Poverty and Social Impact Analysis by the IMF

Review of Methodology and Selected Evidence

Robert Gillingham
Editor

INTERNATIONAL MONETARY FUND

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I. Introduction

The Poverty Reduction and Growth Facility (PRGF) is the instrument used by the IMF to provide support for countries in the implementation of their poverty reduction and growth strategies, as identified in their Poverty Reduction Strategy Papers (PRSPs). The core objective of the PRSP approach is to arrive at policies that are more clearly focused on growth and poverty reduction, in which the poverty reduction and macroeconomic elements of the program are fully integrated, and that embody a greater degree of national ownership, thereby leading to more consistent policy implementation. Key requirements in the design of the PRGF programs that support this approach are an understanding of the effect of program measures on vulnerable groups—particularly the poor—and designing measures to mitigate any negative effects. Poverty and Social Impact Analysis (PSIA) is, in turn, a critical instrument for pursuing this goal. In this regard, IMF staff is expected to draw on PSIAs carried out by other institutions (such as the World Bank) and donors in addressing distributive concerns in PRGF-supported programs. To this end, the IMF established a small in-house capability on PSIA to facilitate the integration of PSIA into PRGF-supported programs. The group has only four full-time positions, so its activities are designed to leverage expertise and available resources both inside and outside the IMF. In limited cases, the group also conducts PSIAs in areas that are central to the work of the IMF and where no other analysis is available. The goals of the PSIA group are to assist mission teams to

- better understand the likely impact of key macro and structural reforms on different population groups, particularly the poor, on the basis of available PSIA;
- assess the appropriateness, timing, and sequencing of alternative measures in the design of programs and, where appropriate, design and integrate into IMF programs compensatory and complementary measures to mitigate any negative effects of reform policies; and
- perform distributional analyses to fill critical information gaps in areas of the IMF's core competence.

The PSIA group pursues these goals in several ways. First and foremost, the group works closely with development partners—especially the World Bank—to keep abreast of ongoing PSIA activity and help set priorities for future work that will support the integration of PSIA into IMF programs. Second, the group works with area department mission teams on several levels to

- draw lessons from existing PSIAs to assess the likely impact of program measures on vulnerable groups and, where appropriate, craft compensating measures;
- participate in area department missions when an economic reform has a potentially significant poverty or social impact and can benefit from more intense attention by a member of the PSIA group; and
- perform a limited number of new PSIAs in the areas of the IMF's core competence.

Table 1.1 summarizes the country work of the PSIA group since its inception in 2004 through December 2007.

Third and finally, the group produces reviews of PSIA methods and results that can be used by IMF economists to inform their own efforts in PSIA. For instance, the group has summarized its work on the distributional impacts of energy subsidies in a working paper entitled "The Magnitude and Distribution of Fuel Subsidies: Evidence from Bolivia, Ghana, Jordan, Mali, and Sri Lanka" (Coady and others, 2006). It has also produced a companion guidance note on the statistical techniques used in the fuel subsidy analyses.

In this volume, the group's reviews of analytical techniques used in PSIA are combined with reviews of several important topics to which PSIA can make valuable contributions. The volume comprises the following:

- *"A Review of Macro-Micro Approaches for Evaluating the Distributional Impacts of Macroeconomic Reforms," by Moataz El-Said.* This chapter provides a brief and accessible guide to economy-wide modeling approaches—those that are referred to as "macro-micro" techniques—to evaluating poverty and distributional impacts of macroeconomic policies. The chapter highlights how the macro-poverty links are modeled; the underlying assumptions; the trade-offs involved in terms of data, time, and resource requirements; and the typical policy questions addressed by these techniques.

- *"The Distributional Impacts of Indirect Tax and Public Pricing Reforms: A Review of Methods and Empirical Evidence," by David Coady.* The reform of indirect taxes and public sector prices is a key component of many structural adjustment programs in developing countries. These reforms can have important implications for income distribution and poverty. This chapter reviews the various methodological approaches to evaluating these impacts, highlighting their interrelationships and relative resource requirements. It also identifies general policy implications from the empirical literature.

- *"Analyzing the Impact of Trade Liberalization and Devaluation on Poverty," by Alejandro Simone.* This chapter lays out an organized approach to analyzing the distributional aspects of trade liberalization and devaluation with a specific focus on poverty impact. It discusses selected theoretical issues to consider in evaluating existing empirical studies on trade liberalization and devaluation and concludes with a road map providing guidance on how to analyze the impact of trade liberalization and devaluation on poverty.

- *"The Distributional Impact of Agricultural Sector Reforms in Africa: A Review of Past Experience," by David Newhouse.* African governments have intervened in the agricultural sector for decades, but generous pricing policies and operational inefficiencies have often necessitated large budgetary transfers to parastatals. This chapter evaluates the liberalizing reforms undertaken in the past 20 years, the channels by which these reforms affected stakeholders, and the outcomes of the reforms on poor households.

Chapters II and III focus primarily on methodological issues. They are useful to anyone wanting to understand how to embark on a PSIA. Chapters IV and V focus on important topic areas and are a useful reference for someone wanting to address either of these topics in a particular country. In particular, Chapter V focuses on the results of existing PSIAs in the covered topic area. All four chapters were written primarily to inform the PSIA efforts of IMF economists, but should be useful to a broader audience as well.

Table 1.1. Summary of Activities and Outputs of the Poverty and Social Impact Analysis Group (October 2004–December 2007)

Country	Topic	Activity	Output
	2004		
Bolivia	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (October)	Aide-mémoire for WHD and country authorities
Mali	Impact of recent shocks (terms of trade for cotton and petroleum products, locust infestation) on welfare of poor and potential mitigating measures	Mission (November)	Aide-mémoire for AFR and country authorities
Senegal	Impact of groundnut sector reform on poor and potential mitigating measures	Mission (November)	Aide-mémoire for AFR and country authorities Selected Issues Paper
Tajikistan	Welfare impact of energy sector reforms and performance of mitigating measures	Mission (December)	Aide-mémoire for MCD and country authorities Selected Issues Paper
	2005		
Ghana	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (January)	FAD Technical Assistance Report
Jordan	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (February)	FAD Technical Assistance Report

Bosnia and Herzegovina	Distributional impact of replacement of sales taxes with value-added tax (VAT) and potential mitigating measures	Mission (May)	FAD Technical Assistance Report
Uganda	Distributional impact of reform of indirect tax system and potential mitigating measures	Mission (May)	Aide-mémoire for AFR and country authorities
Djibouti	Distribution of impact of devaluation versus wage reform in public sector	Support to area department (June/July)	Desk study for MCD
Mali	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Support to area department (July/August)	Advice, programming support, and review of Working Paper by AFR staff
Sudan	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission with AFR (November)	Aide-mémoire for MCD
	2006		
Ethiopia	Review of World Bank study on fuel subsidy reform	Support to area department (January)	Note for AFR
Namibia	Review of area department chapter on "Dimensions of poverty and social policy towards the poor" for Selected Issues Paper (SIP)	Support to area department (January)	Annoted review for AFR
Bangladesh	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission with APD (February)	Aide-mémoire for APD

(continued)

Table 1.1 ***(continued)***

Country	Topic	Activity	Output
Gabon	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Support to area department (February)	Selected Issues Paper; IMF Working Paper 06/243
Malawi	Distributional impacts of agricultural input subsidies and potential mitigating measures	Mission (March)	Aide-mémoire for AFR and country authorities
Angola	Review of World Bank study of fiscal and social cost of fuel subsidies	Area department support (March)	Short note for AFR
Madagascar	The relative distributional and welfare implications of rice tariff reforms and targeted transfer programs	Support to area department (April)	Desk study for AFR
Burkina Faso	Distributional impact of electricity subsidies	Support to area department (May)	Desk study for AFR
Mauritius	Impact of reform of price subsidies and social transfers and potential mitigating measures	Mission (March)	FAD Technical Assistance Report
Moldova	Magnitude and distribution of energy subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (June)	Aide-mémoire for EUR and country authorities
Sri Lanka	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (July)	Selected Issues Paper

Honduras	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (August)	FAD Technical Assistance Report
Philippines	Distributional impact of changes in VAT system and accompanying mitigating measures	Mission with APD (November)	Selected Issues Paper
Honduras	Follow-up on Poverty and Social Impact Analysis (PSIA) mission to evaluate plan of the state-owned electricity company to reduce subsidies	Mission (November)	Addendum to original technical assistance report
Cameroon	Magnitude and distribution of tax preferences for energy commodities, welfare impact of reduction in preferences, and possible mitigating measures	Mission (November)	Aide-mémoire for AFR and country authorities
Moldova	Follow-up on earlier PSIA mission on energy subsidies	Mission (December)	Revision of aide-mémoire
	2007		
Gabon	Evaluation of alternative measures to mitigate impact of higher energy prices on the poor	Mission (January)	Aide-mémoire for AFR and country authorities
Morocco	Note on "Measures to mitigate the adverse poverty impact of higher fuel prices in Morocco"	Support to area department (February)	Note for MCD
Caribbean	Note on "Social protection for structural adjustment in the Caribbean"	Support to area department (February)	Note for WHD
The Gambia	Impact of groundnut sector reform on poor and potential mitigating measures	Mission (April)	Aide-mémoire for AFR and country authorities

(continued)

Table 1.1 ***(concluded)***

Country	Topic	Activity	Output
Central African Republic	Magnitude and distribution of tax preferences for energy commodities, welfare impact of reduction in preferences, and possible mitigating measures	Mission (May)	Aide-mémoire for AFR and country authorities
Republic of the Congo	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, and potential mitigating measures	Support to area department (July/August)	Advice, programming support, and review of PSIA by AFR staff
Macedonia	Distributional impact of existing social assistance programs as well as implicit electricity subsidies	Support for and participation in FAD technical assistance mission (July)	Contribution to FAD Technical Assistance Report
Republic of the Congo	Magnitude and distribution of fuel subsidies, welfare impact of subsidy reform, potential mitigating measures, and evaluation of authorities' plan	Mission (November)	Aide-mémoire and Technical Assistance Report for AFR and country authorities
Lebanon	Magnitude and distribution of gasoline, agriculture, and electricity subsidies, welfare impact of subsidy reform, and potential mitigating measures	Mission (November)	Aide-mémoire and Technical Assistance Report
Mongolia	Distributional incidence of tax and spending policy (including evaluation of recent reforms)	Mission (December)	Aide-mémoire and Technical Assistance Report

Notes: AFR = African Department; APD = Asia and Pacific Department; EUR = European Department; FAD = Fiscal Affairs Department; MCD = Middle East and Central Asia Department; WHD = Western Hemisphere Department.

II. A Review of Macro-Micro Approaches for Evaluating the Distributional Impacts of Macroeconomic Reforms

A. Introduction

The poverty and social implications of macroeconomic and structural reform policies are increasingly being recognized in IMF-supported programs and IMF policy advice. In 1999, the IMF replaced the Enhanced Structural Adjustment Facility, its assistance program for supporting low-income countries, with the Poverty Reduction and Growth Facility (PRGF), which explicitly gives poverty alleviation more prominence in its operations. In addition to its focus on promoting macroeconomic stability and growth, the PRGF program focuses on the relationship between macroeconomic policies and their poverty implications.

A new set of analytical tools and techniques is required, however, to evaluate the poverty and distributional effects of macroeconomic policies. The PRGF programs continue to rely on the IMF financial programming model (FPM) as a key analytical framework for a consistent set of macroeconomic policies. However, the FPM does not account for the diverse channels through which macroeconomic policies affect poverty. Therefore, it is necessary to complement the existing analytical framework with tools and techniques to address macro-poverty links.

Modeling the linkages among macroeconomic policies, growth, and poverty is a challenging task. The macro-poverty links are diverse and country specific. A number of economic mechanisms and economic agents are involved, and their roles in markets vary from one country to another. In addition, poverty is multidimensional. It is critical to recognize the characteristics of the poor—their consumption patterns, their sources of income, and the overall environment in which they operate. Furthermore, macroeconomic analysis uses different data sets from those used for traditional micro analysis of poverty.

Nevertheless, a variety of analytical approaches that address the macro-poverty links exist. The approaches vary across many domains. Some of the approaches focus on the consumption effects associated with a change in policy through their effects on prices, whereas other approaches focus on factor markets and how policies affect wages and employment. The methods also range from static to dynamic, with a partial equilibrium or a general equilibrium focus, and with or without behavioral responses.

The focus of this review paper is on a subset of these analytical approaches, those that are referred to as *macro-micro* techniques for evaluating poverty and distributional impacts of macroeconomic policies. These are techniques that follow an economy-wide framework of analysis and have been used in practice to evaluate the poverty and distributional impacts of economic policies. From a modeling perspective these techniques attempt to bridge the gap between two different sets of analytical approaches: those used to analyze macroeconomic policies and those used to analyze poverty and distribution issues. The objective of the review is to provide a brief and accessible guide to these techniques, highlighting how the macro-poverty links are modeled and the underlying assumptions; the trade-offs involved in

terms of data, time, and resource requirements; and the typical policy questions addressed by these techniques.

A selected number of these techniques are reviewed here, including

1. Social accounting matrix (SAM) multiplier models;
2. SAM-based computable general equilibrium (CGE) models;
3. The 123PRSP (Poverty Reduction Strategy Paper) model;
4. The IMMPA (integrated macroeconomic model for poverty analysis); and
5. CGE-microsimulation-based models.

The first and second rely on the SAM database as an economy-wide framework of analysis, whereas the remaining three are extensions of the second approach. Typically the extensions involve additional data and modeling features to expand the analysis of poverty and distribution. The choice of which one of these techniques to use depends on the policy questions each technique can address and its requirements in terms of data, time, and skill. The chapter also considers the relative resource requirements associated with each technique and discusses some of the practical trade-offs involved.

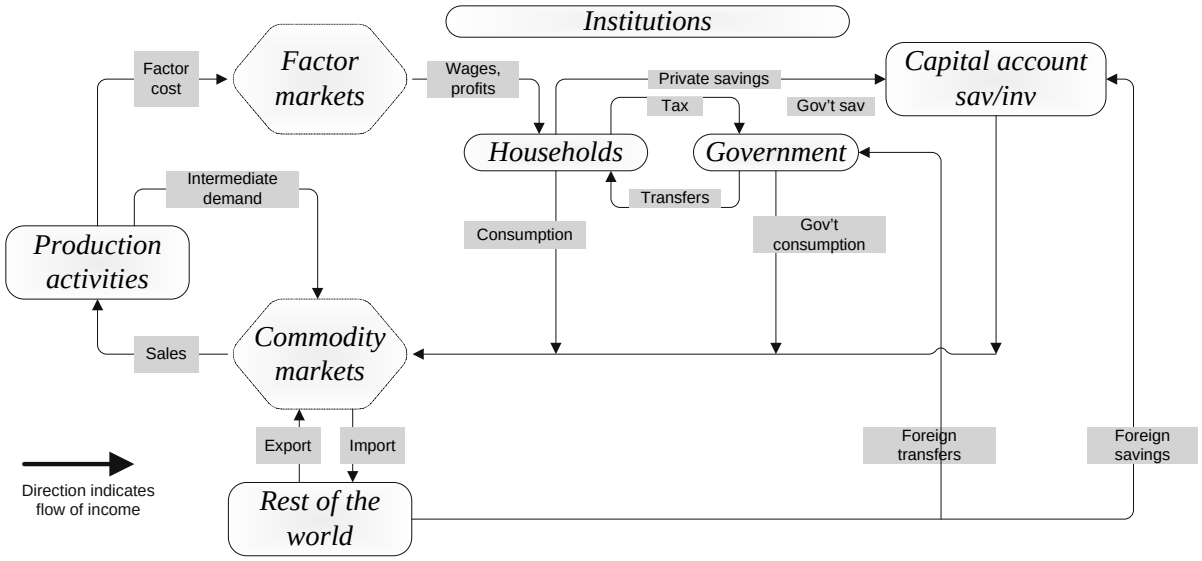
B. Macro-Micro Analytical Approaches

What Is a SAM?

A SAM is a comprehensive, complete, flexible, and consistent system for organizing the social and national accounts of a nation over a period of time, usually a year (Decaluwé and others, 1999). It is comprehensive in the sense that it covers all transactions in an economy, both within the domestic economy and between the domestic economy and the rest of the world. It is complete in the sense that it accounts for all incomes and outlays in the economy—that is, all payments, receipts, and transfers. It is flexible because it can be applied at the national level or can focus on a particular region, commodity, or institution. It can be aggregated or disaggregated to any level according to the requirements of the issue and availability of data. It is consistent in the sense that for each account, total receipts (income) and expenditure of each actor must balance (i.e., equal row and column totals).

A SAM is one approach to presenting the national accounts data of a country. It captures the circular flow of incomes from commodity markets through factor payments to households and back to product markets through spending on final goods (Figure 2.1). A typical SAM includes accounts for production (activities), commodities, factors of production, institutions (households, enterprises, and government), and the rest of the world, all of which receive income and demand goods (see Table 2.1).

Figure 2.1. Circular Flow of Income as Portrayed in a Social Accounting Matrix



Source: Lofgren and others (2002).

Table 2.1. Structure of a SAM

Receipts	Expenditure						Totals -7-
	Activity -1-	Commodity -2-	Factors -3-	Institutions -4-	Capital account -5-	World -6-	
1 - Activity		Domestic sales T_{12}					Activity income Y_1
2 - Commodity	Intermediate inputs T_{21}	Transactions costs T_{22}		Final demand T_{24}	Investment T_{25}	Exports T_{26}	Commodity demand y_2
3 - Factors	Value added (wages/rentals) T_{31}						Factor income y_3
4 - Institutions	Taxes T_{41}	Tariffs T_{42}	Factor income T_{43}	Transfers T_{44}		Transfers T_{46}	Institution income y_4
5 - Capital account				Savings T_{54}		Capital inflow T_{56}	Total savings y_5
6 - World		Imports T_{62}					Foreign exchange outflow y_6
7 - Totals	Total costs y_1	Total absorption y_2	Total factor income y_3	Gross domestic income y_4	Total investment y_5	Foreign exchange inflow y_6	

Source: Lofgren and others (2002).
Note: GDP at factor cost = T_{31} and GDP at market prices = $T_{31} + T_{41} = T_{24} + (T_{26} - T_{62})$.

According to its structure, each account is represented by a row and a column account, where as a matter of convention, incomes or receipts are shown along a row whereas expenditures or outlays are shown down a column. Activities pay for intermediate inputs (T_{21}), factors of production (T_{31}), and taxes (T_{41}), whereas they receive payments from sales of commodities (T_{12}), which at the same time are the commodity account payments for obtaining goods from activities (producers). Other commodity account payments include imports (T_{62}) and tariffs (T_{42}) to the government—an institution. At the same time, commodities receipts come from intermediate sales (T_{21}), final demanders (households, government, and investment; T_{24} and T_{25}), and the rest of the world (exports; T_{26}). The capital account collects savings by institutions (T_{54}) plus capital inflows (foreign savings; T_{56}) from the rest of the world, which are used to finance domestic investment (T_{25}).[1] Gross domestic product (GDP) at factor cost (payments by activities to factors of production) equals GDP at market prices (consumption plus investment plus government demand plus exports minus imports) less indirect taxes (T_{41}).

Compared with input-output (IO) tables, a SAM includes additional information that tracks the circular flow of income from activities to factors and to institutions. A SAM keeps track of returns to factors by sector (T_{31})—the functional distribution of income—and its distribution among households (T_{43})—the size distribution of income. Table 2.2 provides a numerical illustration of a SAM representation of the functional and size distributions of income.

Typically, factors of production include labor and capital and could be disaggregated according to certain characteristics such as skilled or unskilled labor. Similarly, households may be classified according to their income sources or other socioeconomic characteristics such as residence in urban or rural areas. In the first panel of Table 2.2, the unskilled labor row (receipts) indicates that total unskilled labor income equals US$115 million (the sum of activity payments to the factor). The second panel of the table shows the percentage shares of this income by source (in this case its income is almost equally distributed among the three sectors). At the same time the third panel shows how factor income is distributed among different household groups. In this case, 60 percent of unskilled labor income accrues to rural households.

The information in Table 2.2 shows how a SAM can be used to trace the distributional effects of a macro policy from its impact on sectoral production and in turn on factor incomes, and eventually onto households' incomes. For example, if trade liberalization leads to higher demand for unskilled labor, and hence to an increase in its (relative) wage, then it follows that rural households will benefit more relative to urban households. In addition, if poverty is relatively high among rural households, then trade liberalization should lead to a decrease in poverty. In brief, a sufficiently disaggregated SAM reveals a lot of structural

[1] Typically, SAMs do not include separate asset accounts for various flows of funds related to activities of the monetary authorities. It is difficult to analyze the impact of monetary policy (money creation, credit, and interest rate) on the distribution of income within a SAM framework. However, there are examples of SAMs with financial sectors (Sadoulet and de Janvry, 1995) and the IMMPA model discussed below is an example of a SAM-based model that uses a SAM with a financial sector.

Table 2.2. Flow of Factors and Household Incomes in a SAM

(US$ millions)

Distribution of Factor and Household Income in a SAM

	Production Activities			...				
	Agriculture	Manufacturing	Service		Unskilled	Skilled	Capital	**Total**
Unskilled	40	37	38					115
Skilled	25	43	62					130
Capital	35	48	55					138
•								
•								
•								
Rural					70	55	42	167
Urban					45	75	96	216
Total	100	128	155		115	130	138	

Share of Factor Income by Source

	Production Activities			
	Agriculture	Manufacturing	Service	**Total**
Unskilled	34.78	32.17	33.04	100.00
Skilled	19.23	33.08	47.69	100.00
Capital	25.36	34.78	39.86	100.00

Distribution of Factor Income by Household

	Unskilled	Skilled	Capital
Rural	60.87	42.31	30.43
Urban	39.13	57.69	69.57
Total	100.00	100.00	100.00

Source: Illustrative SAM produced by author.
Note: Labor is disaggregated into unskilled and skilled; representative households are split into rural and urban.

detail and interlinkages for an economy and can serve as a bridge between a macroeconomic framework, markets, and institutions (Round, 2003).

SAM Multiplier Analysis

A SAM by itself is not a model; it is a comprehensive database. However, a SAM can serve as a basis for simulating a variety of multisector economy-wide models. The SAM multiplier analysis is a simple SAM-based model. A SAM structure of row and column accounts can be translated into a set of linear equations in which each actor represented in the SAM accounts behaves according to fixed column coefficients (Robinson and Lofgren, 2005). For example, production technology follows a fixed Leontief input-output coefficients structure, returns to

factors (value added) are distributed among households according to fixed shares, and households' savings and spending decisions are fixed shares of total income. The multiplier follows from the Keynesian demand multipliers, because SAM-based multiplier models are driven by exogenous demand and yield an effect larger than the initial exogenous change in demand. The model thus implicitly assumes the existence of unlimited unemployed factor supplies, which severely restricts the usefulness of the results for policy purposes. However, the analysis can usefully identify important channels through which policies may affect household welfare.

Because equilibrium is defined as equal row-column sums in all SAM accounts and with a square matrix, it follows that if $n - 1$ row-column sums are equal then the nth account must also be equal. The SAM multiplier model becomes overdetermined unless a subset of accounts is exogenous. Assuming a partitioned SAM, with a set of endogenous and exogenous accounts, and denoting the vector of totals of n endogenous accounts by y_n and the vector of totals of the exogenous accounts by x, then the incomes of the endogenous accounts (row totals) can be written as:

$$y_n = A_n y_n + x, \tag{2.1}$$

where A_n is an $n \times n$ square matrix of average propensities to consume. Equation (2.1) can also be written as:

$$y_n = (I - A_n)^{-1} x = M_n x, \tag{2.2}$$

provided $(I - A_n)^{-1}$ exists.

The inverted matrix M_n in Equation (2.2) is the SAM multiplier matrix, which relates endogenous income y_n to exogenous injections x (Stone, 1985). The matrix measures the response of the economy to an exogenous change in final demand where the notion of a multiplier is measured by the difference between the initial change in final demand and the total effect of this change on the economy. For example, if the value of the SAM multiplier is 1.5, then a $10 million increase in final demand x (say because of an increase in exports—an exogenous account) will generate a $15 million increase in output. Of this increase in output, $10 million is a direct effect of the change in final demand for the export sector, and the remaining $5 million is split between indirect effects—the change in other industries' output to satisfy the inputs needed for the expanding export sector—and induced effects resulting from increased/decreased expenditures by households from the income gained/lost from the direct and indirect effects of the change in final demand for exports.

SAM multipliers are larger in value than are the standard IO model multipliers. This fact follows from the structure of a SAM, which embodies the IO table accounts in addition to accounts describing the distribution of factor incomes and the distribution of disposable income. The difference is the induced effects generated from specifying the factor accounts and household groups as endogenous in the system. Thus a SAM multiplier allows for induced feedback effects as respending of incomes occurs.

In the SAM multiplier analysis, it is important to decide which accounts to make exogenous. Sadoulet and de Janvry (1995) note that the multipliers are affected by the choice of exogenous accounts and that a choice of an account should be justified on the basis of theory and empirical realism. One criterion is to choose an account for which expenditures are set independently of income. For example, household expenditures depend on household disposable income; thus, choosing a household account as one of the exogenous accounts might not be useful from a policy perspective. Depending on the purpose of the study and the policy questions, the choice for exogenous accounts typically includes one or a combination of the following accounts: (1) the government, (2) the rest of the world, and (3) the capital account.

With a functional and a size distribution of income as specified in the SAM, it is possible to use a SAM-based multiplier analysis to assess the distributional and poverty impacts of a number of policy issues, such as changes in government expenditures or transfers, investment, exports, and remittances. For example, Bautista, Robinson, and El-Said (2001) analyze the growth and income distribution effects of increased investment allocation by economic sector in Indonesia. The results indicate that increased investment in agriculture, compared with food processing and light manufacturing industries, resulted in a more egalitarian growth of the economy. Other examples of SAM multiplier analysis include applications to Mexico (Adelman, Taylor, and Vogel, 1988), India (Hazell, Ramasamy, and Rajagopalan, 1991), and Ghana (Powell and Round, 2000).

It is important to note that SAM multiplier models capture the effects of exogenous injections into the economy on the levels of incomes of the endogenous accounts following a fixed-coefficient (Leontief) technology. In addition, as indicated above, the SAM multiplier analysis assumes fixed prices, implying that production activities' response to the exogenous shock falls entirely on changes in factor supply. In other words, the results are generated under no supply-side constraints—the model is demand driven with an infinite supply of unemployed factors of productions. Income effects arise from increased employment of previously unemployed factors and not from changing factor and product prices. A key contribution of computable general equilibrium models, which are considered in the following section, is the introduction of endogenous flexible prices (for commodities and factors) and a model of behavioral responses by optimizing economic agents reallocating resources between competing uses.

C. Computable General Equilibrium Models

Following the structure of a SAM, a CGE model is a system of simultaneous equations that provides a complete and consistent picture of the circular flow of income in an economy, and at the same time accounts for all market-based interactions among economic agents (Robinson, 1989). In the model, producer and household behavior is based on standard microeconomic theory whereby households maximize utility subject to budget constraints, and producers seek to maximize profits given existing technology and factor and product prices. The model satisfies equilibrium conditions, known as *macro closure rules* in the CGE

literature. These are constraints that have to be satisfied by the general equilibrium model, but are not considered in the optimizing decision of any micro agent (Robinson, 1989).[2]

Using a CGE model for simulating the impact of economic policies involves a SAM calibration process and carrying out at least one policy simulation. CGE model calibration is a step that ensures that the initial model solution, a solution that is typically called the base solution, reproduces the input SAM. In other words, the SAM or the base solution is taken as a benchmark equilibrium—the state of the economy as portrayed in the SAM structure. The next step is to change a key policy parameter in the model to account for a policy shock, then re-solve the model and compare the new solution, which represents a new state of equilibrium, with the base solution to assess the impact of the introduced policy.

Early CGE models that focus on macroeconomic issues of growth, income distribution, and poverty were applied by Adelman and Robinson (1978) to Korea and by Lysy and Taylor (1980) to Brazil. These models investigated the impact of various macroeconomic policies and programs intended to improve the relative and absolute incomes of the poor. Much of this and later work emphasized issues of growth and income distribution, whereas less work was done on poverty.

CGE models address a number of weaknesses in SAM-based multiplier models. First, prices are endogenous. Both prices and quantities adjust in response to an exogenous shock to clear markets. Second, the model specifies factor supply constraints that address the problematic supply assumptions underlying multiplier models. Third, a CGE model is capable of using alternative functional forms to model economic agents' behavioral responses, including fixed-share coefficients as in the SAM multiplier analysis.

However, like SAM multiplier models, CGE model applications classify households into a few broad representative categories—by income and/or by locality. That is, an average representative household (RH) is representative of all the households in its group. Within-group variation is suppressed. For example, when the income of a rural household group grows by *x* percent, that signifies that the mean of the distribution of income for rural households as a group has grown by *x* percent. Consequently, a typical CGE model determines (endogenously) only the variation in the between-group distribution of income. This is a limitation of the approach because within-group heterogeneity is a factor that cannot be ignored when conducting an analysis of inequality or poverty.[3]

Figure 2.2 is another way to illustrate the link between household and factor incomes in a SAM, as presented in Table 2.2. In the context of a typical CGE modeling framework, the

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[2] The closure rules of CGE models—which are a matter of contention in the CGE literature—are discussed further below.

[3] See Cogneau and Robilliard (2000) and Cockburn (2001) who argue against the assumption of within-group homogeneity. According to the former, the contribution of intragroup distribution to total inequality can exceed 50 percent of the total variance.

Figure 2.2. Functional Distribution and Size Distribution of Income (CGE Model)

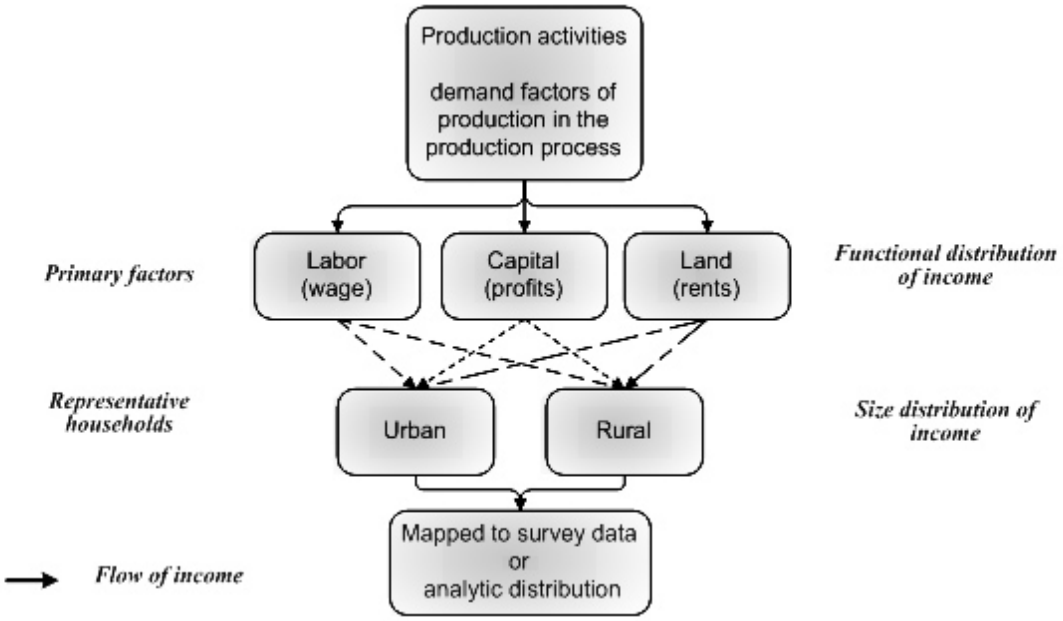

figure illustrates the mechanism through which a macroeconomic policy change trickles down and affects the household at the micro level. At the top level are the production activities, usually disaggregated by sector, that demand factors of production. If profit-maximizing behavior is assumed, the changes in relative prices following a policy or an exogenous shock influence the demand for factors and, ultimately, factor incomes and the functional distribution of income (the second level in Figure 2.2). The third level of Figure 2.2 traces the macro shock to an intermediate, or meso, level where the structure of household ownership of the factors of production (derived from the SAM as fixed shares) is transferred to the micro or RH level. However, according to the RH group mean income (rural and urban groups in Figure 2.2), only changes among group distributions are endogenously determined. Addressing within-group variation requires supplementing the modeling framework with additional information from either survey data or analytic distributions (the lower level in Figure 2.2).

Approaches for Modeling Within-Group Variation in CGE Models

Two common approaches are used to address within-group household income distributions within a CGE framework. One approach assumes that the within-group distribution of household incomes follows a parametric probability distribution. For example, Adelman and Robinson (1978) use a lognormal distribution, and de Janvry, Sadoulet, and Fargeix (1991) use both lognormal and Pareto distributions. More recently Decaluwé and others (1999) used a beta distribution and went further to endogenously determine the monetary value of the poverty line.

Another approach suggested by Coady and Harris (2004) in their analysis of a targeted cash transfer program in Mexico maps each household income (or consumption) observation in a household survey to a corresponding RH group in the CGE model. Doing so attaches a within-group distribution of income to each RH group. Then the within-group distributions are updated by scaling each mapped observation in a particular representative group by the absolute change in the group's mean income (or consumption) plus a household-specific real income change owing to price changes. Under this approach, computed poverty and income distribution indices account for between-group and within-group variations in the distribution of income.

The two approaches are top-down, tracking a macro policy shock at the macro level as it reverberates through the economy and eventually affects the households at the micro level. Following a top-down approach simplifies the analysis because it distinguishes between the economy-wide analysis and the household analysis. This approach is useful especially when adopting a within-group distribution following the second approach because there is no need to integrate the household survey data within the SAM (Lofgren, Robinson, and El-Said, 2003). In this case, the two levels of analysis interact through information—typically prices and wages—passed between the macro level onto the micro level.

Although the analysis in a top-down approach typically ignores household demand and supply responses to price changes, which would be valid only for marginal price changes, these behavioral changes can be easily accounted for by estimating compensating variation or equivalent variation using the functional forms specified in the CGE model. In addition, in a typical CGE model, wages are equalized across sectors. So to the extent this is not a true characterization of the economy, as when labor markets are segmented, important income and distributional effects at the micro household level are ignored. Microsimulation models, discussed below, provide an extension to the analysis as it explicitly addresses some of these issues.

Macroeconomic Closure Rules

Closure rules maintain the equilibrium of the models' macroeconomic balances, which are globally satisfied by the model independent of individual agents' optimizing decisions. The macroeconomic balances in a CGE model are for the same exogenous accounts typically chosen in multiplier analysis. These accounts are for (1) the (current) government balance, (2) the external balance (the current account of the balance of payments), and (3) the savings-investment balance. Technically, a closure rule involves a decision on a choice variable to clear each of the macroeconomic balances.

Because they influence the model results, it is always useful to experiment with different closure rules to gain additional insights into trade-offs involved with alternative macroeconomic closure rules.[4] This is an area of intense debate in the CGE literature because

[4] There is a large body of literature on closure rules; for additional discussions see Sen (1963), Rattsø (1982), Taylor (1990 and 2004), Robinson (1991), and Lofgren and others (2002). Also, Robinson and Lofgren (2005) discuss the theoretical underpinnings of closure rules.

a number of alternative closure rules are possible for each macroeconomic balance.[5] The issue is further complicated by the fact that a choice of one closure rule for one of the balances does not constrain the choice for the other two balances (the appendix discusses commonly used closure rules for the three macroeconomic balances).

In practice, the choice of closure rules should depend on the policy issues being analyzed and the time frame for the analysis. For example, for policy questions involving welfare analysis, a set of closure rules that involves fixed foreign savings, real investment, and real government consumption variables is preferred in order to avoid the un-accounted-for welfare changes resulting from changes in foreign savings and investment. In a static CGE model, these results will not include the welfare changes in later periods that involve a higher foreign debt and lower capital stock accumulation (Robinson, 2005). Similarly, it is analytically plausible to assume fixed government consumption because the model does not keep track of its direct and indirect welfare contributions.[6]

D. The 123PRSP Model

The 123PRSP model is a quantitative framework developed at the World Bank to address the impact of macroeconomic policies on poverty. It is a multilayered model combining different modeling approaches with a simplified core CGE model. Whereas the models are independently used to evaluate one or more of the macro-micro transmission channels—growth and income distribution—the models are also layered to allow model results to feed into one another (Figure 2.3). For example, an estimated 5 percent short-run growth rate obtained from a trivariate VAR (vector autoregression) model is used as an input to the core 123CGE model, which in turn solves for a new set of relative prices consistent with a 5 percent short-run growth rate (Devarajan and Go, 2003).

Accordingly, evaluating the impact of macroeconomic policy on poverty is split among a number of modeling layers as opposed to a full-blown multisector and multihousehold CGE model as described above. At the top is a macro layer consisting of three macro models (a financial programming model, a "Get Real" long-run growth model, and a trivariate VAR short-run growth model) to evaluate the effects of macro policies on growth under the assumption of fixed relative prices, wages, and the composition of output. A meso layer, consisting of a simplified 123CGE model (further described below), takes as input the growth rate of the economy generated from the macro layer to generate changes in relative prices, wages, and sectoral output—under the assumption of full employment. Then a micro layer uses the new set of prices, in combination with income and consumption data, to compute the welfare effects across households (Essama-Nssah, 2005).

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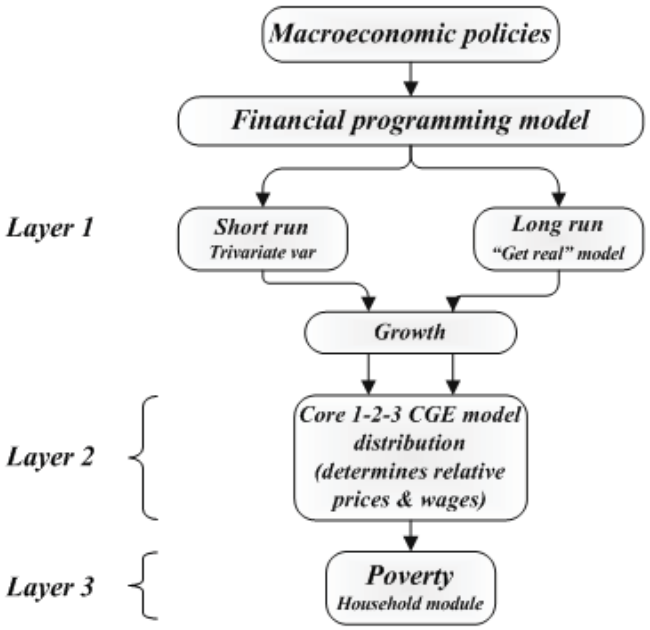
[5] For example, the exchange rate and foreign savings are two closure variables for equilibrating the external balance. Choosing foreign savings (fixing exchange rate) to equilibrate the external account would generate a set of equilibrating relative prices and imply a macroeconomic interpretation different from those generated from the same model with a flexible exchange rate (fixed foreign savings).

[6] For more information on choices of closure rule in welfare analysis, see Lofgren and others (2002) and Robinson and Lofgren (2005).

Figure 2.3. The 123PRSP Macro-Poverty Links



Core 123CGE Model

The 123CGE model is designed to analyze one country, two sectors, and three commodities. The two sectors—exports (*E*) and domestic goods (*D*)—produce two commodities designated for the export market and domestic sales. Imports (*M*) are the third commodity. The model assumes a constant elasticity of transformation, Ω, between exports and domestic goods, and demand for imports and for domestically produced goods, treated as differentiated goods, is characterized by a specified constant elasticity of substitution, σ. The country is assumed to be a price taker in world markets, implying exogenous world prices for imports pw^m and for exports pw^e. The domestic prices of exported and imported products are given by:

$$P^e = pw^e \ (1 - t^e) \ R$$

and

$$P^M = pw^m \ (1 + t^m) \ R,$$

where R is the exchange rate, and t^m and t^e are the implicit tariff and export tax rates.[7]

[7] Compared with the alternative treatment of perfect substitutability and transformability, the assumptions of imperfect transformability (between exports and domestic sales of domestic goods) and imperfect substitutability (between imports and domestically sold domestic goods) permit the model to better reflect the empirical realities of most countries. The assumptions used give the domestic price system a degree of independence from international prices and prevent unrealistic export and import responses to economic shocks. Robinson and Lofgren (2005) note that introducing a degree of substitutability and transformability is

(continued)

The desired ratio between *M* and *D* is a function of their relative prices. Similarly, producers' desired allocation between *E* and *D* is set to maximize profits subject to their relative prices. That is,

$$\left(\frac{M}{D}\right) = CES^{*}\left(\frac{P^{D}}{P^{M}}\right)^{\sigma}$$

and

$$\left(\frac{E}{D}\right) = CET^{*}\left(\frac{P^{E}}{P^{D}}\right)^{\Omega},$$

where *CES** and *CET** refer to the first-order conditions for utility maximization and profit maximization, and P^{D} is the price of domestic goods.

In spite of its simplicity, the 123 model incorporates features capable of addressing a number of policy issues, such as the impact of trade liberalization and devaluation on poverty. Given that *D* is a domestic nontradable good, the relative price of *E* or *M* to *D* is a real exchange rate (the relative price of tradables to nontradables). Therefore, the effect of macroeconomic policies on an important relative price—the real exchange rate—can be endogenously determined by the 123 model. In addition, underlying the transformation frontier between *E* and *D* is a market for labor and capital. That is, with every equilibrium price P^{D} there is also an equilibrium wage rate, which enables the model to generate wages, sector-specific profits (computed as a residual of output after the wage bill), and relative prices (for *D*, *M*, and *E*) in a general equilibrium setting.

Long- and Short-Run Growth Models

The financial programming model is a macroeconomic framework designed to ensure accounting consistency when setting macro and fiscal targets aimed at achieving broad macroeconomic goals (IMF, 1987). In the context of the 123PRSP modeling framework, the FPM provides medium-term projections for the macro variables, which are considered a consensus forecast or a reference growth path for the economy. Alternative macro policies result in a new growth path that is evaluated in terms of deviations from the reference growth path.[8]

The "Get Real" model is a reduced-form model employing cross-country regressions to estimate long-run growth coefficients for a set of policies. The growth coefficients include policy-determined coefficients, such as inflation, the ratio of M2 to GDP, the real exchange rate, secondary school enrollment, infrastructure (telephone lines/1,000), and a black-market

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theoretically consistent with the Salter-Sawn model, which assumes a rigid dichotomy between tradable and nontradable commodities.

[8] For more information on the IMF FPM and its use in the IMF-supported programs, see Khan, Montiel, and Haque (1990).

premium. Other estimated coefficients include the effects of economic shocks, such as terms of trade, interest payments on external debt, and growth in an OECD trading partner.

The trivariate VAR model estimates the short-run growth impact of a policy shock (in terms-of-trade shock, a change in government expenditure, and a change in the real exchange rate) on growth rates. The estimated parameters are interpreted as short-run growth elasticities.

The Household Module

The household module evaluates the impact of macroeconomic policies on household welfare. The module uses survey data on households' labor income and consumption and follows an *envelope* approach (i.e., first-order welfare analysis) to calculate the net welfare impact of macroeconomic policies through linkage variables determined in other layers of the model. According to the envelope approach, changes in the arguments of the indirect utility function—wages, profits, and prices (linkage variables)—are used to approximate the welfare impact at the household level. This impact is equal to the sum of (1) the initial level of labor income multiplied by the relative change in the wage rate, (2) the change in profit income, and (3) the negative of initial consumption times the relative change in commodity prices (Essama-Nssah, 2005).

An application of the 123 model to the case of Zambia evaluated the welfare effects of increased public expenditures and deterioration in copper terms of trade (Zambia's main export commodity). Findings were reported for short-run as well as long-run growth estimates for Zambia's GDP. In the short run, reported results indicate a positive welfare gain associated with increased public expenditures. However, the gains are relatively low compared with the amount of increase in expenditures and the overall impact on the fiscal deficit. For the terms of trade shock, household welfare generally declines and the distributional impact across household deciles shows the poorest households experiencing higher welfare losses. In the long run, the direction of welfare changes is reinforced and the distributional effects, though harsher on poorest household groups, tend to even out across all groups.

Summary

The 123PRSP modeling framework integrates different modeling approaches and allows for a set of welfare and poverty measures consistent with a set of macroeconomic policies. Compared with a full-blown CGE model, the 123 model provides a flexible framework that allows results from different submodels to be linked in a layered structure where results of one model feed into one another. However, the aggregate nature of the sectoral classifications would suggest that the 123 modeling framework is not useful for looking at specific sectoral reforms, such as rice price liberalization. In addition, the layered structure of the 123PRSP model follows a one-way direction of causality from macroeconomic policies to poverty—with no feedback effect of changes at the micro level on macroeconomic balances.

E. The Integrated Macroeconomic Model for Poverty Analysis

The IMMPA is a dynamic quantitative macroeconomic framework developed at the World Bank for analyzing the impact of policy and exogenous shocks on income distribution and poverty in low-income, highly indebted countries as well as middle-income developing economies (Agénor, Izquierdo, and Fofack, 2003). At its core is a financial CGE model with a number of modeling extensions that focus on labor market segmentation, informal activities, credit market imperfections, and the composition of public expenditures.

The IMMPA modeling framework has a relatively rich modeling structure compared with the approaches described above. Its specification of the labor market distinguishes between rural and urban sectors of the economy, and segments the urban labor market between formal employment (in public and private sector) and informal employment. In addition, labor is heterogeneous in the formal sector where skilled workers earn a different wage than unskilled workers. Furthermore, the model allows for labor migration from the rural sector to the urban unskilled labor market according to an expected wage differential between the two markets.

The financial sector treatment in the model links the financial sector with the real side of the economy, which makes it possible to simultaneously analyze the impact of structural reforms on relative prices and output and the impact of short-term stabilization policies and other financial shocks on the economy. At the same time, the model framework allows for analyzing the effects of alternative government expenditures (infrastructure, education, and health) on productivity of the economy and the accumulation of physical and human capital in the private sector.

The IMMPA model follows an RH approach for the distributional analysis; the IMMPA framework can be used to evaluate the distributional effects of a variety of macroeconomic policies that arise in the context of development strategies. For instance, the model can address the distributional effects of shifts in resource allocation associated with structural adjustment policies: What is the best pro-poor allocation of additional debt relief resources in terms of their equity and poverty alleviation effects? What is the impact of a permanent cut in domestic credit to the government? How do employment and poverty effects vary between stabilization and structural adjustment policies? What trade-offs are involved in terms of sequencing policy implementation? What are the short- and long-term policy implications?

Although the IMMPA framework is capable of addressing a wide range of policy questions, its implementation is constrained by the availability of data and the time required to construct its database. The detailed model specification requires a relatively disaggregated labor market and financial sector database, which could be lacking in many developing countries. In addition, a large number of the modeling extensions require additional parameters and elasticities, which increases the data requirements.

F. Microsimulation and CGE Models

A recent advance has been to merge microsimulation and CGE models in an integrated framework. This approach addresses the limitation of the top-down approach to modeling

within-group variations by (1) making the within-group distribution variance endogenous and (2) integrating the household-level behavioral response. Though the CGE-microsimulation merger is fairly recent, microsimulation models have long been applied to tax incidence analysis in developed countries (see, for instance, Orcutt, 1957).[9]

Previous microsimulation models were partial equilibrium models designed to evaluate the distributional effects of changes in tax policies on household incomes and their impact on the budget constraints and resulting decisions faced by households (Atkinson and Bourguignon, 1991). Household surveys, income tax records, and other surveys are the main source of information for these models.

Merging CGE models and microsimulation models, in which each class of models uses different techniques and sources for data, is a challenging implementation task that raises a new set of issues. The integration between economy-wide analysis at one level and household analysis at another level requires the reconciliation of national accounts data with the data obtained from the household surveys. In addition, from a modeling perspective, an approach is needed to integrate the top-down and bottom-up effects in a consistent modeling framework.

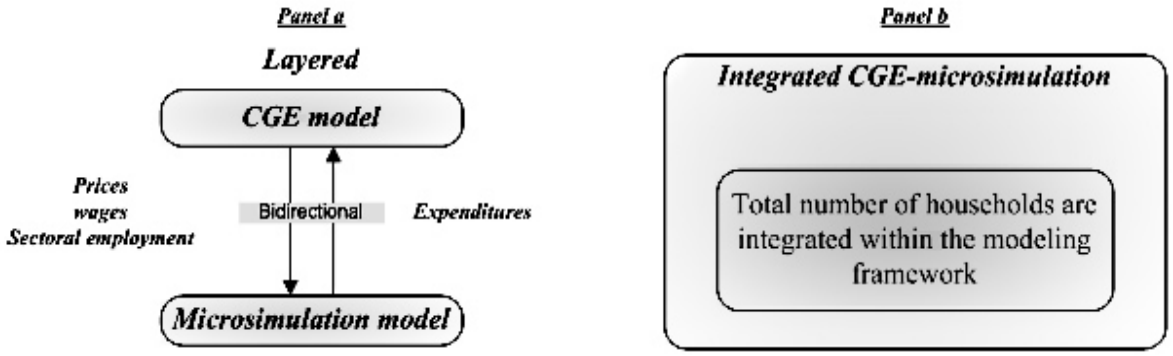
According to the literature, two common approaches are followed in combining CGE models and microsimulation models. In one approach, the two models are layered, and in the second, the two models are completely integrated (see Figure 2.4) (Davies, 2004).

Layered Approach

According to the layered approach, two models—a CGE model and a household microsimulation model—interact through a number of common channels to converge to a consistent solution. Robilliard, Bourguignon, and Robinson (2003) use this approach to address the distributional effects of the 1997 financial crisis in Indonesia. They use a CGE model for Indonesia to capture the impact of the crisis on prices, the exchange rate, and the sectoral structure of production. At the same time, they use a household income microsimulation (HIMS) model—a reduced-form income generation and occupational choice model—to capture the heterogeneity in income sources and other household characteristics (factor endowment, sociodemographic characteristics, and behavior with respect to resource allocation and subject to institutional constraints). The CGE model was solved first, and provided the HIMS model with new data on commodity prices, wages, and employment by

[9] Atkinson and Bourguignon (1991) provide a review of tax-benefit models as they draw lessons from their applications in developed countries for their adaptation in the context of developing countries. Davies (2004) lists some of the microsimulation models found in developed countries (STINMOD on Australia, SPSD/M in Canada, TRIM3 in the United States, TAXMOD and POLIMOD in the United Kingdom).

Figure 2.4. Layered and Integrated CGE-Microsimulation



sector. Then the HIMS model generated changes consistent (with the CGE model) in individual wages, self-employment incomes, and employment status to arrive at a new size distribution of income.

The Robilliard, Bourguignon, and Robinson (2003) model does not fully incorporate bottom-up effects, however. It is better seen as a constrained top-down approach, because the interaction between the two modeling layers imposes consistency constraints from the CGE model on the HIMS model. For example, the HIMS model employs an occupational choice equation to simulate household employment decisions (work or become self-employed) subject to sectoral employment constraints generated by the CGE model solution.

Savard (2003) extends the constrained top-down approach and follows a bidirectional relationship model, which he calls "top-down/bottom-up," to capture the feedback effects coming up from the microsimulation model and passing it on to the CGE model. Consistency between the two models is achieved by recursively iterating solutions between the two models to generate a convergent solution.[10]

Both Robilliard, Bourguignon, and Robinson and Savard compare the microsimulation results with results from a representative household approach. Robilliard, Bourguignon, and Robinson conclude that the RH approach underestimates the inequality and poverty impacts of the crisis compared with their microsimulation results and argue convincingly that the microsimulation improves the distributional analysis. Savard concludes that, although the RH and microsimulation approaches produce similar qualitative and quantitative results at the macroeconomic and sectoral levels, the poverty and inequality results are markedly different

[10] Savard (2003) describes the iteration procedure. First, the top CGE model generates a price vector (including factor payments) with household consumption held constant. Then with the new price vector, household consumption is computed at the bottom level, which is fed again in the CGE model to generate a new price vector, and so on. However, Savard does not explain how a convergent solution is guaranteed.

at the micro level. Even the signs are reversed when the analysis is carried out under the assumption that capital is sector specific in the short run. Savard concludes that it is quite possible for an RH approach to produce misleading results.

Fully Integrated

An alternative approach is to have a CGE model with as many households as in the household survey. In this case, there is no need to specify transmission channels between two models because the micro-level household heterogeneity—factor endowments, labor supply, and consumption behavior—is subsumed within the CGE modeling framework. Two studies following this approach are Cogneau and Robilliard (2000) and Cockburn (2001). The former is a study of the distributional impact of growth on income distribution in Madagascar, and the latter looks at the trade liberalization effects on poverty in Nepal.

The two studies arrive at contrasting results. Cogneau and Robilliard find that overall poverty results using a parametric distribution (log normal) are not significantly different from those obtained from a fully integrated microsimulation model. However, within a household group, the poverty levels are quite different. Cockburn uses a relatively disaggregated factors of production structure and notes that integrating data from the Nepalese household survey within a CGE framework uncovers enormous variation in the distributional detail within the modeled geographic regions when compared with a RH household approach. However, his final conclusion under the two approaches is the same, eliminating tariffs on imported food in Nepal lowers food prices in the cities and hurts agricultural producers, and the final outcome is lower poverty in the cities and higher rural poverty. In conclusion, integrating the CGE and microsimulation models adds a lot of detail to the distributional analysis of macroeconomic policies, but it remains unclear whether the fully integrated or layered approach more accurately reflects the distributional effects of macro policies (Davies, 2004).

G. Relative Resource Needs

When one chooses among techniques for integrating macro models and models of household behavior, practical trade-offs must be systematically evaluated. What are the advantages and disadvantages of each approach? What kind of policy questions is each technique capable of addressing? How much time does it take to apply these approaches? For example, how much time does it take to construct a SAM for a specific country? If a SAM is readily available, what additional data is needed to implement a CGE or an IMPPA model to address poverty and distribution issues? How much distributional detail is gained when one adopts a CGE-microsimulation modeling framework? What follows summarizes the approach in the context of these questions.[11]

[11] Bourguignon and Pereira da Silva (2003) and Essama-Nssah (2005) provide a useful evaluation of each of the techniques covered in this chapter. What follows is a summary of their evaluation.

SAM-Based Multiplier Analysis

Common policy questions addressed using SAM-based multiplier analyses include issues related to government expenditures and transfers, investment, and exports. A SAM would capture the interaction between changes in factor income and household incomes and needs to be supplemented with household survey data to capture the impact of a policy on the size distribution of income. Economic structure and linkages among production sectors, factors of production, and households are the main channels through which macro policies affect the distribution of income and poverty. Constructing a relatively detailed SAM for analysis takes at least one month, with a large variation in the time requirement depending on data availability.[12] In addition, the underlying assumptions are often unrealistic: SAM-based multiplier analysis assumes prices are fixed and the results are demand driven with no supply constraints; the analysis is static and economic agents' behavior follows fixed-share coefficients.

CGE Model

The structure of a CGE model follows the structure of a SAM. Compared with SAM multiplier analysis, a CGE models the supply side of the economy, makes prices endogenous, and considers different functional forms to specify household behavioral responses. CGE models have been applied to a wide range of issues. These include tax policy analysis, subsidies, changes in production technology, public spending, trade liberalization, and devaluation. In addition, the model sectoral detail allows analysis of specific sectoral reforms as well as macro reforms. *Provided that a SAM and a CGE model are available,* an experienced modeler with substantial exposure to CGE models can generate a base solution using a CGE model in a few days. However, if the policy issue requires adjustment to the model or additional data (e.g., an agriculture-focused CGE model, which would require modeling of crop production and hence a more disaggregated SAM), it can take from a few months to a year to construct a CGE model. CGE model results are sensitive to choice of closure rule and hence require a careful understanding of the macroeconomic paradigm underlying each closure rule.

The 123PRSP Model

Common policy issues to which the 123PRSP model has been applied include changes in government spending, trade liberalization, and changes in terms of trade and foreign capital inflows (or outflows). Growth and income distribution are the main transmission channels through which macro policies affect poverty. Following a layered modeling structure provides flexibility in terms of implementation. Typically, a financial programming model is

[12] A SAM combines data from a variety of sources such as national accounts, supply and use tables or an existing IO table, survey data—household, labor, and industrial surveys—and balance of payment data. Although compiling a SAM is a time-consuming task, recent development in SAM compilation and updating using the cross-entropy technique greatly facilitates the task of developing relatively disaggregated SAMs (see Robinson, Cattaneo, and El-Said, 2001; and Robinson and El-Said, 2000, for an introduction to the technique).

available, and growth models can be implemented fairly quickly. Implementing a 123CGE model is relatively straightforward and can rely on national accounts data (at the expense of losing sectoral detail). With all the models available, as well as household survey data, an experienced researcher with knowledge of financial programming and time series analysis can set up and implement a 123PRSP model in a few days.

IMMPA

The IMMPA model is a dynamic financial CGE model with a rich modeling structure that can address a number of issues related to stabilization and structural adjustment programs. Compared with a standard CGE model, the IMMPA model has the detailed labor market structure that is often considered essential to the analysis of poverty and income distribution. However, the time and data requirements of the IMMPA model are more demanding. The process of implementing a fully specified IMMPA model requires at least a few months.

CGE-Microsimulation Models

CGE-microsimulation integration is a relatively recent approach in which both macro and micro behavioral models are linked. In a layered approach, the two models iterate recursively until the solution converges to an equilibrium. The integrated approach drops the representative household approach, and all survey household observations are included in a consistent modeling framework. This approach is increasingly applied, but the applications are still evolving. The approach is relatively demanding in terms of time needed to implement. At least three to six months are needed for an experienced modeler to implement a standard CGE-microsimulation model.

H. Conclusions

The chapter reviewed a number of modeling approaches for evaluating the poverty and distributional impact of macroeconomic policies with emphasis on macro-micro techniques that combine economy-wide general equilibrium models with micro models applied at the individual level. The techniques included SAM multiplier analysis and SAM-based CGE models. Three other approaches that build on the CGE modeling framework and also address the poverty and distribution analysis were also considered: the World Bank 123PRSP and IMMPA models and CGE-microsimulation-based models. The list of models selected is not intended to be exhaustive; rather, the idea is to provide a brief and accessible guide to the approaches and techniques common to the analysis of poverty and distribution using this class of models. What are their underlying assumptions and modeling features? What types of policy questions are typically addressed by these models? What trade-offs are involved in terms of data, time, and resource requirements?

These models can be applied to evaluate the poverty and distribution impacts of a number of policy issues relevant to the IMF programs. A choice of using one modeling framework or another depends on the issue at hand, data availability, and the time frame for carrying out the analysis. Typical macro issues would include trade liberalization, devaluation, tax policy, subsidies, composition of public expenditures, and foreign borrowing. Availability of a

country SAM (or at least the information embodied in a SAM) is a starting requirement for implementing any of these approaches (SAM is a common database underlying all of the analytical approaches reviewed in this chapter). However, the data requirements vary from one modeling approach to another.

Appendix 2.1. Closure Rules Commonly Used in the CGE Modeling Framework[13]

The choice of closure rules imposes a particular macroeconomic interpretation onto computable general equilibrium (CGE) model results, and it is essential to understand the implications of the choice for the model behavior. Macroeconomic closure rules are constraints that have to be satisfied by the economic system, but are not considered in the optimizing decision of any micro agent (Robinson, 1989).

There are three macroeconomic balances: the (current) government balance, the external balance (the current account of the balance of payments, which includes the trade balance), and the savings-investment balance. The mechanisms by which the model satisfies these constraints are called the *closure rules*. A variety of combinations as to how each constraint is equilibrated is possible, and Appendix Table A2.1 provides a summary for a set of closure rules commonly used in the CGE modeling framework.

The Government Balance. A typical specification (*GOV*-1) is to have government savings as a flexible residual with all tax rates for domestic institutions (households and enterprises) being fixed. The other two closures for the government assume fixed government savings with alternative treatments as to how the direct tax rates of domestic institutions are endogenously adjusted to meet changing government spending. For one of these alternatives (*GOV*-2), the base-year direct tax rates are adjusted endogenously by the same number of percentage points. For the second alternative (*GOV*-3), the tax rates of selected institutions are multiplied by a flexible scalar.[14] A fourth alternative is to have government consumption act as an equilibrating variable while savings and the tax rates are fixed. However, it is typical to keep government consumption either fixed in real terms or as a share of total absorption (along with household consumption and investment demand).

The External Balance. The existence of the rest of the world in the model requires an explicit treatment of how the flows of foreign exchange are equilibrated. Typically, the real exchange

[13] The appendix draws on Lofgren and others (2002).

[14] The choice of either one of these two closures, as noted by Lofgren and others (2002), has different implications for changes in post-tax incomes. They provide an example with two institutions, an enterprise and a household, that, under base conditions, both have incomes of 200 and face direct tax rates of 20 percent and 10 percent, respectively, and show that if direct tax collection is to increase from 60 to 90 in order to reach a fixed level of government savings, an increase in the rates by 7.5 percentage points for both institutions (an increase in tax payments by 15 units in terms of absolute flows) is implied under the first closure. However, under the second closure, the new tax rates would be 30 percent and 15 percent, because the base rates are multiplied by 1.5, implying a different increase in the tax payments by each institution (20 for the enterprise and 10 for the household).

Appendix Table A2.1. Alternative Closure Rules for Macro System Constraints

Constraint		
Government	Rest of world	Savings-investment
GOV-1: Flexible government savings; fixed direct tax rates	*ROW*-1: Flexible real exchange rate (via a flexible nominal rate); fixed foreign savings	*SI*-1: Fixed capital formation; uniform MPS point change for selected institutions
GOV-2: Fixed government savings; uniform direct tax rate point change for selected institutions	*ROW*-2: Flexible real exchange rate (via a flexible domestic price level); fixed foreign savings (operationally equivalent to ROW-1)	*SI*-2: Fixed capital formation; scaled MPS for selected institutions
GOV-3: Fixed government savings; scaled direct tax rates for selected institutions	*ROW*-3: Flexible foreign savings; fixed real exchange rate (via fixed nominal rate and fixed domestic price index)	*SI*-3: Flexible capital formation; fixed MPS for all nongovernment institutions
		SI-4: Fixed investment and government consumption absorption shares (flexible quantities); uniform MPS point change for selected institutions
		SI-5: Fixed investment and government consumption absorption shares (flexible quantities); scaled MPS for selected institutions

Source: Lofgren and others (2002).
Notes: Choice of one closure rule for one of the balances does not constrain the choice for the other two. For example, a possible combination of closure rules could include *GOV*-1, *ROW*-2, and *SI*-3. MPS = marginal propensity to save.

rate, defined as the relative price of traded to nontraded goods, is the equilibrating variable.[15] Alternatively, foreign savings (net foreign capital transfers) could serve as an equilibrating mechanism. The model provides a choice among three closures with either a flexible exchange rate and fixed foreign savings, or vice versa. Under the first closure (*ROW*-1) a flexible nominal exchange rate is assumed whereas foreign savings and a domestic price index (here the price index for nontradables was selected) are both fixed. The second closure (*ROW*-2) differs in that the nominal exchange rate is fixed along with foreign savings, whereas the price index for nontradables is flexible. The third closure (*ROW*-3) assumes

[15] Robinson and Lofgren (2005) note that the real exchange rate as defined is not a financial variable that influences financial assets. For more discussion of the real exchange rate in neoclassical, trade-focused CGE models, see Devarajan, Lewis, and Robinson (1993).

a fixed nominal exchange rate (indexed to the model numéraire) whereas foreign savings is flexible.

ROW-1 and *ROW*-2 are operationally equivalent, and there is an assumed relationship between the real exchange rate and foreign saving. For instance, under a flexible exchange rate and fixed foreign savings, an increase in foreign savings leads to an appreciation of the exchange rate—a rise in the relative price of nontraded to traded goods—which leads to a fall in exports as output is channeled to domestic markets and imports rise as consumers switch to imported commodities, which leads to a new equilibrium in the external balance with a new increased level of foreign savings.

The Savings-Investment (S-I) Balance. Two common closures for the S-I balance are the savings-driven and the investment-driven closures. Under the savings-driven closure, savings rates are fixed and investment demand adjusts to match the level of savings (a neoclassical closure). For the investment-driven closure, investment demand is fixed and the value of savings adjusts (a Johansen closure). The CGE model provides five alternative closure rules. The first closure (*SI*-1) is investment-driven, where savings adjust by the same number of percentage points across all institutions. The second closure (*SI*-2) is also investment driven; however, here, savings are adjusted according to a scalar. The third closure (*SI*-3) is savings-driven, and all savings rates are fixed whereas investment in each sector is multiplied by a scalar to equate aggregate saving and investment.

The remaining closures (*SI*-4 and *SI*-5) are "balanced" closures that can be seen as extensions of the investment-driven closures combined with assumptions on the adjustment mechanism for government consumption. The notion is that both the classical and the Johansen closures can be seen as extreme cases. Robinson and Lofgren (2005) note that in situations in which the aim of the analysis is to evaluate the role of complementary policies, it is preferable to choose a balanced closure where adjustment to macro shocks is distributed across the components of consumption and investment (as opposed to either consumption (investment-driven) or investment (savings-driven)) to absorb the full effect of the shock. Accordingly, the nominal absorption shares of investment and government consumption are fixed at base levels, and similarly the residual share for household consumption is also fixed.

III. The Distributional Impacts of Indirect Tax and Public Pricing Reforms: A Review of Methods and Empirical Evidence[16]

A. Introduction

It is common for governments in developing countries to manipulate prices of goods and services using a range of policy instruments and institutional arrangements. The motivations behind these price manipulations reflect varying objectives, such as the need to raise revenue, the desire to redistribute income toward the poor or toward politically important groups, the desire to provide protection to domestic producers, or the desire to influence the levels of supply or demand in other related markets where prices cannot easily be influenced.[17] For example, the major source of revenue in most developing countries is commodity taxation such as domestic sales and excise taxes and taxes on international trade (Burgess and Stern, 1993; and Keen and Simone, 2004); food prices are often kept artificially low for consumers in order to increase the real incomes of poor households (Pinstrup-Andersen, 1988; and Gupta and others, 2000); and public sector prices (e.g., of electricity, gas, petroleum, coal, other fuels, fertilizers) are also often controlled by governments, reflecting either the perceived strategic importance of these inputs for development or the need to provide these sectors with an independent source of revenue and thus greater financial autonomy (Julius and Alicbusan, 1986).

Reform of these indirect tax systems and publicly controlled prices is often an important component of many structural adjustment programs. Reform of indirect tax systems can take various forms, such as reducing high trade taxes and replacing lost revenue through other indirect taxes, replacing trade and sales taxes with a value-added tax, broadening the value-added tax base to include previously exempt goods and services, or simply raising existing tax rates (Abed and others, 1998; and Barbone and others, 1999). Reform of publicly controlled prices typically involves raising subsidized prices closer to world or cost-recovery prices or possibly replacing government price controls with market-determined prices (Gupta and others, 2000).

Governments and other stakeholders commonly express concerns regarding the potential adverse impact of these reforms on poverty. The desirability of these reforms is usually motivated primarily by efficiency and fiscal considerations, that is, the desire to raise revenue with the least distortion of economic activity. However, the associated price changes can potentially decrease the real incomes of households and thus possibly increase poverty. This potential for adverse effects on poverty may underlie the reluctance on the part of governments and other stakeholders to support such reforms. A credible reform strategy therefore requires an analysis of the likely impacts of proposed reforms on household real incomes and the

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[16] This chapter is a revised version of a paper published in Coudouel and Paternostro (2006).

[17] On the structure of taxation and tax reform in developing countries see Gemmell (1987), Tanzi (1987 and 2000), Gillis (1989), Bird (1992), Burgess and Stern (1993), Coady (1997b), Thirsk (1997), Heady (2001), Gemmell and Morrissey (2003 and 2005), and Keen and Simone (2004).

distribution of these across households, with a particular emphasis on the impact on the poorest households. The insights from these analyses should influence program design (i.e., the structure of tax reforms as well as the speed and sequencing of their introduction), as well as inform the choice of alternative approaches to mitigating these adverse effects.

The objective in this chapter is to set out the various methodological approaches that can be used to analyze the impact of tax and price reforms on household real incomes, to explain how these are related and compare their resource requirements, and to identify general policy lessons from existing empirical studies. Section B describes the various methodological approaches used in the literature and identifies their time, data, and skill resource requirements. It supplements the more general discussion of alternative methodologies in Chapter II by providing a more detailed discussion of methodologies in the context of tax and price reforms. As in Chapter II, the alternative approaches are separated into three categories: partial equilibrium, limited general equilibrium, and general equilibrium approaches. This classification is motivated as follows. The total impact on household welfare can be separated into the *direct effect* on households arising from the price effects of the reforms and the *indirect effect* that results once households and firms respond by changing their demand for and supply of goods and services and factors of production (which result in efficiency and revenue impacts). The net distributional effect will depend on the magnitude of these indirect effects and how these indirect effects are distributed across households, such as how the extra revenue is spent. General equilibrium approaches allow for all commodity demand and factor supply responses and thus incorporate both the direct and indirect welfare effects of the reforms. Limited general equilibrium approaches typically focus on a subset of price reforms (e.g., agricultural price reforms) and/or allow for only a subset of household responses (e.g., responses in closely related markets or demand responses alone), thus incorporating only a subset of the indirect effects. Partial equilibrium approaches focus only on the direct effect of reforms on prices and household real incomes.

Section C reviews the findings of the empirical literature using these various approaches and identifies general lessons for policy reform. Reforms that replace trade and sales taxes with a value-added tax typically increase the progressivity of the tax system only if food is exempt or zero-rated. Relatively higher taxes on commodities consumed mostly by higher-income groups (e.g., through additional excise taxes on some energy products) can further increase tax progressivity. It is also important to allow for home consumption of unprocessed food by farm households when evaluating the distributional implications of agricultural pricing reforms because the pattern of market trades, not the distribution of total consumption, determines distributional implications. Incorporating the efficiency consequences of tax reforms through the use of more general equilibrium methodologies is especially important in the context of the reform of trade taxes owing to the narrower tax base (i.e., imports and exports as opposed to total consumption). In general, although narrower tax bases (e.g., in the case of trade taxes or agricultural taxes) may introduce greater potential for improving the progressivity of taxes through tax differentiation, a more inefficient tax structure usually results.

Section D concludes with a summary of the methodological and policy lessons suggested by the review. The argument is made that partial equilibrium analyses can provide very useful

insights into the distributional implications of tax and price reforms but should be combined with at least a qualitative discussion of efficiency issues when policy advice is given. General equilibrium analyses are required to quantify the likely magnitude of the efficiency implications of such reforms and are likely to be especially important in the context of trade tax and agricultural pricing reforms.

A more comprehensive analysis of tax and price reforms would need to address other important determinants of successful reform strategies, particularly the administrative and political constraints on reforms. The fact that such issues are not addressed in this chapter should be interpreted not as an implicit assessment of their relative importance for policy advice but rather as a desire to keep the review manageable and focused. Such issues are addressed only indirectly insofar as they influence the set of tax and price reforms under consideration. Note also that the equity and efficiency implications of reforms can be expected to influence both the need for administrative reforms and the likely political economy of reforms.

B. Alternative Methodological Approaches

One can distinguish among three methodological approaches to the analysis of tax and price reforms: general equilibrium, limited general equilibrium, and partial equilibrium approaches. The total impact of a reform can be separated into its direct effect and indirect effect on household welfare.[18] The direct effect captures the impact arising from the change in consumer prices owing to the reform, which affects household real incomes. The indirect effect captures the welfare impacts that result from demand- and supply-side responses to the reforms, which have implications for efficiency and revenue. The net distributional effect of a reform will therefore depend on the magnitude of these indirect effects and how they are distributed across households, such as how the extra revenue is spent. The three methodological alternatives differ according to the extent to which the indirect welfare effects are incorporated into the analysis. In addition, the data, time, and modeling resource requirements differ substantially across these methodological alternatives (see Appendix Table A3.1).[19]

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[18] A more formal discussion of the welfare impact of tax and price reforms is presented in Appendix 3.1. A similar categorization is employed by Hertel and Reimer (2004) in the context of trade liberalization. Some of the issues discussed below are discussed in more detail in Derviş, de Melo, and Robinson (1982); Ahmad and Stern (1984 and 1991); Drèze and Stern (1987); Newbery and Stern (1987); Gunning and Keyzer (1995); Sadoulet and de Janvry (1995); Deaton (1997); Coady and Drèze (2002); and Coady and Harris (2004). An alternative approach to the simulation approaches discussed in this chapter would be to use the price data available in household surveys to estimate a reduced-form impact of price changes on household real incomes. However, because I am unaware of any such empirical studies, I do not discuss this approach here. The lack of empirical studies in this area may reflect econometric problems related to identifying price effects and separating these from, say, location fixed effects.

[19] Note that with all these methodologies one can also distinguish between first-order welfare measures (i.e., where household net demand is assumed to be fixed) and exact welfare measures (i.e., those that incorporate demand changes). For example, in the case of increases in the consumer prices of final goods, first-order measures will in general overestimate the adverse welfare impact because they ignore the potential for

(continued)

Partial Equilibrium Approach

Partial equilibrium approaches focus solely on the direct effect of reforms on consumer prices and household real incomes. These studies therefore ignore all household and producer responses and focus on the first-order effect on the real incomes of households (or, equivalently, the effect on their cost of living). It is common to interpret these effects as the short-run impact of reforms, prior to household and producer responses. Household responses, such as switching consumption away from taxed goods or toward subsidized goods, tend to decrease adverse welfare impacts and increase beneficial welfare impacts. First-order effects are thus often interpreted as an upper bound on longer-term adverse impacts and a lower bound on beneficial impacts. Producer responses can affect the degree to which the incidence of taxes is pushed onto final goods prices or factor prices and thus also the overall distribution of the welfare impact.

Estimation of these first-order impacts requires household survey information on consumption of the relevant goods and services. Such surveys, which are now widely available for many developing countries, can be used to calculate the budget shares for goods and services. By multiplying budget shares by the proportional increase in the corresponding prices owing to the reforms, one gets an estimate of the proportional change in household real incomes. For example, if a household allocates 10 percent of its total expenditures to food and the price of food increases by 10 percent, a 1 percent decrease in household real income results. Where the prices of many goods are affected, this procedure can be carried out for each good and summed to get the total real income effect. One can then analyze the pattern of these real income changes across households at different levels of income, such as by income deciles.[20] If the percentage decrease in income due to taxes is higher (lower) for higher-income deciles, then the incidence of the tax burden is said to be progressive (regressive).

Where reforms involve a change in the prices of intermediate goods (e.g., energy products), one needs to model the pass-through of these price changes to final goods prices. Such a model requires information on the input-output (IO) structure of the economy as well as information regarding which sectors are internationally traded, are nontraded, or have their prices directly controlled by the government. One typically assumes that such price increases are pushed forward onto output prices for nontraded goods but backward onto factor prices or

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households to switch demand away from goods for which prices increase (Banks and others, 1996). Similarly, they will underestimate the benefits from consumer price decreases. The analysis of marginal reforms essentially assumes that price changes are sufficiently small, and that second- and higher-order welfare effects are also relatively small, so that first-order measures are accurate approximations. Note that although the focus here is on welfare impacts for marginal reforms, one simply needs to replace first-order welfare effects with exact welfare measures (e.g., equivalent variations) for large changes, and the discussion more or less goes through as in the text.

[20] Typically, total household consumption (e.g., in per capita or per capita adult equivalent form) is used to categorize households by welfare level because it is perceived to be a more accurate reflection of household permanent income (Deaton, 1997).

quasi-fiscal deficits for traded or price-controlled sectors. Because the modeling of price shifting is relatively straightforward, subject to data availability, so too is the simulation of price-shifting outcomes.[21]

Partial equilibrium analyses can provide valuable input into policy dialogue and reform, especially when combined with a qualitative discussion of the likely efficiency effects of reforms. For example, switching taxes to products with inelastic demands and/or negative social externalities (e.g., petroleum products, tobacco, and alcohol), where these are initially small, can be expected to increase the overall efficiency of the tax system. Similarly, broadening the tax base to include previously exempt final-consumption goods and services is also generally expected to improve the overall efficiency of the tax system. Such gains can then be juxtaposed against the distributional implications of these reforms to identify possible welfare gains from reforms or any trade-offs between efficiency and distributional considerations.

The policy relevance of such analyses can be strengthened even further by using household survey data to simulate the likely effectiveness of existing or potential safety net expenditures at mitigating any adverse effects of reforms on poor households. Household survey data combined with knowledge of the design of any existing safety net programs can be used to simulate the potential for such programs to protect the poorest households during the reform process and the implications for the net revenue effects of the reforms. Where information on existing safety net programs is weak, one can construct the likely impact of (well-implemented) hypothetical programs as a way of focusing attention on the need for cost-effective programs. The aggregate first-order income effects also provide an estimate of the first-order revenue impacts of the reforms. Similarly, using household data, one can simulate the likely incidence of alternative social expenditures (e.g., increased education and health expenditures) that may be financed by the revenue gains from reforms. Such analyses help highlight the motivation behind and potential benefits from reforms.[22]

Limited General Equilibrium Approach

Limited general equilibrium approaches can be separated into two categories: multimarket models and demand-side models. *Multimarket models* typically focus on a limited set of price reforms (usually agricultural price reforms) and allow for only a subset of demand and supply responses (e.g., in closely related agricultural output markets). *Demand-side models* focus on demand-side responses only and implicitly assume fixed producer prices so that all tax and price reforms are shifted fully forward onto final goods prices. Both these approaches thus incorporate only a subset of the indirect welfare effects.

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[21] Appendix 3.2 presents two examples of the types of price-shifting models that can be used for reforms of indirect taxes and price subsidies.

[22] Note that such simulations of alternative expenditures can also be motivated by a desire to identify the relative distributional implications of alternative ways of, say, reducing a budget deficit.

Multimarket models are useful when one is interested in price reforms in what are perceived as important markets, such as the rice market. These markets are often directly controlled by governments through a range of policy instruments (e.g., trade taxes or direct price controls) and institutional arrangements (e.g., marketing boards). These models attempt to identify important demand and supply responses in a subset of closely related markets, such as in rice and maize markets, which can have important implications for the efficiency and distributional implications of reforms. Identifying these responses in turn requires the estimation of a system of demand and supply elasticities for well-defined sectors using a combination of household survey information on the pattern of consumption, production, and prices across households and possibly time-series data on production and prices for important crops.

Demand-side models usually cover a broader range of goods and explicitly incorporate the efficiency implications of reforms by allowing for demand-side responses. The basic approach is to calculate the welfare (i.e., combined efficiency and distributional) impact of raising one unit of revenue via different indirect taxes. These welfare impacts can then be compared across commodities to identify revenue-neutral and welfare-improving reforms of the current system, by switching revenue raising from commodities with relatively high welfare costs per unit revenue to those with relatively low welfare costs. Alternatively, such an analysis can be used to determine how to raise extra revenue at the lowest welfare cost.

Incorporating the efficiency implications of taxation into the model essentially allows for the fact that the magnitude of the aggregate welfare loss increases when households respond by reducing consumption, such as by switching away from a taxed good.[23] Partial equilibrium models assume away efficiency effects by assuming that demand is fixed so that a household's share of the tax burden from taxing any commodity is given by its share of total consumption of that commodity. If, to take an extreme example, one cares only about the impact on poor households, then one should increase taxes on goods for which the poor have a relatively low share of total consumption, such as luxuries. However, the fact that households respond to a tax increase by decreasing their consumption of the taxed commodity means that taxes have to be higher to raise a given amount of revenue, thus increasing the total tax burden on households.[24] The tax burden on poor households is calculated as their share in the tax burden (i.e., their share in total consumption) times the total tax burden. For example, if luxuries have high price elasticities, then raising revenue by taxing luxuries as opposed to necessities may actually result in a higher tax burden for the poor even though their *share* of the total burden is lower. Therefore, when elasticities differ sufficiently across commodities, partial equilibrium analyses can give a misleading picture of the best way to raise revenue.

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[23] In practice, the aggregate welfare loss can either increase or decrease depending on the existing structure of taxes. For example, it could decrease if a higher tax leads to a switch of demand to other relatively highly taxed goods.

[24] Note that this example implicitly assumes that the efficiency losses are "returned" to households via changes in the tax under consideration.

Introducing efficiency implications into the analysis requires the additional estimation of a system of price elasticities. The data requirements for calculating the distributional effects are the same as under partial equilibrium approaches, that is, household-level data with consumption matched to tax categories and rates as well as an IO table where tax cascading is an issue. On the efficiency side, one needs to estimate the price elasticities of demand and/or supply, which can be done using information in the household survey. Typically there is a trade-off between simplifying assumptions regarding the structure of household demand and/or supply and the ease of calculation of the elasticities.[25] But a useful approach in practice is to start off with a simple model, run through the analysis, and then increase the sophistication of the analysis over time. The calculation of elasticities within the standard utility and profit-maximizing framework also facilitates the estimation of so-called *exact* (as opposed to *first-order*) measures of the welfare impact of tax reforms, such as through the use of equivalent variation measures of the real income impact on households. These measures allow for the fact that households can avoid some of the tax burden by substituting away from highly taxed goods.

General Equilibrium Approach

General equilibrium approaches incorporate indirect effects arising from demand and supply responses in all commodity and factor markets. Implicit in the demand-side general equilibrium models discussed above is the assumption that producer prices, and thus production technology coefficients, are fixed. This assumption is then consistent with the incidence of all taxes being fully pushed forward onto consumers.[26] However, in general, producer and factor prices cannot be assumed to be fixed, so some of the burden of taxation is pushed backward onto factor prices.

In the literature, one can find two approaches to capturing these wider general equilibrium effects of taxes. One approach is to use a computable general equilibrium (CGE) model, which involves setting out a fully articulated system of demand and supply functions for each of the various sectors of the economy. An alternative approach uses *shadow prices*, interpreted as summary statistics from a model that is not fully articulated, in place of producer prices, and the standard welfare analysis goes through as above but using *shadow taxes* (i.e., consumer prices minus shadow prices) in place of actual taxes.

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[25] See Deaton (1995 and 1997) for discussion of alternative approaches to estimating elasticities and the inherent trade-offs between different approaches in terms of data and the restrictiveness of the underlying assumptions.

[26] To the extent that producer prices (including commodity and factor prices) are truly fixed, such as because of the existence of perfectly competitive imports or government price controls, this assumption is obviously valid. More generally, this assumption would be valid if production technology were characterized by constant returns to scale with a single nonproduced factor of production and no joint products. Under these assumptions the so-called "nonsubstitution theorem" holds and producer prices are unaffected by the pattern of demand. See, for example, Mas-Colell, Whinston, and Green (1995, pp. 157–60) for further details on this issue.

Building computable general equilibrium models is time, data, and modeling intensive.[27] However, once constructed, the model can be used to simulate a wide variety of reforms and market structures. One first sets out a system of commodity and factor demand and supply equations for each sector in the economy and specifies market-clearing and macroeconomic closure rules. The various model parameters are either specified exogenously or calibrated with existing data on consumption, production, and trade flows, leading to a set of equilibrium relative prices. Most of these models tend to be Walrasian in that all commodity and factor markets clear through adjustments in prices, although straightforward extensions are possible to allow for simple factor-market distortions.[28] Demand functions are typically some modified version of the Linear Expenditure System whereas production functions are typically of the Constant Elasticity of Substitution variety. Domestic production of traded goods can also be differentiated according to the degree of substitutability in consumption between imported and domestically produced goods so that domestic prices for traded goods do not necessarily move one for one with world prices. Factor markets are often separated into skilled and unskilled labor, irrigated and nonirrigated land, and capital. Total factor supplies are usually fixed but can be reallocated between sectors and even segmented by region within a country. Note that although the model uses country-specific data on consumption, production, and international trade (e.g., from household surveys, manufacturing surveys, and IO tables), the production parameters are often guesstimates based on parameters available in the literature. In this sense, the models are part empirical and part analytical, and sensitivity analyses using different parameters are important.[29]

Once in place, the model is "shocked" with a tax reform, and a new set of equilibrium commodity and factor prices is calculated. These are used to calculate either first-order or exact welfare changes as above, such as by applying the price changes to household-level data. One can then decompose the total welfare impacts across households into those owing to changes in consumer prices and factor prices. One can also identify separately both the efficiency and distributional implications of the tax reform. Welfare-improving tax reform

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[27] For a discussion of these various resource costs for developing empirical CGE models, see Dahl and Mitra (1991). For examples of the importance of modeling assumptions, see Shah and Whalley (1991) and Clarete (1991).

[28] For example, rationing in the labor market (e.g., unemployment) can be relatively easily incorporated by allowing increased production to draw on unemployed labor at a fixed wage, and imperfect competition can be captured through simple price-markup rules. How appealing these extensions are will depend on the policy context. Note also that the presence of rationing means that welfare effects come not only through price changes but also through changes in quantity allocations (e.g., reallocation of labor between segmented markets with differential labor returns and wage rates for otherwise identical labor types). This possibility has generated a related micro-simulation literature, which projects the new equilibrium (i.e., prices and quantities) from the CGE to household data and supplements the standard CGE analysis with an empirical reduced-form rationing model that allocates household labor to different sectors and generates a new distribution of income. For a more detailed discussion of these issues, see Bourguignon and Pereira da Silva (2003) and Kehoe, Srinivasan, and Whalley (2005).

[29] See Warr (2001), which evaluates reform of Thailand's rice export taxes, for an example of a CGE model that incorporates substantial country-specific estimates of the various parameters.

packages can be constructed by first examining the welfare cost of raising a fixed amount of extra revenue through manipulating individual tax rates and using the insights provided by such an analysis to construct reform packages. Given the sophistication and complexity of the models, with typically many commodity and factor markets interacting simultaneously in the presence of numerous distortions, it is important to decompose the source of the welfare changes for an initial set of narrow reforms so as to develop a clear understanding of the channels through which the welfare effects are operating.

The use of shadow prices provides a less resource-intensive approach for incorporating general equilibrium welfare effects of tax reforms. The parameters of the models underlying the calculation of shadow prices are smaller in number than for a typical CGE model. However, the use of a simpler model is traded off against a greater level of sectoral detail than is typical in a CGE model and the greater flexibility available when incorporating the sensitivity of results to alternative market structures and government policies. For example, the most widely used approach for specifying shadow prices is that of Little and Mirrlees (1974); their approach uses world prices as the basis for shadow prices for traded goods and the marginal social cost of production as the shadow price for nontraded goods. These shadow prices depend on underlying government policies as well as market structure; for example, binding trade quotas are captured by treating the relevant goods as being nontraded. Shadow wages are calculated based on a simple model of the labor market that adjusts for the fact that producer prices are not equated with shadow prices, that labor markets may not clear through wage adjustments but through some form of (often poorly understood) rationing process across sectors, and that the underlying distribution of income is not socially optimal. Other factor markets can similarly be adjusted to allow for price distortions (e.g., in agricultural output and input prices for land, or import prices or the interest rate for capital). These simple shadow-pricing rules are consistent with a wide class of second-best analytical models. The calculation of shadow prices is relatively straightforward, using data available in IO tables and household surveys.

A limitation of the shadow-pricing approach from the perspective of distributional analysis is the fact that the distribution of the indirect welfare effects is not typically analyzed in detail. This reflects in part the fact that the main channel through which indirect distributional effects are incorporated is through the shadow wage rate. This *use of a single shadow wage rate* compares with the CGE approach in which the changes in factor prices are modeled explicitly and these changes can be imposed on household survey data to analyze the distribution of factor income changes across households in different parts of the income distribution.

C. Lessons from the Empirical Literature

The discussion below of the empirical tax reform literature distinguishes among the literature in terms of the modeling approach used as well as the type of tax or price reform being considered. The first distinction is drawn, as above, in terms of the modeling approach used in the analysis, that is, between partial equilibrium, limited general equilibrium, and full general equilibrium models. Within each of these categories, a distinction is made

between three categories of reforms: tax reform, trade liberalization, and reform of public sector prices.[30]

Indirect tax reforms include such reforms as the introduction of a value-added tax (VAT) system in place of existing sales and/or excise taxes. A VAT is often seen as superior to sales taxes because intermediate inputs are not taxed (thus avoiding distortion of production techniques) and a VAT often applied to a broader consumption base. Sales taxes are typically levied on both final and intermediate goods, resulting in tax cascading as tax rates are levied on output prices that have already been adjusted upward in response to higher production costs reflecting taxes on intermediate inputs. Other issues that arise include the inability to tax the informal sector (including household agriculture), the existence of tax-exempt and zero-rated goods and services, and the choice of differential or uniform VAT rates.

Trade liberalization refers to reforms that replace taxes on international trade with taxes levied on domestic consumption (including consumption of imported goods). Such reforms are often motivated by a desire to reduce the distortion in the domestic production and consumption of traded goods. Any revenue losses can be recouped by replacing such taxes with taxes levied on a broader base that does not differentiate between traded and nontraded goods.[31] Because these reforms can be expected to result in relatively large changes in relative producer prices (e.g., between tradables and nontradables), one expects that modeling factor price changes is especially important for this set of reforms.

Public sector pricing reform includes reforms that adjust prices controlled by the government. Developing country governments often control the prices of a range of goods. This control could involve the use of marketing boards, combined with domestic trade and government procurement restrictions, to control the price of agricultural food production. These may be motivated by a combination of revenue (e.g., in the case of important agricultural exports) and distributional concerns (e.g., in the case of subsidized agriculture). In some cases, governments also sell processed foods at subsidized prices subject to quantity rationing. Governments also often control prices of energy, such as petroleum products or electricity, especially in the face of rapidly increasing world oil prices.

Before reviewing the literature, it is useful to distinguish between two distributional concepts, which are referred to as *relative progressivity* and *absolute progressivity*.[32] The concept of relative progressivity is commonly used in studies evaluating tax incidence, whereas the concept of absolute progressivity is more commonly used in studies evaluating

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[30] Appendix 3.2 presents some basic models that can be used to model the partial equilibrium effects of tax and price reforms. Appendix 3.3 presents a brief summary of the theoretical tax literature, the insights from which are often the motivating factors behind these reforms.

[31] See Ebrill, Stotsky, and Gropp (1999) for empirical evidence on the revenue implications of trade tax reforms.

[32] See Pfingsten (1986), Pfähler (1987), Besley and Preston (1988), and Coady and Skoufias (2004) for more detailed discussion.

the incidence of public expenditures. A tax system is relatively progressive if the percentage decrease in income is lower for low-income households. This will be the case if the share of low-income households in the tax burden is less than their share of total income. In this case, then, a neutral (or reference) tax system is one such that the percentage decrease in income owing to the tax burden is equal for all households. A tax system is absolutely progressive if the share of low-income households in the aggregate tax burden is less than their population share—for example, if the bottom 20 percent of the population pays less than 20 percent of the tax burden. The reference for neutrality here is thus a uniform absolute tax burden across all groups. It should be fairly obvious that, in the context of taxes, relative progressivity is a stricter definition of progressivity compared with absolute progressivity, because the former implies the latter but not vice versa. In the context of price subsidies or direct transfers, the opposite holds; that is, absolute progressivity implies relative progressivity but not vice versa. Below, unless specifically stated, the terms *regressive* and *progressive* refer to the relative concept.

Partial Equilibrium Studies

Distributional studies based on the consumption patterns in household-level data suggest that reforms that emphasize VAT and excise taxes are progressive. For example, Sahn and Younger (1999a and b) examines the likely incidence of various taxes in six African countries: Côte d'Ivoire, Ghana, Madagascar, South Africa, Tanzania, and Uganda. Their analysis of consumption patterns suggests that gasoline and diesel excise taxes are relatively progressive, followed by the VAT system. Kerosene excise taxes were found to be the most regressive, and export taxes also often appear to be regressive. Because excise taxes are typically levied on products that are thought to have relatively low price elasticities and are associated with negative consumption externalities (e.g., petroleum products, tobacco, and alcohol), and because a VAT is intended to be levied on a broader tax base, tax reforms that shift revenue raising to these tax instruments are typically assumed to improve both the equity and efficiency impacts of the tax system. Reforms that switch tax revenue from trade taxes (which distort both production and consumption) to a VAT (which, in principle, taxes only consumption) are similarly attractive.

The attraction of excises on petroleum products from a distributional perspective is not altered in studies that allow for the cascading effect of these taxes and the indirect effect on households through changes in other prices.[33] The progressiveness of petroleum excise taxes above is based on the fact that low-income households directly consume relatively small

[33] Many developing country governments directly control the price of petroleum and other energy products. For example, the determination of petroleum prices is fully liberalized (i.e., with the private sector determining prices without having to seek government permission) in only a few countries in sub-Saharan Africa (Chad, Kenya, Lesotho, South Africa, and Tanzania). In the majority of countries, prices are either fully controlled by the government without a functioning formula (11 countries) or government-determined with a functioning price formula (17 countries). In a smaller group of countries the government negotiates prices with the private sector using a formula (11 countries). For a discussion of the welfare and fiscal implications of alternative price-smoothing rules, see Federico, Daniel, and Bingham (2001).

amounts of petroleum products. However, a substantial proportion (e.g., over 50 percent) of petroleum product consumption is typically used as an intermediate input into transport and other production activities. Therefore, the net effect on households will depend on how these higher costs are passed on to consumer prices. Studies that use IO techniques to model these indirect impacts find that, although these taxes appear to be less progressive (because lower-income groups consume petroleum products indirectly), they are still more progressive than are other taxes.[34] Import taxes are similarly found to be more progressive (or less regressive), consistent with the consumption of higher-income groups being more intensive in imported intermediate inputs.

The VAT often appears to be an even more progressive tax once one adjusts for the fact that agriculture and small-scale economic activities are typically VAT-exempt. For example, low-income households often consume food directly from their own production or from small outlets that fall outside the VAT system. This feature tends to make the VAT more progressive. In principle, these households may still pay some tax because the VAT on the inputs into these sectors is not rebated and is thus pushed onto consumer prices. However, the level of this taxation tends to be relatively low and, in any case, many agricultural inputs are often zero-rated.

A number of studies have found that replacing a sales tax with a VAT has made the tax system more regressive (or less progressive). Although the VAT is typically progressive it is often less progressive than the sales taxes it has replaced, mainly because sales taxes have not been imposed on basic foods.

- Munoz and Cho (2004) evaluate the impact of replacing a system of sales taxes with a VAT in Ethiopia.[35] Although the VAT was progressive, partly reflecting the importance of own-consumption for the poorest households (and in spite of exempt goods being

[34] See, for example, Hughes (1986 and 1987, for studies on Indonesia, Thailand, and Tunisia); Chen, Matovu, and Reinikka (2001, for Uganda); Rajemison, Haggblade, and Younger (2003, for Madagascar); Coady and others (2006, for Bolivia, Ghana, and Jordan); and Baig and others (2007, for low/middle-income countries).

[35] Their analysis adjusted for the fact that many households consume from their home production, especially food, and are not normally covered by the VAT system, so they pay the VAT only on their purchases from the market. In common with much of the earlier literature, the analysis also allowed for the existence of tax evasion through the use of implicit tax rates, that is, actual tax revenue divided by the tax base, as opposed to statutory rates, which assume perfect implementation. Because of data constraints, an IO table for Tanzania for 1992 was used. Note that this is unsatisfactory in two ways: using Tanzania data for Ethiopia and using 1992 data when the reforms took place in 2003. However, what matters here is not really that the economic structure of these countries may differ (e.g., greater reliance on agriculture or industry) but that the IO coefficients, which capture technologies and relative prices, may differ. But given the importance of intermediate good taxation, the alternative would be to focus only on the impact arising from the direct consumption of households, which would be even more unsatisfactory given that the impact arising from their indirect consumption can dominate. For example, over 50 percent of petroleum products are often consumed in the production and distribution of goods and services. Although results based on imperfect data need to be qualified, they can still provide a valuable input into the policy debate.

disproportionately consumed by the nonpoor), it was less progressive than the sales taxes it replaced.

- Hossain (1995 and 2003) undertook a similar analysis for Bangladesh, which introduced a VAT in 1991 to replace a system of excise taxes on domestic producers, import duties, and sales taxes levied on both imports and domestically produced goods. The analysis showed that a uniform, revenue-neutral VAT would be substantially more regressive with the reform resulting in more than a 2 to 3.5 percent decrease in the real incomes of the lowest income households compared with a 4.5 to 8.1 percent increase for the highest income households.[36] These rates reflected the inclusion of basic cereals and other food within the VAT system.

- In 2005, an IMF Fiscal Affairs Department team analyzed the distributional impact of introducing a VAT in Bosnia and Herzegovina. The existing sales tax had a standard rate of 20 percent, a preferential rate of 10 percent, and a zero rate for exports and a number of basic food items and certain services. The sales tax was collected at the retail stage except for excisable products (i.e., alcohol and alcoholic beverages, soft drinks, coffee, oil and derivatives, and tobacco and tobacco products), for which it was collected at the importer or manufacturer stages. The proposed VAT was expected to involve a single rate of 17 percent, and the inclusion of previously exempt goods at this higher rate gave rise to concerns within the government regarding the impact of the reform on low-income households. The analysis found that the VAT was slightly less progressive than sales taxes. The tax reform would result in an increase in the average tax burden in the range of 1.9 to 2.6 percent across deciles, the higher percentage being for the lower-income deciles.

The progressiveness of the VAT can be improved by zero-rating basic foods. For example, Hossain (1995 and 2003) examines how zero-rating food in Bangladesh would affect the distribution of the tax burden. The existing system (which taxed food) is compared with a system that zero-rated food grains and vegetables, applied a uniform rate on other goods and services, and levied excise taxes on tobacco, energy goods, and sugar. This system is found to be less regressive, with the reform leading to lower losses for lower-income households, in the range of 1.2 to 2.7 percent, and lower gains to higher-income households, in the range of 0.8 to 6.6 percent.[37] Note, however, that although the VAT can be restructured to enhance its

[36] Real income effects were calculated using estimates of equivalent variation based on estimated demand elasticities. Note also that the analysis focused on total consumption and did not distinguish between households that were net producers and those that were net consumers of food grains. Refaqat (2003) uses household survey data for 2001 to evaluate the distributional impact of the VAT in Pakistan and finds that it is very slightly progressive. Chen, Matovu, and Reinikka (2001) find that the VAT introduced in Uganda in 1996 was no less progressive than the sales taxes it replaced.

[37] For other examples of the distributional gains from introducing differential VAT rates, see Ahmad and Ludlow (1989) and Ahmad and Stern (1991, Chapter 7) in the context of Pakistan, and Gibson (1998) in the context of Papua New Guinea. The first two papers also find that the general distributional picture is unchanged when one adjusts for the fact that tax changes are not marginal by using equivalent variation measures of welfare impacts.

progressivity, the substantial leakage of benefits to higher-income households makes such an approach much less attractive than, say, a well-designed and -targeted direct transfer program.

The direct effect of agricultural trade liberalization, which increases prices, appears to be to decrease overall poverty but increase extreme poverty.[38] For example, Ravallion and Lokshin (2004) examine the likely distributional consequences of agricultural trade reform in Morocco. The authors take the output price changes generated by a CGE analysis of the removal of cereal import tariffs and apply them to a household survey to identify their first-order welfare effects, taking into account the fact that some households are net producers and others net consumers of cereals.[39] They find that the consequent price decreases in cereals result in an increase in the rural poverty head count index, reflecting the fact that the rural poor are on average net producers of cereals. Note, however, that this scenario could also be consistent with the extremely poor benefiting if they were net consumers. For example, in their analysis of an increase in rice prices in Indonesia, Ravallion and van de Walle (1991) find that the extreme rural poor, who tend to be landless and net consumers of rice, suffered decreases in income whereas the moderately poor tended to be net producers and to gain from the reform. In addition, as shown below, the impact of the reforms on factor markets tends to reverse these effects so that these output price effects may be interpreted as short-run impacts prior to adjustments on factor markets (e.g., adjustments in unskilled wages).[40]

Limited General Equilibrium Models

One of the central findings of early empirical work on tax reform was the strong trade-off between efficiency and distributional concerns (Ahmad and Stern, 1984, 1987, and 1991). Commodities that were very attractive sources of revenue from the perspective of efficiency (e.g., food, which typically has a low price elasticity and thus a low deadweight loss associated with its taxation) were very unattractive from the perspective of their

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[38] Many partial equilibrium studies evaluate such impacts: see, for example, Trairatvorakul (1984, Thailand); Krueger, Schiff, and Valdes (1988); Deaton (1989, Thailand); Budd (1993, Côte d'Ivoire); Barrett and Dorosh (1996, Madagascar); Case (2000, South Africa); and Chen and Ravallion (2003, China). Reimer (2002) and Hertel and Reimer (2004) provide very good surveys of different trade reform studies and should be consulted for a more detailed and exhaustive summary of this literature. See Cornia, Jolly, and Stewart (1987) and Pinstrup-Andersen (1988) for a discussion of the motivation behind these policies. For an overview of alternative approaches to assessing the welfare impacts of trade policies, see McCulloch, Winters, and Cirera (2001).

[39] Note that although a CGE model generated the price changes, factor price changes are not incorporated into the analysis. The likely implications of this are discussed in later sections. But note that Lofgren (2000) found that, in the short run, although domestic trade liberalization produced aggregate gains for the country, the rural poor lost out.

[40] Ravallion (1990) discusses the importance of wage effects when evaluating reforms in rice pricing in Bangladesh, indicating that wage effects are likely to dominate commodity price effects over the long term, as would be expected from the well-known Stolper-Samuelson theorem. See also Porto (2003a and 2003b) and Nicita (2003) on trade liberalization in Argentina and Mexico, respectively. In the former case, trade liberalization was found to benefit the poor more than the rich. In the latter, although trade liberalization was found to decrease poverty, inequality increased.

distributional impact (e.g., food is relatively more important in the budgets of the poor). In other words, taxing commodities for which low-income households have a relatively small share of the commodity tax burden will not necessarily lead to a smaller welfare loss for these households. This finding has two important implications for tax reform policy. First, ignoring the efficiency implications of taxes can give a misleading indication as to which commodities to tax more if one wants to minimize the welfare impact on poor households. Second, improved distributional outcomes via commodity taxation are typically bought at the expense of substantial inefficiency. Therefore, using the indirect tax system should generally be viewed as a short-term measure until more cost-effective redistributional policy instruments are developed, such as a well-designed and -implemented social protection program.[41]

However, it may be possible to identify commodities that are relatively attractive sources of tax revenue even when both equity and efficiency considerations are taken into account. For example, in the Ahmad and Stern (1991) studies of tax reform in Pakistan, the marginal social costs of raising revenue via taxes on rice, edible oils, housing/fuel/light, and clothing were always below the median. The attraction of taxation of cereals, on the other hand, depended on how concerned one was about distribution when setting tax levels. If effective direct redistribution instruments do not exist, then taxation of cereals is not desirable, even though the distributional gains come at a high efficiency cost.

The ranking of commodities may, however, be sensitive to the initial structure of taxes in a country. The marginal social cost of raising revenue through increasing a tax on a specific commodity depends on the existing level of taxes on commodities as well as on the patterns of own- and cross-price elasticities and consumption across income groups. Therefore, even if one expects that the latter patterns are similar across similar countries, the former may differ greatly. Therefore, one should be cautious when transporting policy lessons across countries.

Studies of agricultural price reforms (e.g., as part of trade liberalization) using multimarket models reinforce the partial equilibrium finding that rural extreme poor and urban poor lose from price increases but the urban moderate poor gain. Minot and Goletti (2000) evaluate the

[41] A recent paper by Nicita (2004) is indicative of the detail that can be introduced on the efficiency side of the analysis. The paper evaluates the potential for welfare-improving marginal price reforms across different food groups in Mexico—abstracting from the issue of effective versus nominal taxation—and makes three interesting innovations. First, using a model developed by Deaton (1987, 1988, and 1990) and Deaton and Grimard (1992), it estimates demand elasticities using a model that allows for quality differences in commodities. Second, separate sets of elasticities are estimated for income quintiles and rural and urban areas. Third, these elasticities are estimated using a series of six household surveys covering a period of 12 years from 1989 to 2000. The results show that income and price elasticities varied substantially across households, with lower-income households tending to have significantly larger income and price elasticities. The results also indicate that, even within these smaller subgroups of consumption, there is potential for welfare-improving price reforms and that there is a trade-off between efficiency and distributional concerns. An interesting extension of this work would be to evaluate separately the importance of calculating exact welfare impacts as opposed to first-order impacts for the distributional and efficiency implications of tax reforms.

distributional impact of the removal of rice export quota controls in Vietnam using a multimarket model. Their model simulates the demand and supply responses in the markets for four staple foods (rice, maize, sweet potatoes, and cassava) in seven regions of the country. The resulting welfare impacts thus take account of important demand and supply responses of households. Their model also allows for the impact of higher rice production in terms of lower world prices. The results of their analysis of the welfare impact of rice price changes indicate that the poorest rural farmers lose from the higher domestic rice prices as do the urban poor, reflecting the fact that both are net consumers. Nonpoor rural households gain, reflecting their net-producer status. A similar but less pronounced pattern was observed when a simple first-order partial equilibrium analysis reflected the fact that the higher rice production reduces world prices so that domestic rice prices do not increase by as much.[42]

General Equilibrium Models

The results from tax reform analysis can differ substantially when one uses shadow taxes in place of effective taxes. For example, Ahmad and Stern (1990 and 1991) look at the implications of this in the context of tax reform in Pakistan.[43] As one would expect given the implicit assumption in the calculation of effective taxes that all goods are nontraded, both sets of taxes differ substantially when goods are traded and subject to trade taxes or price controls. For example, when wheat and rice are treated as nontraded, their revenue collections were applied to the total consumption base, implying tax rates of –1.8 percent and 1.7 percent, respectively. When treated as traded, these revenues were applied to the smaller trade base to give substantially higher rates of –30.3 percent (reflecting import subsidies) and –10.8 percent (reflecting export taxes). But note that effective and shadow taxes can also differ for non-traded goods when factor markets are distorted or the prices of important traded inputs are distorted.

Because existing tax rates enter into the efficiency side of the analysis, not surprisingly, the differences that arise do so with regard to the efficiency implications of tax reform. For example, the large initial subsidy on wheat when shadow prices are used now makes it a much more attractive source of revenue (i.e., by reducing the subsidy) from an efficiency perspective. But such an increase is still as unattractive from a distributional perspective as before. The result is that the trade-off between efficiency and distributional concerns is increased, indicating a potential efficiency gain from having access to an effective transfer system that would enable efficiency considerations to take more prominence when tax rates are set.

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[42] See also Sadoulet and de Janvry (1992) for an analysis of the likely short- and long-run effects on the poor in different African and Asian economies. They also examine the potential for social protection programs to offset the short-run adverse welfare effects on the poor.

[43] See also various chapters in Newbery and Stern (1987) for further discussion of the theory and application of the shadow-pricing approach.

The results from the shadow-pricing literature also highlight the fact that in the evaluation of reforms that liberalize agricultural prices, it is extremely important to capture the nature of and constraints on the policy instruments used as well as the precise consumption and production relationship between alternative agricultural commodities. Coady (1997a) extends the above results for Pakistan to allow for a more realistic and broader set of policy instruments, including the fact that households are both producers and consumers of agricultural commodities so that only net market trades (or marketed surplus) can be taxed. In this context, what matters for efficiency is the net trade (as opposed to total consumption) elasticities. When one allows for the fact that net trade is only a small proportion of total consumption and that commodities that are substitutes in consumption may be complements in production, not only are the net trade own- and cross-price elasticities substantially higher than consumption elasticities but their sign can also be different. For example, in Pakistan in the early 1980s, around 60 percent of wheat and 20 percent of rice were consumed on-farm. Reflecting this, and the fact that wheat and rice are sown in rotation on the same land and thus are production complements, the own- and cross-price net trade elasticities were very high and positive.

The constraint of being able to tax only net trades can therefore have substantial implications for both the distributional and efficiency implications of taxes. For example, in Coady (1997a), although rural households were, on aggregate, net producers of wheat, in rural areas poor households tended to be net consumers and nonpoor households tended to be net producers. As a result, low wheat prices (reflecting low procurement prices) acted as a subsidy to low-income households financed by a tax on high-income households, so that low prices were an extremely powerful redistributive instrument. However, net trade elasticities were also very high so that the efficiency costs of low prices were very large. Therefore, the constraint of being able to tax only net trade magnifies the trade-off between efficiency and distribution in setting taxes.

The corollary is that the efficiency gains from reforming the existing system of tax and price controls were also very substantial—in fact, the direct revenue-reducing effect of higher procurement prices for wheat was swamped by the positive indirect revenue effects through higher government procurement replacing more expensive wheat imports as well as increased production and export of rice resulting in higher export tax revenue. In other words, existing taxes were on the wrong side of the Laffer curve.[44] This finding also reinforces the argument implicit in multimarket modeling that focusing on the price reform for one agricultural commodity in isolation may give misleading results. For example, the welfare impacts of lowering wheat prices were strongly influenced by the indirect revenue effects from lower rice exports. Note also that the presence of this indirect revenue effect

[44] For a similar result in the context of factor market distortions, see Devarajan, Thierfelder, and Suthiwart-Narueput (2001). Using CGE analysis for Bangladesh, Cameroon, and Indonesia they find that some tax increases have a "negative deadweight loss" reflecting reallocation of factors across sectors with differential factor productivities. Their analysis shows that the results can be very sensitive to the underlying assumptions about factor market functioning and that the potential for efficiency improving tax reforms is great.

through rice suggests that low wheat prices may be less inefficient if rice prices were higher. In other words, higher rice prices enable the distributional gains from low wheat prices to be achieved at a lower efficiency cost. This sequential approach to price reform could help mitigate the adverse distributional effects from a move to a more efficient price and tax system until an effective social protection system can be developed.

Analyses of tax systems using CGE models have supported the partial equilibrium findings that energy taxes are progressive and that the distributional effect of a VAT depends on how basic foods are treated.[45] For example, Go and others (2005) test the partial equilibrium findings by Fourie and Owen (1993) that the VAT in South Africa was mildly regressive. Applying the same partial equilibrium method for 2001, they found similar results, with low income households paying over 5 percent of their income in VAT compared with only 3.5 percent for high-income groups. This situation occurred despite the fact that certain food items (e.g., brown bread, maize meal, milk and milk powder, rice, and unprocessed vegetables and fruits) are zero rated and small-scale firms are not required to register for the VAT.

To evaluate the welfare impact of the current VAT, they remove it completely and replace it with a proportional income tax in order to balance the government budget and not influence the overall incidence of indirect taxes. Whereas the overall tax system (including direct taxes, fuel and excise taxes, tariffs, and the VAT) is progressive, the VAT is found to be mildly regressive. Overall, the high-income groups pay over 20 percent of their income in taxes whereas low-income groups pay less than 10 percent. With the VAT, high-income groups pay less than 4 percent whereas low-income groups pay over 5 percent. When the VAT is removed and revenue replaced by scaling up sales taxes (which are levied on petroleum, beverages, and transport equipment) by 262 percent, the overall tax burden becomes slightly more progressive, indicating that a VAT is more regressive than sales taxes. This regressive incidence partly reflects the relatively high VAT rate on food, which is particularly important for poor households, and sales taxes are higher on goods disproportionately consumed by high-income households. Removing the VAT on food and increasing the base rate on other goods to 16.4 percent so as to keep VAT revenue constant transforms the VAT from a regressive to a progressive tax; low-income households pay less than 2 percent in VAT payments whereas high-income households pay more than 3 percent (compared with more than 5 percent and less than 4 percent, respectively, under the previous VAT structure).[46]

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[45] Using a CGE model for Mexico, Sobarzo (2000) found that increasing VAT rates did not lead to substantial changes in producer prices. This is not surprising given the openness of the economy because, for traded sectors, producer prices are determined by world prices. The incidence of VAT increases was found to be progressive whereas the pattern of incidence of higher energy prices was found to have an inverted-J shape, with welfare decreases being higher for the middle-income group, followed by the "poor" and the "rich," ordered by magnitude. Reducing the VAT combined with higher energy prices had a progressive incidence. The poor gained least from the removal of tariffs.

[46] Similar results are found by the Devarajan and Hossain (1995) analysis of taxes in the Philippines, which finds that indirect taxes as a whole are near neutral. Energy taxes are found to be progressive, reflecting the

(continued)

Analyses of the distributional impacts of trade liberalization using CGE models completely overturn the findings of studies that use partial equilibrium and limited general equilibrium models. The distributional impacts through factor markets are likely to be particularly important in the context of trade liberalization, which results in substantial changes in relative producer prices, that is, the relative prices of traded and nontraded commodities. Reimer (2002) and Hertel and Reimer (2004) provide surveys of the empirical findings from analyses of the distributional impact of trade liberalization. They find that a key channel for these impacts is the effect of reforms on factor markets, particularly labor markets. This finding is to be expected insofar as (1) classical trade theory shows that changes in output prices brought about by trade reforms lead to magnified changes in factor prices for intensively used factors, with the degree of magnification being higher in the short run when some sector-specific factors exist; and (2) households are typically more specialized in terms of sources of income compared with consumption patterns. For example, the removal of an export tax on rice will lead to an increase in domestic prices. If rice is relatively intensive in unskilled labor compared with other sectors, then the unskilled wage rate can be expected to increase proportionally more than rice prices. If the poor are net consumers of rice and receive most of their income from their unskilled labor, then the positive wage effect can be expected to dominate the negative effect of higher rice prices. Therefore, evaluations of the distributional effects of trade liberalization need to incorporate these factor price effects into their analysis through general equilibrium analysis.[47]

There is also evidence from CGE analysis that the use of optimal export taxes on agricultural exports can have adverse effects on poverty as well as on market share in the long run. Warr (2001) provides a very interesting and rigorous example of the use of CGE modeling to evaluate the distributional implications of controlling the domestic price of rice in Thailand using export taxes. Thailand is perceived as having some monopoly power in international rice markets so that, on the basis of first-best efficiency arguments, a positive export tax is optimal. With an export demand elasticity for rice of 0.25, the optimal tax from this perspective turns out to be about 42 percent and the net welfare gain is 0.63 of a percentage point of GDP compared with a situation with a zero export tax. However, this tax decreases the domestic price of rice so this aggregate gain comes at the expense of both rural and urban poor, reflecting lower prices for poor producers and lower unskilled wages for poor consumers. Incorporating even relatively modest distributional concerns into the analysis

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relatively high energy-intensity of goods consumed by higher-income households, whereas import and value-added taxes were found to be neutral in their incidence. When combined with the substantial progressive incidence of expenditures, the overall tax-cum-expenditure incidence is strongly progressive. The effect of taxes is virtually identical across income deciles, leading to a 20 percent decrease in real incomes. But there are substantial differences between the incidence of expenditures, with the bottom decile experiencing a 47 percent increase in income, which falls to around 11 percent for the middle two deciles and to less than 7 percent for the top three deciles. The net effect of the tax expenditure system led to a 26 percent increase in income for the lowest decile, about an 8 percent decrease in income for the middle two deciles, and nearly a 20 percent decrease in income for the top decile.

[47] See Shah and Whalley (1991, Pakistan), Clarete (1991, the Philippines), and Harrison, Rutherford, and Tarr (1993, Turkey) for the analysis of the impacts of trade liberalization in specific countries.

substantially changes this outcome, with the optimal situation quickly switching to a subsidy of 20 percent. The results highlight that (1) the main distributional effects come through factor-market prices, (2) higher rice prices are distributionally powerful in the long run even if poor net consumers lose in the short run before unskilled wages increase, and (3) any short-term efficiency gains from export taxes may come at the cost of higher poverty.

Results from CGE analysis also reinforce the finding that there may be substantial welfare gains from using more direct policy instruments to protect the incomes of low-income households in place of adjusting tax rates. For example, Coady and Harris (2004) look at the welfare impacts of using the revenue generated by efficiency-improving tax reforms to finance a (perfectly targeted) direct transfer program in Mexico. The initial indirect tax system was characterized by large agricultural food subsidies and a differentiated VAT structure with a low rate of zero applied to raw and processed food. The tax reforms considered are intended essentially to (1) remove agricultural subsidies, (2) keep the current VAT structure but scale up the rates, and (3) increase the VAT rate on food. When the revenue is raised by removing food subsidies, the cost to households is only 62 percent of the revenue raised (i.e., the cost of a unit of public funds is 0.62). Similarly, when revenue is raised through a single VAT applied to all sectors, the cost of public funds is only 0.95, so the gains from reforming the VAT structure outweigh the losses from the higher average rate required to finance the introduction of the transfer program. The other tax reforms considered all had costs of public funds in the range of 1.05 to 1.07. Although both low-income and high-income households bore a disproportionate amount of this higher tax burden, the existence of a well-targeted transfer program more than offset this negative effect on the poorest households. The gains from introducing such a program are thus twofold. First, the transfers are better targeted than are the subsidies inherent in the tax system. Second, the presence of the program enables one to focus on efficiency considerations when setting VAT rates. These findings were found to be very robust for alternative parameter values for the underlying consumption, production, and trade functions.

When CGE models are used to evaluate tax reforms, it is important to present the sources of the welfare impacts in a transparent manner both to have a clear understanding of the channels at work and to enhance the credibility of findings. For example, in Go and others (2005), the nominal wages of semiskilled and unskilled labor are fixed, reflecting unemployment of these types of labor. Therefore, tax reforms that increase demand in domestic sectors that are intensive in relatively unskilled labor will tend to increase welfare. For example, reducing taxes on a nontraded unskilled-labor-intensive sector can be expected to result in a substantial efficiency gain arising from the conventional decrease in deadweight loss but also the reduction in unemployment. In the language of the shadow-pricing model discussed above, the shadow tax (e.g., consumer price minus the social marginal cost of production) is high for these sectors, so decreasing them can lead to large welfare gains from the elimination of this shadow deadweight loss. It would therefore be useful to identify the various sources of the overall welfare impact, such as changes in output prices, changes in factor prices, and changes in unemployment. Whereas in the Walrasian model, with markets clearing through price adjustment, welfare impacts can be expressed solely in terms of price changes; in models where commodities or factors are rationed (e.g., with unemployment),

welfare impacts depend on both price and quantity changes. Note also that results may in general be very sensitive to the mechanisms used to allocate rationed quantities across households with different socioeconomic characteristics, and the relatively simple allocation process used in a CGE may give very different results to a more sophisticated allocation process, say, similar to those being used in recent CGE-microsimulation models.

D. Conclusions

This section summarizes the main issues and findings discussed in the chapter, dealing first with lessons regarding the use of the alternative methodologies, then summarizes the findings from the empirical literature.

Methodological Lessons

(1) Simple partial equilibrium analyses can provide valuable information on the likely magnitude of the impacts of tax and price reforms on household real incomes as well as the distribution of the impacts across households. These studies have relatively low resource costs in terms of data, time, and modeling requirements and can therefore be undertaken on a routine basis. When combined with a qualitative discussion of their likely efficiency and fiscal implications as well as a quantitative analysis of the potential uses of revenue (e.g., mitigating measures or the financing of other social expenditures), these studies can be a very effective input into policy dialogue and the development of credible and acceptable reform strategies. As with all studies of tax reforms in developing countries, it is important that one incorporates the constraints on tax instruments into the analysis (e.g., the inability to tax consumption from own-production in rural areas or informal sector transactions) because these can greatly affect the distributional impacts of reforms.

(2) General equilibrium models are necessary when one wishes to evaluate and highlight the magnitude of the efficiency implications of reforms and the trade-off with distributional impacts. These studies can help highlight the fact that using indirect taxes to mitigate the adverse effects of taxation on the real incomes of poor households can be a very inefficient approach relative to a more direct approach to social protection through well-designed and well-implemented social safety net programs. Although the shadow pricing approach can provide a flexible and relatively low resource cost approach to explicitly incorporating the magnitude of the efficiency impacts, it is less useful when one wishes to disaggregate the distribution of these indirect effects. For this, a computable general equilibrium model is required. Building such a model from scratch is a resource-intensive activity. However, where one is available, the cost of adapting it for the analysis at hand is much lower.

(3) The use of the computable general equilibrium model is particularly valuable when analyzing the distributional impact of reforms that involve significant changes in producer prices, such as in trade liberalization. The distributional impacts of such reforms arise mainly through changing factor prices as opposed to changing consumer prices, and the relative distributional impacts can differ substantially across these two channels. Typically the consumer price effects are interpreted as short-run impacts until factor prices have time to adjust.

Empirical Lessons

(1) Typically, the introduction of a relatively broad-based VAT in place of sales taxes has reduced the progressivity of the tax system, reflecting the broadening of the tax base to include previously exempt goods and services, which are usually relatively more important in the budgets of the poor, and/or the reduction of taxes on goods that are relatively more important in the budgets of higher-income households. Therefore, revenue-neutral reforms will generally lead to gains by upper-income groups at the expense of lower-income groups.

(2) Excise taxes on petroleum products (except kerosene), tobacco, and alcohol are highly progressive, even after allowing for their indirect effects, which tend to be less progressively distributed compared with their direct effects.

(3) Because both these tax instruments are often associated with a more efficient collection of tax revenue—reflecting their broader base, lower price elasticities, and negative consumption externalities—opportunities exist for improving both the efficiency and equity effects of tax reform. The introduction of the VAT and the use of excise taxes on petroleum products and tobacco play an important role in realizing these welfare gains. For example, the use of excise taxes can help to generate sufficiently large revenues, enabling the VAT to be introduced at a lower rate. The introduction of differential rates, with lower rates on goods consumed disproportionately by the poor, would further improve the progressivity of the VAT.

(4) In practice, distributional gains from tax reform often come at the expense of efficiency, and these may be particularly large in the context of agricultural commodities where households are both consumers and producers and the tax base is limited to net market trades of these commodities. It is therefore useful to have some indication of the relative magnitude of these trade-offs across commodities.

(5) Similarly, although differentiating excise taxes within aggregate commodity groups, such as low taxes on kerosene combined with higher taxes on gasoline and diesel, may help to mitigate the impact on the real incomes of the poor, this is likely to come at a high efficiency and revenue cost given the relatively high degree of substitutability between these different commodities, especially over the long term.

(6) In general, manipulating commodity taxes to mitigate the impact on poor households is a very blunt second-best approach to protecting the real incomes of the poor given the substantial leakage of benefits to higher-income households and the potentially large efficiency costs. In cases where price manipulations provide a very effective approach to distribution—for example, low prices for agricultural goods both produced and consumed by rural households—the efficiency cost is very high. The introduction of well-designed and well-implemented social safety net programs provides a more effective way of protecting the poor and can generate substantial efficiency gains by allowing taxes to be raised more efficiently. In this regard, the paucity of information often available on the design, implementation, and performance of targeted social programs is a major constraint on policy

advice in this area. If an effective safety net system is not in place then knowledge of the magnitude and pattern of the equity-efficiency trade-off can guide the choice of tax-mitigating mechanism that should be used as a short-term social protection measure.

Appendix 3.1. Theoretical Approach to Evaluating the Welfare Impact of Price Reforms

The empirical literature evaluating the welfare impact of commodity tax or price changes (or reforms) covers a broad range of methodological approaches, which can be usefully classified according to whether they are general equilibrium, partial equilibrium, or somewhere in between (often referred to as limited general equilibrium or multimarket models). This appendix sets out a general equilibrium model that captures the key ingredients of any analysis of the welfare impacts of commodity tax or price reforms, recognizing the three different roles played by commodity taxation and price controls, namely, resource mobilization (i.e., government revenue), resource reallocation (or efficiency), and resource redistribution (or equity). Although it focuses primarily on the distributional consequences of price changes, a comprehensive evaluation of such reforms must recognize the other dimensions of these reforms because these may be the main factors motivating the reforms in the first place and can be expected to have important implications for household welfare. For example, the price changes may reflect the desire to reform the structure of commodity taxes to raise either the same or greater revenue more efficiently. Or the price changes may reflect a desire to make public sector prices better reflect the true cost of meeting demand. Where revenues increase, these may be used to increase coverage of social safety nets among the poorest households or to expand access to valuable publicly supplied services, such as education, health and nutrition, or various infrastructures. A comprehensive evaluation of price effects, therefore, needs to take all these implications into account.

The appendix starts by describing the model and deriving analytical equations identifying the main ingredients in the general equilibrium analysis of the welfare impacts of *marginal* reforms. This analysis is then used to interpret partial equilibrium analyses as a special case, making explicit the assumptions behind these analyses. This is followed by a brief discussion of how the analysis needs to be adapted for the evaluation of non-marginal tax and price reforms. Finally, the various data and modeling requirements of each approach and the trade-offs inherent in these choices are set out.

The Model[48]

Consider an economy made up of households (denoted by superscript $h = 1,H$), producers (denoted by superscript $g = 1,G$), and the government. Households choose consumption bundles ($\boldsymbol{x}^h$) based on the following constrained maximization problem:

$$\text{Max } U^h(\boldsymbol{x}^h) \quad \text{s.t.} \quad \boldsymbol{q}.\boldsymbol{x}^h = m^h$$

[48] The model draws heavily on the works of Guesnerie (1979) and Drèze and Stern (1987). Bold face denotes a vector.

$$x_i^h \leq \tilde{x}_i^h \qquad \text{for each } i \text{ ,}$$

where $\boldsymbol{x}(\boldsymbol{q}, \tilde{\boldsymbol{x}}^h, m^h)$ is an n-dimensional vector of net demands of household h, x_i^h is the consumption of commodity i by household h (with $i = 1,N$), $\tilde{x}_i^h$ is a vector of rationing constraints faced by the household, $\boldsymbol{q}$ is a vector of consumer prices (with factor prices entering as negative numbers), and m^h is lump-sum income of household h. The vector $\boldsymbol{x}$ of net consumer demands has the standard properties with respect to $\boldsymbol{q}$ and m^h.[49] Lump-sum income of household h consists of the sum of its share in private profits and a lump-sum transfer (r^h) from the government:

$$m^h \equiv r^h + \sum\nolimits_g \theta^{hg} \prod^g , \tag{3.1}$$

where $\Pi^g \equiv \boldsymbol{p}\cdot\boldsymbol{y}^g$ is the profit of firm g, θ^{hg} is the share of household h in firm g's profit, $\boldsymbol{p}$ is a vector of producer prices, and $\boldsymbol{y}^g$ is the net supply vector (or production plan) of firm g.

Producers choose net supply vectors $\boldsymbol{y}^g$ (with positive entries for outputs and negative entries for inputs) to maximize the following profit maximization problem:

$$\text{Max } \boldsymbol{p}\cdot\boldsymbol{y}^g \qquad \text{s.t.} \qquad \boldsymbol{y}^g \in \boldsymbol{Y}^g$$

$$y_i^g \leq \tilde{y}_i^g \qquad \text{for each } i \text{ ,}$$

where $\tilde{y}_i^g$ is an n-dimensional vector of quantity constraints and Y^g is the production set of firm g, which is assumed to be convex.[50] The solution is denoted $\boldsymbol{y}^g(\boldsymbol{p}, \tilde{\boldsymbol{y}}^g)$ and has the standard properties with respect to $\boldsymbol{p}$, the vector of producer prices.[51]

Let $(\boldsymbol{p}, \boldsymbol{t}, \{\tilde{\boldsymbol{x}}^h\}, \{\tilde{\boldsymbol{y}}^g\}, \{r^h\}, \{\theta^{hg}\})$ be the vector of signals to which households and firms respond. These signals can be partitioned into two types: exogenous signals or parameters, and control variables. The social planner chooses among the set of variables under his or her control (i.e., the control variables), taking other variables (i.e., exogenous variables) as given, so as to maximize social welfare subject to a set of scarcity constraints (i.e., the constraint that demands equal supplies) and its own budget or revenue constraint (discussed below). Denoting the set of control variables by $\boldsymbol{s}$ and the set of exogenous variables as $\boldsymbol{\omega}$, then the planner's problem can be written as choosing the $\boldsymbol{s}$ to

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[49] Note also that, subject to regularity conditions, the constrained demand functions $\tilde{\boldsymbol{x}}(.)$ also have the standard properties with respect to $\boldsymbol{q}$ and m^h. For instance, Roy's identity and the Slutsky equations continue to apply. Similarly, the Slutsky matrix $\boldsymbol{S}$ is symmetric and negative semi-definite and $\boldsymbol{q}\cdot\boldsymbol{S} = \boldsymbol{0}$. The main difference is that the matrix $\boldsymbol{S}$ has columns of zero entries for commodities such that the quantity constraint is binding (because a small change in the price of such a commodity works like a change in lump-sum income).

[50] Strictly speaking, we need only convexity in the space of commodities for which the quantity constraints are not binding.

[51] Note also that the quantity constraints enable one to treat the net supply vectors of firms operating under constant returns to scale as functions rather than as correspondences.

Max $W(...,V^h(\boldsymbol{s};\boldsymbol{\omega}),...)$ s.t. $\sum_h \boldsymbol{x}^h(\boldsymbol{s};\boldsymbol{\omega}) - \sum_g \boldsymbol{y}^g(\boldsymbol{s};\boldsymbol{\omega}) = 0$,

where $V^h(.)$ is the household's indirect utility function and $W(.)$ is a Bergson-Samuelson social welfare function. If $V^*(\boldsymbol{s};\boldsymbol{\omega})$ denotes the maximum value function of this problem, then, from the envelope theorem, the gradient of V^* is the same as the gradient of the following Lagrangian:

$$L = W(...,V^h(\boldsymbol{s};\boldsymbol{\omega}),...) \quad - \boldsymbol{\upsilon}[\boldsymbol{x}(\boldsymbol{s};\boldsymbol{\omega}) - \boldsymbol{y}(\boldsymbol{s};\boldsymbol{\omega})],$$

where $\boldsymbol{x} \equiv \sum_h \boldsymbol{x}^h$ and $\boldsymbol{y} \equiv \sum_g \boldsymbol{y}^g$ denote the aggregate (net) consumer demands and aggregate (net) producer supplies, respectively, and $\boldsymbol{\upsilon}$ is a vector of Lagrangian multipliers or *shadow prices*. If ω_k is a particular component of the vector $\boldsymbol{\omega}$ of parameters (e.g., a tax or lump-sum transfer), then the social value of a marginal change in ω_k (or the marginal social value of ω_k, the reform MSV_k) is

$$MSV_k \equiv \frac{\partial V^*}{\partial \omega_k} \equiv \frac{\partial L}{\partial \omega_k} = \sum_h \frac{\partial W}{\partial V^h}\frac{\partial V^h}{\partial \omega_k} - \upsilon \cdot \frac{\partial (x-y)}{\partial \omega_k} \ .$$

The first term on the right-hand side is the *direct* effect on social welfare and the second term is the *indirect* effect capturing the social value of the additional excess demands generated by the proposed reform. Note that the shadow prices will also depend on the specification of choice variables.

So far the government's budget constraint has not been explicitly introduced. However, by Walras' law, if commodity markets balance then so too does the remaining government budget constraint. Then, as shown by Drèze and Stern (1987), using Walras' law the above Lagrangian can be equivalently rewritten as

$$L(\boldsymbol{s};\boldsymbol{\omega}) = W(...,V^h(\boldsymbol{s};\boldsymbol{\omega}),...) + \lambda R,$$

where R is the shadow revenue of the government, defined as

$$R \equiv \tau \cdot x + \tau^p \cdot y + \sum_g \theta^{0g} \Pi^g - \sum_h r^h \ , \tag{3.2}$$

where $\boldsymbol{\tau} \equiv (\boldsymbol{q} - \boldsymbol{\upsilon}^*)$ and $\boldsymbol{\tau}^p \equiv (\boldsymbol{\upsilon}^* - \boldsymbol{p})$ can be interpreted as shadow consumer taxes and shadow producer taxes, respectively, and $\boldsymbol{\upsilon}^* \equiv \boldsymbol{\upsilon}/\lambda$ is a vector of normalized shadow prices. Note that λ, the shadow value of government revenue, is basically a normalization parameter since a different cardinalization of the social welfare function $W(.)$ leads to a different λ but leaves $\boldsymbol{\upsilon}^* \equiv \boldsymbol{\upsilon}/\lambda$ unchanged. This reformulation is very useful in that it converts this complex general equilibrium model into a more standard format of a trade-off between consumer welfare and (shadow) government revenue.

The relationship between shadow prices and market prices will depend on both the structure of markets and government policy. For example, for a small open economy the shadow price of traded goods is the world price, and a tariff will drive a wedge between market prices and

shadow prices with $\boldsymbol{q} = \boldsymbol{p} > \boldsymbol{\upsilon}^*$. For nontraded goods the shadow price is the marginal social cost of production so that, for example, if the government keeps the price of such a publicly supplied good below this level, $\boldsymbol{q} = \boldsymbol{p} < \boldsymbol{\upsilon}^*$. Imported commodities subject to binding import quotas can be treated as nontraded goods because extra demand must be met from increased domestic production.

Price Reforms

The above model is now used to derive analytical equations for evaluating the welfare impact of a marginal change in the consumer price of commodity *i* (i.e., dq_i), for example, owing to a change in the tax rate or a change in public sector pricing. Differentiating the Lagrangian with respect to q_i (and assuming that producer prices are fixed[52]) results in

$$dW \equiv \frac{\partial L}{\partial q_i} dq_i \equiv -\sum\nolimits_h \beta^h x_i^h dq_i + \lambda \left(x_i + \tau \cdot \frac{\partial x}{\partial q_i} \right) \cdot dq_i , \tag{3.3}$$

where $\beta^h \equiv \frac{\partial W}{\partial V^h} \frac{\partial V^h}{\partial m^h}$ is the social valuation of the marginal utility of extra income to household *h*, more commonly referred to as the social marginal utility of income or the welfare weight. A concern for income inequality is reflected in this weight being higher for lower-income households.

The first term in Equation (3.3) gives the *direct effect* on household welfare of the price change and just says that, for marginal price changes, the level of household consumption gives a money measure of the welfare loss from a price increase—this loss is valued using the social welfare weight of each household. The second term in brackets gives the *indirect effect* on social welfare arising from the change in consumer demands brought about by the price change, which leads in turn to a change in revenue reflecting a more or less efficient pattern of consumption and production.

For example, consider the case in which the price reform involves an increase in the price of a publicly supplied nontraded commodity that was previously priced below its marginal cost of production; so $\tau < 0$ for this commodity, leading to too high a level of consumption. The price increase will lead to an efficiency gain when it results in a decrease in the demand for this commodity, which will show up in higher government revenue. If the price increase

[52] This does not require the assumption that producer prices are *actually* constant. If producer prices are among the "control variables," then the derivation remains valid by the envelope theorem. Further, it should be remembered that the control variables formally *include* the market-clearing variables, that is, the variables that implicitly adjust to clear the scarcity constraints. Seen in this light, the device of holding producer prices constant is much more general than it appears at first sight. More precisely, the derivation is valid if any of the following hold: (1) producer prices are actually fixed (as in Diamond and Mirrlees, 1975), (2) producer prices adjust endogenously to clear the scarcity constraints, or (3) producer prices are directly controlled by the planner.

leads to a shift in the demand toward other commodities that have consumer prices above (below) their shadow value, then the increase will also lead, other things being equal, to a more (less) efficient pattern of consumption and production and this efficiency gain (loss) will again show up as an increase (decrease) in revenue. So increases (decreases) in revenue are associated with more (less) efficient consumption and production patterns. Note that the indirect effect is likely to be relatively large when demand responses are large and/or existing price distortions (i.e., shadow taxes) are large.

The above equation provides a useful focus for classifying the various methodologies used in the empirical literature evaluating the welfare impact of price reforms. These can be categorized into three different types of approaches: (1) general equilibrium, (2) limited general equilibrium, and (3) partial equilibrium.[53] Equation (3.3) gives the full *general equilibrium* welfare impact of a price change and requires one to allow for responses in all commodity and factor markets. *Limited general equilibrium* approaches focus on a few key markets or on just the demand side of the economy. For example, multimarket models typically focus only on key agricultural sectors when analyzing agricultural price reforms. Demand-side models implicitly assume producer prices are fixed and focus on household demand responses, ignoring producer responses. Both approaches ignore factor-market responses. *Partial equilibrium* approaches ignore responses completely.[54] Chapter III reviews the empirical literature in detail using the above three classifications.

The above discussion has also focused on marginal price reforms when in practice price reforms are often sizable so that second-order (and higher-order) welfare effects are likely to be important. However, it is straightforward to incorporate this aspect into the above analysis. For the direct welfare effect on households (i.e., partial equilibrium approaches) the first expression is simply replaced with an estimate of the compensating or equivalent variation of a price change (Triest, 1990). This, of course, involves estimating demand responses, at least in the relevant market. The size of the price response determines how much the direct welfare impact of the price reform differs between marginal and nonmarginal reforms, with the former tending to be an overestimate (underestimate) of the latter, reflecting households' abilities to switch away from (toward) a commodity whose price has increased (decreased). Note also that these responses may in principle differ substantially across income groups and that this could have important implications for the distribution of welfare changes.

For nonmarginal reforms one should in principle also replace local estimates of responses with estimates of responses over the related price change. In addition, the assumption of constant producer prices is less likely to be valid so one may want to model the supply side of the economy more explicitly. One also needs to consider the implications for what

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[53] See, also, Newbery and Stern (1987) and Sadoulet and de Janvry (1995) for further details of these approaches.

[54] Note the slight difference regarding the definition of partial equilibrium compared with standard introductory textbooks, which often include responses in the market under analysis.

constitutes the appropriate shadow price and whether it changes with the reform, such as the extreme case where the price increase results in the commodity changing from being imported to being exported.

The obvious advantage of analyzing marginal reforms is that data requirements are less demanding because one needs only information on the pattern of consumption across households (for the direct effect) and estimates of aggregate price elasticities (for the indirect effect). Cross-sectional household surveys, which are now widely available, typically provide sufficient data for these purposes.

Note, however, that in the above model it is implicitly assumed that all consumption could be taxed. In many developing countries, especially for agricultural commodities, households consume some or all of what they produce (so-called own-consumption) so that this proportion of consumption cannot be taxed. In this case it is useful to treat these producers as being part of the household sector and replace total consumption with net trades and consumption elasticities with net trade elasticities in Equation (3.3).[55] Note that the pattern of net trades across households, such as with poor and landless households being net consumers of food and large-landholder households being net producers, may increase the distributional power of price controls because low prices are effectively a subsidy to the poor financed by a tax on the rich. However, because net trade elasticities are likely to be relatively large, such price controls are likely to be extremely distortionary so that more efficient transfer instruments probably exist.

It is also common for studies to focus explicitly on the distribution of direct and indirect welfare impacts across households in different parts of the income distribution. To focus on income distribution it is useful to rewrite Equation (3.3) above as

$$dW = -\sum_h \beta^h x_i^h dq_i + \lambda \eta x_i dq_i , \tag{3.4}$$

where $\eta \equiv \dfrac{x_i + \tau \dfrac{\partial x}{\partial q_i}}{x_i}$ captures the size of the indirect welfare effect relative to the aggregate direct income effect.[56] Fully differentiating the social welfare function, assuming lump-sum incomes and government revenue are constant and the price of commodity *i* is controlled by the government, results in

$$dW = -\sum_h \beta^h x_i^h dq_i - \sum_h \sum_{j \neq i} \beta^h x_j^h dq_j . \tag{3.5}$$

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[55] See Newbery and Stern (1987) and Coady (1997a) for further discussion and applications.

[56] If one ignores income distribution issues and assumes that government revenue is optimal (i.e., $\lambda = \beta = 1$), if the gain in revenue is less than the aggregate direct income effect (so that $\eta < 1$), then the difference captures the welfare loss from the price increase. This loss is analogous to the partial equilibrium Harberger welfare-loss triangle from taxes. See Coady and Drèze (2002) for more detailed discussion.

Equating the last term on right-hand side of Equation (3.4) to that in Equation (3.5) results in

$$dW = \left[-\sum_h \beta^h \frac{x_i^h}{x_i} - \frac{\sum_h \sum_{j \neq i} \beta^h x_j^h dq_j}{\sum_h \sum_j x_j^h dq_j} \frac{\sum_h \sum_j x_j^j dq_j}{x_i dq_i} \right] \cdot x_i \cdot dq_i \equiv -(\lambda_D - \lambda_I \mu) x_i dq_i , \qquad (3.6)$$

where λ_D and λ_I capture the distributional impact of the direct and indirect income effects respectively (arising solely from changes in commodity and factor prices) and μ captures the efficiency impacts of the price reform. The distributional parameters are essentially a weighted average of welfare weights, with the weights being the share of each household in the total direct and indirect income effects, respectively. For example, in the absence of any efficiency effects, welfare will increase only if the direct income effect is distributed more (less) progressively (regressively) than the indirect income effects, that is, if $\lambda_D > \lambda_I$. The efficiency parameter μ is greater than one if there are additional efficiency gains from the reforms.

Analyses of the distributional impacts of reforms typically capture these effects through indices similar to λ_D above (Coady and Skoufias, 2004). For example, if welfare weights are {1,0} for {poor, nonpoor} then this distributional index is equivalent to the share of the aggregate income effect accruing to the poor. Or one could use the concentration coefficient, which aggregates income shares based on household rankings in the income distribution (regardless of the size of income differences). Or one may look at the posttransfer distribution of income and compare it with the pretransfer distribution using inequality indices such as the Gini coefficient, the Atkinson index, or the General Entropy Family of inequality indices. These indices either explicitly or implicitly assume some underlying welfare weights, so it is important to undertake sensitivity analyses. Alternatively, one could just present numbers on the shares accruing to households in the various income deciles or plot-related concentration curves.

One may also wish to focus on the size of the income effects (and not just their distribution) and the resulting effects on income poverty in order to inform a policy discussion on the design of appropriate compensating policy measures. Or one may wish to understand the distributional effects across socioeconomic groupings (e.g., by region or ethnic group) to understand implications for horizontal (as opposed to vertical) equity or for political economy.

Appendix 3.2. Alternative Price-Shifting Models

In general, tax and price reforms will involve changes in the prices of intermediate goods. The extent to which these price changes are passed forward onto output prices or backward onto factor prices will depend on such things as the structure of the economy, such as how substitutable different commodities are with internationally traded goods, as well as on the degree of control the government has over prices in general. To the extent that taxes are pushed forward onto output prices, the actual tax content of the final equilibrium price, that is, the effective tax (t^e), will exceed that of the nominal or statutory tax on the sector (t). Obviously, subsidies on intermediate goods may mean that $t^e < t$.

In addition, in practice, existing tax systems in developing countries include a range of different tax components (e.g., excise taxes, trade taxes, and value-added taxes) and some sectors fall outside of the tax sector (e.g., agriculture and the informal sector and the existence of sectors exempt from value-added taxation). It is therefore important when modeling the price effects of tax reforms to capture these important features of the tax system, which can be expected to have important implications for the equity and efficiency effects of tax reforms.

This appendix sets out a simple price-shifting model that can be used to capture these different features of tax systems and that simply requires use of available data on the input-output (IO) structure of the economy. The model allows for different degrees of tradability within each aggregate sector of the IO table. Note that to the extent that price changes are not pushed forward onto output prices they must be pushed backward onto factor prices. The model presented does not follow through the implications of these factor price changes or of these changes on output prices. The model is very similar in spirit to that presented in Hughes (1986) and also has much in common with the effective tax model of Ahmad and Stern (1984 and 1991).[57] Once price changes have been calculated, one can apply these to household-level consumption data (as discussed in the main text of this chapter) to evaluate the real income effect on households from the equilibrium output price changes.

A Price-Shifting Model for Energy Taxation

The implications of higher costs for output or factor prices will, of course, depend on the structure of the economy: for example, whether commodities are traded internationally or nontraded, the nature of commodity taxes, and the extent to which prices are controlled by the government. Therefore commodities are first grouped into three broad classifications reflecting the assumed relationships between higher production costs and output prices:

(1) *Cost-Push Sectors*. These are sectors in which higher input costs are pushed fully onto output prices. They therefore can (loosely) be thought of as nontraded commodities.

(2) *Traded Sectors*. These are sectors that compete with internationally traded goods and whose output prices are determined by world prices and the import or export tax regime. Higher input costs are not pushed forward onto output prices, so the brunt of these higher costs is borne through lower factor prices or lower profits.

(3) *Controlled Sectors*. These are sectors in which output prices are controlled by the government. Therefore, the relationship between output prices and production costs depends on if and how the government adjusts controlled prices. If controlled prices are not adjusted then the burden of higher costs will be borne by factor prices, profits, and/or government revenue.

[57] For a discussion of price shifting within a broader class of models (e.g., incorporating different degrees of competition), see Stern (1987).

When modeling price changes, it is useful to think of aggregate commodity categories (e.g., the aggregate categories available from an IO table) as made up of a certain proportion of cost-push, traded, and controlled commodities, with these proportions given by α, β, and γ, respectively. These proportions should obviously sum to unity and never be negative:

$$0 \leq (\alpha, \beta, \gamma) \leq 1$$

$$\alpha + \beta + \gamma = 1.$$

Alternatively, one could interpret these proportions as capturing the degree of tradability of a single commodity.

The technology of domestic firms is captured by a standard IO coefficient matrix, *A*, with typical element a_{ij} denoting the cost of input *i* in producing one unit of output *j*—think of units of output defined such that they have a user price of unity so that price changes can be interpreted as percentage changes. Consistent with the interpretation of *A* as capturing an underlying Leontief (i.e., fixed coefficient) production technology, a_{ij} can be interpreted as the change in the cost of producing a unit of *j* owing to a unit change in the price of input *i*.

For *traded* sectors, user prices, q^*, are determined by world prices, p^w, and by trade taxes (including tariffs and sales taxes), t^*:

$$q^* = p^w + t^* , \tag{3.7}$$

and $q^* = p^* - t^*$ because taxes on domestic production alone (as opposed to on international trade) do not affect user prices but are instead pushed backward onto lower producer prices and in turn lower factor payments and profits. In this sense, foreign goods are deemed to be perfectly competitive with domestically produced traded goods. Changes in the user prices for traded sectors are then given by

$$\Delta q^* = \Delta p^w + \Delta t^* , \tag{3.7}'$$

and both terms on the right-hand side will be specified exogenously by the reform package under consideration.

For *controlled* sectors, producer prices are determined by pricing controls (say, $\tilde{p}$) and for convenience domestic taxes can be thought of as zero so that

$$\tilde{q} = \tilde{p} . \tag{3.8}$$

Alternatively, one could think of the difference between user prices and average unit production costs as an implicit tax with the revenue accruing to the public sector enterprise and thus entering government revenue through the quasi-fiscal side of the budget. The formula for price changes is then given simply as

$$\Delta\tilde{q} = \Delta\tilde{p} , \tag{3.8}'$$

where the right-hand side is specified exogenously in the reform package.

For *cost-push* sectors, the relationship between user prices and producer prices is given by

$$q^c = p^c + t^c, \tag{3.9}$$

where q^c is the price paid by users of a commodity and p^c is the price received by producers, the difference between these being any sales or excise taxes, t^c, imposed by the government. Producer prices are, in turn, determined as follows:

$$p^c = p^c(q, w), \tag{3.10}$$

where q are the user costs of intermediate inputs and w are factor prices. For these sectors, cost increases are assumed to be fully pushed forward onto user prices so that factor payments are fixed. From Equation (3.9) one gets

$$\Delta q^c = \Delta p^c + \Delta t^c. \tag{3.10}'$$

Using Equation (3.10) and the IO coefficient matrix, and assuming factor prices are fixed, the change in producer prices is derived as

$$\Delta p^c = \Delta q^c.\alpha.A + \Delta q^*.\beta.A + \Delta\tilde{p}.\gamma.A, \tag{3.11}$$

where Δ signifies a price change and all price changes are interpreted as $n \times 1$ row vectors where n is the number of commodity groups, (α, β, γ) are now $n \times n$ diagonal matrices, and A is an $n \times n$ IO coefficient matrix. Substituting in from Equation (3.10)′ for Δq^c and using Equation (3.7)′ for Δq^* results in

$$\Delta p^c = \Delta p^c.\alpha.A + \Delta t^c.\alpha.A + \Delta p^w.\beta.A + \Delta t^*.\beta.A + \Delta\tilde{p}.\gamma.A$$

so that

$$\Delta p^c = \Delta t^c.\alpha.A.K + \Delta p^w.\beta.A.K + \Delta t^*.\beta.A.K + \Delta\tilde{p}.\gamma.A.K, \tag{3.12}$$

where $K = (I - \alpha.A)^{-1}$ with I being an $n \times n$ identity matrix. The typical element of the inverse matrix K, k_{ij}, captures the combined direct and indirect use of cost-push sector i used to produce one unit of cost-push sector j. Notice that if the only price changes are changes in controlled prices, then $\Delta t^c = \Delta p^w = \Delta t^* = 0$ so that the final term of Equation (3.12) gives the effect on cost-push sectors of a change in these controlled prices and also $\Delta q^c = \Delta p^c$.

The change in sector aggregate prices is then given by

$$\Delta q = \alpha.\Delta q^c + \beta.\Delta q^* + \gamma.\Delta\tilde{q}. \tag{3.13}$$

This price change is analogous to the effective tax calculations by Ahmad and Stern (1984 and 1991), except their model assumes imported goods to be perfect complements to domestically traded goods, whereas the current model assumes different degrees of substitutability with imported goods.

A Price-Shifting Model for VAT Reforms

For the purpose of deriving the price effects of tax reforms, the study categorizes goods and services (or sectors) into four groups as follows:

(1) *Vatable Sectors* (*V*). These are sectors that fall within the VAT system and include both sectors subject to positive VAT rates as well as those that are zero-rated. These sectors receive rebates of the VAT paid on any inputs but not of other indirect taxes.

(2) *Exempt Sectors* (*E*). These sectors are exempt from the VAT and therefore do not receive rebates of the VAT or other indirect taxes paid on their inputs.

(3) *Excisable Sectors* (*X*). These sectors have an excise tax imposed on their output and are also exempt from the VAT so that they do not receive rebates of any indirect taxes paid on their inputs.

(4) *Vatable/Excisable Sectors* (*Z*). These sectors have both an excise tax and a VAT imposed on them. They therefore receive rebates on the VAT paid on inputs. In addition, the VAT may be levied on the excise-tax-inclusive price.

(5) *Traded Sectors* (*T*). These sectors have to compete with imported goods. They may be subject to the VAT or other sales taxes.

For each of these sectors, one can define two sets of prices: the prices received by producers (*p*) and the prices paid by users (*q*). These differ in the presence of indirect taxes.[58] For each sector, the following holds:

Vatable sectors (*V*): $q^V = p^V + t^V$ (3.14)

Exempt sectors (*E*): $q^E = p^E$ (3.15)

Excisable sectors (*X*): $q^X = p^X + t^X$ (3.16)

Excisable/Vatable (*Z*): $q^Z = p^Z + t^X + t^V$ (3.17)

Traded sectors (*T*): $q^T = p^T + t^T$ (3.18)

[58] Throughout this Appendix, in equations *lower case* refers to row vectors and *upper case* to matrices.

where superscripts are used to denote sectors and *t* denotes the relevant indirect taxes. Taxes are set exogenously through government policy decisions. User and producer prices are determined endogenously, except for the traded sector where these are exogenously determined by world prices and taxes. User prices are determined by producer prices and exogenously fixed taxes. Producer prices are determined endogenously through the following system of equations:

$$p^V = p^V.A^{VV} + p^E.A^{EV} + (p^X + t^X).A^{XV} + (p^Z + t^X).A^{ZV} + (p^T + t^T).A^{TV}, \quad (3.19)$$

$$p^E = q^V.A^{VE} + p^E.A^{EE} + (p^X + t^X).A^{XE} + q^Z.A^{ZE} + (p^T + t^T).A^{TE}, \quad (3.20)$$

$$p^X = q^V.A^{VX} + p^E.A^{EX} + (p^X + t^X).A^{XX} + q^Z.A^{ZX} + (p^T + t^T).A^{TX}, \quad (3.21)$$

$$p^Z = p^V.A^{VZ} + p^E.A^{EZ} + (p^X + t^X).A^{XZ} + (p^Z + t^X).A^{ZZ} + (p^T + t^T).A^{TZ}, \quad (3.22)$$

where A^{ij} is an IO matrix with typical element a^{ij} denoting the amount of sector *i* used in producing one unit of sector *j*. The main difference between Equations (3.19) through (3.22) is that whereas *V* and *Z* pay producer prices on *V* inputs (because VAT on inputs is rebated), other sectors pay user (i.e., VAT-inclusive) prices. In other words, for *E* and *X*, VAT operates just like sales or excise taxes. Note also that all sectors pay tax-inclusive prices for *E*, *X*, and *T* inputs[59] and, to the extent that ad valorem taxes are levied on producer prices that already include these taxes, the tax system is subject to cascading. This system of equations essentially treats sectors *V*, *E*, *X*, and *Z* as being nontraded sectors with all costs (including taxes) being pushed fully forward onto user prices. This is not the case for traded goods whose prices are determined by border world prices and any taxes levied on imports (including VAT). Therefore, the greater the importance of traded goods, the less the overall tax system is subject to tax cascading.

In order to solve out for producer prices, it is useful to think of sectors as aggregate sectors made up of different components of vatable, exempt, excisable, vatable/excisable, and traded goods and services. Then, substituting in for consumer prices, one can rewrite Equations (3.19) through (3.22) as follows:

$$p = p.\alpha.A + p.\beta.A + p.\gamma.A + p.\eta.A + t^X.(\gamma+\eta).A + p^T.\delta.A + t^T.\delta.A + t^V.(\alpha+\eta).A\,.(\beta+\gamma) \quad (3.23)$$

where $p \equiv [p^V\ p^E\ p^X\ p^Z]$ is a row vector of all producer prices, ($\alpha\ \beta\ \gamma\ \eta\ \delta$) are each diagonal square matrices with diagonal elements indicating the share of each sector that is vatable, exempt, excisable, vatable/excisable, and traded, respectively, and the typical element of square matrix *A* is a_{ij}, which is the total input of sector *i* into sector *j*. If there are *n* aggregate sectors, then *p* is a $1 \times n$ row vector, *A* is an $n \times n$ matrix of IO coefficients, and ($\alpha\ \beta\ \gamma\ \eta\ \delta$) are each $n \times n$ diagonal matrices. For each sector, $(\alpha + \beta + \gamma + \eta + \delta) = 1$.

[59] Vatable sectors do not pay the component of VAT in taxes on traded inputs.

Taking all terms with p to the left-hand side of Equation (3.23) and solving out for p gives[60]

$$p = t^X.(\gamma+\eta).A.K + p^T.\delta.A.K + t^T.\delta.A.K + t^V.(\alpha+\eta).A.(\beta+\gamma).K, \quad (3.24)$$

where $K \equiv [I - (\alpha + \beta + \gamma + \eta).A]^{-1}$. Once one solves out for p one can then calculate q using Equations (3.14) through (3.18). By choosing commodity and services units so that user prices, q, are unity one can interpret taxes as ad valorem and A is then the IO coefficient matrix. This choice is very useful empirically because typically one does not have information on unit prices, especially when sectors are aggregations over a number of goods and services. Note that where tax rates, t, are expressed as a proportion of producer prices, then these need to be renormalized and expressed as a proportion of user prices using the transformation $t / (1 + t)$.[61] Note also that one needs to allow for the fact that for the vatable/excisable sectors the VAT is levied on the excise tax inclusive price. This can be done by using $(t^V + t^V.t^E)$ instead of t^V.

Equation (3.24) solves out for the level of producer prices as a function of world prices and indirect taxes. One can rewrite Equation (3.24) in terms of percentage price changes (dp) by simply replacing t with dt and use Equations (3.14) through (3.19) to calculate dq. Note that by interpreting existing taxes as changes (i.e., $dt = -t$), one can derive basic prices, defined as the prices that would exist in the absence of taxes, as[62]

$$q^0 = p^0 = (1+dq) . \quad (3.25)$$

Effective taxes, defined as the difference between current tax-inclusive and basic prices, can then be derived as

$$t^e = (q - q^0) = -dq . \quad (3.26)$$

As written, t^e is a percentage of current tax-inclusive prices, that is, the proportion of taxes in the final user price. If one prefers to have effective taxes expressed as a percentage of basic prices then one can simply derive these as $t^{e0} = t^e / (1 + dq)$.

The main objective of such an analysis is to evaluate the effect of the tax reforms on household real incomes. The effect on household real income can be calculated by multiplying proportional price increases, dq or dq^*, for each good or service by the corresponding budget share for the household and aggregating this product across goods and

[60] The solution vector of prices is a $(1 \times n)$ vector with the elements being interpreted, in general, as the "weighted average prices" for aggregate sectors. Alternatively, one could treat each component of p as a separate $(1 \times n)$ vector and solve out for each vector simultaneously.

[61] Note also that if taxes are imposed at the wholesale stage then these rates will need to be adjusted to reflect the (lower) tax proportion of retail prices.

[62] In this case, for $t > 0$ then $dq < 0$.

services. One can then evaluate the magnitude and distribution of this real income effect for different tax reforms, including a reform that involves a change in tax regime.

Appendix 3.3. General Lessons from Tax Theory

This appendix briefly identifies key insights provided by the theoretical literature in addressing the issue of how to design or reform a structure of commodity taxes. One can find three potential roles for commodity taxation in the literature:[63] (1) raising revenue to finance government activities when lump-sum taxation is not available to the government; (2) reallocating resources to bring about a more efficient reallocation, such as Pigovian taxes; and (3) redistribution of income when lump-sum taxes and transfers are not available to the government. The evolution of the theoretical literature in terms of the extension of tax rules to incorporate each of these roles is briefly discussed below. The theory of optimum taxation is distinguished from the theory of tax reform; the former focuses on what a system of optimum taxes would look like whereas the latter focuses on the identification of welfare-improving reforms. There is obviously an intimate link between these two strands of the literature because an optimum tax system is one from which no welfare-improving reforms are possible.

Optimum Commodity Taxation

One of the earliest contributions to the formal literature on the structure of optimum commodity taxes was Ramsey (1927). This paper examines the optimum structure of commodity taxes when the government had a fixed *revenue requirement* that could not be financed through lump-sum taxation. The main insight from this paper is captured by the so-called Ramsey Inverse-Elasticity Rule, which indicates that taxes should be higher on commodities with low price elasticities of demand. The basic intuition behind this result is straightforward: optimum taxes require that the reduction in (compensated) demand be the same for all commodities, which requires relatively high tax rates on commodities with relatively low price elasticities.

Probably the definitive papers in the area of optimum commodity taxation are by Diamond and Mirrlees (1971a and 1971b), which also focus on the revenue-raising role of commodity taxes. These papers developed the basic analytical framework used in the modern optimum commodity tax literature. A key contribution of this work was the identification of the conditions under which production efficiency was desirable, implying that taxation of intermediate goods was undesirable. In particular, intermediate goods taxation is potentially desirable only when some final consumption goods cannot be optimally taxed (e.g., because of the presence of consumption from own-production in rural areas or the existence of an untaxable informal sector) but can be taxed indirectly via taxes on inputs. Similarly, input taxes may be desirable as a way of taxing economic profits where these cannot be taxed directly via an optimum profits tax. If all consumption by households can be taxed and an optimal profits tax exists, then all revenue should be raised via taxes of final consumption

[63] See Coady and Drèze (2002) for a recent survey of the literature in the context of these three roles.

(e.g., a value-added tax, or VAT), without distinguishing between commodities according to whether they are traded or nontraded. Note that these assumptions also imply that trade taxes are not desirable.

Diamond (1975) extends the above model to allow for the *redistributive role* of commodity taxes. This paper shows that, relative to the tax-efficient structure identified above, taxes should be lower on commodities that are relatively more important in the budgets of low-income households. The fact that these commodities (e.g., necessities) are often those with relatively low price elasticities suggests the existence of a trade-off between equity and efficiency when taxes are set; that is, reducing the burden of taxation on lower-income households is likely to come at the cost of a higher aggregate burden.

Drèze and Stern (1987), building on an earlier model by Guesnerie (1979), develop a fairly general model that captures a wide range of second-best worlds and incorporates a resource *reallocation role* for commodity taxes in addition to the revenue-raising and redistributional roles. They derive a Generalized Ramsey Rule, which shows that the previous rules go through as before but now with actual taxes replaced by shadow taxes defined as the difference between consumer prices and shadow prices. This rule incorporates, for example, the standard Pigovian argument for commodity taxation as well as other second-best departures from the standard Ramsey Rule.

Reform of Commodity Taxes

The earliest work in the area of tax reform was undertaken in the context of trade taxation where revenue requirements were not considered and optimal lump-sum taxes and transfers were implicitly assumed to be available to the government to raise and redistribute revenue. Therefore, this literature was concerned primarily with efficient resource reallocation. Dixit (1975 and 1985), which played an important role in integrating a separate body of theory on trade taxation into the standard analytical approach employed in public finance theory, examines the conditions under which radial reforms (i.e., an equiproportionate reduction of commodity taxes) and concertina reforms (i.e., reducing only the highest taxes) are welfare improving. Such reforms are obviously less interesting in the context of a government revenue requirement.

Ahmad and Stern (1984) introduced the general theory of tax reform in the context of a government revenue requirement and a redistributive role for commodity taxes. This theory was extended by Drèze and Stern (1987) to incorporate a resource allocation role. Their approach is to identify the marginal social cost (MSC) of raising a unit of revenue using alternative commodity taxes while keeping all other taxes fixed. Revenue-neutral and welfare-improving tax reforms can then be identified by decreasing the tax rates on commodities with high MSC and replacing the lost revenue by raising taxes on those with low MSC. Although this approach helps identify potentially welfare-improving and revenue-neutral reform strategies, the focus on single tax rates keeping all other rates fixed introduces limitations to this approach from a policy perspective.

Another related strand of the tax reform literature identifies the conditions under which specific (and commonly discussed) tax reform packages are welfare improving. A corollary of the Diamond-Mirrlees (1971a) production efficiency theorem is simply that replacing trade taxes with optimal commodity taxes, keeping revenue constant, will always be welfare improving under the conditions discussed above (i.e., that all consumption can be taxed and that production exhibits constant returns to scale or, if not, that optimal profit taxes are available to the government).[64] Keen and Ligthart (2002) examine the conditions under which replacing *any* trade taxes with consumption tax reforms that keep consumer prices constant and increase production efficiency are unambiguously welfare improving (i.e., they improve production efficiency, increase revenue, and keep household welfare unchanged). A corollary is that eliminating all tariffs and adjusting domestic consumption taxes to keep consumer prices unchanged will unambiguously increase both household welfare and government revenue. Note that the Diamond-Mirrlees result keeps revenue unchanged and requires optimal commodity taxes.

A key assumption in the above literature is that all the consumption base can be taxed. However, this assumption is implausible for developing countries where many agricultural households consume out of their own food production and the informal sector (including small-scale rural and urban enterprises) is a substantial proportion of the economy. An important finding in Diamond and Mirrlees (1971a and 1971b) is that if the total consumption of a given commodity cannot be taxed then production efficiency is desirable only among the fully taxed sectors. The informal sector can then be incorporated as part of the household sector, with production inputs treated in the same way any household purchases are. In addition, the efficiency implications of taxation will then depend on net trade elasticities (Newbery and Stern, 1987). Note that under these conditions there is no presumption that taxation of inputs is undesirable and such taxes may be a desirable way of taxing the informal sector indirectly (Stiglitz and Dasgupta, 1971; Heady and Mitra, 1982; and Newbery, 1986). This presumption is essentially the issue addressed by Emran and Stiglitz (2005), who show that, in the presence of an informal sector not subject to VAT, replacing trade taxes with revenue-neutral VAT reforms is not necessarily welfare improving.

Tax Reform and Redistribution

A key assumption in all of the above literature is that the government has access to optimal lump-sum transfers. Once one introduces a distributional role for indirect taxes, for example, because direct transfer systems are unavailable or ineffective, then one can say very little regarding the welfare impacts of the tax reform packages conventionally discussed in the literature (Coady and Drèze, 2002).[65] These welfare impacts will depend on the specific patterns of production and consumption found in a country, particularly their pattern across

[64] Note that a proportional reduction in tariffs "financed" by a proportional increase in any existing consumption taxes will not be unambiguously welfare improving; see Anderson (1999).

[65] Note that the radial and concertina reforms are now only unambiguously welfare-improving in the space of shadow taxes.

income groups, as well as the range of policy instruments available for redistributing income (e.g., see Deaton and Stern, 1986). However, a common finding in the empirical literature is that using indirect taxes (including price controls) is a very ineffective instrument for protecting poor households from the adverse effects of taxation (e.g., reflecting the fact that these households account for a small proportion of the consumption base of most commodities) or, when such taxes are distributionally attractive they come at very high efficiency costs (Coady, 1997a). One therefore expects substantial gains from developing effective direct transfer programs, that is, the gains from having better targeted transfers plus those from not having to incur the standard trade-off between equity and efficiency when using taxes to redistribute income (Coady and Harris, 2004).

Appendix Table A3.1. Alternative Approaches for Evaluating the Welfare Impacts of Tax and Price Reforms

	Characteristics	Resource Requirements	Modeling Requirements
Partial equilibrium	Incorporates only the direct effect of reforms, focusing only on welfare impact arising through changes in consumer prices. Ignores efficiency effects resulting from demand and supply responses. Can also incorporate revenue effect and alternative mitigating measures.	*Data:* Requires information on tax and price system and reforms as well as household survey data on consumption of relevant commodities. Input-output tables are required when evaluating changes in prices of intermediate goods. *Time:* Basic analysis can be completed in around two person-weeks once relevant data have been collected and processed.	Simple models capturing the key features of the tax and public price system are relatively easy to construct and implement using household survey and tax data. Typically only welfare effects through consumer price changes are captured.
Limited general equilibrium (Multimarket models; demand-side models)	Incorporates direct effect and a subset of indirect effects, e.g., demand and supply responses in a subset of (typically agricultural) markets or just demand effects in all final product markets. Ignores factor-market responses. Can also address alternative mitigating measures.	*Data:* As above but now requires detailed information on sectors being analyzed and demand and supply elasticities. *Time:* Basic analysis can be completed in around eight person-weeks once relevant data have been collected and processed.	Needs to model sector supply and demand responses explicitly as well as interaction between sectors. Relevant modeling skills take longer to acquire.
General equilibrium (Shadow-pricing approach; computable general equilibrium models)	Incorporates direct effects and indirect effects through product and factor markets. Can address equity and efficiency implications of a wide range of policy scenarios including mitigating measures.	*Data:* Very data-intensive approach requiring detailed information on consumption and income patterns of households, factor intensities of all relevant sectors, and trade statistics. Typically have to make assumptions about wide range of consumption and production response parameters. *Time:* Can take up to six person-months to organize data and get basic analysis completed.	Approach is very modeling intensive and therefore requires strong modeling skills.

IV. Analyzing the Impact of Trade Liberalization and Devaluation on Poverty

A. Introduction and Summary

Trade liberalization and devaluation (TLD) policies have always been present in many IMF-supported programs. Tariffs, quotas, and other trade restrictions reduce the level of trade and tend to foster the development of import substitute industries that often fail to attain the degree of efficiency and flexibility shown by firms continuously exposed to international competition.[66] Programs tend to promote the removal of trade restrictions in order to improve resource allocation and growth outcomes in the medium term. Devaluation policies in IMF programs tend to play a shorter-term adjustment role instead. The objective is in most cases to restore external viability by switching expenditures from the nontradables sector to the tradables sector.

There is a renewed interest in assessing the distributional impact of these policies, particularly in the Poverty Reduction and Growth Facility (PRGF) program context. This interest stems from the fact that TLD policies are sometimes politically opposed on distributional grounds. Although these policies can improve the well-being of vulnerable groups in the long run as a result of growth-enhancing effects, concerns about negative short-term consequences to the poor can hamper their implementation in the political arena.

The purpose of this chapter is to lay out an organized approach to assist mission teams in analyzing distributional aspects of trade liberalization and devaluation with a specific focus on poverty impact.[67] In order to achieve this goal, selected theoretical considerations are discussed to the extent they foster an understanding of the empirical studies and their limitations; also, the main findings from the relevant empirical literature are summarized. Finally, guided by the findings in the literature, the chapter concludes with a road map providing guidance on how to analyze the impact of trade liberalization and devaluation on poverty.

The main results in terms of the impact of trade liberalization on poverty that emerge in a review of the related literature are as follows. The literature seems to suggest that overall trade liberalization tends to reduce poverty in the long run given its positive impact on economic growth but that short-term negative effects are possible. In particular, the aggregate gain in the welfare of the poor in the long run would come from the impact of trade liberalization on productivity and growth and the negative correlation between growth and

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[66] For an in-depth discussion of import substitution experiences in Latin America see Edwards (1994). For a critique of the traditional view on import substitution strategies, see Rodriguez and Rodrik (2001).

[67] Although poverty is a multidimensional concept encompassing not only insufficient income but also other important dimensions, such as lack of access to adequate health, education, and sanitation services, the definition of poverty for the purposes of this chapter is limited to monetary measures of poverty. The rationale underlying this choice is that this definition is typically adopted by most papers in the surveyed literature.

poverty. However, there will likely be winners and losers in the short run. Specific characteristics of the countries' economies and how these are related to poverty will determine if the poor tend to be among the winners or losers. Important characteristics of the countries' economies are (1) the relationship between the different economic sectors, labor intensity, and the degree of initial economic protection, and (2) the extent to which factor markets, especially the labor market, are flexible.

The possibility of adverse short-term impacts on poverty should not be an argument for not pursuing trade liberalization. Instead, the likelihood of positive long-run effects on the poor argues for adequately deciding the pace of reform, identifying the losing poor, and considering possibilities to compensate these groups for negative short-term impacts. The rationale for compensation is also given by the fact the poor tend to be less able to cope with shocks than do the nonpoor and that some mechanisms the poor use to respond to shocks may be detrimental for their well-being in the long run. Compensation mechanisms should take into account the magnitude of the welfare loss faced by poor households, factoring in the transmission of border price shocks to local prices, the ability of poor households to smooth and respond to shocks, and the government's resource constraint.

The degree of access that the poor have to key assets, information, and infrastructure should be an important consideration to take into account when assessing the poverty impact of trade liberalization. Numerical estimates of poverty impacts of trade liberalization on the positive or negative side tend to be quite modest. A frequently given explanation in the literature for these small impacts is that the impact of trade policies often depends on complementary policies to trade liberalization. These policies help the poor gain access to key assets, infrastructure, and information that may be essential to take advantage of the benefits of liberalization or protect themselves from short-term adverse effects.

With respect to the impact of devaluation on poverty, the review of the literature suggests the following main conclusions. The impact of devaluation on the poor in the short term depends mainly on the economic structure of countries and its relationship with the characteristics of the poor. In particular, the empirical literature suggests that devaluations are likely to have a positive poverty impact in countries where, in the context of an overvalued exchange rate, the poor work mostly in rural areas, are net producers of tradable products such as the ones related to agriculture, and are not landless workers who sell their labor. For countries with overvalued exchange rates where the poor work mostly in urban areas in an informal nontradables service sector, the income of the poor depends significantly on salaried employment, and factor mobility between sectors (labor mobility in particular) is limited, a devaluation may have negative poverty effects.

Analyzing the impact of devaluation on overall inflation and the labor market is crucial to the analysis of poverty effects. Important characteristics of economies to take into account when analyzing the impact of devaluation on inflation are the domestic distribution margin for imported goods, the elasticity of demand for exports, the elasticity of substitution between tradables and nontradables, the share of tradable and nontradable goods in the household consumption basket, and the wage-setting mechanisms. The degree of labor market

flexibility in terms of labor mobility, possibilities for more casual work employment, unionization, and the presence of indexed labor market contracts should be considered in the analysis of labor market adjustment.

Even though a devaluation can imply a contractionary impact on the fiscal stance, it should not be assumed that the impact of this fiscal adjustment on the poor will necessarily be negative. For example, if part of the savings coming from the devaluation impact on government accounts were to be used to increase spending in areas that are better targeted to the poor, such as in a well-functioning safety net, the net impact on the poor could be positive.

This chapter sets out an argument essentially for the following four-step approach to analyzing the impact of trade liberalization and devaluation: (1) conduct a qualitative analysis that tries to ascertain which channels of impact are likely to be more important for a given case; (2) quantify to the extent possible in a formal model the channels deemed relevant to obtain numeric estimates of poverty impacts and the changes to the income distribution; (3) conduct sensitivity analyses to ensure the robustness of poverty impact results; and (4) analyze the impact of compensatory policies to mitigate poverty effects if needed. This chapter is organized as follows. Section B briefly discusses selected methodological issues related to empirical papers that study the distributional impact of trade liberalization and devaluation, highlighting their main advantages and disadvantages. Section C covers the main findings of the empirical literature related to the impact of trade liberalization on poverty and general implications for policy analysis. Section D covers the main findings of the empirical literature related to the impact of devaluation on poverty and general implications for policy analysis. Section E concludes by proposing a roadmap to systematically analyze the impact of trade liberalization and devaluation on poverty.

B. Selected Methodological Issues

Overview of Methodological Approaches

Generally, three broad types of methodological approaches are employed to analyze the poverty impact of trade liberalization and devaluation in empirical studies: general equilibrium, limited general equilibrium, and partial equilibrium.[68,69] Studies with general equilibrium approaches evaluate both the *direct* as well as the *indirect* effects that arise from

[68] Another strand of studies analyzes the impact of trade liberalization on poverty by assessing its impact on several variables related to the labor market that are highly correlated with poverty. These studies have as a premise that, given that it is difficult to establish a relationship between trade policies and aggregate poverty measures, it is more manageable to relate changes in trade policy to particular phenomena or variables that are highly correlated with poverty. Consistent with this view, for example, are studies that assess the impact of trade liberalization on transitional unemployment, economy-wide unskilled labor wages, industry sector wages, and child labor. For a survey of these studies see Goldberg and Pavcnik (2004).

[69] For a more detailed and general discussion of this typology of studies for general price reforms (trade liberalization and devaluation in most respects could be considered as special cases of price reforms), see Coady (2006).

a specific reform on household welfare. The direct effect captures the impact on welfare arising from the change in consumer prices resulting from the reform that affects the household's real income. The indirect effect captures the welfare impacts that result from demand- and supply-side responses to the reforms, which generate efficiency and revenue impacts. Limited general equilibrium approaches (sometimes referred to as *multimarket*) similarly evaluate the direct effect but incorporate only a subset of market responses, for example, by focusing on responses in key agricultural markets related to an agricultural commodity whose price is changed or only on final demand responses, ignoring factor demand responses. Partial equilibrium approaches ignore all responses and focus solely on the direct effect.

A comprehensive study of the distributional impact of trade liberalization and devaluation ideally requires a general equilibrium approach. Because these policies have significant effects on factor prices in addition to changing consumer prices, general equilibrium approaches are necessary to incorporate relevant indirect welfare effects into the results and avoid serious partial equilibrium biases.

In practice, however, data limitations and time constraints typically determine the level of analysis in empirical studies related to distributional effects of trade liberalization and devaluation. Information requirements for the estimation of fully fledged general equilibrium models are quite high for the average developing country. Therefore, many empirical studies of trade liberalization and devaluation are conducted at the partial equilibrium level with implicit or explicit assumptions regarding the significance of general equilibrium effects that could significantly alter their conclusions.

Another practical difficulty facing studies is being able to separate empirically the impact of each policy and define the relevant counterfactual. On many occasions several economic policies are implemented at the same time the policies of interest are implemented. Therefore, disentangling the separate effects may prove very difficult. The issue of the counterfactual refers to defining the initial position to which to compare the outcome postimplementation of the economic policy to be analyzed. For example, in the case of devaluation, comparing the situation after devaluation with an unsustainable initial situation would not be appropriate. Ideally, the comparison should be with the situation that would have prevailed in the absence of devaluation.

The remainder of this section discusses the main economic mechanisms linking trade policies and devaluation to poverty use in empirical studies. The discussion below follows very closely that in Winters, McCulloch, and McKay (2004).[70]

[70] Although the work of Winters, McCulloch, and McKay (2004) refers specifically to trade liberalization, the flow channels of impact of a devaluation on poverty are similar and therefore the same framework is also applicable. However, unlike trade liberalization, a devaluation can affect poverty indirectly through stock channels or balance sheet effects. Specifically, if a country's private sector and/or the government (composed of banks and nonfinancial firms) have significant unhedged foreign currency liabilities, a significant devaluation

(continued)

Economic Impact Mechanisms of Trade Liberalization and Devaluation on Poverty

Winters, McCulloch, and McKay (2004) refer essentially to two types of mechanisms: those of a macroeconomic nature and those of a mainly microeconomic nature. *Macroeconomic mechanisms* are those that have a mostly indirect impact on poverty whereas *microeconomic mechanisms* tend to affect the household's budget constraints in a more direct fashion.

The main mechanism of a macroeconomic nature that is common between devaluation and trade liberalization is the impact of these policies on growth and then from growth to poverty. The specific channels by which growth is affected by these policies differ, though. Trade liberalization can affect growth through its impact on productivity. Devaluation can correct a real exchange rate overvaluation and stimulate growth through renewed export growth that reflects improved competitiveness resulting from lower real wages. Another shared mechanism is the impact of the policies on the overall level of revenues and expenditures of the government. However, the specific impacts on revenues and expenditures and therefore the poverty impact of this mechanism will differ across countries, depending on the characteristics of revenues and expenditures.[71]

Two additional macroeconomic mechanisms of impact on poverty are applicable to trade liberalization specifically. One is the increase in the openness of the economy. Increased openness may increase macroeconomic volatility because of the increased possibility of economic fluctuations related to the exposure to new risks such as terms of trade shocks, which may create difficulties or opportunities for different types of economic agents. The second mechanism is the creation or destruction of markets. Significant changes in relative prices resulting from trade liberalization may cause the disappearance of markets with a potentially adverse poverty impact and/or the creation of markets for goods and services that were previously unavailable, with a potentially positive poverty impact.

On the microeconomic mechanisms side, trade liberalization and devaluation are likely to impact goods and factor income prices directly and indirectly through responses in revenue and expenditure policies of the government. Regarding factor price changes, the impact on wages is of particular interest because in some countries most of the poor rely on labor markets for the bulk of their income. When labor market rigidities preclude the full adjustment of wages to a new equilibrium in the short term, the impact on unemployment also becomes relevant because the adjustment in the labor market will occur partly through changes in wages and partly through changes in unemployment depending on the degree of flexibility in the labor market.[72] With respect to changes in government policies, for

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can generate a financial crisis by making a large number of banks and/or firms bankrupt with a potentially very strong negative impact on economic growth and an indirect impact on poverty. This issue is discussed further in Section D.

[71] See Sections C and D for discussion.

[72] See Sections C and D for further discussion.

example, these may come as a response to the possibility that trade liberalization may lower trade revenues that need to be replaced to maintain fiscal sustainability.

The microeconomic transmission mechanism of border price shocks (created by trade liberalization or devaluation) to local prices and the ability of households to respond to price changes are very important to incorporate into any assessment of the poverty impact. Border shocks are typically not fully reflected in local prices. The extent of transmission may be limited by a number of factors, including transport costs and other costs of distribution; the extent of competition between traders and the functioning of markets more generally; and infrastructure, domestic taxes, and regulation. In addition, the ability of households to respond to price changes seems to vary and may significantly alter the welfare impact of the shocks generated by devaluation and trade liberalization. Important determinants of the level of price response of households seem to be the level of access to key inputs, markets, and infrastructure because these determine the extent to which households can protect themselves from the negative consequences or take advantage of the opportunities provided by trade liberalization or devaluation.[73]

C. Main Results of the Literature: Trade Liberalization

The results are presented briefly in subsections below in line with the different channels of impact on poverty discussed in Section B, namely

- Economic growth,
- Macroeconomic volatility,
- Creation and destruction of markets,
- Prices of commodities,
- Factor prices and unemployment, and
- Government revenues and expenditures.

To close the section, some general implications of findings in the literature for policy analysis are briefly discussed.

Economic Growth

Most theoretical papers highlight different channels by which increased openness positively affects the growth of productivity and therefore economic growth in the long term. Productivity growth can be spurred by improved access to technology, improved access to intermediate and capital goods, benefits of scale and competition, and constrained government incompetence and corruption (Lucas, 1988; Romer, 1990; Grossman and Helpman, 1991; and Rivera-Batiz and Romer, 1991). The most notable

[73] See Sections C and D.

exception to this general view is that increased openness, and therefore increased importance of comparative advantage in determining production patterns, may lead countries into less dynamic sectors (e.g., primary extraction) and therefore less economic growth (e.g., Rodriguez and Rodrik, 2001).

Empirical papers broadly support the view that increased openness is positively associated with growth in the long term.[74] In addition, some empirical studies highlight the need for complementary policies such as adequate investment policies for the benefits of trade liberalization to materialize (e.g., Taylor, 1998; and Wacziarg, 2001). Methodological difficulties in empirical papers relate to problems in measuring the trade stance, the endogeneity of the variables used to measure openness in studies,[75] the possibility that openness may be correlated to other policies that could be causing growth, and that most of the results are based on the use of cross-country regressions with their many conceptual shortcomings.[76]

Economic growth is found to reduce poverty *on average* in empirical studies.[77] Recent research has confirmed the long-maintained position that economic growth is on average positively correlated with poverty reduction (Ravallion, 2001; and Dollar and Kraay, 2002). However, there may be considerable variations in the impacts on different vulnerable groups. A recent study (Ravallion, 2004) concludes that there is considerable heterogeneity in the welfare impacts of trade liberalization among the poor, with both gainers and losers. Notwithstanding the general positive impact on poverty, it is not difficult to imagine situations in which there may be economic growth and increases in poverty in the short term. In particular, if productivity increases as a result of improved access to technology, rationalization gains defined as the shrinking or elimination of inefficient firms may reduce employment and increase unemployment in the short term if there is little labor market flexibility. If the specific sectors that are to undergo the rationalization process are where most of the poor work, poverty may increase in the short term.

Overall, the evidence on this channel of impact suggests that trade liberalization is likely to promote economic growth and reduce poverty on average in the medium to long term. Even if the poor do not benefit directly from increased demand generated by trade liberalization, they may do so indirectly, as those who do benefit directly increase their demand for inputs and consumption of goods and services. For example, some studies such as Delgado and others (1998) argue that these spillover effects for several African countries may be

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[74] See Dollar (1992), Sachs and Warner (1995), and Edwards (1998) for examples. These studies also discuss many of the methodological difficulties inherent in empirical analyses of the welfare impacts of trade liberalization.

[75] A recent paper by Lee, Ricci, and Rigobon (2004) shows that even after correcting for the endogeneity problems, openness would have a positive though small effect on growth. For a more general discussion of the methodological problems, see Rodriguez and Rodrik (2001).

[76] See Winters, McCulloch, and McKay (2004, p. 78), for a brief discussion.

[77] For examples, see Ravallion (1995) and Bruno and others (2002).

significant. The effectiveness of spillover effects in increasing the income of the poor depends on the ability of local business to respond to the increased demand. However, on some occasions, as highlighted above, it is possible that trade liberalization could have, through the rationalization process that may accompany it, an adverse short-term impact on the poor. However, evidence in the literature supporting these kinds of situations is limited.[78] A recent survey on the relationship between trade, growth, and poverty by Berg and Krueger (2003) is also consistent with these results.

Macroeconomic Volatility

Increased openness could theoretically increase the exposure of the economy to output volatility. A more open goods market may imply higher specialization and reduced risk of spreading opportunities in production, implying higher output volatility[79] (Razin and Rose, 1994). In addition, the more open the economy, the larger the impact of a given terms of trade volatility on output. If the increased terms of trade volatility increases output uncertainty, then investment could be reduced with a negative impact on growth (Basu and McLeod, 1991).

The empirical support for the increased output volatility resulting from increased openness hypothesis is inconclusive. Easterly and Kraay (2000) found that small states that are generally more open than larger states have more volatile growth, albeit at higher averages. However, other studies found no correlation or negative correlation between openness and output volatility (Razin and Rose, 1994; and Lutz and Singer, 1994, respectively).

Even if it were accepted that increased openness resulting from trade liberalization contributed to increased output volatility, this increased openness would not necessarily imply increased household vulnerability to external shocks and risk of falling into poverty. First, as shown by Easterly and Kraay (2000), although volatility may be higher in more open economies, mean income also tends to be higher, so the chances of a household falling into poverty will depend on the relative sizes of these shifts. Second, a large body of literature on poor households shows that these households take steps to insure themselves against bad outcomes or to protect themselves from the effects of negative shocks.[80]

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[78] See Section C for more details.

[79] If trade liberalization is accompanied by capital account liberalization, the reduced risk spreading in production could be at least partially diversified away from using the international capital markets.

[80] Insurance actions taken by poor households include diversifying income (Ellis, 1998), engaging in precautionary savings (Townsend and Mueller, 1998), maintaining buffer stocks of key assets (Rosenzweig and Wolpin, 1993) and building social capital (Grimard, 1997). Actions to address negative shocks include asset depletion (Rosenzweig and Wolpin, 1993), borrowing (Udry, 1995), changes in labor supply (Kochar, 1995), temporary migration (Lambert, 1994), and reductions in human capital investment (Jacoby and Skoufias, 1997).

However, there is evidence that the poor are much less insured and much less able to cope with negative shocks than are the nonpoor. Evidence is provided in Jalan and Ravallion (1999). In particular, some mechanisms to cope with shocks, such as reducing education and health investments, are likely to have negative long-run consequences for the poor. This suggests that if trade liberalization is expected to increase the variability of the income of vulnerable groups, attention should be paid to the effectiveness of mechanisms available to the poor to smooth consumption.

Creation and Destruction of Markets

Greater openness arising from trade liberalization can result in a wider variety of commodities being available and new opportunities for production. Examples of these positive effects are illustrated in Booth and others (1993) and Gisselquist and Grether (2000). In the first study, the greater availability of goods at international prices was regarded as beneficial by the rural poor in Zambia even though it entailed an increase in prices. In the second study, the increased availability of inputs resulting from the liberalization provided substantial benefits to agricultural producers in Bangladesh.

There have been cases in which changes in domestic marketing arrangements accompanying trade liberalization measures have destroyed markets. A subset of households can become completely isolated and suffer substantial income losses in these circumstances. An example in Winters, McCulloch, and McKay (2004) refers to the elimination of marketing boards that imposed artificially low prices on farmers for their produce. If marketing boards were providing financial services to small farmers preliberalization by allowing them to secure inputs against future output and if such services are discontinued postliberalization, small farmers could experience significant income losses even if prices for their output have risen significantly. Winters (2000) discusses the case of rural Zambia where the abolition of the official maize-purchasing monopoly in the early 1990s led to the abandonment of purchasing maize from poor farmers in remote areas and the suspension of the financing arrangements. Transportation costs were partially responsible for this situation. Heavily deteriorated roads made purchasing maize from farmers in remote areas unviable. For more details on these issues, see Chapter V.

Prices of Commodities

The impact of trade liberalization on the prices of commodities and the resulting impact on household welfare shows mixed results depending on household characteristics. Barrett and Dorosh (1996) and Minot and Goletti (2000) analyze the impact of rice market liberalization in Madagascar and Vietnam, respectively. The first study estimates that one-third of poor households could lose from higher prices because they were net consumers of rice. The second study instead reports a more mixed picture depending on the type of households. Whereas poor rural households were net sellers of rice and benefited from the reform, urban poor households were net consumers and suffered adverse effects.

Evidence suggests that changes in border prices following liberalization may not be fully reflected in changes in local prices. The transmission mechanism tends to smooth the price changes at the border for different reasons.[81] In agriculture, many export crops, especially those of small farmers, are sold through public or private marketing agencies that set the prices below the f.o.b. export prices. The differential reflects transport, marketing, and other costs of the agencies, including monopsonistic profits. For example, increases in international prices may not be fully reflected owing to increased marketing costs or a change in the profit margin required by the agencies. Another example is the existence of high transaction costs, such as high transport costs. These costs may reduce the impact of changes in border prices on local prices. In the extreme, as Goetz (1992) suggests, high transport costs prevent some households from trading in many parts of sub-Saharan Africa, particularly poor households in remote rural areas. A more recent example of high transport costs is Nicita (2005), which concludes that the Doha trade liberalization round will not significantly affect Ethiopia in part because the poor are isolated from markets residing in remote areas and engaging in pervasive subsistence.

There is substantial evidence on the responses of households to price shocks that affect them as consumers or producers.[82] In particular, this evidence could also be applied to trade liberalization if it is thought of as an external price shock. Responses relate to households protecting themselves from adverse effects as well as taking advantage of opportunities. Coping strategies could include reorganizing households to locate dependents in low-cost locations and workers in households that could employ them, increasing hours of work, postponing deferrable consumption, reducing investment in human capital, and dissaving. In particular, the responses in savings and investment highlight that the trade liberalization impact may also have an intertemporal dimension depending on the magnitude of these responses. Frankenberg, Smith, and Thomas (2003) illustrates these coping mechanisms for the Indonesian crisis over the 1997–98 period and how they could reduce decreases in total family income to only about half of the fall in individual real earnings. With respect to illustration of production responses and taking advantage of opportunities, agricultural producers seem to be quite responsive to price incentives when they have access to the necessary inputs, information, and credit as illustrated in McKay, Morrissey, and Vaillant (1997).

Evidence from the agricultural sector suggests that the nonpoor are in general better placed to respond to price shocks and opportunities than are the poor. This is due to better access to land, physical and human capital, key productive assets, and infrastructure. The better-endowed nonpoor also tend to have better access to credit, which is typically related to endowments, given the need to provide collateral. Examples of the impact of insufficient capital or key productive assets on poor small farmers include Deininger and Olinto (2000)

[81] This tendency is typically true for importable goods subject to tariffs. In the case of exportables, if there are no marketing boards and there are export taxes, changes in the world price would be smaller than changes in the price of the exportable good.

[82] See also footnote 12.

for Zambia; López, Nash, and Stanton (1995) for Mexico; and Heltberg and Tarp (2002) for Mozambique and Madagascar.

The asymmetric capacity of the poor and nonpoor to respond to shocks is generally interpreted as a justification for complementary policies to trade liberalization. These policies would help poor households enhance their access to key inputs, education, and infrastructure and take advantage of the opportunities brought about by trade liberalization or protect themselves for short-term adverse impacts, if any. A recent study by Porto, Brambilla, and Balat (2004), which analyzes the relationship between trade and poverty in Zambia, finds that complementary policies (i.e., extension services in agriculture and job programs supporting employment opportunities to heads of households) could be important to allow households to take full advantage of trade liberalization. Another complementary policy deemed necessary for the poor to take advantage of trade liberalization, also specifically in the agricultural sector, is liberalizing domestic product and factor markets (Anderson, 2004). Hertel and Winters (2005) also stress the need for complementary policies and the need to liberalize services trade and investment to allow the poor to take advantage of the new opportunities brought about by the Doha trade liberalization round.

The flexibility of vulnerable households to respond to shocks and the capacity to provide adjustment support are important considerations that need to be factored in when deciding on the pace of trade liberalization. Although it is sometimes politically convenient to push for trade liberalization in a nongradual fashion, abrupt liberalizations could sometimes exacerbate short-term adverse negative effects because households do not have sufficient time to respond and prepare adequately for the change in relative prices. On the other hand, the pace of liberalization could be sped up if adequate social safety net instruments that facilitate the targeting of adjustment support to vulnerable groups are in place.

Factor Prices and Unemployment

The impact of trade liberalization on factor prices,[83] particularly on wages, is found to be more important in magnitude as a channel of impact on poverty than are commodity prices. Studies that highlight this point are Coxhead and Warr (1995) for the Philippines, Harrison and others (2003) for Turkey, Warr (2001) for Thailand, and Porto, Brambilla, and Balat (2004) for Zambia. This result is also highlighted in a recent survey (Hertel and Reimer, 2004). This empirical result is consistent with the well-known Stolper-Samuelson theorem in classical trade theory.[84] The Heckscher-Ohlin theorem establishes that a country has a comparative advantage in the good that intensively uses the relatively abundant factor.

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[83] Given that different types of households own the factors of production in different degrees, movements in factor prices are expected to be a key determinant of the impact of trade liberalization on the distribution of income.

[84] This interpretation is subject to the caveat that when the basic Heckscher-Ohlin model is generalized by introducing additional factors, sectors, and nontradable goods, the mapping between goods prices and changes in factor prices becomes much more complex.

Because the price of the good for which the country has a comparative advantage will tend to be relatively lower than in other countries in autarky, trade liberalization will tend to increase the price of that good. The price increase of this good not only will generate an increase in the real return of the abundant factor used in the production of the good but also implies that the increase will be larger in percentage terms than the increase in the price of the good. Another strand of literature has focused on the effect of trade liberalization on industry-level wages as tariffs are frequently applied at an industry level (Goldberg and Pavcnik, 2007).

The skill premium—the difference between skilled and unskilled wages—has been increasing in developing countries at the same time that trade liberalization episodes occurred. The skill premium result is based mostly on the Latin American experience. Several empirical papers surveyed in Goldberg and Pavcnik (2004) provide empirical support for several hypotheses linking the increasing skill premium to trade liberalization episodes.[85] This finding could be relevant for poverty analysis in countries where the main source of income for the poor is unskilled wages and where such wages have been falling. The emphasis of this literature, though, is on explaining the reasons for the increased demand for skilled labor and the resulting increase in income inequality. The attention to cases in which the wages of unskilled declined and poverty was increased is limited. However, in a recent paper related to the literature, Topalova (2006) analyzes the regional impact of trade liberalization in India by looking directly at poverty measures such as the head count ratio and the poverty gap. Although the study did not assess the India-wide effects of trade liberalization on poverty, Topalova finds that rural areas with a high concentration of industries that were disproportionately affected by tariff reductions experienced slower progress in poverty reduction. This result reflects the limited labor mobility across regions, industries, and districts in India documented in Topalova (2004). The limited labor mobility reflects, in part, labor market rigidities fostered by inadequate regulations.

There is little evidence on adjustment costs of liberalization related to transitional unemployment and if the poor are disproportionately affected. Some studies, such as Matusz and Tarr (1999), discuss transitional unemployment generated in the manufacturing sector and find relatively minor costs and short unemployment durations. Attanasio, Goldberg, and Pavcnik (2004) find that increases in the probability of unemployment before and after tariff reductions were not larger in the manufacturing sector (where tariff cuts were the largest) than they were for workers with the same observable characteristics in the nontraded sectors. Evidence of transitional unemployment and of whether the poor are disproportionately affected on specific sectors of interest, such as the agricultural

[85] These hypotheses include the following: (1) trade liberalization increased the returns to particular occupations that are associated with a higher educational level; (2) trade liberalization eliminated the protection in the unskilled-labor-intensive sectors that were the most protected previous to the reform; (3) trade liberalization encouraged outsourcing: Foreign direct investment flows from developed-country firms associated with more capital-intensive technologies increased skilled labor demand in developing countries because of the complementarity of capital and skilled labor; (4) trade liberalization has brought about technological change that encourages the use of skilled labor; and (5) the product mix in developing countries is shifting toward more skilled-labor-intensive products.

sector, the service sector, or the informal sector seems to not be available. However, the limited evidence of adjustments costs of liberalization does not imply they are negligible. Adjustment costs are likely to be greater the more protected the liberalized sectors were originally, the greater the magnitude of the implied price shock, and the more inflexible the factor markets, particularly the labor market.

Government Revenues and Expenditures

The reduction in trade tax rates that occurs with trade liberalization does not necessarily need to be accompanied by a reduction in revenues from trade taxes. This is especially the case for countries with a high level of protection. Some measures associated with liberalization, such as the simplification of tariff structures, conversion of nontariff barriers into tariffs that give the same level of trade, and the elimination of exemptions on the purchase of imported inputs used by sectors protected with a high tariff on their outputs, may be revenue enhancing. Another consideration is that a reduction in tariffs could potentially be revenue increasing if tariffs were beyond the revenue-maximizing point.[86] In the medium term, the fall in consumer prices of tradable goods and the expansion in the revenue base associated with increased real income and improved growth rates are likely to imply improved revenues from a value-added tax (VAT), profit and income taxes, and other taxes. Examples of cases in which trade liberalization enhanced revenue collection can be found in Ebrill, Stotsky, and Gropp (1999).

If risks of falling trade revenues generate the need for fiscal adjustment, vulnerable groups could be affected depending on the instruments used to replace the trade revenues or to reduce expenditures. To the extent that trade liberalization ultimately entails reduced revenues from trade taxes, measures may be needed to compensate for revenue losses or to reduce expenditures. In particular, on the revenue side, indirect taxes and, to a lesser extent, strengthening of income taxes of both individuals and companies are possible ways to replace the lost revenues. Distributional concerns are typically focused on indirect tax replacement, which is deemed regressive. This is particularly the case with VAT, especially where foods are incorporated at the standard rate. On the expenditure side, cutting of social expenditures is another area of concern regarding impact on the poor.

Recent empirical evidence suggests that although revenue from trade taxes fell in many developing countries, recovering them through indirect taxes posed no significant difficulties. Trade revenues were recovered in many cases by introducing a VAT. Keen and Simone (2004) show that, on average, countries in all income groups managed to raise indirect tax revenue by about as much as trade tax revenue fell. The exception is countries in sub-Saharan Africa where, although trade taxes were reduced, indirect tax collections remained mostly constant.

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[86] Ebrill and others (2001) arrive at the broad conclusion that trade tax revenues tend to fall with tariff levels when the latter, measured as the ratio of trade tax revenue to import value, is beyond 20 percent. However, Khattry and Rao (2002) estimate it to be about 40 percent.

The risks of impact on vulnerable groups of increasing indirect taxation or reductions in social spending as a response to reduced trade revenues should not be overplayed. Indirect taxes such as the VAT may not necessarily be regressive. A Poverty and Social Impact Analysis (PSIA) study regarding the replacement of a sales tax with a VAT in Ethiopia (Munoz and Cho, 2004) shows that in spite of being less progressive than the sales tax, the VAT is still progressive. In addition, the income loss to the most vulnerable groups did not exceed 1 percent of their consumption. The limited impact on the poor was fundamentally due to the high ratio of in-kind transactions that are not taxed and because many of the exempt goods under the sales tax were not disproportionately consumed by the poor. This result is consistent with Sahn and Younger (1999b) on the progressivity of VAT in African countries. More arguments belying the regressivity of the VAT can be found in Ebrill and others (2001). With respect to reductions in social spending, Winters, McCulloch, and McKay (2004) survey several papers suggesting that there is consensus on the fact that social spending has in general been relatively protected, especially when compared with capital expenditures.

General Implications for Policy Analysis

The literature seems to suggest that given its positive impact on economic growth, overall trade liberalization tends to reduce poverty in the long run but short-term negative effects are possible. In particular, the aggregate gain in the welfare of the poor in the long run would come from the impact of trade liberalization on productivity and growth and the negative correlation between growth and poverty. However, there will likely be winners and losers in the short run. Specific characteristics of the countries' economies and how these are related to poverty will determine if the poor tend to be among the winners or losers. Important characteristics of the countries' economies are (1) the relationship between the different economic sectors, labor intensity, and the degree of initial economic protection and (2) the extent to which factor markets, especially the labor market, are flexible. Even if poverty were to decrease in the short term, there may still be winners and losers among the poor if the poor are a heterogeneous group.

The possibility of adverse short-term impacts on poverty should not be an argument for not pursuing trade liberalization. Rather, the likelihood of positive long-run effects on the poor argues for adequately deciding the pace of reform, identifying the losing poor, and considering possibilities to compensate these groups for negative short-term impacts. The rationale for compensation is also given by the fact that the poor tend to be less able to cope with shocks than the nonpoor and that some mechanisms the poor use to respond to shocks may be detrimental for their well-being in the long run. Compensation mechanisms should take into account the magnitude of the welfare loss faced by poor households, factoring in the transmission of border price shocks to local prices, the ability of poor households to smooth and respond to shocks, and the government's resource constraint consistent with macroeconomic stability.

The degree of access that the poor have to key assets, information, and infrastructure should be an important consideration when assessing the poverty impact of trade liberalization.

Numerical estimates of poverty impacts of trade liberalization on the positive or negative side tend to be quite modest. A frequent explanation for these small impacts in the literature is that the impact of trade policies often depends on complementary policies for trade liberalization. These policies help the poor gain access to key assets, infrastructure, and information that may be essential to take advantage of the benefits of liberalization or protect themselves from short-term adverse effects. The relevance of these policies will depend on the variety of country contexts.

More generally, in thinking about poverty impacts of trade liberalization it is important to identify which channels are going to be emphasized and the rationale for the choice. Papers in the literature typically tend to use models that capture only a subset of channels at a time in their poverty impact analysis and do not always justify their choice of channels. Reasons for the different choices are likely to be data limitations, differences in the economic structure, heterogeneous characteristics of poverty, and differences in implementation of trade liberalization policies. In addition, the need to keep models tractable is likely to be another important constraint. However, justifying the choice of channels explicitly is important in making a convincing argument that the model underlying the poverty impact estimates captures the main relevant effects and is therefore adequate for policy analysis.

D. Main Results of the Literature: Devaluation

The results are presented following the same scheme as for trade liberalization. The different channels of impact on poverty to be discussed in this section are as follows:[87]

- Economic growth,
- Prices of commodities,
- Factor prices (in particular wages) and unemployment, and
- Government revenues and expenditures.

To close the section, some general implications of the literature for policy analysis are briefly discussed.

[87] Macroeconomic volatility and creation and destruction of markets are not discussed in this section because the author is not aware of papers or evidence establishing them as potential channels of impact in the case of devaluation.

Economic Growth

The theoretical impact of devaluations on short-term output growth is generally ambiguous.[88] In Agénor and Montiel (1999), the many different channels by which aggregate demand and supply may be impacted by devaluation and could potentially conflict with each other are illustrated in the context of the dependent economy model. For example, although nominal wage stickiness resulting from fixed nominal contracts could imply an expansionary supply effect in the short run as a result of reduced real wage costs, an income redistribution effect (where income is transferred from individuals with high marginal propensity to consume, such as wage workers, to individuals with low marginal propensity to consume) could imply a contractionary effect on the demand side. On the investment side, increasing prices for capital and intermediate inputs could also have contractionary effects on aggregate demand. In addition, structural characteristics of the economies may change the direction of impact of a specific effect. For example, in economies where private sector asset holdings are not indexed to the domestic price level, a devaluation reduces the real value of existing wealth and therefore negatively affects aggregate demand. If the private sector instead holds mostly foreign assets, the opposite result would hold.

The empirical evidence on the short-term impact of devaluations on output growth is also inconclusive. This is due in part to the many possible conflicting theoretical channels of impact that may vary depending on country structures and the several different empirical methodologies used to test the theoretical models. Agénor and Montiel (1999) reviewed the empirical evidence in this area. Reviewed macro simulation studies such as Gylfason and Schmid (1983) find that devaluations are expansionary in 8 out of 10 countries in their sample because of the prevalence of expansionary expenditure switching effects. Other studies of the same type, such as Gylfason and Radetzki (1991), find that although devaluations are expansionary in developed countries, they are contractionary in developing countries. Econometric studies, such as Edwards (1986 and 1989), find that devaluation is contractionary in the short run on a sample of 12 developing countries.[89]

A strong supply response is a necessary but insufficient condition for a growth-enhancing devaluation to be poverty reducing in the short term. The structure of the economy and the

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[88] This section assumes that the nominal devaluation will have real effects, namely, increase the real exchange rate defined as the relative price of tradables versus nontradables. The implicitly assumed situation underlying the discussion of the impact of a devaluation is that the equilibrium real exchange rate is overvalued. If the exchange rate is overvalued, the devaluation is presumed to return the real exchange rate to its equilibrium level typically by achieving a reduction in real wages. The reduction in real wages helps clear the labor market by reducing unemployment, and therefore boosts growth and reduces poverty in the medium to long term. The assumed capacity of a devaluation to restore the real exchange rate to its equilibrium level is not a trivial assumption. An increase in inflation could potentially eliminate completely the real impact of the devaluation under certain circumstances. Section D discusses important considerations related to the inflationary impact of a devaluation.

[89] Large devaluations are likely to fall mostly on the contractionary side, as suggested by Burstein, Eichenbaum, and Rebelo (2003).

characteristics of the poor are key determinants of the impact of devaluation on poverty. For example, if the economy's tradables sector is relatively large and mostly composed of mineral production (which makes intensive use of natural resources and capital), the poor are mostly employed in the labor-intensive nontradables sector (i.e., services), and their wage is their main source of income, a devaluation may increase poverty. The relative price shift toward tradable goods could imply an increase in output growth resulting from increased tradable production. However, this same change in relative price would imply a reduction in real wages as a result of Stolper-Samuelson effects and reduced employment in the nontradables sector in a neoclassical setting. If labor market rigidities, such as wage inflexibility, say, resulting from fixed labor contracts and/or limited sectoral mobility of labor, are assumed, a devaluation may imply increased unemployment as a result of the contraction of the nontradables sector and only a partial absorption by the expanding tradables sector in the short term. The increase in unemployment could then have a negative poverty impact. For a more detailed discussion see Stewart (1995).

In economies with vulnerable balance sheets, a devaluation could generate significant balance sheet effects and trigger a financial crisis with strong and persistent negative effects on growth and indirect effects[90] on poverty. Balance sheets may be vulnerable, for example, if the private sector, including the financial system, and/or the government have large unhedged liabilities in foreign currency. Countries with a history of inflation and that experienced extensive currency substitution as a result are more likely to be in this type of position. As suggested in Allen and others (2002), the transmission mechanism by which such weaknesses in the balance sheets could trigger an external balance of payments crisis typically goes through the domestic banking system. For example, concerns about the government's ability to pay its debt as a result of the devaluation due to the its foreign currency denomination of debt could quickly destabilize the confidence in the banks holding this debt and lead to a deposit run. Alternatively, a change in the exchange rate coupled with unhedged foreign liabilities in the corporate sector can also undermine the confidence in the banks that lent to that sector. The run on the banking system could then take the form of a withdrawal of cross-border lending by nonresident creditors, or the withdrawal of deposits by domestic residents. A banking crisis typically tends to exert strong negative short-term effects on output through financial accelerator channels, and these can be quite persistent.

Prices of Commodities

The impact of devaluation on inflation is an important element to consider when analyzing poverty impacts. If a devaluation leads to high and variable inflation as indicated in Günter,

[90] The indirect impact on poverty through growth is the only one highlighted in the text because it is typically assumed in the literature that the poor have few assets and not much attention is given to what may happen to nonpoor groups. However, in countries that have sufficiently important banking systems, a large devaluation could have a direct impact on poverty by causing nonpoor groups to fall into poverty. A large devaluation could not only significantly reduce their real income but also significantly reduce the real value of deposits that could be an important asset.

Cohen, and Lofgren (2005), this is likely to have a negative impact on poverty through the negative impact on economic growth and the lack of protection of the real value of the incomes and assets of poor people from inflation.[91]

The impact of devaluation on inflation depends on several characteristics of the economies. Burstein, Eichenbaun, and Rebelo (2004) isolate some characteristics of economies that can dampen the response of inflation to a devaluation by generating a slow adjustment of nontradable goods prices. These characteristics are low share of tradable goods in consumption (which is related to the openness of the economy), high domestic distribution margin for imported goods, low elasticity of demand for exports, and low elasticity of substitution between tradables and nontradables. In addition, wage-setting mechanisms of the economy will play a crucial role in determining the magnitude of the price responses of nontradable goods to devaluation.[92]

The impact of relatively large devaluations on inflation seems to have been relatively low in contractionary devaluations during the 1990s. When analyzing nine large contractionary devaluations in the 1990s, Burstein, Eichenbaum, and Rebelo (2002) suggest that this has been the case. The reasons presented are that tradable goods require nontradable distribution services to be sold and that households substitute higher cost imports with low-quality nontradable goods. Both arguments predict an increased share for nontradables in the price index. Because nontradables prices typically tend to adjust slowly[93] or are adversely affected in devaluation episodes, the direct impact of the devaluation on the price of tradable goods in the price index is at least partially offset by the impact on nontradables prices.

The impact of devaluation on cost of living for the poor depends on the share of tradable and nontradable goods in their consumption baskets. The larger the share of tradable goods, the larger the possibility of a negative impact. For example, Minot (1998) shows for the case of Rwanda that increased prices of clothing account for almost half of the negative effect on low-income rural households.

There is evidence of several types of household responses to large devaluation episodes to mitigate adverse effects. McKenzie (2001) finds that the main smoothing mechanism used by households during the 1994 Mexican crisis was a change in the composition of their consumption. The paper shows that households have increased their expenditure share on certain food items even more than Engel's law would predict[94] by reducing expenditure on

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[91] For additional papers documenting the generally nonlinear negative relationship between inflation and poverty, see the short survey in Cashin and others (2001).

[92] See discussion in Section D.

[93] See Burstein, Eichenbaum, and Rebelo (2003). The key factor underlying this behavior on nontradable goods prices is the sluggish adjustment of nominal wages. See the factor price section for more details.

[94] Engel's law is reflected in McKenzie (2001) as an Engel curve linking household expenditures on individual goods to total expenditure and to the demographic characteristics of the household. The Engel curve effect of a fall in income on expenditure is to reduce the share of spending in luxury goods and increase the share of

(continued)

luxury goods. Labor supply response was found to be weak. Fallon and Lucas (2002) described how households have smoothed their incomes in the context of the Asian crisis. Labor supply responses seem to have been stronger, increasing labor force participation in particular. Increased reliance on transfers has been another important smoothing mechanism.

The increase in the relative price of tradables implied by devaluation seems to have been poverty reducing in African economies.[95] In African economies, poverty is mostly rural and most of the rural poor rely on earnings from the labor-intensive agricultural sector for their livelihoods (Sahn, Dorosh, and Younger, 1997). Studies such as Dorosh and Sahn (2000) typically conclude that because poor rural farmers[96] are net producers of agricultural tradables, they tend to benefit because devaluation increases the relative price of tradables. The urban poor, on the other hand, tend to be negatively affected because they are net consumers of tradables. More generally, these studies highlight the role of devaluation in reducing or eliminating the negative impact of overvalued exchange rates on agriculture as a source of poverty reduction.[97] Impacts, however, may be of limited magnitude because in many African countries the poor have only limited access to markets and the cash economy and rely on self-production for subsistence.

The results on the poverty impact of devaluation for the African economies cannot be easily extended to Latin American countries. There are key structural differences in the economies as suggested in Agénor (2004) and Fallon and Lucas (2002): The poor are more evenly split between urban and rural sectors, a larger fraction of the poor depend on salaried employment for their income rather than direct production of agricultural crops (formal sectors are larger), and greater real wage rigidity prevails in labor markets. These conditions generally tend to increase the chance of negative poverty effects of devaluation.

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spending in necessities. The observed fall in the consumption of luxuries and the increase in the consumption of necessities for the Mexican case was bigger than the one captured by an estimated Engel curve.

[95] Azam (2004), however, argues that poverty increased massively in the wake of the 1994 devaluation despite a significant recovery in economic growth. The paper presents a model in which formal sector workers are at the same time investors in the informal sector, providing employment to vulnerable groups. The main model storyline is as follows: If formal sector workers anticipate that a devaluation will lower their salaries, they start saving before the devaluation by investing in their informal sector businesses, their main savings vehicle. After the devaluation actually happens, they start dissaving by reducing the activities of their informal businesses, which affects the vulnerable groups employed by them. This retrenchment produces the increase in poverty. The paper's empirical evidence seems limited because only the case of Côte d'Ivoire is considered.

[96] If rural farmers are landless workers depending on salaries, a devaluation can make them worse off, as pointed out in Fallon and Lucas (2002).

[97] For an earlier example of this type of literature, see Schiff and Valdes (1992).

Factor Prices and Unemployment

The impact on factor prices of a real devaluation[98] on the poor will depend on factor intensity characteristics of the tradables and nontradables sectors. The poor typically sell their labor and own few assets. Therefore it is assumed that their well-being will change with the price of labor at the highest level of aggregation. If the tradables sector is the labor-intensive sector, in the context of a two-sector Heckscher-Ohlin model the poor would be expected to benefit from devaluation. The opposite would be expected to hold if the nontradables sector were labor intensive. Finer levels of disaggregation differentiate between several types of tradable and nontradable activities, skilled labor and unskilled labor, and the degree of formality of the activities. Because the poor tend to be unskilled workers working in informal activities, factor intensities are sometimes defined in these more disaggregated sector definitions. Results are quite sensitive to the structure of the models.

The impact of devaluation on the labor market tends to be especially important in determining the poverty impact of devaluation. As highlighted in Agénor (2004), the poor often generate a significant share of their income from labor services, and, because of their precarious condition, can be particularly affected by labor market imperfections that prevent an efficient allocation of resources. In particular, lack of labor mobility across sectors and nominal wage rigidity may lead to increased unemployment and poverty when the relative price change implied by devaluation requires resource reallocation to the tradables sector. Corbacho, Garcia-Escribano, and Inchauste (2003) highlight the importance of changes in employment status as a significant source of vulnerability during the 1999–2002 Argentine crisis.

Evidence from large devaluations in financial crises episodes suggests that labor market flexibility could be important in reducing the poverty impact of the crises. Fallon and Lucas (2002) show that cross-country evidence reveals strong positive associations between depreciation of the exchange rate and the cut in real wages and between the cut in real wages relative to the decline in GDP and loss in employment. Where cuts in real wages did not materialize as a result of lack of labor market flexibility, high unemployment levels could have exacerbated the negative poverty impact of the crises. The great deal of turnover in employment that accompanied the crises, more casual wage employment, and self-employment were all deemed to have been critical in sustaining or even increasing employment.

The response of nominal wages to devaluation is a critical factor in the determination of its inflationary impact. Because wages are typically a large share of production costs, especially for nontradable goods, their response will be a key determinant of the response of prices in the economy and the behavior of real wages. The stabilization literature suggests that the higher the degree of anticipation of devaluation, the stronger the power of labor unions in

[98] This refers to a nominal devaluation that managed to increase the relative price of tradables with respect to nontradables.

wage negotiations, and that a history of high inflation tends to increase the response of nominal wages to inflation and reduce the reduction in real wages that can be achieved by a devaluation. A history of inflation may imply the presence of indexation mechanisms on wage contracts that automatically adjust wages on the basis of price changes. For a survey and more detailed discussion of the stabilization literature, see Agénor and Montiel (1999).[99]

Government Revenues and Expenditures

Devaluation can also impact poor households by changing the real value of tax revenues and the real value of government expenditures. If devaluation increases the amount of net resources available to the government, then the final outcome on the poor will depend on how the additional resources are allocated (reduce revenues, increase spending, or pay off debt). If devaluation reduces the net resources available to the government instead, the poverty impact will be affected by the way the additional resource gap is financed (increasing revenue, reducing expenditure, or adding more foreign or domestic financing).

The effect of devaluation on revenues will depend on their composition and whether rates are specific or ad valorem. If revenues are dominated by trade taxes and the rates are ad valorem, revenues are likely to increase in real terms (i.e., the tax burden increases) in the short term because the rate of devaluation will exceed inflation. If instead rates are mostly specific and there are collection lags, the Olivera-Tanzi result holds and revenues will decrease in real terms. If revenues are from domestic economic activity, the impact on real revenues is likely to depend on the composition of the tax base in terms of taxed tradables and nontradables sectors. For example, after a devaluation, tradables firms' profits are likely to increase whereas nontradables firms' profits are likely to decrease in the short term. Therefore, profit tax collections will depend on the composition of the tax base in terms of tradables and nontradables firms.

Interest spending may increase significantly if debt is denominated in foreign currency. If debt is denominated in foreign currency, a devaluation will increase the value of debt expressed in domestic currency. Because the price-level reaction tends to lag the increase in the exchange rate, the real value of interest payments may increase significantly.

The effect of devaluation on non-interest expenditures will depend on the tradable content of the spending. The more tradable the content of spending, the more likely non-interest expenditures will go up in real terms. Burnside, Eichenbaum, and Rebelo (2003) suggest that because the rate of devaluation will be larger than inflation in the short term and that a large fraction of expenditures is nontradable (such as the wage bill in health and education), the reduction in real value of spending may be large.

Recent empirical evidence on large devaluations suggests devaluation has tended to imply a contractionary impact on the fiscal stance. Burnside, Eichenbaum, and Rebelo (2003) suggest

[99] In particular, see Chapters 10 and 12.

that in recent large devaluations, fiscal policy was rather contractionary because the eroding Olivera-Tanzi effect on tax revenues of devaluation could be more than offset by the reduction in the real value of non-interest expenditures.

An increase in the tax burden may not necessarily imply that its incidence will fall on the poor. In developing economies, the poor tend to work in informal sectors that by definition are mostly outside of the tax net. A relatively small share of formal sector contributors is typically responsible for a large share of tax revenues. Under these circumstances, it is conceivable to imagine cases in which the increase in the tax burden will not significantly affect the poor.

Reduced real social spending does not necessarily mean a negative impact on the poor. Government social expenditures are on many occasions being captured by nonpoor groups and are therefore poorly targeted (Agénor, 2004). In some countries these nonpoor groups may be providing services in the sectors. For example, in the education sector, determination of teacher salaries is influenced by powerful unions and is weakly related to opportunity cost or productivity. If expenditures are reduced and the composition of spending changes toward areas of spending that are more beneficial for the poor, such as an effective safety net, there may be a positive poverty impact.

General Implications for Policy Analysis

The impact of devaluation on the poor in the short term depends mainly on the economic structure of countries and its relationship with the characteristics of the poor through the channels of impact. In particular, the empirical literature suggests that devaluations are likely to have a positive poverty impact in countries where in the context of an overvalued exchange rate the poor work mostly in rural areas, are net producers of tradable products such as the ones related to agriculture, and are not landless workers who sell their labor. In countries with overvalued exchange rates where the poor work mostly in urban areas in an informal nontradable service sector, the income of the poor depends significantly on salaried employment, and factor mobility between sectors (labor mobility in particular) is limited, a devaluation may have negative poverty effects.

Analyzing the impact of devaluation on overall inflation and the labor market is crucial to the analysis of poverty effects. Important characteristics of economies to take into account when analyzing the impact of devaluation on inflation are the domestic distribution margin for imported goods, the elasticity of demand for exports, the elasticity of substitution between tradables and nontradables, the share of tradable and nontradable goods in the household consumption basket, and the wage-setting mechanisms. In the analysis of labor market adjustment, the degree of labor market flexibility in terms of labor mobility, possibilities for more casual work employment, unionization, and the presence of indexed labor market contracts should be considered.

Even though a devaluation can imply a contractionary impact on the fiscal stance, it should not be assumed that the impact of this fiscal adjustment on the poor will necessarily be

negative. For example, if part of the savings coming from the devaluation impact on government accounts were to be used to increase spending in the areas that are better targeted to the poor, such as in a well-functioning safety net, the net impact on the poor could be positive.

E. Toward a Systematic Approach to Assessing Distributional Impacts

A useful starting point when analyzing poverty impacts of trade liberalization and devaluation is likely to be conducting a qualitative analysis to ascertain which channels of impact are likely to be more important for a given case. Specifics such as the structure of the economy and the characteristics of the poor are likely to help narrow down which channels of impact are likely to be more important. Appendix Table A4.2 presents a set of questions suggested by the review of the literature whose answers could be useful in assessing the importance of the different channels of impact of TLD on poverty discussed in this chapter. The need to determine key channels of impact stems from the fact that tractable theoretical models that could be estimated in a subsequent step typically will capture only a limited number of channels of impact.

The second step involves trying to quantify in a formal model the relevant channels to obtain numeric estimates of poverty impacts and the changes to the income distribution. In general, the sophistication with which this step is undertaken will depend on the availability and quality of disaggregated data, resources, and time available. The different types of empirical studies discussed in Section B illustrate the broad set of options typically used by researchers and their advantages and disadvantages. Although a general equilibrium approach should ideally be used, if data is limited, the focus should be directed to the type of quantification that can be adapted to the data limitations, acknowledging the biases to which it may be vulnerable. For a recent survey of techniques to quantify poverty impacts of economic policies such as trade liberalization or devaluation, see Chapter II. For a more detailed discussion of specific techniques, see Bourguignon and Pereira da Silva (2003).

The third step involves sensitivity analysis. Because the estimation is typically subject to significant uncertainty, providing estimates of poverty impacts for a range of different key parameters is necessary to increase the confidence in the robustness of the results. This step will also be informative regarding the need of policies to mitigate adverse poverty impacts depending on the direction and magnitude of poverty impacts.

The final step involves analyzing the impact of compensatory policies that mitigate poverty effects if needed. For example, this step could include increasing expenditures on the safety net, introducing commodity-based subsidies, and better targeting education and health expenditures and other policies. Sensitivity analysis could also be conducted for the impacts of the different policy changes.

Appendix Table A4.1. Approaches to Analyzing the Welfare Impacts of Trade Liberalization and Devaluation

	Characteristics	Advantages	Disadvantages
Partial equilibrium	Incorporates only the direct effect of reforms, focusing on welfare impacts arising from changes in consumer prices. Ignores efficiency effects resulting from demand and supply responses. Can also incorporate revenue effect and alternative mitigating measures.	Has relatively modest information requirements. A household survey is the minimum information requirement. If impacts of reforms on prices of intermediate inputs are analyzed, input-output tables are also needed. Models are simple and therefore the results are easy to interpret.	Tends to overestimate adverse welfare impacts and underestimate benefits from price declines. This is because partial equilibrium studies tend to ignore the response of households to price changes by reallocating spending across commodities. Ignores factor-market responses and supply effects that may lead to inadequate conclusions on welfare impacts of reforms. Two households with the same consumption profile can have very different income profiles and therefore the poverty impact on them could be very different. With respect to supply effects, households could alter the type of crops they cultivate in response to price changes and change the welfare impact of the reforms.
Limited general equilibrium	Incorporates direct effects and a subset of indirect effects, e.g., demand and supply responses in a subset of (typically agricultural) markets or just demand effects in all final product markets. Ignores factor-market responses. Can also address alternative mitigating measures.	Incorporates demand responses and supply responses in a subset of markets, reducing the partial equilibrium biases on welfare impact. In this fashion the models also partially capture the efficiency-enhancing effects of the reforms.	Modeling and information requirements are more stringent. Demand responses as well as interactions between sectors need to be explicitly modeled. With respect to information, in addition to the partial equilibrium information requirements, detailed information on sectors being analyzed and demand and supply elasticities are required. Ignores factor-market responses.
General equilibrium	Incorporates direct effects and indirect effects through product and factor markets. Can address equity and efficiency implications of a wide range of policy scenarios including mitigating measures.	Incorporates demand, supply, and factor-market responses capturing all the efficiency effects of the reforms. Factor-market responses allow the construction of estimates of the impact of reforms on income distribution. Rich structural specification allows better separation of impacts of different policies.	High informational and modeling requirements. Models can quickly become difficult to understand. Robustness of the results is typically an important issue given the large number of parameters and functional assumptions required. Intragroup heterogeneity tends to be limited by the representative agent type assumption.

Appendix Table A4.2. Useful Questions to Establish Key Qualitative Channels

Topic	Questions Applicable to Both Trade Liberalization and Devaluation	Questions Applicable Mostly to Trade Liberalization Reforms	Questions Applicable Mostly to Devaluation
Characteristics of the economic structure	What is the degree of openness of the economy? Which main economic activities compose the tradables and nontradables sectors? What is the importance of the main economic activities in GDP and in generating economic growth? Is agriculture an important sector? What is the unskilled-labor intensity of the different economic activities? What is the price elasticity of supply of the different activities?	What is the initial degree of effective protection of the sectors affected by the trade liberalization reform? What is the average tariff level inclusive of the implicit protection implied by nontariff barriers to trade?	What is the unskilled-labor intensity of the tradables and nontradables sectors? Is the economy heavily reliant on imports? If so, is it reliant especially on capital and intermediate inputs or in general, including, for example, food and medicines? Are private sector institutions (financial and nonfinancial firms) and/or the government exposed to balance sheet risks that could be exacerbated by devaluation?
Characteristics of the poor	Which are the main goods and services consumed by the poor? What is the share of self-produced goods in total consumption? (Especially relevant for food items) For the goods they produce and consume, are they net producers or consumers? What are the main sources of income for poor families and in which sectors are they typically employed or self-employed? What are the mechanisms the poor use mostly to protect themselves from shocks? What is the level of access of the poor to markets, key production inputs, education, and infrastructure? How heterogeneous are the poor as a group?		What is the share of tradable goods consumed by the poor versus nontradable goods? What is the share of the income of the poor that is generated in tradable versus nontradable activities?

(continued)

Appendix Table A4.2 ***(concluded)***

Topic	Questions Applicable to Both Trade Liberalization and Devaluation	Questions Applicable Mostly to Trade Liberalization Reforms	Questions Applicable Mostly to Devaluation
Price transmission and creation and destruction of markets	What is the pass-through of border price shocks to local prices? What kinds of transmission mechanisms underlie the result?	What is the reason for the typically imperfect transmission? Are there high distribution margins for imported goods? Do marketing boards interfere with the pricing? Are transportation costs high? Are markets being created or destroyed?	What is the reason for the typically imperfect transmission? Is the share of nontradable goods high? Are there high distribution margins for imported goods? Is there a low elasticity of substitution in consumption between tradable and nontradable goods? Is there a low elasticity of demand for exports? Is the wage-setting mechanism producing a sluggish adjustment of nominal wages?
Characteristics of the labor market	How mobile is labor across sectors? Are there significant constraints to hire or fire employees? What is the degree of informality in employment practices in the economy?		What is the degree of unionization? Are formal or informal indexation practices prevalent in setting wage levels?
Characteristics of government revenues and expenditures	How will the government react to the net increase or decrease in government real resources generated by the trade liberalization or devaluation reforms? (May involve changes in revenue, expenditure, or debt policies) Are there any studies analyzing to what extent the poor bear the burden of taxation and benefit from government expenditures? Are there any safety net programs? Are these programs well targeted?	What is the share of tax revenues obtained by trade taxation? If revenues were to fall and the government decided to replace them with other revenues, would indirect or direct taxation instruments be used?	Is taxation mostly ad valorem or specific? Is the tax base composed mostly of tradable or nontradable activities? What is the share of trade taxes in tax revenue collection? What is the share of government expenditures on tradable goods? Is external debt a significant share of total debt?
Specific characteristics of trade liberalization and devaluation policies	Are the reforms accompanied by other complementary policies?	Does the trade liberalization involve mostly the reduction of existing tariffs or the substitution of nontariff barriers with tariffs? What is the magnitude by which trade liberalization will reduce the effective protection of different sectors?	What will be the initial magnitude by which the currency will be devalued? Is the devaluation expected or will it be largely unanticipated?

V. The Distributional Impact of Agricultural Sector Reforms in Africa: A Review of Past Experience

A. Introduction

This chapter reviews the distributional impact of agricultural sector reforms in Africa. African governments have intervened in the agricultural sector for decades, but generous pricing policies and operational inefficiencies have often necessitated large budgetary transfers to parastatals. Over the past 20 years many African countries attempted to liberalize their agricultural sector, with mixed success. This chapter describes the forms of government intervention in agricultural markets, the liberalizing reforms undertaken in the past 20 years, the channels by which these reforms affected stakeholders, and the outcomes of the reforms on poor households.[100]

Four main lessons emerge from past experience. First, past reforms have not lived up to expectations, reflecting erratic policy implementation, low levels of public goods, and weak market institutions. In particular, price liberalization alone has proven insufficient to spur agricultural growth in the presence of structural weaknesses in rural markets. Second, postreform price changes have not significantly harmed the poor in the aggregate. The feared increase in the consumer price of food, which would have reduced the purchasing power of the majority of the rural poor who are net food consumers, never materialized. Instead, liberalizing procurement markets increased competition among traders and processors, which reduced marketing margins and benefited both producers and consumers. Third, reforms that removed input subsidies and devalued the currency did not markedly increase agriculture yields, as private credit and input markets functioned poorly after reforms. In many cases, however, the poor were not major beneficiaries of input subsidies and were therefore less affected by their withdrawal. Finally, farmers in more remote locations were disproportionately harmed by the removal of both direct input subsidies and cross-subsidies from uniform national pricing.

Therefore, reforms of input market reforms should proceed carefully, and compensation should be considered for farmers in more remote areas. This compensation should, if possible, build on existing social safety net programs. It could consist of targeted transfers to poor remote households, or conditional targeted transfers that promote human capital investment (including agricultural extension services), or investments in physical infrastructure, such as irrigation, roads, or utilities.

For most households, the primary effects of agricultural sector reforms are changes in producer or consumer prices. In principle, the best way to measure the distributional impact of price changes is to use a household survey to examine the relationship between households' economic welfare and their net consumption of the goods in question. This

[100] The review draws heavily from Kherallah and others (2002) and Lundberg (2005).

chapter does not discuss this kind of price-incidence analysis, which is described in Chapter III above. Instead, it reviews the contextual background and lessons from past reforms. Section B describes the historical background of marketing boards and the need for reform. Section C lays out the channels by which producers, consumers, and private traders were affected by the reforms. Section D presents four case studies of reforms, and Section E concludes by reviewing the effects of the reforms.

B. Rationale for Intervention and Reform

Public intervention in agricultural markets is common throughout the world because of the importance and volatility of these markets. In most developing countries, agricultural markets are the main source of livelihood for the majority of households in rural areas, where poverty is concentrated, and they provide staple foods for urban consumers. Subsidizing rural farmers and domestic consumers, sometimes at the same time, was perceived politically both as an obligation of postcolonial governments and as an effective strategy to reduce poverty. In most developing countries, these attitudes matched many leaders' general distrust of the free market and specific concerns about the market power of traders and farmers' access to credit for inputs. Furthermore, in many African countries, the economic importance of agriculture made it a natural source of tax revenue, which was collected by setting producer prices substantially below world prices and channeling output through publicly run marketing boards.

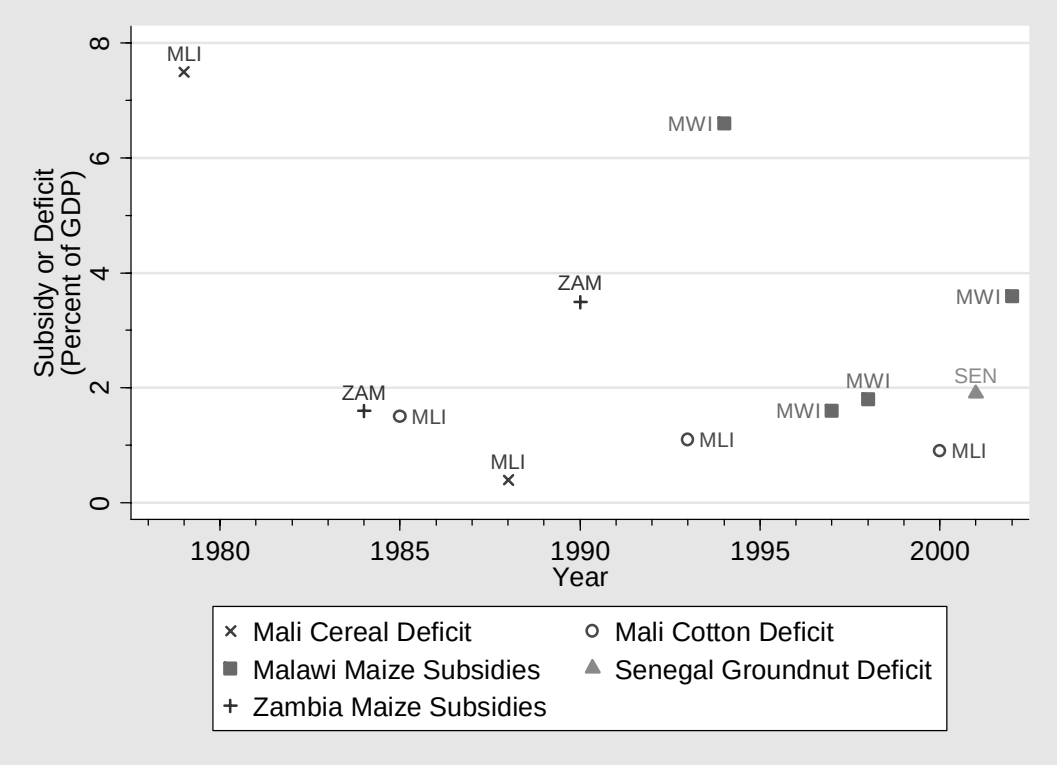
Price volatility in international and domestic agricultural markets encouraged state intervention. For export crops, price volatility stems from weather or other supply shocks that affect competing exporters. For domestically consumed food crops, farm households often sell only the portion of their harvest that remains after self-consumption, so that weather shocks can lead to large relative changes in supply and prices. Underdeveloped credit and insurance markets also exacerbate price volatility. In theory, policies that reduce price volatility in food and export crops can increase investment and benefit producers, to the extent that farmers currently sacrifice higher returns to mitigate risk.

In Africa, a desire to smooth volatility, support the poor, and capture rents led governments to establish state marketing boards. Appendix Table A5.1 lists 14 sectors in 12 African countries where state marketing boards maintained fixed prices, price ceilings, floors, or bands. Fixed prices were constant throughout the year (pan-seasonal) and throughout the country (pan-territorial). To enforce state-set prices, marketing boards were granted monopsony and sometimes monopoly power. As an additional incentive to accept below-market producer prices, marketing boards also offered input subsidies. Seeds, pesticides, and especially fertilizer were tightly controlled and heavily subsidized. Input subsidies also took the form of exemptions from indirect taxes, concessionary credit, insurance, subsidized extension services, and transport services. In cases where the state did not set prices by law, marketing boards maintained a price band by setting aside a fund and conducting open-market

operations. Quantity rationing was less common, although production quotas were imposed in formerly socialist countries such as Ethiopia, Madagascar, and Guinea.

In most countries, state marketing boards proved financially unsustainable. The oil price shocks in the 1970s dramatically increased the price of fertilizer in dollar terms and governments increased subsidies rather than prices. Because of pan-territorial and pan-seasonal pricing, rising oil prices also increased transport and storage costs, which were absorbed by marketing boards. In some countries, pan-seasonal and pan-territorial pricing led to high marketing costs in remote areas because of the circuitous transport of food to urban areas for storage and back to rural areas for consumption (Seshamani, 1998). Predictably, subsidizing both producers and consumers proved expensive, particularly in years when harvests were good. Finally, in general the parastatals themselves were corrupt and/or poorly managed. Many governments responded to increasingly large revenue shortfalls by cutting producer prices further, which led to the emergence of parallel markets and further depressed production. Figure 5.1 shows examples of the substantial losses incurred by state marketing boards in four countries, which ranged from 1 to 6 percent of GDP.

Figure 5.1. Agricultural Sector Losses in Selected Countries



Parastatals' fiscal difficulties, falling export commodity prices, and donor pressure led most countries in sub-Saharan Africa to implement structural adjustment programs during the 1980s. Agricultural reforms were a major part of these programs, which followed three major paradigms. First, input and output prices were liberalized, by removing input subsidies, setting domestic prices in line with world prices, eliminating pan-territorial and pan-seasonal pricing, and in some cases devaluing the currency. Second, regulatory controls were lifted in the transport, procurement, marketing, and, occasionally, the production sectors. Third, public enterprises were restructured to focus on support activities such as maintaining buffer stocks and providing information instead of pricing and marketing activities. Because of the importance of the agricultural sector in these countries, these reforms had far-reaching effects.

C. Stakeholders and Channels of Impact

Consumers, producers, and traders are generally the groups most widely affected by reforms, though processors and parastatal employees are also affected. Of course, reforms have heterogeneous effects within groups. These effects are primarily felt through changes in consumer and producer prices, input prices and subsidies, and the structure of the market.

For producers, the effect of changes in producer prices on welfare depends on the household's net production of the good. Many reforms eliminate producer price or input subsidies. These harm net producers, who tend to be wealthier farm households. However, the patterns of net production vary by crop and by country. Therefore, if possible, the incidence of producer price changes should be assessed using a household survey with production and consumption data. However, such analyses should be treated with proper caution, because they typically ignore crop substitution effects on both the intensive and extensive margins. In particular, wealthier and better-educated households are likely to adapt to price changes more effectively (Schultz, 1975), in which case first-order incidence likely overstates the loss of wealthier households relative to poorer households.

The removal of input subsidies will harm farmers to the extent that they purchase subsidized inputs. Prereform input subsidies were often poorly targeted, as large farmers generally used more inputs and in some cases captured the subsidies. However, the effect of removing input subsidies for the poor can still be substantial, because the increased cost may significantly reduce their income and the fall in input use may have a larger effect on the yield of poor farms. Again, information on poor households' use of inputs and input subsidies may be available in a household survey or agricultural census. Finally, reforms that improve competition in procurement and transport markets reduce marketing margins, which can be passed through at least partially to producers in the form of higher producer prices.

For consumers, the effect of a price change in a food crop, because of the withdrawal of subsidies, will depend on household net consumption of the good. Urban consumers

have higher net consumption on average. Price increases in food crops tend to hit poor households harder because food budget shares fall as income rises. In most countries, large-scale household data can be used to examine the correlation between household budget shares and household economic well-being. Because demand is generally more elastic for poor households, such first-order incidence analysis may overestimate the impact of a price increase on the poor relative to the nonpoor, especially for nonstaple goods.[101] This is particularly true when close substitutes are available. Also, consumer prices typically fall after restrictions in transport markets are removed, which reduces marketing margins and benefits consumers across the board.

Liberalizing transport and procurement markets has in most cases led to the entry of private traders, who benefit from the opportunity to compete away the monopsony rents earned by marketing boards. The removal of interregional trade restrictions and taxes benefits these new traders. Of course, employees of parastatals typically suffer from the loss of rents. Market liberalization and/or privatization of parastatals lead to layoffs following reforms; the distributional effects of these layoffs depend on the negotiated severance agreements as well as the state of the labor market in the country.

Many past reforms harmed poor urban consumers and remote rural farmers. Reforms create winners and losers through their effects on prices and rents. Policies that remove output subsidies and lower producer prices harm net producers, who tend to be wealthier. Policies that lead to consumer price increases in food items harm consumers in proportion to the percentage of their budget devoted to that item. Typically, poor urban consumers bear the brunt of food price increases, especially for staples. Liberalizing procurement and transport markets benefits consumers and producers by reducing marketing margins. However, rural producers in remote areas, who tend to be poor, are disproportionately harmed by the removal of both direct input subsidies and the implicit subsidies deriving from pan-territorial pricing. Farmers in remote areas may also be constrained by poorly functioning collection markets because of the difficulties in obtaining information and credit.

D. Case Studies

Malawi's Maize Market

The Agricultural Development and Marketing Corporation (ADMARC) is a monopsonistic buyer for smallholders' maize at fixed prices. ADMARC was established in 1971 to market agricultural produce and inputs, assist smallholder agriculture, act as a buyer and seller of last resort, and store food and inputs at about 350 market centers located throughout the country. ADMARC's financial position

[101] One example of substitution is the switch from refined meal to hammer-milled meal in Zambia, as described below. Similarly, a 53 percent rise in the price of refined meal raised expenditures of low-income households by only 1 percent, because of the substitution of cheaper hammer-milled meal (Jayne, Tschirley, and Rubey, 1995).

deteriorated for several reasons. Revenues from tobacco exports, which originally subsidized these activities, dried up when tobacco prices fell in the late 1970s. As a result, Malawi signed a structural adjustment agreement in 1981, but little progress was made, as maize subsidies continued to amount to between 0.4 and 1 percent of GDP. (Sahn, Dorosh, and Younger, 1997). Marketing and procurement markets were liberalized in 1987, reforms in 1993 opened up the fertilizer market, and subsequent reforms in 1995 liberalized prices. However, ADMARC still maintains a price band and acts as a residual buyer.

The liberalizing reforms were generally unsuccessful, partly because of uneven implementation and continued ADMARC involvement in the sector. Although the reforms coincided with a short period of growth in both GDP and the agricultural sector, they failed to reduce the fiscal deficit or promote longer-run growth (Appendix Figure A5.1), and the poverty rate increased from 54 to 65 percent between 1991 and 1998. The 1995 price liberalization led to price increases, which harmed net consumers, including many of the rural poor (Chilowa, 1998). The liberalization did not increase the number of traders, and marketing margins remained high, although higher prices increased production. ADMARC's financial performance continues to be hampered by ill-fated business ventures and high overhead costs. Until 2002, ADMARC ran a cotton ginning company and a bus company, both of which lost money. As a result, repeated ADMARC bailouts of 1.6 percent of GDP in 1997/1998, 1.9 percent in 2000/2001, and 3.6 percent in 2002 threatened macroeconomic stability. Finally, ADMARC's unauthorized sale of its grain reserve in 2000, allegedly to politically well-connected buyers, depressed producer prices and contributed to a food security crisis in 2001.

Mali's Cereals Sector

Mali traditionally subsidized urban cereal consumers by imposing low pan-seasonal and pan-territorial producer prices on farmers. For example, in 1979, Mali's millet and sorghum producer price was half of Burkina Faso's price. Producers were legally required to sell to OPAM (Office des Produits Agricoles du Mali) or Office du Niger, which were the official grain and rice marketing agencies. However, the majority of marketed cereals were sold through private channels or smuggled to neighboring countries. Farmers also responded to depressed producer prices by switching to other crops. In the late 1970s, Mali moved from being a net exporter to being a net importer of grains. Because the subsidized consumer price was below the imported price, the budget deficit increased rapidly, as OPAM's deficit reached 7.5 percent of GDP in 1979.

The government agreed to liberalize the grain trade and improve the marketing boards' operating efficiency in 1981. The multi-donor-financed Cereals Market Restructuring Programme first focused on eliminating parastatal monopolies by negotiating changes in their role, providing management assistance, and financing severance pay for laid-off employees. Producer, consumer, and export prices of cereals were fully liberalized in 1987. By the mid-1990s, the program had shifted to

helping the marketing board establish a marketing information system and provide subsidized credit to private traders.

The liberalization program was successful. Both GDP and the agricultural sector grew following reforms, despite continued fluctuations, and the fiscal deficit was virtually eliminated by 1996 (see Appendix Figure A5.1). In the grain sector, the large-scale entry of traders following liberalization reduced margins and led to cost savings on the order of 3 percent of GDP (Akiyama and others, 2001). In the rice sector, reform proceeded more slowly. Parastatal millers remained inefficient until privatization in 1994, and the Office du Niger required a budgetary transfer of 0.4 percent of GDP in 1990. Nonetheless, rice and maize production increased dramatically following the reforms (Dembele and Staatz, 1999). Most farmers added $100 per year to their incomes. In a 1999 survey of farmers, 74 percent of the respondents indicated that their incomes had improved since cereal markets were liberalized. Medium-sized and large farmers experienced 143 percent and 62 percent increases, respectively, in the real return to family labor, whereas small farms increased by only 35 percent (Dembele, Staatz, and Weber, 2003).

Senegal's Groundnut Sector

Sonacos, a Senegalese parastatal, traditionally enjoyed a near monopoly on groundnut oil processing and export. Groundnut oil is an important source of revenue for much of the rural population, and exports amounted to 1.4 percent of GDP and 4.6 percent of total exports in 2003. Sonacos processes around 20 percent of the total amount of groundnuts grown in Senegal and produces roughly 90 percent of total groundnut oil exports. Besides processing groundnuts, Sonacos ran a subsidiary called Sonagraines, which licensed agents to provide subsidized inputs and collect groundnuts from farmers. A quasi-public regulatory association sets a pan-territorial and pan-seasonal producer price each year. In 2001, the government intervened to further increase the producer price, which along with the continued subsidization of seeds and fertilizer caused Sonacos to run a large deficit. The resulting bailout amounted to 1.9 percent of GDP. In the aftermath of this transfer, with donor encouragement, the government dissolved Sonagraines and allowed private traders to engage in procurement.

The elimination of Sonagraines has been criticized for its haste. Reportedly, after Sonagraines withdrew, private traders obtained below-market prices by exploiting farmers' ignorance or need for cash, although there is no systematic evidence on the price received by groundnut farmers. The reported disruption of seed markets caused a steep decline in groundnut production in the 2002–03 campaign. Agricultural output fell as well, before recovering the following year (see Appendix Figure A5.1). After that, Sonacos barely turned a profit. Under continued donor pressure, the government sold Sonacos to a private bidder in 2005. The newly privatized Sonacos has agreed to buy groundnuts for a price of CFAF105 per kilogram, but the regulatory association has set the producer price of CFAF150 per kilogram; the difference will be made up by government subsidies amounting to 0.3 percent of GDP. In addition, Sonacos has

successfully lobbied to maintain tariffs on imported refined vegetable oil that protect its vegetable oil refining business.

Zambia's Maize Sector

Subsidies to the state-controlled maize sector became unsustainable in the late 1980s. Prior to 1990, the government set maize prices, and the procurement, distribution, and processing of maize was undertaken solely by state-owned enterprises and cooperatives. Maize is the staple food in Zambia, and these marketing agencies were subsidized in order to maintain low margins. The cost of these subsidies rose from 1.6 percent of GDP in 1984 to 3.5 percent in 1990, as cotton prices fell in the 1980s. In 1990, with the fiscal deficit at 8 percent of GDP, maize procurement was partially liberalized, which allowed private traders to enter while retaining the state monopoly on international and long-distance trade.

After multiparty elections in 1991, the new government undertook major macroeconomic reforms, including the liberalization of exchange rates and commercial interest rates, tighter fiscal and monetary policy, and the liberalization of agricultural markets. In 1993, one year after a major drought, maize prices were liberalized and maize marketing and processing was decentralized.

Zambia's experience following the reforms was mixed. A poorly planned decentralization of state-led marketing created difficulties in the provision of credit to farmers. Parallel efforts at macroeconomic stabilization drew investments into treasury bonds, at high real interest rates designed to curb inflation. The resulting private sector credit crunch, along with the inexperience of the new credit institutions, proved disastrous. At the end of the season in October 1993, farmers were owed a total of 1.5 percent of GDP for their crops, and most were not paid until February 1994. The unsuccessful liberalization of credit and fertilizer supply increased rural poverty, primarily impacting net maize producers, who tend to be better off (McCulloch, Baulch, and Cherel-Robson, 2001). Nonetheless, this experience illustrates the difficulties of abrupt liberalization of micro-level credit institutions in countries undertaking aggressive macroeconomic stabilization policies.

The privatization of the industrial milling agency and liberalization of milling markets was far more successful. Prior to the reform, poor households spent 15 percent of their budget on industrial maize and it was feared they would be harmed by the withdrawal of subsidies. However, the liberalization of the processing market allowed small-scale hammer mills, which produce maize that is up to 80 percent cheaper, to increase their market share. As a result, between 1991 and 1998, the poor reduced their consumption of industrial maize from 12 percent to 4 percent, and increased consumption of hammer-milled maize from negligible levels to 18 percent of their budget (Balat and Porto, 2005). This underscores the positive effect of reforms of uncompetitive processing and milling markets in mitigating the harmful effects of withdrawing subsidies on the poor.

Overall, the liberalization policies were not implemented consistently and in some cases reversed. Until 1995, publicly set floor prices were announced, impeding the entry of private traders. An export ban was introduced for one year in 1995, but subsequent tight licensing restrictions depressed producer prices. Pan-territorial prices were reintroduced in 1997 and continued to provide subsidized fertilizer inputs. Since then, GDP growth stabilized at approximately 4 percent and the agricultural sector became less volatile, but the fiscal deficit has gradually worsened, to 7 percent of GDP in 2001 (Appendix Figure A5.1).

An important obstacle to effective reform has been the continued intervention of the Food Reserve Agency (FRA). The FRA, ostensibly created to stabilize prices, continued to sell maize to selected large urban millers at up to 25 percent below the market price, depressing competition in processing. The FRA also sold imported maize at below-market prices in 1997 and 1998, which in turn crowded out private importers. In 2001, the FRA instituted a floor price for maize. The FRA's plans and ability to import maize are not announced beforehand, and resulting uncertainty over the market price complicates the decisions of private importers and farmers. Finally, the FRA imports maize only for large-scale millers, which lowers the supply of hammer-milled maize. Households purchase cheaper hammer-milled maize in the four months following the harvest, until stocks run out at local markets and they are forced to purchase more expensive industrial milled maize.

E. The Impact of the Reforms

Reforms failed to generate a large supply response. Donors and policymakers expected that liberalizing the sector would raise producer prices and generate a supply response that would spur growth in the sector. Over time, it became clearer that insufficient implementation, poorly functioning institutions, and insufficient public goods hampered the expansion of the sector.

In many countries, reforms were not fully implemented. Appendix Table A5.2 describes these reforms in more detail for the sample of countries and sectors listed in Appendix Table A5.1, and illustrates the incomplete progress of reforms as of 2002. Of the 14 sectors listed, private trading was liberalized in 11, but parastatal companies or marketing boards remained active in 11 cases. Price intervention of some sort still occurs in 9 of the 14 countries, though in some countries, such as Kenya and Uganda, the price regulations are relatively mild. Concerns about food security led governments in southern and eastern Africa to continue intervention in the maize market, as in Zambia. Marketing boards still conduct a large share of crop marketing in some countries, such as Malawi. State-owned enterprises or multinational firms continue to dominate input markets in many countries. Reforms also have been reversed, particularly in Eastern and Southern Africa. For example, Malawi has revoked and reinstated fertilizer subsidies twice in the past 20 years, and Zambia reinstated pan-territorial maize pricing. Zimbabwe, after liberalizing its internal trading and milling markets for maize in 1993, subsequently increased the role of its grain marketing board

and reintroduced price controls in 1998. Kenya reintroduced maize price supports in 1998 after eliminating them in 1994.

Lasting and effective implementation of reforms was hampered by several factors. Liberalizing reforms impinged on rents earned from state intervention. Donor-led reform efforts failed to generate ownership and enthusiasm from either the bureaucracy charged with implementing reforms or stakeholders in civil society. The rationale for reforms was rarely explained publicly. Loan disbursements were conditional on a wide package of economy-wide reforms, and donors were reluctant to delay disbursements owing to noncompliance in the agricultural sector. Donor coordination in policies was lacking in some instances. Finally, African government officials are often undertrained and underpaid, and state capacity for monitoring and implementation is weak.

Despite inconsistent implementation in some countries, the liberalizing reforms have overall had a positive effect on export crops and a mildly positive effect on the sector as a whole. The liberalization of internal procurement and transport markets induced large-scale entry of private traders, which reduced marketing margins and more closely integrated agricultural markets, increasing producer prices for farmers and decreasing consumer prices. In addition, the reforms engendered a limited supply response, which was stronger for export crops than for food crops. In some countries, devaluations raised the producer price of export crops relative to food crops. Also, fertilizer is used more intensively for export crops, partly because their markets tend to be more vertically integrated and public stabilization policies reduce price volatility.

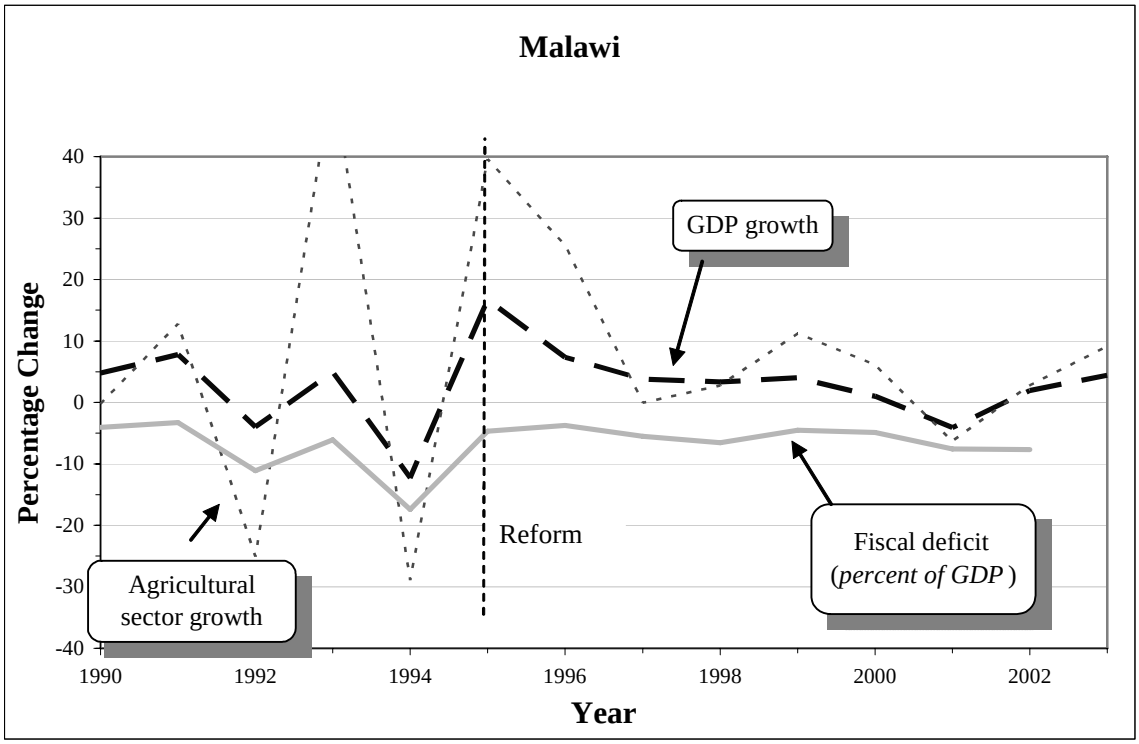
Several factors moderated the effect of the reforms on poor households, although the effect on poor households was mixed. In grain markets, most poor rural households are net consumers, but grain prices did not generally increase after reforms because of the decline in marketing margins. Food and fertilizer subsidies often did not reach the poor or were distributed inefficiently, which attenuated the negative effects of the withdrawal of these subsidies. However, private rural credit markets did not function well, and reforms reduced overall fertilizer use.

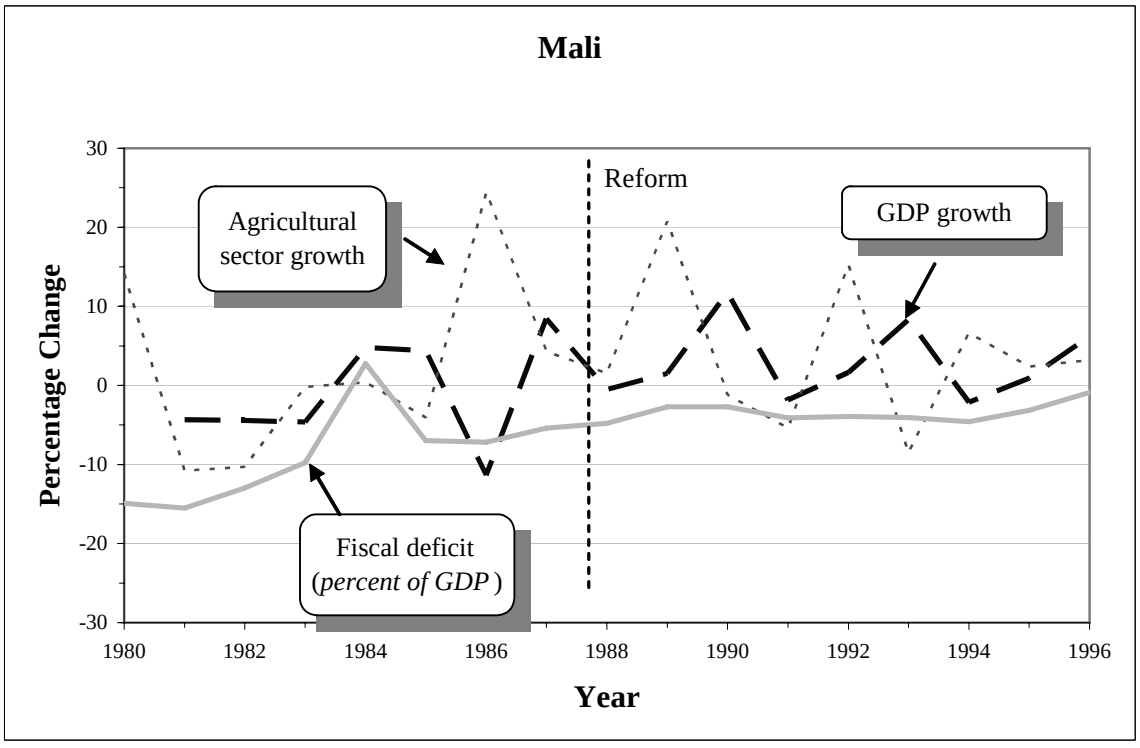
The reforms were particularly beneficial for export crop farmers and farmers in more accessible areas with marketable surpluses. Declining marketing margins and exchange rate depreciation increased the income of small export growers by roughly 20 percent. Meanwhile, net producers in remote areas suffered from the elimination of pan-territorial and pan-seasonal pricing and from the withdrawal of input subsidies. This highlights the need for consideration for farmers in remote areas who may be hurt by reforms.

Overall, the outcomes of the reforms were mixed. Liberalizing reforms in the agricultural sector were precipitated by inefficient and unsustainable state involvement in price-setting, transport, and marketing. Reforms generally scaled back the role of state marketing boards, liberalized internal trade, and removed subsidies or restrictions on inputs, outputs, and price. Liberalizing transport and procurement markets reduced

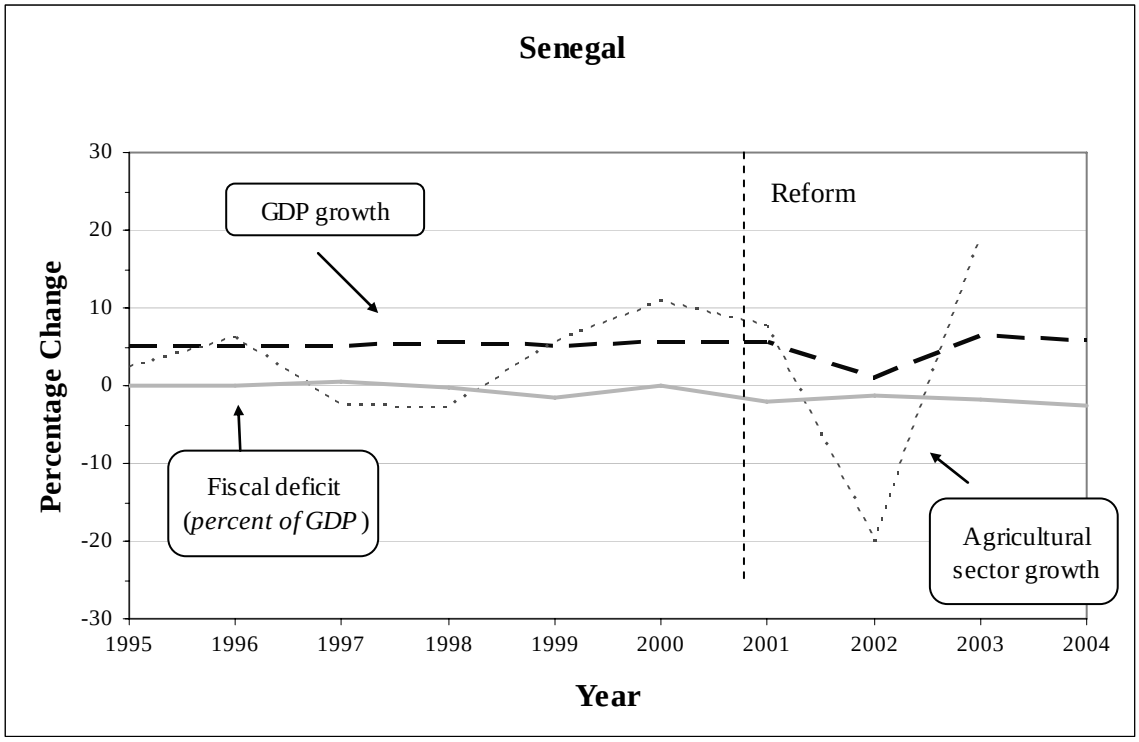
marketing margins. However, the hoped-for supply response did not materialize, largely because of weak implementation, institutions, and public goods provision. State involvement in input markets was not replaced by well-functioning private markets. Finally, reforms that ended input subsidies and pan-territorial pricing disproportionately harmed farmers in more remote areas.

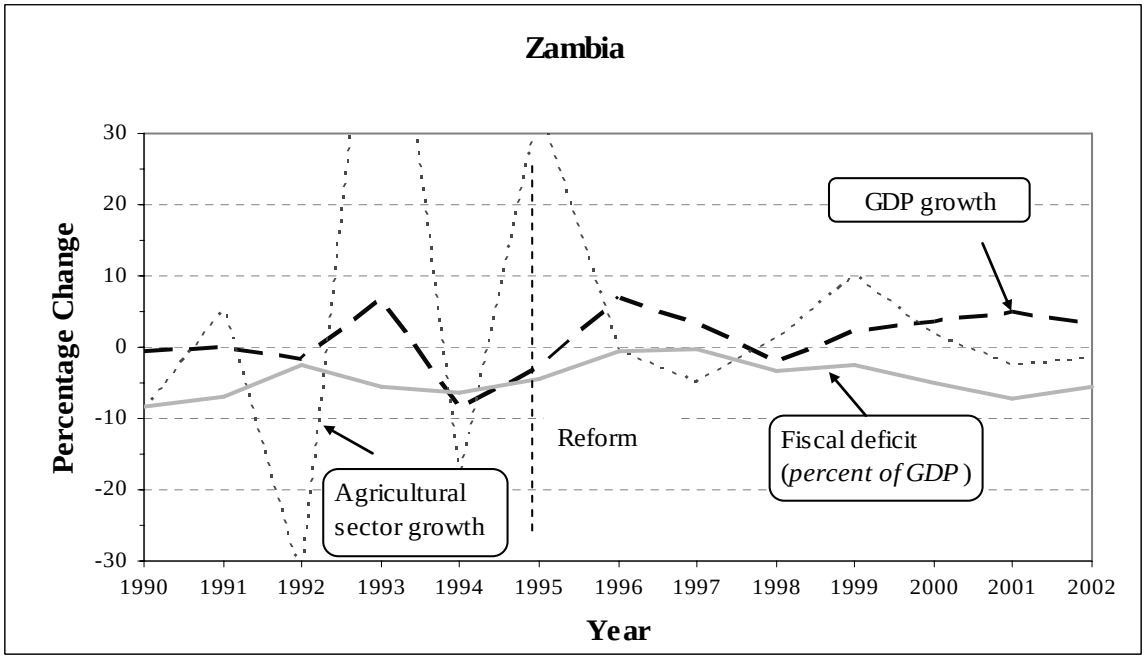
Appendix Figure A5.1. Pre- and Postreform Trends in GDP Growth, Fiscal Deficits, and Agricultural Production





Appendix Figure A5.1 (*concluded*)





Appendix Table A5.1. Marketing Boards and Interventions

Country	Crops	Intervention
Benin	Cereals	Cereal Marketing Board, created jointly with local organizations, attempted to control 25 percent of the cereals market in 1983.
Benin	Cotton	Full parastatal control of prices, marketing, and input.
Ethiopia	Cereals	Grain trade strictly controlled: State set production quotas and below-market producer prices, and private trade was prohibited.
Ghana	Cocoa	Full parastatal control of prices and marketing.
Kenya	Maize	Reform since 1980 slow and uneven. National Cereals Board shared an oligopoly in maize trade, and domestic trade was prohibited, until 1993.
Madagascar	Rice	Assembly, processing, transport, and marketing of rice nationalized in 1976. Consumer prices were subsidized and producer received minimum prices.
Malawi	Maize	Monopsony marketing board (ADMARC) maintains pan-territorial and pan-seasonal prices, subsidized through tobacco exports. Starting in 1995, ADMARC has been administering a price band and acting as a residual buyer.
Mali	Grains, Rice	Monopoly parastatal in grain until 1980s, in rice until 1987.
Mali	Cotton	Price remains publicly set and the parastatal holds a monopoly in procurement, input, ginning, and export markets.
Senegal	Groundnuts	State-owned parastatals. SONAGRAINES distributed subsidized seeds and fertilizer, in return for SONACOS purchasing and processing output. Pan-seasonal and pan-territorial prices continue to be set.
Uganda	Coffee	Coffee Marketing Board fixed and administered low producer prices and high taxes until 1991.
Tanzania	Maize	Monopoly parastatal. Coffee board completely controlled marketing.
Zambia	Maize	National Marketing Board purchased grain at pan-territorial and pan-seasonal prices.
Zimbabwe	Maize	Parastatal marketing board.

Appendix Table A5.2. Agricultural Market Reforms

Country	Sector	Year	Reform	2002 Status		
				Parastatal	Price intervention	Trading restricted
Benin	Cereals	1990	Limited marketing board to extension and resource activities.	Y	N	N
Benin	Cotton	1989, 1995	Procurement and transport liberalized in 1989. A few private ginners allowed in 1995, but prices are set publicly and the parastatal dominates input provision and exports.	Y	Y	N
Ethiopia	Cereals	1990	Dissolved marketing corporation parastatal, legalized private trade, eliminated per-producer quotas, and liberalized producer and consumer prices. Informal cross-district taxes remained.	Y	N	N
Ghana	Cocoa	1993, 2001	In 1993 permitted domestic procurement (but not export). Reforms in 2001 privatized the marketing board and in 2001 private firms were allowed to export up to 30 percent of domestic procurement.	N	N	N
Kenya	Maize	1994	Liberalized prices and allowed private traders to enter in procurement markets. Withdrew subsidies to roller meal producers. Marketing board still supports maize price in selected regions, and maize tariffs are highly variable.	Y	Y	N
Madagascar	Rice	1986	Liberalized procurement market in 1986 and liberalized prices in 1991. Reduced import tariffs from 30 percent to 10 percent in 1994.	N	N	N
Malawi	Maize	1995	Privatized procurement market, lifted ban on export of food crops, and moved pricing policy to a band instead of a fixed price. However, the parastatal remained the dominant buyer.	Y	Y	N
Mali	Rice	1987	Allowed private entry into rice milling, and abolished marketing board's commercial purchasing and selling functions.	Y	N	N
Mali	Cotton	None	Price remains publicly set and the parastatal holds a monopoly in procurement, input, ginning, and export markets.	Y	Y	Y
Senegal	Groundnuts	2001	Liberalized procurement and transportation and discontinued input subsidies. Interprofessional association continues to set price and parastatal remains state-owned.	Y	Y	N
Tanzania	Maize	1990	Liberalized procurement and transport, but exports are still regulated.	Y	Y	Y
Uganda	Coffee	1992	Export market liberalized; producer floor price linked to world price.	N	Y	N
Zambia	Maize	1995	Abolished state marketing board and privatized national milling industry. Created a price stabilization agency, which selectively sold maize at below-market prices to selected millers. A pan-territorial price was reinstated in 1997. Fertilizer markets are still controlled by the stabilization agency amid allegations that politically favored buyers are granted access to subsidized fertilizer.	Y	Y	N
Zimbabwe	Maize	2000	Reintroduced price controls through the grain marketing board. Controls imports and exports and banned private trade.	Y	Y	Y

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