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A GENERAL EQUILIBRIUM ANALYSIS OF THE WELFARE IMPACT OF PROGRESA TRANSFERS

by

David Coady and Rebecca Lee Harris

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CONTENTS

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EXECUTIVE SUMMARY

The recently introduced PROGRESA program in Mexico can be interpreted as having multiple objectives, namely, (i) the alleviation of current poverty through the transfer of cash payments to poor households, and (ii) encouraging the accumulation of human capital by these households through the conditioning of these transfers on attendance at school and health centers. The latter can also be interpreted in terms of generating a sustained decrease in poverty over time. In this report we are concerned solely with the first objective. To date, the analysis of the welfare impact of these transfers has essentially been undertaken within a partial equilibrium framework which focuses exclusively on the direct effect of the transfers on the beneficiaries. In this report we emphasize the need to take a general equilibrium perspective of the program. In particular, we focus in on the indirect welfare effects which arise from the need to finance the program domestically. This focus is motivated by the belief that any credible poverty alleviation strategy must have underlying it a credible financing strategy.

Both in the body of the report and more formally in the appendices, we show how the indirect effects arising from the need for domestic financing can be separated into three components: (i) the *redistribution effect* due to some households being taxed to finance the transfers to households, (ii) the *reallocation effect* which results when those financing the program have different consumption patterns (or income elasticities) from those receiving the transfers so that there is a second-round effect on government revenue when taxes differ across commodities, and (iii) the *distortionary effect* which arises when the program is financed by manipulating distortionary taxes and subsidies. The first effect can be viewed as capturing the equity implications of the program and the last two effects as capturing the efficiency implications.

The approach taken in our analysis is to model the indirect income effects arising from the cash transfers using a computable general equilibrium model of the Mexican economy. We then super-impose both the consequent direct and indirect income effects onto a household-level data set and calculate the resulting welfare effects within a standard social welfare framework. We do this for a number of policy scenarios involving the elimination of food subsidies and various reforms of the structure of value-added taxes (VATs). The actual program was financed by the elimination of subsidies so the various forms of VAT financing can then be interpreted as alternative financing strategies which can be compared to the chosen one. We also address the issue of the expansion of the program to urban areas with the transfers being financed through a combination of eliminating subsidies and alternative reforms of the structure of VATs.

In presenting the results of our simulations we show how the three separate components of the indirect income effects can be subsumed within one parameter, the *cost of public funds*. This term represents the welfare cost of financing the program and should be compared to the welfare benefit from the transfers. These costs and benefits will obviously depend on how society values extra income to different (e.g. extremely poor, moderately poor, and non-poor) households. We start by ignoring welfare gains arising from the redistribution of income, i.e. we assume that income to all households is seen as being of equal social value. In this case the redistribution effect is zero so that the underlying cost of public funds captures the efficiency (i.e. reallocation and distortionary) effects associated with financing the transfers.

Our results show that financing the program through the elimination of distortionary food subsidies is associated with a substantial welfare *gain*, with the cost of raising $100 being only $62. In other words, even if we do not attach any social value to the redistribution of income such a cash transfer program is welfare improving. Every $100 raised to finance the program increases welfare (and GDP) by $38. This compares extremely favorably with the alternative forms of VAT financing. Although two of the VAT reform alternatives (i.e. a uniform rate of 7.2% in place of the bottom two rates of 0% and 5% - BVAT - or a single uniform rate of 8.3% in place of the existing three rates of 0%, 5%, and 10% - UVAT) are also associated with welfare gains, these are much smaller with every $100 raised costing $97 and $95 respectively. These welfare gains result from the reform of the VAT structure with a shift of taxes towards price inelastic commodities, a more efficient structure for raising revenue. The other three VAT alternatives (i.e. a uniform top rate VAT of 11.4% in the place of the top rates of 5% and 10% - TVAT, a higher top rate of 16.1% instead of the existing 10% - HVAT, and a proportional increase in all the existing rates to 0%, 7.3% and 14.6% - PVAT) have welfare costs of between $105-$107 per $100 raised.

The whole motivation of the transfer program is, of course, the underlying belief that there are welfare gains associated with the redistribution of income to lower-income households. The existing VAT structure with zero rating of price inelastic necessities (such as basic and manufactured foods) consumed disproportionately by low-income households and higher rates on price elastic luxuries (such as consumer durables) consumed disproportionately by higher-income households, is presumably motivated by similar equity objectives. It is not surprising then that when we allow for such concerns the welfare impact of the program increases substantially. Not only does the benefit of the program increase but the cost of raising this revenue decreases.

For example, at only moderate levels of aversion to income inequality the benefit-cost ratio with subsidy financing is about four, i.e. every $100 raised to finance the program increases welfare by $400, a very high social return by any standards. This high return reflects the efficient targeting of transfers to poor households and the fact that the non-poor bear the brunt of the withdrawal of food subsidies. However, it does appear that while the poor as a whole do not bear the brunt of the subsidy withdrawal, the poorest of the poor do lose out. Thus, as we place a relatively higher social value on income to the poorest households we find that the cost of raising a unit of public funds begins to increase. But because of the efficient targeting of transfers the social benefit of the transfers increases by even more so that the benefit-cost ratio for the program increases systematically as our concern for the poorest households increases. This pattern also holds for all of the VAT financing alternatives, but these are always clearly dominated by subsidy financing. The results from our simulations therefore clearly bring out the welfare gains from introducing a new efficiently targeted redistributive program; not only are the benefits from more efficient targeting substantial but they are reinforced by the welfare gains from being able to reform the existing system of subsidies and taxes to reduce the underlying trade-off between equity and efficiency. The previous system of food subsidies and zero rating of foods had a high efficiency cost because of the need to address equity concerns.

Because the actual program transfers cash to only the rural poor, we find that poverty increases in urban areas because these are hit by the withdrawal of food subsidies and, after the program, over 30% of the poor are located in urban areas even when we focus on severe poverty. We therefore also simulated a program where the transfers were also given to the urban poor, this program being financed by a combination of the elimination of food subsidies and alternative VAT reforms. The transfer budget increases by 50%, from 2% to 3% of household consumption. We find that although the welfare impact per peso transferred is lower (because the poorest of the poor are concentrated in rural areas) and the cost of public funds higher we still observe very favorable benefit-cost ratios, of the order of three to four for very moderate levels of aversion to income inequality. So our results clearly indicate substantial welfare gains from the expansion of the program to include the urban poor. Such arguments are reinforced by the principle of horizontal equity and possibly even in terms of the cost of alleviating poverty.

A GENERAL EQUILIBRIUM ANALYSIS OF THE WELFARE IMPACT OF PROGRESA TRANSFERS

Dave Coady and Rebecca Lee Harris

1. INTRODUCTION

The expressed objective of PROGRESA is the reduction, and eventual elimination, of poverty in Mexico. The program is essentially a conditional cash-transfer program whereby households receive money if they enroll their children in school and ensure adequate attendance and/or if family members adhere to a pre-determined schedule of visits to health centers. Therefore, for evaluation purposes, it is useful to view the program as having multiple objectives (Coady, 2000), namely: (i) the alleviation of current poverty through cash transfers, and (ii) the accumulation of human capital (i.e., education and health status). The second objective can be usefully seen in terms of the elimination of future poverty or the generation of a sustained decrease in poverty. In this report, however, we are concerned solely with the first objective, i.e., the transfer of cash to households with the aim of decreasing current poverty.

The cash transfers in PROGRESA constitute, on average, about 30% of initial household monetary income. When evaluating the economic impact of such transfers, it is useful to separate these into direct and indirect income (or welfare) effects. The direct income effects reflect the design of the program (i.e., the rules for targeting transfers) and impact on what might be called the beneficiaries. These are often referred to as first-round effects and are captured by partial equilibrium approaches to policy evaluation. Much of the analysis of PROGRESA to date (e.g., the targeting report) has focused only on these initial or direct income impacts of the program. The indirect effects capture the second-round income changes brought about both by the impact of cash transfers on the level and composition of demand and supply. The focus in this report is primarily on the indirect income effects, more particularly those that are a consequence of the need to finance the program domestically. We view this dimension of the program to be especially important because any credible poverty alleviation strategy must have underlying it a credible financing strategy. The latter can have important consequences for the level and distribution of household incomes and economic welfare.

There are a number of reasons why one should endeavor to evaluate the indirect effects of the program. Firstly, these may offset the first-round impact on beneficiaries and thus return to frustrate the achievement of objectives. Secondly, they affect individuals not included in the program but whose well-being enters into our measure of social welfare. This is particularly important in the presence of partial or imperfect targeting, e.g., when because of the design of a poverty-alleviation program some poor households (such as those in urban areas) have been excluded. Thirdly, in the presence of commodity taxes and subsidies, some of the indirect income effects emerge through changes in government revenues and expenditures thus impacting on the budgetary consequences of the transfer program, an outcome of particular importance to policy makers. Fourthly, the indirect effects on non-beneficiaries can have an important bearing on the political economy dimensions of the program: one may be willing to trade-off program effectiveness with program acceptability, although the two are obviously not unrelated.

In order to facilitate our understanding of the sources of the indirect welfare effects we separate these effects into three components. Firstly, there is a *redistribution effect* because someone must be taxed in order to pay for the cost of the transfer program. If high income households bear the brunt of this taxation, and if we attribute a social value to a more equal distribution of income, then the resulting welfare cost will be less than the direct welfare gain from the transfers. Secondly, there is a *reallocation effect* which results from the fact that the pattern of demand will change if those who finance the program have income elasticities of demand different from those who receive the transfers. The resulting demand changes can have important consequences for government revenues when taxes vary substantially across commodities. The welfare effects arise essentially because demand shifts away from (or towards) commodities for which demand was previously too low due to their relatively high tax rates. Thirdly, there is a *distortionary effect* because of the need to raise the revenue to finance the program through manipulating distortionary commodity taxes. If the program is financed by reducing distortionary subsidies, then this effect is positive, but if financed by increasing distortionary taxes then it may be negative. We consider both of these alternatives.

In general, then, the indirect (or "multiplier") effects can be positive or negative and can accrue to both beneficiaries and non-beneficiaries. The sign and magnitude of these effects, and how they work themselves through the economy (i.e., to whom they eventually accrue), depend on the structure of economic activity which determines how equilibrium is restored to commodity and factor markets, and how the government budget is balanced, in response to the transfers and the demand impacts they generate. Allowing for these "second round" effects is what essentially characterizes general equilibrium approaches to policy evaluation.

The layout of the report is as follows. In Section 2 we present the framework for our evaluation of the direct and indirect welfare impacts of the program. In Section 3 we discuss the structure of the computable general equilibrium model used to trace through the general equilibrium responses to the initial increase in demand generated by the transfers. We describe the data and assumptions used to construct the model. We finish this section by discussing the different policy scenarios (or simulations) that we evaluate and also emphasize the importance of addressing the need to finance the transfers by mobilizing domestic resources (e.g., taxation) while maintaining macroeconomic balance. In order to motivate, and provide a basis for, the evaluation of the program, Section 4 presents a brief discussion of the level and distribution of welfare and poverty before the program is implemented. The results of the simulations are presented and discussed in Section 5. Section 6 provides a brief picture of the distribution of welfare and poverty after the program. In the final Section 7 we draw some general lessons from our results.

2. METHODOLOGY

This paper focuses primarily on analyzing the level and distribution of indirect income effects. To trace through these indirect effects we need to specify the structure of the economy so as to identify how the changes in supply and demand which result from the transfers work themselves through the various commodity and factor markets. This includes specifying not only how equilibrium is restored in these markets but also specifying how equilibrium is restored to government finances as a result of both the direct and indirect impacts on government revenues and expenditures.

With regard to commodities one can consider a number of alternative market structures, of which the following two are at different ends of the spectrum:

(i) *Markets clear through production*: At one extreme we can assume that excess capacity exists throughout the economy so that the extra demand generated by the transfers absorbs some of these "surplus" resources thus generating Keynesian-type income multiplier effects (i.e., demand-led growth). This extra income gives rise to further rounds of increased demand and associated income effects, and so on through further rounds of expenditure. Such general equilibrium responses are captured by so-called social accounting matrix (SAM) multipliers with market prices being unaffected by changes in demand.

(ii) *Markets clear through prices*: At the other end of the spectrum lies a view of the economy characterized by full capacity so that extra demands result in price increases which bring about an appropriate reallocation of resources between sectors and consequent supply changes but no further income effects. For given demand changes, the more mobile are factors in and out of a sector then the smaller the price change required to bring forth the necessary supply responses. An extreme case is where factors are sector specific and fixed in supply so that prices increase but quantities supplied remain unchanged.

In general, the first set of models generate much higher (and positive) indirect effects than the second set. In between (i) and (ii) one has an economy with surplus resources in some sectors but with other sectors characterized by full capacity. The existence of international trade provides another "leakage" which may reduce multiplier effects or result in general equilibrium being restored through changes in factor prices rather than through commodity prices.

Since we are concerned primarily with the indirect welfare effects arising from the need to domestically finance the transfer program, the model we use to identify these assumes that markets clear through prices. Given the structure of the economy, the general equilibrium welfare impacts will also depend on (i) the existing structure of taxes and subsidies (including price controls) on commodities and factors, and (ii) how the transfers are financed (i.e., which combination of taxes or subsidies are changed). We simulate a number of alternative financing arrangements with the program being financed either by reducing existing subsidies or by increasing value-added tax (VAT) rates differently. In reality the program was delivered only to rural areas and financed by a reduction in subsidies. In order to address the issue of program expansion to urban areas, we also simulate an alternative program which is delivered to both rural and urban areas and is financed by both a reduction in subsidies but also by an increase in VAT rates. As with the initial simulation we consider a number of alternative VAT structures.

In order to identify the general equilibrium effects identified above, we use a computable general equilibrium model (CGE) for Mexico - the structure of this model is explained in detail later. We use a *two-step* approach. First the transfers are fed into the model and we consider alternative market structures and budget-closure rules. Then the resulting direct and indirect income effects, as well as the price changes, are taken from the CGE and, together with disaggregated household data, are used to calculate the impact on social welfare within the standard theory of social welfare.[1] In Appendix A we show that the welfare impact (dW) can be calculated as:

$$dW = \sum_h \beta^h y^h \left[\gamma^h + \phi^h - \sum_i \theta_i \pi_i \right] \qquad (1)$$

where y^h is total income of household *h*, β^h is the social valuation of extra income to household *h*, γ^h and ϕ^h are the proportionate changes in household income brought about by the direct transfers and indirect income effects respectively, π_i the proportionate change in the price of commodity *i*, θ_i^h is the share of expenditure on commodity *i* in the total expenditure of the household, and we use the condition $\mathbf{p.x}^h = y^h$. The term in brackets can be interpreted as the proportionate change in real incomes (i.e., nominal incomes minus a cost-of-living index). These proportionate changes are outputs from the CGE model and are then applied to household-level data.

In order to apply the above approach, one needs to specify the term β^h. This can be calculated as:

$$\beta^h = (y^k / y^h)^\epsilon$$

where y^k is the income of a reference household (for which β^k=1) and ϵ can be interpreted as an "inequality aversion" parameter with concern for inequality increasing with ϵ. For

[1] See Drèze and Stern (1987) for a more detailed and complete description of such a model.

example, with ϵ=0 all welfare weights take the value unity so that extra income to all households is considered equally socially valuable. With ϵ=1, the social value of extra income to a household with twice the initial income of k is considered only as half as socially valuable as extra income to k. This welfare weight decreases to a quarter when ϵ=2 and so on.

In Appendix A we also formally decompose the indirect welfare effects into three components: the redistribution, reallocation and distortionary effects. The latter two effects can be interpreted as efficiency effects. Here we present a very simple model which helps to bring out the main points and to motivate the results presented later.[2] The welfare impact of the program can also be written as:

$$dW = \sum_h \beta^h \, dm^h - \lambda \sum_h dm^h \qquad (2)$$

where dm^h is the direct cash transfer to household *h*, $\sum_h dm^h$ is the program budget, β^h the social valuation of this transfer, and λ the social cost of raising the money to finance these transfers (or the so-called "cost of public funds"). The first term on the r.h.s. is then the direct welfare impact of the program and the second is the indirect welfare impact of the program. The sign of the indirect effect is determined by the sign of λ. If the government is unconcerned about income distribution (e.g., either because incomes are already equalized or ϵ=0) then $\beta^h=1(=\beta)$ for all households. If, in addition, the transfers (and other government revenue needs) are financed by non-distortionary lump-sum taxes then we have $\beta=\lambda=1$. The program then results in no overall change in welfare.

However, if the transfers have to be financed by introducing distortionary taxes then we have $\beta=1$ and $\lambda>1$ so that the net welfare impact is negative due to an indirect distortionary effect

[2] See Coady and Drèze (2000) for a more detailed discussion of the literature on optimal taxation.

capturing the so-called "deadweight losses" associated with taxes. If distortionary taxes already existed then the sign of 8 will depend on whether these were optimally set or not and which taxes (subsidies) are increased (decreased) to finance the program. If initially taxes were set optimally then 8>1 and welfare decreases.[3] If instead the program is financed by the removal of distortionary subsidies then 8<1 and welfare increases. If initially taxes were not set optimally then 8>1 (8<1) if the program is financed by raising taxes which were initially too high (low). In the presence of an inefficient tax structure one also gets reallocation effects if income elasticities differ across those receiving and financing the budget. For example, if the poor (who receive transfers) have a relatively high propensity to consume highly taxed commodities from extra income then this will decrease 8 reflecting the lower net revenue cost of the program.

Even if the two efficiency effects are zero, 8 can still differ from unity if income distribution is sub-optimal. If, in such a situation, the incidence of taxation falls on relatively low-income (high-income) households then 8>1 (8<1) reflecting a higher (lower) social cost of raising revenue. The belief that 8<1 is obviously the central motivation for the program in the first place.

We are interested in determining the overall welfare impact of the actual transfer program but also in comparing across alternatives. The actual program is the transfer program financed by a reduction in food subsidies. The alternatives reflect alternative financing scenarios, namely, alternative reforms of the VAT system. In order to motivate the manner in which we present our results, it is useful to rearrange equation (2). Since the direct welfare impact is common across all (i.e., the actual and alternative) programs, one can equivalently compare the welfare impacts by comparing the benefit-cost ratios of programs defined as:

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[3] Optimal taxation requires that, for all taxes under the control of the policy maker, the deadweight loss from raising extra revenue (i.e., 8) is equalized across all tax instruments.

$$\theta_j \equiv \frac{\sum_h \beta^h \, dm^h}{\lambda_j \sum_h dm^h} = \frac{\sum_h \beta^h \alpha^h}{\lambda_j} = \frac{\lambda_D}{\lambda_j}$$

where λ_j is the social cost of raising the revenue to finance the program (i.e., one for each of the actual and alternative financing strategies, *j*), α^h is the transfer received by household *h* as a proportion of the transfer budget, and λ_D is a weighted average of household βs since $\sum_h \alpha$=1. One can also interpret λ_D as the welfare impact of the direct transfers and λ_j as the welfare cost of the indirect income effects.[4] In principle one should choose the program with the highest θ_j>1, i.e., conditional on benefits exceeding costs one chooses the program which exhibits the lowest social cost of delivering these benefits. Or, in other words, θ_j is the social return to every dollar raised to finance the program. Later we present results for λ_D, λ_j, and θ_j.

Rather than focusing on welfare as above, alternatively one could use poverty measures as welfare indicators with welfare weights associated with households above the poverty line being zero. However, while poverty measures are a useful device for tracking and drawing attention to the extent of human misery, it is unlikely that our social objectives are as precisely defined as such an indicator suggests (e.g., with a weight of zero to households with one peso more than a household on the poverty line). This aspect of poverty measures manifests itself partly through the continuous debate regarding where to draw the poverty line. In any case, choosing high values for , (e.g., in the range 2 to 5) probably adequately captures concerns for poverty since the social welfare function converges towards the

[4] Strictly speaking these are marginal welfare effects so that the total welfare effects are derived as (λ_D-λ_j) times the program budget. The term λ_D is analogous to what is commonly referred to as the *distributional characteristic* of policy instruments or programs (Feldstein, 1974). In our case, as implicit in equation (1), we can also think of the direct and indirect income effects of the program as two separate programs (or program components) which can be evaluated separately. It is also straightforward to show that $\lambda_T = \alpha\lambda_D + (1-\alpha)\lambda_I$ where λ_T is the welfare impact of the full program, λ_I is the welfare impact (or distributional characteristic) of the indirect program component, and α is the share of the direct income transfers in the total (i.e., direct plus indirect) income effect of the program. One can also easily show that $\lambda_I = \alpha\lambda_j$.

Rawlsian maxi-min function which focuses solely on the welfare of the lowest income group (which could, of course, be defined as those below the poverty line). Our preferred approach is thus to choose alternative values for , and explore the implications for our policy analysis. This approach can be viewed as setting the poverty line at the highest income level. For completeness, though, we will also document the impact of the transfers on the various poverty measures (i.e., the headcount index, the poverty gap, and the severity index).[5]

In the next section we give a detailed description of the CGE model used to generate our results. We then present a description of the levels and distribution of welfare before the transfers are implemented. This is followed by an analysis of our results.

3. THE CGE MODEL

In this section we discuss the nature of the CGE model which is used to simulate the general equilibrium responses to the program.[6] We start by describing the database which links the various sectors of the economy and determines the channels through which the general equilibrium effects work. We then discuss the way in which factor and product markets operate and interact to determine how equilibrium is restored after the program is implemented. This is followed by a brief discussion of the various policy simulations undertaken in the subsequent section, concentrating mainly on the nature and magnitude of the resulting sectoral and macroeconomic flows.

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[5] See Atkinson (1987,1992) and Deaton (1997) for a more detailed discussion on these issues.

[6] This model builds on the work of Harris (1999).

3.1 The Database and SAM

The CGE model used in this analysis relies on a social accounting matrix (SAM) of Mexico, based on 1996 data[7]. The SAM accounts for all income and expenditure transactions of all sectors and institutions in the national economy, and thus serves as the underlying data framework for the CGE model[8]. The data were first collected as a national SAM, which was then divided into 5 regions. The model is able to capture differences among the regions in terms of production and consumption patterns, in a "top-down" approach: rather than having complete regional SAMs, the model regionally disaggregates the national SAM only by production and factor markets as well as households.

The model includes four rural regions, North, Central, Southwest and Southeast, which produce only primary agricultural products[9]. There is one "national" urban region, which comprises all of the urban areas of Mexico, regardless of geographical location. The urban area produces processed agricultural goods and other goods and services. Appendix Table 1 shows which states are in each rural region. Generally, the North region produces more high-valued agriculture, in particular fruits and vegetables, much of which is exported. Agriculture production relies on more irrigated land use, and households are wealthier. The Southeast region is poorest, more of the land used is non-irrigated, and there is less commercial farming. The Central and Southwest regions are a mixture of the first two, with

[7]The data used in constructing the SAM include: "Sistema de Cuentas Nacionales de México," INEGI, 1996, for national accounts data and other macro data; Informe Anual, Banco de México, 1996 for macro data; SAGAR, 1996 for data on crop yields and land utilization; Encuesta Nacional de Ingresos y Gastos de Hogares, INEGI, 1994, for household income and expenditure data; GTAP database for import and export data. The input-output coefficients come from a 1985 input-output table.

[8]For a detailed discussion of SAMs, see Pyatt and Round (1985).

[9]The definition of "rural" used in this model is somewhat different from the standard. Here we use an urban-rural cutoff set at 15,000 individuals.

a range of subsistence and commercial farming and agricultural technology. These two areas also produce the largest amounts of basic grains and beans.

The SAM and CGE model permit the regionalization of agriculture. Each rural region produces 6 agricultural activities: maize, wheat, other grains, beans, fruits and vegetables, and other crops. The models allows for multiple production activities to produce one national commodity. For example, all four rural regions produce the maize activity, which is supplied to a single national maize commodity market. Thus there are 24 agricultural *activities* but 6 agricultural *commodities*. A given sector's production is differentiated among the regions according to output levels and technology (in terms of factor and input usage). The livestock/forestry/fishery sector is not regionalized, due to data limitations. The urban region produces all other goods, including processed agricultural goods. Appendix Table 2 lists the sectors used in the model.

There are 4 types of non-agricultural labor: professional, white-collar, blue-collar, and unskilled/informal (referred to in this paper as unskilled), and four agricultural labor categories, differentiated by region. The agricultural activities employ only agricultural labor and non-agricultural activities do not use any agricultural labor. Each rural region uses two types of land, irrigated and non-irrigated, for a total of 8 land types. There is one capital category, used by all sectors. The model may be thought of as medium-term in nature, since labor is mobile across sectors, but capital and land are not.

Each region has 3 households, defined as poor, medium or rich according to the income tercile into which they fall.[1] The delineation among the categories comes from national data. In this way, distributional impacts of different scenarios can be observed among income groups as well as among the regions. The rural regions get labor income from all labor types, distributed according to national survey data. Poor rural households receive 45% of the agricultural returns to dry land in their region, while medium rural households receive

55% of dry land income. All of the irrigated land payments go to the rich households. The land returns (to dry land) for the livestock/forestry/fishery sector are split among the medium and rich rural households. Rural households also receive capital income indirectly through enterprises. This income is calculated as the residual between income and expenditure. Urban households do not receive any income from agricultural labor; the other labor categories distribute payments to the households according to shares given in the national survey. Urban households do not receive any land income and, like their rural counterparts, receive capital payments via the enterprise account.

Household consumption patterns also come from the survey data. Rural households have home consumption of the agricultural goods produced in their respective regions; all other goods are bought on the national market. All households save according to parameters estimated from household survey data.

The government and the enterprise account already alluded to are the other domestic institutions in the SAM. The government, which is national, collects seven types of taxes: a value-added tax, a producer tax, an export tax, a sales tax, an import tariff, a payroll tax and an income tax. It receives transfers from the rest of the world and provides transfers to households and enterprises. The rest of the world account provides transfers to households, buys Mexico's exports, and sells its imports.

With the data for the SAM coming from so many disparate sources, it is not surprising that its initial construction was neither balanced nor consistent. The SAM was therefore balanced using maximum entropy techniques to incorporate prior knowledge in a consistent way.[10] In Appendix Table 3 we present some useful summary statistics of the data used in the analysis.

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[10] For discussion on this technique, see Robinson *et al* (1998).

3.2 Description of the CGE Model

The computable general equilibrium model used in this study follows the sectoral and socio-economic structure of the SAM described above. The CGE model is neo-classical in spirit, with agents responding to price changes. The model is Walrasian, determining only relative prices. Product prices, factor prices and the equilibrium exchange rate are defined relative to the consumer price index, which serves as the price numeraire. The country is "small" in the sense that it takes world prices as given.

The production technology is a nested function of constant elasticity of substitution (CES) and Leontief functions. At the top level, domestic output is a linear combination of value added and intermediate inputs. Value added is a CES function of the primary factors of production (the land types, labor types and capital mentioned above) and intermediate input demand is determined according to fixed input-output coefficients. The commodity output is a composite of different activities, which are imperfectly substitutable: thus this framework allows multiple activities to produce one commodity, as discussed in the SAM description. Producers decide to supply their output to either the export or domestic market according to a constant elasticity of transformation (CET) function, which permits some degree of independence from international prices. The composite consumption good is a CES function of imported and domestically produced commodities. This aggregation, known as the Armington function, permits imperfect substitutability, and therefore, two-way trade, between imported and domestically produced goods.

Households receive income from factor payments (land, labor and capital payments) net of factor taxes, government transfers, and transfers from the rest of the world. They consume goods according to a linear expenditure function (LES), purchasing goods from the market as well as from home production (in rural areas only). They also pay taxes on their monetary income and save a share of their total income. Enterprises serve as the conduit between the capital factor account and the other institutions (households, government and rest of the world). They receive capital income minus capital payments to the rest of the world, as well as government transfers. Enterprises transfer that payment, net of depreciation and taxes, to households. Government income is the sum of all taxes: direct taxes on households and enterprises, value-added taxes, producer taxes, import tariffs, export taxes, social security taxes and sales taxes. The government consumes commodities according to fixed shares (given in the SAM) and also spends money on producer subsidies, transfers to domestic institutions, and transfers to the rest of the world.

Macro closure refers to the four macroeconomic accounts which must be balanced in the CGE model: the current account with the rest of the world, the government account, the savings-investment account, and the factor markets. In each condition, there are variables which serve to equilibrate the equation. The current account can be balanced by either the foreign savings variable or the exchange rate. This study chooses the latter, so that the welfare analysis is not based on changes in foreign inflows. The choice of government budget closure will depend on the simulation being performed; in all cases, government savings (or dissavings, as the case may be), will be held fixed, as will real government spending. One of the tax instruments will be free to adjust to keep government savings at its base-line level. This will allow us to perform government budget-neutral experiments without having government purchases of goods and services affect the welfare analysis. Similarly, in the savings-investment balance, real investment will be held fixed, and the marginal propensity to save equilibrates the account. In the factor market equilibria, either a factor is immobile and the wage can vary across sectors or the factor is free to move and the wage fixed across sectors. Here, labor is mobile and capital is fixed. Land is mobile across the sectors within its region.

The above gives a general description of the model structure. In Appendix B we present a more detailed discussion of a number of important features of the model, namely, the

Armington treatment of imports, the price equations, and the LES consumption behavior. Appendix C contains a complete listing of the CGE equations.

3.3 General Equilibrium Simulations

In this section we briefly discuss the impact of each PROGRESA experiment on macroeconomic, sectoral and regional flows. Two different types of simulations are performed with the CGE model to experiment with different ways of raising the money needed to pay for the current PROGRESA transfer program. In the first, consumer subsidies are removed to finance the transfer. The second set of simulations experiments with different types of value-added tax (VAT) reforms. A third set of simulations tests the possibility of expanding the current program into urban areas. In this set, both urban and rural poor households receive an extra government transfer equivalent to 30% of their income, which is funded by a combination of decreased subsidies and different types of VAT reforms.

In the base-run, the government deficit is $12 billion.[11] The CGE model is programmed to keep this number constant. In each simulation, the method of "closing" the budget must take into account the general equilibrium consequences of the transfer. For example, although the direct cost of the PROGRESA program is $57 billion, it may be that increased (or decreased) tax revenues from the second-round effects of the transfer decrease (or increase) the amount of revenue the government needs in order to keep its budget constant. The model adjusts for this through one of the equilibrating tax variables, specified below. The results (i.e., proportional income and price changes), used for our following discussion of the channels through which general equilibrium effects flow under the various scenarios, are presented in Table 1. Table 2 gives the resulting changes in factor prices and the exchange rate.

[11]Note that we will follow the convention of using "$" to signify Mexican pesos.

Subsidies

In the base run of the model, subsidies on *Manufactured Maize, Manufactured Wheat* and *Dairy Manufacturing* imply a consumer subsidy on these goods of 25%, 20% and 20%, respectively[12]. These subsidies cost about $58 billion, so their removal can be used to finance the PROGRESA transfer. In the experiment, the income tax, which is modeled as a lump sum tax, serves as the equilibrating variable for the government budget and it falls slightly. Removing the distorting subsidies causes a slight improvement in the macroeconomic accounts, with consumption increasing three-quarters of a percent and GDP and absorption rising by one-half of one percent.

At the the micro level, the decreased subsidies directly lead to decreases in production of the formerly protected goods, and as a consequence, the output of their intermediate goods (raw *Maize*, *Wheat* and *Livestock*, in particular) also falls. This causes resources to shift to the other agricultural goods, and in fact, overall agricultural output increases because resources are now allocated more efficiently. As a result, there is downward pressure on most agricultural factors of production — the exceptions are agricultural labor in the Central region, where the labor-intensive *Beans* production experiences a large increase in output, and irrigated land in the Southeast region, where *Other Crops* has a relatively larger increase in output. The fact that most rural factors now receive lower payments explains in large part the decline in non-benificiary rural household income as well as why beneficiary households end up receiving less than the full amount of the income transfer.

The urban area's production contracts by ½ percent point as a result of the policy. This is mainly due to the decrease in production of the processed foods which were formerly

[12]In 1996, the base year of the model, most consumer subsidies had already been abolished. This model augments the subsidies on these three goods in an attempt to recreate the pre-reform environment and show the effects of removing those subsidies in order to pay for the PROGRESA transfer, as did occur in reality.

protected. Thus, all urban factors of production receive lower payments, which leads to a decline in urban household incomes. This also negatively impacts rural households due to their reliance on urban factor income.

Value-Added Taxes

The base data has three levels of the value added tax (VAT)[13]: all raw agricultural goods, processed agricultural goods, and food have a VAT rate of zero; the "middle" VAT rate is imposed on *Light Manufacturing, Intermediate Goods,* and *Professional Services* at 5%; and the "high" VAT rate is on *Capital Goods, Consumer Durables, Construction,* and *Commerce, Trade and Transportation*, equalling 10%. The VAT is adjusted in five ways to raise the revenue needed to fund the PROGRESA transfer. In the first experiment (PVAT), the VAT is raised proportionally on all goods, which causes the middle VAT rate to increase to 7.3% and the higher rate to increase to 14.6%. Next, the VAT is increased only for those goods with the upper rate, rising to 16.1% (HVAT). Thirdly, the VAT is increased and made uniform for the goods which initially had a VAT imposed on them, with the resulting new rate equal to 11.4% (TVAT). Then, the VAT is increased and made uniform for the goods which initially had either zero VAT or the middle rate, so that these goods are now subject to a 7.2% VAT, while the high VAT rate remains at 10% (BVAT). Finally, the VAT is adjusted so that it is uniform for *all* goods, including the ones which were previously exempt, for a single VAT rate of 8.3% (SVAT). See Table 3 for a summary of these experiments.

Two of the VAT experiments slightly improve the macroeconomic indicators, namely, the uniform increase of the zero and low VAT goods (i.e., BVAT), and the uniform increase of

[13]These data do not reflect actual VAT rates because they are imposed on composite production goods, the individual components of which may have different rates and may include exports (which are zero-rated). Thus the rates must be interpreted as *average* VAT rates for these aggregated sectors.

all goods (i.e., SVAT). The resulting VAT structures from these experiments are less distorting than the other experiments. On the other hand, because these two VAT changes increase the VAT rate on agricultural products, agricultural factors of production suffer from lower returns. For example, when the VAT is made uniform for all activities, agricultural wages fall by between 7.6% to 8.9%, and land returns fall by between 8.2% to 10.6%. This then dampens the income gains to recipient households, by about 5.5% to 6.5% percent in either experiment. The increase in the VAT for the sectors which originally had a low VAT decreases payments to the urban factors, which hurts both urban and rural household income.

The other three VAT experiments are more inefficient, as evidenced by the slight decline in macroeconomic indicators. However, since raw agricultural production and processed agriculture is not taxed, the increased demand for these products raises the agricultural wages in all three experiments. This does not imply that beneficiary household incomes increase beyond the transfer payment, because of their reliance on urban factor income. The VAT lowers urban wages by more in these scenarios, because urban sector production is harder hit, and this negatively impacts all rural households, including the beneficiaries. However, their income changes are still higher than in the two VAT simulations mentioned above. And, as expected, urban households see even greater decreases in their income with the more distorting VAT systems, since the VAT rates are now higher for the goods from which they receive factor income.

Rural and Urban PROGRESA

In the third set of experiments, the PROGRESA transfer is expanded to urban poor households. In these simulations, all poor households in the model receive an extra income transfer from the government, equivalent to 30% of their initial incomes. The extra cost to the government of extending the program is about $54 billion. This larger program is paid for by eliminating the subsidies *and* increasing the VAT collection, using the same VAT combinations as above. The resulting VAT tax rates are presented in Table 4 and the nominal income changes are presented in Table 5.

To some degree, the results echo those of the VAT simulations described above. Because of the extra increase in income to urban poor households, who constitute a larger percentage of the whole population, there is a positive impact on the macroeconomic indicators in all cases. It is most favorable for the less distorting VAT (BVAT and SVAT) systems as before, with GDP increases of about 0.6% for both experiments. As in the earlier experiments, in these two cases, the imposition of a VAT on agricultural goods hurts agricultural wages, which has a greater impact on the incomes of rural poor. At the same time, the urban target group as well as the other urban households have better incomes with the less distorting VAT programs, since the urban factors as a whole bear a relatively lower share of the VATs.

4. THE LEVEL AND DISTRIBUTION OF WELFARE BEFORE THE PROGRAM

In this section we present a very brief description of the spatial distribution of social welfare in Mexico prior to the reforms under consideration. This will provide a reference point from which to evaluate the impact of the reforms on social welfare. Our analysis uses the 1996 nationally representative household survey data (ENIGH96): our indicator of welfare is adult-equivalent household per capita expenditure (henceforth referred to as consumption or income) denoted by y.

It is useful to think of welfare (W) as being the product of the mean level of consumption, μ, and some measure of inequality, I, as follows:

$$W = \mu (1 - I)$$

where W is increasing in mean consumption but decreasing in the index of inequality. This formulation captures the standard notion of a trade-off between efficiency and inequality, i.e., we are willing to trade-off a lower mean for a more equal distribution or vice versa. The willingness to trade-off can be captured by the inequality aversion parameter, ,, utilized earlier. A higher value of , implies that we require a greater increase in mean income to compensate for a given increase in inequality. Alternatively, for a given mean income, W decreases the more unequal the distribution around the mean. For our measure of inequality we use the Atkinson index which has a basis in standard welfare theory.[14]

To be comparable and consistent with our CGE analysis, we group households into five regions: (1) North, (2) Central, (3) South West, (4) South East, and (5) Urban. The distribution of all households across regions is presented in Table 6. One can see that over one half of the population live in the urban areas and Urban's even higher share of total income is consistent with a higher productivity of labor. Urban and North have the highest mean income with South East having the lowest. However, these two wealthier regions also have the most unequal distribution of income. Notice also that their inequality ranking switches as we go from $I(0.5)$ to $I(1)$, consistent with income in North being especially unequally distributed at the lower end of the distribution. Decomposing by region, we found that differences in mean incomes across states account for only around 15% to 20% of total

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[14] See Atkinson (1970) for details, and also Deaton (1997) for a useful discussion on this approach. This Atkinson index can be written as $I = 1 - (y_e / \mu)$, where y_e is the "equally distributed equivalent income", i.e., the amount of income which if distributed equally would result in the same level of social welfare as the existing distribution of income. Since social welfare is decreasing in inequality we have $y_e < \mu$, with their ratio decreasing the greater our aversion to inequality (i.e., the higher ,). So y_e already encapsulates the concern for unequal distribution. For this reason, I is often referred to as an "index of waste" since it captures the amount of social welfare lost through not having an equal distribution of income. The index takes the value zero either when income is equally distributed (with everyone having mean income so that $y_e = \mu$) or when we are unconcerned about the distribution of income (i.e., , = 0), in which case social welfare is adequately captured by focusing only on mean income.

income inequality (with this proportion increasing in ,) indicating a substantial inequality of income within regions.[15]

The above pattern of mean income and inequality has the implication that our spatial ranking by welfare can in principle depend on our aversion to inequality. However, in the present case, it is fairly obvious that the differences in means will dominate the differences in inequality levels (over plausible value for ,) with the result that the ranking by mean income gives simultaneously the welfare rankings. This is indeed borne out by our welfare index.

For completeness, we also present a brief "poverty profile" for Mexico. Although we expect this profile to mimic the welfare discussion above, it is useful also to have a picture of the distribution of poverty since later we are essentially using the poverty criterion as our "targeting rule" for determining who gets transfers and who does not. In this sense, we are using the poverty analysis in a "positive" as opposed to a "normative" manner. Assuming that one third of Mexicans are "poor", we identify poor households as those in the bottom tercile of the income distribution. Since this may be viewed as a relatively generous poverty line, we describe poverty using a range of indices which capture varying degrees of aversion to the "severity of poverty". By construction, the national headcount index (i.e., the percentage of households falling below the poverty line) is 33.3%, although this can vary by region, and by design will be affected by the reforms to be analyzed below. We also present the "poverty gap" which (unlike the headcount index) measures the depth of poverty and, if multiplied by the poverty line, indicates the increase in mean income required to eliminate poverty completely. This should of course be interpreted as the minimum required since the elimination of poverty with this "budget" would also require it to be "optimally" allocated (e.g., with zero "leakage" or "under-coverage") and, even then, it ignores any deadweight

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[15] The Atkinson index is not additively decomposable. However, the same pattern is displayed by other decomposable inequality measures such as the Theil index and other members of the general entropy family of inequality indices. See Cowell (1995) and Kakwani (1980) for detailed discussion of alternative indices of inequality.

losses (or incentive effects) associated with the policy instruments used to transfer income and to finance these transfers. Finally, we also present the "severity index" which attaches a greater weight to households the further they are below the poverty line.[16]

Using this relative poverty line (which comes out at just below 657 pesos in terms of household per capita adult equivalent consumption), we categorize households as poor and non-poor. The distribution of poor households across regions is presented in Table 7. Using the headcount ratio (i.e., the proportion of households classified as poor) we find that whereas only 18% of urban households are classified as poor, nearly 29% of the poor are found in urban areas. Within rural areas, over half of households in both Central and South East are classified as poor and just over 53% of the poor are found in these two regions. So although a relatively high percentage of rural households are poor, there is still a substantial number of poor located in urban areas. This is important since, in the reforms to be evaluated below, the poverty alleviation budget will for the most part be targeted only to rural areas, although we will eventually also analyze the impact of extending the program to include urban areas.

The total poverty gap comes out at 76 pesos per household (or 5.3% of aggregate income) so that a 5.3% increase in mean incomes, with the proceeds allocated optimally over only poor households, would be required to eliminate poverty completely.[17] This compares to the poverty alleviation budget which constitutes around 2% of total income in the case of the rural program and 3% when the program is expanded to include urban areas. Alternatively, the alleviation of poverty would require an optimal lump-sum transfer from the non-poor

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[16] See Ravallion (1988) and Deaton (1997) for a more detailed discussion of these indices.

[17] These are crude measures in that household size may vary by income level. For example, if the poor have larger families then these numbers would be an underestimate of the percentage poverty gap.

(who account for 90% of total income) equivalent to 5.9% of their income.[18] Over 81% of this gap is concentrated in rural areas, especially in the Central and South East regions. The "poverty shares" of these two regions (and of South West) increase in moving from the poverty gap to using the severity index, suggesting that the poorest households are also located in these rural areas.

5. SIMULATIONS AND RESULTS

In this section we very briefly describe our policy simulations and then evaluate their impacts on welfare. As mentioned earlier, this involves taking the indirect welfare impacts from the CGE analysis and superimposing them on the household-level data. We simulate two different programs: (a) the actual program which gives transfers to the rural poor, and (b) an expansion of the program to include the urban poor.

5.1 The Rural Program

The program is modeled as a poverty alleviation program which transfers income to "poor" households in rural areas, equivalent to a 30% increase in their nominal incomes and 2% of GDP. The total welfare impact of such a program will depend on how it is financed and we consider a number of alternatives. The actual source of finance is the elimination of food subsidies. The other alternatives considered involve various reforms of the value-added tax (VAT) system. The present VAT system is modeled as having three rates: 0%, 5%, and 10%

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[18] Obviously this tax should not be collected from those sufficiently near the poverty line that payment of the tax would push them into poverty. Also, in practice governments have to resort to "distortionary" tax instruments which would tend to require a higher tax rate (reflecting the substitution of households away from taxed activities). These, and other such issues, are addressed by our analysis below.

on agriculture/processed foods, light manufacturing/ intermediate goods, and consumer durables/capital goods respectively. We consider the following alternatives to finance the program:

(i) *Proportional Increase*(PVAT): in all VAT rates to 0%, 7.5% and 15%, respectively.
(ii) *Increase High Rate* (HVAT): from 10% to 16%.
(iii) *Uniform Top Rate* (TVAT): with the top two rates made uniform at 11%.
(iv) *Uniform Bottom Rate* (BVAT): with the bottom two rates made uniform at 7%.
(v) *Uniform Single Rate* (SVAT): with an 8.3% rate on all goods.

The basic approach is to compare the social costs of raising the necessary revenue to finance the program (the "cost of public funds", 8_j) with those of the actual financing instrument, i.e., the elimination of food subsidies, as well as with the program benefit (i.e., 8_D).

The results of our simulations are presented in Table 8. We start by comparing the cost of public funds across alternative financing packages for ,=0, i.e., where we are concerned only with the efficiency aspects of the program and not with its impact on the distribution of income or poverty. It is clear that, from an efficiency perspective, financing the program by reducing subsidies dominates with the cost of raising \$100 being only \$62. These substantial gains result from the elimination of a highly distortionary subsidy. But two of the VAT alternatives, i.e., SVAT and BVAT, also result in welfare gains, with the cost of raising \$100 being \$95 if financed by a move to a single uniform VAT rate or \$97 if financed by a move towards a uniform VAT rate in the place of the bottom two rates. These efficiency gains arise from the reform in the VAT structure. In general, the inefficiency associated with a tax system is minimized by having relatively higher rates on commodities with relatively low own-price elasticities of demand.[19] Since basic food items tend to have low price elasticities,

[19] We are implicitly assuming that cross-price elasticities are zero or sufficiently small as to make this general rule of thumb valid. See, for example, Coady and Drèze (2000) and Myles (1995) for more detailed discussion.

shifting taxes towards these commodities will tend to increase welfare and this is what happens in both the case of SVAT and BVAT. Our results tell us that the gains resulting from thus reforming the VAT structure outweigh the welfare losses from the higher average rate required to finance the program.

The other VAT alternatives considered all have a cost of public funds greater than unity, ranging between $105-$107 per $100 of revenue raised. All of these involve an increase in the VAT rates of one or both of the top two VAT rates and the commodities falling within these rates tend to be the most price elastic. These welfare losses mean that, in the absence of any social value being attached to any improvement in the income distribution, such a program would be welfare decreasing. However, not only are distributional concerns the motivating force for the program in the first place, but they also tend to be the motivation behind tax structures which exhibit high tax rates on low price-elastic luxuries typically consumed disproportionately by higher-income households. Therefore, any evaluation of the program should explicitly address this issue.

Introducing distributional concerns involves analyzing the results for values of , >0. The cost of public funds for a number of financing instruments is presented in Figure 1A: in order to avoid clutter we focus on only three of the VAT alternatives, i.e., the most inefficient system (HVAT) and the two most efficient systems (BVAT and SVAT). The first thing to notice is that once we introduce even a little concern for income distribution (e.g., , =0.5) the cost of raising a peso becomes substantially less than one peso for all financing instruments. This reflects the fact that the indirect income effects are distributed in favor of the poor at the expense of the non-poor. The second thing to notice is that the relationship between the cost of public funds and , is U-shaped, with the former beginning to rise after , =1. Eventually, at around , =3, the cost of public funds goes above unity. This pattern indicates that although the poor as a whole benefit from the indirect effects, the poorest of the poor do not, and the greater the weight we place on the income of the poorest the higher the social cost of raising revenue through the alternative VAT instruments.

Introducing distributional concerns into the analysis also changes the ranking of VAT instruments. This is brought out in Figure 1B where we plot the cost of public funds for ,=0 to ,=3. At ,=0 the cost is highest for HVAT and lowest for SVAT. However, by ,=0.5 SVAT is replaced by BVAT as the least costly alternative and by ,=2 SVAT replaces HVAT as the most costly alternative. Therefore, although SVAT is the most efficient form of VAT financing it becomes the least attractive form of financing when one has a high degree of aversion to inequality or severe poverty.

Although the cost of financing the program through reducing subsidies follows the same U-shaped pattern, it remains the most attractive form of finance throughout. In fact, for higher values of ,, it also appears to be the least regressive form of financing. This is brought out clearly in Figure 2 which shows the benefit-cost ratios (BCRs) across the instruments discussed above. The higher the value of , the more attractive subsidy reductions look relative to VAT financing. But even the BCRs for VAT financing increase with , reflecting the targeting of the transfers at poor households. This brings out one of the main attractions of the program, i.e., the fact that it is very efficiently targeted. More generally, it indicates the potential return in welfare terms from introducing a more efficiently targeted transfer program. The presence of such a program enables one to design a more efficient tax system by lessening the need to trade-off efficiency goals against equity objectives, e.g., by reducing the need for high subsidies or high taxes on price-elastic luxuries which exist for equity reasons.

5.2 The Rural and Urban Program

We now address the issue of the expansion of the program to include the urban poor and the need to generate higher revenue to finance these extra transfers. The total transfers to poor households (i.e., rural and urban) now constitute 3% of GDP, i.e., a 50% increase on the rural component. This is financed by the elimination of food subsidies combined with one of a number of alternative reforms in the VAT system. The VAT alternatives considered are the same as those outlined earlier.

Table 9 presents the results for this expanded program. Notice that for ,=0 the cost of raising a unit of revenue is less than unity, i.e., there are efficiency gains associated with all of the financing alternatives. This reflects the combination of VAT financing with financing through the elimination of food subsidies. As above, the cheapest forms of finance are the movement to a single uniform rate (SVAT) and to a uniform rate at the bottom end of the structure (BVAT). The least efficient form of financing is also again financing through increasing the top rate (HVAT). The profile of these alternatives for various values of ,>0 are presented in Figure 3 where they are compared to those associated with subsidy financing of the rural program. The same U-shaped pattern emerges for the same reasons. But the cost of raising a unit of revenue is always higher under the expanded program.

Turning to the benefit side, Figure 4 compares the welfare benefits arising from the transfers across the two programs. We can see that at low levels of , the two programs produce similar welfare impacts per unit of revenue transferred. However, for higher values these benefits are higher for the rural program. This reflects the relatively greater severity of poverty in rural areas. This pattern of benefits, combined with the above pattern of costs, produces a predictable pattern of benefit-cost ratios, with that for the rural program being higher than for the combined urban/rural program (Figure 5). However, the fact that benefits exceed costs for the latter means that such an expansion of the program is welfare improving.

In fact, every peso raised to finance the program generates a social return of around six pesos (for ,=2), an attractive investment by any standards!

6. THE SPATIAL DISTRIBUTION OF WELFARE AFTER REDISTRIBUTION

We complete our analysis of the welfare impact of PROGRESA transfers by returning to the issue of the trade-off between mean income and income inequality at the regional level which was discussed earlier in Section 4. However, here we focus primarily on the indirect impact of the transfers.

The relevant results are presented in Table 10A which compares regional mean incomes, inequality and welfare after the transfers with the levels and distribution before the transfers. We examine both the direct impact of the transfers and the combined direct and indirect impacts assuming that the government budget is balanced by eliminating distortionary food subsidies. The first panel of results presents the situation before the program is implemented. As discussed earlier, before the transfers regional mean incomes are negatively correlated with regional inequality.

The second panel of results presents the situation after we account for the direct impact of the transfers. There we see that mean incomes increase on average by 2% but that this growth is distributed strongly in favor of the poorest regions. For example, the poorest region, South East, exhibits a 8.8% increase in mean income. This is expected since the transfers are targeted at the poor and these regions have higher poverty rates. Since the transfers were concentrated towards the lowest income tercile, inequality also falls substantially, on average by 11% of the previous level. Again this fall is strongest in the three poorest regions (at 23%). Both of these combine to produce an average increase in welfare of 12.4% which is similarly biased towards the poorest regions.

The substantial increase in welfare from the direct effect of the transfers is unsurprising since the transfers are targeted at the poor, but especially because this ignores the need to finance the transfers domestically. The final panel looks at the situation when the transfers are financed by eliminating food subsidies. Here, mean income increases by 0.8% compared to the pre-transfer situation, thus capturing the efficiency gains from eliminating distortionary food subsidies. However, one observes very different effects across regions. Whereas the mean incomes of the three poorest regions increase, the mean incomes for the two richest regions decrease. Inequality also falls in the poorest regions so that one observes a substantial increase in welfare in these regions. Although mean income falls by 2.4% in North, inequality also decreases by 17.6% resulting in an overall increase in welfare of 11%. The small 0.4% decrease in mean income in Urban combines with a 1.5% increase in inequality to give a 1.7% decrease in welfare. Overall, the 0.8% increase in mean income is combined with a 9.3% decrease in inequality to give a 10.4% increase in welfare. So welfare goes up overall and also in all regions except Urban. The latter reflects the regressive impact of eliminating the subsidy on poor households.

The issue of expanding the program to urban areas is obviously a very important one. Table 10B presents the results for such an expanded program, the transfers being financed by both the elimination of subsidies and the introduction of a uniform VAT rate. Under this scenario mean income goes up by 0.8% overall, inequality decreases by 12.6% so that welfare increases by 13.9%. The main change in the regional pattern is that mean incomes no longer fall in Urban and, since inequality now goes down by 12.6%, welfare now increases. Welfare increases in the rural areas are slightly lower reflecting the need to finance the larger budget. The higher welfare gain for the expanded program, i.e., 13.9% compared to 10.4% previously, indicates that there is a substantial return to such an expansion.

The above presents the impacts in terms of our social welfare measure, trading off changes in mean incomes and inequality. For completeness we also present the impact on poverty, in terms of regional changes in poverty rates and the distribution of poverty across regions (Table 11A). The impact on poverty across different regions presents a slightly different picture from our focus on welfare above. Focusing on the direct impact and the headcount index, we see that the percentage of people who are poor decreased by 19%. However, unlike in the case of welfare, this decrease is biased towards the better-off rural regions. This different pattern reflects the fact that although poverty (by all measures) is lowest in these regions, their higher incomes mean that most of these are concentrated just below the poverty line. Thus, the transfers are able to bring a greater proportion of the poor in these regions above this line.

Our other measures of poverty show a similar result but less pronounced. The fact that the decrease is less biased towards the richer rural regions reflects the smaller degree of inefficiency in the transfers in poorer regions. In the richer regions a lot of income is wasted (from the perspective of poverty alleviation) in that it is more than sufficient to raise people out of poverty and we are now also attaching a value to pushing the poor "nearer" the poverty line rather than to above the poverty line, with the value increasing the greater the initial distance from the poverty line.[20] However, this inefficiency is offset by the lower initial poverty levels in richer areas so that we still observe a bias in poverty reduction towards those areas in terms of percentage reduction. As expected, with these poverty measures we also observe a more substantial percentage reduction in poverty, especially in the poorest rural regions.

One expects that when one allows for the fact that the program must be financed domestically the impacts on poverty will decrease and this is indeed the case. Overall

[20] This inefficiency is not as severely "punished" using our welfare measures since income above the poverty line has some (although less) social value.

poverty decreases by 14.7% and 33.3% according to the headcount and severity indices respectively, compared to 19.2% and 37% previously. But the biggest changes are in North which experiences a 30.4% reduction in headcount poverty compared to 44.6% previously. The fact that this difference is not as pronounced using the severity index (52.8% compared to 58.3% previously) suggests that those who lose from the indirect effects are concentrated around the poverty line. In addition, the headcount poverty increases in Urban by 4.4% since these households do not receive benefits but must help to finance the program. The increase in urban poverty is greater using the severity index suggesting that the poorest of the poor are worst hit.

When the program is extended to urban areas the impact on poverty is much more substantial as expected, with poverty decreasing by 24.6% and 44.4% according to the headcount and severity indices respectively, compared to just 14.7% and 33.3% previously under the rural program (Table 11B). This reflects substantial decreases in poverty in Urban by 38.3% and 57.9% respectively, compared to increases of 4.4% and 10.5% respectively under the rural program. Otherwise the poverty impacts in other regions are not very different. As with our welfare calculations above, this reinforces the substantial poverty gains from extending the program to urban areas.

We finish by examining the impact on the distribution of the total level of poverty across the regions (Table 12). The main message from these results is that after the rural program a greater percentage of the poor, and indeed the poorest of the poor, are now to be found in urban areas. Not only are the poor in these areas excluded from the program, they are also worse off from being excluded because they get hit by the elimination of food subsidies. Using the headcount ratio, the percentage of the poor found in urban areas increases by 6.4 percentage points, from 29% to 35.4%. Using the severity index, the proportion of poverty found in urban areas increases by 12 percentage points, from 18.6% to 30.6%. Under all three measures, the proportion of poverty located in urban areas is over 30% after the program is implemented. This result highlights clearly the need to include the urban areas in any poverty alleviation package.[21] When the program is extended to urban areas the regional distribution of (the now lower level of) poverty is very similar to that before any program is implemented; in fact now, using the severity index, 85% of poverty is to be found in rural areas compared to 81.4% prior to the program.

7. SUMMARY AND CONCLUSIONS

The recently introduced PROGRESA program in Mexico can be interpreted as having multiple objectives, namely, (i) the alleviation of current poverty through the transfer of cash payments to poor households, and (ii) encouraging the accumulation of human capital by these households through the conditioning of these transfers on attendance at school and health centers. The latter can also be interpreted in terms of generating a sustained decrease in poverty over time. In this report we are concerned solely with the first objective. To date, the analysis of the welfare impact of these transfers has essentially been undertaken within a partial equilibrium framework which focuses exclusively on the direct effect of the transfers on the beneficiaries. In this report we emphasize the need to take a general equilibrium perspective of the program. In particular, we focus in on the indirect welfare effects which arise from the need to finance the program domestically. This focus is motivated by the belief that any credible poverty alleviation strategy must have underlying it a credible financing strategy.

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[21] The argument is reinforced by the principle of horizontal equity under which excluding households using spatial (i.e., irrelevant) criteria is not an acceptable approach to policy formulation. Of course, spatial criteria may be important if the cost of alleviating poverty varies spatially, but even then this cost may be lower in urban areas.

Both in the body of the report and more formally in the appendices, we show how the indirect effects arising from the need for domestic financing can be separated into three components: (i) the *redistribution effect* due to some households being taxed to finance the transfers to households, (ii) the *reallocation effect* which results when those financing the program have different consumption patterns (or income elasticities) from those receiving the transfers so that there is a second-round effect on government revenue when taxes differ across commodities, and (iii) the *distortionary effect* which arises when the program is financed by manipulating distortionary taxes and subsidies. The first effect can be viewed as capturing the equity implications of the program and the last two effects as capturing the efficiency implications.

The approach taken in our analysis is to model the indirect income effects arising from the cash transfers using a computable general equilibrium model of the Mexican economy. We then super-impose both the consequent direct and indirect income effects onto a household-level data set and calculate the resulting welfare effects within a standard social welfare framework. We do this for a number of policy scenarios involving the elimination of food subsidies and various reforms of the structure of value-added taxes (VATs). The actual program was financed by the elimination of subsidies so the various forms of VAT financing can then be interpreted as alternative financing strategies which can be compared to the chosen one. We also address the issue of the expansion of the program to urban areas with the transfers being financed through a combination of eliminating subsidies and alternative reforms of the structure of VATs.

In presenting the results of our simulations we show how the three separate components of the indirect income effects can be subsumed within one parameter, the *cost of public funds*. This term represents the welfare cost of financing the program and should be compared to the welfare benefit from the transfers. These costs and benefits will obviously depend on how society values extra income to different (e.g., extremely poor, moderately poor, and non-poor) households. We start by ignoring welfare gains arising from the redistribution of income, i.e., we assume that income to all households is seen as being of equal social value. In this case the redistribution effect is zero so that the underlying cost of public funds captures the efficiency (i.e., reallocation and distortionary) effects associated with financing the transfers.

Our results show that financing the program through the elimination of distortionary food subsidies is associated with a substantial welfare *gain*, with the cost of raising $100 being only $62. In other words, even if we do not attach any social value to the redistribution of income such a cash transfer program is welfare improving. Every $100 raised to finance the program increases welfare (and GDP) by $38. This compares extremely favorably with the alternative forms of VAT financing. Although two of the VAT reform alternatives (i.e., a uniform rate of 7.2% in place of the bottom two rates of 0% and 5% - BVAT - or a single uniform rate of 8.3% in place of the existing three rates of 0%, 5%, and 10% - UVAT) are also associated with welfare gains, these are much smaller with every $100 raised costing $97 and $95, respectively. These welfare gains result from the reform of the VAT structure with a shift of taxes towards price inelastic commodities, a more efficient structure for raising revenue. The other three VAT alternatives (i.e. a uniform top rate VAT of 11.4% in the place of the top rates of 5% and 10% - TVAT, a higher top rate of 16.1% instead of the existing 10% - HVAT, and a proportional increase in all the existing rates to 0%, 7.3% and 14.6% - PVAT) have welfare costs of between $105-$107 per $100 raised.

The whole motivation of the transfer program is, of course, the underlying belief that there are welfare gains associated with the redistribution of income to lower-income households. The existing VAT structure with zero rating of price inelastic necessities (such as basic and manufactured foods) consumed disproportionately by low-income households and higher rates on price elastic luxuries (such as consumer durables) consumed disproportionately by higher-income households, is presumably motivated by similar equity objectives. It is not surprising then that when we allow for such concerns the welfare impact of the program increases substantially. Not only does the benefit of the program increase but the cost of raising this revenue decreases.

For example, at only moderate levels of aversion to income inequality the benefit-cost ratio with subsidy financing is about four, i.e., every $100 raised to finance the program increases welfare by $400, a very high social return by any standards. This high return reflects the efficient targeting of transfers to poor households and the fact that the non-poor bear the brunt of the withdrawal of food subsidies. However, it does appear that while the poor as a whole do not bear the brunt of the subsidy withdrawal, the poorest of the poor do lose out. Thus, as we place a relatively higher social value on income to the poorest households we find that the cost of raising a unit of public funds begins to increase. But because of the efficient targeting of transfers the social benefit of the transfers increases by even more so that the benefit-cost ratio for the program increases systematically as our concern for the poorest households increases. This pattern also holds for all of the VAT financing alternatives, but these are always clearly dominated by subsidy financing. The results from our simulations therefore clearly bring out the welfare gains from introducing a new efficiently targeted redistributive program; not only are the benefits from more efficient targeting substantial but they are reinforced by the welfare gains from being able to reform the existing system of subsidies and taxes to reduce the underlying trade-off between equity and efficiency. The previous system of food subsidies and zero rating of foods had a high efficiency cost because of the need to address equity concerns.

Because the actual program transfers cash to only the rural poor, we find that poverty increases in urban areas because these are hit by the withdrawal of food subsidies and, after the program, over 30% of the poor are located in urban areas even when we focus on severe poverty. We therefore also simulated a program where the transfers were also given to the urban poor, this program being financed by a combination of the elimination of food subsidies and alternative VAT reforms. The transfer budget increases by 50%, from 2% to 3% of household consumption. We find that although the welfare impact per peso transferred is lower (because the poorest of the poor are concentrated in rural areas) and the cost of public funds higher we still observe very favorable benefit-cost ratios, of the order of three to four for very moderate levels of aversion to income inequality. So our results clearly indicate substantial welfare gains from the expansion of the program to include the urban poor. Such arguments are reinforced by the principle of horizontal equity and possibly even in terms of the cost of alleviating poverty.

To date, the analysis of the welfare impact of the PROGRESA transfers has essentially been undertaken within a partial equilibrium framework which focuses exclusively on the direct effect of the transfers on the beneficiaries. In this paper we emphasize the need to take a general equilibrium perspective of the program which involves identifying both the equity and efficiency impacts of the program and addressing the commonly observed trade-off between the two. The equity effects arise from the transfer of income to the poor, with these transfers being financed by taxing the non-poor. The efficiency effects arise from the fact that this taxation potentially distorts the allocation of resources. Of course, this taxation may also have adverse implications for equity, e.g., when the poor are also hit by the higher taxes. The last two effects are referred to as the indirect (or general equilibrium) welfare effects.

The approach taken in our analysis is to model the general equilibrium responses to the injection of cash transfers using a computable general equilibrium model of the Mexican economy. We then super-impose both the direct and indirect effects onto a household-level data set and calculate the resulting welfare effects within a standard social welfare framework. We do this for a number of policy scenarios involving the elimination of food subsidies and various reforms of the structure of value-added taxes.

We draw a number of important lessons from our results. Firstly, we show that the magnitude of the indirect effects can be substantial when viewed as a proportion of the direct effects, so that focusing exclusively on the latter can lead to a substantial overestimate of the net welfare impact. It is often argued that because the transfers are small, the indirect effects will also be small and can thus safely be ignored. This is in general incorrect since the appropriate focus for welfare analysis is not the absolute magnitude of the effects but their size relative to partial equilibrium estimates. These can (and in our model will always) be relatively substantial even for small cash transfers when the initial allocation of resources is distorted through taxation or imperfect market functioning.

Secondly, we find that in most cases these indirect effects are channeled through factor price changes as opposed to commodity price changes. This reflects in part the openness of the Mexican economy to foreign trade; in order to remain competitive with imports the effects of changes in demands must be pushed back onto factors rather than forward onto commodity prices. But it also reflects the policy instruments used to restore equilibrium, e.g., when the exchange rate was allowed to change this led to a decrease in the price of tradeables which thus became an important source of the indirect effects. A similar pattern could emerge under sales tax financing since this involves higher domestic prices for imports. However, in our case this was not so pronounced due the broad tax base relative to the transfer budget. Our expectation is that such aspects of the model mainly determine the source of the indirect effects as opposed to their relative magnitude.

Thirdly, although the relative magnitude of the indirect effects decrease as our aversion for inequality and poverty increase, they remain significant even at extreme degrees of aversion. Using what many would argue is a too extreme bias in favor of redistribution, we find that the indirect effects can still be as large as 10-18% of the direct effect. The decreasing proportion reflects the fact that, although the indirect costs may have adverse consequences for distribution, the strong redistributional nature of the direct transfers dominates our welfare calculations as our aversion to inequality increases. One should also keep in mind that we have biased the evaluation in favor of the redistributional gains from the program since we have assumed that there is no "leakage" or "under-coverage". This is obviously not a good representation of reality, or of the actual design of PROGRESA transfers, where there may be an important degree of leakage and under-coverage. We may attempt to simulate the impact of such leakages in future work. It could also be argued that we underestimate the indirect efficiency effects since our description of the pre-program situation is one where the existing level of taxes are low.

Fourthly, given that the transfers have to be financed domestically through distortionary taxation, it is important to try to identify the most efficient method of finance. We address this issue using benefit-cost ratios which capture the welfare gain per unit welfare cost with the most attractive financing instrument being the one with the highest ratio. When we focused on the two most distortionary sources of finance, i.e., the sales tax and the VAT, we found that their ranking can be quite sensitive to the degree of inequality aversion one assumes. Whereas the sales tax appeared to be the most attractive source of finance at low levels of inequality aversion, the VAT very quickly becomes the more attractive as this aversion increases. Therefore, the issue of the source of finance requires careful consideration and may make a real difference to the net welfare impact of the program.

Finally, our analysis of the spatial distribution of the welfare impacts highlights two important issues. The first concerns the design of the program which excludes the urban poor. Not only do these not benefit from the transfers, they are also likely to be worse off since they will most likely bear some of the brunt of the higher taxation. The net result is that urban areas become an important reservoir of poverty and low income. The welfare and poverty impact of the program can therefore be greatly enhanced by extending it to include the urban poor. Such arguments are reinforced by the principle of horizontal equity and possibly even in terms of the cost of alleviating poverty. The second issue concerns the use of poverty indices as a way of evaluating welfare impacts and their spatial distribution as opposed to our main focus on social welfare which addresses explicitly the trade-off between equity gains and efficiency losses. Focusing on the poverty indices leads to a very different conclusion regarding the spatial impact of the program with the rural poverty impact being disproportionately concentrated in the better off rural areas. Our welfare calculations present a reverse picture with the poorest rural areas experiencing greater welfare gains. This finding reinforces our view that whereas a focus on poverty may be useful (if not essential) for highlighting the need for public action, it has important shortcomings when used for policy evaluation. The evaluation of PROGRESA is no exception to this rule.

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Table 1—CGE Changes in Nominal Income (% from base)

			VAT adjustments[2]				
Households	Transfer[1]	Subsidy	PVAT	TVAT	SVAT	HVAT	BVAT
North							
Poor	30	26.2	24.61	23.97	23.65	24.93	23.91
Medium		-4.61	-2.58	-3.08	-4.81	-2.24	-4.43
Rich		-8.62	-0.46	-1.72	-9.22	0.17	-7.79
Central							
Poor	30	28.15	25.64	24.7	24.24	26.08	24.65
Medium		-3.07	-2.55	-3.16	-4.64	-2.19	-4.25
Rich		-8.64	1.16	0.46	-7.04	1.5	-5.81
S.West							
Poor	30	26.62	26.16	24.98	23.03	26.66	23.73
Medium		-3.34	-2.87	-3.7	-5.5	-2.49	-4.96
Rich		-3.9	-3.79	-4.41	-6.5	-3.55	-5.99
S.East							
Poor	30	27.14	26.19	25.14	23.89	26.73	24.43
Medium		-2.93	-3.31	-3.96	-4.46	-2.89	-4.2
Rich		-1.91	-3.1	-3.97	-3.8	-2.62	-3.52
Urban							
Poor		-1.85	-4.31	-4.73	-3.52	-4.04	-3.55
Medium		-1.62	-3.76	-4.1	-3.08	-3.59	-3.1
Rich		-1.47	-3.27	-3.55	-2.55	-3.2	-2.58

Note:

[1] The program gives cash transfers to poor households in rural areas, equivalent to a 30% increase in nominal incomes. Poor, medium, and rich correspond to income terciles.
[2] See Table 3 for an explanation of VAT experiments.

Table 2— CGE Changes in Factor Prices (% from base)

Factors	Subsidy	VAT adjustments[1]				
		PVAT	TVAT	SVAT	HVAT	BVAT
Labor						
Agr-North	-8.43	2.66	2.14	-8.93	2.94	-7.30
Agr-Central	6.64	1.16	0.68	-7.57	1.40	-6.32
Agr-Southwest	-5.54	2.25	1.73	-8.82	2.52	-7.25
Agr-Southeast	-3.53	1.97	1.42	-8.77	2.26	-7.24
Professional	-1.16	-3.13	-3.77	-3.46	-2.90	-3.24
White Collar	-1.00	-3.19	-3.36	-2.52	-3.20	-2.55
Blue Collar	-1.44	-2.93	-2.98	-2.62	-3.02	-2.64
Unskilled	-1.38	-2.78	-2.90	-3.28	-2.82	-3.16
Land						
Dry-North	-12.11	4.09	3.67	-8.18	4.29	-6.46
Dry-Central	-9.70	3.37	2.86	-8.93	3.63	-7.19
Dry-Southwest	-14.43	4.47	3.97	-8.38	4.73	-6.58
Dry-Southeast	-7.46	2.64	2.09	-8.73	2.94	-7.12
Irrig-North	-12.87	3.10	2.53	-9.47	3.41	-7.70
Irrig-Central	-15.06	2.48	1.88	-10.32	2.82	-8.53
Irrig-Southwest	-18.21	2.93	2.33	-10.55	3.27	-8.67
Irrig-Southeast	2.54	-0.40	-1.00	-9.64	-0.08	-8.31
Capital	-1.67	-2.96	-3.40	-2.71	-2.86	-2.60
Exchange Rate[2]	0.99	1.01	1.00	1.00	1.01	1.00

Note:

[1] See Table 3 for explanation of VAT experiments.
[2] An increase in the exchange rate is a depreciation.

Table 3— Description of VAT Experiments for Rural PROGRESA Program

VAT Experiment	Description	Low Rate[a] (%)	Middle Rate[b] (%)	High Rate[c] (%)
Base	--	0.0	5.0	10.0
PVAT	proportional increase in Base VAT rates	0.0	7.3	14.6
HVAT	increase in High Rate only	0.0	5.0	16.1
TVAT	uniform top rate	0.0	11.4	11.4
BVAT	uniform bottom rate	7.2	7.2	10.0
SVAT	single rate	8.3	8.3	8.3

Note:

[a] Low Rate is applied to all raw agricultural, processed agricultural and other food activities.
[b] Middle Rate is applied to *Light Manufacturing*, *Intermediate Goods*, and *Professional Services* activities.
[c] High Rate is applied to *Capital Goods, Consumer Durables, Construction,* and *Commerce, Trade and Transportation* activities.

Table 4—VAT Rates for Rural/Urban PROGRESA Program Experiments

VAT Experiment	Low Rate[a] (%)	Middle Rate[b] (%)	High Rate[c] (%)
Base	0.0	5.0	10.0
PVAT	0.0	7.0	14.0
HVAT	0.0	5.0	15.3
TVAT	0.0	11.0	11.0
BVAT	6.8	6.8	10.0
SVAT	8.1	8.1	8.1

Note:

[a] Low Rate is applied to all raw agricultural, processed agricultural and other food activities.
[b] Middle Rate is applied to *Light Manufacturing, Intermediate Goods,* and *Professional Services* activities.
[c] High Rate is applied to *Capital Goods, Consumer Durables, Construction,* and *Commerce, Trade and Transportation* activities.

Table 5—CGE Changes in Factor Prices (% from Base) in Rural/Urban PROGRESA

	VAT adjustments[1]				
Factors	PVAT	TVAT	SVAT	HVAT	BVAT
Labor					
Agr-North	-7.71	-8.17	-17.27	-7.50	-15.69
Agr-Central	6.09	5.61	-3.20	6.33	-1.64
Agr-Southwest	-5.00	-5.46	-14.55	-4.78	-12.97
Agr-Southeast	-3.15	-3.65	-12.63	-2.90	-11.05
Professional	-3.55	-4.08	-4.16	-3.34	-3.87
White Collar	-3.53	-3.60	-3.16	-3.54	-3.15
Blue Collar	-3.82	-3.74	-3.78	-3.90	-3.76
Unskilled	-3.53	-3.55	-4.29	-3.56	-4.12
Land					
Dry-North	-10.62	-10.99	-20.67	-10.45	-19.02
Dry-Central	-8.67	-9.14	-18.90	-8.45	-17.19
Dry-Southwest	-12.83	-13.26	-22.81	-12.63	-21.17
Dry-Southeast	-6.25	-6.74	-15.95	-6.01	-14.33
Irrig-North	-11.84	-12.32	-21.56	-11.61	-19.95
Irrig-Central	-13.31	-13.79	-22.93	-13.07	-21.34
Irrig-Southwest	-17.10	-17.56	-26.63	-16.87	-25.07
Irrig-Southeast	2.74	2.17	-6.66	3.02	-5.08
Capital	-4.25	-4.55	-4.12	-4.16	-3.97
Exchange Rate[2]	0.99	0.99	0.98	0.99	0.99

Note:

[1] See Table 3 for explanation of VAT experiments.
[2] An increase in the exchange rate is a depreciation.

Table 6— Inequality Profile Using ENIGH96

Region	Atkinson Inequality Indices			Population Share	Mean Income	Income Share	Welfare Index (, =2)
	, =0.5	, =1.0	, =2.0				
North	0.182	0.291	0.437	0.060	1349	0.057	759
Central	0.141	0.251	0.411	0.152	878	0.093	517
South West	0.137	0.248	0.417	0.086	975	0.059	568
South East	0.140	0.250	0.411	0.166	782	0.091	460
Urban	0.169	0.293	0.462	0.536	1868	0.700	1005
All Regions	0.187	0.323	0.506	1.000	1429	1.000	706

Note: The welfare index is calculated by multiplying mean income by one minus the relevant inequality index.

Table 7— Poverty Profile Using ENIGH96

		Poverty Indices		Regional Distribution of Poor	
Region	Headcount	Gap	Severity	Headcount	Severity
North	0.332	0.091	0.036	0.060	0.040
Central	0.529	0.199	0.098	0.240	0.272
South West	0.451	0.164	0.080	0.117	0.128
South East	0.589	0.239	0.122	0.293	0.373
Urban	0.180	0.049	0.019	0.290	0.186
All Regions	0.333	0.116	0.054	1.000	1.000

Note: Poverty line is approximately 657 pesos. N=13208 households

Table 8—Social Cost of Public Funds For Rural Program

Inequality Aversion[2]	Benefit (λ_D)	Cost of Raising a Unit of Revenue ($\lambda_{j,}$)[1]					
		Food Subsidies	PVAT (0,7.5, 15)	HVAT (0,5,16)	TVAT (0,11)	BVAT (7,10)	SVAT (8.3)
$\varepsilon=0$	1	0.625	1.061	1.071	1.051	0.969	0.955
$\varepsilon=0.5$	1.242	0.468	0.732	0.751	0.718	0.668	0.685
$\varepsilon=1$	1.584	0.397	0.611	0.633	0.602	0.560	0.599
$\varepsilon=2$	2.792	0.395	0.658	0.679	0.664	0.612	0.690
$\varepsilon=3$	5.448	0.557	1.023	1.045	1.054	0.970	1.109
$\varepsilon=4$	11.549	0.996	1.962	1.988	2.042	1.882	2.155
$\varepsilon=5$	26.011	2.060	4.227	4.263	4.425	4.082	4.671

Note:

[1] The actual VAT structure is modeled as 0% on basic unprocessed foods, 5% on processed foods and intermediate goods (including financial services), and 10% on consumer durables and capital goods. The numbers in brackets indicate the rates after financing the program.

[2] The value $\varepsilon=0$ indicates no distributional concerns with aversion for inequality captured by $\varepsilon>0$, with $\varepsilon=5$ incorporating the greatest concern for poorest households.

Table 9—Social Cost of Public Funds For Rural and Urban

Inequality Aversion[2]	Rural Benefit(8_D)	Rural/Urban Benefit (8_D)	Cost of Raising a Unit of Revenue ($8_{j,}$)[1] Food Subsidies	PVAT (0,7.5, 15)	HVAT (0,5,16)	TVAT (0,11)	BVAT (7,10)	SVAT (8.3)
,=0	1	1	0.625	0.765	0.773	0.756	0.726	0.715
,=0.5	1.242	1.218	0.468	0.540	0.549	0.527	0.514	0.503
,=1	1.584	1.521	0.397	0.443	0.452	0.433	0.424	0.414
,=2	2.792	2.572	0.395	0.432	0.440	0.432	0.421	0.415
,=3	5.448	4.839	0.557	1.606	0.615	0.621	0.605	0.604
,=4	11.549	9.978	0.996	1.084	1.096	1.127	1.102	1.109
,=5	26.011	22.053	2.060	2.242	2.263	2.353	2.306	2.332

Note:

[1] The actual VAT structure is modeled as 0% on basic unprocessed foods, 5% on processed foods and intermediate goods (including financial services), and 10% on consumer durables and capital goods. The numbers in brackets indicate the rates after financing the program.

[2] The value ,=0 indicates no distributional concerns with aversion for inequality captured by ,>0, with ,=5 incorporating the greatest concern for poorest households.

Table 10A— Distribution of Welfare After Rural Program Impact

Location	Before			Direct			Subsidies		
	Mean Income	Inequality	Welfare	Mean Income	Inequality	Welfare	Mean Income	Inequality	Welfare
North	1349	0.437	759	1396	0.373	875	1317	0.360	843
				(0.035)	-(0.172)	(0.152)	-(0.024)	-(0.176)	(0.110)
Central	878	0.411	517	943	0.332	630	904	0.316	618
				(0.074)	-(0.238)	(0.218)	(0.030)	-(0.231)	(0.196)
South West	975	0.417	568	1032	0.339	682	1001	0.337	664
				(0.058)	-(0.23)	(0.2)	(0.027)	-(0.192)	(0.168)
South East	782	0.411	461	851	0.332	568	843	0.331	564
				(0.088)	-(0.238)	(0.234)	(0.078)	-(0.195)	(0.224)
Urban	1868	0.462	1005	1868	0.452	1005	1861	0.469	988
				(0.00)	(0.00)	(0.00)	-(0.004)	(0.015)	-(0.017)
All	1429	0.506	706	1458	0.456	793	1440	0.459	779
				(0.020)	-(0.110)	(0.124)	(0.008)	-(0.093)	(0.104)
Dispersion	(0.049)	(0.001)	(0.05)	(0.041)	(0.007)	(0.026)	(0.042)	(0.009)	(0.025)

Note: Percentage changes from "Before" in parentheses. Our measure of dispersion is $0.5CV^2$ where CV is the coefficient of variation.

Table 10B— Distribution of Welfare After Rural/Urban Program Impact

Location	Before			Direct			Uniform VAT		
	Mean Income	Inequality	Welfare	Mean Income	Inequality	Welfare	Mean Income	Inequality	Welfare
North	1349	0.437	759	1396	0.373	875	1263	0.343	830
				(0.035)	-(0.172)	(0.152)	-(0.064)	-(0.215)	(0.093)
Central	878	0.411	517	943	0.332	630	878	0.305	610
				(0.074)	-(0.238)	(0.218)	(0.000)	-(0.258)	(0.180)
South West	975	0.417	568	1032	0.339	682	982	0.336	652
				(0.058)	-(0.230)	(0.200)	(0.007)	-(0.192)	(0.147)
South East	782	0.411	461	851	0.332	568	831	0.331	556
				(0.088)	-(0.238)	(0.234)	(0.063)	-(0.195)	(0.207
Urban	1868	0.462	1005	1893	0.414	1009	1883	0.421	1090
				(0.013)	-(0.116)	(0.104)	(0.008)	-(0.089)	(0.085)
All	1429	0.506	706	1472	0.439	826	1441	0.442	804
				(0.03)	-(0.153)	(0.170)	(0.008)	-(0.126)	(0.139)
Dispersion	(0.049)	(0.001)	(0.05)	(0.042)	(0.003)	(0.036)	(0.045)	(0.005)	(0.037)

Note: Percentage changes from "Before" in parentheses. Our measure of dispersion is $0.5CV^2$ where CV is the coefficient of variation.

Table 11A—Impact of Rural Transfers on Regional Poverty

Location	Headcount			Gap			Severity		
	Before	Direct	Subsidy	Before	Direct	Subsidy	Before	Direct	Subsidy
North	0.332	0.184	0.231	0.091	0.043	0.048	0.036	0.015	0.017
		(0.446)	(0.304)		(0.527)	(0.473)		(0.583)	(0.528)
Central	0.529	0.385	0.407	0.199	0.121	0.124	0.098	0.053	0.057
		(0.272)	(0.231)		(0.392)	(0.377)		(0.459)	(0.439)
SouthWest	0.451	0.311	0.343	0.164	0.099	0.105	0.080	0.044	0.047
		(0.31)	(0.239)		(0.396)	(0.360)		(0.45)	(0.413)
SouthEast	0.589	0.460	0.472	0.239	0.152	0.155	0.122	0.069	0.070
		(0.219)	(0.199)		(0.364)	(0.351)		(0.434)	(0.426)
Urban	0.180	0.180	0.188	0.049	0.049	0.052	0.019	0.019	0.021
		(0.00)	-(0.044)		(0.)	-(0.061)		(0.)	-(0.105)
All	0.333	0.269	0.284	0.116	0.081	0.084	0.054	0.034	0.036
		(0.192)	(0.147)		(0.302)	(0.276)		(0.37)	(0.333)

Note: Percentage changes from "Before" in parentheses.

Table 11B— Impact of Rural/Urban Transfers on Regional Poverty

	Headcount			Gap			Severity		
Location	Before	Direct	Uniform VAT	Before	Direct	Uniform VAT	Before	Direct	Uniform VAT
North	0.332	0.184	0.245	0.091	0.043	0.049	0.036	0.015	0.017
		(0.446)	(0.262)		(0.527)	(0.462)		(0.583)	(0.528)
Central	0.529	0.385	0.421	0.199	0.121	0.127	0.098	0.053	0.056
		(0.272)	(0.204)		(0.392)	(0.362)		(0.459)	(0.429)
SouthWest	0.451	0.311	0.363	0.164	0.099	0.109	0.080	0.044	0.049
		(0.310)	(0.195)		(0.396)	(0.335)		(0.450)	(0.388)
SouthEast	0.589	0.460	0.488	0.239	0.152	0.159	0.122	0.069	0.073
		(0.219)	(0.171)		(0.364)	(0.335)		(0.434)	(0.402)
Urban	0.180	0.098	0.111	0.049	0.022	0.024	0.019	0.007	0.008
		(0.456)	(0.383)		(0.551)	(0.510)		(0.632)	(0.579)
All	0.333	0.225	0.251	0.116	0.066	0.071	0.054	0.028	0.030
		(0.324)	(0.246)		(0.431)	(0.388)		(0.481)	(0.444)

Note: Percentage changes from "Before" in parentheses.

Table 12—The Regional Distribution of Poverty

Region	Population Share	Before			Rural Program			Rural/Urban Program		
		Headcount	Gap	Severity	Headcount	Gap	Severity	Headcount	Gap	Severity
North	0.060	0.060	0.047	0.040	0.049	0.034	0.028	0.059	0.041	0.034
Central	0.151	0.240	0.261	0.272	0.217	0.222	0.229	0.254	0.270	0.279
South West	0.086	0.117	0.112	0.128	0.104	0.108	0.113	0.125	0.133	0.139
South East	0.116	0.293	0.343	0.373	0.276	0.304	0.324	0.323	0.371	0.397
Urban	0.536	0.290	0.226	0.186	0.354	0.332	0.306	0.238	0.185	0.150

Note: Numbers are shares so that each column sums to 1.0.

FIGURES

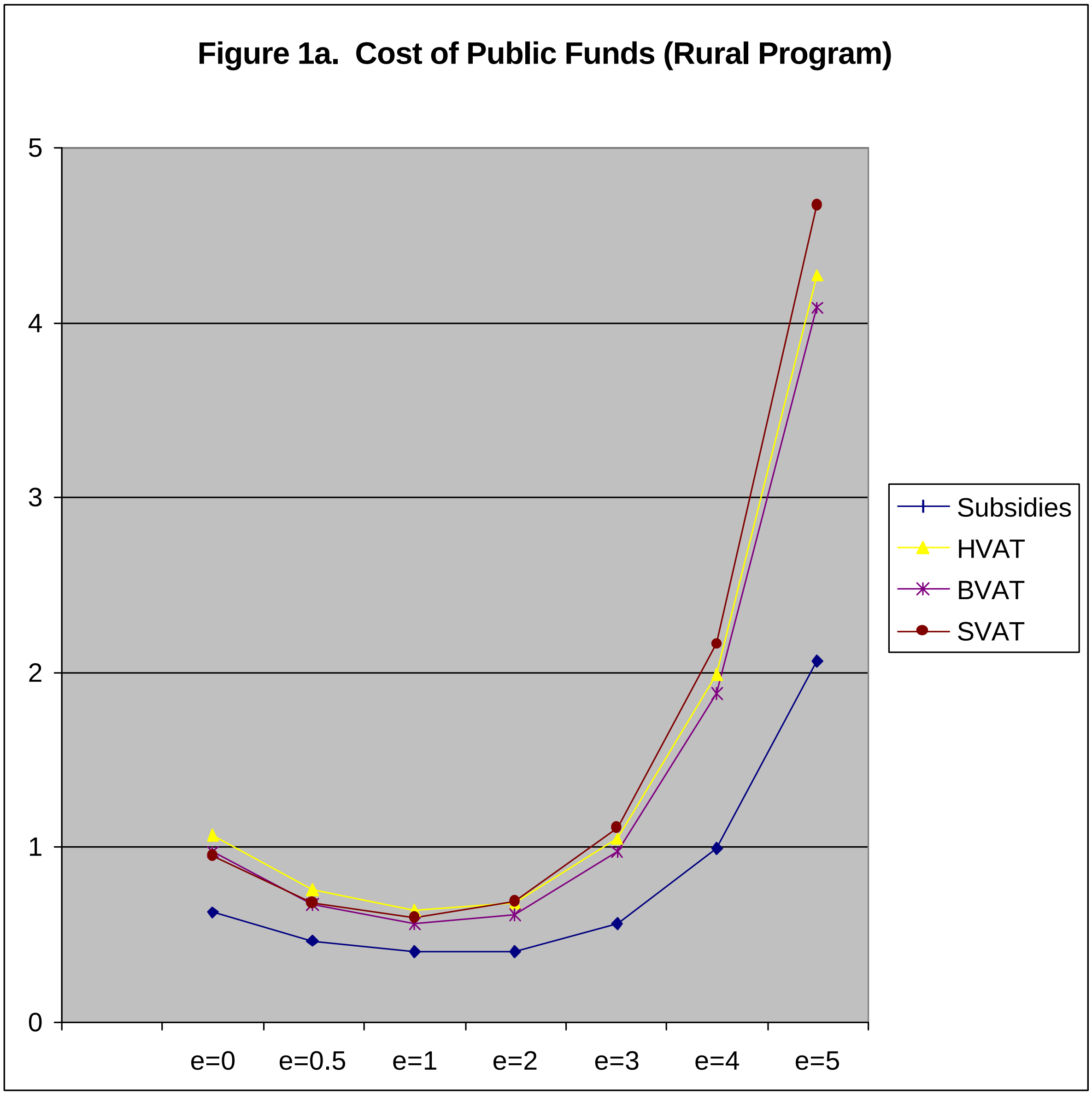


Figure 1a. Cost of Public Funds (Rural Program)
5
4
3
2
1
0
e=0
e=0.5
e=1
e=2
e=3
e=4
e=5
Subsidies
HVAT
BVAT
SVAT

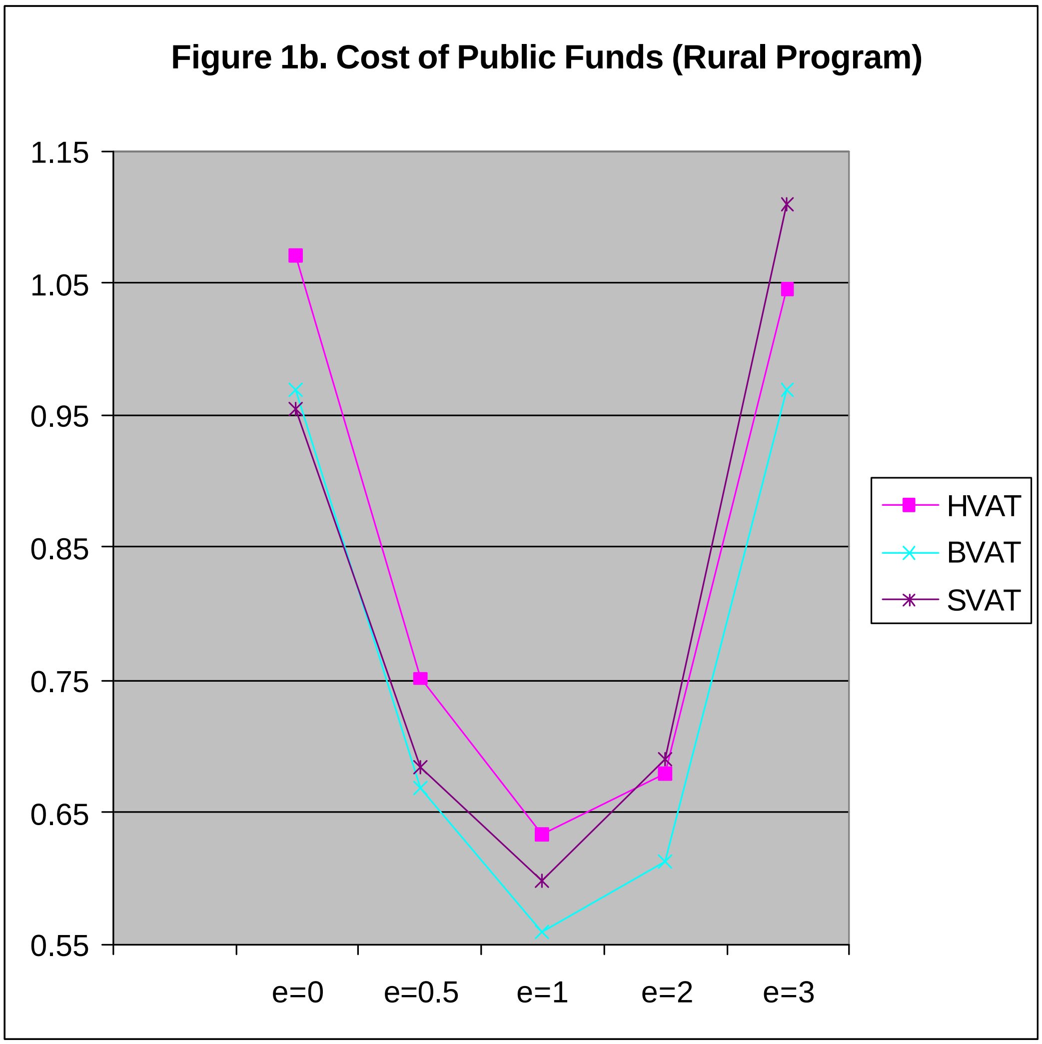
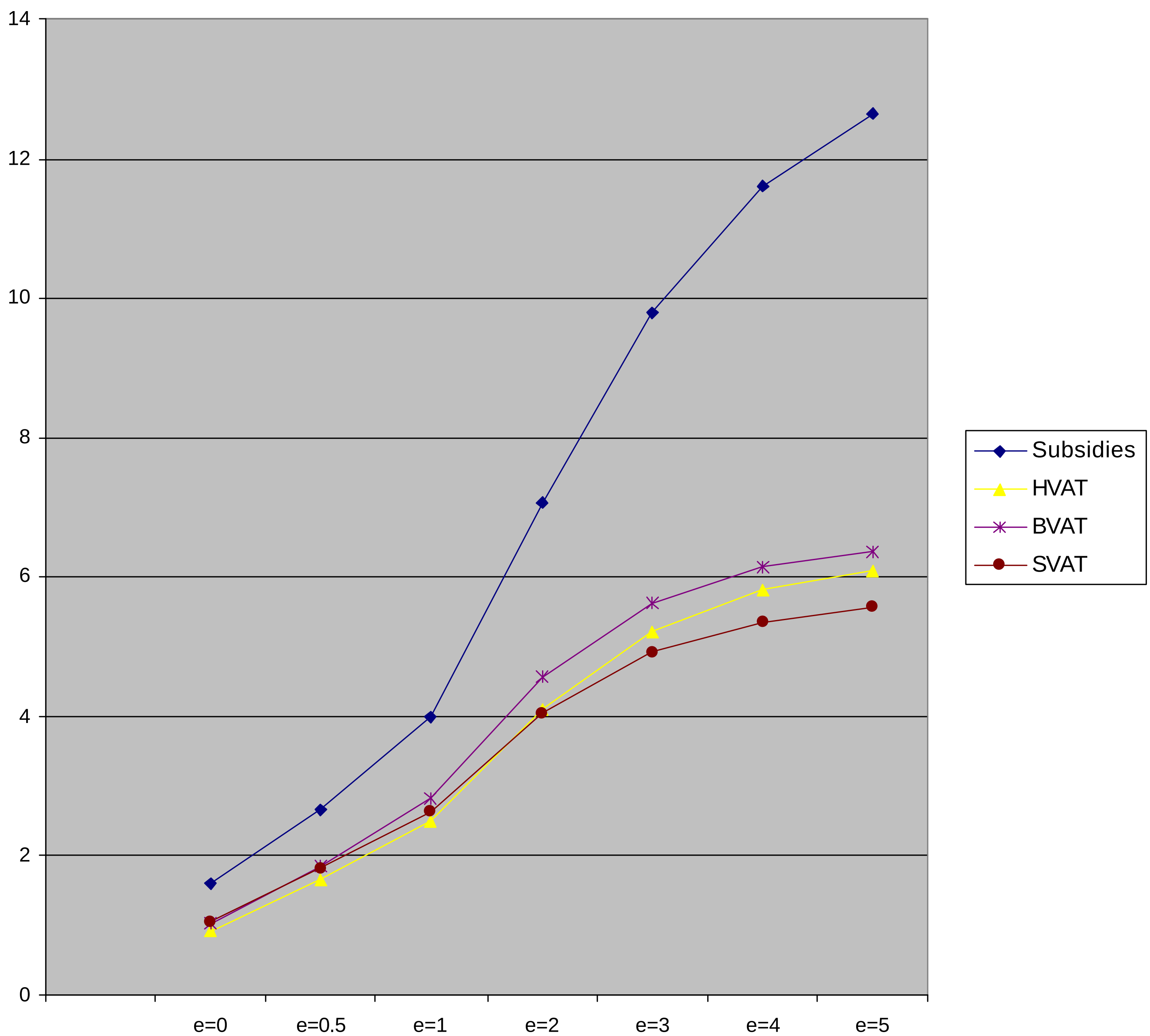


Figure 1b. Cost of Public Funds (Rural Program)
1.15
1.05
0.95
0.85
0.75
0.65
0.55
e=0
e=0.5
e=1
e=2
e=3
HVAT
BVAT
SVAT

Figure 2. Benefit-Cost Ratios (Rural Program)



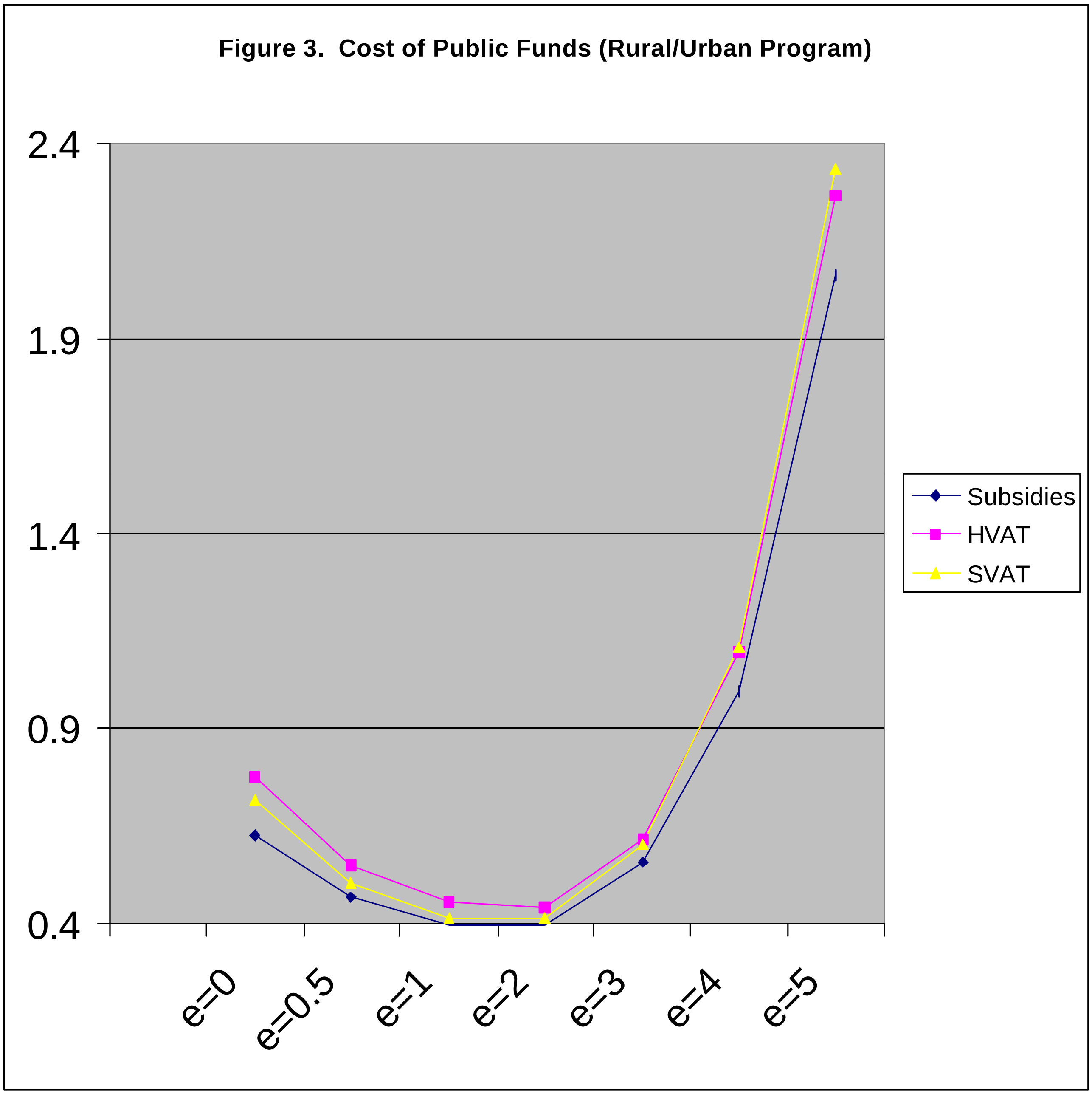


Figure 3. Cost of Public Funds (Rural/Urban Program)
2.4
1.9
1.4
0.9
0.4
e=0
e=0.5
e=1
e=2
e=3
e=4
e=5
Subsidies
HVAT
SVAT

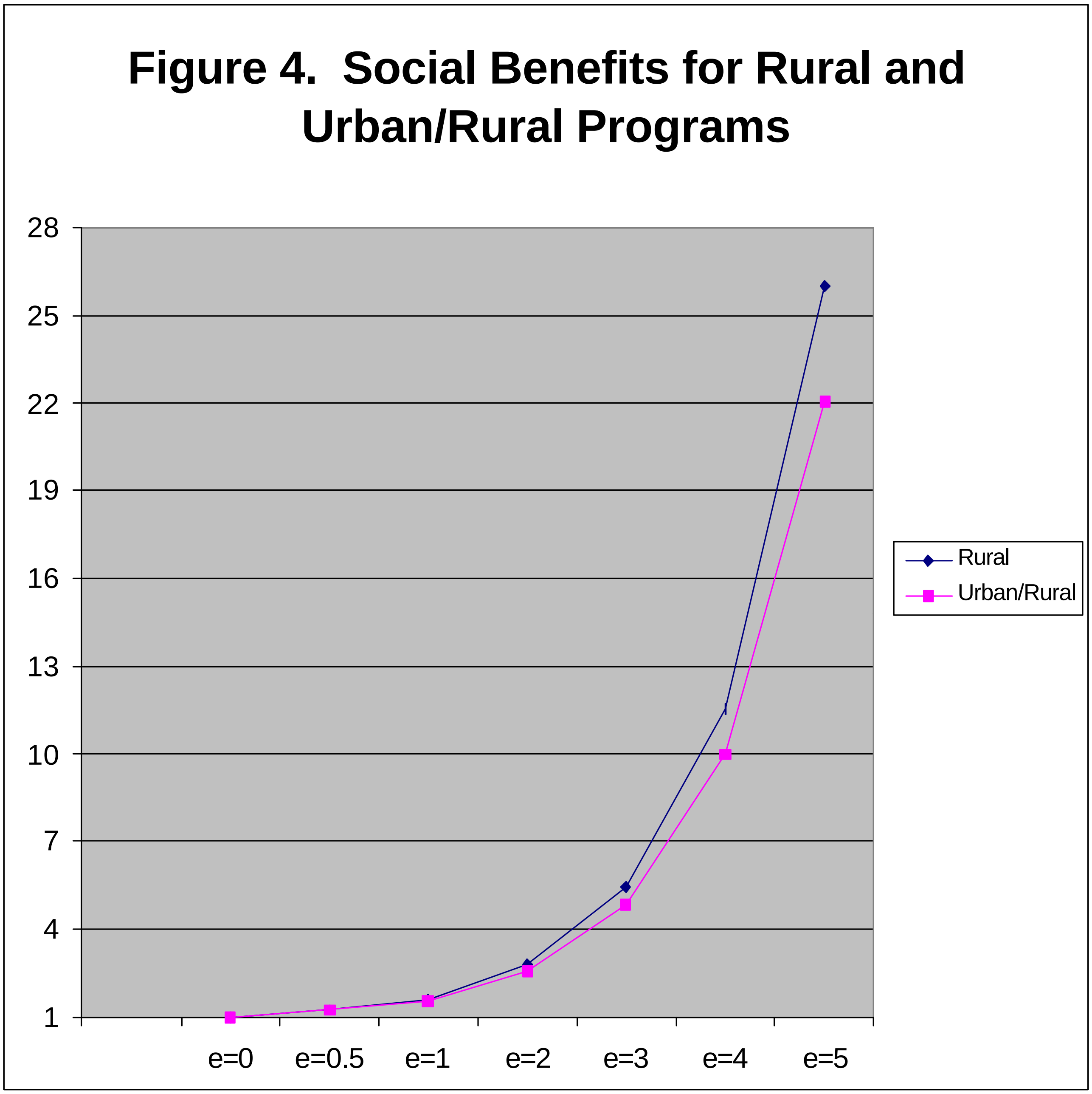


Figure 4. Social Benefits for Rural and Urban/Rural Programs
28
25
22
19
16
13
10
7
4
1
e=0
e=0.5
e=1
e=2
e=3
e=4
e=5
Rural
Urban/Rural

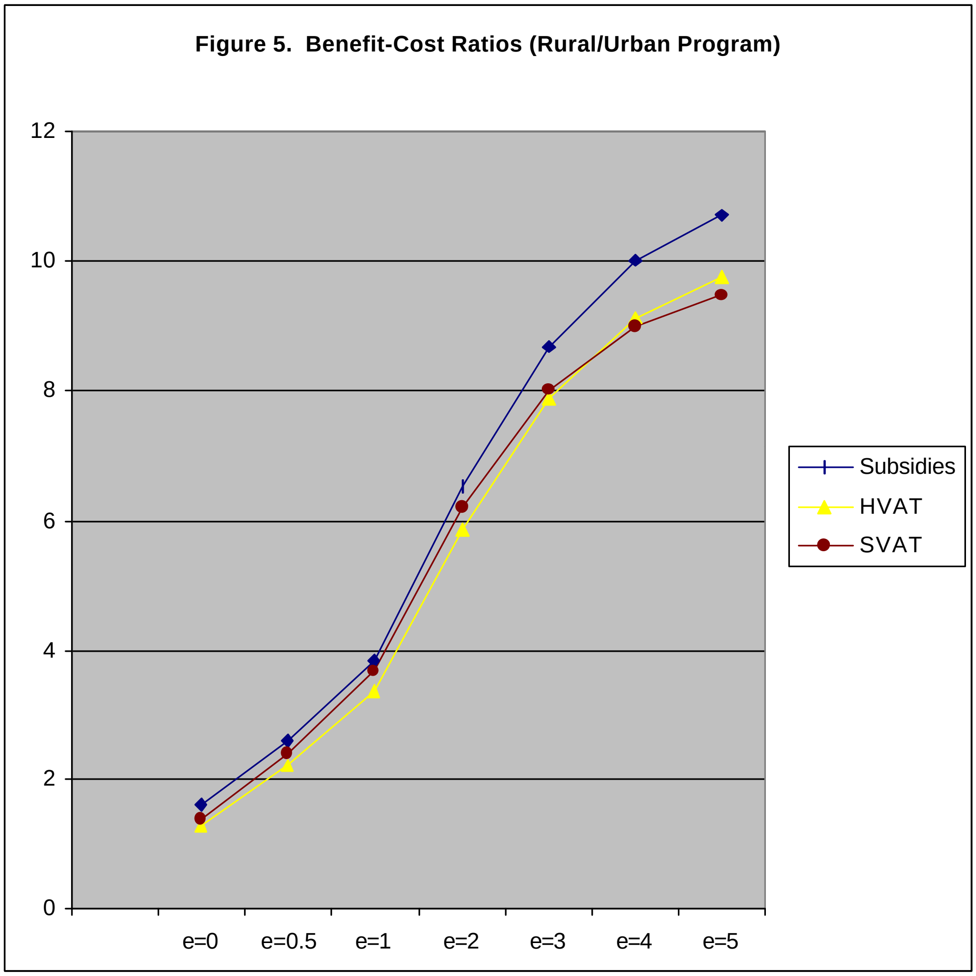


Figure 5. Benefit-Cost Ratios (Rural/Urban Program)
12
10
8
6
4
2
0
e=0
e=0.5
e=1
e=2
e=3
e=4
e=5
Subsidies
HVAT
SVAT

APPENDIX A

Formal Derivation of Welfare Impact of Cash Transfers and Separation into Redistribution, Reallocation and Distortionary Effects

In this appendix we present a more formal discussion of the welfare impacts of cash transfer programs. Consider a simple economy made up of households, firms and the government. We assume that welfare of household *h* is captured by a standard indirect utility function, $V^h(\mathbf{q},\mathbf{w},m^h)$, where **q** is a vector of commodity prices, **w** a vector of factor prices, and m^h is household lump-sum income (including government transfers, r^h, and lump-sum taxes, T^h).[22] The budget constraint for each household (denoted by *h* superscript) is then given by $\mathbf{q}.\mathbf{x}^h = \mathbf{w}.\mathbf{f}^h + m^h$ where **x** and **f** are the demand for final goods and the supply of factors respectively. Firms are assumed to operate under constant returns to scale so that supply is demand determined and profits are zero. The government's budget constraint is given by:

$$R \;/\; \mathbf{t}.\mathbf{x} + \mathbf{J}.\mathbf{f} - E_h\, r^h + E_h\, T^h$$

where **t** and **J** are vectors of taxes on commodities consumed and factors supplied by households respectively, and $\mathbf{t}=\mathbf{q}-\mathbf{p}$ with **p** being a vector of producer prices. Since producer prices are assumed fixed we have $d\mathbf{q}=d\mathbf{t}$.

The objective of the "social planner" is to introduce policy reforms which increase social welfare as captured by a conventional Bergson-Samuelson social welfare function:

$$W(V^1(\mathbf{q},\mathbf{w},m^1), \ldots\ldots\ldots\ldots.., V^h(\mathbf{q},\mathbf{w},m^h), \ldots\ldots\ldots\ldots\ldots\ldots.., V^H(\mathbf{q},\mathbf{w},m^H))$$

---

[22] Throughout we use bold type to denote vectors (small letters) and matrices (capital letters).

defined over H households.[23] The social welfare effects of income and price changes are calculated as:

$$dW = \sum_h \frac{\partial W}{\partial V^h}\frac{\partial V^h}{\partial m^h}\, dm^h + \sum_h \frac{\partial W}{\partial V^h}\frac{\partial V^h}{\partial q}\, dq + \sum_h \frac{\partial W}{\partial V^h}\frac{\partial V^h}{\partial w}\, dw$$

where the first term captures the direct welfare effect from income transfers and the final two terms capture the indirect welfare effects coming through the resulting general equilibrium changes in commodity and factor prices. Defining $\beta^h \equiv (\partial W/\partial m^h)$ and using Roy's identity, this can be rewritten as:[24]

$$dW = \sum_h \beta^h\, dm^h + \sum_h \beta^h\, de^h - \sum_h \sum_i \beta^h\, x_i^h\, dq_i$$

where β^h is the so-called social marginal utility of income to household *h* (or "welfare weight"), de^h is the change in factor incomes, x_i^h is the quantity of commodity i consumed by household *h*, and dp_i the corresponding price change. Multiplying and dividing both terms by total income y^h and the second term by q_i, this can be rewritten as:

$$dW = \sum_h \beta^h y^h \left[\phi^h + \gamma^h - \sum_i \theta_i \Delta_i \right]$$

where ϕ^h and γ^h are the proportionate changes in household income due to the direct transfers and indirect income effects respectively, Δ_i the proportionate change in the price of commodity i, θ_i^h is the share of expenditure on commodity i in the total expenditure of the household, and we use the household budget constraint. The term in brackets can be

[23] This specification has important implications for the way in which we model the program below. In particular, the absence of public goods from the utility functions and the static nature of the specification means that to ensure consistency we must keep both the supply of public goods and investment constant in our CGE model.

[24] From Roy's identity the effect from d**w** (subsumed within dy) will depend on the level of factor supplies, i.e., $(\partial V^h/\partial \mathbf{w}) = \mathbf{f}^h$.

interpreted as the proportionate change in real incomes (i.e., nominal incomes minus a cost-of-living index). These proportionate changes are outputs from the CGE model and are then applied to household-level data.

In order to make explicit the three welfare impacts of the program (i.e., redistribution, reallocation and distortion), it is useful to formally derive the welfare impact of cash transfers within the above framework.[25] The problem the "social planner" then faces is to redistribute resources using the most efficient policy instruments from among a set which includes, for example, commodity taxes or subsidies and cash transfers. The constraints facing the planner are the market equilibrium constraints that demand must equal supply as well as the government budget constraint. For ease of exposition, factor supplies are subsumed within the vector **x** with negative values if the household is a net supplier of these factors. As shown in Drèze and Stern (1987), using Walras' law, the planner's problem may be rewritten as:

$$\mathcal{L}(s;\omega) \equiv W(\ldots,V^{h}(s;\omega),\ldots) + \lambda R \qquad (A1)$$

where **s** is a vector of policy instruments which are completely controlled by the planner and are chosen optimally, ω is a vector of policy instruments which are outside the planner's complete control and which include the policy instruments highlighted above, and λ is the Lagrange multiplier on the government budget constraint (i.e., the marginal social - or shadow - value of government revenue). As before, $V^h(.)$ is the indirect utility function for h, and W(.) is a Bergson-Samuelson social welfare function. This formulation of the problem has the attraction of presenting the problem in terms of the standard trade-off between consumer welfare and government revenue. The impact of any "policy reform" on

[25] To bring out the main sources of welfare changes, the model presented is more simple than the CGE. More complex market structures can, however, be easily incorporated by replacing producer prices with shadow prices and actual with shadow government revenue (see Drèze and Stern, 1987).

W(.) captures the direct welfare impact of the reform while the impact on revenue captures the indirect welfare impacts.[26]

The policy reform under consideration is a cash transfer program, $d\mathbf{r} \equiv \{dr^h\}$. Differentiating (1) w.r.t. **m** we get:[27]

$$\frac{\partial W}{\partial \boldsymbol{m}} d\boldsymbol{r} = \sum_h \beta^h\, dr^h - \lambda\left(\Sigma_h\, dr^h - \boldsymbol{t}.\boldsymbol{X}_{\boldsymbol{m}}.d\boldsymbol{r}\right) \qquad (A2)$$

where $\mathbf{X}_m$ is a matrix with each household's marginal budget shares across commodities as column entries. The first term captures the direct welfare impact of the cash transfer program; as captured by typical evaluations of such programs. The term in brackets is the net revenue cost of the program calculated as the program budget adjusted for any changes in revenue due to higher demands by these households. λ is the social cost of the revenue used to finance the transfer and will depend on the set of instruments used to balance the budget.

Pinning down the value of λ involves specifying how the program is to be financed. If it is to be financed by lump-sum taxes, T^h, then we have a similar equation as (3) replacing d**m** with d**T**. The net impact on welfare is then:

$$\frac{\partial W}{\partial \boldsymbol{r}} d\boldsymbol{m} = \sum_h \beta^h(dr^h - dT^h) + \lambda\left[-\sum_h dr^h + \boldsymbol{t}.\boldsymbol{X}_{\boldsymbol{m}}.d\boldsymbol{m} + \sum_h dT^h - \boldsymbol{t}.\boldsymbol{X}_{\boldsymbol{m}}.d\boldsymbol{T}\right]$$

where d**m**=(d**r**-d**T**). If lump-sum taxes exactly cover the direct transfers, i.e., $\Sigma_h dT^h = \Sigma_h dm^h$, then we have:

---

[26] This implicitly assumes that the only distortions in the economy are government induced. Where other market imperfections exist one needs to focus on "shadow revenue" which captures income effects accruing outside the government budget. See Drèze and Stern (1987) for detailed discussion.

[27] We also use the property that the gradient of ‹ equals the gradient of V^*.

$$\frac{dW}{d\boldsymbol{r}}\, d\boldsymbol{m} = \sum_h \beta^h \left(dr^h - dT^h\right) + \lambda\left[\boldsymbol{t}.\boldsymbol{X}_{\boldsymbol{m}}.d\boldsymbol{r} - \boldsymbol{t}.\boldsymbol{X}_{\boldsymbol{m}}.d\boldsymbol{T}\right]$$

where the first term captures the pure *redistribution* impact and the second captures the *reallocation* impact. If the reallocation effect is zero (e.g., if marginal budget shares are the same across households or if taxes are zero), then we are left with only a redistribution effect.[28]

Now consider the program being financed by a change in indirect taxes, d**t**. Using the standard properties of the indirect utility function, the welfare impact of a tax change is then:

$$\frac{\partial W}{\partial \boldsymbol{t}} = -\boldsymbol{\beta}.\boldsymbol{x}.d\boldsymbol{t} + \lambda\left(\boldsymbol{x} + \boldsymbol{t}.\frac{\partial \boldsymbol{x}}{\partial \boldsymbol{t}}\right) d\boldsymbol{t} \qquad (A3)$$

The first term indicates that households gain from the reform according to the level of their existing consumption, i.e., the existing level of demand gives a measure of this welfare effect in money terms. The direct impact on social welfare is greater the more poor households consume the commodities with the highest tax increases. Again, the social cost of raising revenue using a commodity tax is lower if households respond to the price change by switching demand away from (towards) relatively highly subsidized (taxed) commodities. Fully differentiating the budget constraint, setting $\mathbf{x}.\mathbf{dt}=\Sigma_h dr^h$, and using the Slutsky decomposition, we get a net change in welfare:

$$\frac{\partial W}{\partial \boldsymbol{t}}\, d\boldsymbol{t} = \sum_h \beta^h \left(dr^h - \boldsymbol{x}^{\boldsymbol{h}}.d\boldsymbol{t}\right) + \lambda\, \boldsymbol{t}.\boldsymbol{X}_{\boldsymbol{m}}.\left(d\boldsymbol{r} - \boldsymbol{x}.d\boldsymbol{t}\right) + \lambda\, \boldsymbol{t}.\frac{\partial \boldsymbol{x}^{\boldsymbol{c}}}{\partial \boldsymbol{q}}.d\boldsymbol{t}$$

---

[28] In general, because of the presence of indirect revenue effects, we can not solve out analytically for the vector d**T** which keeps revenue constant. To do so we would have to assume that marginal budget shares are constant across households.

where x^c is the compensated demand function. Again the first term is the redistribution effect, the second the reallocation effect, and the third is the *distortion* effect of using distortionary taxes to finance the transfers.[29]

The above analysis identifies the source of the welfare impacts from a poverty alleviation cash transfer program financed domestically, identifying separately the equity (i.e., distribution) and efficiency (i.e., reallocation and distortion) impacts. It also provides a useful framework for interpreting the results from our analysis presented later in the text, especially in understanding the origin of the indirect welfare effects.

---

[29] When indirect taxes are set optimally we further know that $\mathbf{t}.(Mx^c_i / M\mathbf{q})/x_i=b_i/8$, where b_i is a weighted average of household $b^h=\$^h\text{-}8^h+8\mathbf{t}.(M\mathbf{x}^h/Mm^h)$ with the share of each household in the total consumption of commodity *i* as weights. See Coady and Drèze (1999) for a more detailed discussion.

APPENDIX B

Details of the CGE Model Structure

In this appendix we present a more detailed discussion than that in the text of important features of the model structure. We discuss, in turn, the Armington treatment of imports, the system of price equations, and the LES consumption behaviour.

The Armington Function

The use of the Armington function in trade differs from the standard neoclassical trade model in which all goods are tradable and all domestically produced goods are perfectly substitutable with imports. The standard treatment has several drawbacks. It leads to the conclusion that the domestic relative price of tradeables is fully determined by world prices, which is not the case empirically. These models result in the full transmission of world price changes and in extreme specialization in production. In the Armington framework, the economy is less responsive to world price changes, thus dampening the move toward specialization. Also, this set-up accounts for two-way trade in a given sector, which occurs regularly even in very disaggregated sectors.

De Melo and Robinson (1989) show the importance of the elasticity of substitution in their discussion of how a terms of trade deterioration affects the exchange rate. For a low elasticity, say 0, which may represent a developing economy, the exchange rate must depreciate so that the country can export more to earn the foreign exchange needed for the non-substitutable import. For a higher elasticity, as in a developed country, the economy switches its production from the export sector into the domestic substitute for the import. In order to encourage this contraction of exports, the exchange rate must appreciate.

The parameters for this CGE model are given in Appendix Table 4. The trade parameters were not available empirically, and thus may be considered "guestimates".

Price Determination and Role of Taxes

The price equations in the model (see Appendix C) highlight the imperfect substitutability in trade and show where the taxes fit into this model. Equations (1) and (2) describe the import price (PM_c) and export price (PE_c) respectively. These prices are composed of the world price, valued in domestic currency, along with the import tariff or export tax. With the world prices set exogenously, the country is assumed to be "small."

PQ_c, the domestic composite price (Equation (3)), is the average of the price of the commodity produced and sold domestically and the price of the imported commodity, weighted by their respective quantities, plus the sales tax. Thus, the sales tax is imposed on both domestically produced goods as well as imports (which are already tariff-ridden). Implicit in Equation (3) is the Armington assumption (described above), since the price that the consumer faces is not totally determined by world prices.

Equation (4) gives the average output price of the commodity output, PX_c. It is the weighted average of the price of domestically produced goods sold domestically and domestically produced goods which are exported. This equation reflects the use of the CET function described in Section 3.2, which implies that the world price is not completely transmitted to the output price that domestic producers receive.

In Equation (7), the value added price, PVA_a, is described as the activity price minus any tax on (or subsidy to) producers, as well as the cost of intermediate goods. Equations (8) and (9) give the definitions of the consumer price index and the producer price index, respectively. As is standard in CGE models, this model solves for *relative* prices. Thus one price, in this case, the consumer price index, is chosen as the *numeraire*, around which the other prices, including the exchange rate, are based.

Equation (11) describes factor demands which are derived from the first-order conditions of the CES function for the primary factors. In the model it is assumed that the primary factors are paid the same average rental or wage (WF_f), regardless of sector. To adjust for distortions in factor markets, a sector specific variable ($WFDIST_{f,a}$) is included. If there are no distortions in a particular factor market, this variable is equal to one for all sectors and demand for the factors in determined by their marginal products. This equation shows that marginal cost must equal marginal revenue; since PVA is multiplied by the value added tax, tva_a, it can be seen that an increase in the value added tax lowers the marginal revenue and thus causes lower factor prices.

The income tax, TTINS, appears in the equations for institutional behavior in Appendix C. It is imposed as a lump-sum tax (i.e., it does not affect the agent's decisions with respect to earning income) on households and the enterprise. For both types of institutions, the income tax affects the amount of inter-institutional transfers, since taxes must be netted out of income before any transfers can be made (equation 27). Similarly, savings is based on net income. Households do not pay income tax on home consumption.

Consumption Behavior

Consumption is determined by two inter-dependent LES functions, which account for marketed consumption and home consumption[30]. The LES equation comes from the maximization of the Stone-Geary utility function:

---

[30]Note that the use of two interdependent functions is necesitated by the differentiation between *activities* (whose purchase by households designates home consumption) and *commodities* (whose purchase by households signifies marketed consumption).

$$u_h = \prod_c \left(QH_{c,h} - \gamma_{c,h}\right)^{\beta_{c,h}}$$

in which the utility of household *h* is the product of quantity consumed of good *c* minus the subsistence minimum of that good for the household, $\gamma_{c,h}$, all raised to $\beta_{c,h}$, which is the marginal budget share of good *c* for the household. The resulting demand functions, in Equations 29 and 30 of Appendix C show that the amount of expenditure on a good will consist of the subsistence expenditure plus the marginal budget share of the "supernumerary income" — that is, the income which is left over after accounting for the subsistence expenditures of all other goods. The parameters for the system were not available for Mexico; instead, they come from the adaptation of parameters used in a study of Zimbabwe (Bautista *et al*, 1999). These parameters are presented in Appendix Table 5.

APPENDIX C

CGE Model Sets, Variables and Parameters of CGE Model

SETS

AAC global set

SUBSETS OF AAC

a	Activities
c	Commodities
cm(c)	Imported Commodities
cnm(c)	Non-imported Commodities
ce(c)	Exported Commodities
cne(c)	Non-exported Commodities
f	Factors
lab(f)	Labor Factors
ld(f)	Land Factors
ins	Institutions (domestic and rest of world)
id(ins)	Domestic Institutions
h(ins)	Households
en(ins)	Enterprises

PARAMETERS

$"^{a}_{a}$	shift parameter for CES activity production function
$"^{ac}_{a}$	shift parameter for domestic commodity aggregation fn
$"^{q}_{c}$	shift parameter for Armington function
$"^{t}_{c}$	shift parameter for CET function
$\$^{h}_{a,h}$	LES marginal budget shares for home consumed goods (activities)
$\$^{m}_{c,h}$	LES marginal budget shares for marketed goods (commodities)
$cwts_c$	consumer price index weights
$*^{a}_{f,a}$	share parameter for CES activity production function
$*^{ac}_{a,c}$	share parameter for domestic commodity aggregation fn
$*^{q}_{c}$	share parameter for Armington function
$*^{t}_{c}$	share parameter for CET function
$dwts_c$	domestic sales price weights

$({}^{h}_{a,h}$	LES subsistence minima for home consumed goods (activities)
$({}^{m}_{c,h}$	LES subsistence minima for marketed goods (commodities)
$ica_{c,a}$	intermediate input c per unit of activity a
$insub_{a}$	input subsidy for activity a
mps_{ins}	marginal propensity to save for domestic institution
$p01_{ins}$	0-1 parameter (1 for institution with variable income tax rate -0 for others)
$p04_{a}$	0-1 parameter (1 for activity with variable VAT rate -0 for others)
$qbardst_{c}$	inventory investment by sector of origin
$qbarg_{c}$	exogenous (unscaled) government demand
$qbarinv_{c}$	exogenous (unscaled) investment demand
D^{ac}_{c}	domestic commodity aggregation function exponent
D^{q}_{c}	Armington function exponent
D^{a}_{a}	CES activity production function exponent
D^{t}_{c}	CET function exponent
$shif_{id,f}$	share of domestic institution id in income of factor f
$shii_{id,idp}$	share of domestic institution id in post-tax post-savings income of institution idp
$supernum_{h}$	LES supernumerary income
ta_{a}	producer tax rate
te_{ce}	export tax rate
tf_{f}	tax per physical unit of factor f
$2_{a,c}$	yield of commodity c per unit of activity a
$tins_{ins}$	direct tax rate on institution ins
tm_{c}	tariff rates on imports of c
tq_{c}	sales tax
$tr_{i,aac}$	transfers from institution or factor ACC to institution i
tva_{a}	value added tax for activity a

VARIABLES

CPI	consumer price index (PQ-based)
DPI	index for domestic-sales producer prices (PDS-based)
DTINS	change in domestic institution tax share
DTAXADJ	direct tax scaling factor
DVATADJ	VAT scaling factor
EG	government expenditure
EXR	exchange rate
FSAV	foreign savings
GADJ	government demand scaling factor
GSAV	government savings
IADJ	investment scaling factor (for fixed capital formation)
INVEST	total investment value
PA_{a}	output price of activity A
PDD_{c}	demand price for com'y c produced & sold domestically
PDS_{c}	supply price for com'y c produced & sold domestically
PE_{c}	price of exports

PM_c	price of imports
PQ_c	price of composite good c
PVA_a	value added price
PWE_{ce}	world price of exports
PWM_{cm}	world price of imports
PX_c	average output price
$PXAC_{a,c}$	price of commodity c from activity a
QA_a	domestic activity output
QD_c	domestic sales
QE_{cm}	exports
$QF_{f,a}$	demand for factor f from activity a
QFS_f	factor supply
QG_c	government consumption
$QH_{c,h}$	household consumption demand
$QINT_c$	intermediate demand for c
$QINV_c$	fixed investment demand
QM_{cm}	imports
QQ_c	composite goods supply
QX_c	commodity output
$QXAC_{a,c}$	ouput of commodity c from activity a
SADJ	savings adjustment variable for dom. inst'ons
SAVINGS	total savings value
$TRII_{i,ip}$	transfers to domestic institution i from domestic institution ip
$TTINS_{ins}$	total direct tax on institution ins
TVAADJ	change in activity's VAT share
WALRAS	savings-investment imbalance (should be zero)
WF_f	average factor price (rent)
$WFDIST_{f,a}$	factor market distortion variable
YD_{id}	expendable income
YF_f	factor income
YG	government income
YHA_h	own household consumption/income
YHM_h	marketed income
YI_{ins}	income of (domestic non-governmental) institution i
$YIF_{ins,f}$	income of institution i from factor f

Notes: A bar over a variable indicates that the variable is exogenously fixed.
A "p" added to a set symbol indicates an alias.

MODEL EQUATIONS

Table C1— Price Block

$$PM_{cm} = \overline{PWM_{cm}} \cdot (1 + tm_{cm}) \cdot EXR \qquad \textbf{(15)}$$

$$PE_{ce} = \overline{PWE_{ce}} \cdot (1 - te_{ce}) \cdot EXR \qquad \textbf{(16)}$$

$$PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_{cm} \cdot QM_{cm} \qquad \textbf{(17)}$$

$$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_{ce} \cdot QE_{ce} \qquad \textbf{(18)}$$

$$PDD_c = PDS_c \qquad \textbf{(19)}$$

$$PA_a = \sum_{c} \theta_{a,c} \cdot PXAC_{a,c} \qquad \textbf{(20)}$$

$$PVA_a = PA_a \cdot (1 - ta_a + insub_a) - \sum_{c} ica_{c,a} \cdot PQ_c \qquad \textbf{(21)}$$

$$\overline{CPI} = \sum_{c} cwts_c \cdot PQ_c \qquad \textbf{(22)}$$

$$\overline{DPI} = \sum_{c} dwts_c \cdot PDS_c \qquad \textbf{(23)}$$

Table C2—Supply and Trade Block

$$QA_a = \alpha^a_a \cdot \left(\sum_f \delta^a_{f,a} \cdot QF_{f,a}^{-\rho^a_a}\right)^{-\frac{1}{\rho^a_a}} \quad \textbf{(24)}$$

$$WF_f \cdot \overline{WFDIST}_{f,a} = PVA_a \cdot (1 - DVATADJ \cdot tva_a \cdot (1 + tvaadj \cdot P04_a)) \cdot \alpha^a_a \cdot \left(\sum_{fp} \delta^a_{fp,a} \cdot QF_{fp,a}^{-\rho^a_a}\right)^{-\frac{1}{\rho^a_a}-1} \cdot \delta^a_{f,a} \cdot QF_{f,a}^{-\rho^a_a-1} \quad \textbf{(25)}$$

$$QINT_c = \sum_a ica_{c,a} \cdot QA_a \quad \textbf{(26)}$$

$$QXAC_{a,c} = \theta_{a,c} \cdot \left(QA_a - \sum_h QAH_{a,h}\right) \quad \textbf{(27)}$$

$$QX_c = \alpha^{ac}_c \cdot \sum_a \left(\delta^{ac}_{a,c} \cdot QXAC_{a,c}^{-\rho^{ac}_c}\right)^{-\frac{1}{\rho^{ac}_c}} \quad \textbf{(28)}$$

$$PXAC_{a,c} = PX_c \cdot \alpha^{ac}_c \cdot \left(\sum_{ap} \delta^{ac}_{ap,c} \cdot QXAC_{ap,c}^{-\rho^{ac}_c}\right)^{-\frac{1}{\rho^{ac}_c}-1} \cdot \delta^{ac}_{a,c} \cdot QXAC_{a,c}^{-\rho^{ac}_c-1} \quad \textbf{(29)}$$

$$QX_{ce} = \alpha^t_{ce} \cdot \left(\delta^t_{ce} \cdot QE_{ce}^{\rho^t_{ce}} + (1-\delta^t_{ce}) \cdot QD_{ce}^{\rho^t_{ce}}\right)^{\frac{1}{\rho^t_{ce}}} \quad \textbf{(30)}$$

$$QX_{cne} = QD_{cne} \quad \textbf{(31)}$$

$$QE_{ce} = QD_{ce} \cdot \left(\frac{PE_{ce}}{PDS_{ce}}\right) \cdot \left(\frac{1-\delta^t_{ce}}{\delta^t_{ce}}\right)^{\frac{1}{\rho^t_{ce}-1}} \quad \textbf{(32)}$$

$$QQ_{cm} = alphaq_{cm} \cdot (deltaq_{cm} \cdot QM_{cm}^{-rhoq_{cm}} + (1 - deltaq_{cm}) \cdot QD_{cm}^{-rhoq_{cm}})^{-\frac{1}{rhoq_{cm}}} \quad \textbf{(33)}$$

$$QQ_{cnm} = QD_{cnm} \quad \textbf{(34)}$$

$$QM_{cm} = QD_{cm} \cdot \left(\frac{PDD_{cm}}{PM_{cm}}\right) \cdot \left(\frac{\delta_{cm}^{q}}{1 - \delta_{cm}^{q}}\right)^{\frac{1}{1+\rho_{cm}^{q}}} \quad \textbf{(35)}$$

Table C3—Institution Block

$$YF_f = \sum_a \overline{WF}_f \cdot \overline{WFDIST}_{f,a} \cdot QF_{f,a} \tag{36}$$

$$YIF_{id,f} = shif_{id,f} \cdot (YF_f - tr_{row,f} \cdot EXR) \cdot (1 - tf_f) \tag{37}$$

$$YI_{id} = \sum_f YIF_{id,f} + \sum_{idp} TRII_{id,idp} + tr_{id,gov} + tr_{id,row} \cdot EXR \tag{38}$$

$$TTINS_{idp} = (\overline{DTAXADJ} \cdot tins_{idp} - \overline{DTINS} \cdot p01_{idp}) \tag{39}$$

$$TRII_{id,en} = shii_{id,en} \cdot (1 - \overline{SADJ} \cdot mps_{en}) \cdot (1 - TTINS_{en}) \cdot YI_{en} \tag{40}$$

$$TRII_{id,h} = shii_{id,h} \cdot ((1 - \overline{SADJ} \cdot mps_h) \cdot (1 - TTINS_h) \cdot YHM_h + YHA_h) \tag{41}$$

$$\begin{aligned} YD_h = {} & (1 - SADJ \cdot mps_h) \cdot ((1 - \sum_{ins} shii_{ins,h}) \\ & \cdot (1 - TTINS_h) \cdot YHM_h + YHA_h) \end{aligned} \tag{42}$$

$$\begin{aligned} PQ_c \cdot QH_{c,h} = {} & PQ_c \cdot \gamma^m_{c,h} \\ & + \beta^m_{c,h} \cdot (YD_h - \sum_{cp} PQ_{cp} \cdot \gamma^m_{cp,h} - \sum_a PA_a \cdot \gamma^h_{a,h}) \end{aligned} \tag{43}$$

$$\begin{aligned} PA_a \cdot QAH_{a,h} = {} & PA_a \cdot \gamma^h_{a,h} \\ & + \beta^h_{a,h} \cdot (YD_h - \sum_c PQ_c \cdot \gamma^m_{c,h} - \sum_{ap} PA_{ap} \cdot \gamma^h_{ap,h}) \end{aligned} \tag{44}$$

$$YHA_h = \sum_a PA_a \cdot QAH_{a,h} \tag{45}$$

$$YHM_h = YI_h - YHA_h \tag{46}$$

$$\begin{aligned} YG = & \sum_{id} (TTINS_{id}) \cdot YI_{id} + \sum_{a} DVATADJ \cdot tva_a \cdot (1 + tvaadj \cdot P04_a) \cdot PVA_a \cdot QA_a \\ & + \sum_{a} ta_a \cdot PA_a \cdot QA_a + \sum_{cm} tm_{cm} \cdot QM_{cm} \cdot \overline{PWM_{cm}} \cdot EXR \\ & + \sum_{ce} te_{ce} \cdot QE_{ce} \cdot \overline{PWE_{ce}} \cdot EXR + \sum_{c} tq_c \cdot PQ_c \cdot QQ_c \\ & + \sum_{f} tf_f \cdot YF_f + tr_{gov,row} \cdot EXR \end{aligned} \tag{47}$$

$$EG = \sum_{c} PQ_c \cdot QG_c + \sum_{id} tr_{id,gov} + \sum_{a} insub_a \cdot QA_a \tag{48}$$

$$QG_c = \overline{GADJ} \cdot qbarg_c \tag{49}$$

$$GSAV = YG - EG \tag{50}$$

$$QINV_c = IADJ \cdot qbarinv_c \tag{51}$$

$$INVEST = \sum_{c} PQ_c \cdot (QINV_c + qbardst_c) \tag{52}$$

$$\begin{aligned} SAVINGS = & \sum_{en} \overline{SADJ} \cdot mps_{en} \cdot (1 - TTINS_{en}) \cdot YI_{en} \\ & + \sum_{h} sadj \cdot mps_h \cdot (1 - TTINS_h) \cdot YHM_h + YHA_h) \\ & + GSAV + \overline{FSAV} \cdot EXR \end{aligned} \tag{53}$$

Table C4—System Constraint Block

$$QQ_c = QINT_c + \sum_h QH_{c,h} + QG_c + QINV_c + qbardst_c \tag{54}$$

$$\overline{QFS_f} = \sum_a QF_{f,a} \tag{55}$$

$$\sum_{cm} \overline{PWM_{cm}} \cdot QM_{cm} + \sum_f tr_{row,f} = \sum_c \overline{PWE_c} \cdot QE_c + \sum_{id} tr_{id,row} + \overline{FSAV} \tag{56}$$

$$SAVINGS = INVEST + WALRAS \tag{57}$$

Appendix Table 1—Rural Regions

1. North
   - Baja California Norte
   - Baja California Sur
   - Sonora
   - Sinaloa
   - Chihuahua
   - Coahuila
   - Nuevo Leon
2. Central
   - Durango
   - Zacatecas
   - Aguascalientes
   - San Luis Potosi
   - Guanajuato
   - Queretaro
   - Hidalgo
   - Tlaxcala
   - Puebla
   - Tamaulipas
3. Southwest
   - Nayarit
   - Jalisco
   - Colima
   - Michoacan
   - Estado de Mexico
   - Distrito Federal
   - Guerrero
   - Morelos
4. Southeast
   - Veracruz
   - Oaxaca
   - Chiapas
   - Tabasco
   - Campeche
   - Yucatan
   - Quintana Roo

Appendix Table 2—National Sectors in Model[1]

1. Maize
2. Wheat
3. Beans
4. Other Grains (Sorghum, Barley)
5. Fruits and Vegetables
6. Other Crops (Tobacco, Hemp, Cotton, Cocoa, Sugar, Coffee, Soy, Safflower, Sesame and Others)
7. Livestock/Forestry/Fisheries (Bovines, Goats, Sheep, Bees, Poultry and Others, Forestry and Fisheries)
8. Dairy
9. Prepared Fruits and Vegetables
10. Wheat Manufacturing
11. Corn Manufacturing
12. Sugar Manufacturing
13. Other Processed Foods (Coffee Manufacturing, Processed Meats, Oils and Fats, Feeds, Alcohol, Beverages and Others)
14. Light Manufacturing (Lumber, Wood, Paper, Print, and Cigar Manufacturing, Soft Fiber Textiles, Hard Fiber Textiles, Other Textiles, Leather, Apparel)
15. Intermediates (Chemicals, Synthetics, Rubber, Glass, Cement,Fertilizers, Other Chemicals, Oil Refining, Oil and Gasoline, Petrochemicals, Coal, Iron, Non-Ferrous Metal, Sand/Gravel, Minerals)
16. Consumer Items (Pharmeceuticals, Soaps, Plastic, Metal Furnishings, Household Appliances, Electronic Equipment, Automobiles and Parts)
17. Capital Goods (Metal Products, Metal Manufacturing, Non-Electronic Machines, Electronic Machines, Other Electric Goods, Transportation Materials, Mineral Manufacturing, Iron Manufacturing, Non-Ferrous Metal Manufacturing, Others)
18. Professional Services (Professional Services, Education, Medical, Finance/Real Estate, Public Administration and Defense, Electricity, Gas and Water)
19. Other Services (Other Services, Restaurants
20. Construction
21. Commerce, Trade and Transportation

[1] Note that there are four activities for each of the agricultural crop sectors (sectors 1- 6): one for each region. Otherwise, the activities are the same as these sectors. The commodities are the same as these sectors.

Appendix Table 3—Summary Statistics

	Prod. Tax[1]	VAT	Sales Tax	Tariff	Export Tax	Output	Sectoral Composition (%) Dom. Supply	Imports	Exports	Exports/ Output	Imports/ Dom. Supply
Maize	0.000	--	0.006	0.012	0.007	0.62	0.83	1.17	0.03	0.85	24.19
Wheat	-0.571	--	0.000	0.007	0.032	0.12	0.12	0.00	0.01	1.44	0.07
Beans	-0.003	--	0.008	0.009	0.006	0.11	0.10	0.14	0.17	29.03	24.37
Oth. Grain	-0.449	--	0.000	0.000	0.008	0.16	0.16		0.00	0.15	
Fruit & Veg	-0.001	--	0.006	0.000	0.018	0.75	0.64	0.32	0.95	23.43	8.55
Oth. Crops	-0.002	--	0.007	0.016	0.006	0.84	0.77	1.55	1.89	41.72	34.75
Livestock	0.001	--	0.008	0.014	0.033	2.20	2.21	0.39	0.42	3.53	3.00
Dairy	-0.308	--	0.008	0.005	0.007	1.81	1.89	0.56	0.12	1.18	5.04
Maize Manuf.	-0.308	--	0.008	0.018	0.007	1.47	1.47	0.02	0.10	1.28	0.28
Wht Manuf.	-0.308	--	0.008	0.030	0.006	1.13	1.03	0.17	0.70	11.54	2.75
Fr.Veg. Prep	0.002	--	0.006	0.017	0.009	0.30	0.20	0.18	0.69	43.62	15.60
Sugar	0.002	--	0.005	0.034	0.023	0.40	0.41	0.35	0.30	14.09	14.94
Other Food	0.002	--	0.008	0.016	0.007	4.29	4.46	3.38	2.50	10.81	13.01
Light Manuf	0.002	0.05	0.007	0.027	0.009	5.50	5.73	11.78	10.27	34.71	35.29
Intermediates	0.002	0.05	0.006	0.016	0.019	5.43	5.57	12.50	11.44	39.14	38.54
Cap. Goods	0.002	0.10	0.007	0.021	0.012	7.36	9.89	46.26	30.68	77.52	80.23
Cons. Items	0.002	0.10	0.007	0.023	0.006	11.96	8.41	21.24	39.74	61.78	43.33
Construction	0.003	0.10	0.006	--	--	5.24	5.28	--	--	--	--
Prof.Services	0.007	0.05	0.008	--	--	19.96	20.15	--	--	--	--
Oth. Services	0.004	--	0.009	--	--	11.15	11.27	--	--	--	--
Commerce	0.003	0.10	0.009	--	--	19.22	19.43	--	--	--	--

Note:
[1] A negative entry for the producer tax represents a producer subsidy. The figures for the regionalized agricultural activities are weighted averages.

Appendix Table 4— Production Elasticities

	Elasticity of Substitution For Production Function	Armington Elasticities	CET Elasticities
Maize	0.6	4	4
Wheat	0.6	4	4
Beans	0.6	4	4
Other Grains	0.6	4	4
Frt & Veg	0.5	2	4
Other Crops	0.5	4	4
Livestock	0.6	3	0.5
Dairy	1.5	3	3
Fr & Veg Prep	1.5	3	3
Wheat Mfg	1.5	3	3
Maize Mfg	1.5	3	3
Sugar	1.5	3	3
Other Food	1.5	3	3
Lt. Manuf	2	0.2	2
Intermediate	0.6	0.2	2
Capital Goods	0.6	0.2	2
Consumer Goods	1.5	0.2	2
Construction	0.8	2	2
Prof. Svcs	0.8	2	2
Other Svcs	2	2	2
Commerce	0.8	2	2

Appendix Table 5A—Marginal Budget Shares for Home Consumed Goods

Sectors\ Households	RP-N	RP-C	RP-SW	RP-SE	RM-N	RM-C	RM-SW	RM-SE	RR-N	RR-C	RR-SW	RR-SE
Maize	0.000	0.003	0.003	0.004	0.000	0.003	0.001	0.002	0.000	0.001	0.000	0.003
Wheat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Beans	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oth. Grains	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Frt & Veg	0.001	0.000	0.001	0.001	0.000	0.002	0.000	0.001	0.001	0.000	0.000	0.002
Oth. Crops	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note:

The column labels refer to the following sets of household and regions:

Households		**Regions**	
RP	Rural Poor	-N	North
RM	Rural Medium	-C	Central
RR	Rural Rich	-SW	Southwest
UP	Urban Poor	-SE	Southeast
UM	Urban Medium		
UR	Urban Rich		

Appendix Table 5B—Marginal Budget Shares for Marketed Goods

Sectors\ Households	RP-N	RP-C	RP-SW	RP-SE	RM-N	RM-C	RM-SW	RM-SE	RR-N	RR-C	RR-SW	RR-SE
Maize	0.001	0.008	0.006	0.010	0.000	0.005	0.002	0.003	0.000	0.013	0.005	0.000
Wheat	0.002	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Beans	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.005	0.001
Oth. Grains	0.003	0.001	0.002	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.011	0.000
Frt & Veg	0.007	0.009	0.010	0.007	0.007	0.011	0.011	0.008	0.005	0.004	0.015	0.010
Oth. Crops	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.000
Livestock	0.017	0.018	0.031	0.042	0.010	0.011	0.021	0.023	0.015	0.003	0.012	0.012
Dairy	0.066	0.057	0.066	0.050	0.045	0.035	0.052	0.041	0.023	0.010	0.065	0.028
Fr.Veg Prep	0.014	0.010	0.011	0.006	0.010	0.009	0.009	0.006	0.003	0.000	0.007	0.004
Wheat Mfg	0.018	0.027	0.025	0.027	0.013	0.019	0.024	0.023	0.020	0.007	0.021	0.016
Maize Mfg	0.037	0.034	0.035	0.038	0.030	0.026	0.043	0.030	0.079	0.013	0.062	0.023
Sugar	0.018	0.024	0.019	0.040	0.009	0.016	0.016	0.017	0.001	0.004	0.013	0.005
Other Food	0.079	0.061	0.058	0.062	0.079	0.056	0.067	0.059	0.056	0.043	0.067	0.050
Lt. Manuf	0.049	0.041	0.034	0.032	0.049	0.051	0.047	0.038	0.051	0.048	0.063	0.045
Intermediate	0.014	0.008	0.008	0.007	0.014	0.010	0.009	0.008	0.004	0.012	0.012	0.009
Cap. Goods	0.110	0.071	0.068	0.063	0.103	0.081	0.080	0.067	0.105	0.094	0.095	0.078
Cons.Goods	0.082	0.053	0.050	0.049	0.110	0.076	0.068	0.077	0.083	0.228	0.080	0.057
Prof. Svcs	0.083	0.077	0.081	0.072	0.082	0.076	0.071	0.068	0.043	0.156	0.086	0.053
Other Svcs	0.134	0.136	0.101	0.087	0.138	0.167	0.134	0.153	0.135	0.107	0.127	0.185
Commerce	0.264	0.360	0.391	0.399	0.297	0.342	0.344	0.374	0.373	0.256	0.251	0.418

Appendix Table 5C—Own Price Elasticity of Home Consumed Goods

Sectors/ Households	RP-N	RP-C	RP-SW	RP-SE	RM-N	RM-C	RM-SW	RM-SE	RR-N	RR-C	RR-SW	RR-SE
Maize	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	0.0	-0.6	-0.6	-0.6
Wheat	-0.2	0.0	0.0	-0.2	-0.2	0.0	0.0	0.0	-0.6	0.0	0.0	0.0
Beans	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.6	0.0	-0.6	-0.6
Other Grains	-0.2	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	0.0
Frt & Veg	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.6	0.0	0.0	-0.6
Other Crops	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.6	0.0	-0.6	-0.6

Appendix Table 5D— Own Price Elasticity of Demand for Market Consumed Goods

Sectors\ Households	RP-N	RP-C	RP-SW	RP-SE	RM-N	RM-C	RM-SW	RM-SE	RR-N	RR-C	RR-SW	RR-SE	HHUP	HHUM	HHUR
Maize	-0.10	-0.11	-0.11	-0.11	-0.10	-0.10	-0.10	-0.10	--	-0.61	-0.60	--	-0.10	-0.10	-0.60
Wheat	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.60	--	-0.60	--	-0.20	-0.20	-0.60
Beans	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.60	-0.60	-0.60	-0.60	-0.10	-0.10	-0.60
Other Grains	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	--	--	-0.60	--	-0.20	-0.20	-0.60
Frt & Veg	-0.31	-0.31	-0.31	-0.30	-0.40	-0.41	-0.41	-0.40	-0.60	-0.60	-0.61	-0.60	-0.31	-0.40	-0.60
Other Crops	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.60	--	-0.60	-0.60	-0.30	-0.30	-0.90
Livestock	-0.90	-0.90	-0.90	-0.90	-0.80	-0.80	-0.80	-0.80	-0.70	-0.70	-0.70	-0.70	-0.90	-0.80	-0.70
Dairy	-0.91	-0.91	-0.91	-0.91	-0.81	-0.81	-0.81	-0.81	-0.71	-0.70	-0.72	-0.71	-0.91	-0.81	-0.71
Fr. Veg Prep	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.80	--	-0.80	-0.80	-0.90	-0.90	-0.80
Wheat Mfg	-0.71	-0.71	-0.71	-0.71	-0.80	-0.80	-0.80	-0.80	-0.80	-0.80	-0.80	-0.80	-0.71	-0.80	-0.80
Maize Mfg	-0.61	-0.61	-0.61	-0.62	-0.71	-0.71	-0.71	-0.71	-0.82	-0.80	-0.81	-0.80	-0.61	-0.70	-0.80
Sugar	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.80	-0.80	-0.80	-0.80	-0.90	-0.90	-0.80
Other Food	-0.45	-0.44	-0.43	-0.44	-0.54	-0.53	-0.53	-0.53	-0.62	-0.62	-0.63	-0.62	-0.43	-0.53	-0.62
Lt. Manuf	-0.43	-0.42	-0.42	-0.42	-0.52	-0.53	-0.52	-0.52	-0.62	-0.62	-0.63	-0.62	-0.42	-0.52	-0.62
Intermediate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cap. Goods	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cons. Goods	-0.54	-0.53	-0.52	-0.52	-0.73	-0.72	-0.72	-0.72	-0.73	-0.77	-0.72	-0.72	-0.53	-0.72	-0.73
Prof. Svcs	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.53	-0.52	-0.58	-0.54	-0.53	-0.55	-0.58	-0.60
Other Svcs	-0.91	-0.91	-0.91	-0.91	-0.91	-0.92	-0.91	-0.92	-0.83	-0.82	-0.83	-0.84	-0.91	-0.91	-0.84
Commerce	-0.93	-0.94	-0.94	-0.94	-0.93	-0.93	-0.93	-0.94	-0.87	-0.85	-0.85	-0.88	-0.94	-0.93	-0.85