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Capacity Utilization, Income Distribution, And The Urban Informal Sector: An Open-Economy Model

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Abstract

Developing economies worldwide have experienced rapid informal sector expansion in response to formal sector unemployment. However, the macroeconomic effects of formal-informal sector dualism have been widely overlooked. This paper develops a two-sector, structuralist, macroeconomic model to analyze the impact of urban informal sector activity on export-led growth policy. The model uses stylized facts from the Johannesburg informal sector and is applicable to countries where informal sector production is concentrated in low-wage goods and commercial services. The paper finds that trade-offs between capacity utilization and reduced income inequality could be magnified when the existence of an urban informal sector is incorporated.

Key words: informal sector, South Africa, macroeconomic policy

JEL classification: O11,O17,O41,O55

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1 Introduction

Macroeconomic implications of the informal sector merit increased attention given both the predominance and growth of this sector in developing economies.[1] Many countries that underwent neoliberal economic reform in the eighties experienced rapid expansion of informal sectors in response to contracting formal economies. Today, development programs often include an informal sector/microenterprise support component based on the belief that informal firms can improve economy wide employment through the labor-intenstive nature of their production. In opposition to development policy, much of the recent theoretical literature finds that formal sector output is inversely related to informal sector output. Since formal sector production is assumed to be more productive and lucrative than informal sector production,[2] this literature suggests that informal sector expansion reduces economy-wide income. Thus, given the contrast between informal sector development policy and the macroeconomic literature, additional research is needed to determine the nature of formal-informal sector dualism.

Interestingly, the inverse relationship between formal and informal sector output described in the literature is common despite the wide variety of approaches used. For example, neoliberal studies of Braun & Loayza (1994) and Fortin, Marceau & Savard (1997) treat the informal sector as tax evading and find that a growing informal sector congests public services and reduces the economy-wide growth rate. Studies by Chaudhuri (1989), Rauch (1991), Agenor & Aizenman (1994), and Ranis & Stewart (1994) employ a labor market segmentation framework and find that formal sector contraction leads excess labor to flood the informal sector, lowering the informal sector market clearing wage, and allowing informal sector output to expand through a decline in factor costs. Gibson, Lustig & Taylor (1986), Gibson & Kelley (1994), and Kelley (1994) use structuralist multi-sector

macroeconomic models and either find that macroeconomic adjustment occurs through employment shifts between the sectors due to a fixed labor supply (the first two studies) or that the informal sector competes with the formal sector in product markets and hinders demand-led growth (Kelley's 1994 study).

Nevertheless, despite the common finding of an inverse relationship between the sectors, the existing literature is limited in the reality and breadth of its application. For example, the neoliberal studies model informal sector growth as a result of increased government involvement, an approach unable to explain why informal sector activity has skyrocketed at the same time that structural adjustment programs have required deregulation and contraction of the public sector. Similarly, the labor market segmentation models define the driving force for informal sector activity as a rigid real wage, an approach inappropriate for explaining the empirical trend of an expanding informal sector occurring in conjunction with economic restructuring that reduces labor market regulations.

The structuralist multi-sector macromodels provide a more realistic foundation for explaining informal sector expansion due to their assumption that informal sector activity is driven by inadequate demand in the formal sector. Existing structuralist models have thus far been focused on East Asia or Latin America where informal sector enterprises are strongly incorporated into the formal economy through subcontracting arrangements, often competing with formal sector firms in production. For example, in Kelley's 1994 study, his findings that the Peruvian informal sector competes with the formal sector and reduces the spending multiplier rest on the assumption of sufficiently strong elasticities in substitution between formal and informal output. However, this assumption may be less applicable to countries in Africa or South Asia where informal sector production is concentrated in wage goods or commerce and cannot easily substitute for formal sector

production. Therefore, extending structuralist analysis to these economies may allow for a complementary relationship between the formal and informal sectors to exist.

In addition, current theoretical work on the informal sector tends to model the interplay between informal-formal sector dualism and international competition in a simplistic manner. Specifically, this literature has downplayed international trade with the assumption that informal sector participants do not export. While the assumption is empirically robust, these models fail to consider the role of international competition in tempering formal exporting firms' pricing behavior. Such international competition may force formal sector firms to reduce prices to preserve market shares and create macroeconomic adjustment based on changing relative prices between the formal and informal sectors.

Therefore, in response to limitations in current work on the informal sector, this paper develops a two-sector, structuralist, macroeconomic model designed to determine the effect of urban informal sector activity on growth policy and income distribution. The existence of informal sector activity in the model rests on inadequate demand in the formal sector. To make the model applicable to an economy where the informal sector is concentrated in the production of wage goods or commercial services, the model includes a number of stylized facts from Schaefer's (2001) empirical analysis of the urban informal sector in Johannesburg, South Africa. Additionally, to incorporate international competitiveness considerations, the model assumes that formal sector firms set prices based on a flexible mark-up factor over variable costs, allowing formal sector producers to squeeze profits in order to maintain market shares in the world economy.[3]

1.1 A South African Case Study

This section presents some empirical evidence on the informal sector in Johannesburg, South Africa to be used as stylized facts incorporated into the model in the next section. In particular, empirical evidence on formal-informal sector linkages, informal sector labor supply, access to capital in the informal sector, and formal sector pricing behavior are discussed. The empirical information is drawn from Schaefer's (2001) analysis of cross-sectional survey data collected by the World Bank's 1999 Greater Johannesburg Metropolitan Area study.[4] This survey includes data on 500 informal sector firms, defined as firms not formally registered, and 328 large formal manufacturing firms, defined as firms formally registered and having more than 50 employees.

Johannesburg, South Africa, was chosen as a case study for this paper for three reasons. First, the Johannesburg informal sector exemplifies the type of informal sector seen in many areas of Africa or South Asia where informal firms have relatively weak forward linkages to the formal sector. Second, in the post-Apartheid era, South Africa has transitioned from a relatively closed economy to one that is more open to international trade, exposing long-protected formal firms to foreign competition (Chandra et al., 2000a). Third, for a number of institutional and structural reasons, the urban informal sector in South Africa is poised to expand rapidly in the future, yet little analysis has been done on the macroeconomic implications of a growing informal sector. In fact, in the post-Apartheid policy debate over how to meet the challenges of extreme income inequality, unemployment, poverty and international competition, the distributional effects of urban informal sector activity have largely been ignored.

1.1.1 Some stylized facts

As shown in Table 1, one stylized fact about the Johannesburg informal sector is that firms have relatively weak forward linkages to the formal sector. Only 20.2 percent of informal sector firms reported selling their output to small formal sector firms and less than 5 percent reported selling output to large formal sector firms or foreign buyers. This data is consistent with the literature on African informal sectors that describe them as concentrated in the production of low-wage goods or services targeted to the domestic economy (Meagher, 1995).

Insert Table 1

A second stylized fact about the Johannesburg informal sector is that the majority of participants engage in informal sector activity due to formal sector unemployment. Table 2 shows that 51.6 percent of informal sector business owners reported started their business for this reason while only 9.1 percent indicated profit opportunities as their primary motivation. Hence, the Johannesburg evidence confirms the common structuralist view that the majority of informal sector participants are there as a residual labor force.

Insert Table 2

Within the Johannesburg informal sector, it is also evident that not all participants may have equal access to resources. To illustrate this point, Schaefer (2001) divided the Johannesburg informal sector into two classes based on a combination of monthly sales and start-up capital requirements.[5] For example, Table 3 shows the level of capital required to start-up business by monthly sales range and shows that more than 50 percent of owners in the lowest two sales ranges (i.e., 1 to 1500 Rands) had start-up capital requirements of

1000 Rands or less. However, once an owner is in the third sales range (i.e., 1501 to 3000 Rands), he/she is more likely to have had a start-up capital requirement of more than 1000 Rands. In Schaefer (2001), informal sector owners who needed to secure more than 1000 Rands in start-up capital were thus defined as "entrepreneurs" and informal sector owners who could commence business with 1000 Rands or less were defined as "laborers".

Insert Table 3

Using Schaefer's (2001) class division, Tables 4 and 5 suggest that informal sector participants have different skills and access to infrastructure. In Table 4, all informal sector participants appear to be relatively unskilled. However, while over three-fourths of the labor class have no vocational qualification and only 20 percent are skilled or semi-skilled, 59 percent of those in the entrepreneurial class have no vocational qualification and 29 percent are skilled or semi-skilled. In Table 5, roughly 25 percent fewer informal sector owners in the labor class have access to their own transport, water, and electricity than do those in the entrepreneurial class.

Insert Tables 4 and 5

Finally, data on large formal sector firms in Johannesburg illustrate that certain sector asymmetries may exist between the formal and informal sectors. One important asymmetry regards capacity utilization. Table 6 shows capacity utilization measures for large formal firms. For both 1997 and 1998, less than 10 percent of firms reported producing at full capacity and, for those producing with excess capacity, the average increase in output they could produce was over 40 percent. Additionally, only 37 percent of large formal firms operated a double or triple labor shift in either year. Conversely, when informal sector participants were asked the number of days they worked per month, 95 percent of informal

sector firms reported working more than 20 days a month (indicating a response broadly consistent with a double or triple shift).[6]

Insert Table 6

The sector asymmetry in capacity utilization suggests that pricing behavior between the sectors may also be different. While it is often assumed that informal sector firms operate in perfectly competitive markets with flexible prices (Webster and Fidler, 1996), formal sector firms in South Africa are faced with a significant degree of unionization in the labor market that could create a wage rigidity. In fact, more than 90 percent of large formal firms reported working with one or more unions and 85 percent reported having a collective agreement with their workers (Chandra et al., 2000a). This data is consistent with Gibson and Van Seventer (1995) who assume the existence of mark-up pricing in the formal sector due to concentration in industry, the less-than-full capacity utilization rates of formal firms, and the extent of unionization of the formal sector labor market.

2 The Open-Economy Model

This section constructs a short-run, two-sector, open-economy, structuralist macroeconomic model with an urban informal sector. Structuralist refers to the modeling framework of Taylor (1983) and (1991) and is based on the acknowledgement that an economy's structure, as determined by its history, institutions, and political context, makes some patterns of resource allocation more likely than others. In order to illustrate these factors and determine causal linkages, a modeling methodology is needed. However, the focus in this section is on the basic intuition of the model and its policy implications. A more detailed discussion of the mathematical derivations is provided in the appendix.

To address policy implications, the model is used to examine the informal sector's effects on capacity utilization and income distribution when either a policy of export-led growth or trade liberalization is pursued. An export-led growth strategy is examined by conducting comparative static analysis of a devaluation of the nominal exchange rate. Trade liberalization is indirectly examined by analyzing a reduction in formal sector producer's monopoly power resulting from increased exposure to international competition. While trade liberalization leads to a wide array of changes within an economy, this paper examines a reduction in monopoly power because it is directly linked to questions of income distribution and is appropriate in South Africa, where long protected firms are now being exposed to international competition.[7]

2.1 Assumptions

The economy consists of two sectors, a formal sector and an urban informal sector. In accordance with the Johannesburg stylized facts, urban informal sector production is assumed to be concentrated in wage goods or commercial services with weak forward linkages to the formal sector or foreign markets. As such, the major market for informal sector goods is domestic, low-income consumer groups. Output in the informal sector is:

$$X_n = C_{fn} + C_{nn} \tag{1}$$

where X_n is the quantity of informal sector goods and C_{in} is the quantity of informal sector goods consumed by sector i with $(i = f, n)$.

The informal sector is further characterized as consisting of two classes of participants. One class, which can be called "entrepreneurs," consists of individuals who occupy more lucrative activities and have capital. The other class, which can be called "labor," consists of marginal owner-operators. Barriers to entry into the entrepreneurial class could be

based on factors such as start-up capital requirements, necessary skills, access to loans and infrastructure, gender, and subcontracting networks. With both classes of informal sector participants assumed to be producing the same good, total informal sector output is the sum of the outputs of each group:

$$X_n = X_{ne} + X_{nw} \tag{1'}$$

where X_{ne} is the quantity of informal sector output produced by entrepreneurs and X_{nw} is the quantity of informal sector output produced by workers (the "labor" class).

Unlike the informal sector, the formal sector produces a wide variety of capital and consumption goods and exports a portion of its output. With formal sector exports assumed to consist primarily of industrial or manufactured goods,[8] output in the formal sector can be written as:

$$X_f = C_{ff} + C_{nf} + g_f K_f + g_n K_n + E \tag{2}$$

where X_f is the quantity of formal sector goods, C_{if} is the quantity of formal sector goods consumed by sector i, K_j is the sectoral capital stock (fixed in the short run), and g_j refers to the capital accumulation rate in sector j. Due to the industrial nature of the good, formal sector exports are assumed to be nationally differentiated facing a demand with a positive and finite price elasticity of ψ. This yields the following export demand function, in which the constant term $A > 0$ incorporates exogenously determined foreign income effects:[9]

$$E = Aq^{\psi} \tag{3}$$

Regarding the informal sector labor market, wage employment is not modeled and instead both classes of informal sector participants are assumed for simplicity to be self-employed.[10] However, to reflect the existence of barriers to entry into the entrepreneurial

class, it is assumed that the supply of informal sector entrepreneurs is fixed in the short run and only the entrepreneurs in the informal sector have access to capital. Thus, the output-capital ratio in the informal sector, x_n, must refer to the level of output produced by entrepreneurs, X_{ne}, divided by the capital stock owned by entrepreneurs, K_n.

$$x_n = X_{ne}/K_n \tag{4}$$

Economy-wide, full employment in the labor market is assumed and total labor is divided between formal sector and informal sector workers.[11] The total labor supply, $\overline{L}$, is fixed in the short run. Consistent with the Johannesburg stylized facts, once output and labor demand in the formal sector are determined, excess labor is employed in the informal sector as a residual labor force. With L_{iw} referring to demand for workers in sector i and b_{iw} referring to the fixed technical labor coefficient in sector i, labor market equilibrium can be defined by:

$$\overline{L} = L_{fw} + L_{nw} \tag{5}$$

with

$$L_{fw} = b_{fw}X_f \tag{6}$$

$$L_{nw} = b_{nw}X_{nw} \tag{7}$$

Prices in the two sectors are the sum of variable costs and profits. In the informal sector, labor earns an implicit real wage, w_n/P_n, in terms of their own good that is exogenously determined by the productivity of their labor, $w_n/P_n = 1/b_{nw}$. Thus, prices in the informal sector are:[12]

$$P_n = w_n b_{nw} \tag{8}$$

However, entrepreneurs are assumed to be more productive than labor because entrepreneurs have access to capital. Given their greater labor productivity, and the assumption of an

equal implicit wage rate on their labor time, informal sector entrepreneurs earn positive implicit profits. With r_{ne} defined as informal sector entrepreneur's rate of profit:

$$P_n = w_n b_{ne} + r_{ne} P_f / x_n \tag{8'}$$

In contrast to the informal sector, formal sector workers are assumed to earn an institutionally fixed nominal wage, w_f, set by union-management bargaining. Regarding imported intermediates, formal sector producers are assumed to face constraints such as skills or infrastructure that limit their ability to supply adequate inputs for import substitution.[13] To capture the structural dependency on intermediate imports, the formal sector import coefficient a_f is assumed to be fixed. Excluding tariffs and subsidies for simplicity, formal sector prices can be expressed as:

$$P_f = w_f b_{fw} + P_{wm} e a_f + r_{fk} P_f / x_f \tag{9}$$

where e is the nominal exchange rate in domestic currency per unit of foreign currency (a policy variable that is fixed in the short run), P_{wm} is the world price of imported intermediates, r_{fk} is the profit rate for formal sector capitalists, and x_f is the output-capital ratio in the formal sector:

$$x_f = X_f / K_f \tag{10}$$

In terms of supply, the stylized facts for Johannesburg suggest that the formal sector operates at less-than-full capacity, with rigidities in prices due to oligopolistic firms that could employ mark-up pricing. With excess capacity and mark-up pricing, the output-capital ratio in the formal sector, x_f, acts as the adjusting variable to achieve equilibrium and x_f is an endogenous variable. Formal sector firms set their prices by using a mark-up factor, $\tau > 1$, over variable costs:

$$P_f = \tau(w_f b_{fw} + P_{wm} e a_f) \tag{11}$$

Defining $\pi = r_{fk}/x_f$ as the profit share of total formal sector income and substituting π and equation (9) into equation (11) yields:

$$\pi = (\tau - 1)/\tau \tag{12}$$

with a corresponding wage share of gross output as:

$$w_f b_{fw}/P_f = (1 - \pi)(1 - \phi)$$

where ϕ is defined as the share of imported intermediates in domestic unit variable costs:

$$\phi = \frac{eP_{wm}a_f}{w_f b_{fw} + eP_{wm}a_f} \tag{13}$$

Under the small country assumption, the foreign price of manufactured goods, P_{wx}, and the world prices of imported intermediates, P_{wm}, are exogenously fixed. Due to the assumption of nationally differentiated exports, however, the law of one price need not hold. Therefore, the domestic price of formal sector exports, P_f, is not constrained to equal the world export price. Nevertheless, formal sector pricing is affected by international competitive pressures as formal sector firms attempt to maintain their market shares in world trade. To accommodate this price responsiveness, the formal sector mark-up factor is assumed to be partially flexible. However, formal sector prices are not flexible enough to clear markets and some quantity adjustment is still required. Following Blecker (1989) and Blecker & Seguino (2002), the mark-up factor adjusts to international competition according to the following constant-elasticity function:

$$\tau = \overline{\tau}(\frac{eP_{wx}}{P_f})^{\theta} = \overline{\tau}q^{\theta} \tag{14}$$

where $\overline{\tau} > 1$ is the constant target mark-up factor, $\theta > 0$ is the constant elasticity of the actual mark-up factor with respect to the relative price of foreign competing goods, and q

is the real exchange rate defined as:

$$q = eP_{wx}/P_f \tag{15}$$

To illustrate how formal sector firms try to maintain international competitiveness, equation (11) can be substituted into equation (14) to yield:

$$\tau = \overline{\tau}^{1/(1+\theta)}\epsilon^{\theta/(1+\theta)} \tag{14'}$$

where for notational convenience, ϵ is defined as the ratio of the price of foreign export-competing goods to the unit average variable costs of domestic export goods and serves as a measure of international competitiveness:

$$\epsilon = q\tau = \frac{eP_{wx}}{w_f b_f + eP_{wm}a_f} \tag{16}$$

If formal sector wages were to rise, then the country's international competitiveness would suffer (i.e., ϵ would fall), and in order to maintain market shares in international trade, domestic firms would decrease ("squeeze") their profit margins.

Unlike the formal sector, the informal sector is assumed to operate at full capacity with competitive, price-taking firms. Therefore, in the informal sector, prices are the adjusting variable and x_n is exogenously fixed. The informal sector relative price z is defined as:

$$z = P_n/P_f \tag{17}$$

In terms of consumption, there are three social classes which are assumed to have different propensities to spend and save. Formal sector capitalists earn profit income and are assumed to spend with a marginal propensity to consume of γ_{fk} with $(0 < \gamma_{fk} < 1)$. Informal sector entrepreneurs earn a net product (i.e. the sum of their implicit wages and profits) and are assumed to spend with a marginal propensity to consume of γ_{ne} with

$(0 < \gamma_{ne} < 1)$.[14] Formal and informal sector workers earn wage income and, for simplicity, are assumed to spend all of their income on consumption.

Following Taylor (1991), total nominal consumer spending by all three social classes can be defined as D, where:

$$D = w_f L_{fw} + \gamma_{fk} r_{fk} P_f K_f + \gamma_{ne} P_n x_n K_n + w_n L_{nw} \tag{18}$$

The ratio of D to the population, N, which is assumed to be fixed in the short run, yields per capita nominal consumption, Y:

$$Y = D/N \tag{19}$$

Then, defining the sectoral relative capital stock as:

$$\lambda = K_n/K_f \tag{20}$$

per capita nominal consumption can be shown to be a positive function of the two endogenous variables x_f and z: $Y = Y(x_f, z)$ with $Y_{x_f} > 0$ and $Y_z > 0$.[15]

Sectoral consumption can be expressed through the following four equations in which $P_j C_{ij}$ represents consumption by sector i of sector $j's$ good, β represents the uniform share of consumption expenditures on informal sector goods, and $(1 - \beta)$ represents the share of consumption expenditures on formal sector goods.

$$P_f C_{ff} = (1 - \beta)[w_f L_{fw} + \gamma_{fk} r_{fk} P_f K_f] \tag{21}$$

$$P_n C_{fn} = \beta[w_f L_{fw} + \gamma_{fk} r_{fk} P_f K_f] \tag{22}$$

$$P_f C_{nf} = (1 - \beta)[\gamma_{ne} P_n x_n K_n + w_n L_{nw}] \tag{23}$$

$$P_n C_{nn} = \beta[\gamma_{ne} P_n x_n K_n + w_n L_{nw}] \tag{24}$$

As with per capita consumer spending, these four sectoral consumption equations can be reduced to functions of the two endogenous variables, x_f and z. Moreover, it is assumed that the sectoral budget share for informal sector goods, β itself is endogenously determined by per capita consumption and sectoral relative prices:

$$\beta = \beta(Y, z) \tag{25}$$

Thus, total demand for each good can be expressed simply as total nominal consumer spending times the sectoral budget share:

$$P_n(C_{fn} + C_{nn}) = \beta(Y, z)D = \beta[Y(x_f, z), z]D$$

$$P_f(C_{ff} + C_{nf}) = [1 - \beta(Y, z)]D = [1 - \beta(Y(x_f, z), z)]D$$

The above two equations illustrate that a change in either x_f or z will induce a change in per capita consumption, Y, through changes in income. This effect is akin to the principle of income elasticity of demand. A change in Y will then result in a change in the relative demand for each good, through a change in the sectoral budget share. Given that informal sector goods in the types of economies being modelled here are typically staple goods or manufactured goods of a lesser quality, it is assumed that a rise in income reduces the informal sector budget share. As such, the elasticity of the sectoral budget share with respect to a change in per capita income, β_Y, is assumed to be negative:[16]

$$\beta_Y = (\eta - 1)\beta/Y < 0$$

with η as a constant parameter and $(0 < \eta < 1)$.

In addition, it is assumed that as z rises and the income of informal sector participants increases, there is the tendency for informal sector consumption to rise by relatively less in accordance with the negative income elasticity of β. However, changes in z produce not

only income effects for the sectoral budget share, but also relative price effects as a rising z translates into more expensive informal sector goods. If $\beta_z Y_z < 0$ represents the income effect of a change in z and β_{z_p} represents the price effect of a change in z, then β_z is the total elasticity of the sectoral budget share with respect to a change in z:

$$\beta_z = \beta_z Y_z + \beta_{z_p} = (1 - \nu)\beta/z$$

with ν as a constant parameter.

The elasticity β_z is not assumed to have any particular magnitude at this time. It is possible that as z rises and informal sector goods become more expensive, consumption shifts toward formal sector goods through substitution. In this case, both the price effect and income effect induced by a rise in z translate into a lower informal sector budget share and $\nu > 1$ (i.e. the case of a price-elastic budget share). However, in the case of a sufficiently price-inelastic budget share, $\nu < 1$.[17]

Regarding imports, only the formal sector is assumed to purchase imported capital with perfectly price-inelastic demand. For simplicity, it is also assumed that there are no imports of consumption goods. With g_{fm} representing the growth rate of imported capital, $g_{fm}K_f$ representing the quantity of imported investment goods, and P_{wi} representing the exogenously determined world price of imported capital goods, total import demand expressed in terms of domestic formal sector output is:

$$M = (eP_{wm}a_f X_f + eP_{wi}g_{fm}K_f)/P_f \tag{26}$$

Following Blecker & Seguino (2002), imported investment goods are assumed to be a fixed proportion μ_f of home investment goods ($g_f K_f$) such that:[18]

$$g_{fm}K_f = \mu_f g_f K_f \tag{27}$$

Using this assumption, equation (26) becomes:

$$M = q\rho_m a_f X_f + q\rho_i \mu_f g_f K_f \tag{26'}$$

where ρ_i is the relative world price of imported capital to exports:

$$\rho_i = P_{wi}/P_{wx} \tag{28}$$

and ρ_m is the relative world price of imported intermediates (i.e. raw materials) to exports:

$$\rho_m = P_{wm}/P_{wx} \tag{29}$$

Turning to the specification of investment demand, informal sector investment is assumed to be determined residually by informal sector savings:[19]

$$g_n = (1 - \gamma_{ne}) x_n z \tag{30}$$

The formal sector, on the other hand, has an independent investment demand function. Borrowing from the structuralist models of Marglin & Bhaduri (1990) and Gibson and Van Seventer (1995), formal sector investment demand is assumed to depend on the level of autonomous investment (reflecting Keynesian "animal spirits"), $\overline{g}_f$, the profit share, π, and the accelerator effect, x_f:[20]

$$g_f(q\rho_i\mu_f + 1) = \overline{g}_f + g_1\pi + g_2 x_f \tag{31}$$

Finally, balance of payments is modeled simply as net exports plus net foreign capital outflows, F, where the latter are assumed to be endogenous:

$$F = E - M \tag{32}$$

Then, following from equation (31), the equation specifying equilibrium between total investment and total saving (i.e. the goods market equilibrium condition) can be defined:

$$g_f K_f + F = (1 - \gamma_{fk}) r_{fk} K_f \tag{33}$$

In accordance with the assumption of no intersectoral capital flows, there is no sectoral trade balance term in the investment equal to savings equilibrium condition. Therefore, this equilibrium condition represents equality between planned investment and realized savings in the formal sector only.

All the equations necessary to complete the model have been specified. The equations and variables of the model are listed in Tables 7 and 8. The solution of the model is obtained by reducing it to two independent, simultaneous, equations in the endogenous variables x_f and z using the investment-saving equilibrium and the informal sector goods market equilibrium:[21]

Insert Tables 7 and 8

Using investment equal to savings equilibrium, the variable z does not enter into equation (33) such that an explicit solution for the equilibrium level of formal sector output, x_f^*, can be derived:

$$x_f^* = \frac{(\overline{g}_f + g_1\pi)R_f + A/K_f(q^\psi)}{(1-\gamma_{fk})\pi + q\rho_m a_f - g_2 R_f} \tag{34}$$

where $(1-\gamma_{fk})\pi + q\rho_m a_f - g_2 R_f > 0$ for Keynesian goods-market stability. Also, for notational simplicity, $R_f = (1-q\rho_i\mu_f)/(q\rho_i\mu_f + 1)$, is the ratio of domestically purchased investment goods minus imported investment goods to total investment purchases, and $0 < R_f < 1$.

Equation (34) can be plotted in $(x_f \times z)$ space and is called the "IS Curve." As reflected in Figure 1, the IS curve has a zero slope, showing that the investment-savings equilibrium condition for the formal sector goods market is independent of the sectoral terms of trade and occurs at a level, $x_f^* > 0$, which is determined only by conditions in the formal sector. The model's structure is thus a recursive one in that the level of formal sector output is

determined within the formal sector, and (given the level of formal sector output) informal sector activity acts only to determine sectoral relative prices, the share of informal sector goods vs. formal sector goods consumed by participants throughout the economy, and the real wage in both sectors.[22]

Insert Figure 1

Using informal sector goods market equilibrium, equation (1) can be re-written to express excess demand equal to zero in the informal sector:

$$(\beta x_f/z)[(1-\pi)(1-\phi)+\pi\gamma_{fk}]-(1-\beta\gamma_{ne})x_n\lambda-(1-\beta)[\overline{L}/(K_f b_{nw})-x_f b_{fw}/b_{nw}]=0 \quad (35)$$

Equation (35) plotted in $(x_f \times z)$ space is called the "NN Curve." The intuition for a positively sloped NN curve lies in the fact that as formal sector output rises, some of the increased formal sector income is injected into the informal sector such that excess demand is created in the informal sector goods market. To eliminate the excess demand, informal sector relative prices must rise.[23]

Note, however, that as z rises, some of the increased informal sector income is leaked back to the formal sector, creating a positive feedback effect. The steepness of the NN curve depends partially on the magnitude of this leakage from the informal sector back to the formal sector, a magnitude that is positively related to the price and income elasticities of β. For example, when β is both income and price inelastic, the slope of the NN curve is relatively flat because increases in x_f and z do not lead to significant substitution in consumption away from informal sector goods (left panel of Figure 1). And, when β is both income and price elastic, the slope of the NN curve is relatively steep yielding an equilibrium level z_2^* for any given x_f^* that is relatively lower than the equilibrium level z_1^* with an income and price inelastic β (right panel of Figure 1).

2.2 A Devaluation Of The Nominal Exchange Rate

One export-led growth policy commonly employed in South Africa is a nominal devaluation. Equation (14′) verifies that a nominal devaluation encourages exports in this model through an improvement in international competitiveness, ϵ, which in turn allows formal sector producers to increase their actual mark-up factor, τ. A nominal devaluation also means, however, that imported intermediate goods are more expensive for formal sector producers. Consequently, both the rise in τ and the increase in imported intermediate costs translate into higher formal sector prices. Nevertheless, despite the rise in P_f, a nominal devaluation also leads to a rise in the real exchange rate, q, because the formal sector mark-up factor does not rise by enough to offset the rise in cost competitiveness, ϵ.

Therefore, a devaluation of the nominal exchange rate affects formal sector output and informal sector relative prices through three channels: (1) the rise in e leads to a rise in the actual mark-up factor, τ, and hence an increase in the formal sector profit share, π, creating a class redistribution of income; (2) the rise in e translates into a depreciation of the real exchange rate, q; and (3) the rise in formal sector prices, P_f, results in a direct increase in formal sector purchasing power over informal sector goods. The overall effect of a nominal devaluation on x_f^* and z^* is, thus, ambiguous and depends on which of these channels carries the strongest impact.

For the first channel, an increase in the formal sector profit share stimulates formal sector investment demand given that $g_1 > 0$. However, a rise in π also entails income redistribution toward formal sector capitalists who have a lower marginal propensity to consume than formal sector workers. Due to this redistribution of income, total formal sector consumption falls and investment demand is decreased through the accelerator effect, given that $g_2 > 0$. Under the assumptions of this model, the effect of the fall in consumption

demand dominates the effect of the rise in profitability.[24] Thus, a nominal devaluation has a contractionary effect on formal sector output through its contractionary effect on domestic absorption.

For the second channel, a higher q raises export demand as determined by the price elasticity ψ, increases the cost of imported intermediate goods, and lowers the share of investment income devoted to domestically produced investment goods, R_f. Assuming that exports are sufficiently price-elastic, a depreciation of the real exchange rate has the net effect of improving the trade balance (i.e. E-M).[25] Thus, a nominal devaluation has an expansionary effect on formal sector output through its expansionary effect on net export demand.

Overall, if the increase in net exports is relatively small, then the contractionary effects of a higher π on domestic absorption will dominate the expansionary effects of a higher q on the trade balance. In this case, a nominal devaluation reduces the equilibrium level of formal sector output, x_f^*, and the economy is said to be stagnationist.[26] On the other hand, if the increase in net exports is sufficiently high, then the gain in external competitiveness will raise the trade balance more than enough to compensate for the loss in domestic absorption. Under these conditions, a nominal devaluation raises the equilibrium level of formal sector output and the economy is said to be "exhilarationist."[27]

While the existing literature has described stagnationist and exhilarationist economies, the more interesting results of this model pertain to the informal sector. In terms of informal sector equilibrium prices, a nominal devaluation translates into higher formal sector prices and initially improves formal sector purchasing power over informal sector goods (the third channel). This purchasing power effect, called the "PPE", increases demand in the informal sector goods market, pressuring informal sector relative prices

to rise. However, the increase in π and resulting redistribution of income effect, called the "RIE", lowers the formal sector marginal propensity to consume and decreases formal sector demand for informal sector goods (the first channel). The rise in e also increases the share of imported intermediates in unit variable costs, ϕ, through a rise in the real exchange rate, q (the second channel). With a rise in ϕ, the formal sector wage share is decreased and, through its impact on formal sector consumption, further reduces demand for informal sector goods. Finally, in addition to the direct effects of a rise in e on z^*, a nominal devaluation indirectly affects the informal sector goods market through its impact on x_f^*.

Insert Figure 2

Figure 2 roughly summarizes the different channels by which a nominal devaluation impacts the equilibrium levels of formal sector output and informal sector relative prices. As stated earlier, the net effect is ambiguous and depends on which of these channels carries the strongest impact. If the formal sector is stagnationist, as shown in Figure 3, then a nominal devaluation lowers x_f^* and the IS curve shifts down to IS$'$. Regarding informal sector relative prices, however, there are two possibilities for the new equilibrium level $z^{*'}$. For example, if the RIE is relatively strong, then the combined impact of the RIE and the higher ϕ decrease formal sector demand for informal sector goods despite the PPE. As a result, the NN curve shifts left to NN$'$ (left panel of Figure 3). Compounding this leftward shift, the fall in x_f^* lowers formal sector demand for informal sector goods as illustrated by the movement along the NN$'$ to $z_1^{*'}$. In this case, a nominal devaluation depresses economy-wide income and increased exports come at the cost of worsened income inequality within the formal sector as well as between the formal and informal sectors.

Insert Figure 3

On the other hand, if the RIE is sufficiently weak, then the PPE could be strong enough to raise formal sector demand for informal sector goods, despite the RIE and higher ϕ. As a result, the NN curve shifts right to NN$'$ (right panel of Figure 3). Moreover, if the rightward shift in the NN curve is larger than the downward shift in the IS curve, then demand is raised in the informal sector goods market, despite the lower x_f^*. In this case, z^* actually rises to $z_2^{*'}$. Thus, in a stagnationist economy with a weak RIE, a nominal devaluation could theoretically increase both exports and informal sector incomes. However, export expansion is accompanied by a decrease in formal sector incomes and worsened income inequality between formal sector capitalists and workers.

Insert Figure 4

Figure 4 illustrates a nominal devaluation in an exhilarationist economy. As the figure shows, a nominal devaluation raises formal sector equilibrium output and the IS curve shifts up to IS$'$. Following the same intuition as above, if the RIE is weak, then the NN curve shifts right to NN$'$ due to the positive effect of the PPE on informal sector demand (right panel of Figure 4). Compounding the rightward shift in the NN curve, the higher level of x_f^* raises demand in the informal sector goods market, as illustrated by the movement along the NN$'$ curve to $z_2^{*'}$. In this case, a nominal devaluation truly succeeds in achieving export-led expansion because it raises both formal and informal sector incomes.

If the RIE is sufficiently strong, however, then the NN curve shifts left to NN$'$ (left panel of Figure 4). And, if the leftward shift in the NN curve is larger than the upward shift in the IS curve, then z^* falls to $z_1^{*'}$. In this case, export-led growth is achieved for the formal sector, but informal sector participants suffer from a loss in purchasing power

over formal sector goods. As such, in an exhilarationist economy with a strong RIE, the burden of macroeconomic adjustment is partially shifted away from formal sector workers onto informal sector participants due to a conflictive relationship between the formal and informal sectors.

2.3 A Fall In The Formal Sector Target Mark-Up Factor

Due to South Africa's opening up to international trade, and the corresponding trade liberalization policies that have been implemented, it is possible that the formal sector target mark-up factor of domestic firms has been lowered. When formal sector producers experience a decrease in their monopoly power, then $\overline{\tau}$ falls, creating a fall in τ as well. Similar to a nominal devaluation, a fall in the formal sector target mark-up factor affects formal sector output and informal sector relative prices through three channels: (1) the fall in $\overline{\tau}$ leads to a fall in the actual mark-up factor, τ, and hence the formal sector profit share, π, creating a class redistribution of income; (2) the fall in τ results in a fall in formal sector prices, P_f, and a depreciation of the real exchange rate, q; and (3) the fall in formal sector prices results in a direct decrease in formal sector purchasing power over informal sector goods.

Insert Figure 5

The effect of a reduction in $\overline{\tau}$ on the trade balance follows directly from the intuition for a nominal devaluation. However, as shown in Figure 5, the effect of a reduction in the formal sector profit share is to increase domestic absorption, increase formal sector output in equilibrium, and make the economy unambiguously stagnationist. Regarding demand in the informal sector, the positive RIE effect on formal sector consumption works in contrast to the initial decrease in formal sector purchasing power over informal sector goods. Thus,

for informal sector relative prices to fall in response to a reduction in $\overline{\tau}$, the PPE must be large enough to outweigh the expansionary effects of both the RIE and the higher x_f^* on demand for informal sector goods. Where trade liberalization leads to a reduction in formal sector monopoly power in an economy with large class differences in consumption, the model therefore suggests that income in both sectors would likely grow and income distribution within and between sectors would improve.

3 Synthesis And Conclusions

This paper constructed a two-sector macroeconomic model designed to incorporate the structural factors present in Johannesburg, South Africa (and most likely present in other urban areas of Africa or South Asia) and, as such, extends formal-informal sector dual analysis beyond Latin America. Specifically, the model captures an informal sector that expands as a result of inadequate formal sector demand and produces wage goods or commercial services targeted toward domestic low-income consumers. The model includes open-economy considerations by adding a formal sector mark-up factor endogenously determined by international competitiveness. This addition is useful for depicting sectoral price adjustment and for creating the possibility of growth in both sectors. As such, the model not only allows for either a complementary or conflictive relationship to exist between the formal and informal sectors, but it makes explicit the factors that determine the nature of this relationship.

For example, the comparative statics for a nominal devaluation illustrated that export-led growth occurs only under certain conditions. In an exhilarationist economy, a nominal devaluation succeeds at achieving export-led growth in the formal sector. However, for informal sector incomes to grow, the higher profit share resulting from the devaluation must

translate into a relatively small reduction in formal sector consumption demand for informal sector goods (i.e. the RIE must be small). If the RIE is relatively large, then a nominal devaluation decreases demand in the informal sector and export-led growth in the formal sector is accompanied by a contraction in informal sector incomes and worsened income inequality both within the formal sector as well as between the formal and informal sectors. The trade-off between formal and informal sector incomes illustrates that a conflictive relationship could exist between the sectors in response to a higher profit share.

If the economy is stagnationist, a nominal devaluation is contractionary because the resulting fall in domestic absorption outweighs the gains from an improved trade balance. As such, a nominal devaluation succeeds in promoting exports, but fails to increase capacity utilization. Furthermore, when the RIE is strong, the formal sector contraction is accompanied by a deterioration in informal sector incomes such that it may be better to instead implement policies that raise the formal sector wage share.

One way in which the formal sector wage share could be increased is through a lower target mark-up factor. With a lower target mark-up factor, the real exchange rate depreciates and, assuming adequate elasticities, the trade balance is improved. Coupled with a trade balance improvement, domestic absorption increases, and assuming an adequate RIE, demand is raised in both sectors. Thus, irrespective of whether an economy is stagnationist in response to a nominal exchange rate, a lower target mark-up factor is likely to increase formal sector output, increase informal sector relative prices, increase net exports, and improve income distribution both within the formal sector as well as between the sectors.

In the case of South Africa, it is likely the economy has been developing more exhilarationist possibilities since 1994 when the country started opening up further to international trade. South African formal sector producers are now exposed to significant international

competition suggesting a small degree of exchange-rate pass through, while at the same time, they are hedged on their import costs (Chandra et al., 2000a). Therefore, when South Africans try to pursue export-led growth through nominal devaluation, this model suggests they may have to grapple with the trade-off of worsened income inequality and increased vulnerability for the poorest groups in urban society. However, contrary to current efforts to foster export-led growth through exchange-rate policies, trade liberalization efforts may bode well for the South Africans' dual goals of growth and improved income distribution.

Beyond South Africa, this model highlights the need to consider class consumption behavior before blindly advocating development policies that aim to promote informal sector expansion in response to formal sector unemployment. If informal sector relative prices fall during a formal sector contraction, as in the case of a nominal devaluation with a strong RIE, income distribution could worsen between the sectors, and informal sector participants could bear a disproportionate share of the burden. Given that the nature of the formal-informal sector relationship is complementary when formal sector class differences in consumption are significant (a common structural feature across many developing countries), informal sector participants could likely suffer the greatest increase in vulnerability during an economic crisis.

Mathematical Appendix

Per Capita Nominal Consumption

Equation (19) can be reduced to a function of x_f and z by substituting in equations (5), (8′), (12), and (18):

$$Y = (1/N)[w_f b_{fw} x_f K_f + \gamma_{fk} \pi x_f P_f K_f + \gamma_{ne} P_n x_n K_n + w_n(\overline{L} - b_{fw} x_f K_f)]$$

Factoring out K_f and simplifying:

$$Y = (K_f/N)[x_f w_f b_{fw} + x_f \gamma_{fk} \pi P_f - x_f w_n b_{fw} + z\gamma_{ne} x_n \lambda P_f + w_n \overline{L}/K_f]$$

Consistent with the labor market assumptions, as x_f rises, per capita consumption will rise due to an increase in formal sector employment, which works to absorb previously employed informal sector workers. As workers who were previously employed in the informal sector, earning a nominal wage of w_n, get absorbed into the formal sector they earn a higher nominal wage of w_f and overall income and consumption rise. Additionally, as z rises, per capita consumption rises through increased informal sector income. As such, $Y_{x_f} > 0$ and $Y_z > 0$.

Derivation of the Model Solution

To derive the model solution, equation (1) and equation (33) can be expressed in the form of excess demand equal to zero. In equation (33), the term K_f can be divided from both sides and equations (3), (15), (26′) and (32) can be substituted in to yield:

$$(\overline{g}_f + g_1 \pi) R_f + A/K_f(q^{\psi}) + x_f[g_2 R_f - (1 - \gamma_{fk})\pi - q\rho_m a_f] = 0$$

For excess demand to equal zero in the informal sector goods market, the term K_f can be divided from both sides of equation (1), equations (1′), (4), (5), (12), (20), (22) and (24) can be substituted in to yield:

$$(\beta/P_n)[w_f b_{fw} x_f + \gamma_{fk} \pi x_f P_f + \gamma_{ne} P_n x_n \lambda + w_n(\overline{L}/K_f - b_{fw} x_f)]$$

$$-x_n \lambda - (1/b_{nw})[\overline{L}/K_f - b_{fw} x_f)] = 0$$

Then, substituting in equations (7), (9), and (17):

$$(\beta x_f/z)[(1-\pi)(1-\phi) + \pi\gamma_{fk}] - (1 - \beta\gamma_{ne}) x_n \lambda - (1-\beta)[\overline{L}/(K_f b_{nw}) - x_f b_{fw}/b_{nw}] = 0$$

The NN Curve

Recalling that $\beta = \beta(x_f, z)$ is endogenous, the slope of the NN curve is:

$$\frac{dx_f}{dz} \Big|_{NN} = -N_2/N_1 > 0$$

where

$$N_1 = (\beta/z)[(1-\pi)(1-\phi) + \pi\gamma_{fk}] + (1-\beta)(b_{fw}/b_{nw})$$

$$+(\beta_{x_f} x_f/z)[(1-\pi)(1-\phi) + \pi\gamma_{fk}] + \beta_{x_f}\gamma_{ne} x_n \lambda + \beta_{x_f}[\overline{L}/(K_f b_{nw}) - x_f b_{fw}/b_{nw}] > 0$$

$$N_2 = -\beta x_f[(1-\pi)(1-\phi) + \pi\gamma_{fk}](1/z^2)$$

$$+(\beta_z x_f/z)[(1-\pi)(1-\phi) + \pi\gamma_{fk}] + \beta_z\gamma_{ne} x_n \lambda + \beta_z[\overline{L}/(K_f b_{nw}) - x_f b_{fw}/b_{nw}] < 0$$

The first term in N_1 is positive and represents an injection into the informal sector resulting from increased formal sector consumption as x_f rises. The second term in N_1 is positive and represents an injection into the informal sector resulting from the corresponding rise in formal sector employment. Specifically, with each unit rise in x_f, fewer workers are left as residual labor in the informal sector and informal sector consumption of formal sector goods is reduced. The third, fourth, and fifth terms in N_1 are the weighted income effects from x_f on the informal sector budget shares and are negative to correspond with equation (25). These income effects act as a leakage from the informal sector, because with each unit increase in x_f, per capita consumption rises, but the informal sector budget share falls due to the staple or lesser quality nature of informal sector goods.

To determine the sign of N_1, it is necessary to determine whether, for any given change in x_f, informal sector injections are greater than informal sector leakages or vice versa. It seems reasonable to assume that the direct change in informal sector consumption resulting

from a unit rise in x_f (i.e. the injections) will exceed the indirect change in informal sector consumption resulting from a percentage change in the informal sector budget share induced by a unit rise in x_f (i.e. the income effect leakages). This assumption assures that as x_f rises, there will always be a net injection of spending from the formal sector to the informal sector such that $N_1 > 0$.

The first term in N_2 represents a leakage from the informal sector resulting from the decreased purchasing power of formal sector participants as z rises. This term is negative. The second, third, and fourth terms in N_2 represent the changes in informal sector consumption resulting from the impact of a change in z on the informal sector budget share. For simplicity, these terms can be called the price effects. Both terms would be negative if the informal sector budget share is price-elastic (i.e. an additional leakage from the informal sector) such that $\beta'_z < 0$ and $\nu > 1$. Both terms would be positive if the informal sector budget share is sufficiently price-inelastic (i.e. an injection from the formal sector) such that $\beta'_z > 0$ and $\nu < 1$.

Again, it seems plausible to assume that the direct change in informal sector consumption resulting from a unit rise in z (in this case the leakages) exceeds the indirect change resulting from a percentage change in the informal sector budget share due to a unit rise in z (i.e. the injections where $\nu < 1$). As a result, irrespective of the price elasticity of β, it is assumed that $N_2 < 0$ and the slope of the NN curve is positive.

Stability of the Model Solution

Given the nonlinearity of the NN curve and the fact that β is endogenously determined by x_f and z, the model can only provide an implicit solution for the equilibrium level of informal sector relative prices, z^*. To determine the stability of the solution, local

stability analysis can be performed using the Taylor expansion method to obtain a linear approximation to the nonlinear system. In reduced form, this linearization is as follows:

$$\begin{pmatrix} dx_f \\ dz \end{pmatrix} - \begin{pmatrix} [g_2 R_f - (1-\gamma_{fk})\pi - q\rho_m a_f] & 0 \\ N_1 & N_2 \end{pmatrix} \begin{pmatrix} x_f \\ z \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

where the Jacobian matrix is evaluated at the equilibrium. As discussed in Chiang (1984), local stability is determined by examining the signs of the determinant and trace of this Jacobian matrix. Specifically, stability requires that the determinant of the Jacobian, $\mid \mathbf{J} \mid = [g_2 R_f - (1-\gamma_{fk})\pi - q\rho_m a_f]N_2$, is positive and the trace of the Jacobian, $tr\mathbf{J} = [g_2 R_f - (1-\gamma_{fk})\pi - q\rho_m a_f] + N_2$ is negative. Given the assumptions regarding the slopes of the IS and NN curves, the equilibrium is locally stable.

Comparative Statics

Mathematically, the solution for a unit change in e on x_f is obtained by differentiating equation (34) with respect to e:

$$\frac{dx_f}{de} = \frac{G_e}{[(1-\gamma_{fk})\pi + q\rho_m a_f - g_2 R_f]^2}$$

where

$$G_e = [g_1 R_f(den) - (1-\gamma_{fk})(num)](d\pi/de) + (A/K_f)(den)(dq^{\psi}/de)$$

$$-(\rho_m a_f)(num)(dq/de) + [(\overline{g}_f + g_1\pi)(den) + g_2(num)](dR_f/dq)(dq/de)$$

with *den* standing for the denominator, *num* standing for the numerator, and Table 8 listing the solutions for dq/de, dq^{ψ}/de, $d\pi/de$, and dR_f/dq.

Insert Table 9

The mathematical solution for a unit change in e on informal sector relative prices is obtained by differentiating equation (34) with respect to e and x_f:

$$\frac{dz}{de} = \frac{N_e}{N_2} - \frac{N_1(dx_f/de)}{N_2}$$

where

$$N_e = (\beta x_f/z^2)[(1-\pi)(1-\phi) + \pi\gamma_{fk}](dz/dq)(dq/de)$$

$$+(\beta x_f/z)(1-\gamma_{fk}-\theta)(d\pi/de) + (\beta x_f/z)(1-\pi)(d\phi/de)$$

with Table 3 listing the solutions for the partial derivatives.

The mathematical solution for a unit change in $\overline{\tau}$ on x_f is obtained by differentiating equation (35) with respect to $\overline{\tau}$:

$$\frac{dx_f}{d\overline{\tau}} = \frac{G_{\overline{\tau}}}{[(1-\gamma_{fk})\pi + q\rho_m a_f - g_2 R_f]^2} < 0$$

where

$$G_{\overline{\tau}} = [g_1 R_f(den) - (1-\gamma_{fk})(num)](d\pi/d\overline{\tau}) + (A/K_f)(den)(dq^{\psi}/d\overline{\tau})$$

$$-(\rho_m a_f)(num)(dq/d\overline{\tau}) + [(\overline{g}_f + g_1\pi)(den) + g_2(num)](dR_f/dq)(dq/d\overline{\tau}) < 0$$

The mathematical solution for a unit change in $\overline{\tau}$ on informal sector relative prices is obtained by differentiating equation (35) with respect to $\overline{\tau}$ and x_f:

$$\frac{dz}{d\overline{\tau}} = \frac{N_{\overline{\tau}}}{N_2} - \frac{N_1(dx_f/d\overline{\tau})}{N_2}$$

where

$$N_{\overline{\tau}} = (\beta x_f/z^2)[(1-\pi)(1-\phi) + \pi\gamma_{fk}](dz/dq)(dq/d\overline{\tau})$$

$$+(\beta x_f/z)(1-\gamma_{fk}-\theta)(d\pi/d\overline{\tau})$$

Notes

[1]The term "informal sector" refers to a dualistic pattern of development present in labor-surplus economies. When capital is scarce, institutions are weak, and/or markets are not functioning perfectly, the modern (i.e. capitalist) sector of the economy is unable to absorb the entire labor force and there is growth in a traditional, subsistence, agricultural sector and/or an urban, tertiary sector called the informal sector. Estimates of the informal sector share of employment vary from thirty to forty percent in Latin America to sixty or seventy percent in sub-Saharan Africa. See Chaudhuri (1989), Gibson et al. (1986), Harris & Todaro (1970), Lewis (1954) or Meagher (1995).

[2]This view is based on the relatively capital-intensive nature of production in the formal sector and disadvantages faced by informal sector producers with regard to access to markets, public services, and infrastructure (Webster & Fidler 1996).

[3]For this purpose, theoretical contributions from Kelley's (1994) model of the informal sector, Blecker's (1989) model of international competition, Blecker's (1996) model of North-South international trade, and Blecker and Seguino's (2002) model of an export-oriented, semi-industrialized economy are used. Blecker's (1996) model and Blecker and Seguino's (2002) model are built on earlier work of Dutt (1990), Taylor (1979) and (1983), and others. The models are appropriate for this analysis since many of the asymmetries between the formal and informal sectors are similar to those modeled in the North-South trade literature.

[4]See Chandra et al. (2000a, 2000b, and 2000c).

[5]Schaefer (2001) discusses that the informal sector could be divided into more than two classes but uses this grouping simply to illustrate differences in firm characteristics.

[6]If 5 days a week is considered full-time, then working more than 20 days a month is suggestive of over-time.

[7]However, if South Africa opens up to a lot of direct foreign investment by multinational corporations, a new form of oligopoly power could re-emerge.

[8]This simplification is made to facilitate analysis of the complex fix-flex pricing framework between the formal and informal sectors. In the case of South Africa, the effect of exogenous mineral exports could be added, but the addition would not affect the analytical structure of the model.

[9]This model specification is borrowed from Blecker & Seguino (2002).

[10]Schaefer (2001) confirms that informal sector entrepreneurs use a significant amount of family labor or apprentices. The wide use of family or apprentice labor by informal sector entrepreneurs allows them to pay extremely low to negligible wages or to receive free labor.

[11]In this sense, informal sector entrepreneurs are treated as a separate factor of production. They are assumed to have enough capital to be self-employed, but not enough capital to hire workers. An alternative assumption to full employment would be that total informal sector employment is fixed in the short run due to a necessary base level of skills, allowing for the existence of unemployment as in Raychaudhuri & Chatterjee (1997). However, the results of this model will largely remain unchanged if similar consumption behavior is assumed for the unemployed and informal sector workers.

[12]Given the assumption of weak informal sector forward linkages, it is assumed that informal sector participants do not purchase imported intermediates either.

[13]Chandra et al.,(2000b) show that less than one third of formal large manufacturing

firms in Johannesburg engaged in import substitution during the Rand depreciations of 1997 and 1999. As a result of these constraints, the simplifying assumption is made that formal sector firms are so dependent on imports of intermediate goods that their demand for such inputs is perfectly price-inelastic.

[14]Empirical evidence from Chandra et al.,(2000b) shows that informal sector entrepreneurs have poor access to bank finance and must save to invest.

[15]Given that the model is formalized in a fix-flex price framework, in which one of the crucial differences between the sectors is the way that each sector adjusts to disequilibrium, x_f and z are especially helpful for showing comparative static effects.

[16]Embodied in β_Y are the income effects produced by a change in x_f, holding z constant, and vice versa. It follows that $\beta_{x_f} = \beta_Y Y_{x_f} < 0$ because as formal sector output rises, total income rises, and informal sector consumption rises by proportionately less.

[17]If a rise in z fails to induce sufficient substitution in consumption toward formal sector goods, due to the staple nature of the product, then the price effects and income effects from a change in z work in opposite directions. For the informal sector budget share to increase from a rise in z, the price inelasticity of the budget share must dominate the income inelasticity of the budget share.

[18]Domestic investment generally consists of certain types of goods (e.g. factory buildings or mining construction) while imported investment generally consists of other types of goods not supplied by domestic producers (e.g. machines embodying a certain technology).

[19]Since the model does not include financial markets, it is assumed that capital is not mobile between the sectors and each sector's savings finances its own investment. When

examining how informal firms finance investment, generally 80 percent or more comes from personal or family savings (Chandra et al., 2000b).

[20]Both of these models build on earlier work of Robinson (1962), Dutt (1984) and (1990), and Rowthorn (1982). The investment function of Marglin & Bhaduri (1990) is an implicit form investment function, while the one in this model is linearized. This difference has implications for comparative statics and will be discussed in the next section.

[21]A third equation for equilibrium in the formal sector goods market (equation (2)) could also be used. Given Walras' law, however, this equation is not independent. The solution is obtained and shown to be stable in the appendix.

[22]This asymmetrical influence of the formal sector on the informal sector is reminiscent of many North-South trade models, such as those developed by developed by Dutt (1990), Taylor (1983), and Blecker (1996).

[23]A more in depth discussion of this slope is provided in the appendix.

[24]This result is due to the linear functional form of equation (33), representing formal sector investment demand, along with other assumptions such as the absence of workers' savings. For a discussion, see Marglin & Bhaduri (1990), Taylor (1990), and Blecker (2002).

[25]Given this model assumes that import demand is perfectly price-inelastic, for a depreciation of the real exchange rate to improve the trade balance, the price elasticity of export demand must be greater than one.

[26]Stagnationism is a term used in the structuralist literature that originated with Steindl (1952), who argued that there is a tendency in capitalist economies for industries to concentrate, profit margins to rise, and overall aggregate demand to stagnate. Building on

Steindl's work, models by Dutt (1984 and 1990), Rowthorn (1982), and Taylor (1979 and 1983) have shown that a rise in the profit share depresses both capacity utilization and growth in economies characterized by excess capacity under certain conditions.

[27]This terminology is borrowed from Marglin & Bhaduri (1990) to describe a positive relationship between capacity utilization and the profit share. With a linearized form of the investment demand function, the exhilarationist result is only possible due to the existence of international trade. See Marglin & Bhaduri (1990), Mott & Slattery (1994), and Blecker (2002) for a discussion.

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Table 1: Percent of Firms in Each Sector that Sell Output to Firms From Another Sector (Johannesburg 1999)

Buyer	Seller	
	Informal Firms	Large Formal Firms
Large formal firms	4.8	88.6
Small formal firms	20.2	n/a*
Foreign firms	3.0	45.8
Government	2.0	34.6
Households	88.8	n/a
Number of respondents	499	328

Source: Adapted from Schaefer (2001) based on survey data for the Greater Johannesburg Metropolitan Area.

* The abbreviation n/a means not available.

Table 2: Reasons Why Informal Sector Owners Started Their Business (Johannesburg 1999)

Reason for Starting Business	Percent of Informal Sector Owners
Unemployed	51.6
Have job but income insufficient	27.9
Profit opportunity	9.1
Family business	6.6
To work from home	3.4
Disabled	0.4
Household reasons	1.1
Number of respondents	473

Source: Adapted from Schaefer (2001) based on survey data for the Greater Johannesburg Metropolitan Area.

Table 3: Percent of Informal Sector Owners by Value of Capital Required to Start-Up Business and Average Monthly Sales Range (1999)

	Average Monthly Sales (Rands)				
Start-Up Capital Requirement	1 to 1000	1001 to 1500	1501 to 3000	3001 to 10,000	Over 10,000
0-500 Rands	57.0	33.3	27.1	22.9	27.3
501-1000 Rands	18.3	16.7	16.8	10.0	7.3
1001-2000 Rands	8.6	20.8	16.8	8.6	14.6
2001-5000 Rands	9.7	16.7	14.0	15.7	10.9
Over 5000 Rands	6.5	12.5	25.2	42.9	40.0
Total	100	100	100	100	100
Number of respondents	96	97	108	142	56

Source: Adapted from Schaefer (2001) based on survey data for the Greater Johannesburg Metropolitan Area.
Note: The average 1999 exchange rate was 6.10 Rands per US Dollar.

Table 4: Percent of Informal Sector Owners by Skill Level (1999)

Skill Level	Labor Class	Entrepreneurial Class
No vocational skills	75.5	59.0
Skilled/semi-skilled	18.5	29.0
Master craftsman	6.0	12.0
Total	100	100
Number of respondents	233	266

Source: Adapted from Schaefer (2001) based on survey data for the Greater Johannesburg Metropolitan Area.

Table 5: Percent of Informal Sector Owners Reporting Access to Infrastructure (Johannesburg 1999)

Type of Infrastructure*	Labor Class	Entrepreneurial Class
Own transport	27.0	56.8
Post box	25.3	33.8
Telephone	36.9	48.1
Water	59.7	81.2
Electricity	61.4	85.0
Number of respondents	233	266

Source: Adapted from Schaefer (2001) based on survey data for the Greater Johannesburg Metropolitan Area.
*Questionnaire asked owner to reply yes or no to whether they had access to each asset or service.

Table 6: Capacity Utilization Measures for Large Formal Firms (1997 and 1998)

	1998	1997
Percent of firms producing at full capacity	7.0	8.8
Percent of firms running double or triple labor shift	37.2	37.5
For firms at less than full capacity:		
Mean percentage more they could produce with existing capacity	46.0	43.7

Source: Adapted from Schaefer (2001) based on survey data for the Greater Johannesburg Metropolitan Area.

Table 7: Equations of the Model

Equation Number	Equations
(1)	$X_n = C_{fn} + C_{nn}$
or (2)	$X_f = C_{ff} + C_{nf} + g_f K_f + g_n K_n + E$
(1′)	$X_n = X_{ne} + X_{nw}$
(3)	$E = Aq^{\psi}$
(4)	$x_n = X_{ne}/K_n$
(5)	$\overline{L} = b_{fw} X_f + b_{nw} X_{nw}$
(6)	$L_{fw} = b_{fw} X_f$
(7)	$L_{nw} = b_{nw} X_{nw}$
(8)	$P_n = w_n b_{nw}$
(8′)	$P_n = w_n b_{ne} + r_{ne} P_f / x_{ne}$
(9)	$P_f = w_f b_{fw} + P_{wm} e a_f + r_{fk} P_f / x_f$
(10)	$x_f = X_f / K_f$
(11)	$P_f = \tau(w_f b_{fw} + P_{wm} e a_f)$
(12)	$\pi = (\tau - 1)/(\tau)$
(13)	$\phi = \frac{e P_{wm} a_f}{w_f b_f + e P_{wm} a_f}$
(14′)	$\tau = \overline{\tau}^{1/(1+\theta)} \epsilon^{\theta/(1+\theta)}$
(15)	$q = e P_{wx} / P_f$
(16)	$\epsilon = q\tau$
(17)	$z = P_n / P_f$
(18)	$D = w_f L_{fw} + \gamma_{fk} r_{fk} P_f K_f + \gamma_{ne} P_n x_n K_n + w_n L_{nw}$
(19)	$Y = D/N$
(20)	$\lambda = K_n / K_f$
(21)	$P_f C_{ff} = (1 - \beta)[w_f L_{fw} + \gamma_{fk} r_{fk} P_f K_f]$
(22)	$P_n C_{fn} = \beta[w_f L_{fw} + \gamma_{fk} r_{fk} P_f K_f]$
(23)	$P_f C_{nf} = (1 - \beta)[\gamma_{ne} P_n x_n K_n + w_n L_{nw}]$
(24)	$P_n C_{nn} = \beta[\gamma_{ne} P_n x_n K_n + w_n L_{nw}]$
(25)	$\beta = \beta(Y, z)$
(26′)	$M = q\rho_m a_f X_f + q\rho_i \mu_f g_f K_f$
(27)	$g_{fm} K_f = \mu_f g_f K_f$
(28)	$\rho_i = P_{wi} / P_{wx}$
(29)	$\rho_m = P_{wm} / P_{wx}$
(30)	$g_n = (1 - \gamma_{ne}) x_n z$
(31)	$g_f(e P_{wi} \mu_f + 1) = \overline{g}_f + g_1 \pi + g_2 x_f$
(32)	$F = E - M$
(33)	$g_f K_f + F = (1 - \gamma_{fk}) r_{fk} K_f$

Table 8: Variables of the Model

Number of Variables	Endogenous Variables	Exogenous Variables
1	X_f	K_f
2	X_n	K_n
3	C_{ff}	$\overline{L}$
4	C_{nf}	b_{fw}
5	C_{fn}	b_{ne}
6	C_{nn}	b_{nw}
7	L_{fw}	w_f
8	L_{nw}	x_n
9	X_{ne}	γ_{fk}
10	X_{nw}	γ_{ne}
11	D	N
12	Y	$\overline{g}_f$
13	P_f	g_1
14	P_n	g_2
15	r_{fk}	A
16	r_{ne}	a_f
17	β	$\overline{\tau}$
18	g_n	θ
19	g_f	ψ
20	π	P_{wm}
21	z	P_{wx}
22	x_f	P_{wi}
23	w_n	μ_f
24	λ	e
25	E	
26	ϕ	
27	q	
28	τ	
29	ϵ	
30	M	
31	g_{fm}	
32	ρ_i	
33	ρ_m	
34	F	

Table 9: Solutions to Some Partial Derivatives

$dq/d\overline{\tau}$	$=$	$\frac{-1}{1+\theta}(\overline{\tau}^{\frac{-2-\theta}{1+\theta}}\epsilon^{\frac{1}{1+\theta}}) < 0$
$dq^{\psi}/d\overline{\tau}$	$=$	$\frac{-\psi}{1+\theta}(\overline{\tau}^{\frac{-\psi-1-\theta}{1+\theta}}\epsilon^{\frac{\psi}{1+\theta}}) < 0$
dq/de	$=$	$\frac{1}{1+\theta}(\overline{\tau}^{\frac{-1}{1+\theta}}w_f b_{fw}{}^{\frac{-1}{1+\theta}}P_{wx}{}^{\frac{1}{1+\theta}}e^{\frac{-\theta}{1+\theta}}) > 0$
dq^{ψ}/de	$=$	$\frac{\psi}{1+\theta}(\overline{\tau}^{\frac{-\psi}{1+\theta}}w_f b_{fw}{}^{\frac{-\psi}{1+\theta}}P_{wx}{}^{\frac{\psi}{1+\theta}}e^{\frac{-\psi-1-\theta}{1+\theta}}) > 0$
$d\pi/d\overline{\tau}$	$=$	$\frac{1}{1+\theta}(\overline{\tau}^{\frac{-2-\theta}{1+\theta}}\epsilon^{\frac{-\theta}{1+\theta}}) > 0$
$d\pi/de$	$=$	$\frac{\theta}{1+\theta}(\overline{\tau}^{\frac{-1}{1+\theta}}w_f b_{fw}{}^{\frac{-\theta}{1+\theta}}P_{wx}{}^{\frac{-\theta}{1+\theta}}e^{\frac{-2\theta-1}{1+\theta}}) > 0$
dR_f/dq	$=$	$\frac{-2\rho_i\mu_f}{(q\rho_i\mu_f+1)^2} < 0$
$d\phi/de$	$=$	$\frac{b_{fw}P_{wm}a_f w_f}{(w_f b_{fw}+eP_{wm}a_f)^2} > 0$
dz/dq	$=$	$P_n/eP_{wx} > 0$

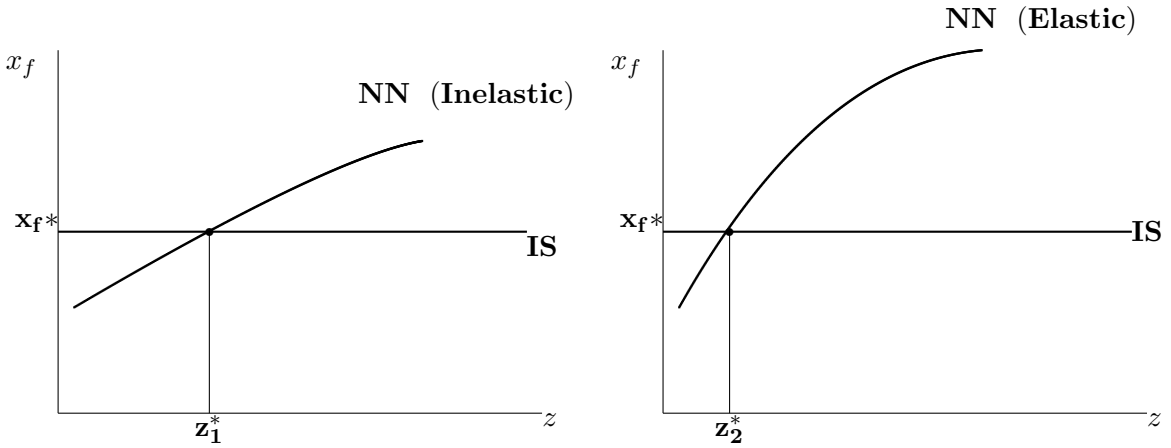

Figure 1: IS and NN Curves: Inelastic Informal Sector Budget Share vs. Elastic Informal Sector Budget Share

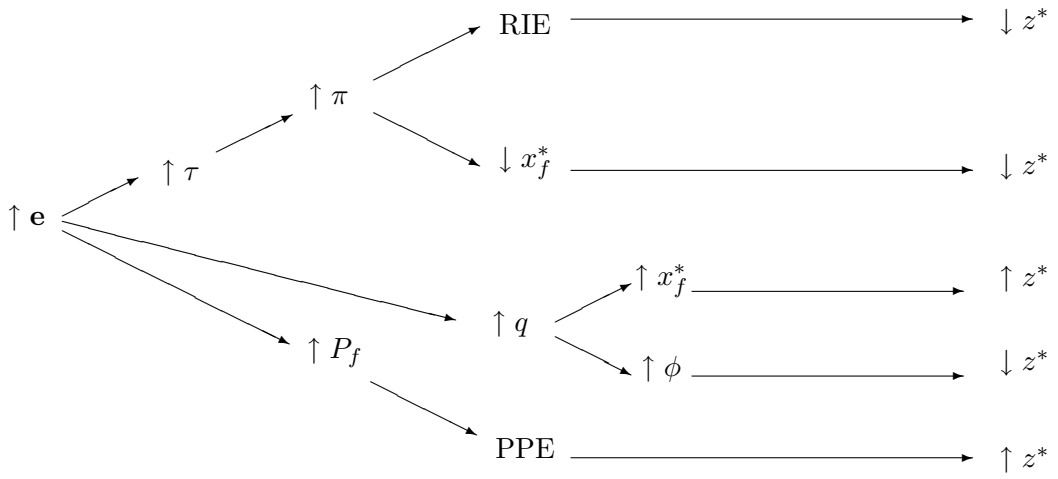

Figure 2: Flow Chart of a Devaluation of the Nominal Exchange Rate

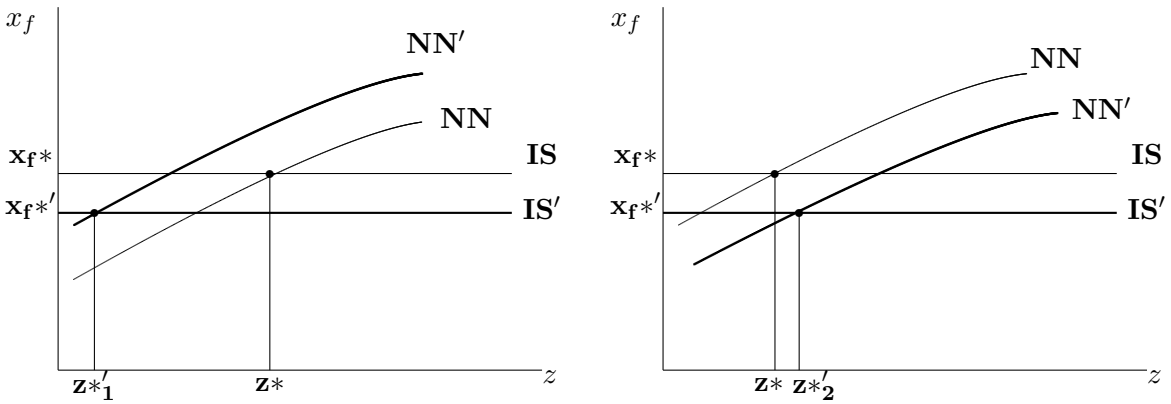

Figure 3: Devaluation of the Nominal Exchange Rate in a Stagnationist Economy: Strong RIE (left panel) vs. Weak RIE (right panel)

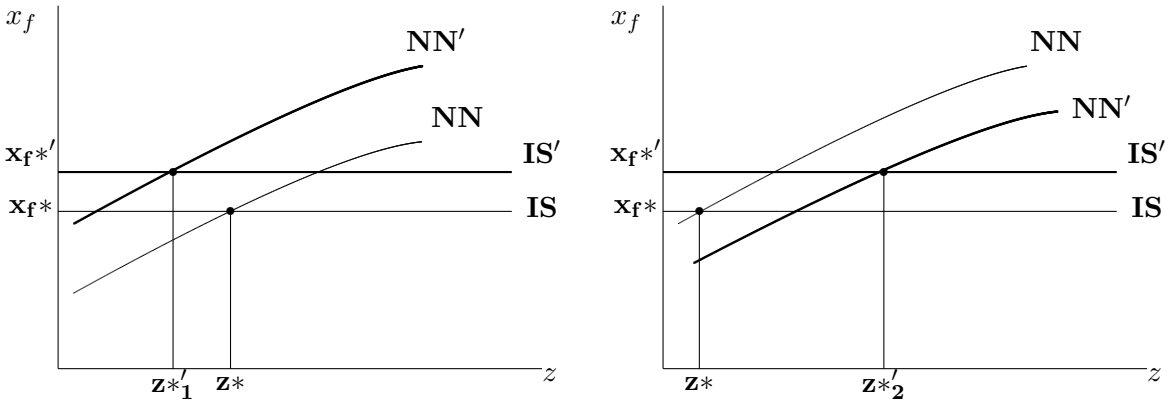

Figure 4: A Devaluation of the Nominal Exchange Rate in an Exhilarationist Economy: Strong RIE (left panel) vs. Weak RIE (right panel)

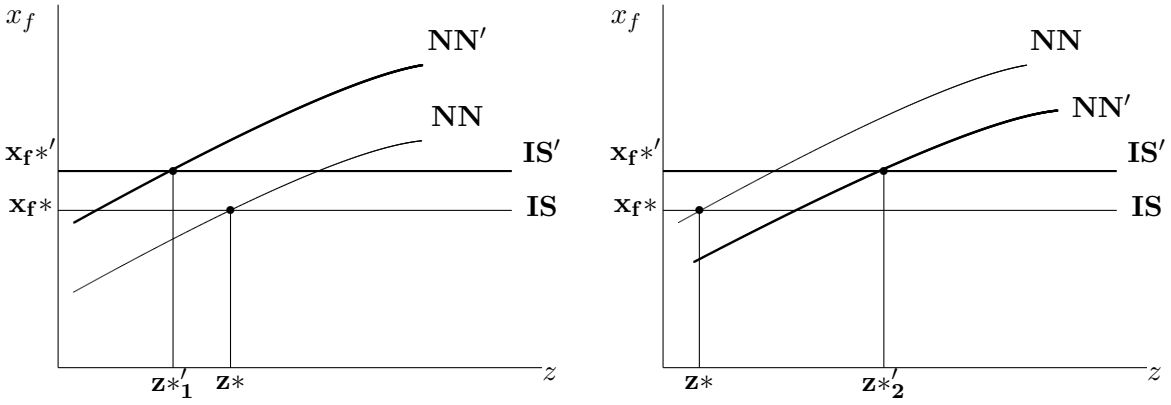

Figure 5: A Fall in the Target Mark-Up Factor: Weak RIE (left panel) vs. Strong RIE (right panel)