


Evidence-based Employment Scenarios

Appropriate Analytical Tools for Economy-wide Analysis of Employment Creating Policies in South Africa

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APPROPRIATE ANALYTICAL TOOLS FOR ECONOMY-WIDE ANALYSIS OF EMPLOYMENT CREATING POLICIES IN SOUTH AFRICA

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Introduction

This concept paper explores the usefulness of appropriate analytical tools to undertake economy-wide analysis for employment creating policies in South Africa. The compilation is neither complete nor exhaustive. We start with some background to the HSRC's concerns about the lack of employment creating policies in South Africa, as this forms the context of our overview. We then pay some attention to the crucial importance of quantitative analysis and economy-wide consistency, followed by an appropriate database and modelling framework to undertake such analysis. We review databases and analytical frameworks that have been used in the past in South Africa. A number of other modelling frameworks of potential interest to the HSRC are also reviewed in Section 6. We then turn to what could be considered as ideal modelling framework for the HSRC. Finally, given limited resources we make recommendation as to a workable set of modelling frameworks and some notes about the need for capacity building.

1. Background

Many economic observers have highlighted the employment crisis in South Africa. Unemployment has deepened over many years in South Africa, to the point of reaching crisis proportions. In the past decade just under a million formal jobs were lost. To make matters worse, the labour market expands by about 500,000 each year. Broadly defined unemployment has risen to just over 36%. The social impact of unemployment is particularly severe in the context of a fragile safety net for the poor, with a small informal sector, weak asset base and very limited social welfare net.

The build up of unemployment in SA over the past decades can most accurately be attributed to the demise of jobs in traditional resource based industries in agriculture and mining, without a concomitant employment take-up in more advanced industrial sectors, as would be expected in a process of structural change and development.

The demise of employment in major primary resource based industries can be explained by commodity price trends, technical conditions (in mining) and domestic market deregulation and fear of potential land tenure claims and labour rights (in agriculture). The slow pace of land reform and protectionist stance of the US and the EU further limit the expansion of new agricultural activity.

SA bypassed the phase of development where large numbers of workers are absorbed into low cost, low skill labour intensive tradables. The ideal period for this phase arises where there is a labour surplus in a context of low economy-wide cost structures. The low cost structures are often maintained by an agriculture sector that supports large numbers of under-employed workers. Furthermore, exports of low skill labour intensive tradables have been discourages over many decades as a result of a combination of factors including political isolation as well as a relatively overvalued exchange rate. The latter typically follows from South Africa being a resource-based economy. Exports of gold and other minerals kept the exchange rate at relatively high levels, thereby encouraging imports of consumer goods

While labour intensive industries such as, for example, clothing have been promoted in South Africa since the 1920s, this was done within a context that severely limited its growth: a closed economy with constrained domestic demand. So, between 1972 and 1990, the capital stock in the clothing sector fell by 19%. Similarly, there was only marginal investment in the four most labour intensive industries over this 18-year period (Kaplinsky 1995). Between 1984 and 1990, investment was so low that it did not even cover depreciation, so that the manufacturing capital stock actually diminished.

Of course, unemployment is caused considerably by the legacy of Apartheid. Other minerals economies such as Australia and Canada, are wealthy because they invested their 'resource rents' in human and physical capital accumulation over many years. In contrast, the SA government wore down its human and physical capital. Minerals

wealth would have enabled the maintenance of a minority's lifestyle and continuation of the political system for longer than would have otherwise been possible.

Now the SA economy is fairly diverse, but not particularly labour absorbing. Given the specific characteristics of the SA economy, a more aggressive approach to the stimulation of more labour absorbing non-traded sectors may be required, if only over a period of 10 years. However, any noticeable stimulatory package could have negative macroeconomic implications, a problem often glossed over by Keynesian proposals.

If government implements identified use of policy instruments, what would be the potential consequences for inflation, the balance of payments and for public borrowing? What are the degrees of flexibility in macroeconomic policy should targets not be reached? This would require an explicit prioritisation of each of the major policy variables which may have implications for sector accords, particularly where government plans to intervene in specific markets such as food or construction.

Employment is popularly seen as a labour market problem, when in fact, there is a macro-economic angle to it as well. What does this mean in practical terms? The solutions in South Africa will reside in a range of microeconomic policy interventions. There is no magic button or lever that can be switched. Interventions may be related to both the lifting of supply constraints and demand stimulation. Government intervention on the demand side is possibly more important in SA than in other economies due to the geographical location, the small domestic market and various manifestations of Apartheid policy. Any scenario that has the potential to make inroads into the unemployment problem will necessarily have substantial implications for macroeconomic policy. So, if the 'first order' macroeconomic targets are inflation and public sector borrowing, etc., then the status quo will remain, and the economy may generate some jobs as a result of supply side interventions resulting in export expansion. In this way, one should not expect employment growth of more than 0% to 1% per annum.

There is another way to approach these targets. We would be asking how much inflation or borrowing could be seen as acceptable if a credible set of growth and employment-inducing microeconomic policies were formulated. Clearly, there are trade offs to be considered. Somehow one needs to find a way of raising employment, reducing unemployment, without undermining macro balance. Problem solving should be done in this direction. It is unclear whether we fully understand the relationship between interest rates, inflation, investment and employment.

2. Consistent analytical tools

What is required here is an analytical framework that can start identifying some of these trade-offs in a structured manner. The challenge is to tease out the counterbalancing effect and determine what the net effect is of a set of policies. These sets of questions can be addressed through the development of an economy-wide modelling framework. Such a framework should offer guidelines for the actual policy parameters, or the "rules of the game". Although it emphasizes the limits of policy actions, in terms of reaching particular employment or other policy targets such a framework also should create a reduction in uncertainty and an internal coherence that was to many observers missing from the GEAR macroeconomic framework. By this we mean that, unlike the GEAR framework, there are important trade offs to be considered given the structure of the South African economy as a "mineral economy", in that certain policy actions cannot be seen in isolation from other important economic variables unless some heroic assumptions are made about increases in multifactor productivity or "investor confidence". The latter, in particular, has been an important ingredient in South Africa's macroeconomic policy setting without sufficient underpinning in empirical economic analysis. How much "investor confidence" has been gained with the fiscal discipline policies of the last 5 years and how much private sector investment has actually been made and how much employment has actually been created as a result, still remains to be seen.

Moreover, the apparent lack of coordination between fiscal and monetary policies is still very much evident in current macro policy environment. The tax relief announced in the 2002 budge was followed by an increase in the interest rate not more than a week later thereby cancelling out the demand stimulus that was introduced in the first place.

It is self-evident that applied quantitative economic analysis can improve policy decisions. Sound economic principles certainly make for better policies than weak ones, but there are many reasons why policy analysts need to go beyond general principles.

- Theory often suggests that a policy may have ambiguous effects. Empirical analysis of the specific circumstances is then necessary to determine what the *net* effect will be. This is especially so when the economy-wide impact of a policy operates through many channels.
- In a wide range of cases, the intended outcome somehow needs to be measured. As a simple example, a tax rate change may be proposed in order to generate a certain amount of revenue. Applied quantitative economic analysis is necessary to determine the amount by which the rate needs to be changed.

The term 'quantitative applied economic analysis' is used in its widest meaning. For many economists the primary quantitative applied economic technique is

econometrics. While the HSRC project has some interest in econometrics, it is believed that too much emphasis can be placed on it, to the detriment of policy analysis based on economic structures, consistency and a holistic view of the issues at hand. Our experience suggests that there are more basic techniques that are now urgently needed in South Africa policy analysis and policy making institutions.

One possible reason is that econometric analysis in South Africa is inherently limited because

- Data do not allow robust econometric analysis because time series are not long enough and there are insufficient sources of cross-sectional data;
- Policy regime instability violates basic econometric assumptions
- Econometric analysis generally lacks the scope to undertake economy-wide policy analysis with industry level detail. Critical questions as to the impact of exchange rate devaluation on specific industries are difficult to address with an econometric model

Although econometricians have developed techniques that allow some of these limitations to be dealt with, the capacity of policy analysts to use these techniques for policy analysis of the "what if" type is limited and most applications have focused on forecasting. Except in the Reserve Bank and the National Treasury, there is also a tendency to use econometrics (if at all) in its basic OLS form.

Consequently, the reality is that even relatively well-trained policy analysts (people with undergraduate or masters degrees in economics) do not have the skills and experience to carry out sophisticated econometric analysis. Furthermore, even those who are able to do so at a technical level have difficulty in translating their findings into a form that is digestible by policy makers and senior policy analysts.

There are numerous examples where this level of analysis is undertaken by people outside the policy process, either as academic research papers or as commissioned consultancy reports. But even in these cases there is an obstacle to the results feeding into policy formulation, because of the low absorptive capacity within the commissioning institutions. Reports are often shelved because unfamiliarity with the techniques results in a lack of ownership.

In our perception, what is needed for the majority of official policy analysts are:

- A sensible attitude to the use of data to inform policy judgments;
- Basic technical skills to undertake spreadsheet analysis;
- A holistic approach to data and an understanding of data consistency requirements;
- Familiarity with data sources and their limitations.

Ultimately it is only when policy analysts have the capacity to develop their own applied economic analyses in-house that such analyses will be used as the foundation for policy formulation.

In addition to this focus on applicable data analysis techniques, HSRC programme should also aim to develop a capacity to understand and use economy-wide modeling techniques. Policy makers often view such techniques with skepticism. However, it is our perception that, while this skepticism is sometimes justified, it is often misplaced.

- Economy-wide models involve a high cost in terms of data. While this has largely been true in the past, these costs have been declining in recent years with the development of standardised approaches to data collection and computer programmes to transform them into a useable analytical framework.
- It is our experience that policy makers have difficulty in comprehending the *ceteris paribus* methods of partial equilibrium. The notion of 'holding every thing else constant' as is typically the case in single equation econometric policy analysis, is alien to those unschooled in formal economics. Although economy-wide modeling may be complex, the underlying philosophy – that policies need to take account of interactions and feedbacks – is much closer to the 'real world' views of the practicing policy maker.
- The development of standardised techniques and computer packages has brought down the intellectual effort required by policy makers to use economy-wide models. However, although, good economy-wide models should generate recommendations that can be explained in 'common sense' terms, without having to rely on a range of *ceteris paribus* assumptions, these recommendations should also not have to refer back to the model. Put differently, a policy analyst should not be reporting on a particular modeling result to his or her policy maker that "because that's what the model says…" but refer to basic underlying economic principals.

Apart from these arguments against the critics of economy-wide modeling, we believe that there are substantial potential benefits for the policy process to be gained by using such models:

- Literature on the interactions between economy-wide policy levers such as fiscal & monetary policy and employment suggests that such an approach is one of the appropriate research methodologies;
- Becoming familiar with economy-wide models teaches policy analysts the important lesson that policy packages have to be *consistent*. Because economy-wide models are based on consistent data sets, one very quickly learns that one cannot change one variable, without adjusting other variables in order to maintain overall consistency.
- Apart from being necessary as part of the model building, the process of assembling the data required provides the modeler with an excellent understanding of the structure of the economy;

- Although the output of the model is the primary goal, the process of building an economy-wide model also provides good insights into 'areas of ignorance', as regards both data limitations and our understanding of behaviour and behavioural parameters of the economy at hand. The exercise can be seen as an educative process rather than product oriented. It provides an agenda for on-going research.

The appropriateness of economy-wide modelling frameworks for the HSRC's purposes is emphasised by a repeat of the above. If government implements identified use of policy instruments, what would be the potential consequences for inflation, the balance of payments and for public borrowing? What are the degrees of flexibility in macro-economic policy should targets not be reached. Certainly this would require an explicit prioritisation of each of the major policy variables and in turn this may have implications for sector accords, particularly where government plans to intervene in particular markets such as food or construction.There is also another way to approach these targets. We would be asking how much inflation or borrowing could be seen as acceptable if a credible set of growth and employment-inducing microeconomic policies were formulated.

We somehow need to find a way of raising employment, reducing unemployment, without undermining macro balance. Problem solving should be done in this direction. It is unclear whether we fully understand the relationship between interest rates, inflation, investment and employment. For example: if the concept of a NAIRU[1] is extended to SA, what would ours be? 25% or 30% ? If it is that high, how could we lower it? It is quite likely that any credible programme to expand employment would have an inflationary effect, in the short run at least.

It is possible that an economic expansion could have a negative effect on the current account, due to import intensity of production, at least in the short run. So what would be the impact of an economic expansion for the public sector borrowing requirements, exchange rates and the balance of payments? To come back to the above mentioned statements on consistency, because economy-wide models are based on consistent data sets, one very quickly learns that one cannot change one variable, without adjusting other variables in order to maintain overall consistency or "general equilibrium". Since economy-wide policy models emphasise consistency, this must be reflected in the underlying data bases In what follows we will first discuss in more detail some conceptual issues around a social accounting matrix (SAM) followed by an overview of their applications in South and Southern Africa.

[1] The NAIRU is the 'non-accelerating inflation rate of unemployment'. It is a clumsy term that usually refers to a developed country context where unemployment falling below the NAIRU would result in rising inflation due to the institutional underpinnings of the economy (usually referring to the extent of labour market segmentation) and to normal levels of frictional unemployment (where people are between jobs).

3. SAM background and concepts

Since the first formal input-output (IO) tables was compiled for the US economy, more than 60 years ago, IO analysis has played an important role in shaping quantitative analysis in the economic structures analysis profession as the standard means by which inter-industry interactions can be described. However, due to the popularity of the "trickle down" development paradigm of the 1960s and 1970s, in which social issues such as poverty and income redistribution would resolved themselves inevitably as a results of higher industrial production, single point estimated general equilibrium analysis has mainly focused on industrial production activities.

Whilst the foundations were laid by Stone (1966) as early as the mid 1960s, the shift of attention in quantitative economic analysis towards more direct interventions in human development issues only gained ground during the latter half of the 1970s with the logic extension of the IO into a social accounting matrix (SAM) framework.

In spite of the fact that the IO framework contains more information than just t-accounts for goods and services, production and the generation of income, for example, final consumption expenditure is shown by product or industry of origin and intermediate consumption is shown both by product or industry of origin and by product or industry of destination, the framework does not incorporate a complete interrelationship between value added and final expenditure and therefore does not show the entire circular flow of income at a meso (in between macro and micro) level.

Towards the end of the 1970s and the beginning of the 1980s, policy-makers started recognising that the above mentioned "trickle-down" theory of development, which relies solely on increasing physical production, was inadequate to solve the developmental problems that had surfaced at the time. Growth in income was increasingly challenged by concerns about the distribution of income and human development in the face of mounting environmental constraints. However, the analytical framework for addressing these new development challenges lacked an appropriate underpinning. The subsequent decade saw a considerable effort from institutions such as the World Bank, various United Nations (UN) organisations and academia (see Pyatt & Round, 1985) to expand the conventional *SNA* format and IO framework in order to engage quantitatively in the new debates that emerged. The 1993 *SNA* incorporates a large number of recommendations that followed from these challenges including a format of presenting economic information in an enhanced input-output framework, which had for some time been labelled the social accounting matrix (SAM).

Due to its close relationship with the System of National Accounts (SNA), the SAM framework can first of all be seen as a consistent accounting framework for disparate data sources at the sectoral and institutional level. In fact, when aggregated up to its highest level, the SAM merely presents the system national accounts in an oversized

chess-board format, in which the revenues of the relevant institutions are shown as rows and their expenditures as columns. The advantage of this framework is that each entry only has to be recorded once, as opposed to the conventional double entry bookkeeping framework in which the expenditures of one account have to be recorded as receipts of another account. Although, at the macro level of the national accounts the gain of the single entry accounting convention is rather small, this is clearly a benefit at a lower level of detail with say, 50 industries / commodities and 10 households as this would require a equal number of t-accounts.

A further advantage of the SAM framework is that it forces consistency on a wide range of disparate data sources. In the case of South Africa, we can, for example, think of the national accounts, data from sectoral censuses (such as manufacturing, mining and agriculture), manpower series, the most recent population census and household surveys, statistics on government income and expenditure, trade and expenditure on capital goods. Because of the internal consistency requirements which demands the income and expenditure of each individual account to be equal, information needs to be mindfully assessed and adapted, which may expose gaps in the data. This may have beneficial effects on future rounds of data collection. In addition, the logic extension of a SAM, the System of Social Accounting Matrices and Extensions (SESAMEs) pulls a further range of data sources into the fold, such as data on employment, non-monetary human development indicators and the environment (van der Merwe & van Seventer, 1995).

The real substance of the SAM is derived from its comprehensive recording of relationships at the more detailed sectoral and institutional level (Keuning & De Ruijter 1988). Some form of disaggregation of institutions is required together with a disaggregation of the primary inputs into the production process. Together this should result in a reasonably disaggregated income distribution picture, which is, in addition, relevant to the institutional realities of the economy at hand. Clearly, these realities apply to all disaggregations that are considered in the SAM and a substantial effort is often directed at identifying economic variables appropriate to the policy analysis of the economy at hand. For example, until recently, SAMs for South Africa had identified only three skill categories in the labour market. However, faced with skill shortages and a pool of unemployed unskilled workers, the World Bank, who had used this SAM for modelling purposes has now decided that it is appropriate to consider a further detailed disaggregation, which will allow for more nuanced analysis.

4. SAMs in South Africa

Although IO tables are available from Stats SA for selected years going back as far as the early 1970s, the SAM history in South Africa is more recent. SAMs have been compiled on an ad-hoc basis for South Africa starting with an effort by the former Central Economic Advisory Service (CEAS, 1986) for the year 1978, van Seventer et al (1992), Central Statistical Services (CSS, 1992 & 1993) for the year 1998, van der Merwe & van Seventer (1995) for the year 1993 and WEFA (1997, 1999) for the years 1995 and 1997 respectively.

The most recent offering is a SAM for the year 1998 compiled by Thurlow & van Seventer (2002) which is based on a Supply-Use Table for the year 1998 and institutional details from the WEFA (1999) SAM for the year 1997. This SAM incorporates the latest input-output and household income and expenditure available and is tailored to the specific needs of an economy-wide modelling framework. Although the intermediate demand structure of the 1998 Supply-Use Table is still based on the 1993 Supply – Use Table, the updating routines employed by Stats SA claim some economic content (see Miller & Blair, 1985: 289-290) notably if supplemented with additional exogenous information. An updated Supply – Use Table for the year 1999 is believed to be in the process at Stats SA as well as the compilation of an ambitious SAM for South Africa that closely follows the 1993 SNA with several layers of income distribution as well as a full blown financial accounting framework. The latter is apparently circulating for evaluation. Since this process is expected to take some time, with the final SAM expected to be available only towards the end of 2002, Thurlow & van Seventer (2002) have estimated a temporary SAM for 1998.

Several extensions to the South African SAM frameworks in the direction of SESAMEs have taken place over the years. The tables for the years 1993, 1995 and 1997 all contain matching sectoral employment and capital stock information. Gibson & van Seventer (1996a) describe how a SAM, tailored to specifications of a dynamic CGE of the South African economy has been extended with stock and flows of financial assets and liabilities. An outline of the integration of an environmental database with sectoral information on resource use, pollution generated and abatement costs (Forster, 1998) with the same SAM is available in Gibson & van Seventer (1996b).

5. SAM applications in South Africa

In addition to the role it plays in organising data and pointing out gaps, the SAM framework can be used as a basis for various kinds of economic models. In this section we briefly discuss a number of applications for South Africa

5.1 Descriptive analysis

In its simplest form the SAM framework can be used as a model to describe the interdependencies embedded in the SAM. Here, one can think of the input structure of production activities, notably the combination of capital, labour and local and imported intermediates employed, as well as household income distribution and expenditure patterns. In the South African context such applications have been undertaken, amongst others, by Eckert & Crouch (1988) and Eckert et al (1992).

5.2 First-generation SAM-based modelling

A second broad field of modelling with SAMs involves the construction of so-called first generation SAM based models. The methodology employed by such models has been described extensively in the literature (see for example, Pyatt & Round, 1985 and Roukens de Lange & van Seventer, 1990) and will only be reviewed briefly. Essentially, first generation SAM-based modelling attempts to quantify the backward linkages of an impulse in the economy at hand. As such they only focuses on demand-side effects and assume that production technologies as well as prices remain constant.

An important assumption of first-generation SAM based modelling is that the production structure remains constant. Thus, this kind of analysis is comparative static by nature and ignores any dynamic effects, such as substitution between production factors labour and capital and between domestic and imported intermediates. This kind of SAM-based modelling therefore has a modest approach, in that it can answer "what if" type questions while holding all other economic conditions constant.

Like standard input-output analysis, SAM analysis also assumes that there is sufficient capacity available in the backward linkages to satisfy the demand of the stimulus at hand and that prices will therefore remain constant. This may be true for most secondary and tertiary sectors, but not necessarily for primary sectors. For example, it is possible that agriculture or the coal sector will *not* expand their production to meet additional demand for those products that are directly or indirectly related to, say, a public sector infrastructure investment or any other injection into the economy. It is conceivable that those sectors will, for example, divert exports to an expanding domestic market. This can be addressed by imposing supply side constraints on the multipliers (Lewis & Thorbecke, 1992: 887). For a South African application see Vink

et al (1996) and for provincial level application see McDonald & Punt (2002). In a SAM modelling context, the same principle can be expanded to apply to all endogenous variables. This offers the possibility of modelling fiscal discipline so that additional government revenue is *not* used to finance additional government expenditure. In stead, taxation and other forms of government income can then be modelled to retire public sector debt which will result in a leakage from the demand model and a reduced multiplier effects.

A number of first-generation SAM-based modelling applications have been undertaken in the South African context. See for example Dryer & Brand (1986), van Seventer (1987), Wang & Mullins (1988), Roukens de Lange (1989) and more recently McDonald & Punt (2002). In general, these applications have focused on the economy-wide impact of exogenous shocks, macro-policies and income redistribution.

Due to the limitations mentioned above, it is, however, appropriate to employ these kind of models to applications that involve marginal changes such as investment projects or DTI incentive schemes. Because of their easy of application, many of such applications are undertaken in the private sector, for example, to evaluate the impact of a new aluminium smelter in Coega, a new casino or new electricity power plant. Such analysis is often required at the provincial level and for that purposes, provincial input-output tables have been estimated using a shortcut technique (Eckert *et al*, 1997 and van Seventer, 1999)

5.3 Second-generation SAM-based models in South Africa

Although the behavioural specifications in a first-generation SAM based multiplier model emphasise important linkages in the economy the models are demand driven and are awkward in dealing with issues such as resource allocation, productivity and price changes and factor utilisation. Fixed coefficients mean that substitution possibilities in consumption, production, imports and exports are ignored as well as supply-demand interactions of institutions operating across markets in response to shifts in market signals. Various macroeconomic adjustments or "closure rules" allow for different macro theoretical perspectives or major macro policy levers to be identified as the drivers of the economy. The most contentious one is whether the South African economy is savings or investment driven.

Economists of a neo-classical persuasion forcefully argue that it is *prior saving* that matters for investment. The policy recommendations are then clear-cut: efforts should be focused on maintaining high levels of national saving to finance investment spending. Specifically, fiscal policy can actively promote national saving through cuts in government spending and subsequent increases in government saving. Monetary policy on the other hand should keep real interest rates positive and high to encourage saving through the financial sector which can then be used to finance investment spending in an efficient way. The neo-classical paradigm is unequivocal in its view that saving causes investment.

By contrast, economists of a Keynesian or post-Keynesian view present a major departure from the neo-classical saving-investment paradigm. The argument is advanced that investment causes saving, not the other way around, and that cuts in government spending and high real interest rates suppress investment output and therefore investment growth. The policy prescriptions then focus on the incentives to invest and how government policies can create a favourable environment for sustained increases in private investment expenditure and income and therefore savings. A recurrent policy prescription in Keynesian writings is the emphasis on the complementary relationship between public investment and private investment (the so called "crowding-in" effect), and how low real interest rates impact positively on private investment by lowering the cost of capital.

Whether there is a long-run relation between investment and saving and whether it is saving that causes investment, or the other way around, may have major implications for the conduct and efficiency of monetary and fiscal policy. The causal relation cannot be determined by second generation SAM based model itself, however, this requires econometric analysis, but once this relationship is established, the model can be set up to act in the required way.

So, a third broad field of applications with the SAM is the development of more sophisticated formulations of how an economy adjusts to an external shock or potential application of a policy lever. Based on the theoretical foundations described amongst others by Powell (1981), Taylor (1990) and Robinson (1989 & 1991) a number of applications have been undertaken in South Africa. Gelb et al (1992) developed a dynamic one-sector computable general equilibrium (CGE) model of the South African economy, based on an aggregate SAM extended with financial variables for the year 1990. The model was used to evaluate the impact of a negative external shock and of a programme of government stimuli.

Using a rigid, albeit multi-sectoral modelling template, previously developed at the World Bank, Naude & Brixen (1993) examine the impact of an increase in government expenditure, export demand, world price and a lowering of import tariffs under various sets of "closure rules". Tarp & Brixen (1996) have taken the IMF's financial programmeming model and the World Bank revised minimum standard model and applied it to the South African economy, basing the modelling framework on a single sector accounting framework that can in principal be represented in SAM format. With this framework they then investigate exchange rate devaluations, external borrowing by the government and higher international reserves.

Subsequently, several a large scale multi-sectoral CGE models of the South African economy were developed by the Industrial Development Corporation (Coetzee et al, 1997), the World Bank/OECD (Van der Mensbrugghe, 1995) and the Development Bank of Southern Africa (Gibson & Van Seventer, 1996a) which resulted in a number of applications such as investigations in trade liberalisation, green trade restrictions, devaluation and government expenditure and restructuring (see for example Cameron 1994, Gibson & van Seventer (1996b, 1997a, 1997b, 2000a, 2000b, Gibson, 2000a, Devarajan & van der Mensbrugghe, 2000).

5.4 CGE models currently available in South Africa

From the applications mentioned above it would appear that there is a rich tradition of second-generation economy-wide policy modelling in South Africa. However, in spite of some recent references, most applications are at least a number of years out of date and a survey of the most recent literature reveals that this activity has lost some of its intensity. The most recent application mentioned above that we are familiar with describes a modelling framework, which was developed at the World Bank (Lewis 2001). Based on the 1997 SAM estimated by WEFA, this modelling framework was used to explore policies to promote growth and employment in South Africa, including further tariff reform, and a range of exogenously imposed factors such as additional FDI inflows (following further privatisation), responsiveness of export sectors and increased savings as well as further labour market reform. The latter was captured by means of increased supply of skilled labour and lower wages of unskilled labour following a wage subsidy.

Because the policy changes under consideration do not affect the economy only in a single year, the model moves forward and looks at growth trajectories. The model is "dynamised" by building in a set of cumulating and updating rules, and providing a time path of a range of exogenous variables (world prices, capital inflows, etc). The policy options are thus pitched against a benchmarked status quo base line which runs over the period 2001 to 2010.

The alternative scenarios illustrate how an economy-wide model of South Africa can according to the author be used to evaluate policy options that could promote growth over the medium term. While the representation of policy packages remains relatively broad (and short on administrative detail), the results nevertheless suggest that, with concerted effort in a number of key areas, there is substantial scope for raising medium-term growth and job creation. The concerted effort is, however, imposed as a costless exogenous shock based on the main assumption that FDI flows into the South African economy by itself, increased savings are automatically converted into investment while increases in the supply of skilled labour are achieved without raising government expenditures. Important trade-offs are therefore glossed over and a win-win situation is presented as a target that is only dependent of political will. Moreover the analytical framework ignores the impact of monetary policy, in particular the interest rate, as an import policy lever feeding through into investment as a cost of capital that could easily spoil the outcome, as it has in the case of GEAR.

In spite of it being the most recent application on record, anecdotal evidence suggests that the World Bank framework as described above is not operational at this stage. A new version may be on the cards with updated input-output and expanded labour market data and the framework may well behave in a very similar way. A comparative static application of the framework is currently underway at UCT as part of its masters course programme, in which the impact of employment subsidies are investigated under different financing structures. This exercise is expected to be completed in May 2002.

It is also possible that the IDC modelling framework described by Coetzee et al (1997) is still active, although no recent applications have been reported in the literature apart from the it being used as a tool to generate industry level forecasts (IDC 1998). Forecasting requires a dynamic set up, which is probably achieved in a similar way as the World Bank framework and as such the model could also be used to undertake policy simulations. Apart from the dynamics, the IDC modelling framework is also similar in terms of structure and adjustment mechanisms to the World Bank in that it follows neo-classical optimisation rules and savings driven macro adjustments as its guiding principal. Anecdotal evidence suggests that due to severe human resource constraints the framework has not seen major policy modelling applications in recent years.

Two clones of the IDC modelling framework, using similar configurations as described by Coetzee et al (1997) are, again according to anecdotal evidence, currently under development, although the status of this process is not clear at this stage. The one initiative is taking place at the University of Pretoria (see for example, de Wet & Van Heerden, 2001 and Van Heerden & De Wet, 2002) while the other is developed for private sector impact analysis by the consulting firm WEFA-DRI. Both may be limited to comparative statics and may therefore have the further limitation of not being able to move forward and examine growth trajectories, as is the case with the World Bank framework.

Comparative statics is also one of the characteristics of the economy-wide modelling framework currently under developments at the University of Natal, in collaboration with TIPS. As part of a wider capacity building exercise, the standard CGE modelling framework of the International Food Policy Research Institute (IFPRI) was chosen as a starting point (Lofgren et al, 2001). Based on an estimated SAM for South Africa, as mentioned above and described by Thurlow & van Seventer (2002), the framework is neo-classical by nature, but the macroeconomic adjustment options are sufficiently flexible to accommodate a fairly wide range of views on how an economy operates. The intention is to develop the model and evaluate some fairly standard scenarios such as an increase in public sector expenditure, tariff reduction and productivity increases, in order to check the broad directions of the results. Upon completion, a more serious application will look at the economy-wide impact of a basic income grant under various financing options. The two exercises, basic model development and basic income grant, are expected to be completed in June 2002.

The South African input-output table and SAM are incorporated in the Global Trade Analysis Project (GTAP) database. GTAP is involved in quantitative analysis of global economic issues within an economy-wide framework. Now that South Africa is part of the GTAP database it can be employed to evaluate global trade issues on the South African economy. Of course one does not necessarily need a global modelling framework to do this as these issues are exogenous to the South African economy and little spill over and feedback may be expected. Nevertheless, global trade issues can be simulated much easier and in a consistent fashion using a global framework than using an ad-hoc analysis. GTAP is also very flexible in setting up the country/regional and activity/commodity configuration so that bilateral trade agreements between South Africa and potential partner countries can be explored at relatively short notice and in

a consistent global framework. Examples of GTAP applications which involved South Africa are Davies, 1998; Lewis *et al*, 2001; Stern & Stevens, 2001 and Andriamananjara & Hilberry, 2000. Only Stern & Stevens (2001) has been a home-grown application, all others were undertaken by foreign institutions. However, a number of South African analysts are conversant with the framework and future applications are certainly possible. The great advantage of GTAP is the easy to use modelling interface but the downside is that the framework is often operated as a black box. Another disadvantage is that GTAP only identifies a single representative household, so in order to bring the results of any analysis down to specific groups of households such as the poor, some additional side calculations need to be undertaken.

Final to our overview of current CGE applications, we mention reference to a development by McDonald *et al* (2001) which has a provincial or regional as well as agricultural focus. Anecdotal evidence suggests that the National Department of Agriculture may have bought into this initiative by means of a four-year programmeme to extend this framework to a number of regions of South Africa. Agriculture is usually represented in a South African SAM or CGE as a single activity/commodity. The agricultural focus in the McDonald initiative emphasises the disaggregation of agriculture into a number of commodities and activities. Although agriculture only represents less than 5% to South Africa's GDP, the contribution to employment is much higher, while the contribution to gross geographic product (GGP) may also be much higher for some provinces or regions. Disaggregation of agriculture may point to some important trade-offs in terms of offering support to certain crops over others while locale linkages with off-farm activities may also differ.

6. What other analytical frameworks can be considered for the HSRC initiative?

Although we would argue that a SAM based approach to the quantitative analysis of degrees of flexibility in macroeconomic policy should targets not be reached and explicit prioritisation of major policy variables because of its internal consistency, other types of analytical frameworks need some consideration.

6.1 Econometrics

Starting with econometrics, this has a much richer tradition in South Africa than CGE modelling. In a very simplistic way, two different approaches can be identified.

- **Single equation and partial equilibrium time series analysis** focuses on a particular issue, such as investment behaviour, without worrying much about other aspects of economy-wide adjustment. Based on historical trends, past behaviour is analysed, often with great statistical accuracy, and policy conclusions are drawn. An example of such a study is can be found in Fedderke et al (2000) in which important behavioural relationships were tested which suggested that investment in South Africa is as much dependent on capital costs, and markets as on socio-political stability. It may follow, one could argue, that in order to stimulate investment the obvious policy recommendation is to lower interest rates, corporate tax rates, boost domestic demand and government socioeconomic expenditure. All these recommendation would, however, impose side effects, which may or may not counter balance firm investment behaviour. These general equilibrium feedback effects are typically ignored by single equation and partial equilibrium analysis.

  What can one achieve with econometrics? As mentioned above, Fedderke et al (2000) has applied industry data to estimate investment functions for clusters of sectors. This effort can be improved from a several ways, one being the application of quarterly data at the sectoral level. Another econometric relationship that has been explored is the one between employment and trade (Fedderke et al, 1999); again this can be improved with an examination at the sectoral or cluster level. Recently, a first step has been estimate price mark-up equations by Schaling & Fedderke (2001). They found that at the macro level the mark-up is considerably higher in South Africa compared to the United States. This approach holds great promise for application at the industry level, as this would give an indication of cost-push pressures and market concentration. In terms of trade, Gumede (2000) has estimated import elasticities for a limited number of sectors, which can be extended to cover substitution between domestic and imported goods (Armingtons) more industries as well as the evaluation export price and substitution (CET)

behaviour. Similarly, the database could be used to investigate wage equations at the sectoral level in addition to production functions.

This type of analysis remains imperative, since it can describe the behaviour of important economic variables, such as pricing, wage setting, import and export behaviour, substitution in production, household consumption and others. Moreover, single equation econometric modelling is very much complementary to general equilibrium analysis in that the estimated parameters of this king of analysis provide the necessary ingredients[2] to successful economy-wide policy modelling. The latter is often dismissed because of the lack of statistical accuracy, and complementing the two approaches may well be the next best solution to simultaneous estimation of a full-blown CGE.

- **Economy-wide econometric modelling** has also been very popular in South Africa. Here, we are talking about a comprehensive representation of an economy in which the behavioural relationships are all fully estimated and often (but not always) re-estimated on a regular but probably mostly on single equation basis. Several the more well know macroeconometric models are those maintained by the SARB and the Bureau for Economic Research (BER) at the University of Stellenbosch. While there are a number of other macroeconometric models around but these are mainly used for private sector forecasting purposes. The BER modelling capacity also offers private sector forecasting services but appears to have some influence on the macroeconomic forecasting capacity of the National Treasury which creates the 2 to 3 year outlook that can be considered as the benchmark for policy makers in all other government departments as part of their annual Medium Term Expenditure Framework (MTEF).

  A description of the SARB macroeconometric model has been made public in bits and pieces over a period of around 10 years (de Jager & Small, 1989; Pretorius & Small, 1994; Pretorius & Knox, 1995; Pretorius, 1998; Smith & Van den Heever, 1995; Smal, 1995 & 1996 and de Jager 1998). Like the BER model, the SARB model can probably be summarised as a conventional Keynesian demand-oriented model with explicit supply elements. These supply elements consist of a measure of potential output which, in conjunction with the expenditure-determined actual output, provides an estimate of economy-wide capacity utilisation. This will also generates an estimate of the potential rate of

[2] Econometric estimates of elasticities and coefficients of single equations are sometimes difficult to employ directly in an economy-wide modelling framework because it is not always possible to control for the all the other economy-wide effects. A degree of "loading" would thus take place. For example, elasticities that drive the substitution between domestic and imported supply of a particular commodity in an Armington setting could easily be estimated at around 3 or higher, but could just as easily prevent a CGE from converging to a feasible solution. The general rule of thumb is that such parameters lie within a much more narrow economy-wide range, although the econometric estimates could still offer commodity or activity specific rankings.

growth. The latter then serves as a variable supply constraint in the determination of imports, investment, prices and wages. Cyclical movements are captured for a range of macroeconomic variables up to 5 years ahead.

Apart from forecasting both the BER as well as the SARB econometric modelling frameworks can also be used for policy analysis purposes. The BER framework, for example, has been used by the national treasury to evaluate macroeconomic implications, if any, of the recently concluded arms deal, as well as the macroeconomic impact of HIV/Aids (BER, 2001a). Limited policy analysis with the SARB macroeconometric model has reached the public domain.

For purposes of the HSRC needs these type of modelling frameworks in themselves are less appropriate as they do not contain sufficient industrial and institutional detail. In other words, they do not allow for poor households or unskilled unemployment to be identified, neither for their linkages to major macro policy levers to be explored. One solution is to apply the econometric estimation approach to a multi industry/institution framework. This may seem a daunting task but has in fact been achieved by Adelzadeh (1997) for the National Institute for Economic Policy (NIEP). The model includes detailed econometric estimation for a number of industries in the South African the economy (including 4 primary sectors, 28 manufacturing sectors, and 7 service sectors) in terms of their output, employment, investment, wages, prices, exports and imports, using time series data from 1970 to 1998 and. An earlier version of this model was extensively used for the MERG report (1993) and was initially derived from the one sector Gelb et al (1992) model mentioned earlier. The new version of the model appears to be designed for macroeconomic and industry studies of alternative scenarios for South Africa's industrial and economy-wide development. Its structure includes rich linkages among different parts of the economy as well as among the above-mentioned industries of the economy. It is unclear whether this model is still available at NIEP.

A shortcut to this methodology would be to break a macroeconomic forecast or the results of a macroeconomic policy simulation down to the industry level by means of a simple first generation input-output or SAM modelling application. Industry forecasts presented by ABSA (2001) are probably generated using such a methodology. A great advantage of this approach is that it is relatively simple, although the other side of the coin is that its simplicity also allows for limited interaction between crucial macro policy levers and the industry level, as the main channel of transmission works just through the aggregate final demand variables. Once a new macro policy environment is successfully translated into a new final demand and the industry structure of that new final demand is assumed to be fixed, it boils down to a simple demand driven first generation input-output or SAM application described above. Any supply-side implications of the new macro policy environment and supply-side constraints are possibly ignored as well as long-term historical trends at the industry level. The latter could lead to the unrealistic absence of particular industries leading or lagging the macro GDP cycle.

Although industry-level forecasting is probably not quite what is required to meet the challenges of the HSRC, it can play an important role as a driver for a separate labour market forecasting model as labour demand is to a large degree determined by economic activity. Another sectoral drivers may be the structural change in the demand for labour, say for skilled labour compared to unskilled labour, which would still have to be determined in a separate exercise, say, through a labour market outlook survey such as the one conducted a couple of years ago at the HSRC by Whiteford et al (1999).

6.2 The bottom-up approach

So far, we have mentioned quantitative analytical frameworks that attempt to explore the impact of major economy-wide policy choices and exogenous shocks from the macro or economy-wide top down ending at the level of broadly defined households or industries. However, the degree of household or enterprise detail in such frameworks is often considered not to be sufficient and policy makers and analysts have been looking for ways of to increase the resolution at the receiving end, as this is where the policies are intended to make their impact.

Bottom up analysis of the developmental impact of policies on households have been attempted for some time (see for example Case, 2000, Leibrandt *et al*, 2000, Seekings, 2000, Whiteford & van Seventer, 2000) while the investigating the impact of policies at enterprise level has only recently started (Chandra *et al*, 2001a & b) as well as Gelb (2001). We discuss each broad group in turn.

Evaluating the impact of policies on labour markets and households has mainly been of a descriptive analysis, with Case 2000 being the only exception. In this application, the impact of tariff reform was evaluated at a detailed household level by means of cross-sectional estimates of linear expenditure systems for a wide range of household types using the 1993 Project for Statistics on Living Standards and Development (SALDRU) survey. The other references mentioned above that employ household level databases have not gone beyond descriptive analysis and links with major policy lever are very tentative. Typical 'what-if' types of questions have not been addressed with such analytical frameworks. During the second half of the 1990s Stats SA started conducting household surveys on a more regular basis. Apart for the household expenditure survey, which is meant to be conducted every 5 years, these surveys have recently been replaced by labour market surveys, which are supposed to be conducted more than once a year. These surveys could form the basis for further analytical work.

Enterprise level analysis based on enterprise surveys suffer from similar drawbacks and even if linkages to the macro environment are made they are only partial at most, ignoring side effects. In addition, enterprise surveys appear to be conducted on a more ad-hoc basis. The main objective of Chandra et al (2001a,b) was to examine factors that constrain firm growth and employment in Greater Johannesburg Metropolitan Area and in the national urban economy, and to seek to identify key areas where efforts can be made to improve the business environment in which firms

operate. Towards this end, using a number of questionnaires, they interviewed CEOs and senior managers of a large number of large manufacturing firms spanning eight sectors. A similar approach was followed with regard to small and medium sized enterprises. Other reports are still to follow. A National Enterprise Survey was conducted by Gelb (2001) to look at investment behaviour and perceptions of entrepreneurs with regard to a range of issues including crime and social issues, government economic policy, labour regulation, interest and exchange rates and others.

Finally, the BER (2001b) conducts opinion surveys for a range of main industries, manufacturing, retail and construction, on a regular basis. These surveys are used to generate industry level outlooks that are probably somewhere at the top linked to the BER macroeconomic outlook to ensure macroeconomic consistency.

Although rich in detail and descriptive analysis with regard to the linkages between the macro policy environment such as labour regulation, crime and violence, volatility, business regulation etc, it would be difficult to address questions such as what would be the impact of a 10 percent increase in public expenditure on crime and violence prevention on investment, growth and employment.

As mentioned above, specific labour market models are apparently available at the HSRC and possibly the SARB. Such models probably offer considerable detail in terms of skill and education requirements. It is unclear whether these frameworks are used just for descriptive analysis or whether some simulation potential is included. For the latter to be achieved some exogenous driver would probably be required. This could be found in any of the macro econometric or preferably economy-wide modelling frameworks mentioned above, preferably those that have the potential to generate an outlook of industry level economic activity.

In conclusion, the level of institutional detail that can be derived from survey based studies is very appealing to policy makers and attempts are currently made elsewhere to bridge the gap between the bottom-up and top-down types of analyses (see below).

7. Summary of modelling frameworks currently available in South Africa

Before we turn to other suitable analytical frameworks we attempt to recap above discussion in a simplified tabular format in which we capture all the most recent modelling experiences that may be relevant to the HSRC initiative.

Table 1 – Summary: modelling frameworks currently available in SA

	Modelling framework	Comment
	Economy-wide policy models	
1	World Bank	Long-standing, recursive dynamic CGE. Future development may focus on further disaggregation of labour market.
2	IDC	Long-standing, recursive dynamic CGE. Future availability unclear.
3	University of Pretoria	Based on IDC methodology, little detail available.
4	University of Natal, Durban / TIPS	Application of the IFPRI standard CGE model, based on a SAM for 1998 with supply-use characteristics. Only comparative static at this stage.
5	University of Cape Town	Comparative static application of the World Bank model (Lewis, 2001) discussed in 1) above.
6	GTAP applications	Easy operation, low threshold but considered to be a bit of black box. No disaggregation of households requires additional modelling if simulations results are to be expressed in terms of poor households.
7	National Department of Agriculture / University of Sheffield	Agriculture & regional focus, no further details available.
	Macroeconometric models	
8	Time series analysis	Widely applied, with potential for industry level detail. Limited used for economy-wide policy analysis purposes.
9	BER econometric model of the South African economy	Widely used, influential in National Treasury, no link with industry, labour market and institutional detail.
10	SARB econometric model(s)	Limited availability in public domain. No visible link with industry, labour market and institutional detail.
11	NIEP	Appropriate detail, high maintenance in terms of econometric estimations at the detailed level.
12	Macroeconometric – input-output/SAM based models	Too simplistic in linking macro environment with industry, labour market and institutional detail.
	Survey based models	
13	Household & labour market models (SALDRU, population census, household income and expenditure surveys, labour market surveys)	Rich in detail but mostly descriptive. Limited applications for policy analysis so far in South Africa.
14	Enterprise survey models (World Bank, NES)	Rich in detail but mostly descriptive. Limited applications for policy analysis so far in South Africa.
15	BER industry surveys	Rich in detail but mostly descriptive. Limited applications for policy analysis so far in South Africa.
16	Labour market (survey) models (HSRC, SARB)	Rich in detail but probably needs to be driven by or interrogated against a macroeconometric (7-10) or economy-wide policy modelling framework (1-6).

8. What is the most suitable framework for the HSRC initiative?

To come back to the HSRC initiative, the initial objective is to explore a more aggressive approach to the stimulation of more labour absorbing non-traded sectors if only over a period of 10 years. However, any noticeable stimulatory package could have negative macroeconomic implications. As mentioned earlier, if government implements identified use of policy instruments, what would be the potential consequences for inflation, the balance of payments and for public borrowing? What are the degrees of flexibility in macroeconomic policy should targets not be reached, somehow this would require an explicit prioritisation of each of the major policy variables. Ultimately, the question is what such policy initiatives, via appropriate representations of the labour market, mean for poverty, expressed not only in terms of monetary or income variables, but also in terms of human development indicators such as calorie intake, access to basic services, health and education.

Clearly, this is a formidable task that somehow requires the combination of some of the modelling efforts discussed in the previous section but combined in a coherent framework. While economic modelling remains an exercise in the art of summarising economic reality, what would be the characteristics of such a "definitive" analytical framework?

8.1 Economy-wide

First of all the framework would have to be economy-wide in that it covers as many aspects of the economy as possible. Here, we already run into a dilemma, do we mean the measured or captured economy, i.e., the formal economy, or do we also want to say something about the informal sector? With an unemployment rate of 40% it would appear to be obvious that the informal sector has to be included. Roukens de Lange (1993) has made an attempt to include specific informal sector activities in a SAM framework for the year 1988, but this approach has not been carried through to more recent application with first or second generation SAM based models. The 1997 SAM and World Bank modelling framework makes mention of informal sector labour, but this is merely an estimate of informal sector activities that is consistent with the SARB's inclusion of the informal sector in the national accounts (round about 5-6% of GDP) and the difference between the broad and narrow definition of employment. Moreover, no specific informal sector activities are identified. Rather, the informal sector activities in, say, the transportation industry, such as minibus taxi operations, are aggregated into the broader transportation industry, thereby assuming that their behaviour is the same as that of the formal sector counter parts. Including informal sector activities would therefore seem imperative, but requires a major exercise, the scope of which is beyond this report.

Time series analysis is important to feed economy-wide frameworks with appropriate estimates of behavioural relationships but on their own cannot be sufficient for the HSRC efforts. The reason is that the analysis is often of a partial equilibrium nature, ignoring important macroeconomic spillovers and feedbacks. Econometric models of the South African economy are in principal economy-wide but most applications focus on forecasting with limited industry or institutional detail and policy modelling potential. Surveys suffer from the same shortcomings as time series analysis, in that analysis with them tends to be of a partial equilibrium nature. In addition, representation of the universe may also be a binding constraint. Nevertheless, the level of detail is appealing to policy makers and our challenge is to bridge the analytical distance between the economy-wide and household levels

8.2 Labour markets

Labour market detail is crucial. Economy-wide frameworks in South Africa tend to be limited in this regard with not more than the three or four skill categories, currently identified. Further disaggregation of the labour market in economy-wide frameworks is an important issue that needs priority. Here some scope exists to disaggregate the labour market information towards a more appropriate number of occupation groups without major demands in terms of data and human resources. It would seem that the World Bank's new initiative is moving in this direction. This also allows for a more seamless integration with existing self-standing labour market models in order to derive skill and education requirements that match chosen macro policy direction.

This ties in with the HSRC's focus on the labour markets. If the HSRC is considering an outlook of labour demand in some detail a simple forecasting tool can be considered as a mechanical consistency complement to a labour market survey as was previously undertaken by Whiteford *et al* (1999). A labour market survey amongst human resource managers of a representative sample of South African firms may reveal interesting changes in current patterns of demand for skills and occupations but the outlook needs to be put into macro or economy-wide perspective. For this, as was mentioned above, an industry level forecasting framework driven by a macroeconometric model may initially be sufficient.

8.3 Households and the micro level

Household detail is another issue that needs attention in a suitable economy-wide policy modelling framework. With a limited number of income classes, the current SAMs and CGEs offer little detail as to the impact of new macroeconomic or economy-wide policy choices in terms of poverty. Ideally one would like to see a link between the macro or economy-wide environment and individual households or narrowly defined groups of poor households. The challenge is to attempt to bridge the gap between economy-wide and household level analysis. Although many links between the two levels can be explored, let us focus, as an example, on one particular

link: the one between trade and poverty. If the primary structural issue facing South Africa is unemployment, poverty and income inequality, while at the same time policy makers and analysts have to deal with the policy problem of how to manage globalisation, this suggests that the analysis of the link between trade and poverty is not inappropriate.

If it is feasible to quantify trade liberalisation and poverty it may be possible to establish some correlation between the two phenomena. Even if one were to get a quantitative handle on poverty, there are, according to McCulloch *et al* (2001), typically a range of other issues that may impact it, of which trade liberalisation is just one. From a simplistic point of view there are two ways of investigating the impact of trade liberalisation on poverty. From the top down, it may be possible to create a laboratory of the economy at hand that has some, albeit even fairly aggregate, poverty features. In such a laboratory it is then possible to simulate features of trade liberalisation while, to the extent that this is realistic from a policy perspective, keeping other potential policy levers and shocks constant. This is typically achieved by the economy-wide policy modeling frameworks mentioned earlier in Table 1.

On the other hand, one can take a bottom up approach which starts by looking at poor households using household surveys, how these households link into the labour market and obtain other forms of income and how trade liberalisation may be one source of impetus that could have an impact on households moving in and out of poverty, i.e., below or above the poverty line. Here the household and labour market surveys mentioned in Table 1 are very useful.

More recently, a middle ground between the two approaches has been explored. Although still in initial stages of development, the approach suggest using the full details of a household survey with respect to certain variables in combination with a scaled down macroeconomic or economy-wide model in an attempt to explore the impact of macroeconomic policies directly on the household or individual level. The advantage is that not only is the richness of household survey information preserved in a partial equilibrium way, some general equilibrium feedback mechanisms are added to the analysis at the same level of detail. In the case of Madagascar, Cogneau & Robilliard (2000: 52-54) note that apart from the affordability of social safety net programmes in a macroeconomic context, some of the initial positive effects of introducing a social safety net may actually be eroded by negative general equilibrium price effects on non-traded 'traditional' goods. Other applications look as the social costs of the financial crisis that hit Indonesia in the late 1990s (Robilliard, Bourguignon & Robinson, 2001) and the impact of trade liberalisation on poverty in Nepal (Cockburn, 2001). An overview can be found in Reimer (2002) and Bourguignon (2001).

Whichever way, our thinking of the paths of impact need to be spelled out and formalised. In order to do so, McCulloch *et al* (2001) suggests ways to measure the impact on poverty, by making use of poverty profiles, including information on consumption, production and employment activities of the poor. Policy according to McCulloch *et al* can then be judged by the number of households that are in poverty, measured in terms of a metric income level. In particular, Winters identifies four

potential routes. These are, prices, enterprises, government revenue and economic growth and technology.

Trade liberalisation can be transmitted down to the poor by way of price changes in a direct way, i.e. through the distribution sector, or indirection through the domain of trade. The state of the distribution sector looks at whether the market is competitive to a more or lesser degree. Moreover, the degree to which price changes are transmitted to the rest of the economy are dependent on the domain of trade, i.e., whether the good is traded internationally, nationally or locally.

Through enterprises, trade liberalisation effects poverty because according to Winters, outputs are sold and inputs are acquired through market transactions and hence the link to border, wholesale and retail prices. Given demand and intermediate supply for goods and services, demand for primary inputs will directly impact on households, since they are the ultimate owners of the factors of production. If the Stolper-Samuelson Theorem were to hold, and trade liberalisation were to increase the demand for labour intensive goods and poor households depend largely on unskilled wage income, poverty will be alleviated. However, liberalisation may well only increase the demand for medium skilled labour and as a result low skilled labour could be left behind. Obviously a number of different configurations to this argument are possible, depending on a range of conditions, such as the supply of the factors of production, the degree to which markets are differentiated and the degree to which trade liberalisation increases volatility in markets.

Trade liberalisation has an impact on government revenue. For those countries that rely heavily on tariff revenue, trade liberalisation could impact on spending and the tax burden. The former may limit poverty alleviation programmes, while the latter could be result in new taxes on staple goods. Finally, the impact of trade liberalisation on the household level is transmitted by means of the economic growth variable. Growth will cut across all other paths mentioned above; according to Winters it will not only affect relative prices but also the incomes generated by the enterprise sector, both in terms of their average level and the number of people working in that sector. If the impact of trade liberalisation on growth is indeed positive, and the discussion about that is not yet concluded, it will also increase demand and generate higher government revenue.

The length of the planning horizon is, however, an important factor. Although, trade liberalisation may improve the plight of the poor in the long run, short-term adjustment costs may still push households into poverty for shorter or longer periods depending on the intensity of the reforms, i.e., concentrated or diffused.

A different issue, which has been largely ignored in the literature, concerns the consequences of poverty for trade policy. To what extent do poverty alleviation objectives constrain trade policy? Gibson (2000b) has some analysis of this in which he asks the question how far do initial conditions regarding poverty constrain the options for managing globalisation? This could occur in several ways. If the initial impact of globalisation, in the narrow sense of trade liberalisation, is to widen income

disparities, does it need to be undertaken more slowly in poorer countries than in richer ones? Is a poor country with low levels of human capital less able to benefit from the opportunities for increased openness than a more richly endowed one?

To cut this digression short, clearly, trade policy reform is but one issue that may produce winners and losers and for each macro or economy-wide policy environment a new set of channels can be considered. The integration of macroeconomic or economy-wide policy modeling frameworks and household or labour market survey data is evidently the way to go in that it offers the policy levers as well as a reasonable richness on the recipient's side.

8.4 Dynamic versus comparative static

While comparative statics are a good starting point, a dynamic analysis of some sort should ultimately be considered. The reason is, as mentioned above, that policy makers would like to know what the adjustment path is to a general equilibrium that represents the new set of policy measures, in stead of assuming that the economy at hand will reach the new equilibrium in 3 to 4 years in a gradual and smooth way. There are various degrees of dynamics that can be considered. As was mentioned above the World Bank CGE for South Africa was "dynamised" by building in a set of accumulation and updating rules. The purpose of the dynamic equations in the model is to "update" various parameters and variables from one year to the next, and for the most part, the relationships are straightforward. Growth in the total supply of each labor skill category is specified exogenously, and for the informal, unskilled and skilled labor groups (for which inflexible wages leads to unemployment), the growth trajectory of real wages is also provided. Sectoral capital stocks are adjusted each year based on investment, net of depreciation, and investment is assumed to respond to differential sectoral profit rates so as to preserve the rental rate differentials observed in the base year data. Sectoral productivity growth (TFP) is specified exogenously (Arndt & Lewis, 2000).

One could if one wanted to specify a richer dynamic adjustment in which for example nominal wages are a function of lagged nominal wages (see Gibson & van Seventer, 1996a). This means that if one were to specify a set of current period mark-up price equations, prices become a function of lagged nominal wages.

In addition, one can consider a set of industry specific investment functions in which capital accumulation is assumed to depend negatively on the cost of capital measured by the real rate of interest and the inflation rate which can be included as an expectational variable. Firm investment increases with an industry's capacity and the after-tax profit rate in which capacity utilisation depends on last period's actual and potential output. In such a set up, investment then increases effective demand in the current period and raises the capacity to produce in the next. This timing is important since investment in the next period will not be undertaken if sufficient installed capacity exists to meet anticipated demand. If accelerator effects are strong, an investment boom can thus lead to cyclical fluctuation in the path of real gross domestic product (GDP).

This kind of modelling requires a much closer look at the structure of South African economy and how it functions, instead of making use of a standard template such as the World Bank or IFPRI model. The trade-off usually is a much longer and labour intensive economic modelling process.

8.5 Model formulation

One can of course take the suggestions made above about independent wage rate specification a lot further by departing more from the ideal of competitive markets and integrating this into an economy-wide analytical framework. As market structure varies by sector, the intention then is to capture the diverse nature of the arena in which market participants interact. Although class structure is already captured, in that savings and import propensities, effective tax rates as well as linkages of financial intermediation and labour market power vary according to social class, a range of additional features can be added to a standard neo-classical CGE modelling framework, in order to better reflect the economic realities of the economy at hand.

For example, structural rigidities imply that the economy is less responsive to changes in relative prices, at least in the short run. The immediate effect is likely to be felt in the distribution of income. Nominal variables which are fixed by policy or tend to adjust slowly to market pressures – such as wages, exchange rates, transfer payments, taxes and interest rates – control corresponding real resource flows for a set of relative prices. If the latter changes quickly, the associated change in real resource allocation can cause macroeconomic imbalances that are resistant to policy which aims at 'getting the prices right'.

Although, possibilities for factor substitution can be included in any reasonable model, the question is about the time horizon over which these forces are assumed to operate. In conventional models, a change in relative factor prices has an immediate effect on factor proportions. Alternatively it is possible to embody adjustment mechanisms which are phased over time.

Savings must balance investment ex post, but there are many ways in which this can be achieved according to the institutional forces at play in the economy. Unemployment arises when investment fails to absorb all available savings through, amongst others, the adjustment in the real interest rate. Outside of equilibrium, loanable funds may accumulate, but only to be drawn down again as unemployment increases. To allow for various ways in which savings comes to equal investment, it is possible to employ an independent investment function rather than assuming that the quantity of savings automatically determines investment, as is the case in the usual set up of the World Bank and standard CGE model mentioned earlier.

In an alternative set up it is furthermore possible to model the public sector as a powerful agent, capable of making policy mistakes, but not barred by first principles from constructive participation in the economy. Key decisions, such as the level of public sector investment, transfers and the method by which deficits are financed, are

likely to reflect structural limits on institutional power. Real-world governments tax, spend on current and capital accounts, transfer, subsidise and provide assets to the private sector as a result of a complex series of negotiations with other powerful actors. Their reach is limited; they can effectively control some nominal magnitudes but are less successful with the corresponding real flows when prices are changing.

The interests of the private sector can conflict with public sector policies, but they may just as well be complementary. Policies succeed or fail if they stimulate private investment, output and employment, whether they are anticipated by rational agents or not. Private investment may then be crowded 'in' as well as crowded 'out' by government activity. If it is crowded in, the government has done its job properly; if it is crowded out the private sector does not agree with the policy and requires a higher interest rate to hold the debt by which the policy is financed.

As mentioned above, the price mechanism can rely on a mark-up over prime costs which include wages and non-competitive intermediate imports. The mark-up can be fixed or vary over the cycle, depending on the structural features of the economy. In more competitive economies, the mark-up is variable. Another crucial determinant is the degree of international competition. If competitive imports are a significant threat, the mark-up cannot rise with capacity utilisation as it otherwise might. If firms cannot fully pass along cost increases, then changing nominal magnitudes imply more rapidly changing real variables.

Constant mark-ups, economy-wide, mean that nominal wage increases are fully passed along. If the exchange rate depreciates at the same rate, then there is no increase in real wages or the real exchange rate since all elements of prime costs are rising together. Industrial sectors in fairly advanced economies such as that of South Africa can perhaps be modelled with fixed mark-ups so that cost increases are fully passed along and profits are insulated from a contraction in demand. Only empirical econometric analysis will tell us if this is the case

At the enterprise level, rational competitive producers increase their demand for labour until the value of the marginal product is equal to the nominal wage. However, if the marginal product is relatively constant, firms may exhaust the supply of willing customers before they exhaust the supply of labour. If the production function is irrelevant, marginal productivity conditions cannot determine the wage and some independent wage equations are a good alternative as mentioned above. Nominal wages adjust according to rules that must fit the economy under study, but real wages are the product of movements in relative prices as discussed above.

In the labour market and depending on market conditions, workers come to a decision about a target real wage. This target depends on the difference between the recent course of productivity growth and the real wage. The struggle for higher nominal wages increases with the difference between the target and current real wage. Success hinges critically on the level of skill. The more skilled the labour is, the higher the target and, presumably, the quicker the adjustment takes place. Tighter labour market conditions facilitate the adjustment and higher current rates of inflation provide additional motivation. For skilled labour, higher sectoral capacity utilisation

increases nominal wages. Lower-skilled workers may have to wait until the capacity utilisation is high in all branches before wages can rise, since excess capacity in any one branch provides a pool of labour for all to draw upon. Again, this calls for empirical econometric analysis in order to determine whether this is indeed the case in South Africa.

Interest rates and the exchange rate are closely linked in the minds of policy-makers concerned with inflation and the external accounts. The interest rate may be set by policy-makers concerned with the maintenance of an acceptable level of inflation, economic activity and reserves to cover imports for the next few months. The authorities cannot always contain speculative pressures and as long as capital flight is a possibility (as it almost always is), the private sector can effectively object to central bank policies as noted above. Growth in money supply is passive in this situation and serves as an indicator rather than a cause of more profound macroeconomic imbalance as is now a more acceptable thought in South African than in the early 1990s.

In an economy with a strong central bank and some capital and exchange controls, it makes sense to specify an exogenous interest rate reaction functions which has to be deduced by careful study of the behaviour of policy-makers. As the new rules are announced, the private sector may well react in ways which could induce further policy changes.

This intricate interplay is further complicated by public finance. As in any macroeconomic system, the public sector borrowing requirement (PSBR) can be financed in any one of three ways: by borrowing either from the private sector, or from the central bank, or from some source outside the country. If the PSBR is larger than the private sector is willing to hold, and the central bank is opposed to further monetary expansion, the government must borrow abroad. If it is not possible to increase foreign debt, the interest rate on government securities must be raised in order to induce the private sector to accept additional debt. A rise in the interest rate will generally cause the return on equities to fall relative to the return on government bonds. The composition of private sector portfolios then responds to a change in the pattern of relative returns on assets. The real-side effect of the higher interest rate is a lower level of investment. This highlights the importance of a financial block to the model often compiled in the form of a financial SAM.

A recent application of such an analytical framework for Paraguay by Gibson (2000b) which includes representations of the informal sector and human capital formation, focuses on policy responses to Globalisation has some relevance to South Africa:

> *The simple macroanalytics of current and capital account liberalization initially involves two contradictory forces. First, tariff reduction is essentially a tax cut which stimulates income, ceteris paribus. At the same time, the relative price effect of tariff reduction causes a rise in imports which offsets the expansionary fiscal effect. Whether output increases or not, the trade balance will initially deteriorate since exports adjust with a lag. Liberalization sets in motion a*

sequence of events which may well require a broader response from policymakers.

A key question is how to manage the real exchange rate, the interest rate and the fiscal deficit. If the state sees inflation as the main problem, it may attempt to use the nominal exchange rate to anchor the price system. The authorities may want to avoid nominal devaluation in an effort to attract portfolio investment by way of a stable currency. If the central bank believes that it must keep the interest rate high to prevent a loss of foreign reserves and the public sector is under pressure to meet a public sector borrowing requirement (PSBR) to GDP target, the combined effect can become contractionary. An overvalued exchange rate together with a high cost of capital leads to falling exports, lower capacity utilization and less formal sector employment. The decline in employment may be aggravated by an economy-wide increase in productivity to the extent that higher profitability does not induce sufficient offsetting investment. At the household level, families can easily slip below the poverty line.

The objective of the model is to provide a basis for policy advice on how to limit some of these contractionary effects of the medium-term consequences of liberalization. There are six adjustment mechanisms, not typically found in CGEs, at work in the model:

- As formal sector employment shrinks, redundant workers join the informal sector. They compete with the formal sector to satisfy aggregate demand, thereby further reducing formal sector profit, and employment and investment.
- The decline in formal sector labor demand reduces both employment and wages. The result is a reduction in household income. If per capita family income falls below a threshold, the dependency ratio (defined as the number of family members who depend on a formal sector worker) must be reduced. This means that some family members must withdraw from educational and training programmes and join the informal sector until a target dependency ratio is re-established.
- Slow growth means lower revenues for the state. If the government chooses to re-establish fiscal discipline by reducing public sector investment in education, health and other social services, the private cost of education will rise and the maximum acceptable dependency ratio must then fall.
- Trade and capital account liberalization initiates structural change in the labor market which can significantly affect the distribution of income. Stepped up participation in the export market generally raises labor productivity as well as introducing a "skill bias" that results from a shift in the composition of GDP toward more skill-intensive tradables. For a given level of aggregate demand, the formal sector absorbs less labor over all, as well as less unskilled labor.
- Income distribution can suffer in two ways; first, "extensively" in that overall employment is lower. The trend in the functional distribution of income favours capital. Income distribution also deteriorates "intensively" in that the gap in remuneration between skilled and unskilled wages widens. The inegalitarian distribution of income exacerbates the shortage in skilled labor

since the poorer unskilled workers are increasingly unable to afford education and training.

- A weak exchange rate would clearly help the extensive deterioration, but even progressive policymakers will be reluctant to devalue if they fear the resulting inflation would ignite a financial crisis or erode the real wages of their political constituencies. Managing inflation appears as the only feasible short-term goal, but even if the overvalued exchange rate serves successfully as a nominal anchor, the real interest rate will rise, at least temporarily. Local investment contracts as a result and with it output and employment. The economy begins to spiral downward.

Successful players in the world economy, on the other hand, see this scenario unfolding in reverse. Exports boom because they are competitive which in turn provides higher employment and real incomes. Because families can now afford to support more dependents, human capital accumulates and skilled labor supply increases. The informal sector shrinks and higher availability of skilled labor prevents bottlenecks that undermine international competitiveness. With higher family incomes, authorities believe they can sharpen competitiveness somewhat via nominal devaluation without provoking a social crisis. Some inflation aids in reducing the real interest and wage rates, at least temporarily. Higher capacity utilization will add to the pressure on inflation, but import competition prevents prices from rising too steeply, as does rising labor productivity. Investment is strong due to cheaper cost of capital as well as higher profit margins. With output expanding, public sector revenues rise so that the state can afford to keep the costs of schooling low.

The author then applies a dynamic CGE framework to test under which conditions current and capital account liberalization can yield positive results. The conclusions suggest that:

- Aggregate demand must be properly managed, as well as the exchange and interest rates and targeting of public expenditure. Relatively small differences in the policy response to the problems of liberalization can generate significant differences in the medium-term growth prospects. Nothing in the simulations of this paper suggests that the market alone will resolve these problems of coordination.
- If policymakers have a narrow conception of what makes the economy attractive to foreign investors, the simulation results presented in this paper suggest that the transition to a more open economy may falter. While the simulation results do not support a policy of unwarranted fiscal and monetary expansion, it is clear that a reluctance to devalue, combined with high real interest rates, falling inflation and fiscal discipline may become very costly in the long run.
- Above all, policies cannot abandon support for the poor without running the risk of creating a bottleneck in the market for skilled labor and a consequent loss of competitiveness in the export market. Even a successful transitionary

process cannot escape a worsening of the distribution of income and widening headcount of the poor. Here support is not limited to income maintenance, but also improvements in the social wage, in particular, reducing the private costs of human capital accumulation.

Building all or even just some of these kind of features in the existing modelling frameworks of the World Bank or the standard CGE is perhaps not possible and it may be better to consider the construction of a new modelling framework altogether, along the line of suggested above. Experience tells us, however, that considerable human resources need to be committed for an extended period before any fruitful results and insights will appear.

9. What is a doable framework for the HSRC initiative?

Keeping in mind the limitations of models: as mathematically expressed analytical tools for testing and comparing the economy-wide effects of proposed policies, they are in themselves not able of actually producing the policies, it is still the only way to get a quantitative expression to the impact of policy formulation that focuses on employment creation. The following recommendations are drawn from the above.

- Labour market forecasting appears to be a high priority for the HSRC. Here the use of a combination of a macroeconometric forecasting model, such as the one at the BER, an input-output industry outlook framework, such as the one that is currently considered by the DTI and a detailed labour market breakdown of the demand for labour by skill and occupation group, to be developed at the HSRC can be considered at short notice as a complementary consistency tool to a repeat of the labour market survey currently considered at the HSRC.
- Of the existing CGE modelling frameworks that are currently in working order, Van Heerden & de Wet (2001), IDC (1998), and UCT's comparative static version of the standard CGE applications based on Lewis (2001), the latter seems the most appropriate and accessible for immediate use.
- The Thurlow & van Seventer framework is now almost finished but still needs to be reviewed. In terms of comparative static applications this framework will also soon be ready for applications. Further conceptual development in the direction of including dynamics is also on the cards. In terms of human resources this option probably requires a team of two modellers, a senior specialist at half time and a junior person working full time at updating, maintaining, expanding and applying such a framework. Because of the rather generic approach the team will need to be supported only on an ad-hoc basis by institutions such as IFPRI. Important consideration is that the team should be allowed to travel to relevant meetings and conferences in order to keep abreast of the latest developments.
- Micro-macro simulations are beginning to be developed elsewhere and it would appear that this is a becoming a more important tool in the near future. Although this has not yet been attempted in South Africa there is some interest to move in this direct. TIPS is currently exploring the use of South African household surveys and IFPRI (Cogneau & Robilliard 2000) is interested in this kind of work and has been involved in similar developments elsewhere, while DFID has expressed an interest in some funding. The team outlined above could in principal take on the required model development, but it needs to be expanded with a further fulltime junior associate that focuses on the household income expenditure surveys with ad-hoc assistance of a senior specialist in this

area (2 months per year). Such a specialist can probably be sourced locally. In addition, the scale of this project may require the establishment of a reference group that meets, say, four times a year. Foreign travel allowance is also important here.

- Going beyond the standard CGE framework as described by for example Gibson (2000b) is important for the reasons mentioned above. However, this probably requires the creation of a new framework as it deviates too much from the standard CGE framework currently under development by Thurlow & van Seventer. This will require extensive data development on the informal sector as well as new programmeming even if some elements of the old DBSA framework can be dusted off. Ideally one would like to combine such a framework with the macro-micro type of analysis mentioned above to get to more resolution in terms of poverty and household income distribution. In addition to the human resources mentioned above, the development of a more comprehensive modelling framework, including informal sector, real-financial interactions and alternative specifications as regards prices, wages, investment, will require ad-hoc assistance by a senior specialist in this area (2 months per year). Such a specialist can probably not be sourced locally. In addition, the scale of this project may require the establishment of a reference group that meets, say, four times a year. Foreign travel allowance is also important here.

Table 2 – Summary: human and other resource requirements

Option	Description	Human resources	Additional resource requirements	Delivery framework
1	Standard CGE framework, extended to include: dynamics	1 x Senior Specialist (half time) 1 x Junior Specialist (full time) Ad-hoc assistance (1 month per year) Reference groups (minimum 4 members, 4 meetings per year)	2x up-to-date computer hardware with extended capacity Specialised software such as GAMS (basic plus 2 solvers: $1 920 for an academic licence, $9 600 for a commercial license, see www.gams.com) Foreign visits (x2 for team)	Draft working papers: end 2002 Policy papers which include amongst others CGE applications: 1st quarter 2003
2	Standard CGE framework, extended to include: dynamics and macro-micro simulation abilities	1 x Senior Specialist (half time) 2 x Junior Specialist CGE/HH surveys (full time) Initial specialised assistance (2 month, probably foreign) Ad-hoc recurring assistance (1 month per year, probably foreign) Reference groups (minimum 4 members, 4 meetings per year)	3x up-to-date computer hardware with extended capacity Specialised software such as GAMS (basic plus 2 solvers: $3 840 for an academic licence, $19 200 for a commercial license, see www.gams.com) Foreign visits (x2 for team)	Draft working papers: 1st quarter 2003 Policy papers which include amongst others macro-micro simulation applications: 2nd-quarter 2003
3	CGE with alternative model specification, dynamics and micro-macro simulation abilities	1 x Senior Specialist (half time) 2 x Junior Specialist CGE/HH surveys (full time) Initial specialised assistance (4 month, probably foreign) Ad-hoc recurring assistance (2 month per year, probably foreign) Reference groups (minimum 4 members, 4 meetings per year)	3x up-to-date computer hardware with extended capacity Specialised software such as GAMS (basic plus 2 solvers: $3 840 for an academic licence, $19 200 for a commercial license, see www.gams.com) Foreign visits (x2 for team)	Draft working papers: end 2003 Policy papers which include amongst others CGE and micro-macro simulation applications: 1st quarter 2003

Finally, experience suggests that the research/dissemination approach by itself has a rather slow impact on working practices within policy-making institutions. There are many reasons for this, including

- The limited capacity of policy makers and official policy analysts to absorb the results of research in a manner that informs policymaking;
- The lack of institutionalised channels for feeding the results of research undertaken by academics or independent researchers into the policy making process;
- The lack of ownership felt by policy makers when presented with findings by outside researchers (even when policy makers have commissioned these).

It is suggested that the research process has to go hand in hand with developing the capacity to absorb research outputs and to use the methodologies in their own policy analysis. TIPS has been involved in several training initiatives together with UCT's School of Economics to conduct capacity building in the area of economy-wide policy impact analysis. They have generally followed a sequence in which we start by looking for a week at first generation models (see www.tips.org.za for a fuller description) followed by two-week course on second-generation models. First-generation applications are useful for policy analysts in government institutions such as the DTI because they do not require specialised software and a high threshold. Participants to this course are subsequently allowed to attend the second-generation modelling course. Both courses are also part of UCT's Trade and Regulation Masters Programme and can be considered as an opportunity to discover potential modellers. The 2001 (first and second generation) courses yielded about three useful modellers that can be considered for participation in the HSRC programme.

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