MACROECONOMIC IMPACT OF THE INFORMAL SECTOR IN FIJI

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1. **INTRODUCTION**

In this paper, our aim is to examine the macroeconomic impact of an expanding informal sector for the Fijian economy. The goal of this paper is achieved using a computable general equilibrium model of the Fijian economy. We stimulate a 10 per cent expansion of the informal sector. While there are a few studies that have examined the role of the informal sector in other developing countries, none of the studies have examined the economy wide effects of the informal sector using a CGE model.

The rest of the paper is organised as follows. In Section 2, we describe the Fiji CGE model. In section 3, we review the literature on the informal sector. In Section 4, we discuss the empirical results, while in the final section we conclude.

2. **The Fiji CGE Model**

2.1. *The I-O – CGE debate*

Leontief (1936, 1937) who first complied an I-O table for the US economy pioneered the I-O analysis. His research, in essence, was responsible for the development of multi-sector models. I-O analysis uses matrix algebra to find out how much output will be utilised in productive activities to obtain a final net output and how much will be left over for consumption (Baumol, 1977). Accordingly, an I-O model can be used to estimate the amount of income, employment, and production that are required to satisfy a given level of demand. I-O models were used to capture the interactions between different production sectors of the economy. Given that I-O models generate estimates of multipliers they appeal to policy makers and researchers when it comes to estimating secondary effects. Multipliers are usually expressed in terms of the effects
on income, employment, and output of a unit change in final demand expenditures. The multiplier effects (direct, indirect and induced) of any initial increase in expenditure on output, income, or employment can be easily calculated by using the ‘Leontief inverse matrix’\(^1\) derived from the basic I-O tables (Khan et al., 1990). Harmston (1969) carried out one of the earliest I-O studies. Since then the I-O models have been widely used and recognised as an important technique in the estimation of economic impacts, particularly of tourism (Archer and Fletcher, 1996; Archer, 1995; Blain, 1992; Fletcher, 1989, 1994; Lundberg et al., 1995; Tabatchnaia-Tamirisa et al., 1997; Wanhill, 1994; West and Gamage, 2001) at both national and regional levels.\(^2\)

I-O models have a number of advantages that have been responsible for the surge in their use in impact studies. Simplicity has been most commonly used to advance its use. I-O approach can be used to analyse policy issues due to a shock whose effects are confined to a particular industry. Its emphasis on sectoral interdependence and elasticities of multipliers are particularly appealing – the latter is helpful to policy makers when it comes to estimating secondary effects.

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\(^1\) The Leontief inverse matrix is a table which shows the direct plus indirect effect of a change in any category of final demand. Generally, tourist expenditure is expected to have direct, indirect and induced effects. Direct effects take place when firms experience increases in sales revenue from catering for increased tourism demand for goods and services. Indirect effects result when an increase in one sector’s output causes the demand for other sectors output to increase due of the intersectoral purchases. These secondary effects are known as the indirect effects. ‘Induced effects arise when the recipients of the direct and indirect expenditure – owners of firms and their employees – spend their increased income’ (Dwyer et al., 2000: 325-6). This leads to a process of successive rounds of purchases by intermediate firms, increased consumption and employment. Together, they contribute to gross domestic product (Archer, 1977; Fletcher, 1994).

A number of reasons have been proffered for the inadequacy of results derived from an I-O model. First, the model is incomplete in that it contrives only a partial view of an economy. It incorporates only the producer-producer relationships while the presence (importance) of institutions in the operation of an economy is basically ignored. Institutions are essential for they entail the legal right to ownership of resources and hence assist in a timely and efficient provision of services. Transactions both among institutions as well as between institutions and producers are commonly referred to as transfer payments, and entail direct and indirect taxes, social security payments, amongst others (West, 1993). The fact that I-O model fails to incorporate this implies that it ignores an important component of the impact of economic activity.

Second, I-O model ignores key aspects of the economy by focusing only on the industry which is directly affected, and on the impacts on the other parts of the economy which are directly affected. The effects due to resource limitations, labour market adjustments and international trade are not captured within the I-O framework; hence, it is not gifted to capture the all important feedback effects, including the potential crowding out effect that is likely with an expansion of tourism or any other export. The poor treatment of international trade by I-O models is anchored to the

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3 Some researches have attempted to correct for the inherent weaknesses in the I-O technique by incorporating the effects of changes in the consumption patterns that occur as income rises (Sadler et al., 1973), and others have introduced capacity constraints into the basic model (Wanhill, 1988; Fletcher and Archer, 1991).

4 An expansion of tourism, by virtue of injecting more tourism dollars, will cause an appreciation of the exchange rate, leading to a reduction in other exports and/or increase in demand for imports at the expense of the demand for domestic import competing commodities (traditional sectors) – mainly, agriculture, mining, manufacturing. This occurs because the appreciation of the exchange rate depletes the
fact that imports are treated as non-competing and international trade is not dependent on relative prices. Exports together with domestic final demand for domestic output are held exogenous. Dwyer et al., (2002) argue that as a consequence of this limitation, I-O estimates of impacts on economic activity generally or on specific variables such as employment are usually overestimates, very often by large margins; and there exist the possibility that the direction of the change (due to the impact) may be incorrectly signed.

Third, I-O models assume that fixed minimum amount of all intermediate inputs and primary factor inputs are required in order to produce a unit of output in each industry.\(^5\) This assumption forces a number of untoward industry behaviour: One, input expands in direct proportion to output; Two, firms input structure is set fixed, hence shortage of inputs cannot be avoided; Third, the responsiveness of input mixes to changes in relative prices is basically blocked.

Fourth, I-O approach is built on the rather naive assumption that prices and wages do not change. When confronted with large export receipts, it is apparent that prices and wages respond. I-O models do not capture this behaviour.

In the light of these deficiencies in an I-O model, CGE models have emerged as able surrogates for the traditional I-O models. CGE models are built on I-O models but competitiveness of these sectors on the world market. If the increase in tourism demand leads to an increase in investment this will increase foreign borrowing and possibly, foreign direct investment for a period, then push the real exchange rate even higher. This will further reduce traditional exports and increase imports (Dwyer et al., 2000: 333).
they have a greater flexibility in that they allow price and wages to vary so as to lead to equilibrium in all markets of the economy. An important outcome of adjustments to prices and wages is the resultant responsiveness of the real exchange rate for appreciation or depreciation of the exchange rate will determine the competitiveness or otherwise of export sectors. Put differently, direct impact on the economy due to an expansion in export is one aspect, the other is the resulting crowding out in other industries. Together they provide a complete picture of the economic impact of an expansion in exports. For instance, when tourism activity expands there is an increase in the exchange rate, which induces a contraction in economic activity in traditional export sectors.

Furthermore, an important feature of a CGE model structure is that demand for and supplies of commodities and factors are specified as functions of activity variables and relative prices. This allows for a variety of linkages between agents in the economy, in addition to those captured in I-O models (Adams and Parmenter, 1999: 113). And, given that a CGE model proffers a complete map of an economy in that it entails a complete specification of both the supply and demand sides of all relevant markets means that all sectors are incorporated into a single model. This allows the analysis of shocks or policy changes in one sector that may have effects on other sectors.

Almost no applied technique or approach ever eludes criticism. CGE models are no exception. In the pre-1985 era, CGE models were chastised for drawing on unrealistic

\footnote{Furthermore, supply side constraints are assumed to be nonexistent. Labour and capital are available with perfect elasticity of supply, implying a flat supply curve and fixed factor prices (see Bandara (1991) for a detailed description).}
neo-classical assumptions such as perfectly competitive markets and constant returns to scale. While this may still be valid for existing models, it has nonetheless been shown that more realistic assumptions can be incorporated in CGE models. Harris (1984), for instance, has incorporated oligopolistic pricing and economies of scale into CGE models.

Another common criticism of CGE models is rooted to the absence of the role of money. Extant CGE models make an inadequate assumption that monetary authorities adjust money supply of the economy such that it is consistent with the changes in the domestic price level, an upshot of policy simulations (see Bell and Srinivasan, 1984). This is because in a CGE model the equilibrium of the real side of the economy hinges on relative prices. In the aftermath of this criticism, some studies have attempted to incorporate money and bond markets into a stylised CGE model of Turkey (Lewis, 1985), a simple monetary sector in Argentina’s CGE model (Feltenstein, 1980, 1983), and a monetary sector into a Johansen class CGE model (Adams, 1988).

Further, Whalley (1985) highlights that little are known about the numerical values of key parameters such as elasticities. This is particularly true in the case of less developed countries (LDCs), where data problems are well known. In the absence of such information modellers are forced to rely on best guess values (off course the same problem in encountered in I-O analysis). Data and parameter values because they are mainly guesses or adopted from other country experience, is regarded problematic for the very reliability of the results are questionable.
Many authors have also warned of the difficulties that arise when it comes to explaining the results from a CGE model to policy makers. ‘The argument is that most practicing economists and policy makers in LDCs are not convinced by the results obtained from a model with complex mathematical structures and solution techniques’ (Bandara, 1991: 31).

Incompleteness or insufficient disaggregation of a CGE model can also be a limitation for it does not allow a complete assessment of a shock. Tourism is a good example. Dwyer et al (2002: 13) argue that most models to not have a tourism industry and that results are sensitive to how well industry supply and pricing conditions are incorporated, and how well tax structures are modelled. Looseness in this regard will have adverse implications on the results.

The CGE models can be regarded as extensions of the multisector (I-O and linear) programming models. It contains other markets and links between markets are explicitly modelled. Household demands are via utility maximisation subject to budget constraints; industry inputs and outputs are modelled; the zero-pure-profits condition for production is implied in most cases; resource allocation is via market forces – in the event markets behave imperfectly unemployment is a distinct possibility; and increasing government expenditures are met either by raising taxes or borrowing which has implications on other economic agents.

In all, a CGE model entails a complete specification of both the supply and demand sides of all relevant markets. A distinction, however, needs to be made between
theoretical general equilibrium analysis and computable or applied general equilibrium (CGE) analysis. Both are interrelated. The general equilibrium analysis has often been associated with the early work of Walras (1874) and Edgeworth (1881). The theoretical general equilibrium analysis received greater attention between mid 1950s to mid 1970s, and is associated with the contributions from Arrow and Debrou (1954), Debreu (1959), Scarf (1967, 1973) and Arrow and Hahn (1971). The main focus of this theoretical literature is on the existence and uniqueness of equilibrium. The CGE modelling approach is considered an empirical counterpart of this theoretical general equilibrium analysis (Bandara, 1991). Shoven and Whalley (1984: 1007) provide further support to this:

The explicit aim of this literature is to convert the Walrasian general equilibrium structure (formalised in the 1950s by Kenneth Arrow, Gerard Debreu, and others) from an abstract representation of an economy into realistic models of actual economies. The idea is to use these models to evaluate policy options by specifying production and demand parameters and incorporating data reflective of real economies.

Johansen’s (1960) seminal contribution has been hailed as the cornerstone for the interest and fashionableness of CGE models. Bergman (1985) provides an apt discussion of the link between Johansen’s path breaking Multi-Sectoral Growth models and the CGE models. Harberger (1962, 1964) has studied the use of general equilibrium analysis of various policies, economic shocks and or changes. Such analysis, however, were confined to two or three sectors until the advent of the more sophisticated CGE models in the early 1970s and 1980s (see, for example, Shoven and Whalley, 1972; Shoven, 1976; and Dixon et al., 1982). Towards the late 1970s, CGE models were for the first time used to analyse less developed countries (Adelman and Robinson (1978) in the case of Korea; Lysy and Taylor (1980) in the case of Brazil).
2.2. Theoretical structure of the Fiji CGE model and interpretation of results

The Fiji CGE model, developed by Levantis (1999), is based on the ORANI model of the Australian Economy. A complete description including the theoretical structure of the ORANI model is explicated in Dixon et al., (1982). The Fiji model, like ORANI, can be described as an economy-wide, comparative static CGE model of the Johansen class (Johansen, 1960). The Fiji CGE model consists of $m=35$ domestic industries, $n=34$ commodities and $q=2$ occupational types. In total, there are 13 agricultural sector industries; 10 industrial sector industries; and 12 service sector industries including hotels, cafes and restaurants. Each commodity corresponds to an industry except for gold, which is split into two different industries because of the different cost structures of the industries. Further, the non-farm informal sector is grouped as a separate industry. This is important in Fiji’s context given that the informal sector accommodates over 75% of the school dropouts and the unemployed who do not find jobs in the formal sector. Unemployment in Fiji is estimated at around 50%. The informal sector activities includes tailoring (garment production) for the local market; selling of handicraft to tourists and locals; fish production and sales to the local market; mechanical and small scale construction work; and other miscellaneous activities such as selling kava, cigarettes and sweets from home or by the road side, and house to house sales of ornaments and other accessories. It is believed that these informal sector activities create significant employment opportunities.

Of the 34 commodities, most have competing imports. In this light, the model adheres to the Armington assumption which takes imports to be imperfect substitutes to domestic goods. A full list of the 35 industries and 34 commodities are in Appendix 1.
2.3. A brief discussion of the equations in the Fiji CGE model


2.3.1. Determination of prices in the model

In section 2 titled ‘price equations’, prices are defined (Table 1). Commodity prices at basic values are defined as the price received by the suppliers after all tax distortions are taken out, i.e., it is the price level net of all tax distortions. The tax imposed on commodities include tariffs, excises and value added tax. In the model, these taxes are applied to the basic price level. So from the price level \( P_{is} \) where \( i \) is the commodity and \( s \) the source of supply (domestic or imported) we have the following definition of prices:

- Prices after tariffs; \( P_{is}^{tf} = (1 + T_{is}^{tf}) P_{is} \), where \( P_{is} \) is the price level of commodity \( i \) from source \( s \) after tariffs, and \( T_{is}^{tf} \) is the tariff rate;

- Prices after excises; \( P_{is}^{exc} = (1 + T_{is}^{exc}) P_{is}^{tf} \), where \( P_{is}^{exc} \) is the price level of commodity \( i \) after excises, and \( T_{is}^{exc} \) is the excise tax rate of commodity \( i \) from source \( s \);

- Private final demand prices after VAT; \( P_{is}^{pfd} = (1 + T_{is}^{pfd}) P_{is}^{exc} \), where \( P_{is}^{pfd} \) is the price level of commodity \( i \) after VAT on private purchases, and \( T_{is}^{pfd} \) is the VAT rate for private purchases;

- Government final demand prices after VAT; \( P_{is}^{gfd} = (1 + T_{is}^{gfd}) P_{is}^{exc} \), where \( P_{is}^{gfd} \) is the price level of commodity \( i \) after VAT on government purchases, and \( T_{is}^{gfd} \) is the VAT rate for government; and
• Export prices after VAT: $P_{is}^{\text{eff}} = \left(1 + T_{is}^{\text{eff}}\right)P_{is}$ is the price level of commodity $i$s after VAT on export purchases, and $T_{is}^{\text{eff}}$ is the VAT rate for exports

Table 1: The Equations of the Fiji CGE model

<table>
<thead>
<tr>
<th>Sector</th>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Production sector</td>
<td>( dY_j = dY_j^{int} + dY_j^n + dY_j^{net} + dQ_j^t )</td>
</tr>
<tr>
<td>1.2 Household sector</td>
<td>( \sum_j dY_j^n + \sum_j dY_j^{net} + dQ^n + dQ^t + dG^{tra} = dC + dS^{pri} + dR^w )</td>
</tr>
<tr>
<td>1.3 Finance sector</td>
<td>( dS^{pri} + dS^{gov} + dQ^k = dI )</td>
</tr>
<tr>
<td>1.4 Government sector</td>
<td>( dG^{tax} + dQ^a = dG^{con} + dG^{inv} )</td>
</tr>
<tr>
<td>1.5 External sector</td>
<td>( dM + dQ^t = dE + dQ^k + dQ^a )</td>
</tr>
<tr>
<td>2. Price equations</td>
<td></td>
</tr>
<tr>
<td>2.1 Price of domestic goods, basic values</td>
<td>( dP_{id} = (1 + T_{id}^{eff})dP_{id} )</td>
</tr>
<tr>
<td>2.2 Price of imports, basic values</td>
<td>( dP_{im} = \varphi dP_{im} + P_{im} d\varphi )</td>
</tr>
<tr>
<td>2.3 Gross prices to producers</td>
<td>( dP_{pr} = \sum_i S_{ij}^{pr} dP_{id} )</td>
</tr>
<tr>
<td>2.4 Net prices to producers</td>
<td>( dP_{pr}^{net} = (1 - T_{pr}^{eff})dP_{pr} )</td>
</tr>
<tr>
<td>2.5 Prices after tariffs</td>
<td>( dP_{is} = (1 + T_{is}^{eff})dP_{is} )</td>
</tr>
<tr>
<td>2.6 Prices after excise taxes</td>
<td>( dP_{is}^{exc} = (1 + T_{is}^{exc})dP_{is} )</td>
</tr>
<tr>
<td>2.7 Private final demand prices after excise tax and VAT</td>
<td>( dP_{is}^{pf} = (1 + T_{is}^{pf})dP_{is} )</td>
</tr>
<tr>
<td>2.8 Govt final demand prices after excise tax and VAT</td>
<td>( dP_{is}^{pf} = (1 + T_{is}^{pf})dP_{is} )</td>
</tr>
<tr>
<td>2.9 Average consumer prices of commodity groups</td>
<td>( dX_i^{c} = S_{i}^{c} dP_{is}^{pf} )</td>
</tr>
<tr>
<td>2.10 Foreign currency price of exports</td>
<td>( dX_i^{e} = S_{i}^{e} dP_{is}^{pf} )</td>
</tr>
<tr>
<td>2.11 Shock in world demand for exports</td>
<td>( ph_i^{exc} = -\sigma_i \cdot ph_i^{e} \cdot i ) T</td>
</tr>
<tr>
<td>2.12 Domestic price of exports, border prices</td>
<td>( dP_{id}^{pf} = \varphi dP_{id} + dP_{id}^{*} d\varphi )</td>
</tr>
<tr>
<td>2.13 Net price of unskilled rural labour</td>
<td>( dW_{na}^{net} = (1 - T_{na}^{r})dW_{na}^{r} )</td>
</tr>
<tr>
<td>2.14 Net price of unskilled formal labour</td>
<td>( dW_{na}^{unet} = (1 - T_{na}^{u})dW_{na}^{u} )</td>
</tr>
<tr>
<td>2.15 Gross price of unskilled rural labour</td>
<td>( dW_{na}^{net} = dW_{na}^{r}, j ) inf normal</td>
</tr>
<tr>
<td>2.16 Urban unskilled wage determination</td>
<td>( dW_{na}^{u} = \mu \cdot \frac{dW_{na}^{c}}{e^{c}} )</td>
</tr>
<tr>
<td>2.17 Net price of informal labour</td>
<td>( dW_{na}^{unet} = \frac{dW_{na}^{c}}{e^{c}} )</td>
</tr>
<tr>
<td>2.18 Consumer price index</td>
<td>( dW_{na}^{net} = \frac{dW_{na}^{unet} + dW_{na}^{net}}{2} )</td>
</tr>
<tr>
<td>2.19 Investment price index</td>
<td>( dW_{na}^{net} = \frac{dW_{na}^{unet} + dW_{na}^{net}}{2} )</td>
</tr>
<tr>
<td>2.20 Net price of skilled labour</td>
<td>( dW_{nb}^{net} = (1 - T_{nb}^{j})dW_{nb}^{j} )</td>
</tr>
<tr>
<td>2.21 Net price of capital</td>
<td>( dW_{nb}^{net} = (1 - T_{nb}^{j})dW_{nb}^{j} )</td>
</tr>
<tr>
<td>2.22 Net price of skilled rural labour</td>
<td>( dW_{nb}^{net} = dW_{nb}^{unet} + dW_{na}^{net} )</td>
</tr>
<tr>
<td>2.23 Net price of skilled urban labour</td>
<td>( dW_{nb}^{net} = dW_{nb}^{unet} + dW_{na}^{net} )</td>
</tr>
</tbody>
</table>
### 3. Production sector equations

**3.1 Intermediate input costs, industry** $j$

$$dY^\text{int}_j = \sum_i \sum_s \left( P_{is} dX^\text{int}_{isj} + X^\text{int}_{isj} dP_{is} \right)$$

**3.2 Labour costs, industry** $j$

$$dY^\text{net}_j = dF_{kj} + F_{kj} dW^\text{net}_{kj}$$

**3.3 Net capital costs, industry** $j$

**3.4 Tax payment, industry** $j$

$$dY^\text{tax}_j = T^\text{pr}_j P^\text{pr}_j dZ_j + T^\text{pr}_j Z_j dT^\text{pr}_j$$

$$dY^\text{net}_j = dF_{kj} + F_{kj} dW^\text{net}_{kj}$$

$$dY^\text{tax}_j = T^\text{pr}_j P^\text{pr}_j dZ_j + T^\text{pr}_j Z_j dT^\text{pr}_j$$

**3.5 Commodity output**

$$dX_{id} = \sum_j dX_{idj}$$

**3.6 Commodity output by industry**

**3.7 Gross output, industry** $j$

**4. Inputs to production**

**4.1 Demand for primary factor – labour**

$$dF_{nj} = \theta_j S^\text{pr}_{nj} dZ_j - \sigma^\text{pr}_j .F_{nj} - S^\text{pr}_{kj} \left( \frac{dW_{nj}}{W_{nj}} - \frac{dE_i}{e_i} \right) - \theta_j .F_{nj} - \lambda_{kj}$$

**4.2 Demand for primary factor – capital**

$$dF_{kj} = \theta_j S^\text{pr}_{kj} dZ_j - \sigma^\text{pr}_j .F_{kj} - S^\text{pr}_{kj} \left( \frac{dE_i}{e_i} - \frac{dW_{nj}}{W_{nj}} \right) - \theta_j .F_{kj} - \lambda_{kj}$$

**4.3 Demand for intermediate inputs**

$$dX^\text{int}_{isj} = S^\text{int}_{isj} dZ_j - \sigma^\text{int}_j .F_{nj} - S^\text{int}_{kj} \left( \frac{dP_{isj}}{P_{isj}} - \frac{dP_{isj}}{P_{isj}} \right) - \sigma^\text{int}_j .F_{kj} - \lambda_{kj}$$

**4.4 Demand for labour by skill level**

$$dF_{nj} = S^\text{q}_{nj} dF_{nj} - F^\text{q}_{nj} \left( \frac{dW_{nj}}{W_{nj}} - \frac{dW_{nj}}{W_{nj}} \right)$$

**4.5 Composite price of labour by industry**

$$dW_{nj} = \sum_q S^\text{q}_{nj} dW_{nj}$$

**5. Labour market conditions**

**5.1 Aggregate demand for** $q$

**5.2 Aggregate demand for** $r$

**5.3 Aggregate demand for** $u$

**5.7 Equilibrium in skilled**

$q = a$; $j \in r, u$ for $q = b$. 
<table>
<thead>
<tr>
<th>rural labour</th>
<th>urban formal labour</th>
<th>informal unskilled labour</th>
<th>unskilled labour</th>
<th>labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>(dF_{nj} = \sum_{j \in r} dF_{nj} )</td>
<td>(dF_{nj} = \sum_{j \in n} dF_{nj} )</td>
<td>(dF_{nj}^h = dF_{nj}, j = \text{informal} )</td>
<td>(dW^c = (1 + \psi) dW_{na}^{\text{em}} )</td>
<td>(dW_{nb}^\text{innet} = (1 + \psi) dW_{nb}^\text{em} )</td>
</tr>
</tbody>
</table>

5.4 Aggregate unskilled labour supply

\[dF_{na} = dF_{na}^r + (1 + \psi) dF_{na}^u + (1 + \psi) dF_{na}^h \]

5.5 Aggregate skilled labour supply

\[dF_{nb} = dF_{nb}^r + (1 + \psi) dF_{nb}^u \]

5.6 Harris-Todaro condition

\[dW^c F_{na}^u + dF_{na}^h = W_{na}^u + dW_{na}^\text{innet} + W_{na}^h dW_{na}^u + W_{na}^h dF_{na}^h - W^c (dF_{na}^u + dF_{na}^h) \]

6. Household sector equations

6.1 Savings

6.2 Disposable income

6.3 Household demand for commodity groups

6.4 Commodity demand by source

7. Government sector equations

7.1 Total tax revenue

\[dG_{\text{tax}} = dR_w^r + dR_k^r + dR_{pr}^r + dR_{exc}^r + dR_{int}^r \]

7.3 Company tax revenue

\[dR_k^r = \sum_{j} \left( W_{kj} F_{kj} dT_{kj}^r + T_{kj}^r F_{kj} dW_{kj} + T_{kj}^r W_{kj} dF_{kj} \right) \]

7.4 Production tax revenue

\[dR_{pr}^r = \sum_{j} \left( P_{jj}^r Z_{j} dT_{j}^pr + T_{j}^pr Z_{j} dP_{j}^pr + T_{j}^pr P_{j}^pr dZ_{j} \right) \]

7.2 Income tax revenue

\[dR_w^r = W_{na}^r F_{na} dT_{na}^r + T_{na}^r F_{na} dW_{na} + T_{na}^r W_{na} dF_{na} + W_{na}^u F_{na} dT_{na}^u + T_{na}^u F_{na} dW_{na} + T_{na}^u W_{na} dF_{na} + \sum_{j} \left( W_{nbj} F_{nbj} dT_{nbj} + T_{nbj} F_{nbj} dW_{nbj} + T_{nbj} W_{nbj} dF_{nbj} \right) \]

7.5 Tariff revenue

\[dR_{\text{exc}} = \sum_{s} \sum_{t} \left( P_{ts} X_{ts} dT_{ts}^{\text{exc}} + T_{ts}^f X_{ts} dP_{ts} + T_{ts}^f dX_{ts} \right) \]

7.7 Government consumption

\[dG_{\text{con}} = \sum_{s} \sum_{t} \left( X_{ts}^c dP_{ts}^\text{gl} + P_{ts}^\text{gl} dX_{ts}^c \right) \]

7.8 Government investment expenditure

\[dG_{\text{inv}} = \sum_{s} \sum_{t} \left( X_{ts}^i dP_{ts}^\text{gi} + P_{ts}^\text{gi} dX_{ts}^i \right) \]

7.6 Excise tax revenue

\[dR_{\text{exc}} = \sum_{t} \sum_{s} \left( P_{ts}^r X_{ts}^c + X_{ts}^r + X_{ts}^g + X_{ts}^i dT_{ts}^{\text{exc}} + T_{ts}^{\text{exc}} \left( X_{ts}^c + X_{ts}^r + X_{ts}^g + X_{ts}^i \right) dP_{ts}^r + T_{ts}^{\text{exc}} P_{ts}^r \left( dX_{ts}^c + dX_{ts}^r + dX_{ts}^g + dX_{ts}^i \right) \right) \]
### 7.7 VAT revenue

\[
dR^{\text{vat}} = \sum_i \left[ P_{id_i} X_{i}^{e} dT_{id}^{\text{efd}} + T_{id_i}^{\text{efd}} dX_{i}^{e} dP_{id} + T_{id_i}^{\text{efd}} P_{id_i} dX_{i}^{e} \right] + \sum_{i} \sum_{j} \left[ P_{ij}^{\text{exc}} \left( X_{ij}^{p} + X_{ij}^{p_i} \right) dT_{ij}^{\text{efd}} + T_{ij}^{\text{efd}} \left( X_{ij}^{p} + X_{ij}^{p_i} \right) dP_{ij}^{\text{exc}} + T_{ij}^{\text{efd}} P_{ij}^{\text{exc}} \left( dX_{ij}^{p} + dX_{ij}^{p_i} \right) \right] \\
+ \sum_{i} \sum_{j} \left[ P_{ij}^{\text{exc}} \left( X_{ij}^{gc} + X_{ij}^{gi} \right) dT_{ij}^{\text{efd}} + T_{ij}^{\text{efd}} \left( X_{ij}^{gc} + X_{ij}^{gi} \right) dP_{ij}^{\text{exc}} + T_{ij}^{\text{efd}} P_{ij}^{\text{exc}} \left( dX_{ij}^{gc} + dX_{ij}^{gi} \right) \right]
\]

### 7.10 Government transfers to households

\[
d^{\text{Gtra}} = G^{\text{tra}} c^{e} c \]

### 8. External sector equations

#### 8.1 Imports

\[
dM = \sum_{i} \left( X_{im} dP_{im} + P_{im} dX_{im} \right)
\]

#### 8.2 Exports

\[
dE = \sum_{i} X_{i}^{e} dP_{id} + P_{id} dX_{i}^{e}
\]

#### 8.3 Determination of imports

\[
dx_{im} = \sum_{j} dx_{mj} + dx_{im}^{\text{pcu}} + dx_{im}^{pi} + dx_{im}^{p} + dx_{im}^{gi}
\]

#### 8.4 Determination of exports

\[
dx_{i}^{e} = dx_{id} + \sum_{j} dx_{idj} - dx_{id}^{pcu} - dx_{id}^{pi} - dx_{id}^{p} - dx_{id}^{gi}
\]

#### 8.5 Net income inflows

\[
dQ^{s} = dQ^{\text{inf}} - \sum_{j} \left( W_{kj}^{\text{net}} dF_{kj} + d\delta_{j}^{s} + \delta_{j}^{s} dF_{kj} \right)
\]

#### 8.6 Gross income inflows

\[
dQ^{\text{inf}} = \varphi dQ^{\text{inf}} + Q^{\text{inf}} d\varphi
\]

#### 8.7 Net private transfers

\[
dQ^{t} = \varphi dQ^{t} + dQ^{t} d\varphi
\]

#### 8.8 Foreign aid

\[
dQ^{a} = \varphi dQ^{a} + dQ^{a} d\varphi
\]
### 9. Finance sector equations

#### 9.1 Nominal private investment

\[ dl = e^i \cdot dI_{\text{real}} + I_{\text{real}} \cdot de^i \]

#### 9.2 Relationship between capital supply and returns

\[ dF_{kj} = \sigma^k_j \cdot F_{kj} \left( \frac{dW_{\text{net}}}{W_{kj}} - \rho - r \right) + F_{kj} \cdot p^h_j f \]

\[ \rho = \sum_j S_{kj} \cdot \frac{dp_j^{pr}}{p_j^{pr}} \]

\[ \frac{dl_{\text{real}}}{I_{\text{real}}} = \sum_j S_{kj} \cdot \frac{dF_{kj}}{F_{kj}} \]

#### 9.3 GDP deflator

\[ \rho = \sum_j S_{kj} \cdot \frac{dp_j^{pr}}{p_j^{pr}} \]

\[ \frac{dl_{\text{real}}}{I_{\text{real}}} = \sum_j S_{kj} \cdot \frac{dF_{kj}}{F_{kj}} \]

### 10. Information equation

#### 10.1 GDP

\[ dY = dC + dI + dG_{\text{con}} + dG_{\text{inv}} + dE - dM \]

\[ p_{Y_{\text{real}}} = \frac{dY}{Y} - \rho \]

\[ p_{C_{\text{real}}} = \frac{dC}{C} - \frac{dE^c}{\epsilon^c} \]

\[ p_{I_{\text{real}}} = \frac{dl_{\text{real}}}{I_{\text{real}}} \]

#### 10.5 Consumption check

\[ dC^{ck} = \sum \sum \left( p_{is}^{\text{fd}} \cdot dX_{is}^{\text{pc}} + X_{is}^{\text{pc}} \cdot dP_{is}^{\text{fd}} \right) \]

\[ dV = dY + dQ^y + dQ^t + dQ^a \]

\[ p_{V_{\text{real}}} = \frac{dV}{V} - \frac{dE^c}{\epsilon^c} \]

### Notes:

- subscripts: \( j = 35 = \text{industries} \), \( i = 34 = \text{commodities} \), \( s = 2 = \text{source of commodity} \), \( d = \text{domestic} \), \( m = \text{imported} \), \( p = 2 = \text{primary factor input} \), \( n = \text{labor} \), \( k = \text{capital} \), \( q = 2 = \text{skill level of labor} \), \( a = \text{unskilled} \), \( b = \text{skilled} \), \( i \in T = 15 = \text{traded commodities} \).
Equations 2.2 and 2.12 correspond to the following equations which relate prices into foreign currency by applying an exchange rate $\phi$ of Fijian dollars per unit of foreign currency:

- Import prices in foreign currency; $P_{im} = \phi P_{im}^*$, where subscript $m$ refers to imports and $P_{im}^*$ is the price of imports in foreign currency; and

- Prices in foreign currency; $P_{id}^{*\text{fd}} = \phi P_{id}^*$, where subscript $d$ refers to domestically produced commodities and $P_{id}^*$ is prices in foreign currency

Source: Levantis, 1999: 30.

The determination of foreign currency prices for those commodities that are exported and considered as tradeable is defined in equation 2.10. This equation corresponds to a definition of elasticity of demand for exports, i.e.; $\sigma_i^e = \frac{dX_i^e}{X_i^e} \frac{dP_{id}^*}{P_{id}^*}$, where $X_i^e$ is export demand for commodity $i$. Equation 2.11 relates an exogenous shock to export demand (in percentage change form). This allows shocks to export demand or export prices.

Equation 2.3 explains the weighted average price producers receive for their output:

$$P_{jpr} = \sum_i \frac{X_{idj}}{\sum_i X_{idj}} P_{id}, \quad \text{where } P_{jpr} \text{ is gross average price to producers of industry } j,$$

and $X_{idj}$ is supply of commodity $i$ by industry $j$. Equation 2.4 explains the net average producer price after taxes on production are deducted:
\[ P_{j}^{\text{prnet}} = (1 - T_{j}^{\text{pr}}) P_{j}^{\text{pr}} \], where \( P_{j}^{\text{prnet}} \) is the net price received by industry \( j \), and \( T_{j}^{\text{pr}} \) is the average tax rate on output of industry \( j \).

Equation 2.9 calculates the average price to consumers of commodity \( i \), weighted according to the respective level of purchases of domestic and imported varieties of commodity \( i \). The consumer price index is defined in equation 2.19 as the weighted sum of changes in consumer prices. The investment price index is defined in equation 2.20. The difference between these two indices is that the CPI is based on the consumption bundle while the IPI is based on the consumption of commodity purchases of investors.

The labour market consists of three sectors: the rural sector, the urban formal sector, and the informal sector. Accordingly the industries are split between rural, formal urban and informal. For instance, industries 1-13 are rural industries, 14-34 is urban formal industries, and industry 35 is the informal industry. Across industries in each sector, a flexible movement of labour is assumed so as to enable wage rates to equilibriate between industries of that sector. However, between sectors wages will be different and the equilibrium conditions between sectors will be discussed later.

The conditions which equilibriate wage rates for unskilled labour across industries within each sector are given by equations 2.15-2.17 of Table 1. Equations 2.13 and 2.14 define the rural and urban unskilled wage rates after income tax. No corresponding equation is defined for the informal sector because the model assumes that it is not charged income tax. Equations of 2.13 and 2.14 correspond to the following equations:
After tax wage rate – rural unskilled labour: 
\[ W_{na}^{\text{net}} = \left(1 - T_{na}^r \right) W_{na}^r, \] 
where \( W_{na}^{\text{net}} \) is the net rural wage rate for unskilled labour (subscript \( a \) denotes unskilled labour), \( W_{na}^r \) is the gross wage rate, and \( T_{na}^r \) is the average income tax rate; and

After tax wage rate – urban unskilled labour: 
\[ W_{na}^{\text{net}} = \left(1 - T_{na}^u \right) W_{na}^u, \] 
where \( W_{na}^{\text{net}} \) is the net urban wage rate for unskilled labour, \( W_{na}^u \) is the gross wage rate, and \( T_{na}^u \) is the average income tax rate.

Source: Levantis, 1999: 32.

All wage rates are assumed to be contingent on market forces except for urban unskilled wages, which is regulated to move with changes in inflation. This is defined in equation 2.18. The parameter \( \mu \) determines the extent of wage indexation. If \( \mu = 1 \) then the assumption is that the unskilled urban wage rate is regulated to move in line with inflation, hence the real wage rate remains constant. If \( 0 < \mu < 1 \), then there is partial wage indexation, and if \( \mu = 0 \) then there is no indexation. The term \( dA^u \) is exogenous and is included in equation 2.18 to enable exogenous shocks to simulate changes in the regulated unskilled wage rate beyond changes due to wage indexation.

Equation 2.22 (for rural industries) and equation 2.23 (for urban industries) explain the condition equilibrating skilled wage rates across industries in each sector. The model assumes that workers in the informal sector are unskilled. In the light of this, the net after tax skilled wage rate in each industry is defined as 
\[ W_{nbj}^{\text{net}} = \left(1 - T_{nbj} \right) W_{nbj}, \] 
where \( W_{nbj} \) is the gross skilled wage rate paid by industry.
j (subscript b refers to skilled labour), $W_{nbj}^{net}$ is the net wage rate, and $T_{nbj}$ is the average income tax rate. The change form of this equation is represented by equation 2.21 (Table 1).

Similarly, the net and gross price of capital for industry $j$ is explained by equation 2.24. This is given as $W_{kj}^{net} = (1 - T_{kj}^k)W_{kj}$. Here, $W_{kj}^{net}$ is the net price of capital for industry $j$. $W_{kj}$ is the gross price, and $T_{kj}^k$ is the average tax rate on capital, which is otherwise defined as the company tax rate. “The price of capital is best interpreted as the return on a given unit of capital, so would include the profit generated in using the capital (gross of depreciation of the capital), and interest payments to the financiers of capital” (Levantis, 1999: 33).  

Production sector equations

Section 3 entails the determination of the components of the production sector equation (Table 1). Equation 3.1, for instance, explains in change form the condition that the outlays by industry $j$ on intermediate inputs at basic values will be:

$$Y_j^{int} = \sum_i \sum_s X_{ij}^{int} P_{is},$$

where $X_{ij}^{int}$ is the intermediate input purchases of commodity $i$ from source $s$ by industry $j$, and $P_{is}$ is the price level at basic values. Equation 3.2 defines labour costs for industry $j$ and is the change form of $Y_j^{n} = W_{nj}^{n} F_{nj}$, where

---

6 A common feature of CGE models is the assumption of zero profits in production. This is a highly restrictive condition to impose as it assumes that perfect competition exists in each industry. Even if we accept this, then one would only feel comfortable with the zero profit condition if looking at the long run perspective so as to allow competition to arbitrage real profits away. The Fiji CGE model does not apply the restriction of zero profits and allows capital usage to adjust according to changes in profits.
$Y_n^j$ is total gross labour costs incurred by industry $j$, $W_n^j$ is the gross average annual wage rate, and $F_n^j$ is the number of employees. Equation 3.3 defines net (after tax) payments to capital, and is the change form of $Y_n^{knet} = W_{kj}^{net} \cdot F_{kj}$, where $Y_n^{knet}$ is net capital costs incurred by industry $j$, $W_{kj}^{net}$ is the net after tax return on a unit of capital, and $F_{kj}$ is the number of units of capital used by industry $j$.

The sum of tax payments by industry $j$ is described by equation 3.4. In the Fiji CGE model taxes paid by producers include production taxes, tariffs on imported intermediate input purchases, and company taxes:

$Y_j^{tax} = T_j^{pr} \cdot P_j^{pr} \cdot Z_j + \sum_i \sum_s T_i^{gf} \cdot P_i X_{isj} + T_j^k \cdot W_j \cdot F_{kj}$. Where $Y_j^{tax}$ is the total tax payments by industry $j$; $Z_j$ is the quantity of industry $j$'s output; and all other variables are as previously defined.

**Determination of demand for inputs**

The demand for inputs in each industry are considered in the model; the conditions determining the demand for inputs are listed in section 4 (Table 1). Levantis (1999) assumes the following Leontief production function for a representative industry $j$ where the subscript $j$ is omitted for simplicity:

$$Z = \min \left[ f_p \left( F_n, F_k \right), f_1 \left( X_{1d}, X_{1m} \right), ..., f_q \left( X_{qd}, X_{qm} \right) \right]$$

where $Z$ is output, $F_n, F_k$ are inputs of labour and capital, and $X_{1d}, X_{1m}$ are inputs of commodity $i$ from domestic ($d$) and imported ($m$) sources. The implication of
the Leontief production function is that there could be substitution between labour and capital as inputs to production, and there can be substitution between domestic and imported varieties of a commodity, but there cannot be substitution between primary factors and intermediate inputs or substitution between commodity groups. The model adopts the ‘Armington’ assumption so that the imported varieties of a commodity are imperfect substitutes for the domestically produced varieties. The functions $f$ are assumed to be constant elasticity of substitution (CES). The demand for labour capital and intermediate input, equations 4.1-4.3, are derived from the assumptions of a Leontief production function and of CES functions for $f$.

The second term on the right hand side of equation 4.1 allows demand for labour to respond according to changes in the relative price of labour to capital. An increase in the relative price of labour will cause a decrease in demand for labour with the magnitude of the decrease contingent on the elasticity of substitution, $\sigma^L_f$. Similarly, the second term in equation 4.2 allows demand for capital to respond to changes in the price of capital relative to labour.\footnote{Note that rather than the cost of a unit of capital being defined as $W_{kj}$ (the return on a unit of a capital), it is proxied by the investment price index. This is different to usual practice in CGE modelling and following from the discarding of the zero profit assumption. In other CGE models which use the zero profit assumption, $W_{kj}$ is defined as the cost of a unit of capita, since there are zero profits. But in the Fiji CGE model $W_{kj}$ is not the cost of capital but the gross return of capital which includes costs and profits. The investment price index is considered a good proxy for the cost...}

The first terms on the right hand side of equations 4.1 and 4.2 link industry output with demand for labour and capital. An increase in output causes a proportional
increase in usage of labour and capital. The parameter $\theta_j$ determines the return to scale. If $\theta_j = 1$ then there is constant returns to scale, implying that a 1% increase in output will cause a 1% increase in usage of both labour and capital. The final terms on the right hand side of equations 4.1 and 4.2 are exogenous shock terms with the variables $\lambda_{nj}$ and $\lambda_{kj}$ exogenous to the model.

The demand for intermediate input equation is similar in principle to the demand for labour and capital equations. The first term on the right hand side of equation 4.3 links output with demand for intermediate inputs, implying that a 1 percent rise in output causes a 1 percent increase in demand for each intermediate input. Meanwhile, the second term allows substitution between the imported and domestically produced varieties of each commodity. The magnitude of the change in demand is contingent upon the size of $\sigma_{ij}^I$, the elasticity of substitution.

Labour is categorised as skilled and unskilled in the Fiji CGE model. For a given level of labour input in industry $j$, the optimal split between skilled and unskilled labour is determined by equation 4.4. Equation 4.1 explains the overall level of labour input. The first term on the right hand side of equation 4.4 defines the link between the overall labour input required and the demand for skilled and unskilled labour. This has the following interpretation: a 1 percent increase in overall labour requirement will increase demand for skilled and unskilled labour by 1 percent. Meanwhile, the second term on the right hand side determines how the demand for skilled and unskilled labour responds to changes in their relative wage rates. It should be noted of capital as it measures the change in average price of replacement capital (Levantis,
that informal industry is assumed not to utilise skilled labour so there is no equation determining skilled labour for the informal industry.

**Determination of the labour market conditions**

The labour market is assumed to have a Harris-Todaro structure where the market is dichotomised between rural and urban areas. In this setting, only the rural labour force can work in a rural industry, while the urban labour force can only work in an urban industry. Urban industries are further distinguished between formal employers and informal employers and apart the non-farm informal industry, which employs informal labour only, all other industries are considered formal employers. In equation 5.1 the aggregate skilled and unskilled employment across rural industries is defined, while equation 5.2 is the corresponding equation for the urban formal sector (Table 1). Granted that there is no skilled informal labour, equation 5.3 defines only total unskilled informal employment.

According to the Harris-Todaro model, for unskilled labour located in the urban labour market, it is assumed that there is less than certain probability of finding formal employment. In the event that one cannot find employment in the formal sector, there exists a situation of surplus labour which is part of informal employment in the Fiji model. By letting \( \pi \) be the expected probability that one will achieve formal employment throughout a period and \( 1 - \pi \) be the expected probability of becoming labour surplus to the formal sector Levantis (1999) defined the expected net (after tax) wage for unskilled labour located in the urban labour market as:

---

1999: 36-37).
\( W^e = \pi.W_{na}^{unet} + (1 - \pi)W_{na}^h \), where \( W^e \) is the net after tax expected unskilled wage in urban areas, \( W_{na}^{unet} \) is the net unskilled formal sector wage, and \( W_{na}^h \) is the average informal (surplus labour) wage. As per the Harris-Todaro model, Levantis (1999) makes a simple assumption that the probability, \( \pi \), is simply the proportion of people in the urban unskilled labour market that are employed in the formal sector, so:

\[
\pi = \frac{F_{na}^u}{F_{na}^u + F_{na}^h}, \quad \text{where } F_{na}^u \text{ is unskilled employment in the urban formal sector and } F_{na}^h \text{ is informal sector employment.}\]

Substituting \( \pi \) into \( W^e \), gives the net expected wage for urban unskilled labour:

\[
W^e = \frac{F_{na}^u}{F_{na}^u + F_{na}^h}W_{na}^{unet} + \frac{F_{na}^h}{F_{na}^u + F_{na}^h}W_{na}^h
\]

Equation 5.6 presents the above equation in change form.

Equation 5.7 consists of the equilibrium condition for the unskilled labour market where the rural wage and expected urban wage equate. The essence of this condition is that it allows for the qualitative differences between living in urban and rural areas to be captured. This is achieved by allowing a higher wage in urban areas than rural areas for one to be equally well off. The theoretical mechanism used in the Fiji model by Levantis (1999) is based on the assumption that each unskilled worker supplies the same \( \psi + 1 \) units of labour in rural and urban areas, but whereas this translates to \( 1 + \psi \) productive units of labour in rural areas, \( \psi \) is labour time wasted in supplying urban labour due to things such as travel, so only one productive unit of labour is supplied in urban areas. This will mean that for an unskilled worker to receive the same wage in rural and urban areas for their \( 1 + \psi \) units of labour supply, then the wage rate will have to be higher in urban areas by a factor of \( 1 + \psi \). In this light, the
equilibrium condition will be: \( W^r = (1 + \psi)W^{r_{net}} \). This is reproduced in change form in equation 5.7. For skilled labour, the same technique is used to allow for qualitative differences in rural and urban wage rates, leading to the equilibrium condition between rural and urban skilled rate (remembering there is no skilled informal labour): \( W_{nb}^{r_{net}} = (1 + \psi)W_{nb}^{r_{net}} \), where the subscript \( b \) refers to skilled labour. Equation 5.8 in change form represents this equation. Equations 5.4 and 5.5 are identities explaining unskilled and skilled labour supply.\(^8\) It is assumed that aggregate unskilled and skilled labour supply is fixed and hence exogenous in the model.

**Household demand and savings conditions**

The block of equations titled “household sector equations” (Table 1) contain conditions determining consumption and savings. The marginal propensity to consume out of disposable income is assumed to be constant and is denoted \( \alpha \). Household savings are therefore determined by the following relationship:

\[
S^{pri} = \alpha Y^{pri},
\]

where \( S^{pri} \) is total private sector savings and \( Y^{pri} \) is aggregate disposable income of the household sector. This is represented by equation 6.1 in change form. Equation 6.2 determines disposable income as simply the gross income of households less income tax payments. Consumption expenditure is then determined as the residual in equation 1.2 of disposable income less savings.

Purchases of commodities for consumption are then assumed to be determined according to the level of total consumption expenditure (i.e. the budget constraint) and relative prices between commodities. It is important to distinguish between

\(^8\) For a detailed description of these identities, see Levantis (1999: 42).
commodity groups and varieties within a commodity group (i.e. domestic and imported varieties). With the assumption of utility maximising individuals and a population with identical utility functions Levantis (1999) derives the aggregate Marshallian demand function for commodities of group \( i \) as: 

\[
X_i^{pc} = X_i^{pc}(P_i^c, C),
\]

where \( X_i^{pc} \) is consumption purchases from commodity group \( i \), \( P_i^c \) is the weighted average price (between the domestic and imported variety) of commodity \( i \) at the consumers’ purchases price, and \( C \) is aggregate consumption expenditure.

Differentiating and rearranging gives:

\[
\frac{dX_i^{pc}}{X_i^{pc}} = \eta_i \frac{dC}{C} + \sum_h \epsilon_{ih} \frac{dP_h^e}{P_h^c}
\]

This is the consumption demand function for commodity \( i \) and is reproduced as equation 6.3. The income elasticity of demand for commodity \( i \) is denoted \( \eta_i \), and the own and cross price elasticity of demand is denoted \( \epsilon_{ih} \). Demand for the domestic or imported varieties of commodity \( i \) are then determined according to the overall level of demand for the commodity group, as determined by 6.3, and the relative prices of the domestic and imported varieties. To determine the purchases of the composite commodity \( i \) Levantis (1999) adopted the following CES function:

\[
X_i^{pc} = \left( \beta_{id} X_{id}^{pc} + \beta_{im} X_{im}^{pc} \right)^{\rho/\rho}
\]

where subscripts \( d \) and \( m \) refer to the domestic and imported varieties, and \( \rho \) and \( \beta_{is} \) are parameters.\(^9\)

\(^9\) For a complete derivation see Appendices 2.1-2.3 in Levantis (1999: 54-58).
**Government sector equations**

Equation 7.1 determines tax revenue as a sum of income tax revenue, company tax revenue, production tax revenue, tariff revenue, excise tax revenue and VAT. The subsequent equations (7.2-7.7) in turn determine each of these revenue components. Government revenue is used for consumption and investment purposes, transfers to households; the balance is either government savings (budget surplus) or dis-savings (budget deficits). Government consumption and investment are defined by equations 7.8 and 7.9 respectively.

**External sector equations**

The model defines aggregate imports as the sum of the value of imports of each commodity at border prices. This takes the form: \( M = \sum_{i} P_{im} \cdot X_{im} \). Here \( P_{im} \) is the import price of commodity \( i \) (subscript \( m \) indicates imports) at the border and \( X_{im} \) is the quantity of imports of \( i \). Similarly the aggregate exports is determined. Aggregate imports and exports, in change form, are given by equations 8.1 and 8.2 respectively.

Imports of commodity \( i \) \( (X_{im}) \) is determined as a sum of the demand for imported intermediate inputs \( (X_{imj}^{int}) \), where \( m \) refers to the imports and \( j \) denotes purchases for industry \( j \), private consumption \( (X_{im}^{pc}) \), private investment \( (X_{im}^{pi}) \), government consumption \( (X_{im}^{gc}) \), and government investment \( (X_{im}^{gi}) \). In change form, this is represented by equation 8.3. Similarly, the exports of commodity \( i \) is determined and is represented in change form by equation 8.4.
The change form of net private receipts is set out in equation 8.5, and has the following form: \( Q^{\text{yinf}} = \phi Q^{\text{yinf*}} \). Here \( Q^{\text{yinf}} \) is the gross receipts from abroad less investment income earned domestically and transferred abroad by foreign owners of capital. It is natural that gross private receipts from abroad will be received in foreign currency \( (Q^{\text{yinf*}}) \); and \( \phi \) is the exchange rate (Fiji dollars per unit of foreign currency). “Investment income that is transferred abroad by foreign owners of capital is determined as the value of net returns on capital multiplied by the share of that capital that is foreign owned” (Levantis, 1999: 49). In the light of this, equation 8.5 has the term \( \sum_j \delta_j W_{kj}^\text{net} F_{kj} \), where \( \delta_j \) is the share of capital in industry \( j \) that is foreign owned, \( W_{kj}^\text{net} \) is the net after tax return to a unit of capital, and \( F_{kj} \) is the quantity of capital used by industry \( j \). In essence \( W_{kj}^\text{net} F_{kj} \) is the net after tax return on capital (returns on debt and equity) invested in industry \( j \).

Net private unrequited transfers in foreign currency is given by: \( Q' = \phi Q'^* \), where \( Q' \) is net private unrequited transfers in domestic currency, and \( Q'^* \) in foreign currency. Meanwhile, foreign aid is defined in a similar manner and exogenous in foreign currency. The change form of foreign aid in domestic currency is given by equation 8.8.

Finance sector equations
The Fiji CGE model differs from conventional CGE models in that it allows investment to feed into capital in the current period. Aggregate real capital consumption is assumed to change proportionally with aggregate real investment
expenditure and this is the premise on which equation 9.4 is based. “With this condition real investment \( I_{real} \) in the current period is therefore allowed to turn into capital consumption (\( F_{kj} \) for each industry \( j \)) in the current period” (Levantis, 1999: 51). Equation 9.1 links nominal and real investment expenditures. Capital consumption in each industry \( j \) is allowed, with the help of equation 9.2, to respond to changes in real returns for that industry relative to the cost of capital. An improvement in real returns in industry \( j \) will be accompanied by an increase in capital consumption.

Levantis (1999) explains equation 9.2 as a simple elasticity relationship:

\[
\sigma_j^k = \frac{dF_{kj}}{F_{kj}} \left/ \frac{dR_j}{R_j} \right.
\]

where \( \sigma_j^k \) is the elasticity of supply of capital for consumption in industry \( j \) \((F_{kj})\) with respect to net returns \( (R_j) \). From here, the percentage change in net returns is the change in nominal returns less inflation and less the cost of capital (the real interest rate):

\[
\frac{dR_j}{R_j} = \frac{dW_{kj}^{net}}{W_{kj}^{net}} - \rho - r
\]

where \( W_{kj}^{net} \) is net nominal returns, \( \rho \) is the GDP deflator, and \( r \) is the real interest rate. Equation 9.2 also includes an exogenous shock term \( ph_{kj}^f \), allowing a simulation of an exogenous percentage change in capital supplied to industry \( j \).
Information equations

These equations (10.1-10.7) are for informational purposes only and do the affect the model. It, for instance, gives information about the change in nominal GDP (equation 10.1); percentage change in real GDP (equation 10.2); real percentage change in consumption (equation 10.3) and investment (equation 10.4). Equation 10.5 measures nominal consumption expenditure according to the sum of expenditures across commodities. Finally, there are equations for national welfare (equations 10.6 and 10.7). The total of GDP, net inflows of investment income, net private unrequited transfers from abroad and net foreign aid receipts from abroad is taken as a measure for national welfare. This can be used to determine how much better off or worse Fiji becomes from a particular shock or policy change. National welfare may be a better indicator than GDP for a foreign investment, while contributing to GDP the value added in production, will also entail income transfers abroad (remittance of profits, etc). It is only correct to deduct this from GDP. The specification of the national welfare equation achieves this.

3.3. Model closure and solution

The closure of a model entails a statement separating the exogenous and endogenous variables. This stems from the fact that when GEMPACK is used to undertake simulations, the number of variables exceeds the number of equations. The number of endogenous variables must be commensurate with the number of equations. In the event this proviso is not met, the model is deemed invalid and model operation is stalled. Solving the model requires a priori allocation of some variables. This is achieved by assigning these variables actual numerical values based on specifying shocks. When this is completed, they are known as exogenous variables. From these
shocks, the equations of the model are solved to determine the remaining variables – referred to as the endogenous variables.

Schematically, the model takes the following form:

\[ F[Z_1(t), Z_2(t), Z(0)] = 0 \]

Here, \( Z_1(t) \) and \( Z_2(t) \) are vectors of values of endogenous and exogenous variables at time \( t \) and \( Z(0) \) is a vector of initial conditions. The equations of the model, described earlier are derived from neoclassical microeconomic assumptions about the behaviour of price taking economic agents. Put differently, consumers maximise utility subject to their budget constraints and producers choose their inputs so as to minimise costs of production. Resources are limited and hence are distributed by market forces, and market imperfections can lead to unemployment. Increasing government expenditure is contingent on raising taxes or borrowing, which has implications on other economic agents such as consumers and firms; this in turn induce other economic effects. The economy is linked to the rest of the world via a foreign exchange market; an increase in exports in one sector leads to a rise in the exchange rate; hence, discouraging other exports and encouraging imports. The model is solved using the GEMPACK software package, developed by the Centre of Policy Studies and the Impact Project, Monash University. GEMPACK is a flexible model for solving CGE models (Codsi and Pearson, 1988). GEMPACK automates the process of translating the model specification into a model solution program. One needs to only create a text file, the syntax of which resembles ordinary algebraic notation, listing the equations of the model. The GEMPACK program TABLO then
translates this text file into a model specific FORTRAN program, which, when executed, solves the model (Horridge et al., 1993: 71).

3.4. A comparative-static interpretation of model results

As mentioned earlier, the Fiji model is built in the image of ORANI – a key feature of the model is that it was initially designed for comparative static simulations. The ‘comparative static’ nature of the model implies that it provides projections at only one point in time, which is the solution year. The model equations and variables, which are described in the next section and Appendix 7.2 respectively, all refer implicitly to the economy at some future time period to ensure that the economy adjusts after the initial shock(s). This concept is illustrated diagrammatically (Figure 1), which plots the values of some variable, say exports of tourism, against time. In this setting, A is referred to as the level of tourism exports in the base period (period 0). Suppose that in period 0 an external shock is applied, say, a 10% fall in airfares. As a result of this shock C is the level of tourism exports that will be attained in T years time, all other things being equal. In the event of no shock B will be the level of tourism exports. The movement from A to B is regarded as the underlying growth path of tourism exports. In essence, comparative static analysis is only concerned about the size of the gap between BC, and not the economic path taken to reach either B or C. In a comparative static simulation, then, the model might generate the change (C-B), percentage change (100(C-B)/B) or both in tourism exports, showing how tourism exports in period T would be affected by the reduction in airfares.
It is important to highlight that comparative static models are not dynamic in that they do not describe the adjustment paths, shown as dotted and bold lines in Figure 1. The other feature of such models is that both short-run and long-run effects of shocks or policy changes can be deduced. The short-run effects are simulated by holding capital stocks at their pre-shock levels. Cooper et al., (1985) find econometric evidence in favour of short-run equilibrium established in about two years, i.e., T=2. On the other hand, the long-run effects are derived on the assumption that capital stocks will have adjusted to restore (exogenous) rates of return, which might take 10 or 20 years, i.e., T=10 or 20. The distinction between a short-run and long-run simulation is not a complex issue for it involves only an alteration of the model closure.
4. Literature Review

Many studies attempted to measure the contribution of the informal sector to macro economy. For instance in the recent works, Charmes (2000) examined the contribution of the informal sector to GDP in Developing countries. For twenty-two countries studied he noticed that informal sector contributed 18.9-92.8 percent to non-agricultural employment, 7.2-58.5 percent to non-agricultural GDP, 7.6-42.9 percent of total employment and 6.9-38.9 percent of the total GDP. In another, Charmes (-) examined the women working in the informal sector in Africa. They find that informal sector contributed 87.6-99.2 percent of the GDP, 45.7-69.8 of total employment. Similarly, Grimm and Gunther (2004) examined the Inter-and intra-household linkages between the informal and formal sector for urban Burkina Faso. They find that informal sector earnings are in indeed positively linked to formal sector earnings on both the macro as well as micro level. This implies that the good formal sector policies are likely to contribute positively to the informal sector. There analysis also showed that good formal sector policies are likely to be beneficial to informal sector earners that are linked to formal sector via the household however less beneficial to informal sector earners that are linked to formal sector via the market.

More over, Venida (1998) examined the employment, productivity and the informal sector in the Philippines using input-output analysis. They attempted to established the sectors which have the potential for employment growth. It was noted that employment growth was sourced from formal as well as the informal sector of the economy. They concluded that an export promotion policy would generate greater employment in formal as well as the informal sector, and subsequent increase in income will increase consumption expenditure and thus promote greater employment once more, and more so in the informal sector.
Tambunan (2004) examined the Urban Poverty, Informal Sector and Poverty Alleviation Policies in Indonesia. The paper partly examined the importance of informal sector for the urban poor. It was reported that sending children to the informal sector was a good means of diversifying the income. It was concluded that while household relied on formal sector the major source of income, informal sector remained important at least as a complementary or secondary source of income. Chiripanhura and Makwavarara (-) examined the labour Market and Economic Development over the period 1980-2000 for Zimbabwe. They noted that the informal sector was the larger employer than the formal sector. Neitzert (1998) examined the Informalisation of the labour force for Canada as part of informal sector sub-project. He reported that informal sector contributed positively to the community economic development. Informal sector contributed positively to the income as well as material wellbeing thus boosting the individual self esteems.

Kar and Baskaran (2005) examined the contribution of informal sector and informal employment in Indian Economy. They used labour input method. They find that informal sector contributes about one third to the GDP. More over it employs about 58.72 percent of the total workforce. In another study Arboleda and Kow (-) estimated the contribution of informal sector to GDP on regular basis. They find that unorganized sector contributed around 43.29 percent to GDP and informal sector made up 25 percent of the unorganized sector of the economy. Further more Gennari (2004) estimated the employment and value added of informal sector in Pakistan. They find that contribution of informal sector is more than 50 percent of the value
added in whole sale and retail, it also contributed substantially to Transport &
communication and especially in Social, community & personal services. However
its contribution remained low in the manufacturing sector.

Further more Ping-yr (1988) examined the role of the informal sector in Chinas urban
development. They found that there exists a multiple link between the informal sector
and the formal sector and that the informal sector contributes positively to urban
development, providing job opportunities to the urban and the rural population.
Moreover Vishwamitter (1988) examined the growth of the urban informal sector in a
developing economy. His study focused on absorptive capacity of in a developing
economy. His study was based on informal sector in the urban informal sector in
Punjab’s urban economy. He found that urban informal sector provides a significant
amount of employment to the urban labor force in Punjab. He found informal sector to
be the major source of employment for single-person families either they are self
employed or casual laborers. In another study Mohammed (1989) examined the role
of informal sector in an urban economy. His study was based on dyderabad. He found
that informal sector has contributed positively to the development of the formal
sector. The informal sector has a high potential of employment and income
generation, which relieves pressure for employment on the formal sector. He also
noticed that informal sector had a great capacity of absorbing goods of the formal
sector. Similarly, Buch and Pathak (1985) examined the role of the informal sector in
the development of small and intermediate cities in India. Though they didn’t find any
correlation between city size and size or informal sector, however they found that
informal sector plays a significant source of employment in small and intermediate
level cities. Sethuraman (1981) edited the urban informal sector in developing countries. He concluded that informal sector greatly absorbs the labor however its capacity to generate income remained low. Reddy et al (2003) examined the informal sector in Fiji. Their analysis shows that informal sector has significantly contributed positively to asset and income of those involve in the informal sector. It was generally observed that people involve in informal sector had only a primary level qualification.

Macharia (1997) examined the social and political dynamics of the informal economy in African countries. In part of his conclusion, he relates that the informal economy in Kenya and Zimbabwe, as well as other third world nation must be recognize as an important part of the general economy of this countries.

5. **EMPIRICAL RESULTS**

**Simulation result: A 10% expansion of the informal sector**

The macroeconomic effects of 10% expansion of the informal sector in Fiji are shown in Table 1. Our main findings are that both private savings and private consumption will increase by approximately 0.25 per cent and 2.2 per cent, respectively. We find that private investment expenditure will increase by 1.3 per cent, total government consumption and government investment both increase by 0.82 per cent and 0.22 per cent, respectively. We also find a slight increase in imports, which is outweighed by the increase in exports, leading to a surplus in the current account.
Table 1: Macroeconomic effects of a 10% expansion in the informal sector in Fiji

<table>
<thead>
<tr>
<th>Variables</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private savings</td>
<td>0.2534</td>
</tr>
<tr>
<td>Private consumption</td>
<td>2.2276</td>
</tr>
<tr>
<td>Private investment expenditure</td>
<td>1.2939</td>
</tr>
<tr>
<td>Total government consumption expenditure</td>
<td>0.8211</td>
</tr>
<tr>
<td>Total government investment expenditure</td>
<td>0.2251</td>
</tr>
<tr>
<td>Total government savings</td>
<td>230.0*</td>
</tr>
<tr>
<td>Imports</td>
<td>0.1198</td>
</tr>
<tr>
<td>Exports</td>
<td>0.2355</td>
</tr>
<tr>
<td>Consumer price index</td>
<td>1.5542</td>
</tr>
<tr>
<td>Investment price index</td>
<td>0.1111</td>
</tr>
<tr>
<td>Private disposable income</td>
<td>0.9626</td>
</tr>
<tr>
<td>VAT revenue</td>
<td>1.4202</td>
</tr>
<tr>
<td>Real aggregate private investment</td>
<td>0.1121</td>
</tr>
<tr>
<td>Real GDP</td>
<td>0.1228</td>
</tr>
<tr>
<td>Real consumption</td>
<td>0.4367</td>
</tr>
<tr>
<td>Real national welfare</td>
<td>0.5627</td>
</tr>
<tr>
<td>Net after tax rural wage rate for unskilled labour</td>
<td>1.8359</td>
</tr>
<tr>
<td>Net urban wage rate for unskilled labour</td>
<td>1.1695</td>
</tr>
<tr>
<td>Wage rate for informal sector labour</td>
<td>5.7882</td>
</tr>
<tr>
<td>Aggregate demand for informal unskilled labour</td>
<td>-2.9222</td>
</tr>
</tbody>
</table>

Note: * indicates value in thousands of Fiji dollars.

Moreover, we find that real consumption will increase by 0.44 per cent leading to an increase in the consumer price index by approximately 1.55 per cent. We find a positive effect of the informal sector on the real GDP and real national welfare.

6. CONCLUSION

In this paper, we examine the role of the informal sector in the contribution of informal sector in the Fijian economy. We find that a 10 per cent expansion in the informal sector makes a positive contribution to the Fijian economy. We find that real consumption, real national welfare and real GDP all increase, although the magnitude of the impact is less than 1 per cent.


Madden, J., and Thapa, P., (2000). The contribution of Tourism to the New South Wales Economy, Centre for regional Economic Analysis, University of Tasmania.


### Appendix 1: List of industries and commodities in the Fiji model

<table>
<thead>
<tr>
<th>Industry</th>
<th>Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugarcane</td>
<td>Raw sugar</td>
</tr>
<tr>
<td>Coconuts</td>
<td>Coconuts</td>
</tr>
<tr>
<td>Rice</td>
<td>Rice</td>
</tr>
<tr>
<td>Ginger</td>
<td>Ginger</td>
</tr>
<tr>
<td>Dalo</td>
<td>Dalo</td>
</tr>
<tr>
<td>Root crops</td>
<td>Root crops</td>
</tr>
<tr>
<td>Kava</td>
<td>Kava</td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td>Fruit and vegetables</td>
</tr>
<tr>
<td>Other crops</td>
<td>Other crops</td>
</tr>
<tr>
<td>Dairy</td>
<td>Dairy</td>
</tr>
<tr>
<td>Livestock</td>
<td>Livestock products</td>
</tr>
<tr>
<td>Forestry</td>
<td>Forest products</td>
</tr>
<tr>
<td>Fishing</td>
<td>Marine products</td>
</tr>
<tr>
<td>Emperor gold mine</td>
<td>Gold</td>
</tr>
<tr>
<td>Mt Kasi gold mine</td>
<td>Gold</td>
</tr>
<tr>
<td>Quarrying</td>
<td>Quarrying</td>
</tr>
<tr>
<td>Sugar manufacturing</td>
<td>Sugar products</td>
</tr>
<tr>
<td>Beverages and tobacco</td>
<td>Beverage and tobacco</td>
</tr>
<tr>
<td>Food processing</td>
<td>Processed foods</td>
</tr>
<tr>
<td>Clothing, footwear and textiles</td>
<td>Clothing, footwear and textiles</td>
</tr>
<tr>
<td>Other manufactures</td>
<td>Other manufactures</td>
</tr>
<tr>
<td>Electricity and water</td>
<td>Electricity and water</td>
</tr>
<tr>
<td>Construction</td>
<td>Construction services</td>
</tr>
<tr>
<td>Commerce</td>
<td>Retail/wholesale services</td>
</tr>
<tr>
<td>Hotels, cafes, restaurants</td>
<td>Hotels, cafes, restaurants</td>
</tr>
<tr>
<td>Transport and communication services</td>
<td>Transport and communication services</td>
</tr>
<tr>
<td>Finance</td>
<td>Financial services</td>
</tr>
<tr>
<td>Insurance</td>
<td>Insurance services</td>
</tr>
<tr>
<td>Property services</td>
<td>Property services</td>
</tr>
<tr>
<td>Business services</td>
<td>Business services</td>
</tr>
<tr>
<td>Other private services</td>
<td>Other private services</td>
</tr>
<tr>
<td>Health</td>
<td>Health services</td>
</tr>
<tr>
<td>Education</td>
<td>Education services</td>
</tr>
<tr>
<td>Other government services</td>
<td>Other government services</td>
</tr>
<tr>
<td>Non-farm informal sector</td>
<td>Informal services</td>
</tr>
</tbody>
</table>
Appendix 7.2: The variables of the Fiji CGE model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$dY_j$</td>
<td>The value of output of industry $j$ at non-distorted prices</td>
<td>$dY_{j}^{int}$</td>
<td>Total intermediate input costs into industry $j$ at non-distorted prices</td>
</tr>
<tr>
<td>$dY_{j}^{n}$</td>
<td>Total labour costs into industry $j$</td>
<td>$dY_{j}^{net}$</td>
<td>Net (after tax) capital cost for industry $j$</td>
</tr>
<tr>
<td>$dY_{j}^{tax}$</td>
<td>Total tax payments by industry $j$</td>
<td>$dS_{pri}$</td>
<td>Private savings</td>
</tr>
<tr>
<td>$dC$</td>
<td>Private consumption exp.</td>
<td>$dG^{tra}$</td>
<td>Govt transfers to households</td>
</tr>
<tr>
<td>$dQ^{r}$</td>
<td>BOP surplus = net change in foreign reserves</td>
<td>$dQ^{k}$</td>
<td>Net capital inflows</td>
</tr>
<tr>
<td>$dQ^{y}$</td>
<td>Net private receipts of investment income from abroad</td>
<td>$dQ^{r}$</td>
<td>Net private unrequited transfers from abroad</td>
</tr>
<tr>
<td>$dQ^{a}$</td>
<td>Net foreign aid</td>
<td>$dG^{tax}$</td>
<td>Total government tax revenue</td>
</tr>
<tr>
<td>$dG^{con}$</td>
<td>Total govt consumption exp.</td>
<td>$dG^{inv}$</td>
<td>Total govt investment exp.</td>
</tr>
<tr>
<td>$dS^{gov}$</td>
<td>Total govt savings</td>
<td>$dM$</td>
<td>Total imports (Fiji dollar)</td>
</tr>
<tr>
<td>$dE$</td>
<td>Total exports (Fiji dollar)</td>
<td>$dl$</td>
<td>Private investment exp.</td>
</tr>
<tr>
<td>$dp_{is}$</td>
<td>Commodity prices at basic values</td>
<td>$dp_{id}^{f}$</td>
<td>Export prices at the border</td>
</tr>
<tr>
<td>$dT_{i}^{efd}$</td>
<td>VAT rate on exports of commodity $i$</td>
<td>$dp_{is}^{f}$</td>
<td>Foreign currency commodity price on world markets</td>
</tr>
<tr>
<td>$d\phi$</td>
<td>Exchange rates (F$/foreign currency)</td>
<td>$dp_{j}^{pr}$</td>
<td>Gross average price received by industry $j$</td>
</tr>
<tr>
<td>$dp_{j}^{pnet}$</td>
<td>Net average price received by industry $j$</td>
<td>$dT_{j}^{pr}$</td>
<td>Ad valorem production tax rate on the value of output of industry $j$</td>
</tr>
<tr>
<td>$dp_{is}^{d}$</td>
<td>Ad valorem tariff on commodity $is$</td>
<td>$dp_{is}^{exc}$</td>
<td>Prices after tariffs and excises</td>
</tr>
<tr>
<td>$dT_{i}^{exc}$</td>
<td>Ad valorem excise rate on commodity $is$</td>
<td>$dp_{is}^{f}$</td>
<td>Private final demand prices, includes tariffs, excise and VAT</td>
</tr>
<tr>
<td>$dT_{i}^{pfd}$</td>
<td>Ad valorem VAT rate for private purchases of commodity $i$</td>
<td>$dp_{is}^{g}$</td>
<td>Private govt demand prices, includes tariffs, excise and VAT</td>
</tr>
<tr>
<td>$dT_{i}^{gfd}$</td>
<td>Ad valorem VAT rate for govt purchases of commodity $i$</td>
<td>$dp_{i}^{c}$</td>
<td>Average consumer price of commodity $i$</td>
</tr>
<tr>
<td>$dx_{i}$</td>
<td>Exports of commodity $i$</td>
<td>$pH_{i}^{xe}$</td>
<td>Exogenous % change shock term for exports of commodity $i$</td>
</tr>
<tr>
<td>$pH_{i}^{pe}$</td>
<td>Exogenous % change shock term for export prices of commodity $i$</td>
<td>$dW^{rnet}_{na}$</td>
<td>Net (after tax) rural wage rate (annual) for unskilled labour</td>
</tr>
<tr>
<td>$dw_{na}$</td>
<td>Gross rural wage rate (annual) for unskilled labour</td>
<td>$dW^{unet}_{na}$</td>
<td>Net (after tax) urban wage rate (annual) for unskilled labour</td>
</tr>
<tr>
<td>Symbol</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW_{na}^u)</td>
<td>Gross urban wage rate (annual) for unskilled labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW_{na}^h)</td>
<td>Wage rate (annual) for informal sector labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW_{na}^c)</td>
<td>Consumer price index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW_{nb}^{net})</td>
<td>Net wage rate (annual) for skilled labour used by industry (j)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW_{nb}^{net})</td>
<td>Average net price of rural skilled labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW_{nj}^{net})</td>
<td>Net rate of payment to capital by industry (j) (after payment of tax on capital)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dT_{nj}^k)</td>
<td>Ad valorem tax rate on capital usage by industry (j)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dF_{pj})</td>
<td>Usage of primary factor (p) by industry (j)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dZ_j)</td>
<td>Real output of industry (j)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\lambda_{pj})</td>
<td>Term in % change form to account for any exogenous change in productivity of primary factor (p) in industry (j)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dF_{nj}^r)</td>
<td>Aggregate demand for rural labour of skill type (q)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dF_{nj}^h)</td>
<td>Aggregate demand for informal unskilled labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dW^e)</td>
<td>Expected urban unskilled wage rate (annual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dX_{is}^{pc})</td>
<td>Private consumption purchases from commodity group (i)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dR^w)</td>
<td>Income tax revenue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dR^p)</td>
<td>Production tax revenue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dR^{exc})</td>
<td>Excise tax revenue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dX_{is}^{gc})</td>
<td>Government consumption purchases of commodity (i)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dX_{is}^{pi})</td>
<td>Private investment purchases of commodity (i)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dQ_{yinf})</td>
<td>Gross inflows of investment income from abroad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dQ^{inf})</td>
<td>Gross inflow of investment income from abroad in foreign currency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dQ^{a})</td>
<td>Net private unrequited transfer from abroad in foreign currency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dQ^{f})</td>
<td>Net foreign aid in foreign currency</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[\text{Gross wage rate (annual) for labour of skill type } q \text{ used by industry } j\]

\[\text{Term for exogenous changes to the urban unskilled wage}\]

\[\text{Net wage rate (annual) for skilled labour used by industry } j\]

\[\text{Average net price of rural skilled labour}\]

\[\text{Gross rate of payment for primary factor } p \text{ by industry } j\]

\[\text{Intermediate input usage of commodity } i s \text{ for industry } j\]

\[\text{Output of commodity } i \text{ by industry } j\]

\[\text{Total supply of commodity } i s\]

\[\text{Usage of labour of skill type } q \text{ by industry } j\]

\[\text{Aggregate demand for rural labour of skill type } q\]

\[\text{Aggregate demand for informal unskilled labour}\]

\[\text{Expected urban unskilled wage rate (annual)}\]

\[\text{Private consumption purchases of variety } s \text{ from commodity group } i\]

\[\text{Company tax revenue}\]

\[\text{Tariff revenue}\]

\[\text{VAT revenue}\]

\[\text{Government consumption purchases of commodity } i s\]

\[\text{Share of industry } j \text{ that is foreign owned}\]

\[\text{Gross inflow of investment income from abroad in foreign currency}\]

\[\text{Net foreign aid in foreign currency}\]
<table>
<thead>
<tr>
<th>$r$</th>
<th>Real interest rate</th>
<th>$dY^{real}$</th>
<th>Real aggregate private investment</th>
</tr>
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<tbody>
<tr>
<td>$\rho$</td>
<td>GDP deflator</td>
<td>$pH_{kj}$</td>
<td>% change shock variable for capital supply in industry $j$</td>
</tr>
<tr>
<td>$dY$</td>
<td>Nominal GDP</td>
<td>$p_{Y^{real}}$</td>
<td>Real % change in GDP</td>
</tr>
<tr>
<td>$pc_{real}$</td>
<td>Real % change in consumption</td>
<td>$p_{I^{real}}$</td>
<td>Real % change in investment</td>
</tr>
<tr>
<td>$dC^{ck}$</td>
<td>Nominal consumption check</td>
<td>$dV$</td>
<td>Nominal welfare</td>
</tr>
<tr>
<td>$pv^{real}$</td>
<td>Real % change in national welfare</td>
<td></td>
<td></td>
</tr>
</tbody>
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