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Export Diversification and Specialization in South Africa

Extent and Impact

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Abstract

Should developing countries focus on diversifying their export basket or should they instead specialize their exports according to their existing comparative advantage? In this paper we attempt to answer this question by reviewing the literature on export diversification and specialization, by investigating the extent of export diversification and specialization in South Africa over the period 1962-2000 and its relationship to GDP per capita. We use a computable general equilibrium (CGE) model to investigate the economy-wide impacts of greater export diversification versus greater export specialization. We find tentative evidence of a U-shaped relationship between per capita GDP and export specialization. Also, Granger causality test suggests that export diversification induces changes in GDP per capita. Our CGE simulations find that export diversification results in higher GDP growth and employment. The main channel for this observation is that greater export diversification results in a more substantial increase in exports (of between 1.28 and 7.03 per cent) than in the case of greater export specialization. We conclude by discussing some policy implications.

Keywords: exports, diversification, specialization, South Africa, general equilibrium modelling

JEL classification: F10, F14, O24, O14, O55

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Acronyms

CGE computable general equilibrium model

HOS Heckscher-Ohlin Samuelson model

SAM social accounting matrix

SITC standard international trade classification

WTO World Trade Organization

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1 Introduction

Whether countries should pursue diversification or specialization in export production has been a topic that has generated much discussion in the theoretical literature and in policy circles. Broadly seen, one strand of the literature advocates greater export diversity as good for economic growth and development, while another sees specialization, in accordance with a country's comparative advantage, as more appropriate. Despite much theorizing however, the empirical evidence on the relationship between export diversification and economic development remains limited[1] (Herzer and Nowak-Lehmann 2006: 1826). There is even less evidence on the economy-wide impacts and requirements of greater export diversification vis-à-vis specialization.

In this paper we add to the empirical literature on export diversification and specialization in two ways. We investigate the extent of export diversification and specialization in South Africa for the period 1962-2000 and its relationship to GDP per capita. Using a computable general equilibrium (CGE) model, we investigate the economy-wide impacts of greater export diversification versus greater export specialization on the South African economy. By focusing on South Africa we contribute towards understanding better the export dynamics of this country, which has not been able to significantly generate export-led growth nor to substantially diversify its range of manufactured exports (Hausmann and Klinger 2006). It has been claimed that the country might have started to de-industrialize prematurely and thereby increasing the concentration of its production and export structures (Tregenna 2007). Most of the concern with South Africa's export dynamics has been focused on its export performance and determinants (e.g. Jonsson and Subramanian 2001; Naudé 2001), with only a few recent studies beginning to investigate its diversification or specialization patterns in trade (e.g., Matthee and Naudé 2007; Edward and Alves 2006; Petersson 2005).

We proceed in section 2 to provide a brief overview of the theoretical understanding of export diversification and specialization, and discuss the various ways in which the degree of diversification (both vertical and horizontal diversification) can be measured. In section 3 we discuss the current state of export diversification and specialization in South Africa, and test for the relationship between export diversification and economic growth. We also introduce the CGE model (UPGEM) which is used to model two broad scenarios. The results are discussed in section 4, while section 5 concludes.

2 Export diversification: theory and measurement

2.1 Theory

One of the earliest ideas in the theory of economic development is that the degree of specialization or diversification of a country's production and trade structure is

[1] A few existing studies find a positive relationship between export diversification and economic growth (De Ferranti et al. 2002; Al-Marhubi 2000; Hausmann et al. 2005; Matthee and Naudé 2007; Funke and Ruhwedel 2005). Feenstra and Kee (2004) find that a 10 per cent increase in export variety in a country's industries raises its productivity by 1.3 per cent. Lederman and Maloney (2002) find that highly concentrated exports are negatively associated with growth.

important for its economic development. From Adam Smith's recognition of the importance of the division of labour and specialization for economic growth and development, to the standard Heckscher-Ohlin Samuelson (HOS) model of international trade, the position in neoclassical economics has been that countries should specialize in producing and exporting according to their comparative advantage.

However, after the Second World War, with the reconstruction of Europe and increasing independence of many former colonies, one of the earliest ideas in the emerging new discipline of development economics was that economic diversification—not specialization—may be good for economic growth and development. Active government intervention in industrialization and export diversification was encouraged. Seminal contributions in this regard include the Prebisch-Singer thesis (Prebisch 1950; Singer 1950) and the 'big push' arguments advocated by Rosenstein-Rodan (1943). The key argument was based on the view that developing countries' dependence on primary commodity production and exports leaves them vulnerable to commodity shocks, price fluctuations and declining terms of trade, especially since the income elasticity of the demand for primary commodities is low. This in turn results in a country's foreign exchange reserves, and thus its ability to afford imported inputs, becoming subject to fluctuation and uncertainty. In such a case, beneficiation of raw commodities before exporting is seen as adding more value to production and raising employment, and providing more stability and growth in export earnings.

At this point it is necessary to make a distinction between vertical and horizontal diversification. Vertical diversification has been the main focus in this initial development literature. It is said to occur when a country's production and export structure shifts from primary commodities to manufactured goods. Most often it occurs when a country starts processing commodities that were previously exported in raw form (Cramer 1999: 1247).

During the 1980s and 1990s, four further strands of literature stressed the potential benefits of export diversification for economic development. One strand proposed that countries should produce and export goods for which the world demand is increasing, and that irrespective of whether or not a country produces primary goods or manufactured goods, it is this compatibility with world demand that will determine the extent to which a country's exports will grow. This strand of literature is strongly based on the view that exports are good for economic growth, and that export-led growth (as experienced by Japan and the East Asian tigers) is the most appropriate development path for the developing world (Alexander and Warwick 2007). In this view, the impact of export diversification is conditional on the type of goods that are exported, and its consistency with world demand.

A second strand of literature has its base in the endogenous growth theory which sees diversification of exports from primary commodities into high-skilled, high-technology goods as desirable because trade in these products allows for more scope for growth through productivity gains than traditional commodity exports. There are more opportunities for spillover effects in manufactured trade than in primary commodity trade (Herzer and Nowak-Lehmann 2006: 1825). Spillover effects are partly due to

skills and technological upgrading (learning-by-doing and learning-by-exporting),[2] which have more positive externalities than in primary commodity production (Petersson 2005: 790). Mengistae and Pattillo (2004) for instance find that manufacturing exporting firms in Africa are up to 17 per cent more productive than non-exporters, primarily due to learning-by-exporting effects.

The two strands discussed above often come to the same practical conclusion in recommending that (i) countries diversify exports into high-skilled, high-technology products and (ii) that countries use trade liberalization as the primary means to obtain higher and more diversified exports (Pineres and Ferrantino 1997; Edwards and Alves 2006: 475).

A third strand takes a portfolio theory approach. Brainard and Cooper (1968) propose that risk-averse countries should diversify their exports taking into consideration the covariability of different export goods' world prices. It recognizes the merits in the neoclassical HOS-trade models' recommendation that a country should specialize according to comparative advantage, but points out that this might not hold under uncertainty, and that uncertainty will reduce overall world trade as risk-averse producers of primary commodities reduce their production thereof (Ruffin 1974; DeRosa 1991). Diversification in exports is needed to offset uncertainty if financial institutions that can provide insurance are lacking, as is for instance the case in many African countries (see Chang 1991; Osakwe 2007). Using cross-country data Strobl (2005) finds that trade liberalization results in greater variability in export earnings, and that there are significant welfare gains for countries in diversifying into a more 'optimal' export structure, although the precise magnitude of these gains are country specific.

A fourth strand of literature where diversification is advocated originated from among the explanations of African countries' poor economic growth in the 1980s. Here it was observed that countries that have a rich endowment of natural resources, and tend to depend on exporting one or a few highly-valued natural resources, such as oil, minerals or coffee, tend to grow slower than countries with a more diversified, non-resource based export structure (Arezki and Van der Ploeg 2007). Sachs and Warner (2001) term this the 'natural resource curse'. Three main reasons have been advanced as to why a rich endowment of natural resources would be bad for economic growth: 'Dutch-disease' effects whereby the real exchange rate appreciates during resource booms (Bonaglia and Fukasaku 2003), increasing rent-seeking behaviour and corruption, and civil conflict over these valuable resources.

Despite the apparent need for diversification as motivated in the literature surveyed above, a thread of scepticism has remained with regard to the appropriateness and practicality of greater export diversification in many developing countries. Owens and Wood (1997) argue that in the case of Africa, comparative advantage implies that the emphasis should not be on vertical diversification, but on expanding primary commodity exports, and horizontally diversifying only primary production and exports. According to Rodrik (1998) the ratio of trade to GDP in Africa is comparable to that of

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2 In the endogenous growth models, learning-by-doing and learning-by-exporting and the resulting greater diversification of exports occur through the imitation of developed countries (Pineres and Ferrantino 1997: 376).

countries of similar size and income. This is taken to suggest that the continent's specialization according to its comparative advantage is not the constraint on its growth.

There is also a growing literature that doubts the practicality of diversification for resource-rich, skill-scarce developing countries. Krugman (1987) illustrates the difficulty of diversifying due to the self-reinforcing (lock-in) effects of initial specialization, which may act as a 'development trap' if that specialization is in slow-growing sectors (Bardhan and Udry 1999: 189). DeRosa (1991) notes that export diversity may not come about without government targeting certain sectors which may, however, be welfare-reducing if fiscal resources are used in this process. Cramer (1999) discusses some of the practical difficulties and country experiences in attempts at vertical diversification. These include poor macroeconomic policies, a high-transaction costs business environment and political uncertainty that reduce foreign direct investment, as well as a lack of efficient trade facilitation (Zanamwe 2005: 6).[3] Developed-country policies towards the developing world have also been seen to be detrimental in some cases to export diversification. Foreign aid, for instance, has been identified as leading to Dutch-disease type of effects in African countries, thereby contributing to limited export diversification (Osakwe 2007:4). Trade preferences (special and differential treatment under the World Trade Organization, WTO) are argued to be undermining the ability of African countries to diversify their export structures (Mold 2005). Gamberoni (2007: 2), for instance, finds evidence that some EU preference schemes (e.g., the ACP Lomé scheme) have been hindering export diversification, either by creating an incentive for countries to specialize in the product(s) with preferential access, or by limiting the efforts of developed countries to open up their markets more generally.

More recently, diversification and specialization have been studied as the part endogenous outcome of a country's stage of development (e.g., Acemoglu and Zilibotti 1997; Imbs and Wacziarg 2003). While this literature focuses on a country's production structure, it has implications for its export structure, given that there is a relation between what countries produce and what they export.[4] One such implication is that a country's sector diversification will benefit the development of its financial sector (by spreading risk), and that the development of its financial sector will in turn support further diversification of the economy (Acemoglu and Zilibotti 1997). Ramacharan (2006: 5) finds that a one standard deviation increase in diversification is associated with about a 0.81 standard deviation increase in the level of credit to the private sector. Thus, diversifying the sectoral composition of the economy will benefit financial development which, in turn, as shown by Chang (1991) may allow a country to engage in more specialization of exports, given that developed financial markets may provide insurance against risk. This reasoning may lead one to infer that a country's export structure may go through phases, from less to more diversified, and followed, as the financial sector development deepens, by a phase of less diversification and more

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3 In many developing countries, especially in Africa export diversification is hampered by insufficient physical infrastructure and facilities for the movement of goods, diverse and uncertain custom procedures, and the use of outdated and inefficient information and communication technology for the exchange of trade-related information (Zanamwe 2005:7).

4 This was already recognized by Adam Smith in his 'vent-for-surplus' theory of exports. In the HOS model of international trade, this will also arise when countries differ in the proportions of their incomes that they consume (DeRosa 1991: 10).

specialization (Saint-Paul 1992). Diversifying the production structure of the domestic economy may therefore be a prerequisite for export diversification and later for export specialization.[5] This does not necessarily imply that we are back at the infant-industry argument for protection: trade policy has been found not to be the first-best policy to address this (Venables 1996; Bardhan and Udry 1999: 189). Better ways that have been identified include financial sector development/credit market intervention (Krugman 1987), coordination of investments between sectors (Murphy, Shleifer and Vishny 1989; Krugman 1991) and science and technology policy to raise the rate of creativity (innovation) and information spillovers in a country in order to find dynamic comparative advantages (Redding 1999; DiPietro and Anuruo 2006; Hausmann and Rodrik 2006).

Diversification may also result more endogenously from a growing demand for a variety of goods as a country's income increases (Imbs and Wacziarg 2003: 82). This in turn suggests that low-income countries with a specialized export structure should aim to maximize the benefits of such exports for household income and demand. It implies that an unequal distribution of income may act as constraint on diversification.

Imbs and Wacziarg (2003) using cross-sectional and cross-country data find a U-shaped relationship between the degree of sectoral concentration in a country's production structure and the level of development (as measured by per capita income). This evidence is consistent with the view that countries will first diversify and then specialize in their production (and exports) over their stages of development. Hummels, Ishii and Yi (2001) and Yi (2003) give further support to the notion that countries at further stages of development may tend to specialize also in their export structure, by identifying the importance of vertical specialization (when a country specializes in a specific stage of production rather than in the production of the whole product) in global trade. Vertical specialization, for example, has been responsible for 50 per cent of the growth in USA trade since 1962 (Yi 2003: 9).

2.2 Measurement

The degree of export diversification (specialization) can be measured in a number of ways. Often the extent of diversification or specialization is merely described by referring to the share of primary and manufactured exports in total exports (vertical diversification) and the shares of the various standard international trade classification (SITC) categories of manufacturing sub-sectors in total manufacturing for horizontal diversification (e.g., Bonaglia and Fukasaku 2003; Edwards and Alves 2006). While useful to describe broad patterns of structural change, these share measures are less useful when export diversification is manifested through changes in export composition within sectors. In such cases, better summary measures of diversification or specialization can be obtained by calculating one of a number of concentration indices. The most common in this regard are the Herfindahl, normalized-Hirschmann and absolute deviation measures (e.g. Petersson 2005; Pineres and Ferrantino 1997). Following Matthee and Naudé (2007), we use these in section 3 to describe the extent of export diversification in South Africa.

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5 According to Hausmann and Klinger (2006), South Africa's slow growth in exports per capita is due to the 'lagging process of structural transformation' of its economy.

The Herfindahl Index can be constructed as follows (Petersson 2005):

$$SPEC_{jt} = \sum_i \left(\frac{E_{jit}}{\sum_j E_{jit}}\right)^2 \quad (1)$$

where E_{ijt} is the exports of a country j of a particular industry (or export sector) i in a given year t. An index value approaching one indicates a high degree of export concentration (or specialization), whereas a value approaching zero signifies a high degree of export diversification (Petersson 2005).

The normalized-Hirschmann index can be calculated as follows (Al-Marhubi 2000; Naqvi and Morimune 2005):

$$H_{jt} = \frac{\sqrt{\sum_{i=1}^{n}\left(\frac{x_{it}}{X_{jt}}\right)^2} - \sqrt{\frac{1}{n}}}{1-\sqrt{\frac{1}{n}}} \quad (2)$$

where x_{it} is the value of exports of industry i located in country j and X_{jt} is the total exports of country j in a given year t. The number of industries is indicated by n. An index value nearer to 1 indicates extreme concentration. Likewise, a value closer to 0 signifies a more diverse combination of exports (Al-Marhubi 2000; Naqvi and Morimune 2005).

A third method to measure export diversification is by the absolute deviation of the country's share of the world's total exports (e.g., Al-Marhubi 2000). This can be calculated as in (3):

$$S_{jt} = \frac{\sum_i \left|h_{ijt}\right| - \left|h_{it}\right|}{2} \quad (3)$$

where h_{ijt} is the share of industry i in total exports of country j and h_{it} is the share of industry i in world exports in a given year t. Again this measure ranges from 0 to 1 where 1 represents total concentration and 0 total diversification (Al-Marhubi 2000).

3 Export diversification and specialization in South Africa

In this section we determine the extent of export diversification and specialization in South Africa, and changes therein since 1962. The reason for this is twofold. The first is to assess, using a long timespan of data and various measures, the degree to which the diversity of South Africa's export basket has changed over time, and to relate this broadly to changes in per capita GDP (as a measure of development). Second, we provide this assessment of the diversification of South Africa's exports in order to create a benchmark against which the economy-wide impact of changes in the extent of diversification can be modelled using a CCE model (see section 4).

In this section, we describe the method (section 3.1), the data used (section 3.2) and the results (section 4.3).

3.1 Method

In section 2 we described the most common methods used to calculate the extent of diversification or specialization in a country's export basket. In this section we apply these. They are, first, the Herfindahl index (SPEC-measure) as described in Equation (1), second the normalized-Hirschmann index (H_{jt} in Equation 2). And third the absolute deviation of the country's share of total world exports (S_{jt} in Equation 3).

3.2 Data

Our main source on data on South African exports is the World Export and Import Data which was constructed from United Nations data by Feenstra and Lipsey for the National Bureau of Economic Research (NBER) (see www.cid.econ.ucdavis.edu/data/undata/undata.html and Feenstra et al. 2004). This database contains South African trade data with 140 countries on 1042 SITC sectors and covers the period 1962-2000. Further data on GDP per capita were sourced from the World Bank's *World Development Indicators* (available at: www.go.worldbank.org/3JU2HA60D0).

3.3 Results

We report our empirical findings in the three following subsections. Subsection 3.3.1 sets out the trends in export diversification/specialization in South Africa between 1962 and 2000 showing that the country's export basket became, initially, more diversified and later less diversified during the period. Subsection 3.3.2 discusses South Africa's export diversification trends in comparative perspective, showing that the country's export basket is relatively diversified compared to that of other developing regions, but that it is less diversified when compared to its major trading partners such as the USA, China, India and also with that of Brazil. Subsection 3.3.3 relates export diversification to GDP per capita, finding from a cross-country sample a U-shaped relation between export specialization and GDP per capita. Evidence of a similar relationship in South Africa is found over time. In this subsection we also perform Granger causality tests between various measures of export diversification. We find no evidence that higher GDP per capita levels lead to changes in export diversification. However we do find some evidence (but not robust) that export diversification 'Granger-causes' GDP per capita.

3.3.1 Trends in export diversification (specialization)

Table 1 gives the four export diversification (specialization) measures for South Africa over the period 1962 to 2000, comparing these to the average of all 141 countries.

It can be seen from Table 1 that despite changes within the relevant years, there was not a huge difference over the 1962-200 era in the degree of export diversification at the start and end of the period. Comparison of the various time periods suggests that diversification levels first increased, declining thereafter, with the economy becoming

relatively more concentrated in its exports between 1980 and 1995. This was followed by an increase in export diversification during 1996-2000.

Table 1
Export diversification (specialization) measures for South Africa 1962-2000

	South Africa	World average
	Measure: Herfindahl (SPEC) index	
1962-69	0.05	0.26
1970-79	0.03	0.23
1980-89	0.07	0.23
1990-95	0.08	0.21
1996-2000	0.04	0.20
	Measure: Absolute deviation of share of world exports	
1962-69	0.76	0.84
1970-79	0.75	0.81
1980-89	0.77	0.81
1990-95	0.74	0.79
1996-2000	0.65	0.78
	Measure: Normalized-Hirschmann index H_{jt}	
1962-69	0.18	0.44
1970-79	0.15	0.40
1980-89	0.22	0.40
1990-95	0.25	0.38
1996-2000	0.17	0.37

Source: Authors' calculations based on UN-NBER World Trade Data.

Table 2
Export diversification in South Africa (sectoral composition of exports) in 1988 and 2002

	1988 (in %)	2002 (in %)
Primary products	71.8	46.2
Manufactured products	27.7	53.4
TOTAL	100.0	100.0
Manufacturing:		
Resource based	44.7	31.4
-Agro processing	17.5	14.2
-Minerals based	27.2	17.2
Low technology	19.4	16.3
-Fashion cluster	4.7	4.4
-Other	14.7	11.9
Medium technology	33.2	47.5
-Automotive	2.3	13.9
-Process	25.7	19.9
-Engineering	5.3	13.7
High technology	2.7	4.9
-Electronic	1.4	2.9
-Other	1.3	1.9

Source: Adapted from Edwards and Alves (2006: 475, 477).

The noted increase in export diversification in our aggregate measures as contained in Table 1 above may reflect a growing vertical diversification in the country's export basket rather than horizontal diversification within the manufacturing sector. Evidence in this regard comes from Edwards and Alves (2006). Applying Lall's (2000) classification of exports to South Africa's technological sophistication, they find evidence that would suggest some degree of vertical diversification of the export structure between 1988 and 2002, but that suggest relatively little horizontal diversification with manufacturing exports. Table 2 shows the extent of diversification in South Africa's exports between 1988 and 2002.

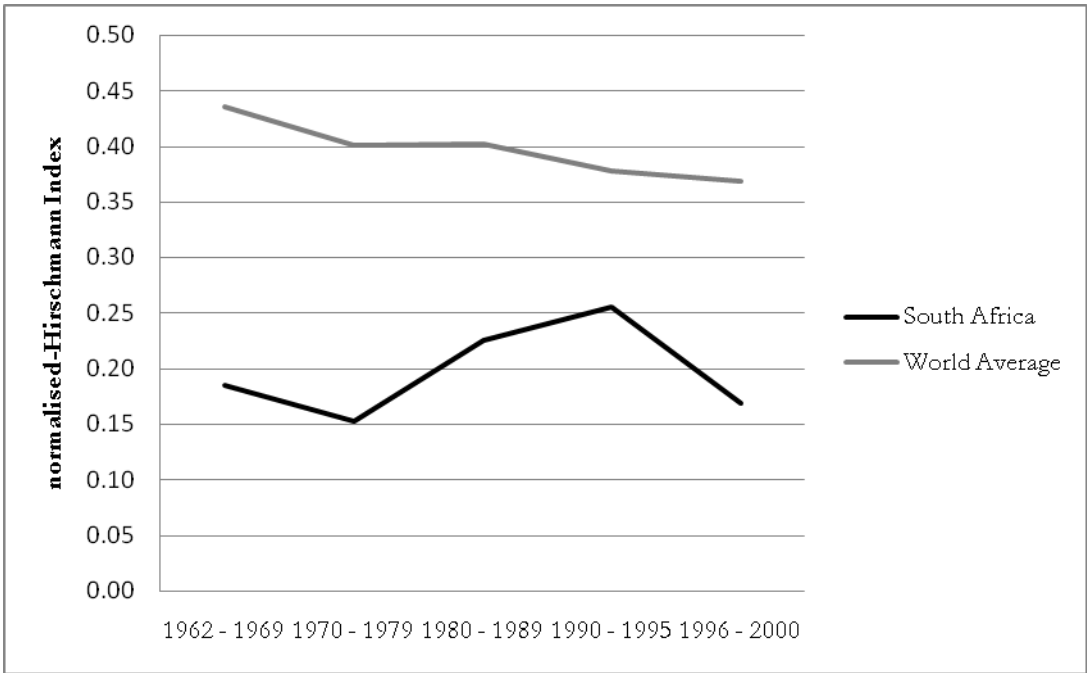
According to Table 2, there has been significant vertical export diversification in South Africa since 1988, with the share of primary commodity exports declining from 71.8 per cent to 46.2 per cent in 2002. Within manufacturing, resource-based and low-technology manufacturing's share in exports declined from respectively 44.7 per cent to 31.4 per cent and 19.4 per cent to 16.3 per cent. In contrast the share of medium-technology products increased from 33.2 per cent to 47.5 per cent between 1988 and 2002. Changes in these relative shares can be due to either increased exports of non-traditional (manufactured goods) or due to reduced exports of primary commodities (Petersson 2005: 785). As is shown in the table, only a small portion of South Africa's manufactured exports are high-technology goods (4.9 per cent in 2002). According to Edwards and Alves (2006: 477) the low share of high-technology goods is a weakness in the country's export structure, since worldwide growth in exports of high-technology goods has been the fastest of any other goods, at an annual average of 11.7 per cent between 1988 and 2002. In contrast exports of primary products grew on average by only 2.4 per cent per annum over this period.

3.3.2 Export diversification/specialization in comparative context

Figure 1 depicts the trends in export diversification in South Africa over the period. It shows that compared to the average country (world average), South Africa's export basket is relatively diversified, but that during the period 1970 to 1995, its exports became less diversified whereas average country exports became consistently more diversified. These years generally correspond to the period when the South African economy was increasingly isolated due to sanctions against the Apartheid regime and the period includes price booms in the international gold price at the end of the 1970s and the national and international debt crises of the early 1980s. It was also an era of import protection, which has been argued to have discouraged the export of manufactured goods. In this regard Edwards and Alves (2006: 2, 9) show that in 1989 implicit taxes on non-commodity exports were 52 per cent compared to 26 per cent on all manufactured goods on average. In contrast the period after 1996 is marked by growing international integration and trade liberalization in terms of the country's membership of and commitments to the WTO (Naudé and Coetzee 2004).

Figure 1 compares the diversity of South Africa's export basket to that of the average for the world; this may mask regional and country-level differences. Table 3 compares the various measures of export diversification of South Africa with those of major world regions.

Figure 1
Export diversity in South Africa according to the normalized-Hirschmann index, 1962-2000



Source: Authors' own calculations based on UN-NBER Trade Data.

Table 3
Comparison of export specialization in South Africa and selected regions, 1962-2000

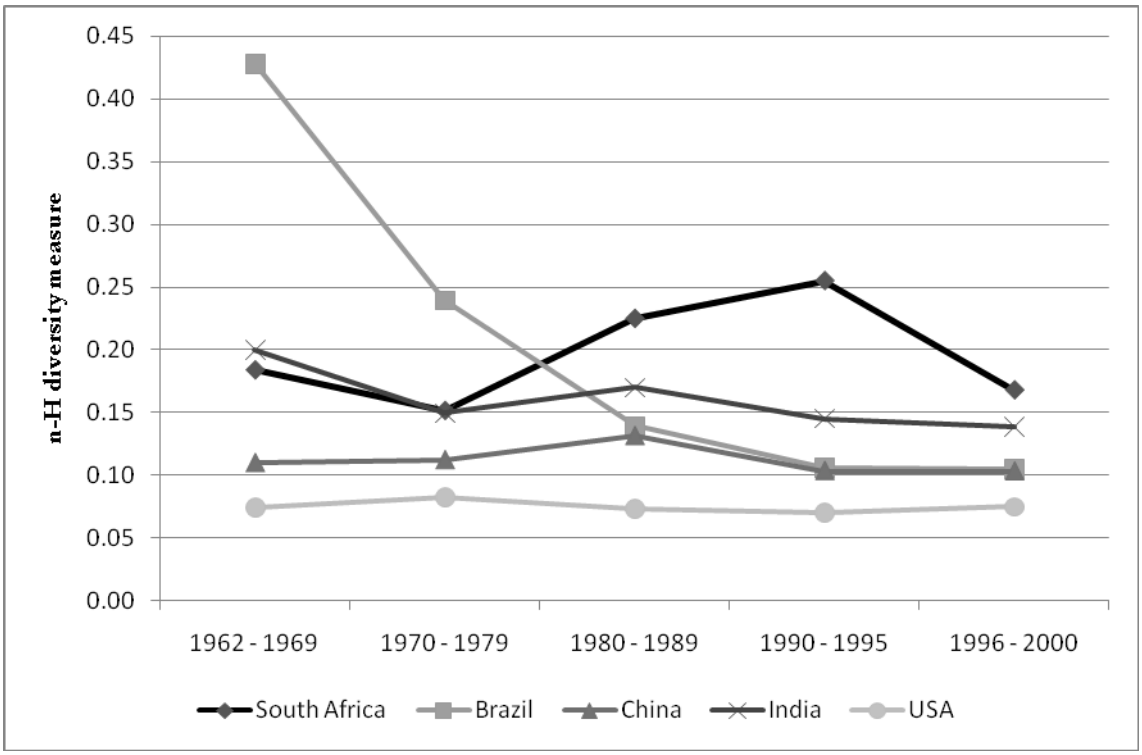
Region	1962-69	1970-79	1980-89	1990-95	1996-2000
	Herfindahl (SPEC) diversity measures for the world, multi- year averages, 1962-2000				
South Africa	0.05	0.03	0.07	0.08	0.04
Rest of Africa	0.34	0.34	0.37	0.35	0.34
Latin America	0.26	0.20	0.19	0.13	0.16
EU	0.05	0.05	0.04	0.04	0.05
Asia	0.27	0.23	0.19	0.17	0.16
North America	0.10	0.07	0.07	0.08	0.06
	The absolute deviation export diversity measures for the world (S_{jt}), multi- year averages, 1962-2000				
South Africa	0.76	0.75	0.77	0.74	0.65
Rest of Africa	0.90	0.89	0.90	0.91	0.91
Latin America	0.87	0.83	0.83	0.82	0.81
EU	0.65	0.61	0.60	0.57	0.55
Asia	0.84	0.80	0.78	0.75	0.73
North America	0.62	0.63	0.63	0.56	0.53
	The normalized-Hirschmann index (H_{jt}) for the world, multi- year averages, 1962-2000				
South Africa	0.18	0.15	0.22	0.25	0.17
Rest of Africa	0.53	0.54	0.57	0.54	0.54
Latin America	0.46	0.40	0.39	0.32	0.34
EU	0.17	0.15	0.15	0.15	0.16
Asia	0.44	0.39	0.35	0.32	0.31
North America	0.23	0.20	0.20	0.22	0.19

Source: Authors' own calculations based on UN-NBER World Trade Data.

Table 3 shows that most measures of export diversity suggests that South Africa's export basket for most of the period 1962 to 2000 was more diversified than that of the typical country in the rest of Africa, Latin America or Asia, but less diversified than that of countries in the European Union (EU) or North America. The indices in Table 3 also suggest that there was relatively little change in South Africa's export diversity over the period (with the exception of the absolute deviation measure which indicates a significant increase in export diversity over 1996 to 2000). In this relative stability of the diversity of its export basket, South Africa is more comparable to the EU than to Asia, for instance, which has experienced significant increases in export diversity according to all measures.

When we compare the export diversity of selected individual countries with that of South Africa, relative changes can be even more pronounced. Figure 2 compares the diversity of South Africa's export basket with that of Brazil, China and India as well as the United States. The latter is included as a benchmark developed country and the former because these often together with South Africa are seen as 'southern engines of growth'.[6] Brazil, China and India are set to join the ranks of the world's five largest economies within the next half century.[7] South Africa is one of the largest trading

Figure 2
Normalized-Hirschmann index for selected countries, 1962-2000



Source: Authors' own calculations based on UN-NBER World Trade Data.

6 See, for example, the UNU-WIDER conference on Southern Engines of Growth, June 2007 at www.wider.unu.edu.

7 China is expected to overtake the USA as the world largest economy by 2041. India is expected to move to the third position by 2050. Brazil is expected to have a larger economy than Germany by 2036 and to be the world's fifth largest economy by 2050 (Wilson and Purushotothaman 2003). The combined the economic size of these three countries currently exceeds US$4.7 trillion in nominal GDP terms, and US$15.6 trillion in PPP-adjusted GDP.

partners in Africa of China, Brazil and India, and the South African government has started bilateral free trade agreements with these countries (Hartzenberg 2003). It is therefore instructive to consider the extent to which these economies have been performing in terms of export diversification or specialization.

Figure 2 shows that ever since the 1980s, all of these important trading partners of South Africa had more diversified export baskets than South Africa. Between 1989 and 1995 the differences became more pronounced due to South Africa's export basket becoming more specialized and that of Brazil, China and India becomes less so. The figure shows the significant degree of export diversification that has taken place in Brazil since 1962.

3.3.3 Export diversification/specialization and level of economic development

In making these comparisons between export diversity between South Africa and other regions/countries, the discussion in section 2.1 should be kept in mind. It was pointed out that the degree of export diversification may be related to a country's stage of economic development (see e.g., Imbs and Wacziarg 2003). Thus, the faster growth in export diversification in the Asia region shown in Table 3 may indicate that this region overall is starting out from a lower base of diversification as well as per capita income compared to South Africa. In order to explore this further and to put the cross-country comparisons in perspective, we plot our measures of export diversification against per capita income for our sample countries. The resulting scatter plot is given in Figure 3, which also shows a regression line depicting the estimated relationship between real per capita GDP and level of export diversification.[8] It is clear that this relationship is non-linear and U-shaped, as suggested by theory (see section 2.1).

We find the same relationship in South Africa when we compare the extent of export diversification over time with per capita GDP. Figure 4 plots the absolute deviation measure (S_{jt} as in equation 4) against real per capita GDP over the period (we get similar results using the other measures). The figure also includes a fitted regression line of the relationship between S_{jt} and real GDP per capita.[9] As can be seen from the figure, this relationship is significantly non-linear (U-shaped). This is consistent with the observation that as an economy develops from lower levels of per capita GDP, it first becomes more diversified, and once a certain level of GDP is reached, it again becomes more specialized in production and exports.

The question to consider is whether this relationship is indicative of changes in export diversification/specialization inducing changes in GDP per capita, or vice versa. Thus, does export diversification or specialization matter for GDP per capita, or does changes in GDP per capita drive the degree of export diversification/specialization?

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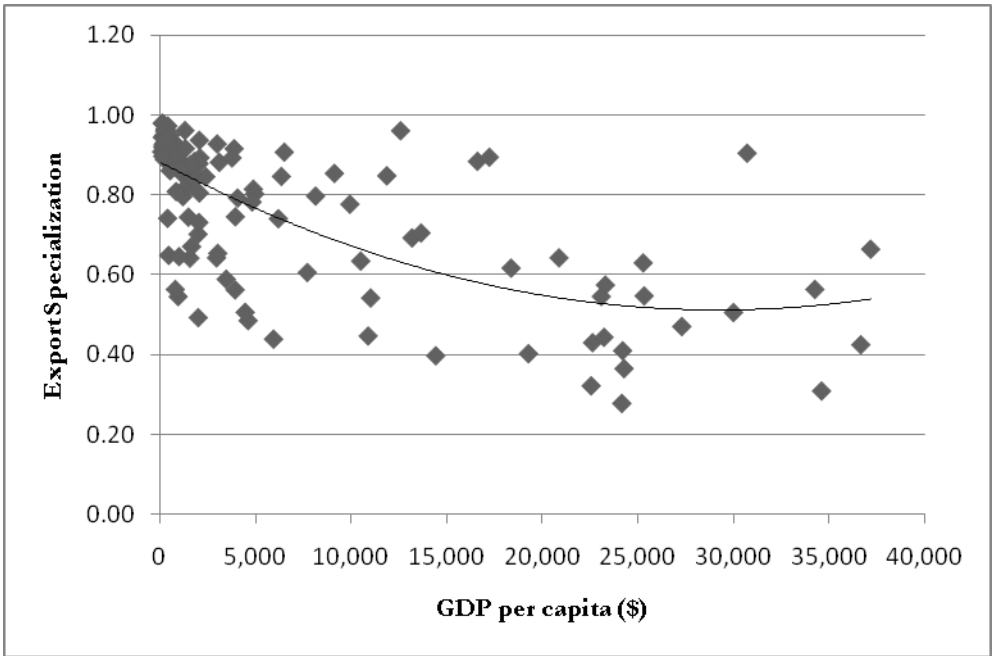
8 For the 139 countries the estimated relationship between S_{jt} and real GDP per capita over the period 1996-2000 was calculated using OLS to be S_j = 0.88 (*51.2*) – 0.00 (*-5.90*)GDPPC + 4.3 (*3.07*)GDPPC^2 where the t-ratios in parenthesis are all significant at the 5 per cent level, and the adjusted R^2 = 0.47.

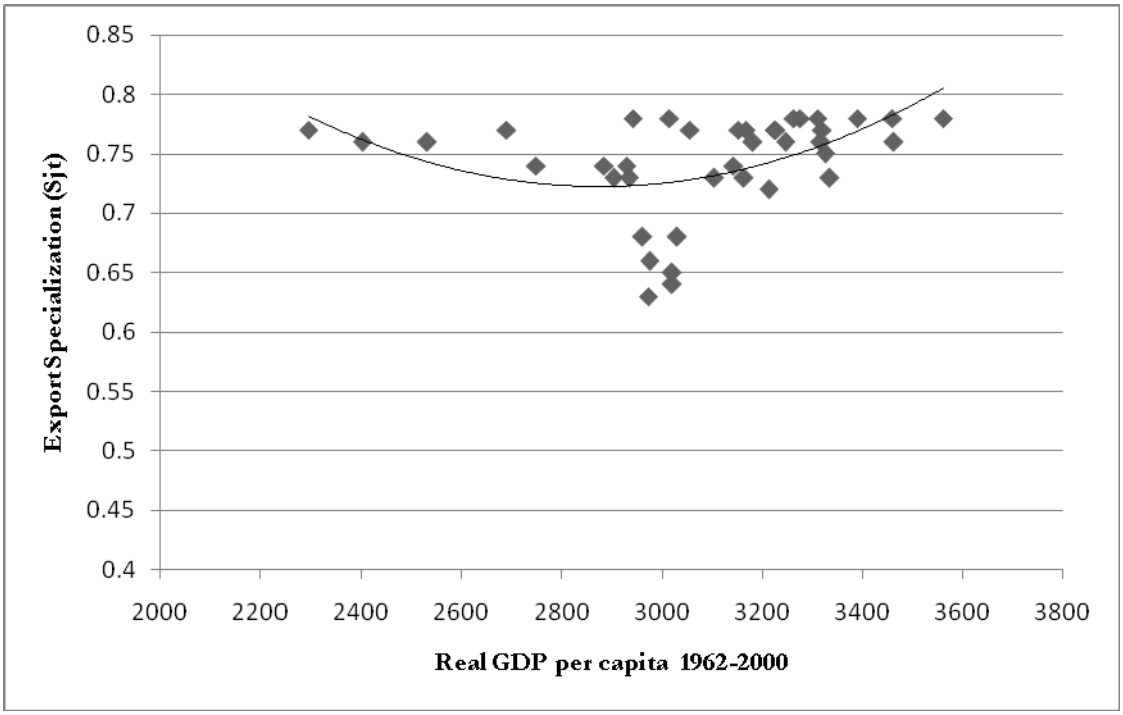
9 The estimated relationship between S_{jt} and real GDP per capita over the period was estimated using OLS to be S_{jt} = 2.16 (*4.42*) – 0.01 (*-3.02*)GDPPC + 1.75 (*3.11*)GDPPC^2 where the t-ratios in parenthesis are all significant at the 5 per cent level, and the adjusted R^2 = 0.19.

Figure 3
Relationship between export specialization and real GDP per capita across the world



Source: Authors' own calculations.

Figure 4
Relationship between export specialization and real GDP per capita in South Africa, 1962-2000



Source: Authors' own calculations.

To answer this we perform Granger causality tests on the relationship between export diversification/specialization and GDP per capita. This entailed running the following two regression equations using the various measures of export diversification.

$$X_t = a_0 + b_i \sum_{i=1}^{n} X_{t-i} + c_i \sum_{i=1}^{n} Y_{t-i} + e_t \tag{4}$$

and

$$Y_t = d_0 + \delta_i \sum_{i=1}^{n} Y_{t-i} + \gamma_i \sum_{i=1}^{n} X_{t-i} + \varepsilon_t \tag{5}$$

where X_t = a measure of export diversification, alternatively the Herfindahl (SPEC) index, normalized-Hirschmann (H_{jt}) index and absolute deviation (S_{jt}) index and Y_t = GDP per capita and e_t and ε_t random errors. To test whether Y 'Granger-causes X or vice versa we test for the joint significance of the c_i and γ_i coefficients in (1) and (2) under the null of no causality. We proceeded as follows. We first tested the individual time series on GDP per capita and the various export diversification measures for stationarity using the Phillips and Perron (1988) test. All the variables except GDP per capita and the absolute deviation index were found to be stationary. In the case of non-stationary variables first differences were taken to estimate (4) and (5) and the error correction term (ECM) was included after it was established that these two non-stationary variables were cointegrated.

The results of these tests are reported in Table 4, wherein the results indicate that we cannot reject the null of no Granger causality from GDP per capita to export diversification: in all cases the measures of export diversification were Granger causing GDP per capita. No evidence of reverse causality was found. These results are consistent with Hausmann and Klinger's (2006: 9) argument that a lack of export diversification is a constraint on South Africa's growth.

Table 4
Granger causality tests

Dependent variable	Herfindahl index [1]	Normalized Hirschmann index [1]	Absolute deviation index (S_{jt}) [1]
Export diversification measure	0.37	2.99	0.48
GDP per capita	4.04*	3.91*	10.80*

Notes: [1] F-test for joint significance of c_i with F(2,30).
* indicates significance at the 5% level.

4 Simulating the economy-wide impacts of export diversification/specialization

In the previous sections we point out that diversification of a country's export basket is often seen as desirable for stabilizing export earnings and for stimulating export-lead growth by allowing a country to benefit from growth in different sectors of the world economy. South Africa is a case in point where export-lead growth remains elusive,

possibly due to limited diversification of the country's export basket (Hausmann and Klinger 2006). In the previous section we present tentative evidence that greater export diversity 'Granger-cause' GDP per capita.

In this section we investigate the economy-wide impacts of the degree of export diversification on the South African economy by using a computable general equilibrium (CGE) model to simulate four scenarios. We briefly describe our CGE model in subsection 4.1, describe the scenarios in subsection 4.2 and show that in the first two scenarios we assume that the country further diversifies its export basket, to a level that is more diversified than that of China. In the second two scenarios, we assume that the country increases its specialization of exports, to a significantly more concentrated level than at present. In subsection 4.3 we set out the results.

4.1 Modelling approach

Since we are interested in the economy-wide impacts, and in particular the impacts on household welfare, inequality and unemployment of export diversification and specialization, the most appropriate modelling tool is a computable general equilibrium (CGE) model. A CGE model is 'an economy-wide model that includes feedback between demand, income and production structure, and where all prices adjust until decisions made in production are consistent with decisions made in demand' (Dervis, de Melo and Robinson 1985: 132). These models are now well-known in policy modelling and have been used since 1993 with increased frequency in South Africa (see e.g., Naudé and Coetzee 2004).

The model is applied (or computed) using economy-wide consistent data on a particular economy as is normally contained in a social accounting matrix (SAM). In the present case, we use the most recent published SAM for South Africa (Statistics South Africa 2004; 2002). We use a South African adaptation of ORANI-G[10] to solve the model, known as the 'UPGEM' and which was developed for South Africa by the University of Pretoria.[11] The UPGEM model used in these simulations distinguishes 32 sectors, six household types and four ethnic groups (Horridge 2000). For a more detailed exposition of the modelling approach followed in UPGEM, see Horridge, Parmenter and Pearson (1993). A recent application of the model to environmental economics in South Africa is contained in Van Heerden et al. (2006).

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10 ORANI-G ('G stands for 'generic') is a version of ORANI which serves as a basis from which to construct new models. It has been applied to many countries including China, Thailand, Korea, Pakistan, Brazil, the Philippines, Japan, Ireland, Vietnam, Indonesia, Venezuela, Taiwan and Denmark (Horridge, Parmenter and Pearson 1993).

11 See e.g., www.monash.edu.au/policy/oranig.htm.

Table 6
Specification of simulations in UPGEM

SAM sector	V4BAS (exports)	Current S_{jt} in UPGEM	Greater diversification (a)	New S_{jt}	Alternative diversification scenario (b)	New S_{jt}	Greater specialization (a)	New S_{jt}	Alternative specialization scenario (b)	New S_{jt}
1 Agriculture	6,630	0.025	0.036	0.021	0.028	0.025	0.048	0.015	0.048	0.015
2 Goldmining	26,303	0.054	0.083	0.041	0.110	0.054	0.116	0.057	0.175	0.086
3 OtherMining	41,176	0.077	0.145	0.064	0.171	0.077	0.181	0.082	0.241	0.112
4 FoodPrcsing	7,664	0.013	0.022	0.008	0.032	0.013	0.027	0.011	0.032	0.013
5 Beverages	369	0.003	0.002	0.003	0.004	0.002	0.002	0.003	0.002	0.003
6 Tobacco	335	0.001	0.002	0.001	0.003	0.000	0.001	0.001	0.001	0.001
7 Textiles	2,366	0.003	0.007	0.001	0.010	0.003	0.005	0.000	0.010	0.003
8 Clothing	2,084	0.017	0.011	0.016	0.017	0.013	0.009	0.017	0.009	0.017
9 Leather	1,429	0.001	0.004	0.001	0.006	0.002	0.006	0.001	0.006	0.001
10 Footwear	205	0.005	0.001	0.004	0.002	0.004	0.001	0.005	0.001	0.005
I1 Wood	2,972	0.003	0.016	0.001	0.018	0.000	0.007	0.006	0.012	0.003
I2 Paper	6,143	0.003	0.018	0.001	0.026	0.003	0.026	0.003	0.026	0.003
I3 PrintPublsh	633	0.003	0.003	0.002	0.007	0.001	0.003	0.003	0.003	0.003
I4 Chemicals	25,152	0.001	0.106	0.002	0.105	0.001	0.171	0.034	0.105	0.001
15 Rubber	1,073	0.002	0.006	0.001	0.008	0.000	0.004	0.002	0.004	0.002
16 Plastic	1,209	0.008	0.007	0.007	0.014	0.004	0.005	0.008	0.005	0.008
17 NMtlMinrals	1,916	0.001	0.006	0.000	0.008	0.001	0.008	0.001	0.008	0.001
18 BasMetalPrd	29,597	0.046	0.097	0.033	0.123	0.046	0.189	0.079	0.123	0.046
19 FabMetalPrd	4,328	0.015	0.023	0.012	0.048	0.000	0.013	0.018	0.018	0.015
20 Machinery	12,321	0.028	0.067	0.020	0.051	0.028	0.051	0.028	0.051	0.028
21 ElecMchinry	6,922	0.094	0.037	0.090	0.083	0.067	0.029	0.094	0.029	0.094
22 TranspEquip	18,580	0.022	0.101	0.011	0.077	0.022	0.077	0.022	0.077	0.022
23 OthManufact	7,992	0.040	0.043	0.035	0.093	0.010	0.033	0.040	0.033	0.040
24 Electricity	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25 Building	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26 CivilEngrng	1,701	0.004	0.007	0.004	0.008	0.004	0.002	0.001	0.007	0.004
27 Trade	294	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28 AccommCater	9,909	0.021	0.041	0.021	0.041	0.021	0.041	0.021	0.041	0.021
29 Transport	1,682	0.004	0.007	0.004	0.007	0.004	0.002	0.001	0.007	0.004
30 Communication	149	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.000
31 FinancServs	12,491	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026
32 CommunServs	6,569	0.014	0.027	0.014	0.027	0.014	0.022	0.011	0.027	0.014
Total	240,194,406	0.533	0.981	0.444	1.182	0.444	1.134	0.590	1.155	0.590

Source: Authors' calculations from data in the 1998 Social Accounting Matrix.

Table 7
Differences between policy scenarios 1a, 1b, 2a, and 2b

Scenarios	Model	Policy interventions incorporated	Policy data used	Policy conclusions	Closure	Variable(s) shocked
Scenario 1a	UPGEM02; de Wet and van Heerden (2002)	Simulation experiment to evaluate the economy-wide impacts on South Africa of greater diversification by generating non-traditional exports and decreasing the level of traditional exports	Simulation experiments and alternative export demand scenarios (shown in table 6); no data required	Greater export diversity leads to a 0.43% increase in real GDP, a 0.67% increase in total employment, a positive trade balance, and higher levels of productivity	DPSV standard short run	f4q("*agriculture,…, CommunServs* ") = various shocks applied, both positive and negative to result in overall higher degree of export diversification
Scenario 1b	UPGEM02; de Wet and van Heerden (2002)	Simulation experiment to evaluate the economy-wide impacts on South Africa of (b) greater diversification by generating non-traditional exports and keeping traditional exports fixed/constant	As given above	Export diversity with no negative demand shocks leads to a 1.16% increase in real GDP, increased employment, and a positive trade balance	As given above	f4q("*agriculture,…, CommunServs* ") = only positive shocks applied to result in overall higher degree of export diversification.
Scenario 2a	UPGEM02; de Wet and van Heerden (2002)	Simulation experiment to evaluate the economy-wide impacts on South Africa of greater specialization by generating traditional exports and decreasing the level of non-traditional exports	As given above	Greater specialization brings about a 0.08% decrease in real GDP, decreased employment, a negative trade balance, and higher inflation levels	As given above	f4q("*agriculture,…, CommunServs* ") = various shocks applied, both positive and negative to result in overall higher degree of export specialization.
Scenario 2b	UPGEM02; de Wet and van Heerden (2002)	Alternative specialization in exports by simply increasing the export shares of mining and agriculture (resource-based specialization)	As given above	Resource-based specialization brings about a 0.21% decrease in real GDP, along with decreased employment, higher inflation and a negative trade balance	As given above	f4q("*agriculture,…, CommunServs* ") = only positive shocks applied to result in overall higher degree of export specialization.

Source: Framework adapted from Shoven and Whalley (1992: 88-90).

4.2 Scenarios

We simulate four scenarios. In the first two scenarios, we assume that the country further diversify its export basket to a more diversified level than that of China. There are two means for diversifying or concentrating the composition of an export basket: (i) through generating non-traditional exports and decreasing the level of traditional exports, and (ii) by generating non-traditional exports and keeping traditional exports fixed/constant. These two methods are used to perform two alternative scenarios for both diversification and specialization.[12] In the final two scenarios, we assume that the country increases its specialization of exports to a significantly more concentrated level than at present. Finally, we model exports specialization without adversely reducing the output of any sector, by simply increasing the export shares of mining and agriculture (resource-based specialization). In essence, the implementation of the scenarios requires that we specify a quantity adjustment to the current levels of sector exports as is reflected in the SAM. This can be explained with the help of Table 6.

Table 6 shows the various sectors' exports in the 1998 SAM in column 2. Based on these, we calculate a measure of export diversification, S_{jt} (see Equation 4) which we report in column 3. In column 4 we show the situation under the first scenario where the export basket is now more diversified. The corresponding S_{jt} (diversification measure) is calculated in column 5 and shows that export diversification has improved as the S_{jt} measure declines in overall value from 0.533 in the base year to 0.444 in the simulation. This is below the level of China and would be reflective of significant export diversification for the country. An alternative diversity scenario is shown in column 6 where export diversity is modelled with no negative demand shocks applied to any of the sectors in the model. The corresponding S_{jt} measure is calculated in column 7 and yields the same result as in the first scenario. In column 8 the situation with respect to export shares is shown where the export basket overall is now more specialized relative to the base year. Column 9 calculates the S_{jt} measure which indicates that export specialization has increased overall with a S_{jt} of 0.590 compared to 0.533 in the base case. Columns 10 and 11 represent a more resource-based specialization scenario. This is calculated as an alternative to the previous scenario.

A comparison of the four scenarios and the closure rules under which we implement each are contained in Table 7. The results of applying the shocks to exports implied in scenarios 1a, 1b, 2a, and 2b in Table 7 are discussed next.

4.3 Results

We describe the results under the headings of macro-economic results, sectoral impacts and household impacts.

4.3.1 Macroeconomic results

In our simulations we implement scenarios 1a, 1b, 2a, and 2b (described in Table 7) by shocking the variable *f4q* in the UPGEM model. This alters the export basket in order to accurately simulate greater diversification and, alternatively, greater specialization in

[12] With greater specialization the focus will be more on generating traditional exports and either (i) decreasing non-traditional exports, or (ii) keeping non-traditional exports fixed/constant.

South African exports. Both diversity scenarios (1a and 1b) result in an increase in real GDP growth, whereas the specialization scenarios (2a and 2b) cause industries to contract, and imports to increase—with an overall negative impact on GDP.

Table 8 summarizes the impacts of the four scenarios on the main macroeconomic variables. Columns 2 and 4 of the table show the results of greater diversification and greater specialization in exports, respectively, whereas columns 3 and 5 hold the results of both alternative scenarios for diversification/specialization. From the empirical evidence and argument put forward in section 2, it should be recalled that greater export diversification can be expected to be generally associated with faster growth. This is evident from the difference in the percentage change in real GDP of the diversity and specialization scenarios (0.17 and 1.16 per cent increase with greater diversity, compared to a decrease of 0.08 and 0.21 per cent with more specialization). However, these simulations are performed using a short-run comparative static closure and do not imply that greater export diversification will improve long-term growth.

It should be noted that although the two export scenarios are implemented over a period of one year, the impact is simulated as a once-off event that plays itself out over a period of about two-three years. The results are then annualized and the impact can therefore be discounted back to reflect annual adjustments over the 1-year period. From Table 8 it is evident that real GDP growth increases under both diversity scenarios on an annualized basis, though the increase is more significant under the scenario of greater export diversity with no negative demand shocks (1.16 per cent compared to 0.43 under scenario 1a).

The more favourable effects of scenario 1a and 1b (greater export diversification) on GDP growth are due to higher overall exports and a more substantial improvement in the trade balance. Conversely, scenario 2a and 2b show less favourable effects on GDP growth resulting from deterioration in the trade balance. In these results, changes in relative consumer prices and their impacts on competitiveness are important. Changes in

Table 8
Impact on macro-economic variables (% change relative to the base case)

		Scenarios			
	Annualized % change	1a	1b	2a	2b
1	% Δ in real GDP* (x0gdpexp)	0.17	1.16	-0.08	-0.21
2	% Δ in aggregate employment (employ_iop)	0.24	2.54	-0.28	-0.48
3	% Δ in GDP price index (p0gdpexp)	0.14	2.68	2.25	1.92
4	% Δ in consumer prices (p3tot)	0.51	2.17	1.66	1.00
5	% Δ in average nominal wage (p1lab_iop)	0.51	2.17	1.66	1.00
6	% Δ in exports price index (p4tot)	-0.90	2.15	2.56	3.22
7	% Δ in total supplies of imported goods (x0imp)	0.87	3.99	2.46	1.22
8	% Δ in export volume (x4tot)	1.28	7.03	1.94	0.45
9	% Δ in Import volume CIF (x0cif_c)	0.87	3.99	2.46	1.22
10	% Δ in competitiveness (p0realdev)	-0.14	-2.61	-2.20	-1.88
11	% Δ in contribution of balance of trade to real GDP (contBOT)	0.17	1.16	-0.08	-0.21
12	% Δ in the terms of trade (p0toft)	-0.90	2.15	2.56	3.22

Note: *Real GDP from expenditure side.

Source: UPGEM model results.

competitiveness will affect foreign export demands and domestic demands for imports. As can be seen from Table 8, deterioration in the terms of trade of 0.90 per cent (scenario 1a) results in an increase in consumer prices. On the other hand, under scenario 2, the terms of trade improvement results in a smaller increase in consumer prices.

In our scenarios greater export diversification results in a more substantial increase in exports (1.28 and 7.03 per cent) than in the case of greater export specialization (1.94 and 0.45 per cent). This requires a fall in export prices (*p4tot*) and leads to an increase in imports in scenario 1a, although the net result is of an improvement in the trade balance. Movements in the trade balance occur due to activity effects and relative price effects.

If South Africa were to specialize in mining exports, such exports would need to grow or increase from the base year by approximately 300 per cent (with no increase in the export demand for other sectors) to result in the same level of growth of total export volumes as under scenario 1a.

Another reason for the higher imports in scenario 1a is a substitution away from domestically produced goods and towards imports as consumer prices increase. In contrast, under scenario 2, with a fall in consumer prices and an increase in competitiveness, import levels fall.

The simulation results also indicate that employment levels will increase with greater diversity and decrease with more specialization. Once again, the increase is more significant under scenario 1b, which can be attributed to the higher level of exports (7.03 per cent) resulting from greater export diversity and because no negative demand shocks were applied.

Table 8 also shows an increase in inflation under all scenarios, though the increase is more significant with greater export diversity. The price increase experienced is due to increases in the average nominal wage. The price level of goods and services (*p3tot*), and nominal wages (*p1lab_iop*) both increase by more than 2 per cent with greater diversification, and increase by less than 2 per cent with greater specialization.[13] The increase in household income in turn leads to higher demand for final products due to less pressure on household budgets, placing upward pressure on domestic prices. In order to achieve equilibrium in both the demand and supply side of the economy, prices have to increase even further, and the spiral effect leads to even more production, more employment etc. until all endogenous variables reaches equilibrium values. The change in the general level of prices is mainly due to changes in the terms of trade, and the fact that real wages are held constant in this model closure, which forces nominal wages to decline with the same amount.

The combined increase in household income and production output causes imported commodity volumes to increase by approximately 0.87 and 3.99 per cent respectively with greater diversification, while the imported price index stays constant as South Africa is assumed to be a price taker in the international market.

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[13] The simulations are done using a short-term comparative static closure for the model. Herein, the rate of return on capital, trade balance, technology variables and the real wage (*realwage*), amongst others, are taken as exogenous. On the income-side of GDP we have *realwage* and capital exogenous (and real cost of labour) and nominal rate of return on capital to adjust. On the expenditure-side of GDP we have *C, I, G* exogenous, which only leaves the trade balance to adjust.

4.3.2 Sector impacts

Tables 9, 10, 11, and 12 set out the sector impacts for scenarios 1a, 1b, 2a, and 2b respectively.

Production volumes in South Africa under scenarios 1a and 1b are higher by approximately 0.26 and 3.89 per cent, respectively, with increased production in most of the sectors (see Tables 9 and 10). The basis for the overall improvement in production levels throughout the economy is due to greater overall export volumes resulting from the diversification of exports. Export growth was thus the main contributor to the

Table 9
Sector results for scenario 1a (structural effects)

	Value added		Exports		Imports		Employment	
	Volume (x1tot)	Price (p1tot)	Volume (x4tot)	Price (p4tot)	Volume (x0imp)	Price (p0imp)	Volume (employ_op)	Price (p1lab_op)
1 Agriculture	0.32	2.41	18.43	2.36	1.52	0.00	1.14	0.51
2 Gold mining	-4.80	-5.59	-4.83	-5.40	-11.10	0.00	-6.85	0.51
3 Other mining	-1.03	-3.60	-2.32	-3.47	-5.68	0.00	-2.53	0.51
4 Food processing	-4.04	0.14	-30.27	0.10	-0.69	0.00	-7.66	0.51
5 Beverages	0.38	0.86	25.74	0.84	2.05	0.00	1.48	0.51
6 Tobacco	0.38	0.86	25.27	0.93	2.36	0.00	1.49	0.51
7 Textiles	-7.00	-0.04	-29.57	-0.15	0.51	0.00	-8.62	0.51
8 Clothing	5.03	0.54	26.97	0.59	1.80	0.00	5.77	0.51
9 Leather	-16.63	-1.09	-26.75	-1.13	-1.91	0.00	-25.15	0.51
10 Footwear	1.43	0.43	27.82	0.42	0.95	0.00	2.30	0.51
11 Wood	7.23	1.36	23.21	1.35	3.73	0.00	9.59	0.51
12 Paper	-7.30	-1.86	-24.30	-1.94	-3.92	0.00	-15.03	0.51
13 Printing and publishing	1.49	0.39	27.83	0.42	0.66	0.00	2.44	0.51
14 Chemicals	0.29	0.15	0.80	0.13	0.20	0.00	0.74	0.51
15 Rubber	4.36	1.62	21.86	1.63	2.62	0.00	9.03	0.51
16 Plastic	4.21	0.65	26.91	0.60	1.63	0.00	5.28	0.51
17 Non-metallic minerals	-3.48	-1.06	-26.87	-1.09	-1.97	0.00	-6.80	0.51
18 Basic metal products	-6.86	-2.32	-13.41	-2.31	-0.78	0.00	-14.46	0.51
19 Fabricated metal products	4.53	0.68	26.46	0.69	1.66	0.00	7.43	0.51
20 Machinery	11.01	1.47	22.52	1.49	0.92	0.00	16.58	0.51
21 Electrical machinery	7.39	1.45	22.66	1.46	1.87	0.00	13.17	0.51
22 Transport equipment	8.78	1.13	24.14	1.16	3.90	0.00	13.43	0.51
23 Other manufacturing	3.30	3.56	13.12	3.54	4.67	0.00	12.02	0.51
24 Electricity	-0.77	-0.78	0.00	0.00	0.00	0.00	-2.54	0.51
25 Building	0.01	0.22	0.00	0.00	0.00	0.00	0.02	0.51
26 Civil engineering	-0.08	0.16	-0.64	0.16	0.00	0.00	-0.14	0.51
27 Trade	0.54	0.62	-2.40	0.61	0.00	0.00	1.02	0.51
28 Accommodation and catering	-0.19	0.15	-0.44	0.11	0.12	0.00	-0.76	0.51
29 Transport	-0.30	0.32	-1.27	0.32	0.11	0.00	-0.65	0.51
30 Communication	0.21	0.60	-2.36	0.60	0.00	0.00	0.48	0.51
31 Financial services	0.06	0.55	-2.14	0.54	0.00	0.00	0.18	0.51
32 Communication services	-0.02	0.48	-1.87	0.47	0.85	0.00	-0.03	0.51
Industry average	**0.26**	**0.14**	**5.13**	**0.16**	**0.19**	**0.00**	**0.39**	**0.51**

Source: UPGEM model results.

Table 10
Sector results for scenario 1b (structural effects)

		Value added		Exports		Imports		Employment	
		Volume (x1tot)	Price (p1tot)	Volume (x4tot)	Price (p4tot)	Volume (x0imp)	Price (p0imp)	Volume (employ_op)	Price (p1lab_op)
1	Agriculture	-0.21	0.57	-2.42	0.61	1.19	0.00	-0.73	2.17
2	Gold mining	-1.27	0.27	-1.32	0.33	10.39	0.00	-1.88	2.17
3	Other mining	-0.47	0.10	-0.66	0.17	0.21	0.00	-1.18	2.17
4	Food processing	-0.75	1.27	-4.85	1.25	1.97	0.00	-1.44	2.17
5	Beverages	1.57	3.85	98.84	3.71	9.58	0.00	6.20	2.17
6	Tobacco	1.59	3.88	105.95	4.27	11.27	0.00	6.27	2.17
7	Textiles	0.27	1.66	-6.14	1.60	6.88	0.00	0.34	2.17
8	Clothing	13.01	2.34	74.70	2.42	7.63	0.00	15.01	2.17
9	Leather	-1.42	1.36	-2.09	1.36	5.62	0.00	-2.23	2.17
10	Footwear	2.45	1.95	68.87	1.87	4.80	0.00	3.95	2.17
11	Wood	12.67	2.96	33.11	2.77	10.79	0.00	16.90	2.17
12	Paper	-0.97	1.54	-5.78	1.50	3.07	0.00	-2.05	2.17
13	Printing and publishing	4.89	2.89	123.19	3.05	3.32	0.00	8.05	2.17
14	Chemicals	-0.81	1.26	-4.71	1.21	3.01	0.00	-2.05	2.17
15	Rubber	10.31	4.58	58.28	4.61	4.35	0.00	21.86	2.17
16	Plastic	22.08	3.31	145.78	3.20	8.38	0.00	28.12	2.17
17	Non-metallic minerals	-0.34	1.64	-0.41	1.64	3.44	0.00	-0.67	2.17
18	Basic metal products	-1.06	1.45	-5.53	1.43	10.69	0.00	-2.29	2.17
19	Fabricated metal products	18.55	4.94	118.66	5.07	10.85	0.00	31.45	2.17
20	Machinery	-3.97	1.43	-5.40	1.40	0.62	0.00	-5.81	2.17
21	Electrical machinery	35.95	7.61	113.68	7.69	7.17	0.00	68.82	2.17
22	Transport equipment	-3.47	1.30	-4.96	1.28	1.18	0.00	-5.18	2.17
23	Other manufacturing	13.87	16.20	54.66	16.03	21.62	0.00	55.77	2.17
24	Electricity	0.27	2.28	0.00	0.00	0.00	0.00	0.91	2.17
25	Building	0.03	1.98	0.00	0.00	0.00	0.00	0.05	2.17
26	Civil engineering	0.33	2.05	5.22	2.05	0.00	0.00	0.58	2.17
27	Trade	0.49	2.30	-8.69	2.30	0.00	0.00	0.93	2.17
28	Accommodation and catering	-0.74	0.79	-2.59	0.66	1.31	0.00	-3.03	2.17
29	Transport	0.55	2.21	-7.06	2.21	3.17	0.00	1.22	2.17
30	Communication	0.74	2.61	62.82	2.61	0.00	0.00	1.69	2.17
31	Financial services	0.02	2.18	-8.25	2.18	0.00	0.00	0.07	2.17
32	Communication services	0.38	2.13	-8.04	2.12	4.88	0.00	0.45	2.17
	Industry average	**3.89**	**2.72**	**30.78**	**2.58**	**4.92**	**0.00**	**7.50**	**2.17**

Source: UPGEM model results.

Table 11
Sector results for scenario 2a (structural effects)

		Value added		Exports		Imports		Employment	
		Volume (x1tot)	Price (p1tot)	Volume (x4tot)	Price (p4tot)	Volume (x0imp)	Price (p0imp)	Volume (employ_op)	Price (p1lab_op)
1	Agriculture	0.79	7.07	31.89	6.94	8.74	0.00	2.88	1.66
2	Gold mining	-0.10	1.47	-0.10	1.48	2.99	0.00	-0.15	1.66
3	Other mining	0.05	1.80	-1.44	1.79	8.69	0.00	0.14	1.66
4	Food processing	-3.67	2.44	-21.95	2.43	3.27	0.00	-6.97	1.66
5	Beverages	-0.42	1.28	-4.78	1.23	3.04	0.00	-1.63	1.66
6	Tobacco	-0.42	1.28	-5.09	1.31	3.24	0.00	-1.62	1.66
7	Textiles	-14.99	0.79	-51.82	0.55	-3.00	0.00	-18.31	1.66
8	Clothing	-1.36	1.14	-4.63	1.19	3.33	0.00	-1.55	1.66
9	Leather	-4.54	1.32	-5.12	1.32	0.22	0.00	-7.07	1.66
10	Footwear	-1.42	0.98	-3.84	0.98	2.20	0.00	-2.26	1.66
11	Wood	-14.80	0.52	-41.41	0.43	-2.65	0.00	-19.07	1.66
12	Paper	-2.05	1.12	-4.31	1.11	0.29	0.00	-4.33	1.66
13	Printing and publishing	-0.64	1.24	-3.99	1.02	0.66	0.00	-1.05	1.66
14	Chemicals	8.36	4.91	33.79	5.07	6.11	0.00	22.35	1.66
15	Rubber	-1.88	1.54	-5.77	1.50	0.99	0.00	-3.80	1.66
16	Plastic	-0.89	1.85	-6.91	1.81	2.89	0.00	-1.11	1.66
17	Non-metallic minerals	-1.98	0.87	-3.39	0.87	0.09	0.00	-3.89	1.66
18	Basic metal products	13.23	5.74	22.96	5.71	9.20	0.00	30.55	1.66
19	Fabricated metal products	-5.23	1.15	-30.89	1.12	2.76	0.00	-8.39	1.66
20	Machinery	-3.29	1.23	-4.78	1.23	0.65	0.00	-4.83	1.66
21	Electrical machinery	-2.44	1.11	-4.32	1.11	-0.02	0.00	-4.22	1.66
22	Transport equipment	-2.68	1.00	-3.88	0.99	0.87	0.00	-4.01	1.66
23	Other manufacturing	-0.90	0.62	-2.44	0.62	0.83	0.00	-3.14	1.66
24	Electricity	0.99	2.83	0.00	0.00	0.00	0.00	3.31	1.66
25	Building	-0.12	1.18	0.00	0.00	0.00	0.00	-0.19	1.66
26	Civil engineering	-4.69	0.36	-71.00	0.34	0.00	0.00	-8.24	1.66
27	Trade	-0.29	1.42	-5.49	1.42	0.00	0.00	-0.55	1.66
28	Accommodation and catering	-0.68	0.55	-1.96	0.50	0.70	0.00	-2.78	1.66
29	Transport	-0.51	1.43	-72.99	1.43	2.54	0.00	-1.13	1.66
30	Communication	-0.27	1.33	-5.16	1.33	0.00	0.00	-0.62	1.66
31	Financial services	-0.26	1.26	-4.91	1.27	0.00	0.00	-0.78	1.66
32	Communication services	-1.95	1.35	-22.44	1.32	1.77	0.00	-2.31	1.66
	Industry average	**-1.53**	**1.69**	**-9.57**	**1.54**	**1.89**	**0.00**	**-1.71**	**1.66**

Source: UPGEM model results.

Table 12
Sector results for scenario 2b (structural effects)

		Value added		Exports		Imports		Employment	
		Volume (x1tot)	Price (p1tot)	Volume (x4tot)	Price (p4tot)	Volume (x0imp)	Price (p0imp)	Volume (employ_op)	Price (p1lab_op)
1	Agriculture	1.03	7.93	27.99	7.74	11.77	0.00	3.78	1.00
2	Gold mining	5.53	11.19	5.57	10.84	29.21	0.00	9.03	1.00
3	Other mining	1.44	7.76	5.31	7.54	7.50	0.00	3.88	1.00
4	Food processing	-2.27	2.64	-9.97	2.66	3.84	0.00	-4.35	1.00
5	Beverages	-0.31	0.93	-3.54	0.91	2.28	0.00	-1.18	1.00
6	Tobacco	-0.31	0.93	-3.69	0.95	2.38	0.00	-1.18	1.00
7	Textiles	-1.58	0.85	-3.35	0.85	0.24	0.00	-1.96	1.00
8	Clothing	-0.93	0.69	-2.74	0.70	2.07	0.00	-1.06	1.00
9	Leather	-3.05	0.91	-3.51	0.90	0.50	0.00	-4.77	1.00
10	Footwear	-0.64	0.58	-2.29	0.58	1.54	0.00	-1.03	1.00
11	Wood	-2.37	1.44	-5.61	1.45	2.52	0.00	-3.11	1.00
12	Paper	-1.33	0.67	-2.62	0.66	0.06	0.00	-2.81	1.00
13	Printing and publishing	-0.51	0.65	-2.55	0.65	0.37	0.00	-0.82	1.00
14	Chemicals	-1.21	0.73	-2.84	0.72	0.40	0.00	-3.05	1.00
15	Rubber	-0.91	0.78	-3.05	0.78	0.77	0.00	-1.85	1.00
16	Plastic	-1.26	0.66	-2.59	0.66	-0.08	0.00	-1.57	1.00
17	Non-metallic minerals	-1.03	0.80	-3.11	0.79	1.16	0.00	-2.04	1.00
18	Basic metal products	-1.98	0.57	-2.23	0.57	-0.23	0.00	-4.28	1.00
19	Fabricated metal products	-0.93	0.55	-2.17	0.55	0.59	0.00	-1.50	1.00
20	Machinery	-1.38	0.49	-1.92	0.49	0.16	0.00	-2.03	1.00
21	Electrical machinery	-0.89	0.43	-1.71	0.43	0.07	0.00	-1.55	1.00
22	Transport equipment	-1.29	0.47	-1.85	0.47	0.44	0.00	-1.93	1.00
23	Other manufacturing	-0.69	0.39	-1.59	0.40	0.53	0.00	-2.42	1.00
24	Electricity	-0.10	1.08	0.00	0.00	0.00	0.00	-0.32	1.00
25	Building	-0.03	0.76	0.00	0.00	0.00	0.00	-0.04	1.00
26	Civil engineering	-0.08	0.82	-3.26	0.83	0.00	0.00	-0.15	1.00
27	Trade	-0.32	0.74	-2.91	0.74	0.00	0.00	-0.60	1.00
28	Accommodation and catering	-0.42	0.38	-1.33	0.34	0.56	0.00	-1.73	1.00
29	Transport	-0.22	0.74	-2.89	0.74	0.85	0.00	-0.48	1.00
30	Communication	-0.19	0.71	-2.81	0.72	0.00	0.00	-0.44	1.00
31	Financial services	-0.27	0.58	-2.30	0.58	0.00	0.00	-0.82	1.00
32	Communication services	-0.46	0.84	-3.29	0.84	0.78	0.00	-0.55	1.00
	Industry average	**-0.59**	**1.55**	**-1.34**	**1.47**	**2.20**	**0.00**	**-1.03**	**1.00**

Source: UPGEM model results.

Table 13
Decomposition of demand for locally produced goods (percentage change)

Fandecomp	LocalMarket	DomShare	Export	Total
	SCENARIO 1a			
Goldmining	0.01	0.00	-4.81	-4.79
OtherMining	-0.43	1.09	-1.71	-1.05
FoodPrcsing	-0.41	0.03	-3.66	-4.04
Beverages	-0.14	-0.20	0.70	0.36
Tobacco	-0.08	-0.19	0.68	0.41
	SCENARIO 1b			
Plastic	3.57	-1.07	19.24	21.74
NMtlMinrals	0.59	-0.88	-0.06	-0.35
BasMetalPrd	2.93	-0.41	-3.57	-1.06
FabMetalPrd	0.97	-2.40	19.88	18.45
Machinery	0.01	-0.91	-2.86	-3.76
	SCENARIO 2a			
Textiles	-2.08	0.10	-13.02	-14.99
Clothing	-0.01	-0.84	-0.88	-1.73
Leather	-0.47	-0.76	-3.33	-4.56
Footwear	0.15	-1.28	-0.29	-1.42
Wood	-2.28	-0.14	-12.44	-14.85
	SCENARIO 2b			
Agriculture	-1.51	-1.29	3.87	1.07
Goldmining	0.00	0.00	5.54	5.54
OtherMining	-0.28	-2.18	3.92	1.46
FoodPrcsing	-0.39	-0.62	-1.21	-2.22
Beverages	-0.02	-0.21	-0.10	-0.33

Source: UPGEM model results.

industries gaining the most, who also experienced an increase in employment levels resulting from greater diversity. With some exceptions, the most trade-exposed sectors did the best. Scenarios 2a and 2b result in decreased levels of production of 1.53 and 0.59 per cent respectively, mainly owing to the decreased export volumes experienced by the majority of sectors resulting from greater specialization in only a few sectors.

Table 9 shows that under our scenario of greater export diversity, traditional export sectors in the South African economy such as gold mining, other mining, basic metal products, electricity, and the transport sectors experience reductions in export volumes. These sectors experienced significant decreases in their export volume (see Table 6 for changes in diversification) which is a direct result of the exogenous shocks applied to the model.

The alternative export diversification scenario (see Table 10) shows a better overall improvement across all sectors. Once again the traditional export sectors as well as some of the non-trading sectors lose out under this scenario even though the overall effect is much more positive than that of scenario 1a.

Tables 9 and 10 also show that these are the sectors where the job loss is the greatest. In the base case, these sectors were more specialized, but with increased diversity they have become less so. The lower levels of output in the electricity and transport sectors are mainly due to capacity constraints (since both sectors produce mainly for the

domestic market and are thus less export oriented). Conversely, Tables 11 and 12 show that chemicals, basic metal products, gold and other mining (the more traditional export sectors in the model) are the sectors that benefit the most from greater specialization, whereas the majority of sectors experience decreased levels of output. This is a direct result of these sectors experiencing increased exports due to greater specialization. The results in Tables 9 and 10 thus show a more positive economy-wide effect than those in Tables 11 and 12.

We decompose the change in demand for the more traditional trading sectors, under all scenarios, between (i) the local market effect (measured as the change in non-export demand for goods and other sectoral outputs), (ii) domestic share effect (measured as the change in domestic use/import ratio for the sectors' output demand) and (iii) the export effect (measured as a change in demand for goods and output exports). In Table 13 the results of this decomposition show that in the case of gold and other mining under scenario 1a and 2b, fluctuations (negative or positive) in demand come primarily through a change in exports. Export demand changes as the export basket becomes more diversified/specialized.

4.3.3 Household impacts

Tables 14 and 15 summarize the differential impacts of export diversification-specialization on households. The 1998 SAM used as basis for the model makes a distinction between white (W), coloured (C), Asian (A) and black (B) households (see Statistics South Africa 2004; 2002). Table 14 shows how these households' consumption (a rough measure of their welfare) is affected by either greater export diversification/specialization. It shows black households tend to suffer somewhat reduced consumption under scenarios 1a, 1b, and 2a, but increase their consumption levels in scenario 2b which is a direct result of the large increase in employment in the more labour-intensive sectors of agriculture and mining. White households suffer a somewhat reduced consumption under scenarios 1b and 2b, whereas coloured and Asian households increase their consumption levels with greater diversity, but experience decreased consumption with greater specialization. These changes in consumption are mainly driven by changes in the consumer price index faced by each household (which depends on its consumption basket) and incomes, which result from its share of unskilled labour. White households experience increased consumption under a scenario with greater specialization in exports, with coloured, Asian and black households experiencing reduced consumption. Conversely, these changes in consumption are driven by both changes in consumer prices as well as decreased levels of employment in the more labour intensive sectors.

Table 14
Percentage change in real household consumption by population group (percentage change)

	Households (x3tot_h)	SCENARIO 1a	SCENARIO 1b	SCENARIO 2a	SCENARIO 2b
1	White	0.11	-0.42	0.65	-0.03
2	Coloured	1.10	2.13	-1.08	-0.60
3	Asian	0.50	1.16	-0.70	-0.65
4	Black	-0.37	-0.08	-0.42	0.22

Source: UPGEM model results.

Table 15

Percentage change in nominal total household consumption (percentage change) [14]

w3totx (quintiles)	W	C	A	B
q1 – d10 (1a)	0.63	1.63	1.01	0.13
q1 – d10 (1b)	1.86	4.27	3.33	1.99
q1 – d10 (2a)	2.23	0.70	0.91	1.32
q1 – d10 (2b)	0.80	0.53	0.29	1.37

Source: UPGEM model results.

In terms of nominal total consumption, Table 15 shows that coloured and Asian households gain proportionally more than others from the greater export diversity. In contrast, white and black households gain proportionally more than others from greater specialization.

Table 15 shows that greater diversification has quite a large effect on the distribution of real consumption, as well as showing that there is some variation across households in the effects of the increase in consumption price indices that comes with greater specialization. This variation across households is explained primarily by the effect of the change in the employment prospects of the households. For example, low-income Asians, who experience the smallest increases in consumption under the specialization scenarios, are relatively heavily concentrated in the textile sector, a sector which is adversely affected by greater specialization. Conversely, with greater diversification, the opposite is true. On the other hand, with improved diversity, high-income coloureds, who experience the largest increases in consumption (see Table 14 and 15), are relatively heavily concentrated in the former non-traded sectors which gain from greater diversity.

5 Concluding remarks

Should developing countries focus on diversifying their export basket or should they instead specialize their exports according to their existing comparative advantage?

In this paper we attempted to answer this question by reviewing the literature on export diversification and specialization, by investigating the extent of export diversification and specialization in South Africa over the period 1962-2000 and its relationship to GDP per capita, and using a computable general equilibrium (CGE) model to investigate the economy-wide impacts of greater export diversification versus greater export specialization.

We found that although South Africa has a relatively diversified export basket when compared to averages for developing regions, its export basket is less diversified than that of the fast growing emerging economies such as Brazil, China or India, and much less diversified than that of its developed trading partners such as the USA.

[14] The reason for the percentage changes per group being the same across quintiles may be attributed to the equation *w3totx(h,p) = w1lab_io(p) + f3labinc*, with *f3labinc* (household consumption/wage income shifter) constant at -0.192, and *w1lab_io* (aggregate payments to labour) varying across household groups.

Over time, there have been relatively little changes in increasing the extent of export diversification. During the period 1962 to 2000, export diversification first decreased, after which it started to revert back to 1962 levels during the middle to end of the 1990s.

We also found evidence that the relationship between export specialization and GDP per capita in South Africa is U-shaped, similar to what we found for a cross-section of countries. This is consistent with the theoretical relationship between a country's level of development and export diversification as put forward in the literature.

Furthermore, increased export diversification may be good for development in South Africa in that export diversity was found to Granger-cause GDP per capita over the period. Further evidence of the positive impact of export diversity was obtained through a simulation of the effects of greater export diversification versus greater export specialization on the South African economy. The CGE modelling results indicated that export diversification results in higher GDP per capita and employment. The main channel for this result is that greater export diversification results in a more substantial increase in exports (of between 1.28 and 7.03 per cent) than in the case of greater export specialization.

We also established that changes in export diversification levels have implications for household inequality, with greater diversification likely to result in greater levels of overall inequality unless accompanied by measures (such as investment in expanding quality education) that would allow black households to upgrade their level of skills, which in turn allows entry into the non-traditional sectors that benefit relatively more during diversification.

The policy implications from these findings suggest that an emphasis on diversifying exports in South Africa's trade and industrial policies—as is currently the case—can be justified. From the discussion in section 2 of this paper the implication is that a prerequisite for export diversification would be to diversify the production structure of the domestic economy. As was stressed, this does not require a return to the infant-industry argument for protection: trade policy has been found not to be the first-best policy to address this. Better ways that have been identified from the literature (see section 2) include financial sector development/credit market intervention coordination of investments between sectors and science and technology policy to raise the rate of creativity (innovation) and information spillovers in a country in order to find dynamic comparative advantages. Also, production diversification may be the result from a growing demand for a variety of goods as South Africa's GDP per capita increases which, in turn, would suggest that policies which would allow a broad sharing in the benefits of economic growth would by itself be better for diversification and even yet further growth. In this way South Africa's high income distribution may act as a brake on the diversification of its production and export sectors.

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