Real Wages, Employment and Macroeconomic Policy in a Structuralist Model for South Africa

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Abstract

It is now commonplace to argue that in South Africa, like many developing countries, higher wages will lower employment. This paper shows that it is difficult to extricate the relationship between wages, employment and output from the macropolicy environment. Dynamic computable general equilibrium simulations show that the employment effects of nominal wage increases depends on induced monetary and fiscal policy when there is monetary "policy dominance". While wage-led growth is inefficient, increasing the wages of unskilled workers can improve the distribution of income, when the induced changes are neutralized.

1. Introduction

The recommendation to lower wages is common advice offered as a solution for a wide variety of policy problems. Whether in the form of labor market deregulation, anti-union legislation or minimum wages, the orthodoxy argues for lower real wages as the means by which lost competitiveness can be restored, growth restarted and higher levels of employment achieved. Structuralist economists, following the lead of Keynes and Kalecki, have been more agnostic about the effect of lower wages [23],[15].In this paper we argue that changing wages in a structuralist model sets in motion a range of complex forces, some expansionary, some contractionary. In order to know the output and employment response to a rise in money wages, a proper accounting of the balance of these forces must be undertaken.

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This paper shows that if the policy establishment were intent on changing the distribution of income via wage increases, it could do so *without loss of employment* provided it neutralizes induced policy changes. It follows that statistical evidence linking wage increases to rising unemployment that ignores these effects has little bearing on policy properly designed to improve equity (see for example [2]). As a corollary, we show that lowering the real wage may be counterproductive in generating growth and higher employment even though real wages do tend to fall when growth accelerates [7], [9]. We marshal computable general equilibrium (CGE) evidence, calibrated to South African data, to support our claims.[1]

The paper is organized as follows. Section 2 presents the multi-sectoral, multi-class dynamic, CGE model and discusses how the policy environment impinges on the real wage-employment relationship. Section 3 discusses the simulations. Nominal wage growth is simulated under a variety of assumptions about the policy landscape and it is seen that when the reaction to wage increases is muted, an increase in the nominal wage loses much of its contractionary character.

2. The South African CGE

Bhaduri and Marglin introduced the distinction between *exhilarationist* and *stagnationist* response as a summary characterization of the effect of real wages on output [1], [22], [3]. If lower real wages lead to higher profits, more investment, faster growth and higher employment, the model is said to be exhilarationist. On the other hand, if lower wages reduce consumption and capacity utilization and this has a depressing effect on investment, the model shows a stagnationist relationship between real wages and output. The literature has recognized that exports further complicate matters since lower wages also depreciate the real exchange rate as well as reduce home consumption of exportables. Here, we are concerned with yet an additional layer of complexity, *viz.,* wage changes typically provoke monetary and fiscal policy reactions which if not sterilized, can heavily influence the character of the response to higher wages.

The link is inflation. Changes in the real wages are usually preceded by changes in the nominal wage in the same direction. A rise in the nominal wage matched by an increase in productivity or a compensating reduction in the mark-up allows the price level to remain fixed. But if a wage increase is accompanied by some inflation, there will often be real appreciation and shift in the structure of relative prices. Depending upon the regime, policy makers will react by adjusting the interest and exchange rates according to their macroeconomic goals. As a result, the unemployment penalty for higher nominal wages can be strengthened. If the

[1] See [8] for a complete technical specification of the model. For a comparision of the present model to the neoclassical framework, see [10]

wage increase induces contractionary monetary and fiscal policy, an inherently stagnationist economy may appear in statistical record to be exhilarationist.

2.1. The Model

In this section we sketch the structure and adjustment mechanisms of the CGE.[2] The model is based on a 93-sector social accounting matrix (SAM) for 1992 [25] which has been aggregated to eight sectors, agriculture, mining, food, textiles, manufacturing, utilities, construction, services.[3] Indices i stand for the goods, and j for the productive sectors. The SAM also includes four labor categories, indexed by l , which are: professional, service, unskilled labor, farm. There are four "races", r, White, Coloured, Asian and Black as well as three income classes, high, medium and low, indexed by the set c. Government functional categories, security, education, health, social services and housing, are classified by g and time is indexed by t. Symbols not indexed by t are parameters calibrated to the base SAM or taken from other sources. A superscripted asterisk $(*)$ refers to the foreign component of the equivalently designated domestic magnitude. Economic agents, firms, households, government and foreign are summarized by the index a. Sets j, r, c, g are then subsets of a.

2.1.1. Income and Expenditure of Households and Firms

The aggregate supply-demand balance is given by:

$$\begin{aligned} p_i(t)X_i(t) &= \sum_j [p_i(t)A_{ij}(t) + p_i^*(t)A_{ij}^*(t)]X_j(t) \\ &\quad + \sum_c \sum_r p_{irc}^c(t)C_{irc}(t) + \sum_a p_k^a I^a(t) \\ &\quad + \sum_g p_i(t)G_g(t) + p_i^*(t)G_{ig}^*(t) \\ &\quad + p_i(t)E_i(t) - p_i^*(t)M_i(t) \end{aligned}$$

where p_i is the goods price. The foreign price p_i^* in local currency units, or rands, is taken as the foreign dollar price multiplied by the nominal exchange rate, e. Output is denoted by X_j and A_{ij} are the intermediate coefficients. Consumer prices are given by p_{irc}^c, a weighted average of domestic and foreign prices including taxes less subsidies.[4] Consumption by good, race and class, C_{irc}, includes

[2] For an introduction to the CGE methodology see [4]. For applications of the structuralist method to a number of countries, see [24].

[3] The aggregated SAM appears on the web-site http://www.uvm.edu/~wgibson.

[4] We have:

consumption of household labor services as well as imports. The capital price is p_k^a.[5] Investment by origin is given by I^a and government spending is G_g, indexed for the five expenditure categories. Exports are denoted by E_i and competitive imports by M_i.

Substitution is allowed between foreign and domestic intermediates according to an Armington function of the imported versus domestic prices.[6] Proportions are fixed within each vector of inputs. There is also Armington substitution in consumption with total consumption given by the linear expenditure system.[7] Consumption can then be expressed:

$$C_{irc}(t) = \theta_{irc} + \frac{\mu_{irc}}{p^c_{irc}(t)}[Y^h_{rc}(t)(1-\bar{t}_{rc})(1-s_{rc}) - \sum_i p^c_{irc}(t)\theta_{irc}] \qquad (2.1)$$

The intercepts are θ_{irc} and the marginal propensities to consume (here calibrated to the average) are μ_{irc}. The term in square brackets in equation 2.1 is total real expenditure of households, which is income, Y^h_{rc}, adjusted for the direct tax at rate $\bar{t}_{rc}$ and saving at rate s_{rc}, both constant as indicated by the absence of a t as an argument. Household income is given by:

$$\begin{aligned} Y^h_{rc}(t) \;=\; & \sum_l \sum_j [w_{rlj}(t) l_{rlj}(t) X_j(t) + \sum_g w^g_{rlg}(t) L^g_{rlg}(t)] \Delta_{rcl} \\ & + p^h_{rc}(t) C^h_{rc}(t) \Delta^h_{rc} + d_{rc}(t) + T^{h*}_{rc} + T^{hg}_{rc} + T^{hh}_{rc} \\ & + [n_h(t) + n^*_h(t)] \Delta^n_{rc} \end{aligned}$$

where the first term in square brackets is labor income from production; w_{rlj} is the nominal wage rate by race, labor category and sector, and l_{rlj} is the direct

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$$p^c_{irc}(t) = [1 + t_{irc}(t)]\{(1-\sigma_{irc})p_i(t)[1-\upsilon^*_{irc}(t)] + p^*_i(t)(1+t^*_{rc})\sigma^*_{irc}(t)\}$$

where t_{irc} is the race and class specific indirect tax rate, σ_{irc} is consumer subsidies on domestic goods, again by race and class and υ^*_{irc} is the proportion of imported consumption. The tariff rate is t^*_{rc}. The VAT is collected on all components of final demand after 1993. The model is initially calibrated to the 1992 SAM and then the indirect tax shifts to a VAT in 1993.

[5] The capital price is given by:

$$p^a_{ki}(t) = (1+t_a)\{p_i(t)\nu^a_i(t) + [1+t^{*a}(t)]p^*_i(t)[1-\nu^a_i(t)]\}$$

where ν^a_i is the domestically produced proportion of investment by agent, t^a is the indirect (or VAT) tax rate applicable by agent and t^{*a} is the rate of customs duties. The VAT is collected on all components of final demand after 1993. The model is initially calibrated to the 1992 SAM and then the indirect tax shifts to a VAT in 1993.

[6] See [4] for the specification and derivation.

[7] For details see [24] and [16].

labor coefficient. The second term is income from public sector employment, with w^g_{rlg} as the government wage rate paid by race, skill and government function and L^g_{rlg} is government employment. The distribution of labor income by race, class and skill is determined by a fixed matrix Δ_{rcl}. Income from domestic services is denoted by, d_{rc} with Δ^h_{rc}as the distribution matrix and p^h_{rc} is the price of household labor services.[8] The demand for household labor services, C^h_{rc}, is determined as part of the LES in equation 2.1. The fourth term is dividends paid by firms as distributed by race and class and will be seen to be important in determining the distribution of income in the simulations below. Transfers to households from foreigners (net) are given by T^{h*}_{rc}, to households from government by T^{hg}_{rc} and to households from households by T^{hh}_{rc}. Interest payments on household deposits (see section 2.1.5 below) is given by n_h and interest payments and capital gains on capital flight is n^*_h and are governed by Δ^n_{rc}. Households in South Africa hold no government bonds by assumption of the makers of the SAM and so there is no direct interest payment from government to the households. Household capital gains on pension and insurance holdings are assumed to be fully reinvested.

Dividends are determined by after-tax firm income Y^f :

$$\begin{aligned} Y^f(t) &= (1-\bar{t}_f)\sum_j \{p_i(t) - [1+t_j(t)]V_j(t)\}X_j(t) \\ &\quad + n^g_f(t) + e(t)n^*(t) + n^f_h \end{aligned}$$

where $\bar{t}_f$ is the corporate tax rate Firm income is total revenue, net of indirect tax, and unit variable costs, V_j,

$$\begin{aligned} V_j(t) &= \sum_j p_i(t)A_{ij}(t) + p^*_i(t)A^*_{ij}(t) \\ &\quad + \sum_r \sum_l w_{jrl}(t)l_{jrl}(t) + w^*_{jrl}(t)l^*_{jrl}(t) \end{aligned}$$

plus net interest payments. Costs include domestic and foreign intermediate and wage payments. Firm income includes interest earned on government debt n^g_f, interest and capital gains on capital flight n^*as well as interest payments from consumers, n^f_h.[9] Dividends can then be calculated directly from firm income as:

$$d_{rc}(t) = (1 - s_f - \pi^g)Y^f(t) - T^{fg} - T^{f*}$$

[8]The price of labor services is determined as an output-weighted average of the wages of unskilled labor in the productive sectors.

[9]Interest on capital flight is net of interest paid on foreign loans.

where s_f is the rate of firm savings or retained earnings and π^g is the fixed fraction of firm income earned by parastatals. Transfers to government and foreigners, by firms are T^{fg} and T^{f*}.

Prices for agriculture and mining are given by the world price, but prices for the other six sectors are determined via a mark-up, τ_i, on intermediate and wage costs.

$$p_j(t) = [1 + \tau_j(t)][1 + t_j(t)]V_j$$

for sectors 3 through 8. The mark-up is given by

$$\tau_j(t) = \tau_j[u_j(t)/u_j(0)]^{\varepsilon_j^\tau} \tag{2.2}$$

where the time index 0 refers to the base SAM. The mark-up increases when capacity utilization is above normal, but is constant below. For $u_j(t) \leq u_j(0)$, $\tau_j(t) = \tau_j(0)$, ; that is, the elasticity, ε_j^τ,is zero. The shape of this relationship has important implications for the simulations as seen below.

2.1.2. Exports

For agriculture and mining, the difference between supply and domestic demand is exported. For the remaining sectors (3-8), exports are determined as a function of capacity output $Q_j(t)$ and the real trade-weighted exchange rate, e_i^r controlled by an elasticity ε_j and calibrated on the constant term, $E_j(0)$

$$E_j(t) = E_j(0)e_i^r(t)^{\varepsilon_j}\frac{Q_j(t)}{Q_j(0)} \tag{2.3}$$

Competitive imports are just the sum of the Armington import proportions of intermediates, consumption and investment. Government competitive imports are assumed to be fixed. Noncompetitive intermediate and investment imports are determined by the level of output and investment demand respectively. There are no other noncompetitive imports in the SAM.

2.1.3. Investment and Capacity

Investment in the model not only affects the level of aggregate demand in the model, but also the generation of capacity in the next period. Given its extraordinary importance we discuss the justification for the specification in more detail than for other equations. A common approach is to model firm investment by destination, I_j^f, as dependent upon a flexible accelerator. Here we write:

$$\begin{aligned} I_j^f(t) \;=\; & [I_j^f + \iota_r^f\pi_j(t) + \iota_g^f I_g(t)/\bar{Q}(t-1) \\ & -\iota_i^f i(t) + \iota_p^f\hat{p}(t) + \iota_{uj}^f u_j(t) - \iota_c^f u_c(t)]K_j^f(t-1) \end{aligned} \tag{2.4}$$

where ι_r^f is the sensitivity of investment to the rate of profit in that sector π_j. The "crowding-in" coefficient is denoted by ι_g^f and describes the sensitivity to government investment, I_g, normalized by aggregate capacity available at the beginning of the period. Sensitivities to the nominal interest rate, i, inflation, $\hat{p}$, sectoral capacity utilization, u_j and capacity utilization in the construction sector, u_c, are given by $\iota_i^f, \iota_p^f, \iota_{uj}^f$ and ι_c^f.

The investment function was designed following [11] which shows that in the South African case, investment is strongly conditioned by demand. This is also confirmed by [6] following [17] and [12] for sub-Saharan Africa. In equation 2.4 we employ the rate of capacity utilization:

$$u_j = X_j/Q_j(t-1) \tag{2.5}$$

as the principal accelerator.[10]

The crowding in term is more controversial. One study, [6] reports significance, but then for reasons that are unexplained, leaves public investment out of the final equation. Mlambo and Nell [13] find strong complementarity between public and private investment, tempered by a simultaneous crowding out-term which in their view captures macroeconomic instability.[11]

All the empirical studies cited here find that the user cost of capital does matter in South Africa, or at least it used to under the trade and financial sanctions of the past (the data on which the regressions were run). In equation 2.4, we include the nominal interest rate as well as the rate of inflation to capture the real cost of capital. The inflation coefficient is somewhat problematic, however, since if $\iota_i^f = \iota_p^f$, a rise in inflation, with the same nominal interest rate, causes the real rate to fall and investment to *increase.* Some studies have found that inflation is a good measure of macroeconomic uncertainly in South Africa and this suggests that ι_p^f should be larger than ι_i^f [13]. The World Bank econometric model, however, rules out measures of macroeconomic uncertainty while at the same time acknowledging it, in an effort to use "solely economic variables" [6]. Kahn, *et al.* successfully employ the standard deviation of the share price on the Johannesburg stock exchange as a measure of uncertainty, but they note that uncertainty around the real exchange rate and thus the real cost of imported investment goods is a strong performer in their regression [11]. Firm savings appears significant in [6], but this is highly correlated with our profit rate term.

[10] It is principal in the sense that the profit rate, π_j, is also strongly correlated with output and thus contributes to the effective size of the accelerator. See [1].

[11] In all studies cited here single equation methods were employed. It is thus impossible to appropriate directly coefficient values, from even the most trusted studies, due to "piling on." As an example, one study found that the accelerator had a coefficient of 1.6 which would send virtually any dynamic CGE into undamped oscillations.

Investment in South Africa consists of a relatively small component of domestic equipment since most is imported. Structures, are, of course, all domestically produced and so it is reasonable to include construction capacity with a small negative coefficient to account for bottlenecks in that industry. This term does not figure importantly into the econometric studies surveyed, but the expansion since 1992 suggests that under the more favorable post-election expectations, capacity constraints have emerged.

Investment of public enterprises and corporations is included in the private sector investment equation, consistent with the treatment of parastatals as part of the productive sector of the economy, accounted for in the SAM. Household, or residential investment is modeled separately, however, according to:

$$I^h_{rc}(t) = [I^h_{rc} + \iota^h_{yrc} Y^h_{rc}(t)/\bar{Q}(t-1) - \iota^h_{irc} i^r(t) - \iota^h_c u_c(t)] K^h_{rc}(t-1)$$

where investment depends on household income, normalized by aggregate productive capacity, $\bar{Q}(t-1)$, a negative term for crowding out that depends on the real interest rate, i^r, and a small coefficient, ι^h_c, for construction capacity.

Once investment by destination is known, investment by origin is determined by fixed proportions following the base SAM. Investment less depreciation, at rate δ, changes the capital stock according the accounting identity:

$$K^a(t) = I^a(t) + (1-\delta)K^a(t-1) \tag{2.6}$$

which holds for all agents, a. Productive capacity of firms is then determined by:

$$Q_j(t) = \kappa_j K_j(t-1) + Q_j(t-1) \tag{2.7}$$

where κ_j is the sector specific incremental capacity-capital ratio.

2.1.4. Nominal Wages

Nominal wage adjustment in structuralist models typically combines a Phillips curve and a more classical notion of a targeted real wage [19],[22]. These two concepts are different ideas about how the labor market works but are not necessarily in conflict with each other. On one hand, tight labor markets and high levels of capacity utilization should allow more rapid nominal wage adjustment to higher prices induced by devaluation or other increases in costs. This is a popular model, useful for open economies with persistent inflation [5]. A classical or conflicting-claims model, on the other hand, focuses on the adjustment toward a target real wage when historical patterns have been perturbed by inflation or productivity growth. If inflation accelerates and nominal wages lag behind, there will be a tendency to try to catch up by more aggressive bargaining or by way

of some explicit social compact in the organized sectors of the economy. Productivity growth exceeding the growth of real wages will cause the share of labor in total output to fall over time, igniting a more militant adjustment process.

In the model, we let the nominal wage rate in the current period be given by

$$\begin{aligned} w_{rlj}(t) &= (1+\bar{w}_l)\{1+\omega_{rlj\hat{p}}\hat{p}_{t-1}+\omega_{rlj\rho}[\hat{\rho}_{lj}(t)-\hat{w}^r_{rlj}(t)] \\ &\quad +\omega_{rlj\bar{u}}\bar{u}(t)+\omega_{rlju_j}u_j(t)\}w_{rlj}(t-1) \end{aligned} \tag{2.8}$$

where $\omega_{rlj\hat{p}}, \omega_{rlj\rho}, \omega_{rlj\bar{u}}$, and ω_{rlju_j} are coefficients with respect to lagged inflation, the difference between the growth rate of labor productivity, $\hat{\rho}_{lj}$, and the real wage growth, $\hat{w}^r_{rlj}$, aggregate capacity utilization and sectoral capacity utilization. Nominal wage adjustment is controlled exogenously via $\bar{w}_l$ in the simulations below.

Productivity is defined as the rate of decline of the labor coefficients (both domestic and foreign)

$$l_{rlj}(t) = [1-\hat{\rho}_{lj}(t)]l_{rlj}(t-1)$$

and rises with sectoral capacity utilization according to:

$$\hat{\rho}_{lj}(t) = \hat{\rho}_{lj} + \hat{\rho}_{lju}u_j(t) \tag{2.9}$$

Here $\hat{\rho}_{lj}$is the (exogenous) base rate of labor productivity growth and $\hat{\rho}_{lju}$ is the coefficient on capacity utilization. Variable productivity growth is an important factor in the simulations discussed below.

A large partial derivative, $\omega_{rlj\hat{p}}$ suggests the presence of inertial inflation or an "accelerationist" Phillips curve while a large partial, $\omega_{rlj\rho}$, suggests a strong attachment to an historically defined real wage or some kind of agreement on sharing productivity gains. The coefficients $\omega_{rlj\bar{u}}$ and ω_{rlju_j} capture the effects labor market conditions as well as substitution. As firms reach full capacity, the only option in the short-run is to hire more labor, bidding up the wage rate, or find ways to increase labor productivity. A similar wage equation was estimated by [6] with the largest coefficient on lagged wages, followed by a term correlated with unemployment.

Government wages are determined in the same way as private wages. As the conditions in the labor market tighten, the public sector must offer higher wages to attract workers.[12]

[12]Part of the macroeconomic strategy of the GEAR [18] is to "improve the State's ability to recruit and retain personnel through achieving parity between pay levels in the public and private sectors." It is also true that lower real wage growth has contributed to the "right sizing" the public sector as the economy has recovered. See [21].

Government expenditure is disaggregated by current and capital expenditure and the former is disaggregated by function. Current spending on domestically produced goods and services is modeled as a share, σ_{ig}, of GDP:[13]

$$G_{ig}(t) = \sigma_{ig} Y(t)/p_i(t)$$

Government employment, L^g_{rlg}, is also determined by the share of the government wage bill, σ^{gw}_{rlg},

$$w^g_{rlg}(t) L^g_{rlg}(t) = \sigma^{gw}_{rlg} Y(t)$$

where $w^g_{rlg}(t)$ is the wage by race, occupational and functional expenditure category.

Government expenditure also includes subsidies to firms, Υ_j, based on output, and subsidies to consumers, Υ_{rc}, are driven by the nominal value of consumption. Transfers from government to households, T^h_{rcg}, are budgeted in nominal terms and typically set by South African policy makers as a fraction of nominal GDP. Similarly, transfers to foreigners $T^*_g$are set as an exogenously determined fraction of GDP, calibrated to the base SAM.

Total current government expenditure, G, can then be expressed as:

$$\begin{aligned} G(t) \;=\; & \sum_g \sum_i (1+t_{gc})\{p_i(t) G_{ig}(t) \\ & + [1 + t^*_g(t)] p^*_i(t) G^*_{ig}(t)\} \\ & + \sum_r \sum_l w^g_{rlg}(t) L^g_{rlg}(t) \\ & + \sum_r \sum_c T^{hg}_{rc}(t) + \Upsilon_{rc}(t) + \sum_j \Upsilon_j(t) \\ & + \sum_g T^*_g + n^g_f(t) \end{aligned}$$

where t_{gc} and t^*_g are the indirect tax and customs duties rates paid by government to itself. Transfers to foreigners on a net basis are given by T^*_g.

Government income is from direct taxes, $\bar{T}$, and indirect taxes T, defined above, parastatals profits, and customs payments, T^* :

$$Y^g(t) = \bar{T}(t) + T(t) + T^*(t) + \pi^g Y^f(t) + T^*(t)$$

all tax and customs rates are calibrated to the base SAM.

[13] The same equation applies for imported government consumption.

The public sector borrowing requirement (PSBR), denote here as Γ, is the difference between current plus investment spending less income:

$$\Gamma(t) = G(t) + \sum_i p^k_{gi}(t) I^g_i(t) - Y^g(t) \tag{2.10}$$

where p^k_g is the price of capital paid by the government. The PSBR to GDP ratio is set in the simulations exogenously as a matter of policy and has been the central measure of government intervention in South Africa.[14]

2.1.5. The Financial Sector

The financial sector in the model consists of equations that describe the nominal interest and exchange rates as well as the portfolio balances of the agents of the model. The financial equations are calibrated to the 1992 flow of funds table [20]. The behavioral parameters for this part of the model were derived through a detailed econometric analysis of the annual flow of funds tables from 1970 to 1994.[15] The financial side of the economy is considerably more compact than the real side. All firms are aggregated into one, including banks, as are households and government by function.

The fundamental accounting identity is the financial surplus, ϕ^a, which is defined as the savings less investment for each agent.[16] The portfolio of each agent must then satisfy the constraint:

$$\phi^a(t) = \delta D^a(t) + \delta B^a(t) + \delta F^a(t) - \delta L^a(t) \tag{2.11}$$

where δD^a is the change in deposits by agent, δB^a is the change in bonds, δF^a the change in capital flight and δL^a is the (net) change in loans from all other agents in the system.

The principal mode of interaction between the financial and real side of the model is through interest payments on government bonds held by banks (firms) and bonds held by the Public Insurance Commissioner (PIC) for retirement of public employees. There are also interest payments on loans from banks to households in the form of mortgages and for speculation in the domestic financial markets, largely through pension and insurance funds (PIFs). Households make loans

[14] Note, however, that the PSBR as defined here and in the base SAM does not correspond to frequently published PSBR ratios, which includes capital transfer, government portfolio investment and losses on forward cover sustained by the SARB. In the case of South Africa, these omissions are not insignificant, pushing the "real" PSBR as measured in the SAM of 5 to 6% of GDP to above 10%.

[15] Details of the econometric evidence are beyond the scope of the study. They are available from the authors upon request.

[16] Since overall savings and investment must be the same, it follows immediately that the sum of the financial surpluses is identically zero.

to firms in the form of equity in the model and banks make loans to firms for working capital. But because banks and firms are aggregated the model does not calculate interest payments on these loans. Interest on capital flight does appear as an income entry for both firms and households as seen above.

Firm and bank portfolios The change in firm deposits is related to income in the model. Extensive regression analysis shows that firm capital flight is best linked to past capital accumulation (positively) and current investment (negatively).

$$\delta F^f(t) = \delta F^f(0) p_k^f(t)[K^f(t-1) - \beta_F^f I^f(t)]$$

where β_F^f is the regression coefficient, and again, the zero time subscript indicates the base-SAM value. The equation implies that if firms are involved in an expansion of productive capacity, then capital flight falls. Total bank loans by firms are assumed to follow a function:

$$\delta L^f(t) = \delta L^f(0) p_k^f(t)[K^f(t-1) + \beta_L^f I^f(t)] + \beta_B^f \delta B^f(t)$$

where β_L^f and β_B^f are determined by regression. Thus, as capital stock rises, so do loans; but they rise even more as investment increases.

The last term requires an increase in loans when firm holding of government bonds, δB^f, increases. We shall refer to this feature of the South African financial system below as "indirect monetization". Thus, as the financing requirements of the government increase, the government offers bonds to the private banks which by tradition, custom or cajolery purchases them. If banks are not at the reserve limit, they may well choose to reduce excess reserves to accommodate the purchase of government paper. Since the resources have in principle been borrowed from the private sector, there should be no monetary implications. In practice, the money supply rises rapidly; the central bank is then forced to push up the interest rate in an effort to slow the monetary expansion. The deficit has been *indirectly* monetized and the rise in the interest rate reduces private accumulation. The policy begins as an offering of public debt, then becomes monetized and ultimately behaves as if it had been debt in the first place.

The composition of loans, domestic and foreign, follows an Armington function in which firms seek to minimize the total cost of borrowing by contracting loans as a function of the ratio of domestic to the foreign interest rate converted at the modeled exchange rate. To guarantee that equation 2.11 will be satisfied, we make equity, included in δL, the residual.

Household's portfolios Households in South Africa (at least White upper middle income and above) are renowned for their speculative investments in the

last decades and this is strongly confirmed by the flow of funds data. There have been enormous investments in the PIFs by households, far greater than can be explained by savings flows alone. In the model, pensions accumulate as a function of household income:

$$\delta P(t) = p(t)\delta P(0) + \beta_P^h \sum_r \sum_c Y_{rc}^h(t)$$

where $p(t)$ is the price index and β_P^h is a regression coefficient. Households borrow to finance the accumulation in pension and insurance funds:

$$\delta L^h(t) = p(t)\delta L^h(0) + \beta_L^h \delta P(t) \tag{2.12}$$

where β_L^h is a regression coefficient. The change in mortgages, δM, is linked to PIF accumulation as well but less strongly than other loans:

$$\delta M(t) = p(t)\delta M(0) + \beta_M^h \delta P(t)$$

where β_M^h is a regression coefficient. Household deposits are also controlled by pension and insurance investment, but here the response is negative:

$$\delta D^h(t) = p(t)\delta D^h(0) - \beta_D^h \delta P(t)$$

where β_D^h is a regression coefficient. Capital flight of households is determined by an initial quantity, δF^h which is then adjusted according to the ratio of the domestic interest rate to international, i^*, converted at the modeled exchange rate. The response elasticity is ε^h.

$$\delta F^h(t) = p(t)\delta F^h [\frac{i(t)}{e(t)i^*}]^{\varepsilon^h}$$

Government portfolio The principal mechanism for the internal financing of public sector debt in South Africa is that government places bonds first with the PICs according to a demand for bonds, δB^p, which depends on the change in the government wage bill:

$$\begin{aligned} \delta B^p(t) &= p(t)\delta B^p(0) + \beta_B^p \sum_g \sum_r \sum_l w_{rlg}^g(t) L_{rlg}^g(t) \\ &\quad - w_{rlg}^g(t-1) L_{rlg}^g(t-1) \end{aligned}$$

where β_B^p is a regression coefficient. Bond holdings by the SARB are held constant in the simulations and the excess bond supply is absorbed by firms as discussed above.

Central Bank reaction function If inflation accelerates, the central bank raises the nominal rate of interest. The central bank reaction function is written

$$\begin{aligned} i(t) &= i(t-1) + i_{\hat{p}}[\hat{p}(t) - \hat{p}(t-1)] + i_u[\bar{u}(t) - \bar{u}(t-1)] \\ &\quad -i_h[T_b(t) - T_b(t-1)] + i_{m3}[M_3(t) - M_3(t-1)] \end{aligned} \tag{2.13}$$

where $i_{\hat{p}}$ is itself a function with some hysteresis built in. The reaction function is aimed at slowing inflation as economic activity accelerates as measured by aggregate capacity utilization, $\bar{u}(t)$. The nominal interest rate is also linked to the trade balance, T_b,with a negative sign. The sensitivity of the interest rate to the money supply, M_3, is given by i_{m3}.

$$e(t) = e(t-1)[1 + e_{\hat{p}}\hat{p}(t)] \tag{2.14}$$

where $e_{\hat{p}}$ is the exogenously given sensitivity to the rate of inflation.

The nominal exchange rate is a second policy reaction function. It is calibrated to the real exchange rate but can be changed exogenously. If policy makers employ the exchange rate as a nominal anchor to resist the upward pressure in prices, then exports will decline with the appreciation.

2.2. How the Model Works

We conclude this section with some observations on the principal adjustment mechanisms of the model and how it is likely to respond to an autonomous increase in nominal wages via an increase in $\bar{w}_l$ in equation 2.8 above. First it is important to see that in a dynamic model, wage changes in one period not only affect contemporaneous output and employment, but also influence profits and thus investment as specified in equation 2.4 above. If the rate of capital accumulation diminishes potential output, Q_j, grows more slowly. Capacity utilization rises in the fix-price sectors and output and employment falls in agriculture and mining.[17]

If the mark-up and real exchange rate remain fixed after a nominal wage change, real wages in terms of the fix-price sectors will not change. Real wages will rise, however, in terms of the remaining sectors, mining and agriculture. This

[17]It should also be stressed that the model is entirely interlinked over the simulated period with the principal endogenous dynamic arising out of the dependence of the investment function, nominal wages, the mark-up and productivity on capacity utilization. As seen in equation 2.5 above, u depends upon current period demand and the accumulation of productive capacity in the *previous* period. Finally, it should be noted that there are no constant growth rates exogenously applied to the model nor is its behavior determined by any steady-state properties built into the framework of equations. For each variable a trajectory is presented along with period averages.

will increase demand for all goods and some inflation will result, especially if capacity utilization rises above normal.

What happens next depends upon the policy response. If the authorities react to higher inflation by raising the nominal interest rate and letting the real exchange rate appreciate, then investment and exports will fall and this will offset the expansionary effect of the wage increase. Imports will fall with income but recover with the real appreciation, so that the trade balance will probably deteriorate, putting further upward pressure on the interest rate which will only reinforce the tendency for investment to fall.

Higher real wages will provoke an apparent substitution of capital for labor via equation 2.9. But note that this is true only if the economy is stagnationist. Labor demand per unit of output falls, but the effect on employment is masked by the overall expansion in activity and real wages appear to be positively correlated with employment.

If the economy is indeed exhilarationist, however, the decline in output will cause productivity to fall, cushioning the unemployment effect of higher wages. Substitution, in terms of labor per unit output, will be perverse due to overhead labor, but now the real wage increase appears to be correlated with unemployment in the proper way. In fact, the effect of higher wages on employment is a result of the combined influence of the overall structure of the economy, including the policy regime.

Since a real wage increase in the private sector typically leaks into the government wage bill, a wage increase will cause to the PSBR to rise. But if the PSBR is fixed relative to GDP by current policy, some other component of government spending will have to fall, and more so if the economy is exhilarationist (See equation 2.10). In South Africa, as elsewhere, it is usually government investment that adjusts when the PSBR ratio must be reduced, with consequent multiplier effects in the short run accentuated by whatever crowding-in may exist. A policy target of a fixed PSBR to GDP ratio thus increases the correlation of unemployment with higher real wages in both stagnationist and exhilarationist regimes.

On the financial side, higher nominal wages will increase the demand for bonds by the PICs. In an exhilarationist regime, the financial surplus of firms will typically rise as lower levels of capacity utilization force a decline in investment. Ironically, this enables the public sector to place its debt more easily and less indirect monetization will take place; $M3$ thus falls and with it the nominal interest rate according to equation 2.13. In a stagnationist system, the opposite occurs and the money supply rises, via indirect monetization, with the wage increase, pushing up the nominal interest rate as the Reserve Bank acts to slow the economy.

But even though the financial system reduces the tendency toward an exhilarationist response, monetary policy in South Africa works in the opposite direction.

Because of the calibrated hysteresis in the interest rate equation, down-side adjustment of the nominal interest rate is not as quick as when inflation accelerates. As a result, the real interest rate rises when inflation falls and the subsequent employment loss is greater due to investment multiplier effects.

3. Simulations

In this section we present some numerical simulations to see if in fact our dynamically calibrated model shows an exhilarationist or stagnationist response. We begin with a base run, calibrated to the data for 1992 to 1995 and then shock the economy with a nominal wage increase by increasing $\bar{w}_l$ in equation 2.8 from zero in the base run to 0.15.[18] As in the real economy, the outcome of the CGE simulation are resultants of a large number of forces which may act in the same or opposite directions. Moreover, as the effects of exogenous changes accumulate or diminish over time, the balance of forces can change from the beginning to the end of the trajectory.

Results are obtained for a general wage increase and a wage increase for only the lowest classification, unskilled labor. We investigate the effects of wage increases on investment, capital accumulation and growth and employment under alternative assumptions about the interest and exchange rate policy, with and without a binding PSBR to GDP constraint. We then lower nominal wages for unskilled labor to gage the symmetry of the model and, finally, we introduce an increase in demand to assess the effect of growth on the real wage.

3.1. The Base Run

Table 3.1 provides an overview of the base run of the model economy in the 1992-95 simulated period and table footnotes indicate which variables were calibrated to historical series.

In 1992, South Africa was emerging from a deep recession and there was little pressure on nominal wages. Inflation was falling and the wage inertia of the past allowed real wages to rise despite slack in the labor market. The recovery caused the level of capacity utilization to rise to 88.5% in 1994 and then to fall again in 1995 as capital and capacity accumulated according to equations 2.6 and 2.7 above.[19]

[18] Thus, for the same values of the endogenous variables on the right-hand side of equation 2.8, the nominal wage response increases by 15%.

[19] More detailed sectoral results of the model (not shown in the table) indicate that there was broad participation in the recovery with the exception of textiles and apparel, sectors that have been hurt by low-cost imports from Asia. Mining also suffered from the decline in the international price of gold.

As output increased, the real interest rate rose as a result of the unanticipated decline in inflation. Investment appears to have been impervious, however, and increasing by 4 percentage points of GDP over the simulated period. This was due in part to the more buoyant expectations following the end of apartheid and transition to a democratic regime under the African National Congress.

Please insert Table 3.1 here.

During the calibrated period, the real exchange rate appreciated somewhat due to higher levels of capital inflow that followed the end of financial sanctions against South Africa. Exports increased by 23% over the four-year period, but imports increased faster, by 37%. Thus the current account went from a small surplus to a small deficit.

The table shows that White real wages increased the fastest in the base run, some 2.5% over the period. Coloured, Asian and Black wages lagged behind. White wages are on average 3.2 times higher than Black wages which were two-thirds of the Asian and 80% of the Coloured average wage. Three quarters of Whites are in the first two of the four occupational categories accounted for in the model, service, professional, unskilled labor and farm workers. Almost two-thirds of Blacks are in the last two categories.[20] Asians and Coloureds fall in between these extremes, but closer to Blacks than Whites. White nonfarm, unskilled labor earned almost three times the real wage of their Black counterpart.

Employment gains in the base run were shared more evenly than wages, although there was a contraction in government employment relative to private (not shown). Observe that on average employment grew less rapidly than output, 5.5% versus 7.7%, cumulatively. Private sector employment grew almost as fast as output as a whole.

The savings on government wages caused the PSBR to GDP ratio to drop from 6.1% to 4.3%. More detailed results (not shown) indicate that while employment in the public sector fell, the wage bill was roughly constant, suggesting that the average government wage was increasing during the period. Government interest on public debt also increased rapidly during the period, by 25.6% from 1992 to 1995. High real interest rates, shown in Table 3.1, accelerated the run up in debt. Remarkably, the PSBR declined nonetheless due the combination of an increase in state incomes (as the economy shifted to a value added tax in 1993) combined with lower transfers.[21]

The last segment of Table 3.1 shows that the money supply was increasing over the period. The counterpart of the observed monetary growth is the increase in the

[20] Only 6.3% of Blacks are categorized as professional, on average over the calibrated period.
[21] The exception is 1994.

value of household portfolios as households became more leveraged. Capital flight of firms also declined during the period in order to finance rising real investment. Bond supply follows the government deficit and the indirect monetization, shown in the last line of the table, was increasing rapidly.

3.2. A Wage Increase with An Aggressive Reaction

Having dynamically calibrated the model to recent South African economic history, we next consider how the economy would have responded to a 15% boost in nominal wages given the aggressive posture of the SARB. By "aggressive" we mean that (1) the bank tightens credit in an attempt to maintain the real interest (see equation 2.13); (2) the nominal exchange rate is allowed to appreciate as a second anti-inflationary measure.[22] We also hold the PSBR to GDP ratio equal to that of the base run. Some of the results of the simulation are shown in Table 3.2 in which nominal wages were increased for all workers on the left and for only unskilled workers on the right-most columns of the table.

Please insert Table 3.2 here.

3.2.1. A general increase in wages

First note that the general wage increase is contractionary in this business-as-usual simulation. In other words, the results show that the South African economy was exhilarationist for the calibrated period. Average output is reduced to 91.8% of the base run and capacity utilization declines on average by 8.5%. The wage increase is inflationary, of course, as prices rise 13.1% in the first simulated period, 1993. There is a quick reaction by the Reserve Bank; the nominal interest rate increases initially by 14.5% with the real rate of interest rising by 1.5%. The shock dissipates in the next two periods such that the real interest rate rises then falls to below the base run level.

The brakes have applied with some force and within three years the inflation rate is contained to less than one percentage point above the base value. The cost, however, has been dear; total investment measured as a percentage of GDP declines steadily over the trajectory relative to the base run.

More detailed model results show that the collapse in investment caused the sectoral GDP of construction to fall by some 23%. Backward linkages of this labor-intensive sector also reduce the demand for food and domestic manufactured goods. The appreciation of the real exchange rate, which averages 5.4%, causes exports to fall by 3%. Imports decline with income but increase with the appreciation so that the current account goes into deficit by 1994 and stays there.

[22] That is, $e_{\hat{p}}$ falls below one in equation 2.14 above.

The decline in reserves puts additional upward pressure on the nominal interest rate according to equation 2.13 above

Despite the large nominal gain, the average real wage increases by only 2.7% in the first year and on average by only 2% over the trajectory as a whole. This is largely the result of the downwardly fixed mark-up in equation 2.2 above and the decline in productivity in equation 2.9, as capacity utilization falls below normal.

Blacks are least vulnerable to the wage-induced decline in employment.[23] Their real wage increases by 2.2% on average, while their employment level falls by 5.6%. Asians suffer the greatest loss in employment due to their relatively higher real wage gains. The elasticity of employment with respect to the real wage is in the range of 2.6-2.8 for all races.

Despite the decline in employment, the increase in wages is progressive as shown by the decline in the disposable income Gini coefficient in the table. Part of the progressivity, however, is due to the reduction in incomes of the rich output, profits and dividends fall. This feature of the model (as well as the economy) is important to keep in mind in interpreting the results of the simulations below.

As seen in the lower part of Table 3.2, public investment drops to only 25.5% of base run level and is completely wiped out by 1994.[24] Even with the increase in public sector wages, real total expenditure remains virtually constant. More detailed results show that the wage bill of the government is indeed 2.7% higher than in the base run in the first year. This is compensated, however, by lower real government interest payments due to the effect of inflation on existing government debt. On the other hand, tax revenues fall with the slowdown in growth. On balance, government current dissaving rises by more than threefold by 1995. The binding PSBR constraint, (shown as zeros in the PSBR/Y row of the table) implies that government investment falls so dramatically.

The loss in employment outweighs the wage gains in this simulation and thus household income falls. As a result, pension accumulation declines by an average of 11.9% over the period. Firms' financial surplus falls with output and capital flight fluctuates with the foreign versus domestic rate of return. Because public

[23] Government wages increase faster than in the private sector due to the contraction of some high wage industries in the mix of private sector output (not shown.) Compositional effects are evidently important in the determination of the average, economy-wide wage rate. Of the four sectors with the highest average wage rate, utilities, services, textiles and manufacturing, the latter two suffered the most significant declines in output and employment. As noted, construction was hurt the worst due to the collapse in investment, but wages in that sector are on the lowest in the nonagricultural economy. Moreover, many blacks are employed in agriculture and mining and are not, therefore, vulnerable to the decline in demand in the same way as the remaining sectors.

[24] This relatively large change is due in part to the low base level of public investment as a share of GDP, 3.4%.

investment has fallen so dramatically to satisfy the PSBR constraint, overall borrowing is lower. The absorption of bonds by the PIC rises slightly (not shown) and thus indirect monetization falls. This slows the rise in the nominal interest rate as seen in equation 2.13 above.

3.2.2. An increase in unskilled wages

The right-hand side of the table shows the more moderate effects of raising unskilled wages only, again by 15% and under the same assumptions about the macroeconomic policy reaction. It is evident that there is less damage done to the economy in terms of lost output and employment. Inflation is lower and the real interest rate is only slightly above the base. The sectoral pattern of output is similar, except that construction does not contract as violently due to the relatively small reduction in total investment. The real exchange rate appreciates, but again not as much as in the first simulation. Neither is the increase in foreign saving as pronounced.

The real wages of Coloureds and Blacks are the highest in this simulation owing to their greater numbers in the unskilled category. They are followed by Asians, but notably Whites suffer a small decline in their average real wage due to the inflation. Employment is also less affected, with Blacks experiencing the smallest contraction in total employment, followed by Whites and Coloureds. Not unexpectedly, the increase in the wages of unskilled labor improves the distribution of income more than a general increase in wages. This is confirmed by the disposable income Gini.

The impact of the wage on the public sector is also much less than in the first simulation. The public sector hires little unskilled labor in South Africa. Public sector investment is far more resilient as a result and also helps to crowd in private investment. Part of the recovery of public investment is due to the fiscal drag prevalent in the South African tax system that compensates partially for the decline in output.

The stronger drop in the Gini coefficient reflects the fact that the loss in income due to rising unemployment is more than offset by the gain in income due to the wage increase for the low-income households. This is especially evident for Blacks who see an average increase of 3.4% in their real wage but only lose 1.6% in employment. Overall, household income does not recover fully compared to the base run as the trajectory for pension accumulation shows.

3.3. Policy Dominance

Monetary policy is dominant in the South African economy, and in the model, in way that might not be entirely evident. Note first that the fixed PSBR to GDP

ratio allows the monetary authority to exert considerable influence over the fiscus. Higher interest rates crowd out pubic sector investment and thus contractionary monetary policy begets contractionary fiscal policy. Second, with crowding in, the effectiveness of monetary policy is increased. Raising the interest rate also stimulates the private sector to acquire bonds, reducing indirect monetization. Finally, when the PSBR constraint is binding, international reserves remain at a higher level, due to lower imports, and devaluation to achieve external balance is not as necessary. Exchange rate policy can then be directed toward fighting inflation.

In order to isolate the effect of the PSBR constraint we next set government investment exogenously at the level of the base run. The increase in wages will then have no effect on government investment and thus one of the main factors in reducing the overall investment share is removed.

Please insert Table 3.3 here.

Table 3.3 provides the details on how the trajectories unfold. As seen, GDP growth initially dips but then recovers. On balance growth is somewhat more robust and capacity utilization is higher. The left-hand side of the table shows that an increase in wages reduces output by 7.4% when all wages are increased and 2.4% when only unskilled wages rise. This is opposed to drop of 8.2% and 2.7% when the PSBR constraint binds. The rise in the real interest rate is initially considerably sharper and remains relatively high since the responsibility for fighting inflation falls only on the shoulders of the central bank with no help from the PSBR rule. With public investment is held constant by assumption, the effect is to crowd out private investment more strongly.

With additional growth (relative to Table 3.2), imports would be higher than when the PSBR constraint binds except for the effect of the depreciated real exchange rate. Exports, on the other hand, are crowded out more strongly, but less so when the wage increase is targeted at low income workers. Imports also rebound with the faster growth on the right-side of the table.

The pattern of change in the average real wage is similar that of Table 3.2. Real wages are marginally higher, as is employment, when the PSBR constraint does not bind. As before, Blacks suffer the least deterioration in their employment relative to the base run. When all wages increase, their real wages rise the least rapidly, but when only unskilled wages increase, the Black real wage experiences the largest jump.

Real wages are higher when the PSBR constraint does not bind because inflation tapers off more rapidly over the trajectory. The explanation lies in productivity growth equation 2.9 above. When real wages increase in an exhilarationist model, output and capacity utilization fall and thus productivity growth slows

down. The downwardly fixed mark-up insures that growth in nominal wages is translated into higher inflation. When the PSBR constraint does not bind, however, capacity utilization and productivity increase together, or at least do not fall as much. Higher nominal wages produce less inflation and higher real wages. The dynamics also work in the same direction: *viz.* as capacity utilization falls, so does investment diminishing the growth of capacity and exports (see equation 2.3 above) for the next period. Slower export growth raises foreign savings which pushes up the nominal interest rate according to the policy response function 2.13. Investment remains below the base-line trajectory even when the PSBR is free to vary.

Observe that the impact on the inequality as measured by the Gini coefficient is *less* than when the PSBR constraint does not bind. As above, this is a reflection of higher profits and dividends compared with Table 3.2.

With public investment fixed at the base level, the PSBR increases by an average of 1.2% and 0.3% of GDP in the two simulations, as seen in the next to the last panel of Table 3.3. The increase in the real interest rate also helps government interest payments to rise in real terms (not shown). As the bond supply increases, indirect monetization must rise with it and this accelerates the increase in the nominal interest rate. The resulting lower levels of private investment causes the financial surplus to rise. Some of this increased liquidity finds its way out of the country in the form of capital flight on the part of firms and into speculative investment for well-off households. Notice that this fluctuates on the right-hand side of the table.

3.4. A Restrained Central Bank Reaction

To investigate the role of the Reserve Bank in creating and exhilarationist response, we re-impose the PSBR constraint and relax the reaction function so that inflation is just matched by the rise in the nominal interest rate. We also restore the time-path of the exchange rate to its base-solution value.

Please Insert Table 3.4 here.

Table 3.4 shows that with a muted central bank reaction, a general rise in wages is now slightly expansionary; i.e., the economy becomes slightly stagnationist. When only unskilled wages increase, real GDP and capacity utilization are very close to the base solution. Inflation is higher but it is well within control. With little decline in capacity utilization, productivity remains high.

Note, also, that trade deficit remains under control, since exports recover faster when the monetary authority abandons its effort to fight inflation with exchange rate appreciation. Also, as a result of the lopsidedly constant mark-up, the change

in the average real wage (when all wages are increased) is virtually nil over the period, less than one-half of one percent. Associated with the increase in wages is only a slight decrease in employment. The average employment elasticity of -0.8 approximates a pure substitution effect of higher wages on employment, in that the level of output is close to the base run, and is similar to what previous studies have found.[25]

But while there is little change when all wages are increased, a targeted wage change has a more pronounced real impact. On the right-hand side of Table 3.4, it is evident that the average real wage of Blacks increases by 3.2%. Coloureds also gain. Without the aggressive response to inflation, employment losses from the wage increase are insignificant. The decline in employment is approximately equally distributed across racial categories in both cases. Whites gain, but only marginally. With an increase in the unskilled wage rate, the distribution of income improves by the most so far. Observe that while the Gini falls slightly less than when the PSBR constraint is relaxed (the right-hand panel of Table 3.3), the difference is related to the overall performance of the economy, now almost fully recovered to the base run. When all wages increase, there is no effect on the Gini.

The financial side of the economy suggests little imbalance. Note that household portfolio investment is fully recovered, relative to the base run. Indeed, when all wages increase, the level of indirect monetization rises by only 2.6% on average and by less than one percent with a targeted wage increase.

The simulation of the right-hand side of Table 3.4 represents a well-managed effort to coordinate a wage increase with few adverse effects. While it is clear from the left panel that wage-led growth is impractical in this model, we can conclude that an attempt to improve the distribution of income is not necessarily disruptive to economic activity.

3.5. Growth and Real Wages

Given an exhilarationist response with aggressive monetary reaction, it is of interest to see if *reducing* nominal wages of unskilled labor by 15% will stimulate growth. Table 3.5 shows that output actually *falls* by almost a percentage point relative to the base run. The root of the asymmetry lies in the hysteresis in the interest rate equation 2.13. As inflation is reduced, the real interest rate increases by 0.9 above the base run on average. This crowds out both public and private investment, while output and capacity utilization decline. As a result, the changes in the economy are largely benign. Only real wages of Blacks and Coloureds decline significantly and as a result they suffer the least amount of unemployment. The Gini coefficient rises, despite the lower level of output.

[25] See [2] for details.

Please Insert Table 3.5 here.

Because the public sector employs mostly non-Black skilled labor, the government real wage bill increases, as do real interest payments, and this contributes to the contractionary nature of the simulation. Government investment falls almost 20% on average, but shows an increasing trend. On the financial side, money growth is slower and indirect monetization is less, both consistent with lower nominal interest rates.

3.5.1. A demand led expansion

In the right-hand panel of Table 3.5, we approach the growth-real wage relationship differently. In this simulation, we increase exogenously investment, government expenditure (including the wage bill) and exports, all in real terms by 10%. As seen, the stimulus brings a burst of growth. For the first time, capacity utilization rises above the base level. This provokes a small increase in the mark-up as indicated in equation 2.2 above and the resulting inflation reduces the real wage for all workers. The rise in public investment crowds in private investment but the increase in the real interest rate crowds it out. Still, total investment increases as a share of GDP relative to the base run. The cumulative effect the growth on employment is strong, some 4.3%.

Observe that the decline in the real wages of Blacks is the same as with a decline in unskilled wages. But in this case, Blacks exchange the loss in real wages for a gain of 3.9% in employment. The implication is clear; when growth produces a fall in real wages, it is shared equally by all workers.[26] When real wages of only unskilled labor decline, the growth fails to materialize. In both cases, the disposable income Gini rises, but less in the second simulation. Notably, the rise is moderated in the second simulation despite the significant rise in output there.

Can we conclude that demand-led redistribution is more effective than a targeted wage increase in improving the distribution of income? Possibly, but there are important warning signs. Note that inflation is high and sustained, unlike all previous simulations. The Central Bank is powerless to arrest the inflation, despite high nominal and real interest rates. Fueled by foreign borrowing at lower real interest rates, investment proceeds at rapid pace. But other imbalances begin to emerge: real foreign saving is the highest of all the simulations, for example,

[26] Wage increases accompanied by a constant mark-up would be obviously less damaging to employment, since inflation and thus the reaction of the monetary authorities would be less severe. On the other hand, when the monetary authority is successful in curbing inflation, real wages rise as a result. But this will reduce private investment, due to lower profits. Public investment will also decline due to a higher public wage bill.

despite the growth in exports.[27]

While the approach to redressing inequality of this simulation is perhaps the most powerful, it is also the least realistic. The simulation implicitly asks South African policy makers to reverse course entirely. Not only must they attenuate their response to inflation, but rather stimulate demand in an economy already suffering from moderate inflation. The prospect, as desirable as it might be for progressive redistribution, is at best unlikely.

4. Conclusions

This paper has shown that whether wage increases lead to a reduction in employment depends crucially on the policy reaction to inflation. In a model made as realistic as possible, and calibrated to recent data, contractionary monetary and fiscal policy must collude to create any significant drop in employment when the wage rate rises. The monetary authorities must overshoot the real interest rate and use the exchange rate as a nominal anchor. Policy dominance via a PSBR to GDP ratio will sharpen the employment response to higher wages. The simulations confirm a growth-equity trade-off in the model, but it is much less severe when wage increases are targeted at unskilled labor.

While the modeling exercise of this paper does not support a wage-led growth strategy, wage-led redistribution certainly appears feasible. If the authorities wish to alter the distribution of income, wage increases need not have a significant impact on employment. These results are all contingent upon the precision of the key equations of model, in particular the investment function and the central bank interest rate reaction function. It is evident that the model will not necessarily apply to other countries (or even other time periods for South Africa) without first undertaking a structuralist analysis as has been done here.

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Table 3.1: The Base Run[1]

	1992	1993	1994	1995	Average
Macroeconomic Data[2]					
Real GDP Growth Rate[3]	-2.4	1.3	2.8	3.4	2.5
Capacity Utilization	86.4	86.3	87.4	86.9	86.9
Inflation[3]	13.9	9.7	9	8.6	9.1
Nominal Interest[3]	15.4	12.8	12.3	14.5	13.2
Real Interest[3]	1.6	3.1	3.4	5.9	4.1
Investment /GDP[3]	16.0	17.0	17.5	19.1	17.9
Real Exchange Rate[3,4]	100	98.9	97.7	95.1	97.2
Exports[4]	78.8	83.1	87.2	97.1	89.1
Imports[4]	64.6	69.7	77.9	88.1	78.6
Real Foreign Savings[4]	-3.9	-2.2	2.1	2.7	0.9
Real Wages, Employment and Income Distribution[5]					
Average Real Wage	100.0	99.6	102.0	103.0	101.5
White	100.0	99.6	102.5	103.4	101.8
Coloured	100.0	99.6	101.7	102.7	101.3
Asian	100.0	99.5	101.8	102.8	101.4
Black	100.0	99.6	101.8	102.8	101.4
Employment					
White	100.0	101.1	101.6	105.1	102.6
Coloured	100.0	101.0	102.0	105.5	102.8
Asian	100.0	100.9	102.9	106.2	103.3
Black	100.0	101.0	102.2	105.5	102.9
Gini-disposable income	0.583	0.587	0.577	0.588	0.584
Government Accounts					
Total Expenditure[4]	98.1	100.2	110.1	103.6	104.6
Indirect taxes[4]	21.5	20.5	30.8	23.5	24.9
Govt Income[4]	90.0	91.3	103.1	99.5	98.0
Govt Investment[3,4]	10.5	10.6	10.3	10.0	10.3
PSBR/GDP[2]	6.1	6.3	5.5	4.3	5.4
Financial Accounts					
Nominal Stock of M3[5]	100.0	107.1	123.9	142.8	124.6
Household Pensions[6,7]	100.0	103.5	117.5	120.5	113.8
Financial Surplus[6,8]	100.0	91.5	63.0	42.1	65.5
Capital Flight[6,8]	100.0	89.1	82.2	63.2	78.2
Bond Supply[6]	100.0	166.2	101.3	147.0	138.2
Indirect Monetization[6]	100.0	230.0	116.3	206.3	184.2

Source: Model computations. *Notes*: 1. Base year is 1992. 2. Percent.
3. Calibrated to historical data. 4. Billions of 1992 rands. 5. 1992 = 100
6. Real terms, 1992 = 100. 7. Investment in PIFs. 8. Firms only.

Table 3.2: 15% Increase in Wages with Aggressive Response by the Central Bank
(Ratios to the base run except where indicated.)

	All Wages				*Wages of Unskilled Labor*			
	1993	1994	1995	Average	1993	1994	1995	Average
				Macroeconomic Data				
Real GDP	93.0	91.4	91.1	91.8	98.1	97.2	96.7	97.3
Capacity Utilization[1]	-8.4	-9.0	-8.2	-8.5	-2.1	-2.9	-2.9	-2.6
Inflation[1]	13.1	1.1	0.8	5.0	4.4	0.3	0.3	1.7
Nominal Interest[1]	14.5	3.3	0.8	6.2	4.3	1.0	0.2	1.8
Real Interest[1]	1.5	2.0	-0.1	1.1	-0.1	0.5	-0.1	0.1
Investment/GDP[1]	-2.3	-3.0	-1.7	-2.3	-0.1	-0.6	-0.3	-0.4
Real Exchange Rate	95.6	94.7	93.6	94.6	98.5	98.2	97.8	98.1
Exports	98.6	96.9	95.6	97.0	99.0	98.4	97.8	98.4
Imports	99.3	99.1	102.0	100.1	100.9	100.1	100.7	100.6
Real Foreign Savings[2]	-1.4	4.6	9.6	4.3	-0.7	3.5	5.5	2.8
				Real Wages, Employment and Income Distribution				
Average Real Wage	102.7	101.9	101.4	102.0	101.3	101.1	100.9	101.1
White	103.1	102.2	101.8	102.4	99.4	99.2	99.1	99.2
Coloured	103.0	102.1	101.5	102.2	102.7	102.5	102.3	102.5
Asian	103.9	103.1	102.5	103.2	101.1	100.9	100.7	100.9
Black	102.9	102.1	101.5	102.2	103.7	103.4	103.2	103.4
Employment	94.1	93.4	94.3	93.9	98.7	98.0	98.1	98.3
White	93.5	92.9	93.6	93.3	98.6	98.1	98.0	98.2
Coloured	93.6	93.1	94.1	93.6	98.4	97.9	98.0	98.1
Asian	91.7	91.3	92.2	91.7	97.9	97.3	97.3	97.5
Black	94.6	94.0	94.7	94.4	98.8	98.2	98.2	98.4
Gini-disposable income[1]	-0.002	-0.005	-0.004	-0.004	-0.006	-0.007	-0.007	-0.006
				Government Accounts				
Total Expenditure	100.3	99.9	99.3	99.8	99.0	99.0	98.7	98.9
Govt Income	93.1	91.4	91.0	91.8	97.8	97.0	96.5	97.1
Govt Investment	25.5	0.0	4.0	9.8	86.8	75.7	73.0	78.5
PSBR/GDP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Financial Accounts				
Nominal Stock of M3	93.9	90.4	91.5	91.9	99.9	98.6	98.5	99.0
Household Pensions	91.1	86.8	86.4	88.1	97.9	96.1	95.3	96.4
Financial Surplus	100.0	93.9	62.6	85.5	94.4	92.6	78.8	88.6
Capital Flight	106.5	106.3	95.5	102.7	100.6	102.8	98.2	100.5
Bond Supply	92.4	92.2	90.1	91.6	98.0	97.4	96.4	97.3
Indirect Monetization	91.8	93.5	90.3	91.9	98.4	97.8	96.4	97.5

Source: Model computations. *Notes*: 1. Absolute differences fom the base run.
2. Billions of 1992 rands.

Table 3.3: 15% Increase in Wages with Aggressive Response by the Central Bank-Variable PSBR
Fixed Investment, Variable PSBR (Ratios to the base run except where indicated.)

	All Wages				*Wages of Unskilled Labor*			
	1993	1994	1995	Average	1993	1994	1995	Average
				Macroeconomic Data				
Real GDP	92.6	92.5	92.6	92.6	98.1	97.5	97.1	97.6
Capacity Utilization[1]	-8.8	-6.5	-4.1	-6.5	-2.1	-2.5	-2.0	-2.2
Inflation[1]	13.1	0.9	0.5	4.8	4.4	0.3	0.3	1.7
Nominal Interest[1]	18.4	6.9	3.3	9.5	4.9	1.8	0.8	2.5
Real Interest[1]	5.3	5.8	2.8	4.6	0.4	1.4	0.6	0.8
Investment/GDP[1]	-2.8	-3.0	-1.6	-2.4	-0.1	-0.6	-0.3	-0.3
Real Exchange Rate	95.4	94.8	94.0	94.7	98.5	98.2	98.0	98.2
Exports	98.7	95.2	93.1	95.7	99.0	98.2	97.3	98.2
Imports	97.1	98.6	101.4	99.0	100.7	100.0	100.6	100.4
Real Foreign Savings[2]	-3.0	4.5	9.9	3.8	-3.9	-0.7	3.5	-0.4
				Real Wages, Employment and Income Distribution				
Average Real Wage	102.7	102.3	102.4	102.5	101.3	101.1	101.1	101.2
White	103.0	102.5	102.5	102.7	99.4	99.3	99.2	99.3
Coloured	102.9	102.4	102.4	102.6	102.7	102.5	102.5	102.6
Asian	103.9	103.2	103.0	103.4	101.1	100.9	100.8	100.9
Black	102.8	102.4	102.4	102.6	103.7	103.5	103.4	103.5
Employment	93.8	94.0	94.6	94.1	98.7	98.1	98.2	98.3
White	93.1	93.7	94.4	93.7	98.6	98.2	98.2	98.3
Coloured	93.3	93.9	94.8	94.0	98.4	98.0	98.1	98.2
Asian	91.3	92.4	93.4	92.4	97.9	97.5	97.5	97.6
Black	94.3	94.4	94.8	94.5	98.8	98.3	98.2	98.4
Gini-disposable income	-0.002	-0.002	-0.001	-0.002	-0.006	-0.006	-0.006	-0.006
				Government Accounts				
Total Expenditure	100.7	102.3	104.0	102.3	99.1	99.5	99.6	99.4
Govt Income	93.0	93.4	93.8	93.4	97.9	97.4	97.1	97.5
Govt Investment	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
PSBR/Y	0.0	0.0	3.7	1.2	0.0	0.0	1.0	0.3
				Financial Accounts				
Nominal Stock of M3	108.2	116.3	130.3	118.3	121.2	108.0	121.1	116.8
Household Pensions	90.9	91.1	92.2	91.4	97.9	96.8	96.6	97.1
Financial Surplus	130.7	140.5	141.4	137.6	99.1	104.1	99.0	100.7
Capital Flight	122.6	120.3	108.2	117.0	103.2	106.3	102.7	104.1
Bond Supply	125.9	162.1	141.9	143.3	103.6	115.0	110.4	109.7
Indirect Monetization	137.5	208.6	160.0	168.7	106.0	126.9	115.2	116.0

Source: Model computations. *Notes*: 1. Absolute differences fom the base run.
2. Billions of 1992 rands.

Table 3.4: 15% Increase in Wages with Restrained Response by the Central Bank-Fixed PSBR
(Ratios to the base run except where indicated.)

	All Wages				*Wages of Unskilled Labor*			
	1993	1994	1995	Average	1993	1994	1995	Average
				Macroeconomic Data				
Real GDP[1]	99.3	100.5	100.5	100.1	99.8	100.1	99.9	99.9
Capacity Utilization[1]	-1.1	0.3	0.3	-0.2	-0.2	0.2	0.1	0.0
Inflation[2]	15.8	-0.1	0.0	5.2	5.3	-0.1	0.0	1.7
Nominal Interest[2]	15.8	0.0	-0.1	5.2	5.3	0.0	0.0	1.8
Real Interest[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Investment/GDP[1]	-0.2	0.0	-0.1	-0.1	0.2	0.2	0.1	0.2
Real Exchange Rate	99.9	100.0	100.0	100.0	100.0	100.0	100.1	100.0
Exports	100.6	99.9	99.8	100.1	100.0	99.4	99.3	99.6
Imports	98.9	100.4	100.5	99.9	99.7	100.1	99.9	99.9
Real Foreign Savings[2]	-3.5	2.2	2.9	0.6	-3.9	-0.7	3.5	-0.4
				Real Wages, Employment and Income Distribution				
Average Real Wage	100.2	100.3	100.3	100.3	100.4	101.1	101.1	100.9
White	100.2	100.3	100.4	100.3	98.5	99.3	99.2	99.0
Coloured	100.2	100.3	100.3	100.2	101.8	102.5	102.5	102.3
Asian	100.3	100.2	100.3	100.3	100.0	100.9	100.8	100.6
Black	100.2	100.3	100.3	100.3	102.7	103.5	103.4	103.2
Employment	99.3	100.1	100.1	99.8	100.0	100.1	100.0	100.0
White	99.2	100.2	100.1	99.9	100.1	100.4	100.1	100.2
Coloured	99.1	100.1	100.1	99.8	99.8	100.0	99.9	99.9
Asian	98.8	100.1	100.0	99.6	99.7	100.0	99.9	99.9
Black	99.3	100.1	100.1	99.9	100.0	100.1	99.9	100.0
Gini-disposable income	0.001	0.000	0.000	0.000	-0.005	-0.005	-0.005	-0.005
				Government Accounts				
Total Expenditure	99.4	99.5	99.5	99.5	98.8	98.9	98.8	98.9
Govt Income	99.2	99.9	100.0	99.7	99.5	99.6	99.5	99.5
Govt Investment	98.1	105.8	105.0	103.0	106.6	107.8	106.0	106.8
PSBR/Y	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Financial Accounts				
Nominal Stock of M3	102.7	106.7	107.4	105.6	105.1	104.9	97.8	102.6
Household Pensions	100.8	101.7	101.8	101.4	100.4	100.6	100.4	100.4
Financial Surplus	106.0	98.0	93.9	99.3	99.5	95.3	90.9	95.2
Capital Flight	101.9	99.3	97.3	99.5	101.3	100.0	98.2	99.8
Bond Supply	96.8	102.6	95.9	98.5	98.8	100.7	98.6	99.4
Indirect Monetization	98.9	110.8	98.2	102.6	100.0	103.2	99.4	100.9

Source: Model computations. *Notes*: 1. Absolute differences fom the base run.
2. Billions of 1992 rands.

Table 3.5: Nominal Wage Decrease and Increase in Demand. Full Reaction-Fixed PSBR
(Ratios to the base run except where indicated.)

	15% Decrease in Unskilled Wages				*Increase in Demand*			
	1993	1994	1995	Average	1993	1994	1995	Average
			Macroeconomic Data					
Real GDP[1]	98.7	98.8	99.7	99.1	103.8	104.7	105.6	104.7
Capacity Utilization[1]	-1.6	-0.8	0.4	-0.7	3.1	2.7	2.7	2.8
Inflation[2]	-5.1	0.1	0.0	-1.7	5.3	4.8	3.4	4.5
Nominal Interest[2]	-3.3	1.1	0.0	-0.7	6.1	6.2	4.5	5.6
Real Interest[2]	1.7	0.9	0.0	0.9	0.7	1.4	1.1	1.1
Investment/GDP[1]	-1.4	-1.0	-0.5	-1.0	0.3	0.0	0.2	0.2
Real Exchange Rate	100.3	100.3	100.5	100.4	100.0	99.9	99.9	99.9
Exports	100.6	100.6	100.4	100.5	105.4	106.3	106.8	106.2
Imports	97.4	98.1	99.4	98.3	104.6	105.3	106.4	105.4
Real Foreign Savings[2]	-3.5	2.2	2.9	0.6	-3.9	-0.7	3.5	5.5
			Real Wages, Employment and Income Distribution					
Average Real Wage	99.3	99.1	99.2	99.2	96.4	96.3	97.1	96.6
White	101.4	101.3	101.3	101.3	95.8	95.8	96.7	96.1
Coloured	97.8	97.6	97.6	97.7	96.5	96.4	97.2	96.7
Asian	99.9	99.7	99.6	99.7	96.0	96.0	96.8	96.3
Black	96.9	96.6	96.6	96.7	96.5	96.4	97.1	96.7
Employment	98.8	99.0	99.8	99.2	104.1	104.2	104.7	104.3
White	98.6	98.9	99.6	99.1	105.0	105.1	105.4	105.2
Coloured	98.7	99.1	99.9	99.2	104.1	104.3	104.7	104.4
Asian	98.6	98.9	99.8	99.1	104.3	104.5	104.8	104.5
Black	98.8	99.1	99.9	99.3	103.6	103.9	104.3	103.9
Gini-disposable income	0.005	0.006	0.006	0.005	0.004	0.004	0.004	0.004
			Government Accounts					
Total Expenditure	101.4	101.4	101.4	101.4	104.7	104.9	105.5	105.0
Govt Income	99.2	99.5	100.3	99.7	104.5	105.1	106.2	105.3
Govt Investment	77.4	77.7	87.0	80.7	101.9	106.8	112.0	106.9
PSBR/Y	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Financial Accounts					
Nominal Stock of M3	97.2	95.0	95.8	96.0	216.9	147.5	144.8	169.8
Household Pensions	93.0	92.9	93.0	92.9	105.5	106.5	109.2	107.1
Financial Surplus	96.8	96.7	96.7	96.8	103.7	108.1	108.1	106.6
Capital Flight	94.2	94.0	94.0	94.1	88.4	90.2	83.6	87.4
Bond Supply	96.2	96.1	96.2	96.2	102.0	106.5	99.5	102.7
Indirect Monetization	95.6	95.5	95.6	95.5	103.3	114.0	102.4	106.6

Source: Model computations. *Notes*: 1. Absolute differences fom the base run.
2. Billions of 1992 rands.