F ○ Poor consumers' welfare is intensive in goods produced in I sectors ○ middle income and wealthy consumers' welfare is intensive in goods produced in F sectors	○ poor has 43 and 33 percent of middle income and wealthy consumers' endowment, respectively ○ middle income consumer has 75 percent of wealthy consumers' endowment ○ foreign consumer is endowed with "foreign" capital

Note. The actual values in the Social Accounting Matrix reflect three internal consistence conditions: zero profit, market clearing, and income balance.

Table 3: Social Accounting Matrix

	Production Sectors																			Consumers			
Markets	T&I (1)	Farm (2)	Hsg (3)	Svcs (4)	Farm (5)	E	M	KM	Wp	Wm	Ww	LIs	LIf	LSp	LFm	LIm	LSm	LFw	LIw	LSw	Poor	mdle	wlthy	frgn
				-5	-10	-20	10																	
P1	150	-25				0			-10	-30	-60													
			-25	-10		-20	5																	
P2	-5	150				0			-5	-40	-50													
P3	-10	-25	150	-5	-10		5		-10	-45	-50													
P4				55	-5				-15	-20	-15													
P5					65				-25	-15	-25													
PWp									65												-65			
PWm										150												-150		
PWw											200												-200	
PLIs				-20								20												
PLIf					-20								20											
												-		20										
PLSIs												20												
													-	20										
PLSIf													20											
PLFm	-20	-15	-10												45									
PLIm					-5											5								
PLSFm															-45		45							
PLSIm																-5	5							
PLFw	-25	-15	-15															55						
PLIw				-5															5					
PLSFw																		-55		55				
PLSIw																			-5	5				
PL														-40			-50			-60	40	50	60	
PK	-55	-40	-45					20														45	75	
PR	-35	-30	-55	-5	-10																15	55	65	

PK4-5	-5	-5				10	
			4	-	-10		
			0	2			
PFX				0			-10
PKr					-10		10

Table 4. Elasticity Choices

Labor/Capital/land elasticity in value-added	1
Elasticity of substitution between intermediate inputs	0
Elasticity of substitution between value-added and Armington aggregate good	0
Elasticity of transformation between domestic and export goods	1
Armington elasticity of substitution between domestic and import goods	5
Elasticity of substitution between formal and informal sector goods in final demand	1
Labor supply elasticity (poor consumer)	4
Labor supply elasticity (middle income consumer)	4
Labor supply elasticity (wealthy consumer)	4

Table 5. Mobility between Urban & Rural and Fixed Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-4.68	-4.15	-3.51	-0.90
Wmiddle	-12.27	-14.47	-9.12	-11.81
Wwealthy	-15.94	-18.63	-11.04	-15.61
X1	-26.24	-25.58	-22.54	-25.62
X2	-21.29	0.19	11.11	-21.10
X3	10.48	-13.05	-9.40	10.43
X4	-13.24	-15.16	-10.47	-10.17
X5	-12.59	-13.99	-6.76	-8.26
P1	-0.29	1.33	4.17	0.23
P2	-0.58	-2.68	-5.86	0.11
P3	-1.16	-0.71	2.78	-0.07
P4	3.08	3.78	3.61	0.72
P5	2.73	3.02	-0.50	-0.95
PK	-25.32	-29.35	-17.47	-24.94
PK45	-26.98	-27.94	-16.69	-9.50
PKm	-1.16	-2.68	-5.86	-0.07
PR	-21.00	-27.84	-16.19	-18.64
PL	9.31	13.64	6.46	7.63
PLFm	9.10	13.51	6.45	7.47
PLFw	9.17	13.50	6.35	7.52
PLIm	11.18	14.77	6.51	9.01
PLIw	10.85	15.14	7.61	8.81
PLIs	9.31	13.74	7.00	7.70
PLIf	9.31	13.55	5.90	7.56

Table 6. Immobility between Urban & Rural and Fixed Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-4.85	-4.27	-3.55	-1.03
Wmiddle	-12.25	-14.46	-9.13	-11.80
Wwealthy	-15.89	-18.59	-11.02	-15.57
X1	-26.12	-25.49	-22.50	-25.53
X2	-21.17	0.29	11.16	-21.01
X3	10.57	-12.98	-9.36	10.50
X4	-13.70	-15.57	-10.82	-10.53
X5	-13.08	-14.28	-6.79	-8.64
P1	-0.48	1.19	4.10	0.08
P2	-0.75	-2.80	-5.91	-0.02
P3	-1.28	-0.80	2.73	-0.16
P4	3.72	4.38	4.10	1.20
P5	3.41	3.44	-0.43	-0.46
PK	-25.35	-29.37	-17.48	-24.96
PK45	-26.62	-27.67	-16.53	-9.13
PKm	-1.28	-2.80	-5.91	-0.16
PR	-20.99	-27.82	-16.18	-18.62
PL	9.46	13.76	6.52	7.73
PLFm	8.33	13.08	6.49	6.90
PLFw	8.69	13.01	5.95	7.14
PLIm	19.66	19.87	6.84	15.29
PLIw	17.95	21.98	12.78	14.25
PLIs	9.46	13.87	7.09	7.81
PLIf	9.46	13.64	5.93	7.66

Table 7. Mobility between Urban & Rural and Elastic Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-5.17	-4.85	-3.76	-1.42
Wmiddle	-12.46	-14.72	-9.20	-12.02
Wwealthy	-13.53	-16.03	-9.87	-13.14
X1	-25.57	-25.67	-22.62	-24.94
X2	-21.36	-4.90	8.66	-21.18
X3	6.21	-13.17	-9.47	6.08
X4	-12.48	-14.29	-10.08	-9.37
X5	-11.58	-12.93	-6.27	-7.19
P1	-0.06	1.55	4.26	0.46
P2	-0.42	-2.51	-5.80	0.27
P3	-1.19	-0.66	2.78	-0.10
P4	2.68	3.17	3.39	0.33
P5	2.23	2.38	-0.72	-1.43
PK	-23.59	-27.64	-16.68	-23.18
PK45	-26.77	-27.85	-16.58	-9.25
PKm	-40.91	-46.29	-26.30	-40.93
PR	-22.35	-28.79	-16.69	-20.02
PL	8.58	12.31	6.02	6.87
PLFm	8.34	12.13	5.99	6.69
PLFw	8.42	12.14	5.90	6.74
PLIm	10.63	13.84	6.25	8.44
PLIw	10.33	14.11	7.31	8.26
PLIs	8.56	12.38	6.55	6.92
PLIf	8.60	12.23	5.48	6.81

Table 8. Immobility between Urban & Rural and Elastic Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-5.36	-5.01	-3.82	-1.56
Wmiddle	-12.44	-14.71	-9.20	-12.00
Wwealthy	-13.49	-15.99	-9.85	-13.10
X1	-25.44	-25.56	-22.56	-24.83
X2	-21.23	-4.76	8.73	-21.07
X3	6.32	-13.08	-9.43	6.16
X4	-13.01	-14.80	-10.48	-9.80
X5	-12.13	-13.33	-6.35	-7.64
P1	-0.27	1.36	4.17	0.29
P2	-0.61	-2.67	-5.86	0.12
P3	-1.33	-0.77	2.73	-0.20
P4	3.41	3.90	3.95	0.89
P5	2.99	2.95	-0.58	-0.87
PK	-23.63	-27.67	-16.69	-23.21
PK45	-26.36	-27.49	-16.38	-8.82
PKm	-40.88	-46.25	-26.28	-40.92
PR	-22.33	-28.76	-16.68	-19.99
PL	8.75	12.46	6.10	7.00
PLFm	7.50	11.52	5.95	6.04
PLFw	7.87	11.55	5.46	6.30
PLIm	20.04	20.85	7.40	15.62
PLIw	18.46	22.42	13.17	14.71
PLIs	8.74	12.55	6.66	7.05
PLIf	8.76	12.37	5.52	6.94

Table 9: Social Accounting Matrix

	Production Sectors																			Consumers			
Markets	T&I (1)	Farm (2)	Hsg (3)	Svcs (4)	Farm (5)	E	M	KM	Wp	Wm	Ww	LIs	LIf	LSp	LFm	LIm	LSm	LFw	LIw	LSw	Poor	mdle	wlthy	frgn
				-5	-5	-20	10																	
P1	160	-20				0			-10	-30	-80													
			-25	-5		-20	5																	
P2	-5	150				0			-5	-40	-55													
P3	-10	-10	150		-10		5		-10	-45	-70													
P4				55	-5				-10	-20	-20													
P5					55				-15	-15	-25													
PWp									50												-50			
PWm										150												-150		
PWw											250												-250	
PLIs				-15								15												
PLIf					-15								15											
PLSIs												-15		15										
PLSIf													-15	15										
PLFm	-20	-15	-10												45									
PLIm					-5											5								
PLSFm															-45		45							
PLSIm																-5	5							
PLFw	-25	-20	-15															60						
PLIw				-15															15					
PLSFw																		-60		60				
PLSIw																			-15	15				
PL														-30			-50			-75	30	50	75	
PK	-65	-45	-45					20														45	90	
PR	-35	-40	-55	-10	-10																10	55	85	

PK4-5	-5	-5				10	
			4	-	-10		
			0	2			
PFX				0			-10
PKr					-10		10

Table 10. Mobility between Urban & Rural and Fixed Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-4.66	-3.88	-3.66	-0.06
Wmiddle	-12.14	-13.99	-8.37	-11.41
Wwealthy	-15.18	-17.69	-10.43	-14.72
X1	-24.97	-25.50	-23.12	-23.37
X2	-20.98	0.85	13.76	-21.02
X3	11.58	-14.61	-11.80	10.29
X4	-15.15	-16.89	-11.91	-10.43
X5	-13.43	-14.79	-6.81	-8.51
P1	-0.54	1.17	4.18	0.09
P2	-0.41	-3.08	-7.62	0.45
P3	-1.17	-0.54	2.77	0.09
P4	4.49	4.76	4.87	0.11
P5	2.72	2.68	-1.06	-1.53
PK	-25.57	-29.79	-17.88	-25.13
PK45	-28.13	-29.47	-17.69	-10.56
PKm	-1.17	-3.08	-7.62	0.09
PR	-21.36	-27.40	-15.38	-18.76
PL	10.81	14.97	6.86	9.08
PLFm	10.70	14.91	6.87	9.01
PLFw	10.65	14.86	6.77	8.97
PLIm	11.69	15.47	6.78	9.67
PLIw	11.40	15.37	7.21	9.53
PLIs	10.79	14.96	7.00	9.09
PLIf	10.82	14.97	6.72	9.07

Table 11. Immobility between Urban & Rural and Fixed Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-4.86	-4.00	-3.73	-0.15
Wmiddle	-12.16	-14.01	-8.39	-11.42
Wwealthy	-15.13	-17.65	-10.40	-14.66
X1	-24.79	-25.40	-23.06	-22.14
X2	-20.82	0.97	13.84	-21.06
X3	11.73	-14.52	-11.73	9.29
X4	-16.05	-17.46	-12.46	-11.14
X5	-13.95	-15.08	-6.80	-8.84
P1	-0.77	1.03	4.09	-0.05
P2	-0.62	-3.21	-7.69	0.30
P3	-1.32	-0.64	2.71	-0.05
P4	5.75	5.58	5.63	1.02
P5	3.43	3.09	-1.03	-1.09
PK	-25.58	-29.79	-17.88	-25.06
PK45	-27.85	-29.30	-17.60	-10.29
PKm	-1.32	-3.21	-7.69	-0.05
PR	-21.33	-27.38	-15.37	-18.91
PL	10.93	15.04	6.91	9.28
PLFm	10.08	14.56	6.98	8.74
PLFw	9.61	14.16	6.14	8.32
PLIm	18.61	19.38	6.26	14.13
PLIw	16.19	18.56	10.01	13.12
PLIs	10.91	15.04	7.05	9.30
PLIf	10.94	15.04	6.76	9.26

Table 12. Mobility between Urban & Rural and Elastic Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-5.08	-4.51	-3.85	-0.52
Wmiddle	-12.30	-14.22	-8.43	-11.59
Wwealthy	-13.30	-15.67	-9.63	-12.78
X1	-24.40	-25.50	-23.15	-23.81
X2	-21.14	-4.29	11.53	-21.05
X3	7.29	-14.13	-11.61	6.92
X4	-14.16	-15.80	-11.49	-9.37
X5	-12.38	-13.68	-6.35	-7.39
P1	-0.23	1.48	4.29	0.38
P2	-0.32	-2.98	-7.59	0.54
P3	-1.22	-0.52	2.76	0.07
P4	3.93	4.02	4.64	-0.45
P5	2.20	2.05	-1.26	-2.03
PK	-23.99	-28.22	-17.23	-23.59
PK45	-27.80	-29.19	-17.53	-10.16
PKm	-41.52	-46.89	-25.87	-41.66
PR	-22.60	-28.33	-15.83	-19.87
PL	10.09	13.72	6.52	8.22
PLFm	9.97	13.63	6.52	8.13
PLFw	9.90	13.56	6.41	8.06
PLIm	11.12	14.48	6.54	8.98
PLIw	10.83	14.35	6.96	8.83
PLIs	10.07	13.71	6.65	8.23
PLIf	10.10	13.72	6.38	8.21

Table 13. Immobility between Urban & Rural and Elastic Capital Supply

	Uniform National Tax (%-Chg)	Local Differentials (%-Chg)	Land & capital exempt in Agric (%-Chg)	Evasion in Informal sector (%-Chg)
Wpoor	-5.31	-4.69	-3.93	-0.69
Wmiddle	-12.33	-14.24	-8.45	-11.61
Wwealthy	-13.24	-15.63	-9.60	-12.74
X1	-24.19	-25.35	-23.07	-23.64
X2	-20.94	-4.08	11.67	-20.88
X3	7.50	-13.99	-11.53	7.09
X4	-15.31	-16.72	-12.19	-10.37
X5	-13.01	-14.14	-6.42	-7.89
P1	-0.51	1.25	4.17	0.15
P2	-0.59	-3.19	-7.69	0.32
P3	-1.41	-0.67	2.67	-0.09
P4	5.51	5.31	5.60	0.80
P5	3.05	2.68	-1.14	-1.42
PK	-24.02	-28.23	-17.24	-23.61
PK45	-27.45	-28.92	-17.40	-9.80
PKm	-41.44	-46.80	-25.80	-41.60
PR	-22.55	-28.29	-15.81	-19.83
PL	10.25	13.85	6.59	8.34
PLFm	9.25	13.11	6.57	7.61
PLFw	8.60	12.46	5.62	6.99
PLIm	19.24	20.45	6.79	14.94
PLIw	16.83	19.40	10.47	13.76
PLIs	10.23	13.85	6.73	8.36
PLIf	10.26	13.84	6.44	8.32

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