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APPENDIX III.1

Trade Reforms and Informal Economy in India: A CGE Analysis

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Trade Reforms and Informal Economy in India: A CGE Analysis[1]

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ABSTRACT

Informality is multidimensional and generally lacks clarity in its description. The ambiguity of the terms has constrained research on the macroeconomic aspects of the informal sector. This also means the linkages of this sector with other economic agents have not been largely examined so far. The current study intends to conceptualise the term 'informal economy' by taking into account firms and workers not protected by any legislation. Given the wide range of activities under the rubric of informal activities, the parameters to describe the informal sector are very varied. The objective of the current macro analysis is to define the macro aspects of the informal sector to enable a measurement of this sector's contribution to the economy. This is done first through the construction of a Social Accounting Matrix (SAM), as reported in Sinha, Siddiqui and Munjal (2004) and second, by using a Computable General Equilibrium Modelling approach to examine the economy-wide impact of trade reforms, as discussed in this paper.

To understand the macro aspects, we consider two major perspectives through which we conceive the informal sector:

- small-scale production, which is identified as the 'unregistered' part in national statistics;
- informal 'factor ownership', i.e., workers involved in casual work and own-account workers.

The informal sector is directly relevant to poverty analysis as most workers in this sector live in poverty (Sinha, Sangeeta and Siddiqui, 2003). There are a large number of case studies that have conducted reviews of the linkage between adjustment and poverty during the 1980s. These have analysed the impact of policy changes in developing countries on poverty and inequality. The findings of qualitative analyses of the relationship between reforms and poverty are presented in a short review by Killick (1995); while White (1997) provides a more recent review. These works describe the reforms undertaken and the changes in a variety of welfare indicators among different household and socio-economic groups. Such studies have been also reported in a series of Background Papers on "Globalisation with Human Face" prepared for the Human Development Report 1999 (UNDP, 1999). Similarly, McCulloch, Baulch and Charel-Robson (2000) provide similar analyses for a set of African countries.

Case study analysis cannot generally trace exact linkages between any policy changes such as trade or fiscal reforms and the welfare changes, as these cannot be statistically tested. The results seen after a policy change could just as well be due to other reasons and no direct linkage may be traced without any quantitative connection. Sometimes, there is no impact of a policy change due to miscellaneous factors. As well, conclusions reached through analyses using qualitative studies cannot be taken as generally applicable and should be limited to the specific group interviewed. The inability of descriptive studies to provide a robust causality between impact and result has made research in modelling approaches more demanding. There are few instruments that can relate macroeconomic policy and microeconomic behaviour.

[1] Comments provided at the NCAER-UNCTAD Workshop in Delhi (January, 2004) on the paper titled "Impact of Trade Reforms on the Indian Informal Economy and Poverty" is thankfully acknowledged. This paper addresses the critical comments and is a revised version of the earlier paper. This is also based on an augmented CGE model that takes into account the model extensions suggested by the experts in the workshop.

The Computable General Equilibrium Models (CGEM) is one such tool used to address these concerns. Such models have been applied to a range of policy questions in a number of economic fields over the last ten or so years. They include public finance and taxation issues, international trade policy questions, and evaluations of alternative development strategies and the implications of macroeconomic policies. Such models can use information from micro studies to design aspects of their behaviour.

Here we have used information from case studies of the rice and garment sector to inform our assumptions. These field studies have shown that many formal firms employ workers on a casual basis. Accordingly, we have designed the formal sector innovatively in the model such that it hires both regular (formal) and casual (informal) workers. Field work shows that there may also be price differences in the formal and the informal sub-sectors of an industry; so here we have treated the two sub-sectors as distinct with different production processes and pricing mechanisms. The prices of the formal part of an industry are formulated by incorporating production taxes. The informal parts do not have any such wedge.

We have attempted to put all the information collected from primary and secondary data in a structured format with explicit connections amongst the major activities and income generation processes in the economy. Lastly we design a general equilibrium model that is able to examine shocks and analyse the economic ramifications or “transmission" of these shocks. Originating from changes in government policy the shocks which are simulated have differential impacts on sectoral production, types of incomes, consumption and trade.

Our findings show that trade reforms cause wages of casual workers to increase with full flexibility in both the labour markets specified in the study (namely formal and informal). This is because casual labour intensive sectors expand (conforming to the typical Heckscher-Ohlin conjecture) under tariff reduction as erstwhile-protected sectors contract. However, when we impose wage rigidity in the forma l labour market, the results differ. Specifically, when the demand for formal labour declines in these circumstances, some formal labour is laid off which then seeks employment in the casual sector, swelling the ranks of casual workers and bidding down their wages. The study shows that the very bindings, which result in greater expansion in the informal sector, namely the wage rigidity causes the informal sector wages to contract. A positive outcome could be obtained for the casual workers letting them attain the benefit from informalisation, if the informal sector workers are protected through minimum/decent wage legislation.

I. Introduction

The view of the informal sector as a holding ground for workers awaiting entry into the formal sector was challenged by the International Labour Office mission to Kenya (1973). Its report instead saw the informal sector as a source of employment in its own right and as a category for economic planning. The ILO went on to commission a series of studies of Third World cities, which were summarised in a book edited by Sethuraman (1981). In most of these studies the informal sector was in practice defined as consisting of private enterprises with ten or fewer employees. The book concluded that 'there is little evidence to show that the participants in this sector hold out for better jobs in the formal sector.

Though the term informal sector was popularised through the ILO's report on Kenya, it has remained an ambiguous term for researchers and policy makers. Generally the term is used to refer to unregulated economic activities. It has been recognised that this sector provides livelihood to the majority of workers, but there is no systematic study to estimate the size and contribution of this sector. One of the reasons for this is the difficulty in collecting data on informal economy. Generally informal activities are carried on without a fixed location or in places that are not easily visible to the authorities, such as small workshops or residences.

There is evidence that most of the workforce in a developing country is involved in informal activities. With competition leading to a reduction in formal employment, the informal sector has been providing livelihoods for the new unemployed (Meagher and Yunus, 1996).

At the same time, workers in this sector remain outside any social security structure and have to operate in very degraded working conditions. The informal sector functions in a grey area and though in most cases, workers are paid, the payment is not formalised. This creates a leakage both for the sector and for the state and generates unaccounted for rents to private agents that do not entitle them to any state benefits. There has been unprecedented expansion of the informal sector in many countries during the past decade and a half. Moreover, the working and linkages of this sector have become critical to understand. In India the informal sector contributes more than 60 percent of GDP (NAS) and covers about 87 percent of the work force (Sinha, Sangeeta, Siddiqui, 2003).

In the late 80s and early 90s many developing countries including India opened up their markets and introduced trade reforms as a major development strategy. This has led to a growing concern to understand the dynamics of the alternative informal economy as the formal sectors adopt cost cutting strategies to survive in a competitive environment. So, working and linkages of this sector have become critical to understand as the economy experiences wide ranging policy reforms under liberalisation.

In the 1990s, India adopted decisive reform policies to bring about growth leading to improved standards of living for the common people of the country. In the pre-reform regime, India nurtured import duties that were among the highest in the world. Tariff duty rates exceeded 200 percent for many items during this period. Since 1991 the maximum tariff rate has been gradually been reduced and now this is 25 percent in 2003-2004. The trade policy regime also included quantitative restrictions on a variety of goods, ways in terms of productivity, employment structure, the relationship with the state, potential income generation and linkages to different household categories.

The trade policy regime in India before 1991 included quantitative restrictions (QRs) on finished consumer goods, industrial raw materials, intermediates and even on components and capital goods. The dismantling of QRs began in the first two years of the reform. Since 1993 industrial raw materials, intermediates, components and capital goods could be imported freely subject to the prevailing tariff levels. The EXIM Policy 1992-97 still embodied a Negative List of imports subject to licensing requirements. All QRs have been removed by April 1, 2001.

Trade reform appears to have stimulated a significant amount of growth in the economy. The major trade reforms since 1991 reflect both unilateral and multilateral characteristics. Unilateral reforms encompassed exchange rate policy (the move in 1993 to a unified exchange rate); the promotion of greater foreign investment; and explicit reform of tariffs and import licensing schemes. These have been buttressed by commitments to WTO with regard to trade in goods and services, trade related investment measures and intellectual property rights. Empirical evidence from a number of studies (for example see Srinivasan, 1998) show that by the late 1990s growth was averaging around 7 percent per annum implying there had been significant effect of trade liberalization on India's growth performance. Though

impact of trade reforms on overall performance has been significant, it is necessary to examine how the more vulnerable sections of the Indian society have fared under the new generation of reforms. Moreover, with as large as 87 percent of workers engaged in informal activities and the informal sector, it is matter of no small importance to examine how trade reforms affect this sector and its workers

There are not many empirical studies, which have attempted to analyse the working of the informal sector and studied its articulation with other actors of an economy in a modelling framework, especially for India. Though, the informal sector at present has been recognised as an important phenomenon due to political, economic and social forces, paucity of macro level data has constrained extensive macro analysis of the sector. So far most research in this area has focussed on the microeconomic aspects of the sectors. It is realised that lack of an overall macro perspective of the interrelationship of this sector with other economic agents would lead to programs, which could endanger the economic security of a large section of the population

II. Modelling Informality

As noted above, there are a number of characterization or facets of the informal sector even at the basic level. This sector has been defined with respect to commodities, markets, activities, enterprises, institutions and individuals. Many a time when the informal sector's domain has been accepted in the broad sense, the immediate motivation of a study resulted in competing definitions. Naturally without a basic format to describe the informal sector itself researchers face difficulties especially when evaluating data issues.

II.1. CGE Analysis of Informality: A Background

Having acknowledged the various dimensions of informality, the CGE structure seems well-suited in terms of conformity with macro analysis with these perceptions of the informal sector. As the CGE methodology is built around both markets (goods and factor) and production (processes), it is necessary to define the informal sector with respect to these dimensions. This could be done in a variety of ways following the theoretical work on this topic. Gibson and Kelley (1994) differentiate between production processes based on profitability while Portes, Castells and Benton (1989) look at the informal sector only in

terms of segmented labour market theories. Another stylised fact associated with the informal sector involves its relationship with the state. The popularity of this theme is mainly due to the work by De Soto (1986), though the legal status of the informal sector has remained a matter of debate since a long time.

A paper by Kelly (1994) suggests that despite the large size and economic importance of the informal sector in the developing world, relatively little is known about the macroeconomic implications of these activities. One important reason is due to data limitations. However, it must also be realised that the lack of a macroeconomic approach to the question of informal activity has also been responsible to this scarcity of analysis. The results presented in the paper reflect that both formal output and informal sector income fall as higher formal sector wages cause informal output to replace formal sector production. Workers who maintain their formal sector employment experience higher real wages, but displaced workers and informal producers both suffer losses in real income. By placing informal activity within a macroeconomic framework, the paper shows that informal producers are better served by policies, which reduce informal production through formal sector growth (implying flexible labour market in the formal sector).

An agriculture focused CGE model for Zimbabwe (Bautista, Lofgren and Thomas, 1998) examines the income and equity effects of trade liberalisation in isolation and in conjunction with potentially complementary changes in fiscal and land policies. The study shows that aggregate disposable household income increase significantly, but the equity impact is unfavourable under pure trade policy reform. The simulation suggest that with an effective land reform and restructuring of government expenditure and taxation, the substantial progress achieved under the Economic Structural Adjustment Program (ESAP) in reforming trade and exchange rate policies in Zimbabwe could have helped promote the twin objectives of overall income growth and equity. More generally, complementarities between trade policy and other aspects of the domestic policy environment are potentially significant.

Marceau and Savard (1997) build a simple computable general equilibrium model in with three forms of dualism - scale, wage and evasion - can be used to analyse the impact of changes in the tax-regulation system. Technological heterogeneity of firms as in the model by Rauch (1991) is assumed in each branch of production. This model offers an explanation for

scale and evasion dualism. Moreover, the model also generates wage dualism in the presence of a government-set wage rate imposing binding constraint on formal sector firms.

The model demonstrates that with firms' heterogeneity and a marginal cost of tax and regulation evasion that increases with the size of the firm, a formal and an informal sector endogenously emerge in some productive branches of the economy. Moreover, waiting unemployment is introduced in the model to account for the high level of unemployment observed in many developing countries, especially in urban regions. The analysis clearly shows the importance of incorporating explicitly the informal sector in future work on the economic reforms are relevant for developing countries.

Agenor and Aizenman (1994) examine the implications of fiscal and labour market policies on output, wages and unemployment in a general equilibrium model of a small open developing economy with a large informal sector, a heterogeneous work force, and segmented labour markets. Unskilled workers working in the formal sector were assumed to earn a legally fixed minimum wage whereas, wages of unskilled workers hired in the informal sector were taken to be fully flexible. The findings revealed that in a two-sector economy where the minimum wage is enforced only in the formal sector and wages in one segment of the labour market are competitively determined, efficiency wage considerations did not alter the standard neoclassical presumption: a reduction in the minimum wage improved competitiveness, and expanded the formal sector at the expense of the informal sector.

While building the current CGE model incorporating the informal sector we used insights from the literature survey of general equilibrium models noted above. The survey conformed that within similar commodity producing sectors a fixed portion could be operating as informal firms. The starting point of recognising a firm as informal would depend not so much on the nature of the goods produced, but on distinction in terms of structure of their production. Also informality has a distinct relationship with the state and modelling could take account of this interlinkage more meaningfully rather than introduce its size while distinguishing the sector in a macro framework.

II.2. The CGE Analysis of the Indian Informal Sector

The current CGE model is an extension both empirically and methodologically, over the basic model developed by Sinha and Adam (2000) that incorporated the informal factor market and the resultant factor flows into various socio-economic household categories. In the present exercise we introduce: (a) production market distinctions; (b) a characterization of household income flows which emphasises a rigid distinction between factor incomes, both wages and capital, accruing from formal and informal economic activities; and (c) labour market segmentation. The reason behind such an approach towards informalisation of the CGE model was to address the concerns facing the informal sector and informal income earners while coping with the trade reforms underway in India. Moreover, each of the extensions was deliberated with the findings from the case studies of the rice and garment sectors (Singh and Sapra, 2003, Ghosh and Sudarshan, 2003 and Ghosh, Kaur and Sudarshan 2003). The technical aspects of production differ between sectors with informal processes characterised as labour-intensive reflecting scarcity of capital by informal firms. The case studies have reported that the labour intensity in formal firms and informal firms differed in terms of quantity and also in terms of work status. The employment structure of formal and informal sectors formulated in the CGE model has been informed by the field studies.

The SAM used in the model is based on that constructed for India by Sinha, Siddiqui and Munjal, (2004) which had taken the informal sector into account. Information on the informal sector is based on the NSSO survey administered in India by the CSO during 1999-2000.

Briefly, the information from the National Account Statistics (NAS) and the NSSO are used in building the SAM. In this study we identify the informal sector from the nation-wide data sets in terms of production and also in terms of workers who are involved in informal activities in order to trace the inter-relationships this sector has with the formal sector. For the production side we have used data from the Central Statistical Organisation (CSO) to break up each sector into its formal and informal parts. As defined by the CSO the formal sector or the registered sector, is comprised by establishments employing 10 or more workers and using electricity or 20 or more workers without electricity and registered in accordance with the Factories Act. These establishments come under the aegis of the Annual Survey of Industries (ASI). The rest of the manufacturing establishments comprise the unorganised sector. Informations on the organised and unorganised sectors are taken from the ASI and the

Enterprise Follow Up surveys to disaggregate the 115 sectors of the CSO's input-output table. These sectors are aggregated to 14 sectors on the basis of their usefulness in providing information about the informal economy. The NAS also provide information about the value added generated from each sector and their break up into registered and unregistered parts. Information regarding households was available from National Sample Survey Organisation (NSSO) data and it has been possible to identify households as formal or informal depending on their major source of income.

For this exercise we have classified households into "pure" categories and have not formulated any mixed income households. This means that we have abstracted somewhat from the exact data and have stylised households that mostly earn income from formal sector employment wages as 'formal' households, ignoring informal income streams. This makes our analysis more transparent while we try to study the impact of policy changes on wages, capital rents and households.

As part of our broader research into the study of the Indian informal sector, we conducted case studies of the rice and garment sectors. The findings show that the formal sub-sector uses more than 1.5 times the quantity of intermediate goods for production than the informal sector. This indicates a stronger linkage with other sectors in the economy. Moreover, labour productivity in the formal sub-sector is about 18 percent higher than that in the informal sector. The largest difference seems to be in daily wages earned in the two types of sub-sectors. Formal sector wage-earners, on average, earn about three and half times more than informal sector wage earners. Apart from the data obtained as above, we have also used this field evidence while building assumptions about wage differentials and labour intensity of the formal and informal sub-sectors in our modelling exercise.

Following convention, we assume that a particular commodity is produced by one and only one sub-sector and each sector produces only one type of commodity so that there is a one-to-one mapping between sectors and commodities. The following basic principles have been followed to construct the sectoral aggregation scheme:

- **Manageability.** The model follows key linkages, which are several, while being compact;

- **Consistency.** Our disaggregation is consistent with the intellectual framework we are adopting and with the fundamental behaviour we want to characterise;
- **Relevance.** Our disaggregation casts light on the policy questions of interest.

Given these principles the key dimensions we need to disaggregate are the degree of informality within a (broad) sector and the extent to which the output of the sector is tradable (internationally) or non-tradable (i.e., determined by domestic forces of supply and demand only). For the disaggregation and classification based on these principles, refer to Sinha, Siddiqui and Munjal, 2004.

As regards the structure of the informal sector, we assume that it hires only casual workers on a day-to-day basis. This then forms a large share of the entire work force. As per the NSSO data, informal workers including own account workers constitute 88 percent of the entire work force.

The economy is assumed to consist of two types of sectors – one producing a high technology good (formal) and the other a relatively low technology good (informal). This also suggests that the sizes of establishments in the informal sub-sector will be small (as such establishments generally use less capital) compared to that of the formal sub-sectors. In this study the formal sub-sector is the "registered" sector as per official records and similarly the informal sub-sector is the unregistered sector.

The other key distinction in the production structure relates to the relationship with the State. The informal sub-sector does not pay any direct tax, whereas the formal part does. In this study, we have divided the entire labour force into casual and regular workers. Further we also assume that the informal sub-sector casual labourers have a lower wage rate than the regular workers. The formal sector hires both regular and casual workers. So even though a worker belongs to a formal firm, she/he is not necessarily a regular worker.

As is standard in this type of CGE models, it is assumed that the Indian economy was in equilibrium in the benchmark year (1999-2000). We have used two versions of the model for our simulation exercise. In the first version of the CGE model we assume perfect competition in the labour markets and there is no unemployment in the economy. If a certain sector contracts labour thrown out of work, being perfectly mobile, are absorbed in the expanding

sectors, while if overall demand for a labour type declines, this drives down the wages to clear the market with fixed labour supply. In the second version of the model we allow for downward wage resistance in the formal sector so that formal workers may face unemployment. We assume, however, that unemployment does not persist and that those laid off from the formal sector immediately swell the ranks of the informal casual labour force.

The advantage of uses of the CGE model is that it interconnects the general equilibrium effects of different policy options. For example a study by Narayana et al (1990) shows that the combination of investment of infrastructure with welfare schemes, such as food for work programme, is a very effective way of reducing poverty compared to providing food subsidy. In another study by Clarete and Roumasset (1990) trade liberalisation for agricultural commodities have been examined and their results show that growth actually depends on the removal of quantitative restriction on industry. Simulation runs can be designed by using the CGE models so as to get various welfare findings. It is possible to determine the winners and losers due to change in policy.

III. Model Structure

We use a relatively standard trade-focussed comparative-static CGE model to analyse the principal distributional consequences of a package of tariff reform and QR reduction. The equations of the model are provided in Appendix I. Reflecting the characterization of formal and informal activities reflected in the disaggregated social accounting matrix, the model maps changes in the functional distribution of factor income into a small set of representative household types. The model is static with neo-classical closure whereby savings determine investment. Perfect competition is assumed but, for institutional reasons, there wage rigidities may exist in the formal labour market.

A standard approach is adopted for modelling the external sector and this is based on the Armington (1969) assumption of imperfect substitutability between domestic goods and imports. Moreover, the world prices of tradable goods are assumed to be exogenous (small country assumption) and the (real) exchange rate adjusts so that the trade account is equilibrated.

The model distinguishes formal and informal 'varieties' of goods, permitting a plurality of technologies (and variations in factor intensities) to characterize the production side of the economy. This distinction allows for tax and tariff structures to vary across sectors, reflecting the general capacity of the informal sector to evade a variety of forms of taxation.

The model is not as fully developed on the consumption side. Households are assumed to consume a vector of goods defined over formal and informal varieties of all goods, with consumption choices being governed by a common set of substitution elasticities. What is not provided for at this stage is for a multi-stage consumption structure which would allow for different categories of goods to retain this same substitutability but where there may be a different and more or less substitutable with its formal/informal variety. The development of the model having such substitution possibilities is the future need of this model.

III.1. Product Market

Here we extend the CGE model that had earlier been developed by Sinha and Adam (2000) to study the impact of policy reforms on informal workers and households earning from informal activities. The model therefore adopts the standard 1-2-3 structure pioneered by Devarajan, Robinson and Lewis (1996). In the current version we have incorporated informal sectors into the model, which have distinct production processes and relationships with the State. We adopt standard product market specifications. Firms are assumed to be perfectly competitive and produce a homogeneous output that can either be sold to the domestic market or exported. In the current version of the model all firms are price takers for all imports. The model consists of 14 productive sectors including formal and informal sub-sectors, as mentioned above each producing a single representative good or service.

Gross output is determined by a fixed-coefficient Leontief production structure where intermediate inputs are combined with value added. We assume ownership of a homogenous sector-specific capital. The distinction of the capital as formal and informal provides a link of capital income to household income. If the prices are equalized the firms are indifferent to the composition of the type of capital. In the current version of the model we employ this simplification. Capital prices are equalized but the sectoral decomposition of capital between formal and informal capital is defined exogenously from the calibration data. This exogenous composition therefore defines the flow of capital income to households.

III.2. Labour Markets

We assume that there are two types of labour in the economy and that the supply of the two labour types is fixed. These labour types are mobile across different sectors in the first version wages clear the two labour markets and in the second, formal labour market has wage rigidity. Since firms are profit maximisers and the two types of labour are mobile, In the first case *average* wages for each broad labour type are driven towards the value of their marginal product in each sector. However, in order to reflect the observed sectoral wage distribution, subsector-specific wage rates are not equalized across sectors but are distributed around the mean wage for each type of labour according to a fixed wage distribution matrix.

This wage dualism has been explained by the existence of labour market segmentation that creates entry barriers to higher wage jobs in the formal sector. This segmentation may result from higher efficiency wages in the formal sector. It may also be consistent with the presence of trade unions in the formal sector that succeed in setting wage rates at levels exceeding those prevailing in the informal sector. Average wages in the informal sector are lower than in the formal sector in the baseline and this persists across all simulations.

The model by Devarajan et al (1996) for Cameroon first used the concept of a fixed distribution of sectoral level wages around an average wage rate as a simple way of reflecting, but not explicitly modelling observed labour market wage differentials. The sectoral distribution of wages around the average wage for each skill type is derived from the calibration and is assumed to be fixed. Hence movements in aggregate demand and supply alters average wages for a skill-type but not the sectoral distribution around the (moving) average.

The sector specific wages are given by the firm's first order condition derived from maximizing the profit function (equation 1):

$$Max_{\{L_{i1c}\}} p_i = pva_i X_i - wa_{1c} \Psi_{i1c} L_{i1c} \qquad (1)$$

where X_i is given by the production function. Thus this leads to the following wage function (equation 2)

$$wa_{lc}\Psi_{i,c} = \frac{X_i pva_i a l_{i,c}}{L_{i,c}} \qquad (2)$$

The specification allows the average wage for, say, casual labour in sector *i* to differ from the wage paid to the same casual labour in sector *j* even though both will rise or fall in proportion with movements in the average casual wage itself. Hence, profit maximization by firms drives *average* nominal wage for each labour type (denoted wa_{lc}) to their market clearing level, but maintains a constant relative *sub-sectoral* distribution around the average.

III.3. Goods Market Allocation Mechanism

In this system, goods in each productive sector are distinguished between exportable and a domestic variant. The economy is assumed to be a price taker for all tradable goods, under the small country assumption. However, domestic goods and factor prices are fully flexible. Output can be consumed or applied to the formation of the capital stock, and is sold either to the domestic market or exported. On the production side, the model assumes that the domestic and export variant of the good are imperfect substitutes so that the firm cannot switch their output costlessly between the domestic and foreign markets. Firms produce a total output that they allocate between the export market and the domestic market according to the sector specific homothetic constant elasticity of transformation (CET) functions.

The consumption of each sub-sectoral output is assumed to be regulated by the Armington assumption of imperfect substitution between domestic product and imports. The demanded composite consumption good is a constant elasticity of substitution (CES) aggregation of imports and domestically produced goods. The composition of consumers' demand between domestic and imported goods by households (in final consumption) and firms (for intermediate purchases) is therefore defined analogously to the firms' production process.

III.4. Prices

The CGE model has a number of prices that clear the different markets defined in the model. As the model is described in entirely real terms, the model solves for relative prices only. The numeraire should be chosen depending on the type of questions the model is designed to address. As we adopt the small country assumption[i], firms and consumers are price takers in the world market; world import prices are, therefore, the numeraire in this model. Domestic

prices for tradables are linked to world prices wedged by the structure of trade taxation and, on the import side by quantitative restrictions. The model is within neoclassical framework and all endogenously determined prices clear their relevant markets.

QRs in this model are treated as tariff-equivalent distortions on import prices which function exactly as formal taxes but where the rents accrue to specific household types. Treating QRs in this tax-equivalent fashion is, of course, a simplification but one that is valuable for simulation purposes since it avoids the complications associated with solving the model under strictly binding quantity constraints on imports. In our simulations, imports for quota-ridden goods can increase.

We start with tradable goods prices. Domestic prices for imports and exports (see equation 3 and equation 4) are defined by the price-taking assumptions where er denotes the nominal exchange rate and tm_i , qr_i and tx_i denote tariff, quantitative restriction and export duty rates for sector i respectively,

To incorporate the tariff equivalent of quantitative restriction we adjust the domestic price of imports as follows:

$$pm_i = p_i^{wm} er(1 + tm_i + qr_i) \tag{3}$$

where tm is the explicit import duty rate and qr is the implicit quasi-rental rate arising from the (partial) quantitative restrictions. Together they generate the wedge between world and domestic prices. There is an important assumption in this structure namely that QRs are partial and hence not binding at the margin. Their effect, therefore, is to act as tariff equivalents only.

A key feature to add is to determine who benefits from the QRs (i.e. to whom do the quasi-rents accrue). Theoretically one could think of a QR as a licence to import a good cheaply (i.e at pwm*er*(1+tm)) and sell it on at the market price (pm). The difference (i.e pm-(pwm*er*tm)) is the quasi-rent per unit of imports. So, unlike tariffs where the revenue accrues in the first instance to government, the QR generates a flow of rent to someone in the

private sector. We therefore assume that the rents accruing from QRs are allocated across the owners of capital and not to wage earners.

The export prices in the model is:

$$pe_i = \frac{p_i^{we} er}{1 + tx_i} \tag{4}$$

Domestic and traded goods are treated as imperfect substitutes so that consumers and producers make decisions over composite consumption (Q) and output (X). By virtue of the CES/CET aggregation functions the true price aggregates for these two composite are defined as:

$$pc_i = \frac{pd_i XD_i + pm_i M_i}{Q_i} \tag{5}$$

for consumption prices, and

$$pq_i = \frac{pd_i XD + pe_i E_i}{X_i} \tag{6}$$

for aggregate output.

This structure serves endogenously to determine the key domestic price *pd* which is the price of domestic output. Composite household demand and aggregate firm-level production determine Q and X. Preferences embodied in the CES/CET functions define the desired combination of tradable and domestic goods. Since *pe* and *pm* are determined by the price-taking assumption, the relative price changes required to clear the market for domestic goods will define the equilibrium value of *pd*.

The remaining prices in the model are, essentially, accounting conventions. First, since production involves both intermediate goods and value added we need to partition the total output price into the relevant prices for the two components. Intermediate goods consist of quantities of Q which are priced at the aggregate price pc and aggregated according to the input-output matrix a_{ji}: Thus the implicit price of value added(equation 7) is defined as the

$$pvq_i = pq_i(1 - pt_i) - \sum_j a_{ji} pc_j \tag{7}$$

difference between the net price of aggregate output and the price of intermediate inputs.

The consumer price index is:

$$CPI = \sum_i wc_i \, pc_i \tag{8}$$

III.5. Household Income and Demand

Factor income flows are augmented by government income transfers and private remittances from abroad to produce gross household income. Moreover, quasi rents from quantitative restrictions accrue to the capitalist households. Net of direct income taxes (which are assumed to be paid only by formal sector households) and savings, this income is allocated to consumption across the composite goods where the price of consumption is the aggregate of the true prices.

$$PC_i = \frac{PD_i \, XD_i + Pm_i \, M_i}{Q_i} \tag{9}$$

The consumption function for each household type is defined as a Cobb-Douglas function, where a matrix describes household consumption shares across the different goods by household type. This structure is probably too simple to reflect the true nature of

consumption choices across the range of goods. The revision of the model currently under way involves a more nuanced characterisation of consumption choices.

III.6. Government

The government in this model is simple. It raises taxes from tariffs, direct taxes on incomes, taxes on production and final sales. Revenue is applied to government consumption, the payment of debt service, direct transfers to households and investment in the public capital stock. The overall budget deficit is financed by direct borrowing from the private sector (although this mechanism remains implicit in the model). Tax rates are exogenous while all government expenditure is fixed in real terms. The overall fiscal balance is therefore endogenous to the level of economic activity and private incomes (operating on the revenue account) and the structure of prices (operating on the cost of government consumption and investment).

III.7. Savings and Investment

The model adopts a simple neo-classical closure. Hence given exogenous foreign savings, total investment is determined by the level of domestic savings. Households are assumed to have a constant propensity to save out of their net of tax gross income, although this savings propensity differs across household types. Government savings are also predetermined (see above). The total level of savings pins down gross investment.

$$DK_i = \frac{\Pi_i [SAVING - pc_{pub}(DK_{pub} + DKG)]}{pc_i} \qquad (10)$$

Investment by sector of demand (equation 10) is translated into a demand for investment goods (typically machinery and construction services) governed by the capital composition matrix $b_{ij.}$

$$ID_J = \sum_i b_{ij} DK_i \qquad (11)$$

III.8. Closure Rules

The model is a comparative static model in which the economy-wide capital stock is fixed but labour (by skill types) is mobile across sectors. Macroeconomic consistency is assumed through a so-called 'neo-classical' closure rule in which aggregate investment is determined by total national savings. National savings, in turn, are the sum of a fixed volume of foreign savings (i.e. lending), domestic private savings, where each household type is assumed to save a fixed proportion of its income, and government savings.

Given that there is no physical capital accumulation in this model, the closure rule has only demand side effects, whereby the endogeneity of investment feeds back on the demand for capital goods.

III.9. Numeraire

CGE models are 'real' or 'barter' models and hence solve for resource allocations as a function of *relative prices* only. In other words they cannot solve for the price level in the economy. Hence the modeller will arbitrarily choose one price (or one vector of prices) as the numerarie against which to measure all other prices. The model assumes a fixed nominal exchange rate and fixed world prices for importables and exportables. Price and value changes are therefore measured relative to this numeraire price.

However, it often makes more sense to report prices and values relative to a more commonly used numerarie such as the CPI. This is done in our presentation of the results.

Macroeconomic balance is determined by three conditions. The first is that the goods market clears (equation 12)

$$Q_i = \sum_{hh} CD_{i,hh} + ND_i + GD_i + ID_i$$

(12)

Current Account balance equation:

$$\sum p_i^{wc} E_i - \sum_i p_i^{wm} (1+tm_i) M_i + SF - debtsrv = 0$$

(13)

The second (equation 13) is that the external balance constraint is satisfied and the third (equation 14) is that the labour market clears:

$$\sum_i L_{i,lc} = \overline{L}_{lc}$$

(14)

Taken together this implies that by the Walras Law the savings equals investment constraint is satisfied ex post.

IV. Simulation Design

In this section, we examine the consequences of trade reforms using the CGE model on overall growth, sectoral production, sectoral employment, wages and prices. During the 90s there have been major changes in tariff rates in the process of economic reforms undertaken by the government. In Table IV.1, we present the change in sectoral custom rates and imports growth the years 1999-00 and 2002-2003. We see that the custom collection rates have been declining and over the period from 1999-00 till 2002-03 and the average custom rate declined by about 30 percent. It is likely that with customs reduced more extensively in the current year and the next and likely growth of imports, the rate would decline quite sharply till 2005.

Table IV.1. Imports and Customs Revenue : Years 1999-00 till 2002-03

Year	Imports	Customs	Imports	Customs
	Level		Growth	Tariff rate
	10 million		%	
1991-92	47851	22257	10.78	46.51
1992-93	63375	23776	32.44	37.52
1993-94	73101	22193	15.35	30.36
1994-95	89971	26789	23.08	29.78
1995-96	122678	35757	36.35	29.15
1996-97	138920	42851	13.24	30.85
1997-98	154176	40193	10.98	26.07
1998-99	178332	40668	15.67	22.80
1999-00	215236	48419	20.69	22.50
2000-01	230873	47542	7.26	20.59
2001-02	241929	40268	4.79	16.64
2002-03	296597	45500	22.60	15.34

Table IV. 2. Sectoral Imports Share

(percent)

	1999-00	2000-01	2001-02	2002-03
Agriculture	2.25	1.79	2.85	2.50
Agro Processing	4.77	3.09	3.09	3.46
Rice Milling	0.01	0.01	0.00	0.00
Readymade Garments	0.03	0.04	0.07	0.04
Other manufacturing goods	79.55	83.32	80.80	80.68
Capital Goods	13.38	11.74	13.19	13.31

The actual imports behaviour is depicted in Table IV.2. The import shares by sectors without the formal informal break up for the period 1990-00 to 2002-03 show that Other Manufacturing Sector has by far the largest share in total imports. This is also due to the fact that petroleum crude and products form part of this aggregated sector (see Sinha, Siddiqui and Munjal, 2004).

To examine the impacts of sharp decline in import tariffs we have designed a series of simulations relating to trade reforms. The simulations are carried out under different closures of the labour markets and under different stances the government takes in relation to their

overall fiscal balance (specifically government's policy to replace the lost revenue from tariffs from higher production taxes on the formal sub-sectors). We carry out two simulations (i) reduction of tariff rate by 60 percent across all sectors and (ii) reduction of QRs also by 60 percent under these different settings. Moreover, the results reported focus on a central case (where the price elasticity of substitution between domestic goods, both formal and informal, and imports is relatively low (at 0.5) implying a relatively sluggish response to demand to change in prices

.

Table IV. 3. Elasticity of Substitution between Imports and Domestic Goods And Between Domestic Sales and Exports

	All Simulations	
Sector	EPSC	EPST
Agriculture	0.50	0.75
Agro Processing	0.50	0.75
Rice Milling	0.50	0.75
Readymade Garments	0.50	0.75
Other manufacturing goods	0.50	0.75
Capital Goods	0.50	0.75
Construction	0.50	0.75
Other Services	0.50	0.75
Government Services	0.50	0.75

Note:EPSC: Armington Elasticity of Substitution (Imports/Domestic goods)
EPST: CET (Constant Elasticity of Transformation) (Domestic Sales/Exports)

We consider eight separate simulations as follows: (a) **simulation 1**: tariff reduced by 60 percent under labour market flexibility and without revenue correction; (b) **simulation 2**: tariff and QRs reduced by 60 percent under labour market flexibility and without revenue correction ; (c) **simulation 3**: tariff reduced by 60 percent with wage rigidity in formal labour market and without revenue correction ; (d) **simulation 4:** tariff and QRs reduced by 60 percent with wage rigidity in formal labour market and without revenue correction; (e) **simulation 5:** tariff reduced by 60 percent under labour market flexibility with revenue correction; (f) **simulation 6**: tariff and QRs reduced by 60 percent under labour market flexibility and with revenue correction; (g) **simulation 7**: tariff reduced by 60 percent with wage rigidity in formal labour market and with revenue correction ; (h) **simulation 8**: tariff

and QRs reduced by 60 percent with wage rigidity in formal labour market and with revenue correction

The major result of the simulations is the positive impact on overall growth of the economy, measured through real GDP growth (Table IV.4). The growth is marginally higher when the government maintains fiscal balance through revenue neutral measures, but growth is noticeably higher when wage rigidity is introduced in the formal labour market. The real GDP grows by nearly a percentage point when both revenue neutrality and wage rigidities are introduced compared to the growth achieved purely under tariff reduction. At the sectoral level, there is an expansion of the informal sector when wage rigidity and revenue neutral stance is introduced. More specifically the informal sub-sector of ready-made garment experiences the highest growth. Construction and informal sub-sector of agroprocessing also register relatively higher growth rates. This clearly indicates that the sectors, which were protected through high tariffs fare worse than those, which had no such protections in the post reform period (namely the informal sub-sectors). As in case of GDP growth, the expansion of output is somewhat higher when trade reform is rendered revenue neutral by offsetting tax increases, but noticeably higher when we assume downward rigidity in the formal sector average wage.

Table IV. 4. Impact of Trade reforms on GDP (Real) and Sectoral Outputs

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism	
	In Rs.10 million	Percentage Growth Ratio							
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral
GDP Real		SIM-1	SIM-2	SIM-3	SIM-4	SIM-5	SIM-6	SIM-7	SIM-8
	1813397	5.221	4.949	5.313	5.699	5.273	5.007	5.325	5.751
Total Domestic Output By Sector Formal	2008068	-0.085	-0.362	0.002	0.405	-0.170	-0.421	-0.190	0.230
Total Domestic Output By Sector Informal	1642055	-0.275	-0.970	-0.213	0.691	0.342	-0.453	0.281	1.491
Agriculture	576304	0.124	0.413	0.131	-1.102	-0.134	0.207	0.044	-1.477
Agro Processing(Formal)	90202	0.479	1.609	0.413	0.988	0.455	1.587	0.396	0.937
Agro Processing(Informal)	65409	0.517	1.541	-4.867	1.171	0.442	1.467	-10.665	1.130
Rice Milling(Formal)	5505	-0.393	-1.597	-0.084	0.679	0.181	-1.120	0.664	1.575
Rice Milling(Informal)	7100	-0.126	-0.673	0.060	0.655	0.010	-0.555	0.401	1.047
Readymade Garments(Formal)	15429	0.775	6.232	1.159	8.553	2.217	7.304	2.332	9.854

Table VI.4 contd.									
Readymade Garments(Informal)	4999	1.293	8.346	1.752	11.997	1.899	8.743	2.748	13.140
Other manufacturing goods(Formal)	567586	-0.182	-0.404	0.039	1.253	0.481	0.096	0.618	1.940
Other manufacturing goods(Informal)	247089	-0.402	-1.277	-0.055	1.421	0.319	-0.706	0.768	2.416
Capital Goods(Formal)	125406	-1.847	-8.643	-1.336	-4.751	-0.068	-7.193	0.219	-2.893
Construction(Informal)	235513	-2.161	-7.533	-0.996	1.201	1.657	-4.297	2.652	5.648
Other Services(Formal)	835988	0.134	0.423	0.113	0.565	-0.815	-0.296	-1.000	-0.623
Other Services(Informal)	505641	0.091	0.239	0.262	1.967	0.259	0.372	0.600	2.425
Government Services(Formal)	367952	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	3650123	-0.170	-0.636	-0.095	0.533	0.060	-0.435	0.022	0.798

As import prices fall as a result of liberalization, real import exchange rates of protected sectors decline in proportion to their protection. This results in higher imports of such items and hence domestic import-substituting activities are squeezed. Transmission of this initial effect through the economy depends on two factors, (i) what happens to the structure of wages and (ii) what happens to aggregate demand. An interesting outcome is when the negative demand effect from removal of the QRs is offset by the increased profitability resulting from depressed casual wages transmitted from formal sector unemployment. This is shown by the contrast in growth experienced by informal agriculture (which is large and mainly supplies the domestic market) and the informal garment sector, which is small and highly export-oriented. In the latter case lower domestic demand has no effect and the sub-sector benefits very strongly when the casual wage is depressed with the decanting of skilled labour out of the formal economy as trade reforms bite. The gains of the garments sector are higher when government adopts a revenue neutral trade reform as this sector bears a very small share of the domestic indirect tax. For agriculture trade reforms in isolation is modestly output enhancing, but when this is coupled with QR reduction the positive effect is enhanced mainly through demand side. Since a reduction in QRs reduce income of the capital owners and increase income of wage earners (?) income flows to households whose propensity to consume food is relatively high. However, this is countered by unemployment and the demand effect enjoyed by agriculture is offset by the fall in the casual informal wages. Moreover, output growth reduces, or even contracts if domestic taxes (which, at least indirectly, fall quite heavily on this sector) are raised to ensure revenue neutrality.

Table IV. 5. Employment by Sector and skill

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism	
	In million number	Percentage Growth Ratio							
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral
Employment by Sector and Skill		SIM-1	SIM-2	SIM-3	SIM-4	SIM-5	SIM-6	SIM-7	SIM-8
Casual Labour	**197.134**	0.000	0.000	0.000	0.000	-2E-05	0.000	0.000	0.000
Agriculture	137.800	0.248	0.829	0.262	-2.192	-0.267	0.414	0.087	-2.933
Agro Processing(Formal)	0.890	1.302	4.493	1.984	9.635	-0.778	2.787	2.186	9.923
Agro Processing(Informal)	3.150	1.641	4.945	-14.573	3.743	1.401	4.706	-29.957	3.611
Rice Milling(Formal)	0.200	-1.234	-4.955	-0.264	2.158	0.550	-3.492	2.109	5.055
Rice Milling(Informal)	0.312	-0.397	-2.111	0.190	2.081	0.032	-1.742	1.271	3.342
Readymade Garments(Formal)	0.112	2.224	20.186	4.469	38.641	4.579	21.907	8.650	44.633
Readymade Garments(Informal)	0.100	4.145	28.832	5.644	43.058	6.127	30.331	8.946	47.724
Other manufacturing goods(Formal)	7.280	-0.771	-1.859	0.739	10.051	-0.535	-1.741	2.831	12.861
Other manufacturing goods(Informal)	9.720	-1.265	-3.977	-0.175	4.555	1.010	-2.213	2.445	7.832
Capital Goods(Formal)	0.300	-6.018	-25.551	-3.213	-6.146	-3.435	-23.563	2.069	0.380
Construction(Informal)	9.500	-2.861	-9.884	-1.321	1.600	2.208	-5.670	3.522	7.574
Other Services(Formal)	2.000	0.106	0.384	1.302	11.002	-5.534	-4.010	-1.789	7.638
Other Services(Informal)	21.200	0.281	0.742	0.815	6.215	0.805	1.157	1.868	7.699
Government Services(Formal)	4.570	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Regular Labour	**41.950**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Agriculture									
Agro Processing(Formal)	1.000	1.669	5.630	0.860	-0.998	2.970	6.688	0.632	-1.433
Agro Processing(Informal)									
Rice Milling(Formal)									
Rice Milling(Informal)									
Readymade Garments(Formal)	0.250	2.593	21.493	3.318	25.195	8.528	26.534	6.998	29.690
Readymade Garments(Informal)									
Other manufacturing goods(Formal)	7.500	-0.412	-0.791	-0.371	-0.623	3.221	1.988	1.268	1.201
Other manufacturing goods(Informal)									
Capital Goods(Formal)	1.100	-5.679	-24.741	-4.280	-15.249	0.212	-20.663	0.517	-9.991
Construction(Informal)									
Other Services(Formal)	15.000	0.468	1.476	0.186	0.236	-1.966	-0.367	-3.282	-3.483
Other Services(Informal)									
Government Services(Formal)	17.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	239.084	0.000	0.000	0.000	0.000	-2E-05	0.000	0.000	0.000
Total Casual Labour-Formal	15.352	-0.394	-0.988	0.601	6.948	-1.046	-1.533	1.367	8.068
Total Casual Labour-Informal	181.782	0.033	0.083	-0.034	-0.517	0.088	0.129	-17.307	-0.416

The wage rigidity in the formal sector puts pressure on formal firms to lay off labour, thus increasing expansion in informal firms. The higher demand for informal workers is however met through the unemployed from the formal sector. This exerts downward pressure on wage rate of this sector even while it expands. Hence, the mechanism, which delivers the strongest output gains for the outward oriented informal sectors, also puts strongest downward pressure on the casual wage rate.

Table IV. 6. Average wage Rate (Real) by Households

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism	
	Defletor-CPI	Percentage Growth Ratio							
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral
AVERAGE WAGE RATE BY SKILL (REAL)		SIM-1	SIM-2	SIM-3	SIM-4	SIM-5	SIM-6	SIM-7	SIM-8
CASUAL LABOUR	2632.306	1.032	5.499	0.063	-2.052	2.562	6.762	-0.091	-2.269
PRIVATE GROSS INCOME									
Rural - Casual Labour	327162	1.026	5.471	0.065	-2.018	2.545	6.725	-0.088	-2.233
Rural - Regular Wage Earner	187550	0.685	4.483	1.178	8.469	-1.084	3.037	1.451	8.991
Rural - OAW	229899	1.277	6.349	0.325	-4.159	2.277	7.176	-0.002	-5.089
Rural - Employer	7658	1.541	-28.406	1.853	-26.425	3.948	-26.749	3.691	-24.560
Urban - Casual Labour	201280	1.028	5.525	0.092	-1.759	2.515	6.754	-0.050	-1.955
Urban - Regular Wage Earner	202793	0.724	4.758	1.178	8.469	-0.887	3.444	1.451	8.991
Urban - OAW	679712	1.250	6.072	1.561	10.127	1.421	6.230	2.082	11.156
Urban - Employer	162403	2.008	-48.151	2.324	-24.954	2.245	-48.918	2.684	-24.790
TOTAL	1998455	1.150	1.129	1.014	1.983	1.421	1.282	1.204	2.294
Total Rural	752268	1.023	5.148	0.440	-0.306	1.572	5.602	0.361	-0.535
Total Urban	1246187	1.227	-1.297	1.361	3.366	1.329	-1.325	1.714	4.002
Total casual	528442	1.027	5.492	0.075	-1.919	2.533	6.736	-0.073	-2.127
Total Regular	390342	0.705	4.626	1.178	8.469	-0.982	3.248	1.451	8.991
Total wage	918784	0.890	5.124	0.544	2.494	1.040	5.254	0.574	2.597
Total Capital	1079671	1.372	-2.270	1.415	1.549	1.745	-2.098	1.741	2.037

Under 'pure' trade reform, average casual real consumption wages rise modestly and this is slightly stronger with a reduction in QRs, for the reason noted above. When both the labour markets operate under wage flexibility, the casual-regular real wage differential narrows under full reforms of tariff and QRs. However, if formal sector labour market rigidities are in

place, the 'cost' of wage adjustment in the informal sector is overwhelmingly borne by casual workers (the old and the new entrants to this market). In case of simulation 3 (the case with tariff reduction only and no fiscal offset) this widens the wage differential but at worst (simulation 8) when QR reductions are considered in a revenue-neutral setting, the average real consumption wage in the casual labour market experience a decline.

Table IV. 7. Household Consumption (in Real terms) by Households

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism	
	In Real Term (Rs.10 million	Percentage Growth Ratio							
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral
TOTAL HOUSEHOLD CONSUMPTION BY HH TYPE		SIM-1	SIM-2	SIM-3	SIM-4	SIM-5	SIM-6	SIM-7	SIM-8
Rural - Casual Labour	53527	0.915	4.973	-0.002	-2.424	0.521	4.644	-1.713	-4.436
Rural - Regular Wage Earner	29544	0.917	5.830	1.573	9.923	-2.653	2.846	0.428	8.449
Rural - OAW	38075	1.038	5.103	-0.086	-5.331	-0.012	4.238	-2.350	-8.149
Rural - Employer	802	1.467	-28.882	1.422	-26.003	2.959	-27.757	2.193	-24.513
Urban - Casual Labour	39389	1.218	6.777	0.493	-0.405	0.752	6.370	-1.045	-2.447
Urban - Regular Wage Earner	26670	0.913	5.847	1.280	9.336	-2.888	2.688	-0.536	7.333
Urban - OAW	32997	1.099	5.318	1.296	9.198	-0.771	3.793	-0.102	7.957
Urban - Employer	7269	2.219	-47.557	2.466	-24.259	0.075	-49.288	0.611	-25.942
TOTAL	228272	1.058	3.777	0.694	1.313	-0.530	2.459	-0.969	-0.633
Total Rural	121947	0.958	4.998	0.363	-0.495	-0.398	3.868	-1.367	-2.606
Total Urban	106325	1.173	2.377	1.074	3.388	-0.680	0.842	-0.511	1.629
Total casual	92916	1.044	5.738	0.207	-1.568	0.619	5.375	-1.430	-3.593
Total Regular	56214	0.915	5.838	1.434	9.644	-2.765	2.771	-0.029	7.919
Total wage	149130	0.995	5.775	0.670	2.659	-0.657	4.394	-0.902	0.747
Total Capital	79142	1.176	0.012	0.740	-1.221	-0.290	-1.188	-1.095	-3.234
Welfare	35.2398	0.024	0.069	0.016	0.024	-0.014	0.038	-0.022	-0.020
CPI	1	-1.183	-7.525	-1.164	-7.807	-1.517	-7.797	-1.430	-8.249

As we examine the household wise consumption under various simulations (see Table IV.7.), we see that casual wage earning households have the lowest gain whereas regular wage earners benefit under all scenarios, specially under wage rigidity set ups. In the case of flexible wages in both the markets, a reduction in tariff and QRs results in welfare gains by

all types of households. Regular wage earners experience the highest gains and the lowest benefit accrues to capital owner households as they lose rental income. The other losers due to reduction in rental income (through reduction in QRs) are the capital owner households. The gains by regular wage earners and the loss by the casual wage-earning households are more pronounced in the case when revenue neutral measures are in place.

IV.1. Impact on Trade

When import prices are reduced through tariff reduction, the imports of formal sector goods increase more rapidly than that of informal sectors. However, ready-made garments are an exception, which have higher imports due to the reforms. In case of exports, the informal sub-sectors experience higher growth, including by ready-made garment sector.

Table IV. 8. Imports by Sector

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism		
	In Rs.10 million	Percentage Growth Ratio								
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	**Wedge Ratio**
IMPORTS		Growth 1	Growth 2	Growth 3	Growth 4	Growth 5	Growth 6	Growth 7	Growth 8	
Agriculture	6378	-0.016	13.253	-0.444	7.199	0.132	13.372	-0.783	6.299	**0.400**
Agro Processing(Formal)	2735	9.800	23.500	9.553	22.050	9.756	23.438	9.389	21.885	**0.600**
Agro Processing(Informal)	2080	9.879	18.058	2.187	15.981	10.052	18.179	-5.675	15.776	**0.500**
Rice Milling(Formal)	11	-0.954	-2.213	-0.813	-1.264	0.715	-0.856	0.417	0.155	**0.091**
Rice Milling(Informal)	18	-0.459	0.100	-0.560	-0.768	0.352	6.318	-0.127	-0.317	**0.111**
Readymade Garments(Formal)	620	-1.744	12.798	-1.034	18.657	0.356	14.587	0.902	21.430	**0.550**
Readymade Garments(Informal)	201	-0.677	18.466	-0.235	22.477	0.807	19.849	1.248	24.514	**0.552**
Other manufacturing goods(Formal)	147206	2.058	13.377	2.317	15.827	2.790	13.973	2.980	16.752	**0.550**
Other manufacturing goods(Informal)	69272	1.764	11.971	2.058	14.732	2.911	12.993	3.022	16.047	**0.550**
Capital Goods(Formal)	43299	1.034	12.489	1.815	19.793	3.123	14.541	3.911	22.919	**0.800**
Construction(Informal)										
Other Services(Formal)	16003	-0.467	-3.577	-0.409	-2.664	-2.724	-5.320	-2.415	-4.810	**0.000**
Other Services(Informal)	9891	-0.443	-3.599	-0.470	-3.277	0.078	-3.198	-0.178	-2.916	**0.000**
Government Services(Formal)										

Table IV.8 Contd.										
TOTAL	297714	1.693	11.570	1.942	14.403	2.532	12.328	2.642	15.502	
TOTAL IMPORTS FORMAL	209874	1.744	12.031	2.090	15.324	2.522	12.743	2.838	16.460	
TOTAL IMPORTS INFORMAL	87840	1.572	10.467	1.589	12.201	2.554	11.335	2.174	13.214	

Table IV. 9. Exports by Sector

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism	
	In Rs.10 million	Percentage Growth Ratio							
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral
EXPORTS BY SECTOR		SIM-1	SIM-2	SIM-3	SIM-4	SIM-5	SIM-6	SIM-7	SIM-8
Agriculture	13157	0.322	2.840	0.951	7.112	-0.510	2.178	1.226	7.398
Agro Processing(Formal)	6362	0.861	5.238	0.998	5.333	0.858	5.254	1.149	5.392
Agro Processing(Informal)	4839	0.852	5.082	-2.447	6.526	0.485	4.781	-6.436	6.661
Rice Milling(Formal)	189	0.385	3.143	0.929	7.443	-0.551	2.386	1.004	7.606
Rice Milling(Informal)	302	0.325	2.961	0.903	7.441	-0.450	2.340	1.118	7.766
Readymade Garments(Formal)	7091	1.984	12.917	2.212	14.047	3.110	13.799	3.018	14.883
Readymade Garments(Informal)	2301	2.238	13.852	2.705	17.681	2.423	13.897	3.467	18.573
Other manufacturing goods(Formal)	46819	1.290	8.399	1.474	9.574	1.895	8.915	1.974	10.162
Other manufacturing goods(Informal)	22032	1.123	7.748	1.548	11.021	1.368	7.957	2.237	11.903
Capital Goods(Formal)	6275	0.880	6.534	1.073	8.137	2.371	7.909	2.026	9.346
Construction(Informal)									
Other Services(Formal)	62630	0.887	5.586	0.767	4.705	1.607	6.249	0.787	4.793
Other Services(Informal)	38714	0.757	5.167	1.178	8.775	0.485	4.945	1.573	9.362
Government Services(Formal)									
TOTAL	210711	0.991	6.526	1.105	7.971	1.337	6.840	1.361	8.425
TOTAL EXPORTS BY SECTOR FORMAL	129366	1.091	7.031	1.128	7.180	1.791	7.654	1.417	7.544
TOTAL EXPORTS BY SECTOR INFORMAL	81345	0.832	5.722	1.068	9.228	0.615	5.547	1.272	9.826

IV.2. Major Macro Ratios

The major macro ratios as presented in Table IV.10 reflect the real world situation. When we compare Table IV.10 with Table IV.11, we see that import shares are marginally more as a result of our analyses because we have less constraint in our model structure, because of the opening up of the economy.

Table IV. 10. Ratios to GDP

	Actual Data			
VARIABLES	1999-2000	2000-01	2001-02	2002-03
	% Share			
Investment	21.864	22.021	21.654	22.993
Exports	8.269	9.750	9.102	10.253
Imports	11.154	11.057	10.535	12.030
Trade Deficit	2.885	1.308	1.433	1.777
Government Deficit	5.427	5.690	6.138	5.900
REVENUE ACCOUNT				
Tariff Revenue	2.509	2.277	1.759	1.833
SalesTax	0.110	0.125	0.144	0.244
SalesTax and Excise	3.318	3.407	3.302	3.953
Direct Tax Revenue	3.635	3.856	3.008	3.715
GDP mp				
	1929641	2087988	2296500	2465525.424

Trade and Government deficits as given in the table on the model results add up to about 9 percent in comparison to the actual ratio of about 7 percent. After assuming an across the board tariff reduction, the tariff ratios are lower in our model results as compared to the actual tariff ratios. Nevertheless, the overall macro results as shown by the key ratios do show realistic outcomes and therefore validate our general findings.

Table IV. 11. Major Ratios to GDP (Real)

		Without Unemployment Mechanism		With Unemployment Mechanism		Without Unemployment Mechanism		With Unemployment Mechanism	
		Simulations							
VARIABLES	BASE	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only Tariff reduced by 60%	Both Tariff and QRs reduced by 60%	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral	Only tariff reduced by 60% and Revenue neutral	Both tariff and QRs reduced by 60% and Revenue neutral
		SIM-1	SIM-2	SIM-3	SIM-4	SIM-5	SIM-6	SIM-7	SIM-8
MAJOR RATIOS TO GDP (REAL)									
Investment	23.70%	21.40%	17.90%	21.70%	19.80%	22.50%	18.80%	22.70%	20.90%
Exports	11.62%	11.20%	11.80%	11.20%	11.90%	11.20%	11.80%	11.20%	11.90%
Imports	16.42%	15.90%	17.50%	15.90%	17.80%	16.00%	17.60%	16.00%	17.90%
Trade Deficit	4.80%	4.70%	5.70%	4.70%	5.90%	4.80%	5.70%	4.80%	6.00%
Government Deficit	3.81%	4.80%	4.60%	4.60%	4.60%	3.60%	3.60%	3.60%	3.60%
REVENUE ACCOUNT									
Tariff Revenue	1.77%	0.50%	0.80%	0.70%	0.80%	0.70%	0.80%	0.70%	0.80%
SalesTax	7.02%	6.70%	6.40%	6.60%	6.20%	7.50%	7.20%	7.60%	7.20%
Direct Tax Revenue	2.64%	2.50%	2.30%	2.50%	2.40%	2.50%	2.20%	2.50%	2.40%

V. Conclusions and Future Research

We are fundamentally interested in studying the impact of trade reforms on informal economy encompassing production process, products, employment, and income distribution. In the current version of the model we have characterised "informal" goods as those which are not taxed at the level of production. A literature survey shows that models incorporating the informal sector can be considered where, in certain sectors a fixed portion can be operating as informal firms. In identifying a firm as informal, it is difficult to use the size of the firm in building a CGE structure. Therefore this distinction is assumed to depend on its other characteristics such as lower capital-labour ratios, or lower output-labour ratios in the informal parts of an industry as compared to formal parts of the industry. We have characterised informal parts of the industry as that which have lower output-labour ratio and also which hire only casual labour. Casual labour has lower wages compared with that of regular labour and are part of a distinct household categories. Another major assumption has been that the informal sector does not pay any production tax to the government. However such firms can both import and export and are thus exposed to external shocks and trade

reforms. The findings of our study depend on the major characteristics adopted while formulating the model.

Though tentative, the model as currently constructed delivers a number of important insights, most of which are consistent with the existing literature. We find that trade reforms (taken to include the removal of QRs as well as a tariff reduction) generate real GDP increases and welfare gains for informal households when no fiscal adjustment is required. These emerge mainly from improvements in real consumption wages (which themselves reflect falling domestic relative prices) and from the reallocation of labour demand from previously highly protected sectors intensive in formal employment to expanding sectors which are relatively intensive in informal (casual) labour. These results do, however, imply deterioration in the fiscal stance of between a half and three-quarters of one percent of GDP in the case where there is no fiscal response to the trade reforms, and similar deterioration of the trade deficit.

The model results bring to light that issue like the phasing out of the Multi-Fibre Agreement in 2005, could result in enhanced competition for Indian exports. With less bonding with the domestic economy, the garment sector could suffer with employment losses for a very large number of informal workers. To make this sector globally competitive, the reduction in tariff in intermediates such as synthetic fibres is a very critical policy decision.

The results of the current study conform to some of the studies cited in this paper. We see that similar to the paper by Kelly (1994) if formal sector is allowed to grow under flexible labour market, then trade reforms lead to relative contraction of the informal sector and substantial gain by casual workers. Moreover under wage rigidity the model generated wage dualism as reported in the paper by Marceau and Savard (1997). Further, we see while introducing revenue neutral policies, that domestic policy environment is potentially significant in determining definite changes in outcome noted by Bautista, Lofgren and Thomas, (1998). The literature surveys emphasised the distinction in the formal and informal labour market in determining realistic simulation results. Our model findings convey that the nature of the labour market functioning is highly significant in casualisation of the labour force and depressing their wages in the process. The major realisation is then that it is very important to put proper labour law in place during a period of opening up of the economy, so that a section of the labour force do not get secluded of benefit of growth (when formal sector employers cut cost by pushing their labour force into informal contracts, without any social

security). Moreover, the measures for providing social security by the state to such workers should be carried out very urgently during this period of adjustment.

As with all CGE models, certain features of the simulation results reflect the 'macroeconomic closure' adopted, i.e., the assumptions imposed to ensure that the model respects the macroeconomic balances of the economy. In this case, the choice of closure combined with the comparative-static nature of the model means that the model does not reflect the true nature of the investment process in India. Specifically, there is no capital accumulation in the model and while the capital stock is fixed by sector, labour is mobile across sectors. The model follows the 'neo-classical' closure rule in which aggregate investment is determined by total national savings. Hence, in a case where government savings fall due to tariff reduction, overall investment would fall in this model causing a decline in the *demand* for capital goods, but this has no effect on the capital stock itself.

The model has not addressed the question concerning the appropriate structure of consumption behaviour. The field surveys were focussed on informality on the production side of the economy, while the data used to construct the SAM are silent on important aspects of household consumption decisions. The current model structure assumes households to consume a basket of goods which contains both formal and informal varieties of all goods. Consumption choices in this set up are governed by a common set of substitution elasticities which does not do full justice to the richness of consumer choices. The study explains why a more detailed and nuanced SAM structure is required to incorporate a multi-stage consumption structure, which would allow high or low substitutability of formal and informal varieties of goods.

In future work on the model it would be useful to is to allow for (relatively) high substitutability between the informal and formal variants of the good and a (relatively) low substitutability between a given good and any other good. This could be done by assuming that the consumption function is a two-stage function, for example, in stage-I there would be substitution between two types of goods, i.e., domestic and imported goods. In stage-II, there could be substitution between formal and informal domestic variants of the goods. So in the second version of the model, we impose the assumption that "informal" goods are qualitatively different from "formal" goods. This can be justified by considering the fact that these goods have a separate cluster of outlets, such as " flea" markets and roadside vending.

This property can be incorporated in the model by extending our Dixit-Stiglitz notion of imperfect substitution between “formal” and “informal” goods. This requires us to characterise consumption patterns of different groups and make an assessment of the substitutability between formal and informal variants of the goods in response to relative price adjustments (which may be driven by trade policy reforms). An important feature is that we can run sensitivity analyses by choice of parameter values, which would allow us to make goods arbitrarily close to being either perfect substitutes or perfect complements in consumption.

The situation of the informal economy and informal workers can improve if there is flow of capital into this sector as suggested by Marjit, et al. (2003). However, it is of common knowledge that it is not easy to get financing for small informal firms. In case resources are made available to such informal firms that develop because of market demand, then the workers entering such firms would have higher productivity and higher returns. Such firms can contribute to public resources and get benefits of social security if supported to grow in a viable manner. Nevertheless, further improvement in capturing the functioning of the economy could be carried out by making capital mobile across firms and a dynamic version of the model should be constructed to allow for investment and growth. Finally, performing econometric studies could allow testing policy predictions of the CGE model. Nevertheless, the analysis clearly shows the importance of incorporating explicitly the informal sector in future work on the economic reforms are relevant for developing countries.

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References

Agénor, P. and J. Aizenman, 1994, "Macroeconomic Adjustment with Segmented Labour Markets", Working Paper No. 4769, *National Bureau of Economic Research*

Agénor, P., A. Izquierdo and H. Fofack, 2001, "IMMPA: A Quantitative Macroeconomic Framework for the Analysis of Poverty Reduction Strategies", Washington, D.C.: The World Bank

Armington, P.S. 1969: '*A Theory of Demand for Products Distinguished by Place of Production*", IMF Staff Papers, 16, pp. 159-78.

Bardhan, P., 1988, "Alternative Approaches to Development Economics", in Chenery, H. and T. N. Srinivasan (eds.) *The Handbook of Development Economics*, Amsterdam: North Holland: 39-72

Bautista M. R., H. Lofgren and M. Thomas, 1998, "Does Trade Liberalisation Enhance Income Growth and Equity in Zimbabwe? The Role of Complementary Policies", TMD Discussion Paper No. 32, *Trade and Macroeconomics Division, International Food Policy Research Institute, Washington, D.C.*

Berry, A., 1998, *Poverty, Economic Reform and Income Distribution in Latin America*, London: Lynne Rienner

Berry, A., S. Horton and D. Mazumdar,1997, "Globalisation, Adjustment, Inequality and Poverty", Department of Economics, University of Toronto.

Calvo, G. A., 1978, "Urban Development and Wage Determination in LDC's, Trade Unions in the Harris-Todaro Model", *International Economic Review* 19: 65-81

Carbonetto, D. and M. Ines Carazo de Cabellos, 1986, *Heterogencidad Technologica y Desarrollo Economico: El Sector Informal*, Lima: Instituto Nacional de Planification

Carbonetto, D., J. Hoyle and M. Tueros, 1987, *Lima: Sector Informal*, Lima: CEDEP

Central Statistical Organisation, 2002: National Accounts Statistics, Government of India, New Delhi.

Central Statistical Organisation, 2000: "Input-Output Transactions Table, 1993-94", Government of India, New Delhi.

Clarete and Roumasset, 1990**:** *"The Relative Cost of Industrial and Agricultural Policy Distortions: A Philippine Illustration"*, Oxford Economic Papers.

De Soto, H., 1986, *El Otro Sendero*, Lima: Instituto de Libertad y Democracia

Devarajan S., S. Robinson and J. Lewis 1996**:** *"Getting the Model Right: Applied General Equilibrium Modelling"*, Cambridge University Press (forthcoming).

Dervis, K., J. de Melo and S. Robinson. 1982. *General equilibrium models for development polic*y. Cambridge: Cambridge University Press.

Fortin, B., N. Marceau and L. Savard, 1997, "Taxation, Wage Controls and the Informal Sector", *Journal of Public Economics*, 66: 293-312

Ghosh P.K. and Ratna M. Sudarshan 2003, *"Trade Liberalisation and Rice Processing Industry in West Bengal"*, paper presented in the workshop "Impact of Trade Reforms on the Indian Informal Economy and Poverty: Macro and Case Study Analyses" at India International Centre, New Delhi, January 2004.

Ghosh P.K., R. Kaur and Ratna M. Sudarshan 2003, *"Trade Liberalisation and Informality: Case Studies of Rice Processing Industry"*, paper presented in the workshop "Impact of Trade Reforms on the Indian Informal Economy and Poverty: Macro and Case Study Analyses" at India International Centre, New Delhi, January 2004.

Gibson, B. and B. Kelley, 1994, "A Classical Theory of the Informal Sector", *The Manchester School*, LXII, No. 1(March): 81-96

Gibson, B. and R. Godoy, 1993, "Alternatives to Coca Production in Bolivia: A Computable General Equilibrium Approach", *World Development*, 21, No. 6: 1007-1021

Gibson, B., 2000, "The Transition to a Globalised Economy: Poverty, Human Capital and the Informal Sector in a Structuralist CGE Model", University of Vermont, Burlington, http://www.uvm.edu/%7ewgibson/glob.pdf

Harris, J. R. and M. P. Todaro, 1970, "Migration, Unemployment and Development: A Two Sector Analysis", *American Economic Review* 60 (March): 126-142

Kelley, B., 1994, "The Informal Sector and the Macroeconomy: A Computable General Equilibrium Approach for Peru", *World Development*, 22, No. 9: 1393-1411

Killick T. 1995, Structural Adjustment and Poverty Alleviation: An Interpretative Survey', Development and Change 26 pp. 305-31

Keuning, J.S. and De Ruijter, W.A., 1988, "Guidelines to the Construction of A Social Accountng Matrix", *Review of Income and Wealth*, 34.

Lindbeck, A and D. J. Snower, 1991, "Segmented Labour Markets and Unemployment", Discussion Paper No. 523, Centre for Economic Policy Research (April)

Marjit Sugata, Saibal Kar, Punyabrata Sarkar 2003**,** 'Trade Reform, Internal Capital Mobility and Informal Wage - Theory and Evidence', Centre for Studies in Social Sciences, Calcutta.

Mazumdar, D., 1975, "The Urban Informal Sector", Working Paper No. 211, Washinton, D.C.: World Bank

Mazumdar, D., 1976, "The Urban Informal Sector", *World Development* 4: 655-679

McCulloch, N., R.J. Baulch and M. Cherel-Robson, 2000**,** 'Poverty Inequality and Growth in Zambia during the 1990s' , Institute *of* Development Studies Working Paper 114.

Meagher, Kate and Mohammed-Bello Yunusa, 1996**:** "Passing the Buck: Structural Adjustment and the Nigerian Urban Informal Sector", United Nations Research Institute for Social Development, Geneva.

Morley, S. and R. Vos, 1998, "Pobreza y Crecimiento Dual en Paraguay", in Ganuza, E., L. Taylor and S. Morely, *Politica Macroeconomica y Pobreza en America Latina y el Caribe*, Madrid: Mundi-Prensa Libros, s.a.

Narayana N.S.S., K.S.Parikh and T.N.Srinivasan, 1990: *"Agriculture, growth and redistribution of income: Policy analysis with a general equilibrium model of India"*, North Holland / Allied Publishers.

Ocampo, J. A. and L. Taylor, 1998, "Trade Liberalisation in Developing Economies: Modest Benefits but Problems with Productivity Growth, Macro Prices and Income Distribution", *Economic Journal* 108, No. 3: 1523-1546

Pyatt, Graham and Thorbecke, E., 1976, "Planning Techniques for a better Future", International Labour Office, Geneva.

Peattie, L., 1987, "An Idea in Good Currency and How It Grew: The Informal Sector", World Development, 15, No. 7: 851-860

Portes, A., M. Castells and L. Benton, (eds.) 1989, *The Informal Economy: Studies in Advanced and Less Developed Countries*, Baltimore: John Hopkins Press

Rauch, J. E., 1991, "Modelling the Informal Sector Formally", *Journal of Development Economics* 35: 33-47

Robinson, S. 1989. Multisectoral models. In *Handbook of development economic*s, Vol.II, eds. H. Chenery and T. N. Srinivasan. Amsterdam: Elsevier Science Publishers.

Rossini, R. and J. Thomas, 1990, "The Size of the Informal Sector in Peru: A Critical Comment on Hernando de Soto's *El Otro Sendero*", World Development 18, No. 1: 125-135

Savard, L. and E. Adjovi, 1997, "Adjustment, Liberalisation and Welfare, in Presence of Health and Education Externalities: A CGE Applied to Benin", *du Centre de Recherche en Économie et Finance Appliquées (Mars)*, Cahier 97-07

Sethuraman, S. V., (eds.) 1981, *The Urban Informal Sector in Developing Countries*,

International Labour Office, Geneva

Singh Navsharan and M. Sapra, 2003, *"Economic Liberalisation and Informality - Case Studies from Garment Sector"*, paper presented in the workshop "Impact of Trade Reforms on the Indian Informal Economy and Poverty: Macro and Case Study Analyses" at India International Centre, New Delhi, January 2004.

Sinha Anushree and Christopher S. Adam, 2000: "Trade Policy Reform and the Informal Sector in India", paper presented at the Thirteenth International Conference on Input-Output Techniques at Macerata, Italy, August.

Sinha, Anushree and Sangeeta, N., 2000: "Value Added from the Informal Sector: Lessons from SAM with Formal/Informal Disaggregation from India" presented in the 4th Meting of Expert Group on Informal Sector Statistics (Delhi Group), Geneva, August.

Sinha, Anushree, K.A. Siddiqui and N. Sangeeta, 2001: 'Impact of Alternative Economic Policies on the Informal Sectors: A Multi-Sectoral Study " NCAER Publication.

Sinha, A., K.A. Siddiqui and N. Sangeeta, 2003, *"The Impact of Alternative Economic policies on the Informal Sector: A Multisectoral Study"*, New Delhi: NCAER.

Sinha, A., K.A. Siddiqui and P. Munjal, 2004, "The Indian Informal Economy within a SAM Framework", within the research project titled "*The Impact of India's Trade Reforms on the Informal Sector"* funded by DFID, UK.

Srinivasan, T.N. 1998: "*India's Export Performance: A Comparative Analysis*" in I.J. Ahluwalia and I.M.D. Little (eds) India's Economic Reforms and Development Essay for Manmohan Singh. Delhi. Oxford University Press.

Stone, R., 1986: ' Social Accounting: The State of Play', in Scandinavian Journal of Economics.

APPENDIX I

Equations of the CGE Model:

Price Block

1- Import price $pm_i = p_i^{wm} er(1+tm_i + qr_i)$

2- Export Price $pe_i = p_i^{we} er(1-te_i)$

3- Consumer price $pc_i = \frac{pd_i xd_i + pm_i M_i}{Q_i}$

4- Output price $pq_i = \frac{pd_i xd_i + pe_i E_i}{X_i}$

5- Average output price by sector $pq_i = \frac{pd_i xd_i}{x_i}$

6- Value added price by sector $pva_i = pq_i(1-ptax_i) - \sum_j io_{ji} pc_j$

7- Value added price by public sector $pva_{pub} = \frac{\sum_{lc} wa_{lc} wdist_{pub,lc} l_{pub,lc}}{x_{pub}}$

8- Rate of capital rent by sector $pk(i) = \sum_i pc_i imat_{i,j}$

9- Consumer price index $cpi = \sum_i wc_i pc_i$

10- Export real exchange rate $erer_i = \frac{pe_i}{pd_i}$

11- Import real exchange rate $mrer_i = \frac{pm_i}{pd_i}$

12- Labour Market Equilibrium $\sum_i l_{i,rl} = ls_{cl} + u_{rl}$

13- $\sum_i l_{i,rl} + u_{rl} = ls_{rl}$

14- $wa_{rl} = wabarrl$

15- $(wa_{rl} - wabarrl) \times u_{rl} = 0$

Output and factor of production block

16- Total domestic output by sector $x_i = ad_i \prod (wdist_{i,lc}, l_{i,lc}^{a_{lc,i}}) kp_{ip}^{a_{ip}} kg^{a_i}$

17- Average wage rate by labour category $wa_{lc} = \frac{x_i \, pva_i a_{lc,i}}{wdist_{i,lc} l_{i,lc}}$

18-Employment by sector and skill $\sum_i l_{i,lc} = ls_{lc}$

19- Total domestic output by sector $x_i = at_i(\Gamma_i e_i^{\ z}) + (1-\Gamma_i xd_i^{\ z})^{\frac{1}{z}}$

(where $z = 1 + \frac{1}{epst}$)

20- Export by sector $e_i = xd_i(\frac{pe_i}{pd_i}(\frac{1-\Gamma_i}{\Gamma_i}))^{epst_i}$

21- Domestic sales $xd_i = x_i$

22- Composite supply $q_i = xd_i$

$rp_i = pva_i x_i - \sum_{lc} wa_{lc} widst_{i,lc} l_{i,lc}$

DEMAND BLOCK

23- Intermediate uses $nd_i = \sum_j io_{i,j} x_j$

24- Price of consumer composite $pc_i = \frac{cles_{i,hh} y_{hh}(1-mps_{hh})(1-dtax_{hh})}{(1+itax_i)cd_{i,hh}}$

25- Total household consumption by household $hhcd_{hh} = \prod (cles_{i,hh} cd_{i,hh}^{\ cles_{i,hh}})$

26- Depreciation expenditure $deprc_i = depr_i kp_i pk_i$

27-Labour income

$yl_{(wcasr)} = wa_{(cl)} wdist_{(agric,cl)} xleo_{(agric,cl)} + 0.5 \times wa_{cl} wdist_{(agroprif,cl)} xleo_{(agroprif,cl)}$
$+ 0.5 \times wa_{cl} wdist_{(rimif,cl)} xleo_{(rimif,cl)} + 0.5 \times wa_{cl} wdist_{(rgmif,c)} xleo_{(rgmif,cl)}$
$+ 0.5 \times wa_{cl} wdist_{(otmgf,cl)} xleo_{(otmgf,cl)} + 0.5 \times wa_{cl} wdist_{(constf,cl)} xleo_{(const,cl)}$
$+ 0.5 \times wa_{cl} wdist_{(otserif,cl)} xleo_{(otserif,cl)}$

28-Labour income $yl_{wregr} = 0.5 \times \sum_i wdist_{i,rl} wa_{rl} xleo_{i,rl}$

29-Labour income $yl_{oawr} = rk_{agric}$

30-Labour income

$yl_{"emppr"} = 0.5 \times (1 - \inf \ shro_{agroprif} rk_{agroprif} + 0.5 \times (1 - \inf \ shr_{rimif}) rk_{rimif}$
$+ 0.5 \times (1 - \inf \ shr_{rgmif}) rk_{rgmif} + 0.5 \times (1 - \inf \ shr_{otmgif}) rk_{otmgif} +$
$0.5 \times (1 - \inf \ shr_{const}) rk_{const} + 0.5 \times (1 - \inf \ shr_{otserif}) rk_{otserif}$

$$yl_{"wcasu"} = 0.5 \times wa_{cl}\, wdist_{(agroprif,cl)}\, xleo_{(agroprif,cl)} +$$
$$0.5 \times wa_{cl}\, wdist_{(rimif,cl)}\, xleo_{(rimif,cl)} +$$
$$0.5 \times wa_{cl}\, wdist_{(rgmif,cl)}\, xleo"_{(rgmif,cl)} +$$
$$0.5 \times wa_{cl}\, wdist_{(otmgif,cl)}\, xleo_{(otmgif,cl)} +$$
$$0.5 \times wa_{cl}\, wdist_{(const,cl)}\, xleo_{(const,cl)} +$$
$$0.5 \times wa_{cl}\, wdist_{(otserif,cl)}\, xleo_{(otserif,cl)} +$$
$$wa_{cl}\, wdist_{(agroprf,cl)}\, xleo_{(agroprf,cl)} +$$
$$wa_{cl}\, wdistxleo_{(rimf,cl)} +$$
$$wa_{cl}\, wdist_{(rgmf,cl)}\, xleo_{(rgmf,cl)} +$$
$$wa_{cl}\, wdist_{(cap,cl)}\, xleo_{(cap,cl)} +$$
$$wa_{cl}\, wdist(_{otmgf,cl)}\, xleo_{(otmgf,cl)} +$$
$$wa_{cl}\, wdist_{(otserf,cl)}\, xleo_{(otserf,cl)} +$$
$$wa_{cl}\, wdist_{(pub,cl)}\, xleo_{"(pub,cl)}.$$

31-Labour income $yl_{wregu} = 0.5 \times \sum_i wdist_{i,rl}\, wa_{rl}\, xleo_{i,rl}$

32-Labour income $yl_{oaw} = \sum_i \inf\ shr_i\, rko_i - yl_{yawr}$

33-Labour income $yl_{emppu} = \sum_i (1 - \inf\ shr_i) rk_i - yl_{emppr}$

34- Quasi rent from QR's $qrent_{hh} = qrshr_{hh} \sum_i qr_i m_i\, pwm_i er$

35- $gdpn = \sum_{hh} yl_{hh}$

36- $gdpr = \sum_i (x_i - nd_i)$

37- Private gross income $y_{hh} = yl_{hh} + cpi \times trans_{hh} + er \times rmit_{hh} + qrent_{hh}$

38-Profit rate by sector $r_r = \dfrac{rk_i - deprc_i}{kp_i}$

39- Weighted avarage profit rate $rbar = \dfrac{\sum_{ip} (rk_i - deprc_i)}{\sum_i kp_i}$

40-Total household savings $hhsav_i = mps_{hh}\, y_{hh} (1 - dtax_{hh})$

41-Government savings $govsav = gr - gotot - er \times debtsrv - \sum_{hh} cpi \times trans_{hh}$

42-Tariff revenue $tariff = \sum_i (tm_i m_i\, pwm_i) er$

43- Indirect tax revenue $indtax = \sum_i (itax_i\, pc_i \sum_{hh} cd_{i,hh})$

44-Production tax revenue $prodtax = \sum_i ptax_i pq_i x_i$

45-Export duty revenue $duty = \sum te_i e_i er \times pwe_i$

46-Direct tax revenue $dirtax = dtax_{hh} y_h$

47-Total direct tax revenue $dtaxtot = \sum_{hh} dirtax_{hh}$

48-Total saving $saving = \sum_{hh} hhsav_{hh} + govsav + er \times sf$

49-Capital share $ki_i = \frac{kp_i}{\sum_i kp_i}$

50-Government revenue $gr = tariff + duty + indtax + \sum_{hh} dirtax_{hh} + prodtax$

51-Total govt consumption $gdtot = (pva_{pva} + \sum io_{i,pub} pc_i) x_{pub}$

52- Rate of capital rent by sector $pk_i = \frac{ki_i (1 + adj(r_i - rbar))(saving - pk_{pub} dk_{pub})}{dk_i}$

53-Final demand for productive investment $id_i = \sum_i imat_{i,j} dk_j$

54-Total investment $invest = \sum_i pc_i id_i$

$$\sum_i pwe_i e_i + sf + \sum_{hh} rmit_{hh} - \sum_i pwm_i m_i - debtsrv = 0$$

Market clearing

55-Composite supply $q_i = \sum_{hh} cd_{i,hh} + nd_i + id_i$

55-Objective function $omega = \sum_{hh} hw_{hh} \log(\prod cles_{i,hh})$

VARIABLES:

ER	Exchange Rate
ERER(IX)	Export Real Exchange Rate
MRER(IM)	Import Real Exchange Rate
PD(I)	Domestic Prices
PM(I)	Domestic Price of Import
PE(I)	Domestic price of Export
PK(I)	Rate of Capital Rent by Sector
PQ(I)	Average output price by Sector
PC(I)	Price of Consumer Composite
PVA(I)	Value added Price by Sector
PWM(I)	World Market Price of Import
PWE(I)	World Market Price of Export
TM(I)	Tariff Rates
TE(I)	Export Duties
QR(I)	Tariff Equivalent QR Rate

CPI	Consumer Price Index
Q(I)	Composite Supply
X(I)	Total Domestic output by Sector
XD(I)	Domestic sales
E(I)	Export by Sector
M(I)	Imports
AD(I)	Production Function Shift parameter
KG	Public capital Stock
KP(I)	Capital Stock by Sector
KI(I)	Capital Shares
WA(LC)	Average Wage Rate by Skill
LS(LC)	Labour Supply by Skill
L(I,LC)	Employment by sector and Skill
HW(HH)	Household Size Weight
RK(I)	Sectoral Profit
RBAR	Weighted Average Profit Rate
ADJ	Investment Adjustment Parameter
INFSHR(I)	Informal Share of Capital and Profits
ND(I)	Intermediate Uses
CD(I,HH)	Final Demand for Private Consumption
HHCD(HH)	Total Household Consumption by household Type
ID(I)	Final Demand for Productive Investment
DEPRC(I)	Depreciation Expenditure
RMIT(HH)	Remittances (US dollars)
QRENT(HH)	Quasi Rent from QR's
Y(HH)	Private Gross Income
YL(HH)	Factor Income
MPS(HH)	Marginal Propensity to Save out of YD
DTAX(HH)	Direct Tax Rate
ITAX(I)	Indirect Tax Rate
PTAX(I)	Production Tax Rate
GR	Government Revenue
TARIFF	Tariff Revenue
INDTAX	Indirect Tax Revenue
PRODTAX	Production Tax Revenue
DUTY	Export Duty Revenue
TRNS(HH)	Transfers
DIRTAX(HH)	Direct Tax Revenue
DTAXTOT	Total Direct Tax Revenue
GDTOT	Total Government Consumption
HHSAV(HH)	Total Household Savings
GOVSAV	Government Savings
IMAT(I,J)	Capital Coefficients
SAVING	Total Savings
SF	Foreign Savings
DEBTSRV	Foreign Debt Service
INVEST	Total Investment
SF	Foreign Savings(Current Account Balance)
DK(I)	Volume of Investment by destination
GDPN	

GDPR	
OMEGA	Objective Function
OBJ	Objective Function
EPST(I)	Elasticity Of Transformation
CLES(I,HH)	ES Consumption Share Parameter
DEPR(I)	Depreciation Rates
IO(I,J)	Input-Output Coefficient
XLE0(I,LC)	Employment by Sector and Skill (Hundred Thousand Persons)
WC(I)	Weight for Consumer Price Index
WDIST(I,LC)	Wage Proportionality Matrix
GAMMA(I)	CET Function Share Parameter
ALPHL(LC,I)	Labour Share Parameter in Production
ALPHL(LC,I)	Labour Share Parameter in Production
ALPHG(I)	Public Capital Share Parameter
ALPHK(I)	Capital Share Parameter in Production
WABARRL	Fixed Wage Rate
U(LC)	Unemployment By Skill

LMEQUILC(LC)	Labour Market Equilibrium
LMEQUILR(LC)	
WAGEFIX(LC)	
KTWARL(LC)	

FORMAL SECTORS (IIF)

AGROPRF	Agro Processing Formal
RIMF	Rice Milling Formal
RGMF	Readymade Garments Formal
OTMGF	Other manufacturing goods Formal
CAP	Capital Goods
OTSERF	Other Services Formal
PUB	Government Services

INFORMAL SECTORS (IFF)

AGRIC	Agriculture
AGROPRIF	Agro Processing Informal
RIMIF	Rice Milling Informal
RGMIF	Readymade Garments Informal
OTMGIF	Other manufacturing goods Informal
CONST	Construction
OTSERIF	Other Services Informal

HH	HOUSEHOLD TYPES	
	WCASR	Rural csual labour House Hold
	WREGR	Rural Rugular labour House Hold

RUCAP Rural Capitalist house Hold
WCASU Urban csual labour House Hold
WREGU Urban regular labour House Hold
OAWU Urban OAW House Hold
EMPPU Urban Employers House Hold

LC LABOR CATEGORIES
CL Casual Labour
RL Regular Labour

KC CAPITAL CATEGORIES
OAW Own Account Worker
EMPL Employer

[i] As India is not in a position to dictate world prices and is a price taker in the world market, we have adopted the small country assumption.