Economic Commission for Africa

Economic Policy Research Center

Pro-Poor Growth Strategies in Africa

A Proposed Gender-aware Macroeconomic Model to Evaluate Impacts of Policies on Poverty Reduction

Expert Group Meeting
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I. Background

The proposed gender-aware model to be presented for a review and endorsement by an Ad hoc Expert Group Meeting on 7 - 9 May 2003 is for the African Centre for Gender and Development (ACGD) of the United Nations Economic Commission for Africa (ECA) to develop for use by governments in Africa. The work aims to develop capacity in African countries to provide a unique value-added to current poverty reduction strategies through gender-aware national accounts and national budgets. This work was prompted by a strong mandate of the United Nations General Assembly Resolutjon (1997) and the Beijing Platform for Action (1995) to engender national development plans.

To launch this programme, ACGD developed in 2001 a conceptual framework for mainstreaming gender perspectives into national accounts and national budgets. The framework, which provides the basic knowledge to support valuation and integration of women's work in these instruments was validated by an Expert Group Meeting in May 2002, Yaounde, Cameroon and endorsed by African Policy makers in October 2002 in Johannesburg, South Africa.

The Ad hoc Expert Group meeting noted that the Beijing Platform for Action (1995) identified women's non-market work (NMW) as a key area of policy intervention to improve the situation of, especially, women in the non-market economy. Women's NMW, which needs to be measured includes domestic work, care of children, the sick and elderly, and voluntary community work. Valuation of women's work would give an accurate picture of their contribution to GDP for better policy formulation. Targeted services/resources can then be channelled to NMW that could reduce women's time burden and free some of their time for market-based activities. This can potentially increase their overall productivity, income generation, economic growth and poverty reduction. Thus, the meeting recommended that women's NMW should be the focus of this programme.

The meeting however noted that integration of this statistically invisible NMW into the System of National Accounts (SNA) and national budget poses several challenges. First is how to get the commitment of key decision-makers, who need to be convinced of the importance of addressing gender-related constraints of growth and poverty reduction. Second is the overwhelming lack of frameworks, tools and methodologies at national and sub-regional levels for engendering these instruments. Third is the little understanding of how macroeconomic policies impact on women's welfare, their productivity and how this relates to the overall macroeconomy. And fourth is the urgent need to increase the current low national capacity to engender national planning instruments.

The meeting recommended that ACGD should launch the programme as soon as possible, beginning with fielding inventory studies to generate information for developing analytical

tools including gender-aware models. Aware that a model will be a powerful advocacy tool to evaluate impacts of fiscal policies on women, growth and poverty reduction, the meeting further recommended that ACGD should constitute an Advisory Expert Group on Gender-aware Modelling to consider in detail the appropriate model for this function. To this end, ACGD engaged a consultant from September - October 2002 to undertake the inventory studies in African countries of existing sex- disaggregated data, gender-aware tools and capacity to engender national planning instruments, and for evaluating fiscal policies. The consultant visited Ethiopia, Cameroon, Uganda, Ghana, Kenya, Zambia and South Africa and discussed the status of comprehensive and gender sensitive data with the officials of the National Statistical Bureau of these countries. She also collected information through Emails and through the Internet.

A major finding of the mission is that there is a critical lack in African countries of appropriate tools for engendering national planning instruments, and for evaluating impacts of macroeconomic policies. Accordingly, the mission recommended that ACGD should develop tools for building the capacity of African countries to: (i) integrate gender perspectives into their planning instruments; (ii) use the engendered national accounts to deepen the understanding of national decision makers on the potential contribution of women to GDP and to assess impacts of national budgets on women's time-use; and (iii) to construct a gender-aware model to evaluate impacts of macroeconomic policies, on women's welfare, growth and poverty reduction. The mission also recommended that ACGD should convene an Ad hoc Expert Group meeting to consider these tools.

These recommendations took cognizance of lessons learnt during the last thirty years. when developing countries, especially, in Sub-Saharan Africa faced major macroeconomic shocks associated with among others, fluctuations in the world price of raw materials and agricultural exports or economic policy reforms such as structural adjustment programmes (SAPs) and the liberalization of commercial trade. These shocks have had significant repercussions on the economies of these countries in particular, in terms of income distribution and poverty levels.

For example, over the past decade, there has been a growing recognition of the importance of macroeconomic policy in influencing women's welfare and their prospects for economic empowerment. It can worsen or improve the living standards of women and contribute to narrowing or widening gender gaps in incomes, health, education, nutrition etc. There has also been increasing concern on how gender inequality can constrain the outcomes of macroeconomic policy. For example, recent work (Haddad et al, 1995, Çagatay, Elson and Grown (eds), 1995; World Bank. 1995; Palmer, 1995) shows that economic reforms with decreased incentives can reduce women's output or restricted access to education, can hinder women's ability to develop their human resources.

II. Scope of Issues

Although gender-related development issues have prompted serious debate, the absence of appropriate gender-aware macroeconomic analytical tools has penalised quantitative analyses. More generally, it must be recognised that there are few instruments, which can relate macroeconomic policy and microeconomic behaviour. In this context, Computable General Equilibrium (CGE) Model is one such a tool than can address these concerns. Such models have been applied to a range of policy questions in a number of economic fields over the last ten or so years. They include public finance and taxation issues, international trade issues, evaluations of alternative development strategies and the implications of macroeconomic policies.

After independence, the African countries adopted an interventionist approach to industrialisation and development. The commercial policies generally kept import prices high, while its tax code selectively promoted certain firms and penalised others. These policies for most countries continued into the late 1980s and early 1990s, when the current account balance in most countries was depleted to a crisis level and structural reforms as recommended by the IMF was implemented together with other fiscal policy reforms. As a result, many African countries such as Cameroon, South Africa, Uganda and others have implemented important commercial and fiscal policy reforms since early I 990s. It is critical to examine such policy reforms through an analytical and quantitative framework and evaluate how fiscal policies bring about a more equitable growth in Africa. From these findings industrial policies could be developed, which would help African economies to utilise their comparative advantages in order to compete in the international market.

Macroeconomic stability and competitive real exchange rates are prerequisites for improved industrial performance, but they are not enough in themselves. Development of competitiveness and enhancement of technological capability require a strengthening of the rule of law and of property rights so that contract can be enforced with the creation of market-supportive institutions to ensure competition and encourage market flexibility. A particularly pressing requirement in Africa is investment in the extension and rehabilitation of the infrastructure - essential if enterprises are to respond to devaluation and other price incentives. Impact analysis can show what volume and patterns of government investment can provide a stimulus to investment by the private sector. Industrial policy also needs to focus on how to spread the benefits of industrial expansion to bring about true economic development. It is generally accepted that the incomes of both the rural and the urban poor must be raised. Food security and employment opportunities are essential features of the spread of the benefits to the poor.

A model analysis would spell out how improved food securities create effective demand and wide markets for consumer goods. The model should answer questions such as: Did reforms create a coherent new set of signals? Was the net effect to stimulate the production of tradable

goods? Was disparity in tax burdens and women's time burden lessened? The broader macro framework designed to strengthen competitiveness is the removal of the anti-export bias that arises in most African countries as a result of continued protection against imports. Continuing protection overvalues the exchange rate and leads to a bias against both exports and import- competing industries in favour of non-tradable such as services. In addition, there is a bias within the tradable sector (that is, importable and exportable products) in favour of import-competing products. This bias results from the incentives that import protection gives for resources to move into import-competing industries and non-tradables and away from exports. A number of African countries, including Mauritius, Kenya, Zimbabwe, Madagascar and Nigeria, have adopted a variety of the export promotion measures, such as have been developed in Asian countries in an attempt to counterbalance this bias. These include export processing zones (EPZs), duty drawbacks and exemptions on imported intermediate products, and in-bond manufacturing. The impacts of such policy reforms are yet to be evaluated.

The composition of government expenditure is as important as its level. This applies particularly to infrastructural investment, which encourages rather than crowds out investment by the private sector, and which increases the likelihood that the price incentives provided by liberalisation will lead to faster growth. Development expenditure on rural infrastructure may be particularly beneficial, by increasing supply response and reducing transport and storage costs. Raising living standards in the immediate future will reduce the damage to the environment that results from pressure on livelihoods when people live in poverty. Social sustainability requires human populations to continue to function in the face of physical shocks such as drought and economic stresses such as fluctuations in crop prices through a check on policy changes.

It is widely recognized that policy changes such as trade policy reforms through reduction of tariff, introduction of export incentives and creation of export promotion zones, etc., or programmes such as SAPs would differentially affect women and men. One reason for this is the nature of participation in work. Greater competition and a need to reduce production cost generally lead to informalization (Portes et al., 1989). It is observed that most of the female work force is involved in informal activities, and there are indications of an increase in the labour force participation of women in the informal sector (Çagatay, Elson and Grown, 1995). The concern expressed by these studies is that the burden of non-market work undertaken by women had increased with such policies. The studies generally indicate that the quality of life has deteriorated for women with the process of structural adjustment mainly because gender relations and outcomes are not considered while implementing such policies.

III. Alternative Approaches for Fiscal Policy Analysis

A very critical policy instrument that the government can use is fiscal policy mechanism. It is important to examine econometric techniques that are essentially suitable and also used more extensively to analyze questions that address issues of development and poverty. Through use of such policies the government changes the structure of an economy and generate revenues and undertakes expenditure. The impact of fiscal policy changes on women and poverty needs to be examined to make suggestions about how such policies should be designed, modified if necessary and implemented. Impact analysis can be carried out through many approaches and most of these can be classified as qualitative and quantitative.

3.1 Qualitative approach

Studies and surveys can be undertaken to collect and analyze information about the nature of refonns, the exact way such refonns are implemented and the resultant impact on different groups of people within the area surveyed. The studies attempt to build reasonable linkage between the reform and the changes in the welfare of different groups such as women labourers and non-market workers. With such an approach a very detailed understanding of the focus of the reforms, the exact implementation procedures and the changes experienced by the group in which the researchers are interested can be obtained.

Several studies have analyzed impacts of policy changes in developing countries on poverty and inequality. Squire (1991) and Van der Hoeven (1996) have conducted reviews of the linkage between adjustment and poverty during the 80s. The findings of qualitative analysis between the relationship between reforms and poverty are presented in a short review by Killick (1995), and White (1997) provides a more recent review on this. Such work describes methodically the reforms undertaken in a country and the changes in a variety of welfare indicators among different household and socio- economic groups. Studies have been also reported in a series of Background Papers on " Globalisation with Human Face" prepared for the Human Development Report 1999 (UNDP, 1999). Similarly Cornia (1999), Handa and King (1997), McCulloch, Baulch and Charel-Robson (2000) provide similar analyses for different African countries.

This approach however cannot identify the exact linkage between for example, trade or fiscal refonns and the welfare changes, as these cannot be tested. The result seen after a policy change could be due to other reasons or mixed outcomes and no direct linkage can be traced without any quantitative connection. Moreover in case there is no impact observed after a policy change this could be really due to some countering factors, even though policy changes have had a direct impact on the stated objective. And, conclusions through analyses using qualitative study cannot be taken as general and should be limited only to the specific

group interviewed. Such studies in spite of being very valuable for in-depth understanding have strong limitations. The inability of descriptive studies to provide a robust causality between impact and result has made research in modelling approaches more demanding, hence the initiative of ECA to embark on quantitative approach to policy evaluation.

3.2 Quantitative approach

Policy makers are interested in studying the impact of particular policy measures, like change in income tax, on welfare of people below poverty linens and other socio- economic categories of households. It is possible to study impact of policies that are targeted and are not likely to have major indirect impact on other variables of an economy. However, economy wide analysis is essential when indirect impact of policy changes are wide and other groups and other markets are affected as a result of a trade or fmancial policy.

3.2.1 Time-Series Econometric Models

Over the past 20 years vector autoregressive (VAR) analysis has become a standard tool in empirical research. For the questions we seek to answer the VAR approach is attractive for several reasons. First, it is a flexible way of modeling since it allows all past variables to effect any present variable. Thus it does not force a certain theoretical structure upon the data (as far as past values are concerned). Many specifications, in particular standard OLS can be seen as special cases of a VAR specification. Second, it is a systems approach that takes into account the interaction of variables. In particular the impulse responses calculated from the VAR trace an innovation to one variable through the entire system. Third, it is has desirable time series properties. In a seminal paper Sims, Stock and Watson (1990) have shown that "... the common practice of attempting to transform models to stationary form by difference or cointegration operators whenever it appears likely that the data are integrated is in many cases unnecessary."

Any coefficient that can be written as a coefficient on an I (0) variable, and in a VAR model these are all estimated coefficients other than those on the constant and the trend, are consistent and have standard distributions (see also Watson 1994, Hamilton 1994). Thus VAR analysis is a convenient tool, when one has doubts about the order of integration of the variables, as is often the case with macro economic data.

Time series techniques have been applied extensively to economic data analysis. Useful applications using frequency domain techniques can be found in Granger and Eagle (1981). The most obvious, and oldest, application is to model a single series to provide what are termed "naive" forecasts against which the forecasts from full-scale econometric model can be compared. More recently, the economic models have performed relatively better, although a more stringent criterion was suggested by Granger and Newbold (1977). It will be interesting to continue to compare forecasts from the two types of model. More natural comparisons

are between econometric models and multi- variate time series, although the best way to specify the latter is still uncertain. No complete comparision of relative forecasting abilities is available at this time. Multivariate time series techniques can also be used to measure the importance, in terms of improved forecasting ability, by adding further variables to the model.

The ARCH model has been used in a number of applications. Engle (1980, 1982) has shown that there are significant ARCH effects in U.S. and U.K. inflation data, and Engle and Kraft (1981) derive conditional multi-period forecast variances from an autoregressive model where the disturbance follows an ARCH process. Robbins (1981) estimates a model in which the conditional variance of excess returns for short rates affects the liquidity premium for long rates. Engle, Granger And Kraft (1981) use a multivariate ARCH model to compute optimal time varying weights for forecasts of inflation from two competing models.

The obvious applications of univariate spectral analysis are to investigate the presence or not of cycles of data. A related application is to compare the estimated spectral shape with that suggested by some theory. Estimate spectra of a wide range of economic series give no evidence of strict cycle except for the seasonal component.

Howrey (1972) calculated the spectra of major variables implied by the Wharton model and compared them to the typical spectral shape and generally found the econometric model did produce the correct spectral shape. The power spectrum is obviously useful both to find out if series contains a seasonal component to measure its strength and also to investigate the effect of seasonal adjustment. The spectral technique has been used also by Sargent and Sims (1977), the Guweke (1975, 1977) and Singleton (1980) to examine unobserved variables in a group of series. The way econometric has developed in the recent year the difference between time series method and the rest of econometrics has become fuzzy. The textbooks on econometrics such as that by Maddala (1977) confirm this view.

The *socia/-we/fare-fimction approach* to policy evaluation allows tradeoffs among the endogenous variables by assuming the existence of a social welfare function to be maxirnised by choice of the instruments subject to the constraints of the model. If W (YT+l,^{r}T+l) is the social welfare function, dependent on both endogenous variables and policy variables and policy variables in the next period, the problem is subject to the constraints of the econometric model.

$$\max_{r} W (YT+I, {}^{r}T+I)$$

T+I

In the case of the non-linear model, W is maximised, so the problem becomes

max W(Φ(YT+1,ZT+l, ^{r}T+1,δ)+ÚT+l,.^{r}T+l)

Generally the social welfare function is a loss function to be minimised. This approach allows trade-off among endogenous variables which policy makers can specify as social welfare function (pindyck, 1973; Chaw 1975, 1981). In case of the simulation approach we can determine alternative combination of policy variables and endogenous variables for a given set of possible policies. In case of ^{r1}T+1, r^{2}T+1….r^{s}T+1 being a set of alternative policy option to carry out simulations to determine the outcome of the endogenous variable where in the case of non-linear function takes the following forms:-ûYw

The policy makers would provide the model builder with alternative policy options whereas the modeller would provide the findings of their result using this policy option. This would make it possible at the governmental level to choose a set of desirable policies depending on the outcome. It is interesting to note that in such simulation exercises on maker's alternative policy option can be incorporated into a macro econometric model if the policy maker can explicitly formulate the steps to be taken. Therefore, this process brings a communication between policy makers and economic modellers so as to formulate the desirable set of polices for improving the condition of the economy.

Unsurprisingly, these advantages of time-series econometric models come at a price. First, the number of variables that can be included in the VAR is limited because due to its unrestricted nature the model runs out of degrees of freedom quickly. "In practice, VAR modeling for more than four variables is rarely feasible" (Charemza and Deadman 1997). Second, since it is a systems approach that rejects the standard endogenous-exogenous distinction, it is against the grain of the model to include exogenous control variables. Thus we do not have control over variables other than the ones in the system except for a time trend. The standard VAR approach regresses all variables on its own lags and the lags of all other variables. Thus, VAR analysis may be inappropriate for gender-aware evaluation of fiscal policies.

3.2.2 Approaches in Macroeconomic Models

Modelling approach has been used for economic analysis for a long time. A model is a simplified representation of the real economy. Econometric models are generally algebraic models that are stochastic in including random variables (as adopted to deterministic models, which do not include random variables). The random variables are generally included as additive stochastic tends to account for human measurement error of data and omissions of variables, etc. Such models can be either linear or non-linear.

One of the earlier applications of the econometric models is to the estimation of the demand relationships (lntriligator, 1978). Pioneering work on demand relationships started in the

nineteenth century with Engel and continued with Scultz and Moore. The functional forms have varied for such models but the most convenient ones are the constant elasticity log linear specifications. The other form is the semi logarithmic specification and the last important specification but not of the least importance is the linear expenditure system.

Apart from econometric modelling of demand there has been progress on modelling of production functions. These functions are used to estimate production of goods with different types of inputs. As in the case of demand equations there are a number of econometric forms of production functions. The most commonly used one is again the constant elasticity log linear specification or the Cobb-Douglas production function (Marsheck and Andrews, 1944, Douglas). In this form the disturbances are treated as exponential. The second widely used form is the constant elasticity of substitution (CES) production function (Arrow, Chenary, Minhas and Solow, 1961). A third specification is the transcendental logarithmic production function (Christensen, Jorgenson and Lao, 1973).

In the 1960s and 1970s many important developments took place in econometric theory and applications. It should be mentioned that great advances have been made in time series analysis. The technological breakthrough of computers and development of sophisticated packages in data handling has made it possible to venture on ambitious data related work. This development has helped in application of econometric methods to household expenditure, demand functions, production and cost functions and macroeconomtric models. Macroeconometric models starting with pioneering work by Timbergen in the 1930s represent very useful application of econometric analysis to determine the Gross National Product and Gross Domestic Product. These models are used to for major three purposes, structural analysis, forecasting and policy evaluation.

The general algebraic form of the macroeconometric model is

$Y=C+I+G$

C=C(Y…,u),
I=I«Y,….,v).

35. In case of policy evaluation, it is possible to assume a set of policy variables included amongst the exogenous variable of the model. The structural form can be:

$$F\ (Y_t, Y_t\text{-}l\ , Z_t\ , r_t, \delta) = \xi_t$$

And for the linear model:

$$Y_t\Gamma + Y_{t\text{-}l}B_1\ z_tB_2 + r_t\ B_3 = \xi_t$$

Where we have a vector of non-policy exogenous variables Z_t a vector of policy variables r_t which are *instruments* in the model. The corresponding reduced form for the model in non-linear specification:

$$yt= \Phi(Y_{t-1}, Z_t, r_t, \delta) + U_t$$

Which can be written in the linear form

$$y_t= y_{t-1} \prod_1 + Z_t \prod_2 + r_t \prod_3 + U_t$$

where:

$$\prod_1 = - B_l \Gamma^{-1}; \prod_2 = - B_2 \Gamma^{-1}; \prod 3 = - B_3 \Gamma^{-1}$$

The problem of short term policy evaluation means choosing at time T a particular set of policy variables T+1 such that r*T+1 under assumption that Y_T is known. Policy analysis using such models can be carried out by at least adopting three alternative approaches: the instruments-targets approach, the social welfare approach and the simulation approach. In the first approach it is assumed that there is one target for the endogenous variable i.e., GNP or GDP. The solution of the model

$$Y_{t+l}= \Phi (y, z_t, r_t, \delta) + U_t$$

An extremely useful model of the 1950s was the Klien-Goldberger model of the US economy over the periods 1929-1941 and 1946-1952 (Klien, 1950, Chris, 1960), which also looked the issue of forecasting GDP and GNP. Two other models that were influenced by this model were the (i) Brookings model for structural analysis of cycles and for growth and policy evaluation. and (ii) the Wharton model developed explicitly for developing forecasts of the future of the economy such as national income components and employment. They are used regularly to forecast eight or more quarters under alternative assumptions regarding exogenous variables, such as government monetary and fiscal policies.

The social welfare function approach to policy evaluation allows tradeoffs among the endogenous variables by assuming the existence of a social welfare function, which is maximised subject to constraints of the model (Pyndick. 1973, Chow, 1975, 1981). The *simulation approach* in econometric modelling does not require a welfare function. The policy makers would provide the modeller with the alternative policies and the modeller would determine the impact of the changes on the endogamous variables of the model (Lucas and Sargent. 1980 and Sargent 1981).

3.2.3 General Equilibrium Models

The general equilibrium models are macroeconomy wide models and are multi-agent, multi-commodity models. Such models have the advantage of responding to shocks while fulfilling the conditions of optimality of agents' behaviour, technological feasibility and resource constrains. General equilibrium analysis has a strong theoretical grounding. In the I 970s there were major advances in solution techniques that permitted application of general equilibrium models to actual data sets. With improvement in data collection and advances in computer technology and software, this has been increasingly used as an advanced methodology of applied policy work. The applied models are treated as representation of reality. Economic theories form the basis to such models, namely, optimization behaviour, budget balance and market clearing.

Since the mid seventies, the question of imperfect competition, increasing returns, price rigidities and many extensions addressing different market and institutions can be included in such models. The general equilibrium concepts have important normative value. The welfare theorems have described relationship between general equilibrium and welfare optimum. Such models have therefore been used to formulate welfare policies. General equilibrium models also facilitate relevant data collection and organisation of such data in a social accounting matrix (SAM) in which different accounts are disaggregated according the focus of the Study.

The first general equilibrium model for a developing country was the model on Korea by Adelman and Robinson (1978). Both this model and later the model by Lysy and Taylor (1980) addressed the two broad questions: (i) what were the impacts of different development strategies on distribution and (ii) what policy packages would reduce incidences of poverty and ameliorate the worsening of distribution, which accompanies industrial reforms. Throughout the 1970s the focus remained on developmental issues and income distribution.

Adelman and Robinson's (1978) classic study of Korea contains 15 different occupational groups, including capitalists, self-employed people and wage laborers, and explicitly models the distribution of income within each of these groups. This approach allows for the estimation of the inequality effects of policy reforms. Similarly, Sahn et al (1997) estimation CGE models in the tradition of Dervis et al. (1982) for five African countries. They then consider the impact of different forms of adjustment to terms-of- trade shocks and show that both the urban and rural regimes.

Kanbur (1987) attempts a simpler approach, which exploits general equilibrium concepts to provide key sectoral divisions, but which also draws on literature on the quantitative measurement of poverty. His model examines the impact of switching policies (that is, exogenous relative price changes, which may be caused by devaluation or trade reform) on poverty,

taking account of the fact that poor households in many countries have multiple sources of income.

More recently, Thorbecke and Jung (1996) used a 'multiplier decomposition' method to measure the impact of different production activities on poverty alleviation. The total impact of a change in the output of a given sector on poverty alleviation depends on the resulting income gains accruing to various household groups and sensitivity of the selected poverty measures to these income gains. Numerous studies have used the Stolper-Samuelson theory (Addison and Demery 1985). These studies exploit the simple two-good/two-factor model. In the short run, both factors employed in the sector that gains from the price change should gain, while the factors that is used intensively in the gaining sector will benefit while the other will lose (see Winters, 2000, for the limitations of simple applications of the Stolper-Samuelson theorem for poverty analysis).

Bourguignon et al. (1992) provide a more ambitious integration of distributional and poverty concerns into general equilibrium modelling. They construct a 'micro- macro' model that combines the explicit portfolio behaviour of macroeconomic models. The impact of policy changes on the distribution of income and wealth (and thereby on poverty) comes through four channels: changes in factor rewards affect household incomes; household real incomes are also affected by changes in real returns on financial assets; and the distribution of household wealth is affected by capital gains and losses. The authors provide estimates for the poverty effects of a number of adjustment policies when applied to a 'representative' developing country of the early 1980s.

Similarly, Bourguignon et al. (1991) uses a similar model of two archetypal economies for Africa and Latin America to examine the impact of different adjustment policies on poverty and income distribution. Three adjustment packages are considered: a rationing adjustment package in which adjustment occurs through import rationing; a structural reform package, which applies the trade and tax reforms typically espoused by the World Bank and the IMF; and a redistribution package in which the structural reform package is augmented by food subsidies and a public works programme.

The structural reform package provides the best poverty outcome, especially when complemented by the redistribution package. Robilliard et al. (2001) took this one step further by lining a national level CGE model for Indonesia to a 'microsimultaion' model based on household survey data.

Finally, although most national level CGE models now incorporate several disagreggated household types, virtually none take account of the gender division of labour within households. Notable exceptions are Fontana and Wood (2000) and Sinha and Sangeeta (2000) who treat male and female labour as separate factors of production. Fontana and Wood (2000) progress further as they also include reproduction and leisure as separate sectors. Using data

from Bangladesh they show that the impact of trade liberalisation on women can be quite different from impact on man so that policies that 'non-gendered' analysis might regard as positive may have negative outcomes for poor women.

3.2.4 CGE Models

The basic CGE- model is specified as follows. There are r commodities, m consumers and n firmst some commodities (factors) are not produced: n<r. Thoset which are produced. are called goods.

Consumer I, 1= 1,…,m has preferences given by a utility function Uj : Rr + →R which is strictly concave, nonsatiated and increasing for at least one consumer (say consumer 1). Each consumer owns nonzero endowments of factors but there are no endowments of goods. Factor endowments of consumer 1 are strictly positive.

Firm j, j= 1,. . .. . .., n produces a single commodity and there is at most one fInD producing each commodity. Its production function f_i: R^r + →R_+ requires positive inputs of at least one factor (like labour). It is monotonic, has constant returns to scale, strictly convex isoquants and inaction is allowed f_i (0)=(0).

We denote consumption by x_i input demand by v_i, gross production by q_i and prices by p. A competitive equilibrium of the basic CaE-model is an allocation x^*_i , q^*_j, **v***j supported by a price vector p., such that:

> (1) Such that consumer maximise their utility subject to a budget constraint. (2) Firm maximise their profits, markets clear determine related price.

The base of CGE model is a social accounting metrix (SAM). Policy analysis can be best carried out using various CGE models to study the impact of indirect taxes, trade policy, income redistribution and public investment. A wide range of examples can be studies from Adelman and Robinson (1978) Dervis et al (1982) etc. The impact analysis includes policy changes on GDP, incomes of various target groups or welfare criteria, market share or production in various industries.

The advantage of CGE models is that it interconnect general equilibrium effects on different policy option (e.g. in study by Narayana et al (1991) which shows that the combination of investment of infrastructure with welfare schemes such as food for work programme is a very effective way of reducing poverty compare to providing food subsidy. In another study by Clarete and Roumasset (1990) trade liberalisation for agricultural commodities has been examined and their results show the growth actually depends on quantitative restriction on industry. Simulation runs can be designed by using the CGE models so as to get various welfare findings. It is possible to determine the winners and losers due to change in policy.

Applied general equilibrium models have been used to analyze a wide variety of policy issues. Trade liberalization was an early field of application. New developments in this area include the modelling of increasing returns to scale, imperfect competition and trade in new commodities such as emission rights. Also the effects of international migration have been studied. Unlike in the earlier studies the new applications suggest that the welfare gains from liberalization can be substantial. Applications, which focus on agriculture often, find that price reform needs to be supplemented with public investments in infrastructure and irrigation: growth perfonnance cannot be explained from price policies alone. Models developed for evaluating energy policies have recently been amended. They are now designed to approximate infinite horizon trajectories and have been extended to deal with environment problems, in particular emission taxes.

Recently, many of these applications have given a more satisfactory treatment of dynamic issues including money, financial assets and demography. The models now often incorporate perfect foresight as well as constraints on short-run adjustment. This has made them suitable for the analysis of phasing issues in policy reform. *For* example, equilibrium models have been used to compare abrupt and gradualist form of structural adjustment [Bourguignon and Morrisson (1992) and de Janvry et al. (1991)]. The dynamic models have the advantage that they show how resource allocation changes over time: as stressed by Powell and Snape (1992). It often is obvious in which sectors jobs will disappear as a result of trade liberalization measures, but not where new jobs will be created.

Overall the domain of applied general equilibrium modelling has expanded. In spite of this success the approach remains in some ways problematic. First the empirical basis is often weak in two respects: the database is incomplete and many of the parameters have not been estimated by formal econometric methods or the estimation methods are very crude. This may restrict the operational usefulness of a model but obviously this cannot be judged in a review such as this one, since it would involve detailed descriptions of country specific circumstances.

Secondly, there are problems in the application of theoretical models. The use of the equilibrium concept in applications remains controversial, for example by ruling out false trading. Applied work in the areas of imperfect competition, non-convexities, infinite horizons and financial assets is quite vulnerable to theoretical criticism. In addition in some cases the theoretical models themselves are still weak (e.g. when they assume perfect foresight).

Nevertheless, the field is promising: theoretical general equilibrium analysis is an active field of research and increasingly applied modellers have shown their ability to incorporate advances in theory.

IV. Gender-A Ware Models

4.1 Gender-aware Models

Macroeconomic policies have different consequences on women and men because women and men differ in their economic and social status. For example, women and men respond differently to economic and trade policies because they have different sets of private resources and levels of access to public ones. Meanwhile, the social and human development impact of macroeconomic policy must look at how choice sets have been altered and how alterations have affected women and men. Both kinds of impact analysis, in turn, help determine the changes in the welfare of both genders. What determines status and control over resources? And what determines women's and men's choice sets? Households operate in an environment structured by economic incentives and institutional constructs.

There are not many models at present having a gender dimension. Still currently with the importance of understanding the contribution of non-market work a few gender-aware CGE models are being developed. A gender-aware CGE model would naturally distinguish between men and women in its variables and behavioural relationships. The Fontana and Wood model (2000) allows for capturing the interactions between productive and care sectors of the economy. Female wage rates rise when the leisure and care sectors are omitted. The changes are larger because omission of leisure and care sectors makes the supply of labour to the market economy much smaller and less elastic. This model considers the details of gender composition of the labour market and household work. The paper studies dte impact of world price change on male workers and female workers in terms of both market and non-market work.

In a CGE model developed for India, Sinha and Sangeeta (2000) distinguished six factors of production by gender and further into rural, urban, fonnal and infonnal. Further Sinha (2002) augmented the CGE model by differentiating factors of production by twelve categories. The other important feature of the studies is the distinction of 13 types of households in the model and each household type has been identified with information of gender ratios. The concept of informal work is very important in developing countries as in most more than 80 percent of the work force are engaged in informal activities (without considering the black economy). Further research in the area would allow to study how non-market work carried out by women and men make different contributions within different types of household categories.

4.2 Microsimulation Model

There have been numerous attempts to adapt CGE models to the analysis of income distribution and poverty issues. The simplest approach is to increase the number of categories of

households. In this context, it is possible to examine how different types of households (rural vs. urban. Landholders vs. sharecroppers, region A vs. region B. etc.) are affected by a given shock. However, nothing can be said about the relative impacts on households within any given category as the model only generates information on the representative (or "average") household. This problem of intra-category variation decreases with the degree of disaggregation of household categories. Yet even in the most disaggregate versions-Piggott and Whalley (1985) have over 100 household categories- substantial intra-category heterogeneity in the impacts of a given shock are likely to subsist.

Decaluwe, Dumont and Savard (1999) present a CGE micro-simulation model for 150 households based on fictional archetypal data. They construct the model so as to allow comparisons with the earlier approaches with multiple household categories and fixed intra-category income distributions. They show that intra-category variations are important. at least n this fictional context.

The only general equilibrium micro-simulations with true data are Tongeren (1994), Cogneau (1999) and Cogneau and Robillard (2001). Tongeren models individual firms rather than individual households. Cogneau's study concerns a city, Arttanarivo, rather than a nation and primarily concerned with labour market issues. Cogneau and Robillard examine the impact of various shocks, such as increases in total factor productivity, on poverty and income distribution in the context of a national model of Madagascar .

The construction of a basic CGE micro-simulation model is technically straightforward although, obviously, more sophisticated approaches can be envisaged. The objective is to integrate every household from a nationally representative household survey directly into an existing CGE model. John Cockburn (2002) uses an existing CGE model constructed by Prakash Sapkota of the Himalayan Institute of Development in Kathmandu (based on an archetypal CGE training model developed by Martin, Souissi and DecaIuwe, 1995), in collaboration with University of Laval and build a microsimulation CGE model.

4.3 Proposed Gender-aware Model for Governments

In a CGE model that addresses the concern of impact analysis having gender differentials would have to contain variables distinguished by gender to the extent possible. Apart from data on market work distinguished by gender, it is essential to capture information on non-market work while we build the base data set for a gender CGE model as such work undertaken by women consume a substantial part of their daily schedule. The CGE model we propose to build will be of the basic nature which will be augmented by a structure of the economy that captures the imperfect substitution of female and male workers, both market and non- market. This suggests that the Social Accounting Matrix on which the CGE is to be

built needs to incorporate details of gender distinguished labour market, non-market that would also include care economy and leisure.

The supply of labour for women would be detem1ined through a household utility function (in the University of Laval work is progressing in which both male and female labour supply is endogenously detem1ined). We proceed on the assumption that men would not substitute non-market work with market work. It is only in the case of unemployment in the labour market that man would be involved in non-market work.

Leisure in developing countries can still be considered as a residual activity. So in case of an increase in either market work or care related work for women, their leisure time would get reduced. It is essential to separate all types of activities, i.e., broadly, market work, non-market work and leisure. This information would be used differently in formulating functions for men and women. In case of men we would proceed in having imperfect substitution between non-market work and leisure. In case of women, imperfect substitution between market work and non- market work, but leisure determined as a residual of all types of work carried out by women. We propose to develop the model in these areas to study the impact of policy changes on welfare of women.

A CGE model we intend to build should be able to answer the questions such as what happens when exports of those goods increase which employ more of women workers. In case demand for women workers increase and supply is non-elastic, wages might rise. Women would spend more time outside homes and their leisure and health would be affected. Therefore as the households with such women workers improve in terms of monetary gain, this would have a trade off in terms of health and other related care activities as well as leisure. Expenditure on childcare and health care might increase and mental stress also might be accentuated in such conditions. Studying the pattern of expenditure on social sector is possible through the CGE analysis and would be very useful in such an exercise.

The direct steps that a government need to take under such conditions could be providing hygienic and safe creches for working mothers. Moreover, increasing budget on women's health (who would be now under greater stress) would have beneficial effect on children's health and save health budget in the future. Such linkage of policies and economic gains can be simulated through a CGE model incorporating consumption on welfare goods.

To build such a CGE model the information on female and male members of a household will help in obtaining differential earning by gender. The information on activities will detennine the resources that women and men can generate. How household income is allocated by gender is a matter of research. It is important to establish any difference in household behaviour that originates due to the female/male ratio in a household. The question is how can one theoretically measure any such pattern of household behaviour. As a consequence aggregate household consumption patterns would reflect the gender composition of income and labour

supply. In the next step we would like to carry forward information on expenditure with gender distinction. A basic CGE micro-simulation model would be built in the next phase to carry out member wise expenditure and income related analysis. The data for such a CGE micro-simulation model would require canvassing of household survey that explicitly includes questions on expenditure on different items by each member of the household and such household from a nationally representative household survey would be directly incorporated into an existing CGE model

V. Recommendations for Developing a Prototype Gender-Aware Model

5.1 Which Model is Appropriate?

In light of the previous sections, we find that we can carry out poverty analysis better with a CGE model than many models as such models have the flexibility to incorporate the structure of the economy and also include different household categories. At present it is best to consider a simple CGE model of the type as given below so as to understand the functioning of the economy. At a later stage micro simulation can be attempted.

General equilibrium models are now widely used to assess the impact of economic shocks that reverberate across sectors and, in some cases, regions of a country or even the world. They are capable of producing disaggregated results at the microeconomic level, while providing a consistency check on macroeconomic accounts. A general equilibrium model is generally calibrated to a Social Accounting Matrix, which is a complete, consistent, and disaggregated data system. The salient feature of Social Accounting Matrixes is that they quantify – at a single point in time – the interdependence of sectors and regions in an economy. General equilibrium models are typically based on neoclassical theories of firm and household behavior, and have a time frame long enough to achieve equilibrium in markets. While most are comparative static in nature, dynamic versions have also been developed to address certain types of issues.

A representative CGE model should be developed for a country for which data are available to construct a SAM. The national accounts data together with data from household surveys are best suited for constructing a SAM. For a gender, it is important to get information on time use. All the data in such form are available for **South Africa**. So it is recommended that at first a model is developed for **South Africa**. This model can be tested and then used for training purpose as well.

There would be a need for training in CGE modeling and GAMS package for the government officials and researchers from other of the African countries so that they can be involved in developing such engendered CGE models.

5.2 Proposed Steps for Developing the Model

I. Prepare a concept paper outlining the rationale and content of a CGE model for analyzing gender and poverty issues (Feb/Mar 2003) and present the paper to an Ad hoc Expert Group Meeting for discussion and endorsement (May 2003)
II. Develop the base data set for the gender CGE model in the form of a SAM for South Africa (June-July 2003)
III. Develop a gender-aware CGE model for South Africa (mid Sept –mid Dec 2003)
IV. Prepare a draft report on the results of gender-aware model tests for a review and validation by an Ad hoc Expert Group Meeting in 2004.
V. Design capacity building program for training modelers in the government and other institutions in countries in 2004
VI. Start developing gender SAMs with local participation for six potential countries (Jan-June 2004).
VII. Organize 2 sub-regional workshops for statisticians, policy analysts and national accountants on macro models (2005).

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