


Employment-oriented Industry Studies

The Economy-wide Effects of Price-Reducing Reforms in Infrastructure Services in South Africa

R. Davies
D.E.N. van Seventer

February 2006

HSRC Human Sciences Research Council

employment growth & development initiative

innovative employment strategies

THE ECONOMY-WIDE EFFECTS OF PRICE-REDUCING REFORMS IN INFRASTRUCTURE SERVICES IN SOUTH AFRICA

Rob DAVIES

Research Associate

Employment Growth & Development Initiative

Human Sciences Research Council (HSRC)

Dirk VAN SEVENTER

Research Associate

Trade & Industrial Policy Strategies (TIPS)

February 2006

HSRC Human Sciences Research Council

employment growth & development initiative

Human Sciences Research Council

February 2006

Miriam Altman at HSRC and Stephen Hanival at TIPS supported the work for this paper. Our thanks to them. Thanks also to Miriam Altman, Channing Arndt, Joe Francois and James Thurlow for comments, suggestions and advice. An earlier version of this paper was presented at the 2005 TIPS Forum. We would like to thank Elsabe Loots and other participants for comments. None of the above is responsible for remaining errors. The paper should not be taken to represent the views of the institutions with which the authors are affiliated.

Produced by: Rob Davies and Dirk van Seventer

Contact: Dr Miriam Altman
Executive Director, EGDI
E-mail: maltman@hsrc.ac.za
Tel: +27 12 302 2402

Contents

Tables

Figures

Abstract

Prices of infrastructure services in South Africa may be higher than in other countries because of imperfect competition, because of non-tariff barriers to trade or because of inefficiencies in production. A static CGE model is used to analyse the economy-wide effects of reducing plausible estimates of high prices from each of these causes in telecommunications and transport. Demand for labour is found to rise significantly. Indirect effects mean that some non-reforming sectors are affected more than the reforming sectors. Income distribution is changed, with poorest and richest households benefiting more than middle income ones. The effect of the three reforms together is generally greater than the sum of their impacts taken separately. A bottleneck in supplies of high skilled labour not only reduces the level of the impact but also changes its sectoral and household composition.

JEL Classification: C68, D42, D58, L13

Key words: imperfect competition, CGE models, non-tariff barriers, services, productivity

1. Introduction

It is widely believed that many services in South Africa are over-priced. There are frequent complaints in the media by business and consumers about the high cost of telephone calls, the poor quality of rail or port services. Although there is disagreement over the magnitude of such over-pricing, its existence has been borne out in a number of research and consultancy reports (van Seventer *et al*, 2005; Genesis, 2005). Infrastructural services such as transport and communications provide significant inputs into the production of other goods and services in addition to any direct contribution they make to the economy. Reforms that reduce their prices might thus be expected to have knock-on effects on the rest of the economy. This paper examines some of these economy-wide effects, in particular the employment effects.

Although the paper emphasises the consequences of price reductions, it does **not** examine the practical measures that might bring about such reductions. Policy recommendations in this regard require a more detailed, sector-focussed approach. Such policies will depend upon the reasons behind the higher prices, but we do not examine these. Rather, we evaluate how reducing some plausible estimates of the extent of over-pricing affect the rest of the economy. Our purpose is to consider what gains there might be from price-reducing measures.

There are, broadly speaking, three channels through which reducing over-pricing will have economy-wide impacts. First, there will be supply side effects. Reducing prices will reduce costs to users. Where these are producers, there will be further knock-on effects. It is likely that this will have a positive effect on GDP and employment. Secondly there will be demand effects. Reducing costs to consumers raises their real incomes, increasing demand not only for the services directly but also for other goods. Expanding employment will also have a demand promoting effect.

The third channel is less obvious. Over-pricing creates an income for some agents in the economy. Removing it can therefore affect the distribution of income. The precise manner in which it does so will depend on the nature of the over-pricing. For example, reducing a monopoly price can reduce the income of agents that benefit from the monopoly. This can have compositional effects on demand. Demand will fall for those goods that are high in the monopolist's consumption bundle and rise for those high in the consumption of groups that benefit from removing monopoly. The beneficiaries could be other consumers, government (through tax effects or share holding) or foreigners (through share holding and consequently foreign transfer payments). These distributional effects can be important not only for understanding the full impact of reforms but also because they give some insight into the political economy of reforms.

These three channels are microeconomic in character: they work through their impact on particular agents in the economy and the behavioural response of those agents. These will be conditioned by macroeconomic responses. Removing over-pricing might upset the balance between aggregate savings and investment. The way in which

this balance is restored will feed back on to the outcomes at the microeconomic level. For example, if there is little possibility for adjustment of the current account and the budget deficit and if aggregate investment is relatively fixed in the short run, the burden of adjustment will fall on private savings and consumption. This will compound or offset the consumption effects referred to above, adding an income effect to those (basically) substitution effects. Similarly, effects will depend on whether the economy responds to the additional demand for labour by creating more employment or raising wages.

To examine these effects we therefore need a model that not only captures inter-industry and income distribution effects, but also has some macroeconomic structure. We therefore use a static economy-wide model, adapting the IFPRI standard model as applied to South Africa by Thurlow and van Seventer (2002, for a full description).

Although 'infrastructure services' – sometimes called social overhead capital services – is comprised of a number of sub-sectors, we focus our attention on communications and transport. These were selected because they were identified by van Seventer *et al* (2005) as two of the three sectors[1] in the South Africa in which the public sector plays an important role as shareholder, while also being seen by most economic commentators as having a crucial role to play in determining South Africa's international competitiveness.

In the next section we discuss the nature and sources of over-pricing in general, focusing on three sources: monopoly, non-tariff trade barriers and inefficiencies. Section 3 provides some rough but plausible estimates of the extent of over-pricing in transport and communications in South Africa. Section 4 discusses the model we use. In Section 6 we provide quantitative measures of the likely impact on the economy of removing all of the over-pricing identified in Section 3. Section 7 then decomposes some of these results, to try to understand better the sources of the biggest changes. Finally Section 8 concludes with some caveats and suggestions for where further research might be undertaken.

We try to keep the discussion intuitive and non-technical. Several Appendices provide more detail on some of the technical aspects of the work.

[1] Electricity also has considerable public sector involvement, but there appears to be less concern about imperfect competition and inefficiencies in this sector.

2. The nature and sources of over-pricing

Popular debates on 'over-pricing' sometimes give the impression that a price is regarded as too high simply because it puts the service beyond the reach of some target group of users, often 'the poor'. Or it is seen to be an unfair price. This formulation implicitly suggests that the price is unnecessarily or unjustifiably high and could be reduced without compromising supply. We need some idea of what a 'justifiable' price would be for policy purposes.

Since this paper is not concerned with the case for subsidising services, we adopt the standard benchmark price used in economics: the price that would obtain in a competitive market. If allowed to work fully, competition will normally drive the price of a good down to the lowest level compatible with covering costs, including some 'normal' profit. Using this as a benchmark does not have to imply that it is the optimal price. We may have reasons for preferring a different price: for example because we want to provide support to an infant industry or because we want to keep the cost of a basic wage good down. But the competitive price does give us one measure of the costs of these policies.

There are many practical difficulties determining this competitive price in the real world. We would ideally want to know what the costs of producing the service are, but in practice many services are produced in multi-product firms. It is difficult to assign overhead costs to each product. What, for example, is 'the' cost of a telephone call? Even if we define this more precisely – say, a 3-minute local call – we run into the problem that other services – international calls, internet connections, trunk calls, conference calls, etc. – use the same facilities. How should we assign the costs of maintaining these facilities? While we can devise neat theoretical ways of apportioning them, in practice we seldom have the data to do so. It is apparent that the same problems arise across almost every service. What is "the" cost of transport? Of financial services?

A common practical solution to this problem is to adopt an international reference price. This introduces a different set of problems: what is the appropriate international comparator? Where a good or service is readily tradable internationally, we might take the price of an import landed in South Africa. But services are not always traded, and we often have to fall back on a 'hypothetical' price: what the service sells for in some comparable market. Selecting such a comparator is difficult. We probably need to make appropriate adjustments for differences in input costs and other country specific factors. We also need to be sure that the comparator country does not sell the service in an uncompetitive market or impose trade barriers on it. This is complex and requires expert knowledge of the particular service sector.

Once we have decided on the appropriate benchmark price, we can think of a **wedge** being driven between it and the actual price[2]. We can represent this in symbols as

$$PW = \frac{P_a - P_b}{P_b} \tag{0.1}$$

where PW is the price wedge, measured relative to the benchmark price, P_a is the actual price and P_b is the benchmark price. It is useful for later discussion to also write the equivalent form

$$P_a = (1 + PW)P_b \tag{0.2}$$

The actual price of the service will be reduced if this wedge is reduced. However, this may not be the only source of potential price reductions for a service. The very factors that allow the provider to charge more than a cost-recovering competitive price may also lead it to have higher costs than necessary. Lack of competition, for example, may allow the provider not only to extract some abnormal profits, but also to get away with not using 'best relevant practice' technology and organisation. Thus, even if the difference between the actual and benchmark prices is zero, there may be an **efficiency gap**, and it may still be possible to reduce the benchmark price.

Broadly speaking then, we can think of a service as being 'over-priced' when the actual price is higher than some reasonable cost recovery price. This gap might be decomposed into a **price wedge** and an **efficiency gap**. (See Appendix B for more technical discussion). We are now in a better position to consider the 'causes' of over-pricing. It is useful to think about the two components separately.

The existence of a price wedge necessarily implies that something prevents competition driving the price down. The providers of the service are somehow able to maintain market power. The source of the market power will depend on the nature of the service. If it is domestically produced, the existence of a wedge suggests there is lack of domestic competition. There are potentially many reasons why this might be so: high start-up costs might limit entry, small market size might create natural monopolies, state licensing policies may bestow market power, providers might be state owned enterprises with legislated monopoly power, and so on.

Where there are also potential foreign providers, a wedge suggests there is some barrier to foreign provision of the service. While trade in services may resemble trade

[2] The term 'wedge' provides a vivid metaphor. A wedge can be used by lumberjacks to drive into a crack in wood to split it apart. That is precisely what is happening here – the actual price and the benchmark price are being split apart by the factors that permit the existence of the wedge.

in goods, in that there is a transaction between a local and a foreign agent, it differs in many important respects for many services. Frequently trade in a service requires movement of people. Tourism, for example, requires the consumer to travel to the service provider's country, while a consultancy service may require the provider travelling to the customer's country. In other cases the service provider may have to establish a physical presence in the customer's country, such as a foreign bank investing in a country.

These variations in the mode of service trade lead to a wide variety of forms of trade restriction. These might include restrictions on the use of credit cards for international transactions, requirements for local partnerships, restrictions on the services that foreign banks can provide, local registration of qualifications and work permit requirements, and so on. Where the foreign service competes with local providers, these restrictions constitute a form of protection, allowing the local provider to charge higher fees than would otherwise be possible.

At one level both imperfect competition and barriers to trade in services have similar effects: they both sustain a price wedge that might otherwise not exist. However, there are some important differences. The price wedge arising from imperfect competition constitutes an income for someone. This may not be the case for non-tariff barriers on service trade. Where the service is only imported, it is not clear that anyone benefits. Even where there are local providers, it is not clear how the full implicit income is distributed.

This point may be clearer if one thinks about a traded good facing a non-tariff barrier. Standard analysis tells us that the barrier raises income for local producers and creates a rent for those who are permitted to import the good – an income that would have been government tariff revenue if there had been an equivalent tariff barrier. In addition there is a dead-weight loss to the economy. With many services, there is no domestic agent who imports it, so there is no rent going to them. At the same time, the barrier does not raise the foreign price received by the foreign supplier, so there is no income going to them either. The "tariff equivalent income" simply disappears. The income of the domestic suppliers is raised, but that is all[3]. The deadweight loss is bigger. However, a barrier in the form of a fee that only foreigners have to pay is in effect a tariff barrier, generating an income to the fee-collecting agency.

We can thus see that a full and detailed analysis of **price wedges** will have to look at the precise forms of barriers in each specific service. We do not do that in this paper, leaving it for detailed sectoral studies to be undertaken later.

The second component of overpricing, **efficiency gaps**, can arise from as many different sources as price wedges. Local technology may not be as up-to-date as in the

[3] Consider the example of using the internet to order a product from a foreign supplier. Restrictions on the use of credit cards for such transactions are a barrier to trade and protect domestic suppliers from foreign competition, but who gets the tariff revenue equivalent as income?

comparator country. In turn, this could because of global or home-grown obstacles. Patents and other forms of monopoly power over intellectual property rights might make foreign technology too expensive to acquire. Local service providers may get away with opting for 'the easy life' because of the lack of a competitive spur. Perhaps local skills shortages render inappropriate the apparently more efficient international technology. Possibly there are technological economies of scale that are not being captured.

Clearly the cause of an efficiency gap has an important bearing on the kinds of policies required to reduce them. Some sources create more intractable problems than others. However, the economic effects of reducing the gap do not in general depend on its cause. Raising efficiency reduces costs[4].

[4] We say 'in general' because there may be differences between pecuniary and technological inefficiencies. This paper does not address the former.

3. Price wedges and efficiency gaps in communications and transport in South Africa

There are currently no studies that measure South African price wedges and efficiency gaps in precisely the form we need for implementing the model. We therefore draw on available literature to get a rough idea of plausible values to use in our model simulations. The study should therefore be seen as exploratory, attempting to determine whether more precise measurement might be worthwhile. We consider the evidence on price wedges first followed by efficiency gaps.

3.1 Price wedges

In the most recent study, commissioned by the HSRC, Botes builds up estimates of transport price wedges in South Africa from microeconomic data. He estimates that price wedges on transport are 10% for domestic transport and 13% for international, with an average of 11% overall (Botes, 2005, Table 9). These are somewhat lower than found in a methodologically different study by Edwards and van de Winkel (2005). They use a more aggregate and econometric approach to infer mark-ups across a wide range of South African industries. They find that between 1994 and 2002, the average mark-up in Transport Services was 101% if intermediates are excluded from costs and 47% if they are included. Although the differences might be explained in a number of ways[5], the wide variation points to the current lack of information. We concur with the view of van Seventer *et al* (2005) that mark-ups in rail transport and ports remain unclear.

The information on mark-ups on Telecommunications in South Africa is even less clear than for transport. Some of the difficulties entailed in measuring these are discussed by Esselar (2006). Edwards and van de Winkel (2005) find average mark-ups over the period 1994-2002 of 116% excluding intermediates and 33% including them. Van Seventer *et al* (2005) report mark-ups of at least 15% in South Africa's fixed line telephone service and potential price reductions of about 50% over the next 5 years in a realistic reform scenario.

All of these studies measure the full price wedge and do not distinguish between imperfect competition and trade restrictions. We are not aware of studies of South Africa that make this separation. However, studies for other countries show that *ad valorem* equivalents of trade restrictions on the two sectors can be significant.

[5] For example, Botes focuses on freight transport while Edwards and van de Winkel incorporate all transport services.

Hoekman (1995: 355-356) estimated that the *ad valorem* equivalent of barriers to trade in the combined sector of transport & communication (ISIC 7) is typically between 100% and 200%. Stern (2000, 24) shows that *ad valorem* equivalents on telecommunication in selected developing countries are between 10-15%, considerably higher than in developed countries where the estimates range from 1% - 4%. Francois *et al* (2003, 21) report on *ad valorem* equivalent estimates for some services sectors using a gravity model, including trade, transport and logistics as well as business services and "other services", with transport estimated at 17.5% and other services at 22.6%. Konan & Maskus (2003) use 30% *ad valorem* equivalent tariffs for transport and 200% for communications in their attempt to evaluate the economy-wide impact of services deregulation in Tunisia.

Pulling this all together it does not seem to be unreasonable to allow for *ad valorem* equivalent tariffs on transport and communication services in South Africa of 15% and 20% respectively. Taken with Edwards and van de Winkel's estimates of the full price wedge, this would suggest that mark-ups from imperfect competition are around 32% for transport and 13% for telecommunications[6].

3.2 Efficiency gaps

There is currently little evidence available on the potential price reductions consequent upon improvements in efficiency in telecommunications and transport in South Africa. Inefficiencies in rail transport show up in as longer delivery times compared to similar services in other countries. However, the main cost this imposes is in encouraging users to use road transport instead (Botes, 2005). Van Seventer *et al* (2005) report on a series of bottom-up investigations that consider a number of quantitative performance indicators in transport and telecommunications in South Africa. While they argue that port reforms could produce efficiencies from tight cost control over labour costs, better deployment of staff and management of overtime labour costs, they do not quantify these gains. They also point out that key railway efficiency gains are related to rolling stock utilization rates. Improved wagon turn-around rates were the central recommendations made by efficiency advisors to Spoornet in 2000. Again these are not quantified.

Van Seventer *et al* (2005) also point to a range of measures that might potentially improve service efficiency in telecommunications. However, they again do not provide quantitative estimates of the potential gains[7].

[6] The *ad valorem* equivalents are calculated on costs including intermediates.

[7] It should be pointed out that Van Seventer and his colleagues are concerned with mapping out a methodology for examining these issues, not with actual measurement.

In the absence of specifically South African data, we have to turn to international literature for guidance. Konan & Maskus (2003) use 1.5% efficiency gains for transport and 15% for communications in their attempt to evaluate the economy-wide impact of services deregulation in Tunisia.

In Table 1 we report the price mark-ups due to imperfect competition, *ad valorem* equivalents of non-tariff measures and potential inefficiency parameters that we use in the economy-wide simulations below.

4. The model

We adapt the IFPRI standard CGE model (Lofgren *et al*, 1999) as applied to South Africa by Thurlow and van Seventer (2002). It is fully described in those sources. Here we highlight basic features and describe how the relevant behavioural relationships have been adapted to accommodate the reform scenarios outlined in the previous section.

4.1 The basic model

The IFPRI Standard model is a static model that is set up to provide modellers with flexibility in their assumptions about factor markets and macroeconomic adjustment, while retaining a standard resource allocation process. In the South African application there are 43 activities that produce 43 commodities. Distinguishing between activities and commodities allows for the possibility that a single activity might produce several commodities and a particularly commodity might be supplied by a number of activities. These are both common at this level of aggregation, as seen in the South African SAM. Thus, although the bulk of the Communications sector's output is communication services, it also supplies some business and some trade services. However, communications services are provided only by the Communications sector. Transport supplies only transport, and transport services are only supplied by the transport sector.

There are four factors of production, capital and three types of labour distinguished by skill. They earn incomes from activities, and pay the income to institutions – enterprises, households, and the rest of the world. This set up (which again is standard) permits a distinction between functional and personal distributions of income. 14 household categories are distinguished by income.

Imports and domestically produced commodities are combined to create a composite commodity, which is then supplied to the different users. This is the standard Armington approach, which permits imperfect substitution between imports and domestic commodities.

Activities allocate the commodities they produce to domestic use or exports. Transformation is imperfect between the two. When export prices rise relative to domestic prices, there may be some stimulus to overall production (as the price of output rises), and the proportion of output exported will rise. This latter substitution effect is generally more important than the income (output) effect, but it depends on the ease with which suppliers can switch between the two markets.

4.2 Modifying the model

The resource allocation processes of the IFPRI model follow the standard microeconomics of competitive markets. Firms are assumed to maximise profits and to demand inputs following standard optimising rules, with competition ensuring the zero profit condition is met: only normal profits are made. We modify the model to include imperfect competition, non-tariff barriers and to allow productivity shocks. Here we provide an intuitive account of the modifications required by each, relegating formalities to Appendix C. We conclude this section with a discussion of macroeconomic and factor market closures, since they are crucial in determining impacts.

4.2.1 Imperfect competition

There are two aspects to the modelling of imperfect competition – how the rents are generated and how they are distributed.

In everyday parlance we tend to think of monopolies in terms of firms. Thus we think of Telkom as a monopoly. However, the monopoly power is exercised over a commodity or service, not an activity. Telkom may have a monopoly over landline phones in South Africa, not necessarily over all telecommunications. Thus we need to formulate our problem in terms of the particular good or service, not the firm. We therefore model the rent by introducing an exogenous mark-up on the price of the commodity concerned. In the standard model, transactions costs (or trading margins) create a wedge between the price purchasers pay (the "demander price") and the price suppliers receive (the "supplier price"). Imperfect competition adds a further wedge, depending on the mark-up (see Figure 4 and Figure 5 in Appendix A).

This adds a new dimension to the standard model. Typically incomes are generated in activities not by commodities. Now we have an income – albeit an unproductive rent – generated by a commodity. We have to think carefully about the channel by which this rent feeds into the incomes of households and other institutions, and into GDP, savings and other macroeconomic aggregates.

It seems reasonable to assume that, although the rent is generated with respect to the service, it is acquired, in the first instance, by the activity producing the service. Telkom acquires all the payments associated with any monopoly rent generated on sales of services. While it is natural to think of monopoly as generating more profits, the rent could in principle result in higher payments to wages or for intermediate inputs. Although the latter may seem implausible if the inputs are sold in competitive markets, the monopolist's desire for a quiet life might lead it to pay a premium to regular suppliers, rather than seek out cheaper alternatives. Even more plausible is that wages and salaries will be higher than in a competitive market. Pay packages for managerial and high skilled labour will more than likely contain a share in the rent. Even unskilled wages could contain an element of rent. Although this might depend

on the extent of unionisation and bargaining power, even in their absence there are grounds for believing that employers will pay higher than average wages in a monopoly[8].

We do not have the information to let us split the rent between profits and wages. Despite these other plausible possibilities, therefore, we assume that it accrues entirely as income of capital in the activity. This means that it is distributed in the same way as 'normal' profits. Capital pays it to Enterprise and to the Rest of The World. Enterprise then saves some ('retained earnings'), pays some tax to Government and distributes the rest to households. In the absence of any other information on the distribution of monopoly rents, this is probably the most neutral assumption to make. The data we have on profit distribution derives from sources that do not distinguish between 'normal' and 'abnormal' profits, but simply look at distributed enterprise income as a source of income for the fourteen household groups. This is an area in which further empirical work could be done.

4.2.2 Non-tariff barriers

The immediate impact of non-tariff measures is modelled by imposing an *ad valorem* tariff equivalent on the imported service in exactly the same way that one would introduce an explicit tariff (see Appendix C for detail). There is thus a gap between the world and domestic price.

In principle, this 'tariff' generates an 'income'. However, as discussed above, it is not clear to whom it should be allocated or whether it is simply a deadweight loss. We model it as a loss, so that no one receives the income generated.

While the tariff equivalent approach is the most widely used, it is not the only approach to handling non-tariff barriers. As discussed in Andriamananjara *et al* (2003), it is possible also to view them as frictions that, while imposing inefficiency losses on an economy, do not generate any rents. The removal of such barriers can be modelled as an import enhancing productivity shock. We do not use this approach.

4.2.3 Efficiency gains

We model the efficiency component discussed above as a decline in total factor productivity on the activities concerned (see Equation 15 of Appendix C for detail). Thus removal of the inefficiency scales up output in the sector concerned.

[8] Conventional economists might appeal to efficiency wage theory to support this view, while those of a less conventional persuasion might use concepts of a labour aristocracy.

4.3 Closures

For our simulations, we assume that savings is constant and that investment adjusts, that government consumption is constant, that the current account balance is fixed and the exchange rate adjusts.

In the factor markets we assume that capital is sector specific and fully utilised. This is consistent with short-run analysis. However, as noted below it raises some complications in handling imperfect competition.

Since we are concerned with what happens to labour demand, we initially assume that the wages of all types of labour are constant and that there is a perfectly elastic supply. It has to be emphasised that this assumption leads to exaggerated results: output can grow to meet rising demand by drawing in labour without having to raise wages. However, we take this approach to try to gauge the impact that the reforms have on demand for labour. Subsequently we discuss the implications of a skills bottleneck, by assuming a fixed supply of high skilled labour.

4.4 Data

The quantitative estimates are based on a social accounting matrix (SAM) benchmarked on the year 2003 and based on a SAM published by Stats SA for the year 1998. The 1998 SAM was updated by Quantec to reflect more recent data on National Accounts, sectoral GDP and output, households, governments, investment and trade.

5 The economy-wide impact of price reductions

We begin this section with an intuitive discussion of the impacts we expect the various price reducing measures to have. We then present numerical results from various simulations. Table 2 gives the names and brief descriptions of the simulations and can be used as a key to the results presented in the subsequent tables.

5.1 Expected impact

Although formal CGE modelling provides extensive numerical results, the insights it gives into the interactions behind the numbers are probably more important. We should always focus more on the 'why' than the 'what' of results. It is therefore useful to begin by thinking of the likely impact of the reforms to have some expectation against which we can judge the results.

It is useful to begin interpreting results by thinking of the immediate impact of the reform on the reformed sector itself, before going on to the way in which this impact ripples through the wider economy. We do not expect impacts to differ qualitatively between our two sectors, and can thus generalise across the two.

- **Removing imperfect competition:** standard microeconomic theory tells us that firms with market power restrict output in order to raise profits. We thus anticipate that removal of market power will expand supply of the reformed sectors: activity levels and labour demand should rise. At the same time the price of the service should fall, stimulating demand for the service. We also expect, *ceteris paribus*, that domestic sales will rise relative to exports, and that domestic supplies will displace imports.
- **Removing non-tariff barriers:** we anticipate that this will reduce both the price and the domestic output of the service. Demand should be stimulated, but the increase will be satisfied more out of imports than domestic production. Any effects on labour demand should be small.
- **Raising efficiency:** the direct impact of improved efficiency on the output of reforming sector would be positive. Demand for output will rise because of substitution effects induced by price reductions. These substitution effects might also lead to small increases in exports and reductions in competing imports. Demand for labour will probably fall: the output demanded can be produced using less labour than before.

We see that the three reforms have reinforcing impacts in some cases and offsetting ones in others[9]. All three reduce prices in the reformed sector but only the removal of imperfect competition raises labour demand. At this level all the output and demand effects are likely to be small as there is no significant rise in incomes to create an income effect. In effect, the changes are predominantly compositional. It is only when the economy-wide impacts are allows to play through that we might see significant income effects. The economy-wide analysis should also allow us to gauge net effects of countervailing impact effects.

Turning to our intuitions about economy-wide impacts, it is useful to think of those operating through the supply side and those operating through the demand side. The supply side effects are initiated by the reductions in prices of the reformed services, which feed through as reduced input costs for other sectors. This stimulates output in all sectors. The supply side effects thus tend to be expansionary, drawing more labour into production and income generation. It is largely through this that the demand side effects kick in. Higher incomes stimulate demand, not only for final goods, but also for intermediate inputs. These demand effects are also likely to be positive.

This is a win-win situation: there are expansionary effects on both sides of the demand-supply equation. Of course expansion does not continue indefinitely. The demand side will be constrained by the normal limits we see on multipliers, determined by leakages in the circular flow. The supply side runs into the usual capacity constraints: as output expands, costs rise, choking off further expansion.

This last effect is important for understanding the economy wide effects we present below. The price reducing reforms in two sectors initially cut costs in all sectors using them. This stimulates production and increases demand for inputs, not only of factors of production, but also intermediates. This creates price-increasing pressures. There are thus two countervailing influences on prices. Sectors that use relatively few inputs from the reformed sectors may find that their overall intermediate input costs rise. Net effects on costs will depend on the structure of production in each sector.

5.2 Numerical results

Let us now look at some quantitative estimates of the different reforms. We begin with the impact of all three reforms in both sectors simultaneously.

5.2.1 Reforming communications and transport simultaneously (FULL)

Implementing all six of the changes noted in Table 1 raises real GDP by 3.9 per cent, a substantial impact (Table 4, column 1). As pointed out above, this result is driven very strongly by the assumption that there is no constraint on labour supplies. The

[9] Table 3 summarises the main expected direct effects.

increased demand for labour is not choked off by wage increases, but met in effect by drawing unemployed people into production[10]. This is a static, once and for all gain; the model does not examine dynamic effects. However, one could say that the price wedges and efficiency gaps in Table 1 cost the South African economy 3.9% of its GDP each year they continue.

As Table 4 shows, there is a substantial rise in private consumption and a lesser one in investment. Government consumption and change in inventories are fixed by assumption. Both exports and imports rise. In principle, higher GDP leads to higher imports, and the exchange rate depreciation is required to raise exports, since the current account balance is fixed by assumption. The exchange rate depreciates by some 3%.

Sectoral demands for capital are fixed by assumption. However, as might be expected from the rise in GDP, the net effect of all three reforms is to raise demand for all types of labour. Demand for unskilled and skilled labour rises by 6%, while that for high skilled rises by 4% (Table 5).

These aggregate changes are mediated through inter-industry effects operating at the sectoral level. These are initiated by the fall in prices of the two reformed sectors. However, as described above, the direct price-reducing effects will be counter-balanced by the price-increasing effects of greater demand for inputs from all sectors. Table 6 gives some relevant information. Columns [1] and [2] show the shares of value added and intermediates in the gross output of each sector. Columns [3] and [4] show the shares of transport and communications, while column [5] shows the two combined. The sectors are arranged in descending order of this sum. Thus, the communications sector is the most intensive in its use of transport and communications as inputs: they account for 34.3% of gross output. The simple average for all sectors is 4.3%. 12 sectors are higher than average intensity and 31 lower.

The final column of Table 6 shows how a price index for intermediate inputs changes for each sector when we implement all three price-reducing measures. As expected, this index declines for those sectors that use transport and communications relatively intensively. With few exceptions, sectors that are below average intensity see a net rise, as the price-raising effects of higher demand more than outweigh the price reducing effects of the reforms.

Table 7 shows the impact on demand for labour at a sectoral level. The percentage change in demand is uniform across all skill categories, as a result of the production function used. Although the patterns are difficult to see at this level of disaggregation,

[10] If we assume that the supply of high skilled labour is completely fixed, the rise in GDP would be 2.5%. We discuss this later.

one feature stands out. Although the two reformed sectors are amongst those with the highest employment expansion, there are other sectors that are as high or higher. The knock-on effects can be bigger than the direct effects. Thus "Petroleum products" leads the field, ahead of "Transport". Table 6 shows that the price of inputs does fall for this sector, which should induce cost reduction and demand expansion. But more importantly, petroleum products are inputs into every other sector in the economy: there are high forward linkages. Furthermore it is complementary to transport, which buys 21% of its output. The reforms in transport thus provide a big stimulus, both directly and indirectly, to petroleum products. This is true of many other sectors. The reforms in communications are important for Business Services, and so on.

Finally, we need to examine the impact of the reforms on incomes. In the first place, both labour and capital income expand (see Table 8). The assumption of fixed wages means that the expansion in labour demand necessarily raises incomes. Capital income rises overall, despite the loss of the monopoly rents in the reformed sector. Expanded production pushes up returns to capital across the economy.

Table 9 shows how these increases in factor incomes map into changes in institutional incomes. Entrepreneurial income rises in line with capital income. Recall, however, that entrepreneurial income is largely transferred to households. We see household incomes expanding by an average of 4.3%. In general middle to high-income households benefit relatively more than both the poorest and the richest households. Interestingly the bottom decile has a higher rise than the second (3.5% vs. 2.8%). These differences arise from the differences in the structure of income sources. Table 10 gives the basic data. It can be seen that the poorest households depend more heavily on labour income than those in the second decile, whose incomes derive more from government transfers. Thus the rise in employment benefits the former more. Similarly, the richest households derive more than 80% of their income from capital. They do not benefit as much from the expanded employment and higher labour incomes as do less capitalistic households.

These differential impacts on income distribution provide a useful pointer to the political economy of the reforms that lie behind the price reductions we are examining. Political power tends to reside with those groups that lose from the reforms. We will return to this in the conclusions.

We have thus far examined the impact of the reforms taken all together. It is useful to consider them in smaller packages for a number of reasons. It is difficult to disentangle the workings of a number of changes undertaken simultaneously, so that decomposing them into the consequences of the component parts may give more insight into the processes at work. There is also the interesting question – from both a policy and a theoretical point of view – of whether the whole is greater than the sum of the parts: does implementing the reforms as a simultaneous package provide better results than they would if taken sequentially? We therefore turn to look at the decomposition.

There are a number of different ways in which we can decompose the overall package. Each reform can be looked in each sector separately. We will not do this, except in passing, since there are a tedious number of results to examine (results are given in the tables already presented.) Rather, we take two cross-cutting approaches. First we compare the results of each reform when undertaken simultaneously in both sectors. Then we compare each package of reforms in each sector.

One needs to be careful when interpreting these comparisons. The impacts of the reforms depend in part upon the size of the initial reform. The relative results would change if the numbers in Table 1 were different. We cannot make sweeping conclusions, such as that "more is to be gained from removing monopoly than from reducing trade barriers". Our comparisons are to the current set of shocks, so we can draw the above conclusion only if we qualify it with "in the context of the current South African economy". This is why it is important to undertake further sectoral analysis to test the plausibility of the numbers in Table 1.

5.2.2 Specific reforms in both sectors (MONO, NTM and PROD)

Removing the mark-ups in both sectors (MONO) has the biggest effect on GDP of all three reforms, raising it by 2.3% (Table 4). Reducing non-tariff barriers (NTM) has hardly any effect, while the improved efficiency (PROD) raises GDP by some 1.5%. This is in line with the qualitative expectations presented in Table 3. In both MONO and PROD, there are strong income effects, particularly through the additional labour demand. The impact effect of NTM is to reduce production – as protection is removed. Furthermore, we have assumed that the rent from the tariff equivalent is completely dissipated, so income effects are insignificant. Note that the effects of the three reforms taken separately add up to their effect when taken as a package (FULL). There appear to be no interaction effects.

From this impact on GDP, it follows that MONO increases labour demand by the greatest amount (Table 5). Here, however, the whole **is** greater than the sum of the parts. Adding up the impacts of the individual reforms gives a rise of 5.5% (= 3.5% + 0.5% + 1.5%) in the demand for low skilled labour, whereas FULL gives a rise of 5.9%. It is the same for the other two skill categories. This is because of the interaction terms. Recall from our discussion of the expected direct impacts of the reforms (summarised in Table 3) that we expected improved efficiency would reduce the demand for labour in the reforming sectors. In Table 7 we see that indeed this is the case, even after the general equilibrium effects have been incorporated. Labour demands in Transport fall by 6.9% and in Communications by 7.8%. But this is offset by both the impact on other sectors, which are stimulated by the cost-reducing effects of improved efficiency in two of their major suppliers, and by economy-wide demand effects. When these effects are reinforced by the large stimulus to demand arising from the removal of mark-ups, they give rise to an even bigger overall effect.

Removing mark-ups raises labour incomes more than the productivity shock, but capital income less (Table 8). This is as one would expect. Removing the monopoly rent reduces capital income initially, although the general equilibrium effects

subsequently offset this. The increase in labour demand drives the results. Raising efficiency reduces employment initially, although this too is offset by the economy-wide feedbacks. Again the whole is greater than the sum of the parts. The policy implication is that it is better to remove monopoly from an efficient sector than an inefficient one and better to promote efficiency in a competitive sector than a non-competitive one.

This differential impact on factor incomes feeds through into a different impact on household incomes. Reducing monopoly benefits households that are relatively dependent on labour income; productivity improvements benefit those relatively dependent on capital. These are strikingly different impacts: generally, productivity increases benefit high-income households more, while more competition tends to favour middle-income households more.

5.2.3 Reforming each sector separately (FULLTRPT and FULLMONO)

Generally reforms to the Transport sector have a bigger impact than those to the Communications sector. We need to emphasize that in part this is because the overall price reductions imposed are greater. But the difference also arises because of the more pervasive use of transport services as an input into the rest of the economy. For the same reasons as with the specific reforms, reforming the sectors together typically has a bigger impact on variables than the sum of reforming each sector in isolation.

5.2.4 The impact of a skills constraint

The foregoing simulations have assumed perfectly elastic supplies of all three skill categories. The economy does not run into labour shortages as it expands in response to the reforms. While this is useful for getting some insight into the effects of the reforms on the demand for labour, it exaggerates the expansionary effects of the reforms. Skills shortages are a major concern in South Africa and shortages of one particular skill will restrict the extent to which demand for other types of labour will rise. The problem is that we do not have clear indications of what the supply curves of different types of labour look like, so that it is difficult to put together a 'realistic' scenario. However, it is instructive to consider how shortages might affect the previous results.

To do so, we assume that the total supply of high skilled labour is completely inelastic: any change in demand for it will be met by changing wages rather than changing employment. This might be regarded by some as reflecting the short-term skills problems that South Africa faces. We could also regard it as representing an extreme bound on skills shortages.

Under this scenario, the initial impact of the reforms is the same as before. However, as the reforming sectors attempt to expand, they are unable to acquire the additional skilled labour by drawing it in from an unemployed pool. Instead they have to recruit it from other sectors where it is already employed. Therefore, whereas previously we expected the expansionary effect on demand for labour to raise employment of high skilled labour across the board, now we expect that employment will rise in some

sectors and fall in others. There is a reallocation of high skilled labour in the economy, not an expansion.

Table 11 shows these results. The first two columns show the impact of the unconstrained full reform (repeating the figures in column 1 of Table 7: recall that in the unconstrained case the demand for labour changes by the same proportion for all three categories in any given sector). Columns 3 shows how sector demands for high skilled labour change when there is a constraint on supply. Column 4 ranks these changes. There are some dramatic differences between the two. The correlation between the rankings is 0.5. As we might expect, even for those sectors that expand, the expansion is lower than previously. As before the two reforming sectors are not highest on the list of expanding sectors. General equilibrium effects still mean that the spill-over effects of the reforms can be more important for non-reforming than reforming sectors.

As we might expect, the most noticeable difference is that there are some sectors that reduce their employment of high-skilled labour (it is now correct to speak of 'employment' rather than 'labour demand'). However, we might have anticipated that these sectors would be at the bottom end of the rankings in the unconstrained case. This is not so and it is instructive to examine why. The most striking reversal of fortunes is in the Non-metallic Mineral Products (ANMMP): previously its demand for high skilled labour rose by 10.9% – the fourth highest positive increase. Now it falls by one percent, the 35 highest. What is it about the sector that causes this?

The main determining factor is the industry's ability to substitute other factors for high skilled labour as the wage rises. Those industries with little ability to substitute skilled and low skilled labour will be forced to fight in the labour market to retain their share of high skills. Otherwise they must accept that their output will decline even though the economy is expanding. So our expectation would be that non-metallic mineral products have a high elasticity of substitution between labour categories.

The elasticities used in the model are derived from Industrial Development Corporation (1997), as reported in Thurlow and van Seventer (2002). There are 14 different elasticity values, ranging from 0.09 to 0.61. It is no surprise that the 0.61 is for non-metallic minerals. However, it is not only elasticities of substitution that will determine this response. 22 activities have elasticities of 0.50; 14 of these increase employment while 8 reduce it. There is an income effect counteracting the elasticities. Expanded output will offset the substitution effect for some activities, but be insufficient to do so for others. Sure enough, when we look at output changes, all of the 22 industries with elasticities of 0.5 that have positive high skilled employment growth for high skilled have higher output growth than do those in which employment falls.

The final step in the puzzle is why these industries are able to expand output sufficiently to offset the impact of higher labour costs for high skilled labour? Clearly this is because of demand feedback. For some industries, the expansionary effect of

the reforms allows them to expand production which allows them to absorb the higher cost of high skilled labour. Whether they can do this depends on a mix of how much demand expands by and how much of that increased demand is satisfied by imports.

What happens to incomes? As expected, the impact of the reforms on factor incomes is very different when there is a skills constraint. The reforms affect capital income through two main channels: expanded demand for capital raises its price, but this is counteracted by the loss of the monopoly rent. The latter is the same in the constrained case as in the unconstrained, but price rise is less. As producers run into the skills constraint the rising demand for capital is choked off. The need for it to be rationed by price increases is lessened, and its price does not rise as much. This means not simply that the constrained case will see a smaller rise in capital income, but that there might actually be a fall, depending on the size of the reforms. This is the case in our configuration – capital income falls by 0.7% compared to the 2.7% rise in the unconstrained case (Table 8).

Income of high-skilled labour increased previously because more was employed. Now it does so because its wage rate rises, by some 10.8%. Since the total employment of high skilled labour is fixed, the high skilled wage bill rises by the same percentage. This is more than in the unconstrained case, where it rose by 4.7%. High skilled labour benefits more from an expanding economy when it is able to appropriate higher wages than when it expands the number of high skilled jobs.

As before, the two other categories of labour benefit from expansion because more jobs are created. However, because of the bottleneck created by the assumed skills shortage, the employment expansion is less than previously, which translates into smaller increases in incomes for each group. The income of unskilled labour as a group rise be 4.1% (compared to 5.5% in the unconstrained case), while that of skilled labour rises by 5.4% (5.9%).

These factor incomes changes affect the changes in incomes of households. The difference between the unconstrained and constrained cases is quite dramatic, but not unexpected. Since the skills constraint means that high skilled labour benefits more from the reforms, skilled and low-skilled less and capital loses out, we would expect households to be affected according to the importance of each of these as sources of income. As seen in Table 10, high skilled labour is the most important source of income households in the eighth decile and above, except for the richest 2.5%, so we expect the reforms now to favour middle- to high-income households. The net effects will depend on the relative importance of other sources. Thus, for example households in eighth decile derive 40.7% of their income from high skills – so will benefit – but 23.4% from capital, and so lose out. We would expect the net effect to be positive but not as high that for the fourth richest group, who obtain 57.8% from the former, but only 14.8% from the latter. The results are summarised in Table 9 and illustrated in Figure 2. The latter showing graphically how the relative benefits are pulled towards the higher income households when skills are constrained. Of course, the benefits to the richest households, who derive most of their income from capital, are much smaller in the constrained case.

6. Conclusions

There are a number of conclusions that we can draw from the above discussion. First, the economy-wide effects of the reforms are significant. In some cases – such as the labour demand effects of efficiency improvements – the general equilibrium effects are strong enough to reverse the expected initial impact effects. Often debates about reforms are conducted within the confines of the reforming sector. For example, opponents of efficiency gains that might necessitate reducing labour demand in a particular industry tend to ignore or minimise the counter-balancing generation of demand that may be induced in other sectors. This study suggests that may be wrong.

Second, purely from the point of view of the static gains, it may be better to undertake the reforms as a package, rather than individually. As we have seen repeatedly, the whole is often greater than the sum of the parts. Often the interactions between reforms are significant. Improved efficiency in an imperfectly competitive industry may simply result in higher monopoly rents. This conclusion does not consider the practicality of undertaking several major reforms simultaneously. Policy makers need to consider whether the task of managing a large number of reforms may lead to them being only partially implemented. Our analysis does not provide an answer to this. Nor does it cast light on the relative merits of different sequences of implementation, should the reforms be undertaken separately.

Thirdly, our study gives some insight into the political economy of reforms. The initial impact of the reforms is felt in the reforming sector. Often this impact is negative for some agent: labour in sectors that enhance productivity, rentiers in sectors that reduce monopoly, producers in sectors that see trade barriers removed. Because these groups are often cohesive entities, they are able to lobby effectively against the reforms. They can speak with one voice. Against this, the gains arise from indirect economy-wide effects, which are generally distributed over a large number of disparate groups. It often is difficult for these groups to speak collectively. Indeed, it may often be difficult for them to see how their interests are affected. Take for example the sectoral labour demand effects given in Table 7. The productivity shock leads to a fall in labour demand of 6.9% in Transport Services and 7.8% in Communications. Overall labour demands rise by around 1.5% (Table 5). Which group is likely to have the loudest voice: the 7% of workers in the two reforming sectors who see the real loss of jobs?, or the unemployed who might potentially be drawn into employment elsewhere in the economy? When these employment effects are coupled with other effects that have large negative impacts on entrepreneurs within the reforming sectors, but smaller but more widely distributed positive impacts on households and other entrepreneurs, we can see the potential for alliances between workers and entrepreneurs against the reforms is much greater than between those in favour.

A fourth conclusion is that skill constraints can affect not only the size of the impact of the reforms but their distribution and composition. It is not simply that everything gets scaled down when there is a bottleneck in the economy, but rather the nature of

the impact changes. In some cases a positive impact may be reversed, depending on the size of the reform and the various parameters in the model.

A fifth conclusion we might draw is that we need to undertake more empirical research. The modelling in this paper has rested on a number of assumptions about empirical matters about which we have little information. First and foremost is the actual size of wedges and efficiency gaps. Sectoral studies are needed to provide more solid numbers to feed into the model. Secondly, we need to have better information about how rents from monopoly and from non-tariff barriers to trade in services are distributed. More generally, we need to up-date model parameters, since we have seen that results are sensitive to underlying elasticities.

Models should be assessed for what they do tell us, rather than for what they don't – areas outside the domain of the model. However, it is sensible to be explicit about what our study does not show. It is based on a static analysis and does not provide information about dynamic impacts. These typically work through changes to capital stock from one year to the next. Although our model shows a rise in real fixed investment, this only has an impact on demand in the economy, not on productive capacity. To develop a dynamic model, we need information about how the increment in fixed investment is allocated to different sectors. Thurlow (2004) has developed a dynamic version of the IFPRI standard model, and applied it to South Africa. The difficulty in using his model for the current study is that we have no information about how changes in monopoly rents affect investment in the sector. This is another area for empirical sectoral work.

Our model also does not address directly another dynamic issue. It is entirely plausible that the reforms we discuss lead to completely new activities developing. For example, reducing the costs of communications can open up information service activities directed at niche markets. For example, in Uganda accounting services are sold internationally to do electronic bookkeeping for small businesses in other countries. Our model captures these only in so far as it does not disaggregate sectors to explain which sub-sectors increase output. Thus expansion of the sector in which the new activity would be classified is consistent with new activities coming into being. However, this assumes that the new activities do not change the production structure – the input structure and the elasticities of substitution – of the overall sector. The model does not allow for new activities that significantly change production processes.

We believe that this analysis has shown that economy-wide effects of price-reducing reforms in infrastructure services are significant enough to merit further research. This research should address some of the empirical foundations upon which the model is based. It might also be fruitful to expand the domain of the model to address the dynamic issues raised. Applying it to similar reforms in other sectors may also be fruitful. Even without this further research, we believe that the analysis shows that policy makers should take seriously the calls for price-reducing reforms and that it is important to examine these in an economy-wide context.

References

Andriamananjara, Soamiely, Michael Ferrantino and Marinos Tsigas (2003) "Alternative Approaches in Estimating the Economic Effects of Non-Tariff Measures: Results from Newly Quantified Measures", *USITC Office of Economics Working Paper No. 2003-12-C*, December

Botes, F J (2005) "Impact of Transport Pricing Practices in South Africa on Freight Transport Costs",Study undertaken for and on behalf of HSRC, December

Chisari, O, Estache, A & Romero, C (1999) "Winners & Losers of the Privatization and Regulation of Utilities, Lessons from a General Equilibrium Model of Argentina", *The World Bank Economic Review*, Vol 13, No 2: 357-78

Edwards, Lawrence and Tijl van de Winkel (2005) *The Market Disciplining Effects of Trade Liberalisation and Regional Import Penetration on Manufacturing in South Africa*, TIPS Working Paper WP1-2005,

Esselar, S (2006) "Difficulties in benchmarking Telecoms Prices", Presentation to HSRC Workshop *The impact of reducing price & improving quality in commercial transport and telecommunications on employment & growth*, February

Francois, J (1998) *Scale Economies and Imperfect Competition in the GTAP Model*, GTAP Technical Paper No. 14

Francois, J, van Meijl, H, & van Tongeren, F (2003) *Trade Liberalization and Developing Countries under the Doha Round*, Tinbergen Institute Discussion Paper, TI 2003-060/2

Hoekman, B (1995) "Assessing the General Agreement on Trade in Services", in Martin, W Winters, LA, eds, *The Uruguay Round and the Developing Countries*, World Bank Discussion Paper No. 307. Washington, D.C.: The World Bank. Revised version published in Martin and Winters (eds.), Cambridge University Press, 1996.

Industrial Development Corporation (1997) .Empirical Estimation of Elasticities in IDC.s General Equilibrium Model., Johannesburg, South Africa.

Konan, DE & Maskus, KE, (2002) *Quantifying the Impact of Services Liberalization in a Developing Country*, unpublished paper.

Lofgren, H, Harris, G & Robinson, S (2001) *A Standard computable general equilibrium (CGE) model in GAMS*, International Food Policy Research Institute, Trade and Macroeconomic Division, Discussion Paper no 75.

OECD (2001) Assessing Barriers to Trade in Services: Revised Consolidated List of Cross Sectoral Barriers, TC/TDWP(99)58/Final

Stern, R (2000) *Quantifying Barriers to Trade in Services*, Research Seminar in International Economics, School of Public Policy, The University of Michigan, Discussion Paper No. 470.

Thurlow, James and Dirk Ernst van Seventer (2002) *A Standard Computable General Equilibrium Model for South Africa*, International Food Policy Research Institute, Trade and Macroeconomic Division, TMD Discussion Paper No. 100. http://www.tips.org.za/research/item.asp?ID=606.

Thurlow, J (2004) *A Dynamic Computable General Equilibrium (CGE) Model for South Africa: Extending the Static IFPRI Model*, TIPS, IFPRI, IRD, UND working paper, http://www.tips.org.za/research/item.asp?ID=707.

Van Seventer, DEN, Goode, R, Steyn, G & Gillwald, A (2005) *Determining an Appropriate Methodology for an Economy-Wide Study of the Impact of Restructuring and Privatization on the South African Economy*, TIPS Working Paper, WP6-2005.

Tables

Table 1 – Estimates used in services reform scenarios

	Non-tariff measures Mode 1	Imperfect competition Mode 3	Total price wedge	Inefficiencies Mode 3
	1	2	3 (=1+2)	4
Communication	20%	15%	35%	10%
Transport	15%	30%	45%	10%

Table 2 – Description of simulations

	Name	Description
1	FULL	(2) and (3) simultaneously
2	FULLTRPT	(5), (8) and (11) simultaneously
3	FULLCOMM	(6), (9) and (12) simultaneously
4	MONO	(5) and (6) simultaneously
5	MONOTRPT	Removal of 30% markup on Transport Services
6	MONOCOMM	Removal of 15% markup on Communication Services
7	NTM	(8) and (9) simultaneously
8	NTMTRPT	Removal of 15% tariff equivalent from Transport Service imports
9	NTMCOMM	Removal of 20% tariff equivalent from Communication imports
10	PROD	(11) and (12) simultaneously
11	PRODTRPT	10% productivity shock to Transport activity
12	PRODCOMM	10% productivity shock to Communication activity
13	SHTGE	(1) with inelastic supply of High Skilled Labour

Table 3 – Expected direct impacts of reforms

	Removing Imperfect Competition	Removing Trade Barriers	Improving Efficiency
Price	-	-	-
Domestic Output	+	-	+
Labour Demand	+	-	-
Domestic Demand[a]	+	+	+
Sales of Domestic Output	+	-	0
Imports	-	+	-
Exports	-	0	+

- = reduces; + = raises; 0 = insignificant effect *[a] Demand effects are likely to be small as they arise only from substitution effect*

Table 4– Expenditure on real GDP (% change)

	FULL	FULL TRPT	FULL COMM	MONO	MONO TRPT	MONO COMM	NTM	NTM TRPT	NTM COMM	PROD	PROD TRPT	PROD COMM	SHTGE
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
ABSORP	3.9	2.7	1.2	2.4	1.8	0.5	0.1	0.1	0.1	1.5	0.8	0.7	2.5
PRVCON	5.6	3.8	1.8	3.6	2.7	0.8	0.2	0.1	0.1	1.8	1.0	0.9	4.4
FIXINV	2.6	2.0	0.5	0.7	0.8	-0.2	-0.2	-0.1	-0.1	2.0	1.4	0.7	-1.7
DSTOCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GOVCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXPORTS	3.3	2.3	1.0	0.1	-0.2	0.2	1.5	1.3	0.2	1.2	0.7	0.6	1.9
IMPORTS	3.5	2.4	1.1	0.1	-0.2	0.3	1.6	1.4	0.2	1.3	0.7	0.6	2.1
GDPMP	3.9	2.6	1.2	2.3	1.8	0.5	0.1	0.1	0.1	1.5	0.8	0.7	2.5
NETITAX	4.9	3.6	1.2	3.7	3.2	0.5	0.3	0.2	0.1	1.9	1.2	0.7	3.4
GDPFC2	3.7	2.5	1.2	2.1	1.6	0.5	0.1	0.0	0.0	1.4	0.8	0.7	2.4

Source: Authors' simulations

Table 5 – Changes in factor demands (%)

	FULL	FULL TRPT	FULL COMM	MONO	MONO TRPT	MONO COMM	NTM	NTM TRPT	NTM COMM	PROD	PROD TRPT	PROD COMM	SHTGE
CAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LABLS	5.9	4.2	1.7	3.5	2.7	0.7	0.5	0.4	0.1	1.5	0.7	0.7	4.3
LABSK	6.0	4.1	2.0	3.9	2.9	0.9	0.3	0.1	0.1	1.5	0.7	0.8	5.5
LABHI	4.3	2.9	1.4	2.7	2.0	0.7	0.2	0.1	0.1	1.2	0.6	0.6	0.0

Source: Authors' simulations

Table 6 – Structure of inputs of sectors

	Share in gross output (%)					% change in price of intermediate aggregate of all three price-reducing measures
	Value added	Intermediates				
		Total	Trans	Comm	Sum	
	[1]	[2]	[3]	[4]	[5]	[6]
ACOMM	41.6	58.4	5.3	29.1	34.3	-12.1
AOTHM	52.4	47.6	23.1	0.3	23.4	-12.7
ACOAL	50.5	49.5	19.5	0.2	19.7	-10.0
ATRAD	51.9	48.1	4.4	7.0	11.4	-3.1
ABUSS	50.6	49.4	2.6	5.5	8.1	-1.0
AAGRI	52.0	48.0	6.7	0.0	6.7	-1.6
AOTHP	59.8	40.2	1.4	3.7	5.2	-0.2
ANMMP	32.8	67.2	7.7	0.3	8.1	-1.5
ABCHM	22.0	78.0	8.5	0.7	9.2	-1.0
AMAOS	40.5	59.5	1.8	4.1	5.9	0.4
AIRON	18.8	81.2	7.7	0.3	8.0	-0.9
APETR	24.0	76.0	6.4	0.1	6.5	-0.3
AVERAGE	34.8	65.2	2.6	1.6	4.3	--
AGOVS	63.5	36.5	1.5	1.6	3.1	-0.3
ATRAN	39.9	60.1	1.0	2.7	3.7	2.4
AFINS	60.3	39.7	0.5	1.0	1.5	4.4
AWATR	34.1	65.9	1.7	0.8	2.4	4.1
AGLAS	34.0	66.0	1.5	0.9	2.4	1.7
AELEG	53.6	46.4	1.1	0.5	1.6	1.9
AHCAT	37.6	62.4	0.2	1.3	1.6	3.5
ACONS	23.8	76.2	0.5	1.2	1.7	2.1
AMACH	23.8	76.2	0.9	0.8	1.6	1.9
AFOOD	19.1	80.9	1.4	0.3	1.7	2.4
ARUBB	25.0	75.0	0.8	0.6	1.4	2.4
ACOME	30.1	69.9	0.7	0.4	1.1	1.6
AGOLD	63.2	36.8	0.4	0.2	0.6	2.1

ASCIE	29.3	70.7	0.4	0.6	1.0	1.8
ATEXT	20.2	79.8	0.6	0.5	1.1	2.2
ATRNE	28.9	71.1	0.5	0.4	0.9	1.6
APAPR	24.1	75.9	0.6	0.4	1.0	2.3
APRNT	37.0	63.0	0.4	0.3	0.8	1.8
AAPPA	28.4	71.6	0.4	0.4	0.8	1.9
AMETP	26.8	73.2	0.4	0.5	0.8	2.6
AELMA	23.9	76.1	0.5	0.3	0.8	2.2
AOCHM	21.3	78.7	0.4	0.3	0.8	1.9
AFURN	24.0	76.0	0.3	0.4	0.7	2.5
AOTHI	43.0	57.0	0.2	0.2	0.5	2.3
ALEAT	14.9	85.1	0.3	0.3	0.7	2.5
ABEVT	33.8	66.2	0.2	0.3	0.5	3.0
ANFRM	30.9	69.1	0.3	0.2	0.5	3.5
AWOOD	30.7	69.3	0.3	0.2	0.5	2.9
APLAS	31.9	68.1	0.2	0.2	0.4	1.9
AFOOT	24.4	75.6	0.2	0.2	0.4	1.8
AVEHI	15.8	84.2	0.0	0.0	0.1	1.7

Source: SASAM 2003; model estimation Note: Column [5] = sum of transport and communications

Table 7 – Changes in sectoral labour demands (%)

	FULL	FULL TRPT	FULL COMM	MONO	MONO TRPT	MONO COMM	NTM	NTM TRPT	NTM COMM	PROD	PROD TRPT	PROD COMM
APETR	23.7	19.0	3.5	13.7	11.8	1.4	0.2	-0.1	0.2	7.5	5.7	1.7
ATRAN	**13.4**	**10.6**	**2.5**	**25.6**	**24.2**	**1.1**	**-3.2**	**-3.4**	**0.2**	**-6.9**	**-7.9**	**1.1**
ABCHM	12.9	10.6	1.9	6.9	6.0	0.8	2.5	2.2	0.3	1.4	0.8	0.7
ANMMP	10.9	8.6	2.0	5.2	4.7	0.4	0.4	0.4	0.1	4.4	3.0	1.4
ABUSS	10.4	6.6	3.4	5.7	4.2	1.3	0.2	0.0	0.2	3.7	2.0	1.6
AWATR	9.8	6.8	2.7	5.9	4.6	1.2	0.2	0.0	0.1	3.1	1.8	1.3
ASCIE	9.4	6.0	3.2	4.5	3.2	1.2	2.0	1.6	0.3	1.6	0.3	1.3
ACOMM	**9.3**	**6.7**	**2.4**	**18.8**	**4.4**	**13.6**	**0.2**	**0.4**	**-0.2**	**-7.8**	**1.5**	**-9.2**
ARUBB	9.3	7.1	2.0	5.4	4.5	0.8	0.6	0.4	0.2	2.6	1.8	0.8
AAPPA	9.2	5.9	3.2	5.3	3.8	1.4	1.2	0.9	0.2	1.9	0.6	1.3
ACOME	9.1	4.1	4.7	4.0	2.1	1.8	0.9	0.8	0.1	3.5	0.7	2.8
AOTHI	8.3	5.8	2.2	4.6	3.6	0.9	1.0	0.8	0.2	1.7	0.8	0.9
AMAOS	8.2	4.8	3.1	4.8	3.3	1.4	0.3	0.1	0.2	2.2	0.9	1.4
AFURN	8.0	5.2	2.5	4.3	3.1	1.1	1.1	0.9	0.2	1.6	0.5	1.1
ATRNE	7.6	5.2	2.1	3.9	2.9	0.9	1.4	1.1	0.3	1.2	0.5	0.8
APAPR	7.5	4.7	2.7	3.8	2.6	1.1	1.3	1.1	0.3	1.5	0.3	1.1
ATRAD	7.4	4.8	2.4	4.0	2.9	1.0	0.6	0.4	0.1	2.2	1.0	1.2
AOCHM	6.6	4.3	2.2	3.7	2.7	0.9	0.8	0.7	0.2	1.3	0.4	0.9
AOTHP	6.6	4.1	2.3	3.8	2.8	0.9	0.1	0.0	0.1	2.1	1.1	1.1
AELEG	6.5	4.4	2.0	3.8	2.9	0.9	0.2	0.1	0.1	2.3	1.2	1.1

AFINS	6.5	4.6	1.8	3.7	2.9	0.7	0.3	0.2	0.1	2.1	1.3	0.9
AAGRI	6.3	4.8	1.3	3.5	2.8	0.6	1.1	0.9	0.2	0.9	0.4	0.5
ALEAT	6.1	3.5	2.4	2.6	1.5	1.0	2.3	1.9	0.4	0.0	-0.8	0.8
AOTHM	5.5	5.0	0.4	3.0	2.8	0.2	0.8	0.7	0.1	0.8	0.6	0.1
ACOAL	5.4	4.8	0.5	3.0	2.7	0.2	0.8	0.7	0.1	0.8	0.6	0.2
AGLAS	5.3	3.3	1.9	2.7	1.8	0.8	1.0	0.8	0.2	0.9	0.2	0.8
APRNT	5.2	2.5	2.6	2.7	1.6	1.1	0.5	0.3	0.1	1.7	0.4	1.3
ACONS	5.0	3.8	1.0	1.7	1.7	-0.1	-0.3	-0.2	-0.1	3.4	2.3	1.1
AELMA	4.8	3.2	1.5	2.1	1.6	0.4	0.4	0.3	0.1	2.0	1.1	0.9
AVEHI	4.7	3.4	1.1	2.5	1.9	0.5	0.9	0.7	0.1	0.7	0.3	0.4
AFOOT	4.6	1.4	3.1	2.2	0.8	1.3	0.9	0.7	0.2	0.9	-0.4	1.4
AMETP	4.6	3.0	1.6	2.1	1.5	0.6	0.8	0.6	0.1	1.2	0.4	0.8
APLAS	4.6	3.0	1.4	2.3	1.7	0.6	0.7	0.6	0.1	1.0	0.3	0.6
AHCAT	4.2	2.5	1.6	2.3	1.5	0.7	0.6	0.5	0.1	0.8	0.2	0.6
AIRON	3.9	3.3	0.5	2.1	1.9	0.2	0.6	0.6	0.1	0.5	0.3	0.2
ATEXT	3.9	2.3	1.4	2.0	1.3	0.6	0.7	0.6	0.1	0.6	0.0	0.6
AWOOD	3.9	2.7	1.1	1.9	1.4	0.4	0.7	0.6	0.1	0.7	0.3	0.5
ABEVT	3.8	2.6	1.1	2.2	1.7	0.5	0.4	0.3	0.1	0.7	0.3	0.4
AFOOD	3.6	2.6	0.9	2.2	1.7	0.4	0.3	0.2	0.1	0.7	0.4	0.4
AMACH	3.5	2.2	1.1	1.5	1.1	0.4	0.7	0.6	0.1	0.7	0.2	0.5
ANFRM	0.7	0.4	0.3	0.3	0.2	0.1	0.3	0.2	0.0	0.0	-0.1	0.1
AGOLD	0.5	0.3	0.3	0.2	0.1	0.1	0.3	0.2	0.0	0.0	-0.1	0.1
AGOVS	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' simulations

Table 8 – Changes in factor incomes (%)

	FULL	FULL TRPT	FULL COMM	MONO	MONO TRPT	MONO COMM	NTM	NTM TRPT	NTM COMM	PROD	PROD TRPT	PROD COMM	SHTGE
CAP	2.7	1.8	0.9	0.4	0.4	- 0.1	0.0	0.1	0.0	2.2	1.3	0.9	-0.7
LABLS	5.5	4.0	1.4	3.8	3.0	0.7	0.4	0.3	0.1	0.8	0.3	0.5	4.1
LABSK	5.9	4.2	1.7	5.0	3.8	1.2	0.0	-0.1	0.1	0.3	0.0	0.3	5.4
LABHI	4.7	3.3	1.5	3.4	2.5	0.8	0.2	0.1	0.1	0.9	0.4	0.5	10.8

Table 9 – Changes in institutional income (%)

	FULL	FULL TRPT	FULL COMM	MONO	MONO TRPT	MONO COMM	NTM	NTM TRPT	NTM COMM	PROD	PROD TRPT	PROD COMM	SHT GE
ENTRP	2.5	1.7	0.8	0.4	0.4	-0.1	0.0	0.0	0.0	2.1	1.3	0.8	-0.8
HHD0	3.5	2.5	1.0	2.5	2.0	0.5	0.1	0.1	0.1	0.7	0.3	0.4	3.0
HHD1	2.8	2.0	0.8	1.9	1.5	0.4	0.1	0.1	0.0	0.5	0.3	0.3	2.1
HHD2	3.8	2.7	1.1	2.7	2.1	0.6	0.1	0.1	0.1	0.7	0.3	0.4	3.1
HHD3	3.5	2.5	1.0	2.3	1.8	0.5	0.1	0.1	0.0	0.8	0.4	0.4	2.6
HHD4	4.4	3.1	1.3	3.0	2.4	0.6	0.1	0.1	0.1	0.9	0.5	0.5	3.7
HHD5	4.5	3.2	1.3	3.1	2.4	0.7	0.1	0.1	0.1	1.0	0.5	0.5	4.2
HHD6	4.7	3.3	1.4	3.2	2.5	0.7	0.1	0.1	0.1	1.1	0.6	0.6	4.6
HHD7	4.8	3.4	1.4	3.2	2.5	0.7	0.1	0.1	0.1	1.2	0.6	0.6	4.9
HHD8	4.8	3.4	1.4	3.3	2.5	0.7	0.1	0.1	0.1	1.1	0.6	0.6	6.0
HHD91	4.8	3.3	1.4	3.2	2.5	0.7	0.1	0.1	0.1	1.2	0.6	0.6	6.4
HHD921	4.9	3.4	1.5	3.4	2.6	0.8	0.1	0.1	0.1	1.0	0.5	0.5	7.5
HHD922	4.6	3.2	1.4	2.9	2.2	0.6	0.1	0.1	0.1	1.4	0.7	0.6	6.1
HHD923	4.5	3.2	1.4	2.7	2.1	0.6	0.1	0.1	0.1	1.5	0.8	0.7	5.3
HHD924	4.1	2.8	1.3	1.6	1.3	0.2	0.1	0.0	0.0	2.3	1.4	0.9	1.0

Table 10 – Sources of household incomes (%)

	HHD0	HHD1	HHD2	HHD3	HHD4	HHD5	HHD6	HHD7	HHD8	HHD 91	HHD 921	HHD 922	HHD 923	HHD 924
Capital	11.5	10.6	12.8	17.4	20.4	21.8	24.8	27.7	23.4	23.9	14.8	31.5	39.2	81.4
Low Skill	26.0	22.8	25.4	23.8	22.3	19.8	16.6	12.6	7.2	5.1	5.4	3.7	3.7	1.3
Skill	23.3	17.0	27.5	22.1	31.7	30.4	29.9	28.9	27.1	22.0	21.7	14.5	12.9	3.4
High Skill	7.7	3.9	6.8	5.4	11.5	18.1	23.7	28.1	40.7	48.3	57.8	49.8	43.9	13.8
Primary	68.5	54.3	72.5	68.7	86.0	90.2	95.0	97.3	98.4	99.3	99.7	99.5	99.7	100.0
Govt Trfrs	31.4	45.5	27.3	31.1	13.8	9.7	5.0	2.6	1.6	0.7	0.3	0.5	0.4	0.1
For. Trfrs	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 11 – Sectoral labour demands with skill shortages

	FULL		SHTGE					
			LABHI		LABSK/LS		TOTAL	
	%	Rank	%	Rank	%	Rank	%	Rank
APETR	23.7	1	15.2	1	20.4	1	19.2	1
ATRAN	13.4	2	6.4	2	11.9	2	11.4	2
ABCHM	12.9	3	4.8	3	10.2	3	9.5	3
ANMMP	10.9	4	-1.0	35	5.2	19	4.8	14
ABUSS	10.4	5	3.2	7	8.5	5	7.4	4
AWATR	9.8	6	3.5	4	8.8	4	7.4	5
ASCIE	9.4	7	0.1	26	5.3	18	4.3	22
ACOMM	9.3	8	2.2	12	7.5	8	6.8	8
ARUBB	9.3	9	2.9	9	7.6	7	7.1	7
AAPPA	9.2	10	2.3	10	7.6	6	7.4	6
ACOME	9.1	11	0.2	24	5.4	17	4.4	19
AOTHI	8.3	12	1.3	17	6.6	11	6.1	9
AMAOS	8.2	13	1.8	15	7.0	10	4.5	18
AFURN	8.0	14	3.2	5	5.4	15	5.3	13
ATRNE	7.6	15	0.1	25	2.5	38	2.0	37
APAPR	7.5	16	-1.2	36	4.9	20	4.4	20
ATRAD	7.4	17	1.2	18	6.4	12	5.7	11
AOCHM	6.6	18	0.3	23	5.4	16	4.5	17
AOTHP	6.6	19	0.4	22	5.6	13	5.5	12
AELEG	6.5	20	2.1	13	7.4	9	5.9	10
AFINS	6.5	21	-0.8	34	4.3	24	2.9	26
AAGRI	6.3	22	-0.3	30	4.9	21	4.7	15
ALEAT	6.1	23	-1.7	40	3.4	26	3.2	24
TOTAL	5.9	24	0.0	28	5.5	14	4.1	23
AOTHM	5.5	25	3.2	6	4.8	22	4.7	16
ACOAL	5.4	26	2.9	8	4.5	23	4.4	21
AGLAS	5.3	27	-0.7	32	2.8	32	2.6	30
APRNT	5.2	28	-0.2	29	3.3	27	2.7	29
ACONS	5.0	29	-4.8	44	0.1	44	-0.2	44
AELMA	4.8	30	-2.6	43	2.5	37	1.6	39
AVEHI	4.7	31	0.7	19	2.6	34	2.3	35
AFOOT	4.6	32	-0.4	31	2.6	35	2.5	32
AMETP	4.6	33	-2.5	42	2.5	36	2.1	36
APLAS	4.6	34	-1.6	39	2.9	30	2.5	33
AHCAT	4.2	35	-1.9	41	3.2	29	2.7	28
AIRON	3.9	36	2.3	11	3.2	28	3.1	25
ATEXT	3.9	37	1.4	16	2.4	39	2.4	34
AWOOD	3.9	38	0.5	21	1.9	40	1.9	38

ABEVT	3.8	39	0.5	20	2.9	31	2.6	31
AFOOD	3.6	40	1.8	14	2.8	33	2.7	27
AMACH	3.5	41	0.0	27	1.1	41	0.9	41
ANFRM	0.7	42	-0.7	33	0.2	43	0.1	43
AGOLD	0.5	43	-1.3	37	0.2	42	0.2	42
AGOVS	0.1	44	-1.5	38	3.6	25	1.4	40

Figures

Figure 1 – Changes in households

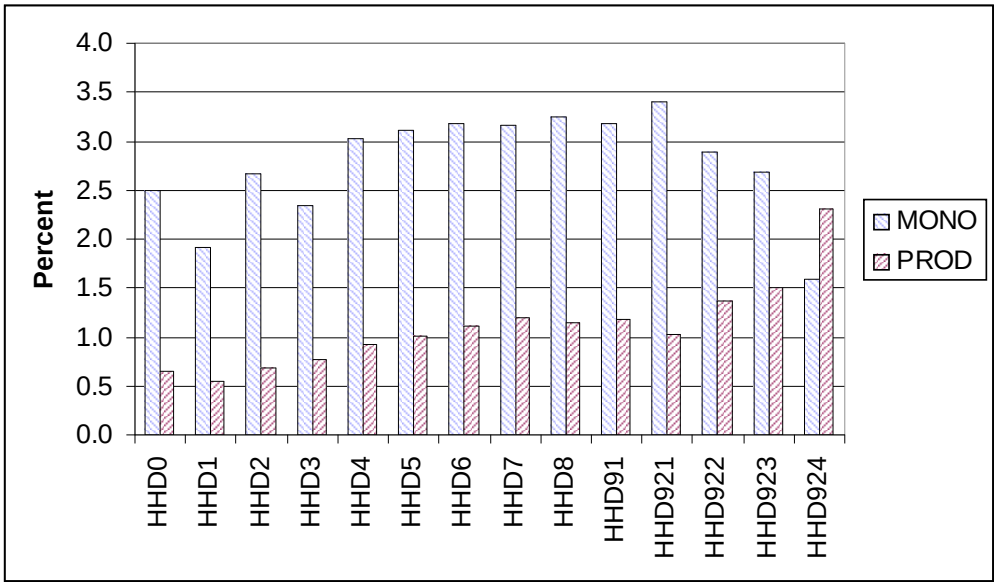
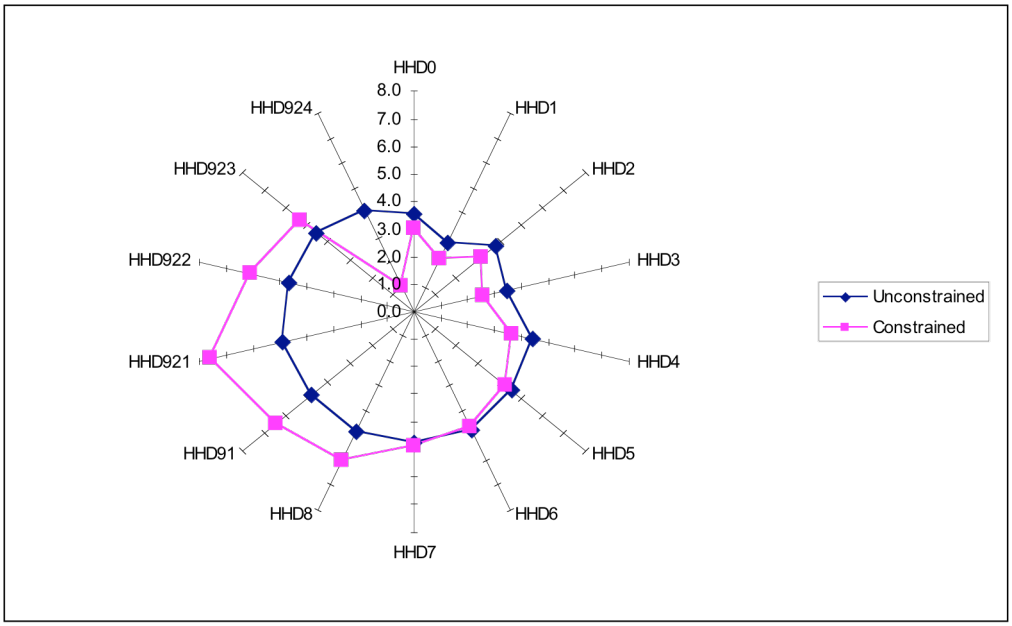
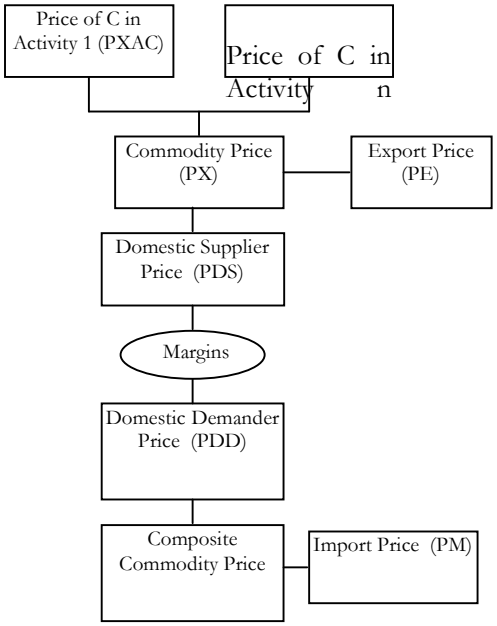


Figure 2 – Relative changes in household incomes

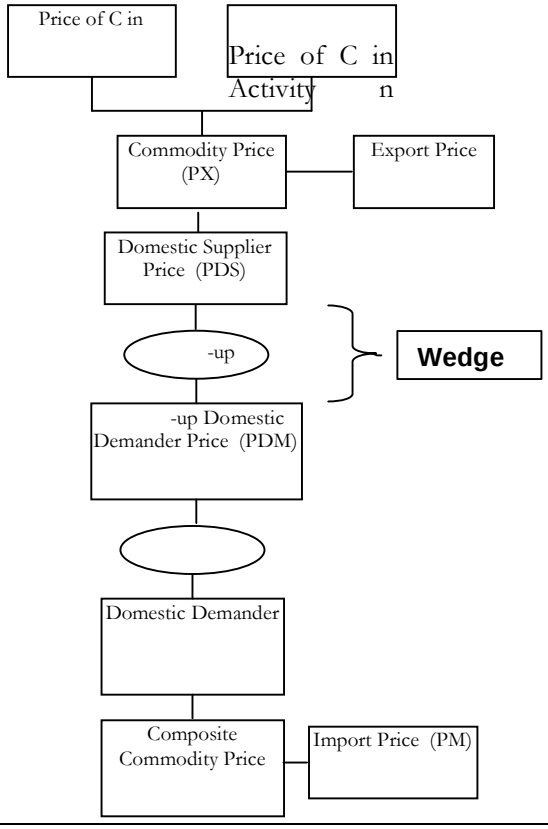


APPENDIX 1. Prices with mark-up

Figure 4: Price relationships without mark-up



3: Price relationships with mark-



The relationships between the various prices in the standard model are described in detail in Thurlow and van Seventer (2002, page 16). Figure 4 shows these relationships, while Figure 3 shows how the mark-up arising from imperfect competition changes them. We can see that the mark-up drives a wedge between the price suppliers receive and the price the demanders pay for sales in the domestic market.

It perhaps helps understanding the processes involved to explain how the various price ratios affect the performance of the economy. The price of the commodity produced in different sectors (PXAC) is essentially a cost driven price. In the case of

our two sectors, transport and communications, the commodity outputs are produced solely by one sector, so this part of the pricing relationships does not apply. However, the removal of the communications mark-up could affect different sectors differently, so that for those commodities, the sources of supply of the disaggregated commodity could change.

The various disaggregated commodities are aggregated (using an Armington type function to capture imperfect substitutability) to give a price PX of the domestically marketed aggregate. One might think of this as a hypothetical warehouse that buys up all outputs of a particular good (produced by different sectors) and figures out an average price based on costs.

This warehouse then allocates the total output between domestic sales and exports, basing its decision on the relative prices it can receive in these two sources[11]. The allocation thus depends on the relative prices received for domestic and export sales, PDS and PE.

Following Francois (1998), we can introduce imperfect competition as a mark-up on the price received for domestic sales, PDS. This interposes a wedge between PDS and PDD, the demander price, on top of any trade and transport margins that are there (Figure 3).

[11] There is a slight inconsistency here. The various forms of a commodity produced in different sectors are seen as close but not perfect substitutes. However, the composite domestic output into which they are aggregated is treated as a homogeneous good. Thus domestic and foreign demanders do not distinguish between different forms based on their source. This may well not be the case. As an example, take jam, which may be produced predominantly in the food sector ('plastic jam'), but may also be supplied from the agricultural sector ('farm jam'). The jam warehouse buys up all jam from both sources, and determines a price of the composite 'jam'. This jam is supplied to the export and domestic markets. But in reality it may well be that the entire output of 'farm jam' is exported – it is a high quality niche market product. A higher export price can only lead to higher production of farm jam, not plastic jam. These could be captured by setting relevant elasticities appropriately.

APPENDIX 2. Price wedges and efficiency gaps

Construct an "index of overpricing" (*IoP*) to measure the difference between the actual price, P_a, and a hypothetical lowest possible benchmark price, P_b.

$$IoP = \frac{P_a - P_b}{P_b} \tag{B. 1}$$

If there are constant returns to scale then marginal will equal average costs. Using the competitive market as our benchmark, we can write the price wedge as

$$PW = \frac{P_a - AC_b}{AC_b} \tag{B. 2}$$

(B. 2) shows the percentage by which the actual domestic price exceeds the best relevant practice competitive price. It can be decomposed into two parts

$$PW = \frac{P_a - AC_a}{AC_a} \cdot \frac{AC_a}{AC_b} + \frac{AC_a - AC_b}{AC_b} \tag{B. 3}$$

The first term on the right hand side of (B.3) shows that part of the price wedge that arises because of domestic factors such as imperfect competition, trade barriers, etc – the price wedge. It is scaled by the ratio of actual to best practice costs to make it commensurate with the second term. The latter shows the divergence arising from use of inefficient technologies and practices – the efficiency gap.

Where there is imperfect competition, the actual price (P_a) will be higher than the marginal cost of producing. Typically market power is measured by the degree to which the price is greater than the competitive price (P_c):

$$P_a = (1+m)P_c \tag{B. 4}$$

The competitive price will be equal to the marginal cost (*MC*): competition will drive the price down until costs (including normal profits) are being covered.

$$P_a = (1+m)MC \tag{B. 5}$$

In the case of a monopoly, standard microeconomic theory shows how market power for a monopolist is related to the elasticity of demand:

$$\frac{P_a - P_c}{P_c} = (1+m) = \frac{1}{\varepsilon} \qquad \text{(B. 6)}$$

where ε is the elasticity of demand and P_c is the competitive price, which will equal marginal cost (*MC*). For imperfect competition, the profit maximising mark-up depends on the number of dominant firms in the industry as well as the market elasticity of demand (Francois, 1998: 5):

$$\frac{(P_a - P_c)}{P_c} = \frac{1}{n}\frac{1}{\varepsilon} \qquad \text{(B. 7)}$$

In which n is the number of market contestants. Francois (1998) has used this in CGE modelling to specify the number of firms in an industry and allow the mark-up to be derived endogenously in a way that is consistent with the exogenous elasticity of demand. In our application we have found it more convenient to specify the mark-up exogenously. We can use (B. 7) to determine the number of firms this implies, but this parameter plays no role in our model.

Non-tariff barriers to trade in services can be formally modelled by introducing a wedge between the domestic price of a service and its world price according to the following expression

$$P_d = (1 + t_{NTB})P_w \qquad \text{(B. 8)}$$

in which P_d is the domestic price of a service, P_w the world price and t_{NTB} an ad valorem equivalent of a tariff on these services.

Inefficiencies can be modelled using a traditional production function set up with the quantity of output a function of the inputs of capital stock and labour and a factor representing Hicks–neutral technical progress:

$$Q = \alpha F(K, L) \qquad \text{(B. 9)}$$

in which Q is output, K is capital stock, L is labour inputs and α the technology factor that shifts the whole function in a uniform way. We model efficiency gains as an increase in α: the 10% for each sector in the fourth column of Table 1 is a 10% increase in α. This is equivalent to increasing the rate of total factor productivity growth. This impacts initially on output, rather than prices as is assumed in equation (B. 9). However, since we assume constant returns to scale in the production set-up, there is a direct translation from one to the other.

APPENDIX 3. Modifications to the standard model

The full model specification is given in Thurlow and van Seventer (2003). Below we specify simply those equations that have been altered. We also give the GAMS coding for the altered equations. Equation numbers refer to those in Lofgren *et a*l (1999)

Domestic import price

Original

[1] $$PM_c = pwm_c \cdot \left(1 + tm_c \right) \cdot EXR + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c}$$

Modified to incorporate ad valorem equivalent of non-tariff measure:

[1] $$PM_c = pwm_c \cdot \left(1 + ntm_c + tm_c \right) \cdot EXR + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c}$$

Demand price for commodities produced and sold domestically

Original

[2] $$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c}$$

Modified to replace domestic supplier price with marked-up price

[2] $$PDD_c = PDM_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c}$$

Mark-up applied (added equation)

[2a] $$PDM_c = MKP_c \cdot PDS_c$$

CES value-added production function

Original

[15] $$QVA_a = \alpha_a^{va} \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}}$$

Modified to incorporate exogenous TFP shock

$$[15] \qquad QVA_a = \alpha_a^{va} \cdot (1 + prodadj_a) \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}}$$

(Note: this does not affect the first order conditions)

Total incomes of domestic institutions

Original

$$[30] \qquad YI_i = \sum_{f \in F} YIF_{i\,f} + \sum_{i' \in INSDNG'} TRII_{i\,i'} + trnsfr_{i\,gov} \cdot \overline{CPI} + trnsfr_{i\,row} \cdot EXR$$

Modified to incorporate rents from mark-ups and non-tariff measures:

$$\begin{aligned} [30] \qquad YI_i = & \sum_{f \in F} YIF_{i\,f} + \sum_{i' \in INSDNG'} TRII_{i\,i'} + trnsfr_{i\,gov} \cdot \overline{CPI} + trnsfr_{i\,row} \cdot EXR \\ & + \sum_{c \in C} mkpshr_{INSDNG} \cdot (PDM_c - PDS_c) \cdot QD_c \\ & + \sum_{c \in C} ntmshr_{INSDNG} \cdot ntm_c \cdot PWM_c \cdot EXR \cdot QM_c \end{aligned}$$

Savings-investment balance

Modified to incorporate a SINK when rents are not redistributed.

$$\begin{aligned} [45] \qquad & \sum_{i \in INSDNG} MPS_i \cdot (1 - \overline{tins_i}) \cdot YI_i + GSAV + EXR \cdot FSAV \\ & = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c + SINK \end{aligned}$$

Note: this is not necessary but is done so that the WALRAS slack variable is still zero when the model solves and the consistency check still applies

Rent Accounts (added)

$$[49] \qquad SINKMKP_i = \sum_{c \in C} \left(1 - \sum_{i \in INSDNG} mkpshr_i \right) \cdot (PDM_c - PDS_c) \cdot QD_c$$

$$[50] \qquad SINKNTM_i = \sum_{c \in C} \left(1 - \sum_{i \in INSDNG} ntmshr_i \right) \cdot ntm_c \cdot PWM_c \cdot EXR \cdot QD_c$$

[51] $SINK = SINKMKP + SINKNTM$

Allocation of rents to institutions

In the typical monopoly set-up, we set $mkpshr_i = 1$ for ENTRP and 0 for all other domestic non-government institutions. This means that total monopoly rent, $\sum_{c \in C} \left(PDM_c - PDS_c \right) \cdot QD_c$, is initially assigned to enterprise. The standard IFPRI model has enterprise receiving all capital income and distributing it to households according to fixed shares derived from the base data:

[31] $TRII_{i\,i'} = shii_{i\,i'} \cdot (1 - MPS_{i'}) \cdot (1 - \overline{tins}_{i'}) \cdot YI_{i'}$

This means that in our set-up households participate in the monopoly rent according to their initial shares in capital income.

As is evident from equation [31], in this set-up enterprise savings and taxes are deducted from the monopoly rent before it is allocated to households. While this reduces the demand impact, it seems a reasonable assumption. Monopoly rents appear in the data under gross operating surpluses (except insofar as workers capture part).

In some experiments we can set $mkpshr_i = 0$, so that the rent is not recycled as income. This would be the case if for example it were a foreign monopoly.

Allocation of revenue from non-tariff measure

In our typical experiment, the income from non-tariff measures is allocated in the same way as the mark-up rent, i.e. $ntmshr_i = 1$ for ENTRP and 0 for all other domestic non-government institutions.