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The Western Cape of South Africa: Export Opportunities, Productivity Growth and Agriculture [1]

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1 Introduction

The last 10 to 15 years have seen a virtually complete liberalisation of the agricultural policy environment in South Africa. The policy changes started long before the ending of the apartheid regime became apparent, and have continued since the transition to democratic government. These changes were largely motivated by internal considerations. However, they have been reinforced by the expansion of export opportunities that accompanied the end of apartheid, moves towards a free trade agreement with the European Union (EU), the so-called EU- South Africa Free Trade Agreement (EU-SAFTA), the discussion about the creation of a free trade area between MERCOSUR and SA, and an expectation that the World Trade Organisation (WTO) negotiations will encourage further liberalisation of agricultural trade policies on a global scale.

The majority of the export potential for South African agriculture is concentrated in the wine grape producing areas of Worcester and Stellenbosch and the deciduous fruit areas centred on Caledon and Ceres, all in the Western Cape province. The Western Cape is the origin of all wine

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exported from South Africa, and 98 percent of export revenues from deciduous fruit and table grapes (CSS, 1996). Between them wine and table grapes and deciduous fruit account for nearly half of agricultural export revenues. However, the wine and fruit growing areas of the Western Cape, which are characterised by a Mediterranean climate, are hemmed in by the sea to the south and west and by the Karoo to the north and east, limiting possibilities of expanding production. However, historically South African agriculture has achieved substantial increases in productivity growth (Thirtle *et al.* 2000); a continuation of such gains might provide a means of relaxing these supply-side constraints.

This paper reports the use of a computable general equilibrium (CGE) model to analyse the impact of increased agricultural export opportunities upon the economy of the Western Cape, with specific reference to grape and deciduous fruit production that have achieved appreciable productivity growth. The model is calibrated with a Social Accounting Matrix (SAM) for the Western Cape in 1993, in which agriculture (24 commodities and 9 agronomic activities/regions) and labour (11 skill classes and 4 racial classes) are extensively disaggregated. The rest of the paper is structured as follows. The next section, two, reviews briefly the changes in agricultural policies in South Africa, and the implications of trade liberalisation. In section 3, the CGE model is reviewed and the data used to calibrate the model are described. The results are reported in section 4 and the paper ends with some concluding comments, section 5.

2 Agriculture and Trade Liberalisation in South Africa

South African agricultural policy has undergone major changes in the last 20 years, moving from a fully regulated marketing environment towards a free market system. Government intervention peaked around 1980, when laws, ordinances, statutes and regulations affected all aspects of agriculture. Political and economic power had become highly concentrated, but the policy environment of racial discrimination and price distortions was unsustainable. Since 1980 past policies have been reversed, with a gradual removal of racial barriers, and increased liberalisation and democratisation of the agricultural sector (Van Zyl *et al*., 1997). The degree of agricultural trade liberalisation has been remarkable. South Africa has fulfilled almost all of its commitments stemming from the Uruguay Round. Quantitative import controls have been replaced with tariffs that are fixed at levels, for most products, far below the maximum bound rates allowed. Minimum market access quotas were introduced, allowing a certain percentage of domestic consumption to be imported at preferential tariff rates, while export and other subsidies have been virtually eliminated (Van der Merwe and Otto, 1997). Coupled with domestic policy reforms this has resulted in South Africa being ahead of its WTO commitments.

The fresh fruit and wine industries have gained the most from the opening up of export opportunities. Between 1995 and 1998 the exports of Deciduous Fruits increased with 32.7 percent from 400,800

tons to 531,800 tons (PPECB, 1999). This increase in exports was achieved with a small increase in the area of planting, namely by 10.9 percent between 1995 and 1998 (DFPT, 1999). From the early 1980s the area of wine grapes in the Western Cape was in steady decline as sanctions reduced export markets. With the opening up of export markets the area of vines and wine exports increased appreciably. The data indicate that wine exports increased by 108 percent from 50.7 million litres to 105 million litres between 1994 and 1996/7 (SAWIS, 1999). The increases in wine exports seem to have come from 3 sources: the increased area of vines, increases in production per hectare of vines and a diversion of sales from the domestic market to exports. Between 1994 and 1996/7 wine production increased by 11 percent from 804 million litres to 890 million litres and the area of vineyards increased by 4 percent from 94,000 hectare to 97,000 hectare (SAWIS, 1999). Thus there was a net production increase of approximately 7 percent. Furthermore from 1994 to 1996/97 the production of good wine increased by 34 percent from 421 million litres to 562 million litres, while at the same time exports as a percentage of good wine produced increased from 12 percent in 1994 to 19 percent in 1996/97. The magnitude of these changes and the implicit changes in production per hectare imply that the viticulture and wine industries were operating below capacity in the early 1990s, suggesting that an increase in measured productivity above a trend rate would be realistic

The agricultural sector has thus been liberalised, but limited gains in market access have been realised (Van der Merwe and Otto, 1997). This situation may improve through free trade agreements within the Southern African Development Community (SADC) and with the EU. Under the proposed SADC agreement it is expected that South Africa will have to scale down tariff levels faster than other SADC countries. The increased export opportunities will be accompanied by increases in competition from imports, leading to suggestions that there will be an increasing need for effective and properly monitored rules of origin (Van der Merwe and Otto, 1997). The EU-SAFTA became effective in January 2000. The EU liberalised 96 percent of its imports from South Africa, while South Africa liberalised 86 percent of its imports from the EU, resulting in more than 90 percent of all trade between South Africa and the EU being free of customs duties. The trade liberalisation however only applies to current South African exports to the EU and does not open new markets for new products. Wines will be subject to quotas at preferential tariff rates, while certain fresh deciduous fruits have been put on the reserve list and are thus excluded from the agreement (National Department of Agriculture, 1999).

3 Data and Model

The macroeconomic implications of shocks, or policy changes, that impact on the agricultural sector are often sufficiently large as to justify the use of general equilibrium methods of analysis. Early linkage analyses, e.g., Hirschman (1958), were based on input-output multiplier analysis. Typically this research concluded that the relatively low linkages associated with agricultural sectors supported

arguments for an industrial/urban bias in policy. The subsequent development of SAM-Leontief models, e.g., Pyatt and Round (1979), indicated that the failure of input-output models to capture the full circular flow distorted the policy implications from linkage analyses. In particular, the distortions with respect to agriculture are typically substantial (see Haggblade *et al*., 1989; and Vogel, 1994). However, SAM-Leontief, and input-output, multiplier models both make two key assumptions; excess capacity in all sectors, leading to supply being perfectly elastic, and fixed prices. In the case of a small open economy, ignoring relative price effects may (just) be defensible, but neglecting capacity constraints, especially for agriculture, is more difficult to justify. Using a second-generation SAM-based general equilibrium model, aka a computable general equilibrium (CGE) model, both of these constraints can be relaxed. The analyses reported in this paper use a comparative static computable general equilibrium (CGE) model.

The model used for this research is calibrated using a SAM for the Western Cape of South Africa. Not only does a SAM provide a convenient and efficient method for organising data for any whole economy model, it also provides a comprehensive conceptual framework within which the patterns of interdependence and a model's behavioural relationships can be organised and reconciled (see Pyatt, 1987). The SAM used for this study is closely related to SAM structure advocated by the System of National Accounts (UN, 1993), and is therefore distinctively different from the (implicit) SAMs used to calibrate the CGE models that have followed the lead of Dervis *et al*., (1982). In particular this SAM records exports as taking place from the commodity accounts, the make matrix includes secondary production and is not necessarily square, and prices are not expressed in terms of basic prices. Hence the model does not start from a reduced form database that has been derived by a linear transformation of supply and use tables.[2]

Data

The Social Accounting Matrix for the Western Cape Province (McDonald and Punt, 2001), is distinguished by an emphasis on agriculture and farm households. The Western Cape Agricultural Social Accounting Matrix (WCSAM) comprises 291 accounts: there are 117 commodities, 90 production activities, 42 factors of production, 30 household groups, 6 government accounts, and various capital and rest of the world accounts. The emphasis on agriculture comes through the 24 agricultural production activities, and 12 rural household accounts. The SAM is for 1993 and the macro SAM is shown in Table 1.

Features of the WCSAM that justify mentioning are:

[2] In fact all models that follow the lead of Dervis *et al*., (1982) are based on a symmetric use matrix, i.e., a genuine input-output table. In such circumstances it is interesting to speculate how the various assumptions underlying the input-output tables, e.g., activity vv commodity account totals and technology assumptions (see Miller and Blair, 1985), have been determined, how they might influence model results and how data from multiple sources have been reconciled.

- The non-agricultural commodity and activity accounts are based upon the account classification scheme used in the Supply and Use tables for South Africa (SSA, 2000), which follows a principal product system of classification. Specifically, industry groups are classified by reference to commodities and then firms are allocated to industry groups by reference to the product that they produce most of, i.e. their principal product.
- The agricultural commodity and activity accounts use a different classification scheme. The commodity accounts were determined by reference to the production and consumption structures in South Africa, with minor adjustments to provide a close mapping to the Global Trade Analysis Project's (GTAP) accounts for the GTAP 5 database. The activity accounts are defined by reference to the political districts of the Western Cape; this is as close an approximation to a classification by agronomic conditions as was possible using agricultural census data.
- The factor accounts distinguish between types of labour on the basis of racial group (4) and skill classification (11), giving rise to 41 labour accounts and a capital account. Land is only identified for agricultural activities, for which the implicit rental price is assumed to be 2 percent of the market valuation, and is paid out of returns to capital.[3]
- The household accounts distinguish between rural and urban households. Other criteria besides location that were used to classify households include population group and per capita incomes. Households from a specific population group in a specific location are divided into income classes based on an equal number of households along the income continuum. The number of income groups depends on the total number of households within each category based on population group and location. The top income band for each race and residential location specific category were subdivided to better represent the wide spread of incomes at higher levels. Due to the very limited number of Asian households in rural areas, the rural urban distinction was not used for Asian households.
- Household expenditure patterns were estimated using data from the 1995 Income and Expenditure Survey (CSS, 1997). Household income patterns were estimated used a database formed by merging the 1995 Income and Expenditure and October Household Surveys (CSS, 1997b).[4,5]
- The government account distinguishes between seven tax instruments and between provincial and central government. While the current estimates of tax incidence are consistent with government accounts, they are not fully articulated and need further refinement.
- The trade accounts distinguish between trade with the Rest of South Africa and the Rest of the World. Data on trade with the Rest of the World were available by port of entry and exit and by

3 Payments to land do not appear in the base WCSAM.

4 These surveys provide information on a common sample of 29,500 households and 130,000 individuals for South Africa. The estimates used for the WCSAM used the Western Cape sub sample.

5 The SAM was balanced using a maximum entropy algorithm (see McDonald and Robinson, 1998).

registered location of the importer or exporter, but this does not guarantee that the Western Cape was the ultimate destination. Trade flows with the Rest of South Africa were estimated in net terms, and justify further analyses.

Table 1 Macro Social Accounting Matrix for Western Cape (1993)

	Commodities	Activities	Factors	Households	Enterprises	Govern-ment	Capital Accounts	RoW
Commodities	0.000	43.559	0.000	33.608	0.000	13.052	7.845	19.114
Activities	101.835	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Factors	0.000	57.167	0.000	0.000	0.000	0.000	0.000	0.000
Households	0.000	0.000	40.527	0.000	5.876	2.207	0.000	0.000
Enterprises	0.000	0.000	7.885	0.000	0.000	3.001	0.000	0.000
Government	3.425	1.109	0.000	7.362	1.854	20.097	0.000	4.508
Capital Accounts	0.000	0.000	8.755	7.640	3.155	0.000	0.000	-11.705
RoW	11.917	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	117.178	101.835	57.167	48.610	10.885	38.020	7.845	11.917

Source: McDonald and Punt (2001).

The version of the WCSAM used to calibrate the model has 100 accounts. Of these 36 are commodity accounts, 36 are activity accounts, 10 are factor accounts, 7 are household accounts and 8 are government accounts. There are 9 commodity and activity accounts specific to agriculture and 10 specific to food processing. Although the supply and use matrices are square they are not symmetric. This is particularly relevant with respect to the sub matrix of the make matrix that refers to agricultural activities and commodities; this matrix is dense with 5 out of 81 cells accounting for more than 5 percent of total agricultural production and 26 account for more that 1 percent. Only one cell has a zero entry.

Model

The model is heavily influenced by a model developed at the International Food Policy Research Institute (see Lofgren, 2001, for a recent description of this model), and the discussion here is deliberately brief. The core price relationships are illustrated in Figure 1. Domestic consumption prices (*PQ*) are Armington (CES) aggregations of the domestic import (*PM*) and domestic consumer (*PDD*) prices that are ridden with a domestic sales tax (*ts*). Import prices are derived using a small country assumption, hence the world price (*pwm*) is a parameter, and are subject to import duties (*tm*) and trade and transport margins (*mktm*). Similar margins apply to both the domestic good (*mktd*), creating a wedge between the consumer and producer (*PDS*) and domestic export (*PE*) prices. The (average) prices of domestically produced commodities (*PXC*) are Armington (CET) aggregations of the domestic export and producer prices. However the system allows for multi-

product activities; the prices of domestic products are Armington (CES) aggregates of the prices received for those commodities by the various activities that produce the commodities (*PXA*). Hence it is (implicity) assumed that activities produce differentiated products and consumers' select between them on the basis of relative prices. Finally the average output price for each activity (*PX*) is a linear aggregation of these differentiated commodities (*PXA*).

Figure 1 Price System for a Western Cape CGE Model

Figure 2 illustrates the quantity system for the model. Domestic demand (Q) is made up of intermediate (*INT*), household (*CD*), enterprise (*ENTD*), government and investment (*INVD*) demand. Demand from enterprises, government and investment is assumed fixed in real terms, while intermediate demand is determined by the production relationships (see below) and household demand by the maximisation of utility subject to Stone-Geary utility functions. Domestic demand is supplied by imports (*M*) and domestic production for the domestic market (*DD*), which are aggregated under the assumption of imperfect substitution (CES). Domestic production (*XC*) is divided between the domestic market (*DD*) and exports (*E*), again under the assumption of imperfect substitution (CET), and is supplied by multi-product activities that produce differentiated commodities (*XA*) that are aggregated using a CES function. The combination of differentiated commodities produced by each activity represents activity output (*X*).

Figure 2 Quantity System for a Western Cape CGE Model

Production relationships are modeled as a 2-stage process. At the first stage aggregate intermediate inputs are substitutable with aggregate primary inputs, while during the second stage intermediate inputs are used in fixed proportions and a CES production function is used to allow substitution between the primary inputs. The model closure rules impose the condition that land is agronomic region specific.

Government income comes from seven tax instruments. Sales taxes, export duties and import tariffs are levied on commodities and indirect taxes are levied on production. All these instruments are expressed as *ad valorem* taxes. Direct taxes on household and enterprise incomes are expressed as simple average rates of total incomes to households and enterprises respectively. Finally there is simple average rate of value added tax. The government also receives large net transfers from the Central government; these are assumed fixed in nominal terms. Government expenditures cover commodities and transfers to households and enterprises; the transfers are fixed in nominal terms. The equilibriating variable is government saving. Other savings come from households, fixed rates of after tax income, and enterprises, defined as income less expenditure, and the capital account of the 'balance of payments'.

The rest of the world account is modeled simply. The expenditures are the imports of commodities; all other transactions are treated as incomes to the province. All transfers from the rest of the world to this economy are treated as net incomes whose magnitudes are determined exogenously.

4 Results

The analyses reported below assume the world prices of exports of selected commodities have increased because of trade liberalisation and the political transformation of South Africa. Data for agriculture in the Western Cape have shown that there has been productivity growth in the Wine Grape, Deciduous Fruit and Wine industries during this period of increasing exposure and access to world markets. The discussion starts with the impact of increases in world prices of wine grapes, deciduous fruit and wine, while assuming increases in productivity growth of Western Cape agronomic regions where the greatest concentration of orchards and vineyards are located. Note that the increase in the world price of wine is introduced through the beverage manufacturing activity. Since the wine industry is dependent upon the availability of grapes from viticulture, the productivity growth in viticulture will effectively relax supply constraints within viticulture because of limited land available for expansion. The final set of results evaluates the impact of world price increases in the absence of productivity growth in contrast to the presence of productivity growth.

The results reported below were derived using increases in the world price of wine grapes of 20 percent, 2.5 percent for deciduous fruit and 1 percent for wine, which produced output and export changes close to those observed. The increase in productivity growth assumed varied between 5 percent and 10 percent for five different agronomic regions in the Western Cape; these were those regions (Boland, Ruens and Grabouw, Breede River and Witzenberg, Swartland and Olifants River) with the greatest shares of output accounted for by grapes and deciduous fruits.

4.1 Exports of Deciduous Fruits, Wine Grapes and Wine and Productivity Growth

In South Africa both Viticulture and Deciduous Fruit production are labour intensive agricultural industries, with relatively large numbers of unskilled labour. This produces a bias in the distribution of benefits towards unskilled labour, specifically with regard to Coloured and African labour (Figure 1). The decrease in Asian labour for both skilled and unskilled labour is the result of the fact that the Asian employment in agriculture is almost negligible in the Western Cape. The concentration of increases in factor income on Unskilled labour, and hence the lower priced labour, suggests that the opening up of export markets may produce useful increases in the wage rates at the lower end of the scale.

Figure 1 Changes in factor incomes as a result of the increase in world prices of wine grapes, deciduous fruit and wine.

The increase in factor incomes impacts on the level of household incomes and consumption. Figure 2 shows the change in disposable household income for the different household categories. The increases in incomes of rural households are consistent with the fact that the use of 'unskilled' labour dominates in rural areas. Given that income to non-white rural households are generally lower than for comparable urban households the sizable rises in incomes to Coloured and African rural households would contribute to government income redistribution objectives. On the other hand, White rural households also gain substantially, which is a reflection of the large proportion of income from land accruing to White landowners. The relatively large increases in incomes of coloured and black urban households can be attributed to the non-agricultural linkages associated with the expansion of exports by the distilleries and winery industry; and indicate that the benefits of increased export opportunities offer substantial positive spill overs into the urban areas.

Figure 2 Changes in disposable household income

The changes in disposable household income are closely linked to the real consumption demand by households. The latter follows the same pattern for each household category as those illustrated in figure 2 and is therefore not shown here. Figure 3 indicates changes in (aggregate) consumption patterns of selected commodities. Results indicate a noteworthy increase in consumption demand for food and agricultural products, especially fresh fruit, livestock and dairy products, and much smaller proportionate increases in manufactured goods. The (domestic) demand for wines is captured in the demand for beverages.

Figure 3 Changes in household consumption patterns

4.2 The Role of Productivity Growth

The results indicated in the sub section above (4.1) are inclusive of productivity growth. It is therefore instructive to examine the extent to which these benefits derive from the increase in export opportunities as opposed to productivity growth. In the event that no productivity growth takes place as a result of global liberalisation, the benefits realised by the Western Cape economy are damped down. This is indicated by the changes in GDP with and without productivity growth shown in Figure 4. This suggests that while export opportunities would produce a useful boost to GDP, the benefits of productivity growth are some four times greater. As will be discussed below the overwhelming source of this extra boost seems to arise from the relaxation of the capacity constraints imposed by the availability of land.

Figure 4 GDP for different productivity scenarios

The results for factor and household incomes, presented in figures 5 and 6, indicate that productivity growth serves primarily to accentuate the pattern of changes in incomes brought about by the expansion of export opportunities. There is less variation in the increases/decreases in the absence of productivity growth. The factor incomes graphic, Figure 5, does not include the changes in payments to land because they swamped the other factors. Without productivity growth the rental price of land is forecast to rise by about 12.5 percent but with productivity growth it rises by 48 percent.

Figure 5 Changes in factor incomes in the absence of productivity growth

It is this sharp rise in land rents that is the driving force behind the increase in household income to White rural households, whereas the rise in household incomes for other rural households derives overwhelmingly from increases in labour payments. These results are indicative of the importance of the benefits of relaxing the capacity constraints imposed by the limited availability of land in the Western Cape.

Figure 6 Changes in disposable household income in the absence of productivity growth

This also feeds through into the demand for labour. This effect is illustrated by the changes in the demand for unskilled Coloured labour in the nine agronomic regions, see Figure 7. Because of the labour intensive nature of much o export agriculture in the Western Cape the relaxation of the capacity constraint produced by productivity growth is translated into an increase in the demand for labour; only one region, namely the Southern Cape, records a (small) decline in the demand for labour. The growth in labour demand is highest for those areas dominated by orchards and vineyard, such as the Breede River Valley and the Boland. Thus productivity growth would be employment generating, but only it appears in the presence of an expansion in market opportunities.

Figure 7 Demand for Unskilled Coloured labour in the nine agronomic regions.

5 Concluding Comments

How economies respond to changes in policy regimes is important to both policy makers and a wide range of interested parties. This is particularly so during periods of pronounced structural change. The last 15 years have seen South Africa undergo major structural changes against a backdrop of a rapidly evolving international policy environment; while the rate of change in the domestic arena may

slow there is little reason to believe that changes in the international policy environment will slow. Certainly the changes in trade policy will continue, not only through the efforts of the WTO, but also *inter alia* through bilateral negotiations with the EU, MERCUSOR and SADC. Since agricultural trade is likely to figure prominently in these policy changes, and the Western Cape is the key province for exports in South Africa, the demand for the results of policy analyses should increase.

The Western Cape province of South Africa appears to have benefited appreciably from the increased export opportunities that followed political reform in the early 1990s. It is important however to recognise that the ability of agriculture to respond to the liberalisation of trade regimes is dependent upon the tightness of supply-side constraints, especially the availability of land resources. The results reported in this paper demonstrate that the economic benefits accruing from expanded export opportunities are not only influenced by these capacity constraints but also by the patterns of interdependence within an economy. In the case of the Western Cape it is evident that the increases in exports of wine, table grapes and other deciduous fruits should have contributed positively to increases in employment and rural incomes, especially among farmworker households. They should also have contributed to reductions in income inequalities. More importantly, the extent to which capacity constraints can be released will be an important determinant of the absolute magnitude of the benefits. This suggests that trade opportunities accompanied by productivity growth are likely to be complementary in the search for growth and reduced inequality.

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Appendix

Table A1.1 Commodity and Activity Accounts

Commodities		Activities	
Cereals	Textile products	Agric Metropolitan	Textile products
Field Crops	Leather products	Agric Boland	Leather products
Other Crops	Wood and Paper	Agric Ruens and Grabouw	Wood and Paper
Wine grapes	Chemical Products	Agric Southern Cape	Chemical Products
Agric Fruit	Rubber and Plastic	Agric Little Karoo	Rubber and Plastic
Other Horticulture and Agriculture nec	Non metal products	Agric Breede River and Witzenberg	Non metal products
Livestock	Metal products	Agric Swartland	Metal products
Milk & Cream	Machinery	Agric Olifants River	Machinery
Forestry Flowers etc	Electrical machines	Agric Great Karoo	Electrical machines
Mining	Vehicles	Other mining	Vehicles
Meat products	Miscellaneous manufactures	Meat	Miscellaneous manufactures
Fruit & vegetables products	Utilities	Fruit	Utilities
Oils and fats products	Construction	Oils	Construction
Dairy products	Trade, transport and communication	Dairy	Trade, transport and communication
Grain mill products	Government services	Grain mills	Government services
Animal feeds	Services	Animal feeds	Services
Bakery products		Bakeries	
Confectionary products		Confectionery	
Other food products		Other food	
Beverages and tobacco products		Beverages & tobacco	

Table A1.2 Factor & Household Accounts

Factors	Households	Government and Other Accounts
African Skilled	African Urban Households	Import Duties
African Unskilled	African Rural Households	Export taxes
Coloured Skilled	Coloured Urban Households	Sales Taxes
Coloured Unskilled	Coloured Rural Households	Production Taxes
Asian Skilled	Asian Households	Income Taxes
Asian Unskilled	White Urban Households	Value Added Taxes
White Skilled	White Rural Households	Factor Taxes
White Unskilled	Business Enterprises	Government
Gross operating surplus		Savings
Agricultural Land		Rest of the World

Figure 1 Price System for a Western Cape CGE Model

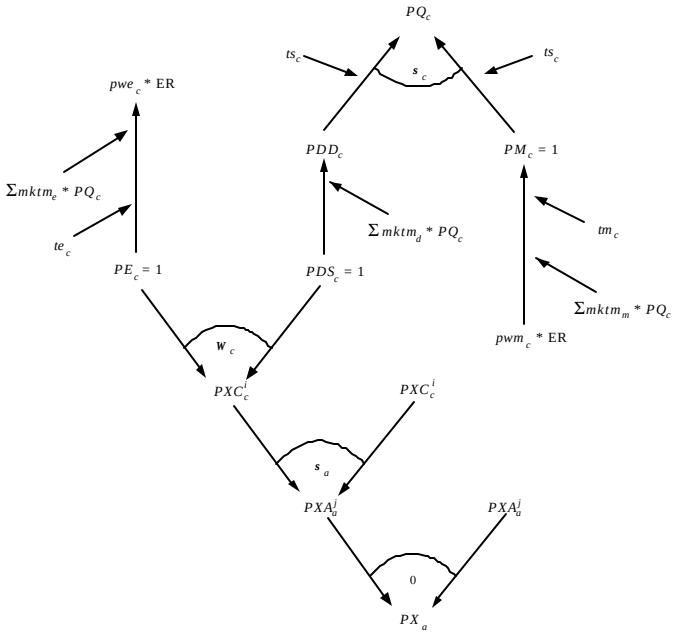

Figure 2 Quantity System for a Western Cape CGE Model

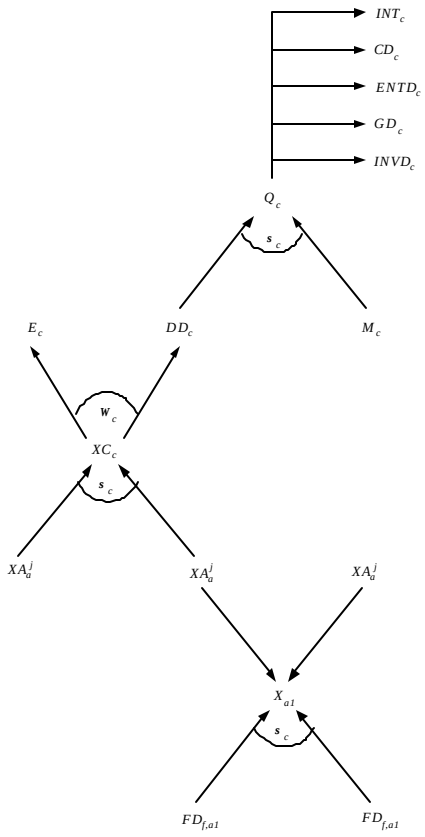

Figure 1 **Changes in factor incomes as a result of the increase in world prices of wine grapes, deciduous fruit and wine.**

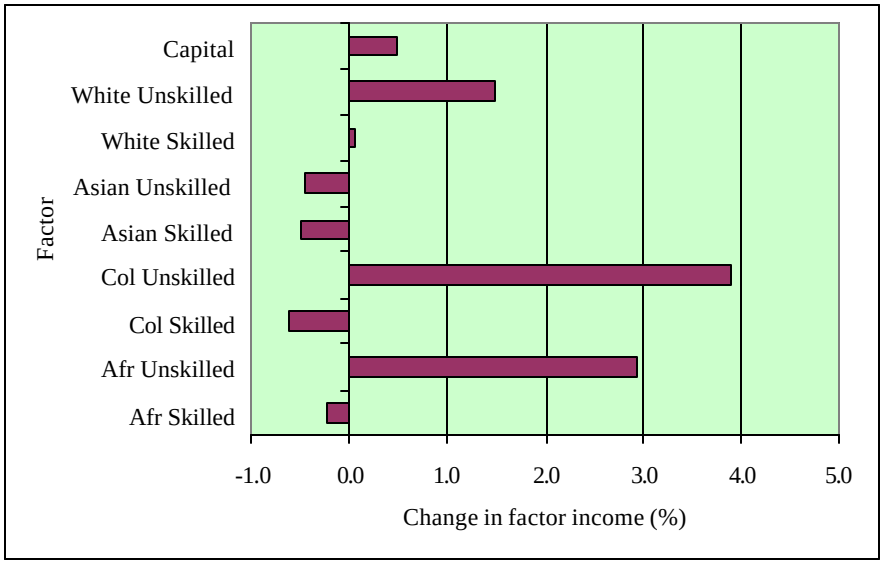

Figure 2 **Changes in disposable household income**

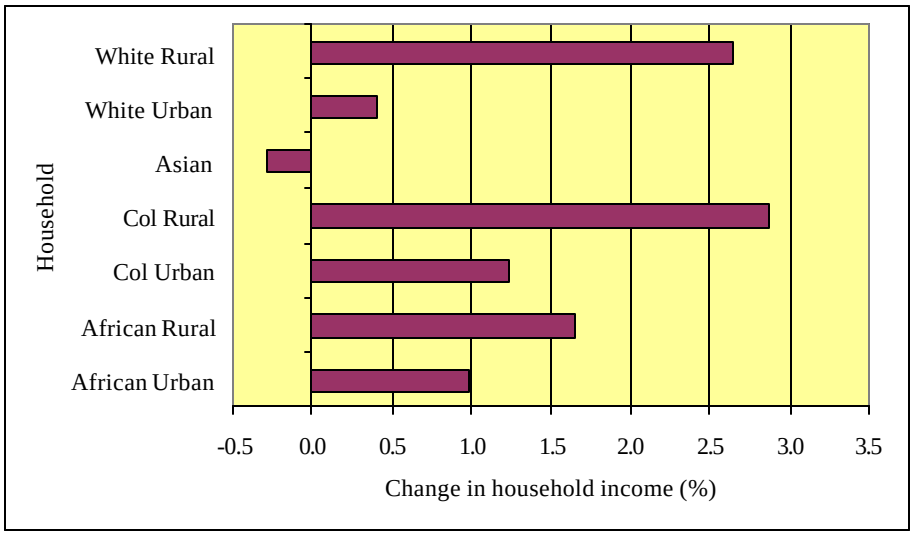

Figure 3 Changes in household consumption patterns

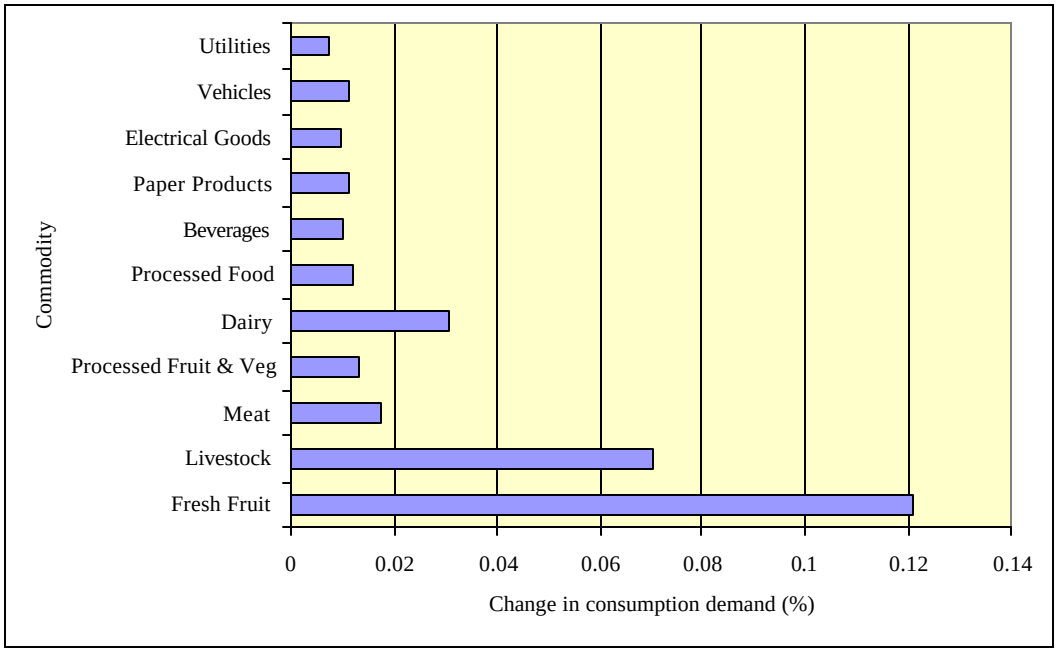

Figure 4 GDP for different productivity scenarios

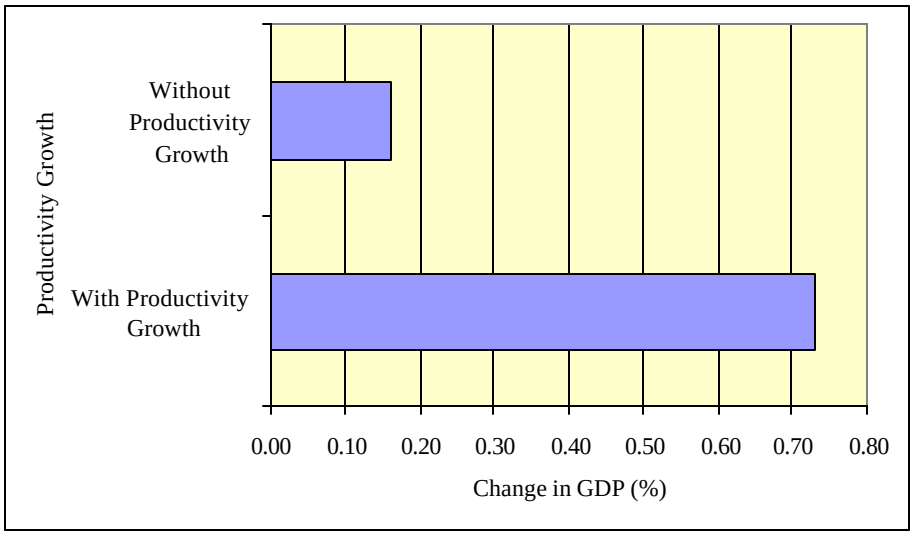

Figure 5 **Changes in factor incomes in the absence of productivity growth**

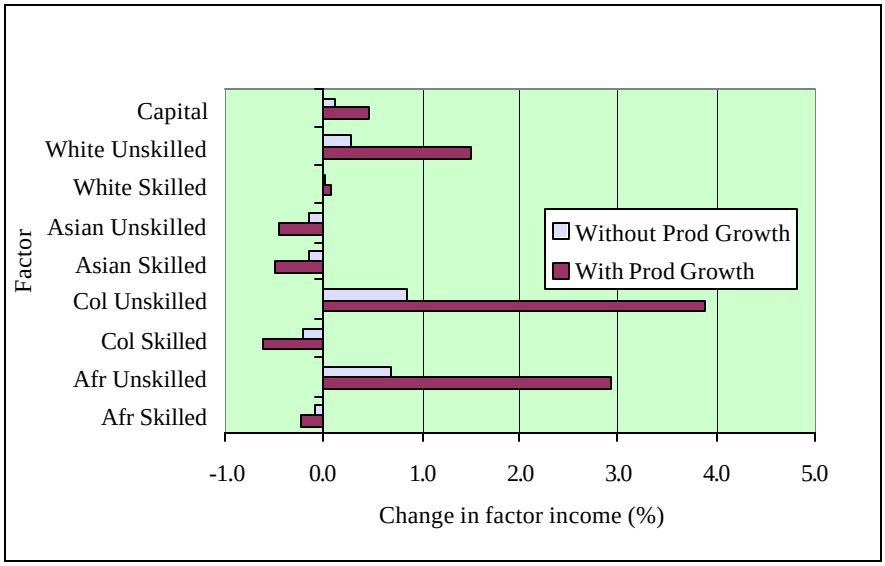

Figure 6 **Changes in disposable household income in the absence of productivity growth**

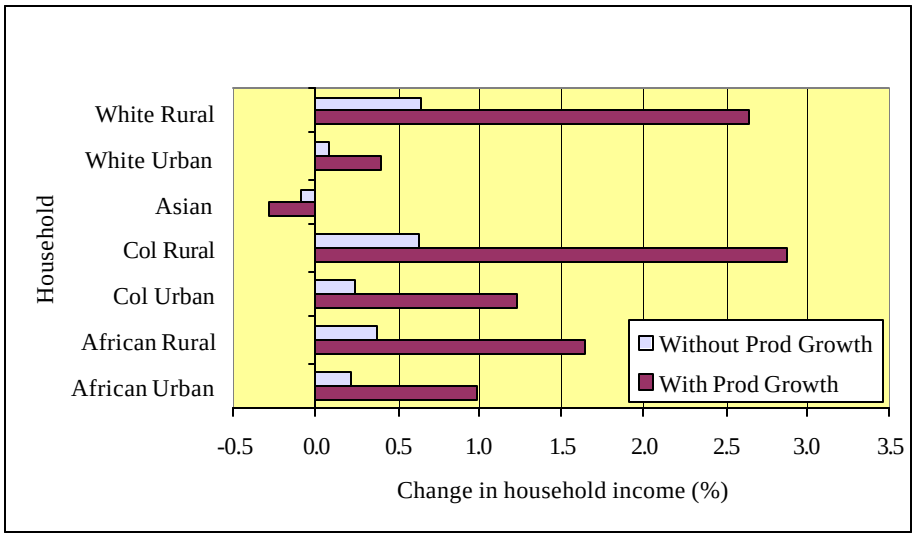
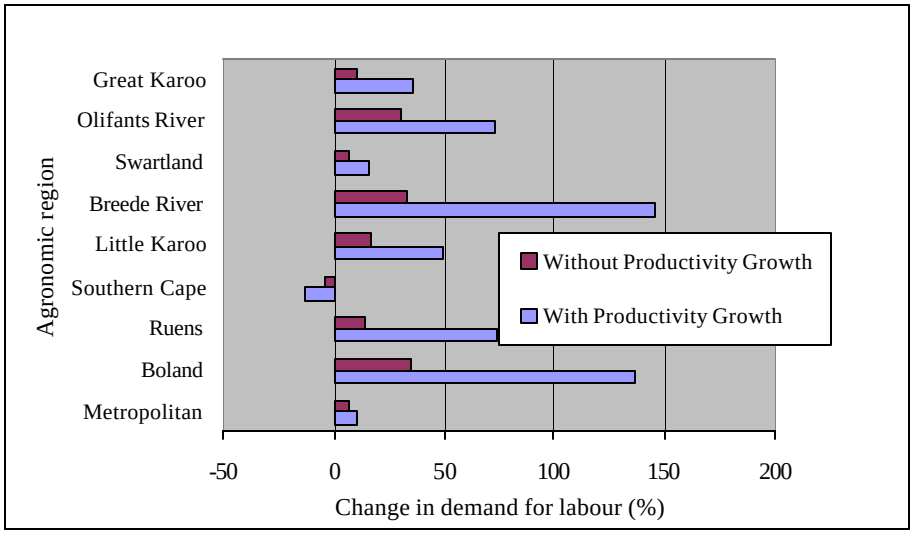
Figure 7 Demand for Unskilled Coloured labour in the nine agronomic re gions.