A Tale of Two Models: Comparing Structuralist and Neoclassical Computable General Equilibrium Models for South Africa

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Abstract

This paper compares two working models of the South African economy, an orthodox, neoclassical computable general equilibrium model in which savings drives investment and a more structuralist, eclectic model for which there is an independent investment function. Both are calibrated to the same social accounting matrix. Comparative statics of simpli...ed prototype models are presented and identical simulations with the corresponding applied versions are compared. It is seen that the neoclassical

model fully supports the principles of the 'Washington Consensus' while the structuralist model requires a far more heterodox set of policies to avoid slow growth or high inflation.

'...it was the age of wisdom, it was the age of foolishness...'

1. Introduction

At the core of most debates in the field of macroeconomics of developing countries is the issue of the proper role of the public sector. Questions range from the size and composition of spending to the impact of trade levies and other government imposed restrictions on international trade flows to the effect on financial markets of the manner by which the fiscal deficit is financed. In models favored by the multilateral institutions, such as the World Bank and the International Monetary Fund, government spending is rarely beneficial, at least macroeconomically. Whether the fiscus is portrayed as inefficient but benign, or simply ruthless in its pursuit of power and privilege on behalf of a select elite, increased spending always diminishes the accumulated store of national savings. Since in the orthodox view, investment depends on the mass of these savings, there is an immediate and inverse relationship between government spending and growth. A second reason to restrict the absorption of resources by the public sector is that they will likely

be squandered on inward oriented projects, diminishing the favorable impact of trade liberalization on growth. Over stimulation by the public sector leads to current account deficits, real exchange rate appreciation and an accelerated decline in export performance.

Structuralist models, on the other hand, are more agnostic about the role of the state, suggesting instead that proper behavior depends upon circumstance. It is not typically assumed that resources are fully utilized in structuralist models, thereby opening a range of demand-side, employment generating policy options, options which have little relevance in the orthodox setting. But it is not only that the demand side 'matters.' What makes a structuralist model structuralist is the specific and path-dependent character of the economy under study. Contrary to the universal prescriptions offered by the neoclassical model, higher government spending may well crowd in rather than crowd out private sector expenditure. Similarly, trade liberalization may or may not cause job loss (Rattso and Taylor, 1998). It will most certainly cause a revenue loss, however, and the fiscal impact may either amplify or diminish the impact of tariff reduction.

This paper analyzes some of these issues by way of two very different computable general equilibrium (CGE) models, one neoclassical and the other structuralist, which have been used extensively in actual policy analysis in South

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Africa[1]. We ...rst calibrate the models to the same to the same Social Accounting Matrix (SAM) data base and then perform comparable simulations. A number of inherent limitations inhibit a clear comparison of the models. The orthodox World Bank model is essentially a static framework and although a dynamic version of the model was available when the policy advice was o¤ered, the modelers regarded the static model as more reliable. The structuralist model, on the other hand, is dynamic with important period-to-period lags. No attempt is made to change the nature of either model to conform to the other; we o¤er only a comparison of two models as they were designed and implemented. Moreover, we do not attempt to construct an idealized neoclassical nor structuralist model in order to highlight their theoretical di¤erences. Rather, the paper reports on two working models, in their roles in o¤ering practical advice, whatever their shortcomings.

With these limitations in mind, the main conclusion of the paper is that the recommendations of the so-called 'Washington Consensus', (Williamson, 1989) small government, liberal trade policies, a weak exchange rate and low wages, are implied by the structure of the orthodox model. These policies do not obtain as readily from the structuralist version. The prescriptions of the latter are not as closely tied to its logical structure, but rather depend far more on empirical content. The comparison also suggests that the orthodox model presented South

African policymakers with a restricted menu of choices. The model supported policies which ultimately led to slower growth and higher unemployment (but lower in‡ation) than could have been achieved if the structuralist model is correct.

The organization of the paper is as follows: the two models are ...rst compared in small, prototypical versions. The qualitative conclusions, noted above, emerge clearly from this discussion but it is left to see whether the full, applied CGEs agree with the results of the smaller models. Three simulations are considered. First, the impact of a reduction in current government expenditure is studies followed by a second simulation in which public sector expenditure is switched from current consumption to investment. The combined e¤ects of the Washington Consensus are examined in the last. A fourth and ...nal section summarizes the conclusions of the study.

2. Two Prototypes

The task of describing the structure and adjustment mechanisms of a large CGE model is daunting in itself, much less for two very di¤erent ones. Hence rather than provide the reader with a detailed accounting of the equations of the models, we seek to capture the spirit of each in two simpli...ed frameworks.[2] These models are not intended to represent all the features of the underlying CGEs nor are they

idealized 'orthodox' or 'structuralist' models. The presentation is to serve as a guide to the discussion of the empirically estimated CGEs.

2.1. The World Bank Model

The orthodox prototype is taken from Devarajan and Lewis, 1990, and is commonly used by the authors of the World Bank South African CGE to explain how their model works. There are two sectors, traded and nontraded and three goods, counting imports. The exportable is not consumed at home and the home good is not exported. This is only approximately true in the 1992 South African SAM on which the full-scale CGE is based (van Seventer, et al., 1992). In reality, about half of exports were from the mining sector and about ...fteen percent of the gross value of mining output is used in domestic consumption. The percentage of domestic consumption is naturally much higher for the non-mining sectors which account for the other half of exports. A second important assumption is that there is only one race and one class of consumers in the prototype version even though there are thirteen occupational categories, six income classes and four races in the base SAM.[3] There are other assumptions that perhaps seem benign, but nonetheless will be seen to pack important implications. First, consumers respond to higher domestic prices by increasing the weight of imports in their consumption basket

and, second, the government consumes the nontraded good, but does not import.

To begin the formal exposition, let X be the level of output of traded goods and Q the output of nontraded goods. The price of tradeables is given in foreign currency at unity and thus the domestic price is simply the nominal exchange rate e: The price of nontradeables is p: The production of each good is governed by a production function:

$$X = X(L_x; K_x) \qquad\qquad (2.1)$$

$$Q = Q(L_q; K_q) \qquad\qquad (2.2)$$

In the orthodox model the capital stock, K_i; (i = x; q) is assumed to be ...xed in both sectors. Employment, L_i; (i = x; q), is set so that the value of the marginal product is just equal to the wage:

$$eX_L = w \qquad\qquad (2.3)$$

and:

$$pQ_L = w \qquad (2.4)$$

where the subscript on X and Q indicates partial di¤erentiation with respect to labor. There is full employment:

$$L_x + L_q = L \qquad (2.5)$$

where L is the labor force. The material balance for the nontraded sector is:

$$Q = Q_c + Q_g \qquad (2.6)$$

where Q_c and Q_g are real private and government spending on nontraded goods, respectively. Government ...nances its expenditure via a tari¤ on imports at rate t; for simplicity, there are no other taxes or subsidies. Total imports, M, trade o¤ with domestically produced goods according to an Armington function of the relative price:

$$Q_c \text{=} M = k[(1 + t)r]^{\grave{\imath}} \qquad (2.7)$$

where k is an arbitrary constant and ¿ controls the elasticity of the response of

domestic to imported consumption with respect to the real exchange rate:

$$r = e/p: \qquad (2.8)$$

The foreign price of imports is also taken to be one. Real foreign savings, B, is the excess of imports over exports:

$$B = M_i X \qquad (2.9)$$

This is a system of nine equations in the eleven unknowns, X; Q; L_x; L_q; p; w; e; r; Q_c; M; and B in the parameters K_x; K_q; k; ξ; L; w and t: Taking the nominal exchange rate, e; as the numéraire, leaves one variable which must be ...xed exogenously for a solution. The most frequent choice is the value of foreign savings, B: The supply of foreign resources may be considered to be outside the control of any domestic player, thereby constraining total consumable resources available to the country.

From the orthodox perspective, this model has many desirable properties. Under the proviso that the level of foreign savings is known, the model is supply driven according to equations 2.1-2.5. Equation 2.7 determines the composition of demand for the domestic good versus imports as a function of the real exchange

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rate. Absolute levels depend on the quantity of imports available. Two constraints are thus necessary, one on factor availability and one on foreign borrowing, in order to determine the relative price, p; or real exchange rate, r: If either the labor supply or foreign savings constraint failed to bind, additional detail on the demand side would be necessary to close the system of equations. In the orthodox model, the real exchange rate adjusts to insure that the given level of foreign savings is fully utilized just as the wage adjusts to bring about full employment of labor.

Investment appears to be left out of the World Bank's analytical model, but on closer inspection, it is unnecessary. Since capital stock is ...xed, investment has no theoretical place in the static formulation.[4] In contrast to the structuralist model discussed below, there is no room for an independent investment function. What is saved out of current consumption is presumably invested in the next period, but this is not seen by the model. The savings decision has no bearing on the current allocation of resources and thus it is irrelevant to the comparative statics of the neoclassical prototype.

2.2. The Structuralist Alternative

The crucial di¤erence in the two models studied here is that the structuralist model takes time explicitly into account. The horizon for which the World Bank

model is constructed, on the other hand, is not well de...ned. In South Africa, the practitioners argued that comparative static multipliers could be interpreted as e¤ective over a two-to-...ve-year period. It is appropriate to think of the structuralist model as dividing the neoclassical horizon into discrete units with explicit lags so that, in principle, the simulations of the two models could be compared.

We do not treat the World Bank's comparative static experiments as a long-term equilibrium to which the economy converges since this interpretation would further diminish the comparability of the models.

This is not the way the models are used in practice. In any case, there is nothing in the dynamic structuralist CGE that insures that it will arrive at a long-run equilibrium if left to run over an arbitrarily large number of periods. But since capital does not grow with investment in the World Bank model, neither can it be regarded as a long-term model. Hence, the most appropriate basis on which the two models can be compared is a 'medium run'; this justi...es the choice of horizon as between two and ...ve years.

As noted, the real exchange and wage rates adjust in the neoclassical model, so that capacity is always fully utilized. In the structuralist model, however, there may be excess capacity such that demand falls short of potential output. With excess capacity, the marginal product cannot determine the real wage. Labor

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markets may have chronic excess supply without an immediate decline in the real wage. It is also essential to distinguish between consumption and investment in the current period, since they are determined di¤erently, and thereby allow for an endogenous level of capacity utilization, as both demand and capacity change. In this section, we modify the nine-equation framework developed above to account for these di¤erences in approach.

First, the production functions of equations 2.1 and 2.2 must be taken to govern full capacity output rather than actual output. The structuralist approach does not assume that output is necessarily less than capacity in every sector, but only that it could be. A reasonable assumption is that the traded good sector always operates at full capacity while the nontraded sector operates below its potential.

Operating at full capacity e¤ectively means that the output of the traded goods sector is taken as given in the current period. This does not, however, imply that a change in pro...tability has no impact on output in that sector, but only that there is no immediate change in output. A rise in the current product wage, for example, could cause a decline in investment. Output growth would slow down in the next period, as in the orthodox model. Higher wages may also provoke some substitution although not in the same way as in the orthodox model. Whether

the demand for labor per unit of output falls depends upon the evolution of the technology between periods, that is, changes in the capital and labor coeﬃcients. Equations 2.1 and 2.2 are replaced in the structuralist model by:

$$X = {}_x I_x^{ti\ 1} + X^{ti\ 1} \tag{2.10}$$

$$Q = {}_q I_q^{ti\ 1} + Q^{ti\ 1} \tag{2.11}$$

where   is incremental output-capital ratio and $I_x^{ti\ 1}$ is previous period's net investment. Of course,   ; may change over time and may in fact be related to the real wage such that a higher real wage increases the marginal amount of capital required per unit of output. In this way, substitution may be taken into account, but between, rather than within periods.[5]

In the nontraded goods sector, the rate of capacity utilization, u, is deﬁned as:

$$u = Y {=} Q \tag{2.12}$$

where Y is the actual level of output in the nontraded sector. Below full capacity, the marginal productivity of labor is replaced by three equations which describe how labor per unit of output and nominal wages change with respect to capacity

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utilization and over time. Although it would be possible to maintain the marginal productivity labor demand functions, in the applied structuralist model below labor demand depends on a labor coefficient that adjusts from period to period according to the rate of labor-saving technological change technical change, $\frac{1}{2}$ For the traded sector we have:

$$L_x = \frac{1}{2}_x l_x^{t_i\ 1} X \qquad (2.13)$$

where $l_x^{t_i\ 1}$ is labor coefficient in the previous period. A similar equation can be defined for the nontraded goods sector. Its labor coefficient can be written as:

$$l = \frac{1}{2}_q l^{t_i\ 1}\ ;\ l_u u \qquad (2.14)$$

The coefficient l_u determines the rate at which the labor coefficient falls with capacity utilization. Employment in the nontraded goods sectors is then determined by:

$$L_q = lY \qquad (2.15)$$

With excess capacity in the nontraded sector, the full employment equation, 2.5, can no longer determine the real wage and is replaced by an equation which shows how the nominal wage, w; adjusts from period to period also according to

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capacity utilization:

$$w = w^{t_i 1} + w_u u \qquad (2.16)$$

where w_u is the sensitivity of wage changes to capacity utilization. Wages are assumed to be the same in each sector for simplicity.

In the structuralist model we separate the component of Q_c into consumption, C; and investment demand, I_p: Real consumption can be written:

$$C = (1 \, \text{¡} \, s)(rX + Y \, \text{¡} \, trM) \qquad (2.17)$$

where s is the savings propensity. Disposable income is $rX + Y$; less total import taxes trM: For comparability to the neoclassical model, we allow for substitution between imports and domestically produced goods, as described in equation 2.7 above.

Private investment depends on an accelerator and the real wage. It also allows for crowding in by way of a government investment term, I_g :

$$I_p = \sum_{i=X}^{Q} I_{p_i} (u_i; w=p; I_g) \qquad (2.18)$$

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Private investment increases with capacity utilization and government investment, but the sign of the partial derivative of I_p with respect to the real wage is more problematic. Since at any level of capacity utilization, an increase in real wages must imply a decrease in the pro...t rate, the sign is usually negative.[6] However, we shall assume that given an exogenous increase in demand, the indirect e¤ect of higher capacity utilization on wages and thus on pro...tability and investment is probably not strong enough to outweigh the direct e¤ect through the accelerator.

These last two equations alter the orthodox model by determining the level of Q_c from the demand rather than the supply side; we can then write:

$$Q_c = C + I_p \text{ ¡ } rM \qquad\qquad (2.19)$$

Income from nontraded production can now be expressed as:

$$Y = Q_c + Q_g \qquad\qquad (2.20)$$

Recall that we must assume given foreign savings in the orthodox model in order to determine the domestic price level. Since exogenous foreign savings is arguably unrealistic, it is more natural, in the structuralist vernacular, to introduce a price

equation for nontraded goods:

$$p = (1 + m)wl \qquad (2.21)$$

where m is a mark-up on labor costs. In the full model, costs include imported in-termediates with associated tari¤s. They are omitted here in order to facilitate the comparison with the orthodox prototype in which imports are not distinguished by use.

As presented here, the structuralist model consists of the twelve equations in this section, equations 2.10-2.21, plus the orthodox equations, 2.5,2.7,2.8 and 2.9 in the sixteen unknowns X; Q; L_x; l; L; u; Q_c; r; p; L_q; w; C; I_p; M; B and Y for each period. The remain symbols are taken as given parameters.

2.3. The Washington Consensus in the Two Models

The World Bank prototype lends support to the fundamental tenets of the Washington Consensus: viz. that the e¢cient allocation of resources (and presumably the fastest rate of growth) requires an outward orientation, small government, a competitive exchange rate and low real wages. The cornerstone of the argument is that with ...xed capital stocks, exports can increase only through technical change or depreciation of the real exchange rate. Since neither the prototype nor

empirical model from which the simulations below are drawn allows for technical progress, increasing exports requires that the marginal products in equations 2.3 and 2.4 must change in a way which reallocates labor from the nontraded to traded goods sectors. Taking the ratio:

$$Q_L = X_L = r \qquad (2.22)$$

it is evident that policies which lead to an appreciation of the real exchange rate in the orthodox model are inconsistent with an outward orientation.

2.3.1. Government

The case against government spending, Q_g; is made by showing that it leads to an appreciation in the real exchange rate and a decline in exports. The model structure implies that increasing government expenditure raises demand, but does nothing for supply and thus the economy turns inward. An export orientation thus requires ...scal discipline.

To see this, write the foreign exchange constraint, equation 2.9, as:

$$B = \frac{Q(r) \ ; \ Q_g}{k[(1+t)r]^{\grave{e}}} \ ; \ X(r)$$

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where X and Q are expressed as functions of the real exchange rate following the discussion of equation 2.22. Di¤erentiating with respect to government spending:

$$\frac{dr}{dQ_g} = \frac{M(1+t)r}{(1+t)r(MdQ{=}dr \ _i \ Q_c dX{=}dr) \ _i \ ¿MQ_c} < 0$$

The sign is immediate inasmuch as an increase in r causes Q to fall and X to rise and thus the denominator is unambiguously negative. Increasing Q_g causes the real exchange rate to appreciate.

The central adjustment mechanism of the orthodox prototype is now transparent and understanding how it works will be useful in intrepreting the results of the empirical simulations below. As the government takes a larger share of output, the private sector must save more and thus per capita consumption falls. But the decline in consumption involves both domestic goods and imports. With ...xed foreign savings and no consumption of the exportable, imports must return to their initial level. Since domestic consumption, Q_c; has fallen, the only possible way to increase imports is through appreciation of the real exchange rate, which induces substitution of imports for domestic goods. If exports fall in response to the appreciation, then imports need not recover as much and the appreciation will not be as strong. On the other hand, if the government ...nances its expenditure

by increasing foreign borrowing, the exchange rate will appreciate even more to allow the absorption of more imports.

Observe that the analysis of government expenditure requires that the import propensity of private sector is greater than that of the government. This is a safe assumption for many countries and true in the South African SAM. But note that when coupled with the assumption of price flexibility leading to full resource allocation, it follows that any policy which stimulates demand for domestic goods relative to imports, (minimum wage or other redistributive interventions) will cause the real exchange rate of the model to appreciate and work against increased openness.

Note that any question of the effect of government spending on employment is defined away in equation 2.5. Neither does income distribution play a role. Real wages change only in response to the demand for labor. If the nontraded goods sector is more labor intensive than the traded goods sector, the real wage will rise with an increase in government expenditure and vice-versa. Since nontraded goods do tend to be labor intensive, 'low real wages' joins 'fiscal discipline' on the list of sound policy advice implicit in this model.

The effect of higher government expenditure in the structuralist model is not so clear cut. Consider the comparative statics of a change in the first period. Totally

di¤erentiate income in equation 2.20 with respect to Q_g taking I_g as given.

$$\frac{dY}{dQ_g} = \frac{dI_p\text{=}dQ_g + r(1 + \bar{s}t)\text{=}z + 1}{D} \qquad (2.23)$$

where $D = s + r(1 + \bar{s}t)\text{=}z + r[(1 + \bar{s}t)(\imath - 1)M + \bar{s}X](w_u\text{=}wQ)$ for notational convenience. The expression references the derivative $dI_p\text{=}dQ_g$ to simplify the result and to emphasize the uncertainty of the e¤ect of government spending on private investment behavior. Note that it re‡ects crowding in and crowding out though the impact of government expenditure on the real wage. Formally, the result is ambiguous. We can only say that if the wage does not increase 'too much' with capacity utilization (i.e., w_u is small), output would rise with government expenditure. As noted, it would be surprising in a structuralist model if the wage term in the investment function would be su¢ciently strong to produce a negative government expenditure multiplier.

The behavior of the structuralist model in subsequent periods is largely deter- mined by the rate of capacity utilization. If u increases, investment is stimulated and the economy cycles upward until the increase in real wages slows further investment. Once initiated, the e¤ects of the stimulus accumulate over the re- maining years of the horizon.

In the orthodox model, an increase in government expenditure appreciated the real exchange rate and provoked an inward orientation and vice-versa when expenditure is reduced. The structuralist framework may well produce orthodox-like results if an aggressive wage response forces an appreciation of the real exchange rate. But the nominal exchange rate can and, in South Africa is, managed to some degree through policy. Exchange rate policy is used, moreover, for con‡icting goals, to o¤set real appreciation or allow overvaluation to combat in‡ation. Depending on circumstances, a policy-induced nominal devaluation may or may not increase the nominal wage by as much and can easily end in some real devaluation. Which way the exchange rate ultimately moves depends on the nature of the policy regime and the strength of the labor movement. In any case, the immediate link between a small public sector, low wages and an export oriented economy is substantially weaker in the structuralist model, hardly the logical necessity that it is in the orthodox framework.

2.3.2. Trade

The Washington Consensus also holds that tari¤s be reduced. The orthodox model fully supports this recommendation while the structuralist model is again agnostic. Lower tari¤s in both models shifts demand to imported goods. In

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the orthodox model p decreases to stimulate domestic expenditure in light of the foreign exchange constraint and the fact that imports are cheaper. Exports increase with the real depreciation, as does private savings while the economy becomes more outwardly oriented. If the traded goods sector is capital-intensive, trade liberalization also causes the real wage to decline.

In the prototype structuralist model a fall in the tari¤ rate is essentially a tax cut that raises both consumption (through the rise in disposable income) and investment (through the accelerator). As capacity utilization rise, upward pressure on the nominal wage rate appreciate the real exchange rate.[7]

To see the resultant, ...rst-year e¤ect on the traded goods sector, di¤erentiate the real exchange rate, r; with respect to the tari¤ rate, t :

$$\frac{dr}{dt} = \frac{frM[\overline{s}_i \ \dot{\iota} + \overline{s}t(1_i \ \dot{\iota})] = (1 + t)_i \ dI_p = dtgrw_u = wQ}{D}$$

In light of equation 2.23, the denominator in this expression is positive so long as government expenditure increases output. Since this was judged likely above, the sign of this derivative depends the numerator.

Unlike the orthodox model in which trade liberalization works unambiguously to depreciate the real exchange rate and increase traded goods output, here the

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e¤ect of trade liberalization depends on the elasticity governing the substitution of imports for domestically produced output (see equation 2.7) For example, if ¿ were set at unity, and investment were una¤ected by the tari¤ rate ($dI_p/dt = 0$) the numerator would reduce to $\bar{}\, sr^2 Mw_u=(1 + t)wQ < 0$. In this case, a reduction in tari¤s would cause the real exchange rate to depreciate ($dr/dt < 0$): It can be further shown that traded output would fall. For $¿ > 1$; the e¤ect is even stronger. If there were no change in the wage, $w_u = 0$, the real exchange rate would remain ...xed.[8]

The explanation of these results is straightforward. Substitution reduces the impact of expansionary ...scal policy (lower duties) since it shifts demand toward foreign production. If the expansive e¤ect on domestic production is signi...cant, the real exchange rate can even appreciate with a deleterious e¤ect on exports.

But the Washington Consensus is, above all, a package of policies and it makes more sense to analyze its components severally. If trade liberalization reduces government revenues, then certainly government spending will be reduced at the same time. The ratio of the PSBR to GDP is the usual indicator of the degree of ...scal intervention. If maintaining this ratio is taken as a policy goal, and tari¤s are reduced, government investment, which has been up until now a ...xed component of Q_g; will have to adjust.

This element of the Washington Consensus, measuring the size of government by the PSBR to GDP ratio, imparts a degree of instability to the structuralist version of the model. If tari¤ reduction reduces output because of the elasticity of substitution of imports, then not only must government spending fall in response to lower revenues, it must decline even more to restore the target PSBR ratio. The contractionary impact of the policy package is further strengthened in the structuralist mode due to less crowding in via the private investment function.

We conclude that while the orthodox model responds well to polices the Washington Consensus, the outcome in the structuralist framework depends on the historical and policy environment to which it is calibrated. Import elasticities could vary and the exchange rate could be managed to either reduce in‡ation or improve the trade balance. In principal, both models could produce the same qualitative conclusions with respect to how the composition of GDP would change in response to the smaller government and lower tari¤s. In focusing on period-by-period adjustment, the structuralist model can account for contractionary e¤ects swept from view by the smooth and powerful price mechanism of the orthodox model. In the next section we shall see how the models behave in full dress, whether they conform to the predictions of their prototypes and to what extent the results are driven by the data rather than the logical structures of the models

themselves.

3. Simulation Results

3.1. Political economy

Although it is well beyond the scope of this paper to enter into a detailed discussion of the political economy of this period, some background is required to understand the design of the simulations. As we have argued elsewhere (Gibson and van Seventer, 1996, 1996a, 1997a), the policy dilemma in South Africa could be reduced to a choice between two fundamental options. One strategy, growth through redistribution, would redirect historically generous levels of public spending toward the needs of the black majority. Although this approach had considerable political support and was advocated by economists aligned with the African National Congress (ANC) before the ...rst general elections in 1994, there were some obvious shortcomings of the strategy (MERG, 1993). Spending in the past had been concentrated on a small sliver of the population and broadening the coverage to include the black majority would either become unsustainable or, if scaled down to reasonable budgetary proportions, have little impact on the welfare of the masses. In either case, it was argued, foreign investors would be

frightened by the populism of the ANC and foreign savings were considered necessary to supplement what was widely perceived as a low savings rate in South Africa.

The South African Reserve Bank (SARB) and Ministry of Finance opposed this strategy, but the ANC sought a compromise in the 'Reconstruction and Development Programme' (RDP), a super-ministerial agency charged with implementing the political goals of the party within the framework of '...scal discipline.' The second strategy, which ultimately prevailed, was to adhere more explicitly to the 'Washington Consensus' as discussed above. The RDP, hamstrung by a organizational di¢culties, lack of old guard bureaucratic support and slow delivery, was eventually replaced by the 'Growth, Employment and Redistribution' (GEAR) program, a change that was far more profound than is revealed in their similar sounding names (Nattrass, 1996).

The essence of the GEAR program was monetary and ...scal policy designed to conform to the targets of the Washington Consensus on public sector participation, liberalization, labor market deregulation and export-led growth. If South African blacks were to raise their per capita income, it would have to be under the aegis of this new policy regime, a regime fundamentally di¤erent from that in which its white minority predecessors had enriched themselves. The new government

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reluctantly accepted the limitation on its power to reshape the economy since the political accord that permitted a peaceful transition hung in the balance. The SARB remained independent and aggressively pursued anti-in‡ationary monetary policy through high real interest rates; the Ministry of Finance set out to contain the size of the government as measured by the ratio of the PSBR to GDP

3.2. The base run

Both applied CGEs, as noted above, are calibrated to the base SAM. The aggregation of sectors, households, and occupational categories are shown in Table 1.

Please insert Table 1 here

The results of the calibration and base run are shown in Table 2. The ...rst two columns con...rm that with no change in any of the parameters, both models produce precisely the same base solution. The structuralist model is calibrated to the years 1992 to 1995 and reproduces the main features of the macroeconomic data of that period. The economy was emerging from a recession which troughed in 1992 (the year of the SAM) and thereafter, real GDP increased every year at

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a average annual growth rate of about 2.5% through 1995. Inflation, which had been inertial, begin to decline from 13.9% to 8.7% by the end of the calibration period. None of this is pertinent to the World Bank CGE, of course, since it can only reflect a one-time change. Although it is admittedly a stretch, we interpret the two-to-five year horizon as relevant to the 1992 to 1995 period.

Please insert Table 2 here

3.3. Fiscal discipline

According to the orthodox prototype, smaller government should release resources to the export sector through a depreciation of the real exchange rate. Indeed, ...nance was successful in reducing the PSBR to GDP ratio between 1992 and 1995 from 6.1% to about 4.3% of GDP.[9] This was achieved largely through a reduction in transfers to households. Government spending on goods and labor services did not decline in real terms, although they did as a percentage of GDP. The recovery of GDP, as the economy began to climb out of the recession that began in 1990, caused tax revenues to increase and as a result, government dissavings fell by half in real terms as shown in Table 2.

Table 2 shows the results of simulations that attempt to capture the effects of

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this strategy of ...scal discipline in both models. The structuralist model is cali-brated to the actual growth, in‡ation, real interest and exchange rates as well as public sector accounts, measured as a share of GDP, from 1992 to 1995.[10] Calibrat-ing the World Bank CGE, however, is more di¢cult, since GDP is essentially ...xed by factor supplies, and thus any decline in the measures of government participa-tion as a share of GDP necessarily implies a decline in real terms. To minimize the incompatibility, and capture the spirit of a fall in the PSBR to GDP ratio, we reduce government spending on goods and labor services as well as transfers in the orthodox model until the PSBR ratio is the same as what was observed in 1995, 4.3% of GDP.

During the calibration period, foreign savings actually increased from approx-imately -4% to -0.2% of GDP and the structuralist model is calibrated to track this. We did not calibrate the World Bank model to a the higher trade de...cit since the foreign exchange constraint is so powerful in that model and could mask the e¤ect of ...scal discipline. The results of the simulation are shown in the second column of Table 2 for the World Bank model and in the last three columns for the structuralist model.

Observe ...rst that in the orthodox model the changes are very slight. This is typical of a neoclassical CGE since GDP is determined by resources supplies which

are themselves una¤ected by the composition of demand. The simulation is in general agreement with the directions of changes as indicated by its prototype. The fall in government spending depreciates the real exchange rate by 0.9% and increases the output of the traded goods sectors by a modest 100 mn rand.

Despite the signi...cant drop in government expenditure, the economy is only somewhat more export oriented. Exports increase by only 1.1%. The simulated fall in government employment allows the nontraded goods sector to expand as well, by 1.8 bn 1992 rand. For the additional labor to be absorbed in the private sector, the real wage had to fall by 0.9%. The distribution of income deteriorates, albeit marginally, as a result.

The applied model is evidently more sanguine about the e¤ect of lower government expenditure since it smoothly reallocates the resources to other uses, in this case investment. This is evident in the ...rst panel of Table 2. As government savings goes up, so does private investment, increasing from 12.8% to 15% of GDP. The main e¤ect of this treatment of investment is to suggest that almost all the growth in the nontraded sectors is concentrated in the construction sector, which expands from 8.8 to 9.5 bn 1992 rand. In fact, construction did recover over the period 1992-5, but not in the very unbalanced way suggested by the World Bank model.

The last four columns of Table 2 report the year-by-year simulations in the structuralist model. The table shows that both traded and nontraded goods sectors expand, despite the fall in the PSBR to GDP ratio. The structuralist model is in broad agreement with the orthodoxy but there remain some points of con‡ict.

A contraction in government spending depreciates the real exchange rate in the small structuralist model, but in fact the SARB took advantage of stepped up foreign capital in‡ow to maintain a strong rand to ...ght in‡ation. The success in reducing the in‡ation rate, together with the increase in capacity utilization, caused real wages to rise, rather than fall, over the calibrated period. Both of these features are absent in the orthodox model, which as noted, predicts a fall in the real wage together with a depreciation of the real exchange rate.

As in‡ation abated, interest rates also declined and so interest payments on public sector debt fell. But the interest rate is sticky and thus the real rate increased markedly with a deleterious e¤ect on investment. Still the latter grew, spurred by the peaceful transition to ANC rule and the return of South Africa to the world community. Both models show a simulated rise in investment as a share of GDP, but the neoclassical model will produce this increase anytime government dissavings is reduced, independently of capacity utilization, pro...tability,

government investment, expectations or the real interest rate.

The growth of the economy brought with it an increase in tax revenues, rising in real terms by almost 25% over the simulated period. This is more or less consistent with the historical record and allowed for the higher levels of real spending, indicated in the bottom panel of the table, as the PSBR ratio itself declined. This important e¤ect is of course entirely omitted in the orthodox model as well as the fact that South Africa restructured its indirect taxes to include a value added tax during the second year of the simulated period.

3.4. An alternative strategy

A cursory glance at the results of Table 2 might suggest that both models respond well to ...scal discipline. But the similarity in the relationship between output growth and the PSBR ratio is more a re‡ection of the structural features of the period than spending restraint. In fact, the strategy of ...scal discipline was costly. A second set of simulations considers an alternative of maintaining the 1992 PSBR to GDP ratio and redirecting public sector spending toward the needs of the black majority. The simulations attempt to capture the spirit of the RDP which sought to redress inequality through public investment projects as well as direct assistance. In this simulation, we maintain the pattern of current government

expenditure on goods, services, interest payments and transfers as in the ...rst, but restore the value of the PSBR ratio by raising government investment. We also restructure the pattern of transfers shown in Table 3 so that per capita transfers are equalized for all races and classes with a constant volume of total transfers. As noted above, this proposal lost in the policy debate in South Africa due, in part, to the in‡uence of the World Bank CGE modeling e¤ort.

Please insert Table 3 here

The results for the World Bank model are shown in the second column of Table 4. Note that public investment rises to 5.4% of GDP to maintain a constant PSBR ratio. The composition of government spending has changed as spending is shifted from current toward the capital account. As a result, the import composition of total government intervention increases. A depreciation of the real exchange rate is required to restore the balance between imports and exports. Exports also grow, but at a slower rate than in the ...rst simulation. The rise in public investment simply crowded out private investment.

It therefore appears that this RDP-styled simulation shows e¤ects operating in the same direction as a reduction in overall spending, but in a smaller magnitude.

In the view of the World Bank's policy analysts, this was clearly as second-best alternative to the GEAR.

Neither could there could be support gained from the World Bank model for the growth through redistribution strategy of the RDP. When we simulated a change in the distribution of transfers only, we found that there was no appreciable a¤ect on any of the reported macro data (not to the ...rst decimal point, at least) despite the fact that real disposable income increases by 7.3% for low income blacks and falls for high income whites by 2.1%. Only the Gini coe¢cient declines.

Please insert Table 4 here

The structuralist model comes to di¤erent conclusions. Table 4 shows that an RDP-styled program of restructuring transfers and maintaining capital account expenditure would have been successful in raising the rate of growth by a full percentage point by the end of the simulated period. There is higher employment and the distribution of income is better.

The principal disadvantage of this strategy is the associated deterioration in the current account. The rise in the real value of foreign savings might well have provoked some nominal devaluation, but that would have only have stimulated

exports, as in the orthodox model, and raised the growth rate further. Observe that real wages also lag slightly as inﬂation accelerates and this would have been worse with a devaluation.

Part of the reason the RDP was scrapped in favor of the GEAR was that foreign investment, modeled here as part of private investment, would be attracted by ﬁscal discipline. From the calibrated structuralist simulations, however, we conclude that lowering the PSBR to GDP ratio evidently did not attract suﬃcient foreign investment to oﬀset the contractionary eﬀect of reducing government expenditure. The cost in terms of growth and employment were substantial. Over the three year period, real output and employment could have been 2.9% and 2.4% higher, respectively. Judged by this standard, the South African policy establishment appears to have been overly cautious. Adhering to the principles of the Washington Consensus strategy did not pay oﬀ and the World Bank CGE seems to have distorted the perception of the options available at the time.[11]

3.5. Trade Liberalization

Cutting the PSBR is only part of the Washington Consensus policy package and it is incomplete unless joined by a liberalization of the capital and trade accounts. To simulate the combined impact, we restore the original pattern of transfers and

reduce the tari¤ rates by half. In both cases, we make the assumption that the PSBR to GDP ratio declines in line with the data for 1992 to 1995. For the orthodox model, we reduce current government expenditure to meet the PSBR constraint. For the structuralist model, we make the far more likely assumption that a PSBR goal will be met via reductions in government investment. The results are presented in Table 5.

Please insert Table 5 here

It is obvious from the table that the orthodox model is very friendly to this set of policy parameters. The fall in government spending is accelerated due to the declining PSBR to GDP ratio and customs revenues which fall from 9.9 to 5.9 bn 1992 rand. The adjustment mechanism is familiar from the discussion of the analytical model and the ...rst simulation above. Declining tari¤s means that, ceteris paribus, imports are cheaper and government spending must fall as government income shrinks. The real exchange rate must also depreciate in order to satisfy the foreign exchange constraint. This increases output of traded goods on its own, but coupled with the precipitous decline in government spending, the real exchange rate must fall even further and this gives an extra boost to exports.

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The decline in the demand for labor causes real wages to fall slightly more than in the ...rst simulation.

Observe that the real value of government savings rises by 5.8 bn rand. Real foreign savings is the same as in the base solution by assumption. Thus, in order for the level of total investment to rise to 19.3% of GDP, private savings has increased. The decline in the real wage redistributes income to higher saving households so that total savings increases. The support for the Washington Consensus is virtually total: the export orientation of the economy in enhanced by exchange rate depreciation, competitiveness by lowering real wages and growth by increasing aggregate savings. Trade liberalization accelerates the process by accentuating the decline in the real exchange and wages rates.

The results for the structuralist model are more mixed, as shown also in Table 5. As noted in the discussion of the analytical model above, the impact of tari¤ reduction depends on the relative weight of the ...scal injection versus the contractionary impact of higher imports.

The table shows that government income indeed falls, by 5.6 bn rand by 1995 compared to the base solution. This causes government investment to decline to only 0.2% percent of GDP by the end of the simulated period.

Output and employment grow more slowly than in the ...rst two simulations.

Inflation is less and real wages are higher. Private investment is spurred by lower interest rates and the economy becomes slightly more outwardly oriented as exports rise and imports take their toll on the 'nontraded' sectors. The real exchange rate moves in the way the orthodox model predicts, relative to the base run, as a result of lower capacity utilization.

The recovery is driven largely by consumption which increases by 1 to 2% of GDP (not shown) as a results of higher real wages. Higher private real wages also drive up the public sector wage bill. The decline in the inflation rate increases the real burden of interest payments and real total expenditure of the government rises relative to the base, despite the fact that goods, imported and domestic, are ...xed in real terms.

Some of the negative effects of trade liberalization that appear in this simulation are not unknown to policymakers around the world. Indeed the prescriptions of the Washington Consensus, as conveyed by the orthodox model, are risky and need not always unfold in the way that model suggests. Conventional wisdom discounts any damage done by import penetration and relies on a good deal of bravado with respect to the direction, magnitude and ultimate impact of the real exchange rate.[12]

4. Conclusions

This paper compares two computable general equilibrium models calibrated to the same South African SAM in an e¤ort to understand more deeply why they support di¤erent policy directions. The orthodox, neoclassical model used by the World Bank in policy discussions in South Africa o¤ers the tenets of the Washington Consensus as the clear implication of its logical structure. Indeed, the model is exceptionally well suited to the policy recommendations of the neoliberal agenda. Small government, trade liberalization, low wages and a competitive exchange rate all derive from the assumptions of competitive labor markets, limited supply of foreign resources and the superiority of an export-led growth path. Nothing can be done on the demand side of the model to improve the economy's performance and thus there is no room, logically or empirically, for anything but ...scal restraint.

Structuralist models on the other hand, are much more dependent on the data of the economy for their conclusions and it is di¢cult to say that the model of this paper presents any consensus at all. Small government can be bene...cial, or not, depending upon the set of constraints facing the economy and recent policy. Trade liberalization can alter structure, but the associated ...scal policy may stimulate or contract GDP depending upon how the public sector adjusts to the loss in tari¤

revenue and how sensitive demand for imports is to the real exchange rate. Low wages can spur investment, or not, depending upon whether low wages subtract from demand more than they add to the incentive to invest through higher profit margins. But high wages tend to leak into the public sector reducing government investment, and therefore private investment, when there is a binding PSBR to GDP constraint. An overvalued exchange rate may keep inflation low, but at the same time will harm exports. Robust recommendations are difficult to come by.

The influence of the World Bank model in policy discussions in South Africa, is entirely out of proportion to its realism or plausibility. The real exchange rate is given pride of place in that model, to the exclusion of other effects that can potentially cumulate and overwhelm its role in resource allocation. Unfortunately, the orthodox model cannot be rescued by way of an appeal to the 'long run' at least insofar as the years beyond the simulated period are concerned. Growth slowed to 3.2% in 1996, to 2.5% in 1997 and 0.5% in 1998. This is an embarrassing record, despite the fact that the economy followed the Consensus path, with a declining government dissavings and PSBR and a rising share of exports in GDP.

Had instead a structuralist model been employed in the crucial transition years in South Africa, the message would have been two-fold: (1) The Consensus policies are risky and unsupported by the historical experience of the country;

and, (2) The menu of choices for the appropriate role of the public sector is wider than was admitted in the post-apartheid policy debate. Rather than embarking on an employment generating growth path, the authorities chose contractionary monetary and ...scal policies under the assumption that signi...cant foreign capital in‡ow would materialize. So far, the gamble has not paid o¤.

5. Notes

Our thanks to Lance Taylor, Jorn Rattso, Stephen Gelb and Diane Flaherty for helpful comments. We would also like to thank the anonymous referees of the Review for their many insightful comments.

1. The ...rst is a model presented in van der Mensbrugghe, 1994, which was sponsored by the OECD, The World bank and the Macro-Economic Research Group (MERG). The structuralist model is described in Gibson and van Seventer, 1997, and was developed at the University of Durban-Westville (also sponsored by MERG) and The Development Bank of Southern Africa (DBSA). For an introduction to CGE modeling from a structuralist point of view see Taylor, 1990, 1991. See also Robinson, 1989.

2. Details of the model and the SAM are available from Bill Gibson at gibson@econs.umass.edu.

3. See Table 1 below for the pattern of aggregation of the CGE.

4. Many neoclassical static CGEs use '...nal domestic demand' without bothering to decompose it into consumption and investment. The orthodox CGE discussed below does identify investment and this has some implications for the pattern of sectoral demand. The variable Q_c implicitly includes investment and Q_g public sector investment. See Gunning and Keyzer, 1995, p. 2050 for a discussion of this problem and the connection to closure rules of structuralist models.

5. Observe that this last equation breaks the relationship in the orthodox model between the output of the two sectors. In the structuralist model, an increase in the supply of nontraded goods sector might well provoke a rise in the real wage, which causes traded output to fall in the next period. But it is also possible that higher wages could be o¤set by labor saving technological change. In the orthodox model any increase in output of the nontraded sector must result in a decline in exports, no matter what happens to the real wage in the adjustment process.

6. It may be wrong to assume that investment will decline in what is called an 'exhilarationist' response to higher wages and lower pro...ts (Bhaduri and Marglin, 1990). Higher wages might increase investment if they create a perception of a strong market for domestic goods, or stimulate investment in labor saving

technologies. Any appreciation of the real exchange rate, brought on by higher wages, will make imported investment goods cheaper and thus tend to spur $I_{p;}$ also counteracting the effect of higher wages. While the a priori reasons are not entirely convincing, we nonetheless take the wage coefficient as negative. See Gibson (1998).

7. In the applied structuralist model, the upward pressure of nominal wages on the domestic price is attenuated by the effect of lower tariffs on imported intermediate costs.

8. This can be seen from the derivative output with respect to the tariff rate:

$$\frac{dY}{dt} = \mathstrut \frac{dr}{dt} wQ{=}rw_u:$$

If the elasticity happens to be $\xi = \bar{s}(1 + t){=}(1 + \bar{s}t) < 1$ the effect of lower government savings is just cancelled by the drag from higher imports.

9. This measure does not take into account capital sales or acquisitions of existing assets and therefore might not match other published PSBR ratios. Moreover, it is measured in terms of the SAM defined GDP which is expressed in producer prices.

10. See the notes to Table 2 for which series are calibrated and which are

endogenous.

11. Monetary policy is also implicated. The high real interest rate that was permitted by the Central Bank as the rate of in‡ation slowed reduces private investment. When we ran the previous simulation holding the real interest rate constant a the 1993 level of 3.1% , growth accelerated. Without crowding out, the growth rate was one tenth of one per cent higher in 1994 and 0.6% higher in 1995. Both private and public investment increase as a share of GDP, especially in the last period, as a result of the lower interest rate for the private sector and lower interest payments for government. The latter allow the government to increase investment for the same PSBR ratio and this aids in crowding in some private investment as well.

12. The structuralist results are sensitive to the elasticity of demand for imports. If we raise the elasticity by one-tenth of one percentage point, the average growth rate over the period is reduced by some four tenths of one percentage point, with in‡ation and employment both declining.

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