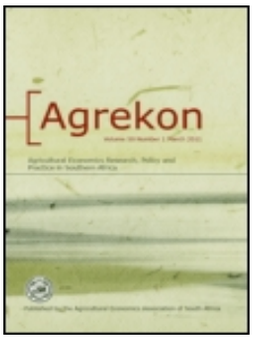

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The rise of Brazilian agriculture: some lessons for South Africa

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THE RISE OF BRAZILIAN AGRICULTURE: SOME LESSONS FOR SOUTH AFRICA

Hans Grinsted Jensen[1], Nick Vink[2] and Ron Sandrey[3]

ABSTRACT

The purpose of this article is to explore some of the possible lessons for South African agriculture from the Brazilian experience. To this end, the article discusses the performance of Brazilian agriculture in terms of land and labour use, production, and exports. This is followed by aspects of Brazilian agricultural policies, namely farmer support, the research and technology transfer system and land issues. The implications for South African agriculture can be summarized as the recognition that history, geography, the development path and agricultural policies all matter. The article then identifies five important lessons for agricultural development in South Africa.

Key words: Brazil, South Africa, agriculture, policy

JEL Classification: Q15; Q16: Q17: Q18

1 INTRODUCTION

The purpose of this article is to explore some of the possible lessons for South African agriculture from Brazil's emergence as a major player in global agricultural markets. To that end, the article starts with a discussion of Brazil's agricultural performance: land use and availability are addressed together with the production and export performance. In section 3 the agricultural policy of Brazil is analysed with a focus on the rates of support to farmers, while the implications for South Africa are assessed in section 4. Section 5 concludes.

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2 AGRICULTURE IN BRAZIL

In this section Brazilian agriculture is briefly described for the benefit of South African readers who may be less familiar with some of the intricacies of that country, and its remarkable performance in agriculture over the past few decades.

2.1 Land and labour use

Brazil ranks third in the world in terms of available arable land (after the USA and China), and has 5.42 per cent of the world's agricultural land and 4.43 per cent of the arable land. Table 1 shows average farm sizes in the *cerrado* or savannah regions of Brazil, which is the main area of new land brought under cultivation over the past three decades, especially of soybeans[4]. The areas furthest south (Rio Grande do Sul and Paraná) have been settled the longest, and farms are small – in both these states more than 90 per cent are smaller than 100 hectares. At the other extreme, in Mato Grosso, which is the heart of the *cerrado* areas that were transformed from extensive grazing on natural pastures to grazing on planted pastures and to cropping areas (Barros *et al.*, 2007; Zylbersztajn, 2010), more than 90 per cent of the farms are larger than 100 hectares, and almost 45 per cent larger than 1 000 hectares.

Table 1: The distribution of farm sizes in the Brazilian cerrado, 2005

State	< 10 ha	10-99 ha	100-999 ha	1000-9999 ha	>10000 ha
	per cent				
Mato Grosso	0.3	5.8	51	40.5	2.4
Goiás	0.7	20	62.2	16.9	0.2
Mato Grosso do Sul	12.6	39.6	38.2	9.2	0.5
Rio Grande do Sul	27.9	66.7	5.1	0.3	0
Paraná	20.4	68.4	10.7	0.5	0

Note: Rows do not add to 100 due to rounding

Source: Conte, 2006

While total employment in Brazilian agriculture declined by 9.4% from 1970 to 2006, employment on farms smaller than 10 hectares declined even more modestly, by 5.3%. However in the centre-west there was a bigger decline in farm

4 Note that sugar expansion takes place in a different part of the country, namely in the North-Northeast and Centre-South Regions (around Sao Paolo) (Deuss, 2012).

employment on farms of less than 10 hectares, namely 23%, or from 160 000 to 130 000 workers. By contrast, total farm employment in the region increased by 9% over this period (from 920 000 to a million) as production shifted from extensive grazing to field crops (Ferreira Filho and De Freitas Vian, 2013).

2.2 Agricultural production

Table 2 compares the growth of Brazilian agriculture from 1995 to 2012 with the other BRICS countries. Brazil outperformed all these countries over the entire period. Nevertheless, only Russia experienced slower growth than the world average over this period.

Beef, sugar and soybeans (in that order) have been Brazil's top three agricultural products by value of production since at least 1980, while chicken meat moved from seventh place in 1980 to fourth after 1990 (FAOSTAT, 2013). Brazil currently ranks as the world's largest producer of sugar cane, oranges and coffee; number two in beef and soybeans; number three in chicken meat and maize; number four in cow's milk; number five in pig meat; and number nine in rice.

Table 2: Index of agricultural production (2004-2006 = 100)

	1995	2000	2005	2010	2012
Brazil	100	116	149	183	190
China	100	125	147	175	186
India	100	112	123	154	161
Russian Federation	100	88	99	94	108
South Africa	100	130	137	158	162
World	100	113	128	144	149

Source: FAOSTAT, 2013

2.3 Brazil's agricultural export performance

The most visible aspect of Brazilian agriculture in recent years has been its performance as an exporter. Globally, the USA is the largest exporter with Brazil essentially in second place as countries such as the Netherlands, Germany and France, while large exporters, are the main conduits for exports from outside Europe into the EU.

To put this into perspective, Table 3 shows the agricultural exports and the growth rates in exports from the 1980s for the top fifteen exporters plus South Africa. Only Indonesia has equalled or outperformed Brazil in every period, followed by Spain and China, while the performances from the USA, France,

Canada, Italy and Australia have all been modest. South Africa represents a mixed case. The country's performance from 1980 is relatively weak, reflecting the decade of sanctions and boycotts of the 1980s. However, in the 1990s agricultural exports did well, being overshadowed only by the fast-growing Brazil, Spain, Indonesia and Argentina, and posting growth on a par with Canada, China and Thailand.

Figure 1 shows the real growth of Brazilian exports relative to South Africa. From the early 2000s, the collapse in the value of the South African Rand made exports more competitive, resulting in a decline in the ratio, albeit only temporarily. South Africa again outstripped Brazil between 2007 and 2009, but in the intervening years Brazil's performance has been better in both absolute and relative terms.

Table 3: Global agricultural exports, 1980-2011

	$m				Change in 2011 over		
	1980	1990	2000	2011	1980	1990	2000
USA	42921186	45221987	56480144	139891089	3.26	3.09	2.48
Netherlands	16091315	30927503	27884754	89329878	5.55	2.89	3.20
Germany	11021979	20374986	24147298	80321346	7.29	3.94	3.33
Brazil	9320492	8763783	12761345	79630341	8.54	9.09	6.24
France	18519111	33432321	32910426	73960489	3.99	2.21	2.25
Argentina	5518628	6976824	10776093	43206677	7.83	6.19	4.01
Belgium			17151412	42909630			2.50
China	3302468	8396162	12111752	42304534	12.81	5.04	3.49
Indonesia	2736910	2802390	4946439	41867553	15.30	14.94	8.46
Canada	7071758	9181264	15657861	41041943	5.80	4.47	2.62
Italy	5677448	11134930	15603560	40992469	7.22	3.68	2.63
Spain	3566320	7825934	13999090	40915988	11.47	5.23	2.92
Thailand	3344140	5387818	7275250	36779807	11.00	6.83	5.06
Malaysia	3953241	4359970	5820951	35709575	9.03	8.19	6.13
Australia	9216112	11758793	15455193	32655860	3.54	2.78	2.11
South Africa	2412905	1798060	2151293	6913921	2.87	3.85	3.21

Source: FAOSTAT, 2012

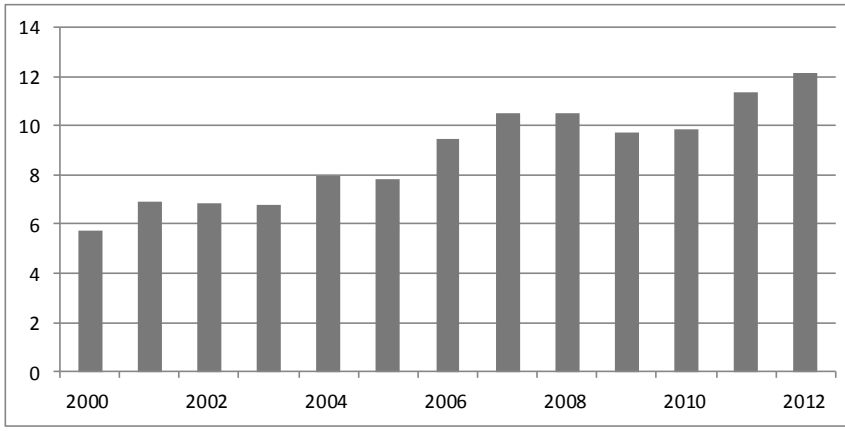

Figure 1: The ratio of Brazilian to South African agricultural exports

Source: Global Trade Atlas

Table 4 shows Brazil's five largest agricultural exports by value from 2003 to 2013 as well as the growth over this period. These commodities represented 57% of all agricultural exports in 2003 and just on 62% in 2013. The top 20 items at the HS 4 level represented 83 per cent of total agricultural exports in 2013. Soybeans and sugar dominate[5].

A more detailed analysis of Brazil's agricultural exports by destination in 2013 shows that:

- Three quarters of soybean exports were destined for China;
- China was the main destination for raw sugar exports, followed by Bangladesh and Algeria;
- Six of the top ten destinations for refined cane sugar were in Africa;
- The main destinations for coffee were the US, Germany, Japan and Italy, with eight of the top eleven being EU destinations;
- The top three export destinations for soybean cake were European countries, followed by Korea and Thailand; and
- Saudi Arabia was the biggest destination for chicken meat, followed by Japan, UAE, Hong Kong and China. South Africa was in 9th place.

5 This is even more apparent when soybean oilcake and soybean oil are added, as the combined soybean complex then adds up to thirty five per cent of total exports in 2013.

Table 4: Brazilian agricultural exports by commodity, HS 4 level, 2003-2011

	2003	2006	2009	2010	2011	2012	2013	2013/ 2003
	$m							
Total agriculture	21247	36516	54609	63486	81469	83204	86419	4.07
Soybeans	4290	5663	11424	11043	16327	17455	22812	5.32
% of total	20.19	15.51	20.92	17.39	20.04	20.98	26.40	
Sugar	2140	6167	8378	12762	14942	12845	11842	5.53
% of total	10.07	16.89	15.34	20.10	18.34	15.44	13.70	
Coffee	1316	2953	3791	5204	8026	5740	4598	3.49
% of total	6.19	8.09	6.94	8.20	9.85	6.90	5.32	
Poultry	1862	3039	4945	5952	7243	6948	7201	3.87
% of total	8.76	8.32	9.06	9.38	8.89	8.35	8.33	
Soybean oilcake	2602	2419	4593	4719	5698	6595	6787	2.61
% of total	12.25	6.62	8.41	7.43	6.99	7.93	7.85	
Top 5 % of total	57.5	55.4	60.7	62.5	64.1	59.6	61.6	

Source: Adapted from Global Trade Atlas, 2014

3 AGRICULTURAL POLICY IN BRAZIL

3.1 The extent of farmer support

Both the World Bank (Anderson and Valdes, 2008) and the OECD (2005) have recently analysed the policies that have resulted in the rise of Brazilian agriculture over the past three decades. In this regard, Lopes *et al.* (2008) emphasise two distinctive periods of Brazilian agricultural policies. The first, through to the early 1990s, was characterised by policy interventions to promote industrialisation through an import substitution regime that resulted in both direct and indirect taxation of the agricultural sector. One major indirect factor was the chronically overvalued exchange rate, accentuated by direct export taxes. Agriculture remained effectively closed to trade due to trade policy instruments that skewed prices on import-competing crops. Overall, the economy stagnated, and inflation created problems for the rural sector.

The second period, from around the late 1980s, was characterised by macroeconomic stability (and most importantly a stable exchange rate) coupled with trade liberalisation and less intervention in agricultural markets. Controls over and taxes on exports were eliminated, and tariffs were reduced from 1989 to 1992. However, the subsequent macroeconomic instability resulted in the

implementation of the "Plano Real" focussing on the exchange rate and government expenditure, albeit with the side-effect of a strengthening inflation-adjusted exchange rate of the *real* (Anderson and Valdes, 2008). There was a transition from 1990 to 1999 when the newly freed imports, spurred on by an appreciating exchange rate, depressed local prices in an environment where farmers were provided little support. This was followed after 2000 by a weaker local currency and higher international prices, which allowed the larger commercial farmers to increase production and consequently exports, mostly of soybean products. Brazil became a major agricultural exporter due to the greater productivity that resulted from investment in agricultural research and from currency stability.

Rural credit schemes were actively pursued by the Brazilian government from the late 1960s (OECD, 2005). However, the rising inflation of the 1980s and the remedial anti-inflation policies resulted in a weakening in the ability of farmers to service their loans. In response, various debt rescheduling programmes were implemented from 1995 onwards, principally in the form of longer repayment periods, interest rate subsidies and debt write-offs (OECD, 2005:90). Currently credit subsidies and debt rescheduling are still implemented for small scale farmers under the "green box" and for commercial farmers as part of "amber box" commitments to the WTO (OECD, 2011).

Increasingly Brazilian agriculture is driven by the larger commercial farms, as the numerically larger small farms are virtually subsistence operators that account for a disproportionate share of poverty in Brazil. Between these two extremes there is, however, a large mid-sized commercial sector that Anderson and Valdes (2008) report as accounting for 5.2 per cent of farms but 20 per cent of output in the late 1990s.

The Nominal Rate of Assistance (NRA) to Brazilian agriculture is reflected in Table 5 for exportables such as beef and sugar, and importables such as maize and rice. For exportables, the patterns are similar for all products, negative in the earlier periods, reflecting taxation of farmers, but then shifting to modest levels of support following the economic reforms. For importables, there was more variability between products and time periods.

The OECD's producer support estimate (PSE) is provided on the right hand side of the table. Although this is conceptually a similar measure of support, the basis of calculation differs, as does the time periods reported here. These show lower estimates of support, although the taxation of the sugar sector in the late 1990s is also evident. The OECD attributes the decline in support to macroeconomic stability from 1994, the trade reforms from the late 1980s and the deregulation of domestic markets that allowed domestic and international prices to converge (OECD, 2005). Yet productivity increases in Brazilian agriculture can also be traced back to the technology research and development system put in place to

support Brazil's farmers, and to infrastructural investment.

Table 5: Assistance to Brazilian agriculture

	World Bank					OECD	
	1966-9	1975-9	1985-9	1995-9	2000-05	1995-9	2000-05
Exportables	-8.4	-30.0	-29.5	0.4	1.3		
Beef			2.7	4.4	3.1	0.0	0.0
Coffee			-25.0	6.8	6.3	0.1	0.1
Poultry			-13.7	1.0	2.3	0.0	0.0
Soybeans	0.0	-15.6	-20.8	-1.2	-2.5	0.1	0.0
Sugar		-52.4	-55.3	-10.3	1.7	-25.6	0.0
Importables	1.4	-1.9	-22.5	8.3	12.0		
Maize	-9.0	-26.0	-33.9	4.0	na	5.1	5.8
Rice		-11.1	3.8	17.2	16.6	8.4	3.1
Wheat	41.4	65.8	-5.8	8.2	0.3	3.1	1.4

Source: Adapted from Lopez *et al.*, 2008: 105-106

3.2 The agricultural research and technology transfer system

Rada and Buccola (2012) test the hypothesis that public research and infrastructural policies made a major contribution to the growth of Brazilian agriculture. They use Brazilian census data to assess that technical progress has been significantly greater in the livestock sector than in the crop sector. Rada and Valdes (2012), using the same Brazilian census data, concur that Brazil could boost its share in global production and trade by raising average efficiency at farm level to what the most efficient producers are achieving: the average farm produced 93 per cent relative to the most efficient farms in 1985, but only 64 per cent in 2006.

The importance of R&D is also identified by Pereira *et al.* (2012) and Martha and Ferreira Filho (2012) who both consider that the key policies that played a central role in the process of agricultural modernization in Brazil were a) the availability of subsidized credit; b) rural extension; and c) the provision of support for agricultural research, principally through the National Agricultural Research System, or EMBRAPA. The cultivation of the *cerrado* required a portfolio of technologies that has made the region one of the top grain and beef-producing regions in the world. These technologies concentrate upon a) biological nitrogen fixing for soybeans on poor acid soils; b) new plant varieties and hybrids and the use of no-tillage systems; and c) integrated crop-livestock systems and the adoption of double-cropping where possible.

Consequently, the total factor productivity (TFP) of Brazilian agriculture increased steadily from 1970. Compared with 1970, TFP increased by 124 per cent, production rose by 243 per cent, and inputs grew by 53 per cent. Gains in productivity represented 65 per cent of agricultural output in the period 1970 to 2006, and inputs accounted for 35 per cent (Gasques *et al.,* 2012). Pereira *et al.* (2012) furthermore reported that between 1950 and 2006 productivity gains accounted for 79 per cent of the growth in beef production in Brazil.

Pereira *et al.* (2012) emphasise that until Brazilian agricultural researchers and partners developed new crops and forage varieties allied with agricultural practices tailored for tropical agriculture, it was thought that only temperate regions could feed the world. Research and entrepreneurial efforts combined in Brazil to develop and cultivate soybean varieties that are producing yields comparable to or even higher than those of temperate regions. Allied with this genetic effort were the new agricultural practices and innovations such as improved seeds, fertilizers, and agrochemicals that all linked to create a new productive environment, and conservation farming practices. Macroeconomic stability, higher commodity prices and the acceptance of the new tropical agricultural technologies led to a new era in Brazilian agribusiness and generated the move from traditionally based agricultural to one based on science and agribusiness.

Barros (2012) also emphasises the role played by agriculture in improving income levels and the distribution of income. Control over inflation ensures that the currency maintains its average buying power, and income transfers makes purchasing power available to the target population. If the beneficiaries of lower inflation and income transfers largely depend on the supply of goods of agricultural origin, it is important to ensure that relative prices in this sector will not increase as transfers take place. Furthermore, if production increases as a result of productivity increases, a more fair distribution of income is created by a drop in relative prices. Before the Real Plan, measures to redistribute income and reduce poverty lost their effectiveness due to high inflation rates. After the Plan's redistributive measures were intensified, the currency inflation corrosion reduced and an increasing availability of goods and services for the majority of the population contributed to the effectiveness of these measures. Brazilian society relies on a competitive agricultural and agro-industrial system that has been successful on a global scale.

3.3 Land issues in Brazil

Bruinsma (2009) shows that Brazil has more unused arable land than any other country in the world – Brazilian data put the availability at 300m hectares. While Brazil is often accused of destroying rainforest to produce soybeans (e.g. Fearnside, 2001; Anon, 2012; Greenpeace, 2012), almost all of this new land

is in the *cerrado*, which is in the largest part geographically removed from the rainforest areas, and largely consists of the conversion of pastures to cropland. However, there is a relocation effect as there has been an increase in pastureland in the more northern locations where new land is being cleared for cattle ranching. It seems that most deforestation in the Amazon is for subsistence agriculture or by larger landowners to expand cattle ranching operations (Greenpeace, 2009), as cattle operations are moving northward because pasture in southern Brazil is being converted to crops. Furthermore, Janks (2012) shows that there has been no recent correlation between Amazon deforestation and sugarcane area in Brazil, as the deforestation rate has declined dramatically since 2004 just as the sugar cane area increased.

Brazil also has more available renewable fresh water than any other country and critically this is well spread: the country has about the same amount of farmland with at least 975 millimetres of rain each year as the whole of Africa. Pereira *et al.* (2012) consider that as well as providing vital environmental services to the world in the form of the Amazon Basin, Brazil contains 13.5 per cent of the world's equivalent potential arable land and 15.2 per cent of the world's renewable water (see also Bruinsma, 2009).

Table 6 shows land use and the growth in land use since 1991 for the major crops in Brazil, ranked by land use in 2011. In total, land under the plough has increased by almost a third since 1991 (and some 2.5-fold since 1961). The unique position taken by soybeans is immediately apparent. In 1961 fewer than 250 000 hectares were planted: this has increased almost 100-fold to between 20 and 25 million hectares, with most added after 1991.

Table 6: Land use in Brazil, 1961-2010

	1961	1971	1981	1991	2001	2011	2011/ 1991
Soybeans	240919	1716420	8501169	9616650	13974300	23968663	249.24
Maize	6885740	10550489	11520336	13063700	12330300	13218904	101.19
Sugar cane	1366640	1728003	2825879	4210950	4957590	9601316	228.01
Beans	2580567	3936281	5026925	5433640	3449610	3673162	67.60
Rice	3174037	4763998	6101772	4121600	3142640	2752891	66.79
Coffee	4383820	2390345	2617836	2763440	2336031	2148775	77.76
Wheat	1022234	2268926	1920142	2049460	1727390	2138916	104.36
Cassava	1381331	2071276	2067253	1944900	1667180	1733513	89.13
Seed cotton	2023000	4459626	3510972	1841390	875107	1405135	76.31

Oranges	118750	215750	575611	983407	824665	817292	83.11
Cashew nuts				644608	638556	764472	118.59
Sorghum	2	900	92191	173603	486185	757410	436.29
Cocoa, beans	474270	447693	504935	667897	665809	680484	101.88
Cashew apple	50000	105000	202589	616674	590000	618542	100.30
Bananas	193815	279968	387828	490617	510290	503354	102.60
Tobacco	227656	241323	297564	287266	302559	454501	158.22
Sisal	197000	272656	312546	300263	204233	285724	95.16
Coconuts	143000	218000	152500	231446	273338	270541	116.89
Vegetables	340000	250000	195000	174000	193000	221592	127.35
Castor oil seed	283405	361000	447364	233555	171618	208476	89.26
Oats	31231	34084	90231	265081	257481	172127	64.93
Potatoes	191255	208051	170982	161626	153974	149212	92.32
Rubber				59044	95000	134947	228.55
Palm oil	2000	2500	6600	33000	46000	109080	330.55
Groundnuts	436381	726470	244806	89414	105000	106679	119.31
Total	26577395	38308218	48884057	51560272	51174559	68190709	132.25

Note: [1] Growth over 1991

Source: Faostat, 2012

Mahr (2011) used satellite data to map cropland expansion and multi-crop intensification in the crucial Mato Grosso area from 2000 to 2010, and found a 25 095 square kilometre expansion of cropland over this period, while the percentage of total area classified as multi-cropping increased from 37.6 to 64.4 per cent. The Mato Grosso rapidly climbed to the second most important cropland state in Brazil and the leading soybean producer from 1990 through to 2004, driven by improved infrastructure, crop technology, deregulation of the agricultural sector and increased world demand. In particular, Mahr (2011) found that the change correlated most closely with the relative rate of exchange of the Brazilian *real* with the exchange rates of the EU and China. The significant appreciation of the *real* since 2009 explains the recent slowing of this expansion.

4 THE IMPLICATIONS FOR SOUTH AFRICA

There are lessons for South Africa from this Brazilian experience. The lessons from the development path followed by Brazil, which has resulted in a decline in inequality, are being addressed in the literature (see e.g. Seidman, 2010; Bargain and Kwenda, 2011; Leibbrandt and Levinsohn, 2011; and Lloyd-Sherlock *et al.*, 2012). However, little has been said about the lessons from the specific agricultural growth path chosen (*cf.* Terra (2010) for an exception in this regard). In this section, key aspects of these lessons are discussed.

4.1 Expansion in output

Agricultural output at the farm level can increase in a number of different ways, each with their own impact on upstream and downstream industries in terms of welfare effects or employment creation, etc. (see Mellor, 1995). In the first instance, agricultural production can increase through an expansion in the area used for farming (area effects). Second, it can increase by means of rearranging production so that it takes place in more suitable places (location effects) or by substituting higher value products for low value products, for instance by switching from wheat under irrigation to strawberries (cropping pattern effects). In the former case the physical yield per hectare will increase, and in the latter the value of production per hectare increases. Third, production can increase through the more intensive use of land (yield effects), usually the result of the application of cutting-edge technologies in production.

In Brazil, output expanded through an expansion in the area under production (see also Deuss, 2012), as well as through location and cropping pattern effects. The latter effects were seen especially with the displacement of extensive cattle farming on natural pastures with a combination of cattle farming on planted pastures and crop (mainly soybean) cultivation in the Brazilian south-west frontier over the past three decades (see Ferreira Filho and De Freitas Vian, 2013).

In South Africa, by contrast, there has been a contraction in the land under cultivation over the past two decades (see Figure 2), mainly because of the decline in the area planted to cereals (maize, wheat) in the period after deregulation of the agricultural sector, a process that started in 1987 for maize, and gained impetus in 1997. Only some of this loss in arable land has been made up by increases in land planted to oilseeds and vegetables, as most has reverted to pasture (e.g. Vink, 2012). The exception is land under oil crops (principally sunflower and soybeans) where there has been an increase in area ploughed. Figure 3 shows that soybean and sunflower yields have not grown as fast as yields for other field crops, fruits, root crops or vegetables.

In the South African case, there is sufficient evidence that area effects have played a role in the increasing industry average yields for the major commodities, especially maize and wheat (Vink, 2012 – see Figure 3). Often a change in the area under cultivation precedes yield increases as production becomes reorganised. For example, deregulation of agricultural marketing in South Africa resulted in large shifts in the location of maize and wheat production, followed by yield increases because of new technologies, such as genetically modified (GM) maize, and better management practices, such as the adoption of conservation agriculture practices. The poor yield performance of oil crops is in great contrast to the expansion of soybean production in Brazil. Finally, production can be increased by intensification (yield effects). In South Africa, this is evident from the increases in yields of roots and tubers, fruit, and vegetables.

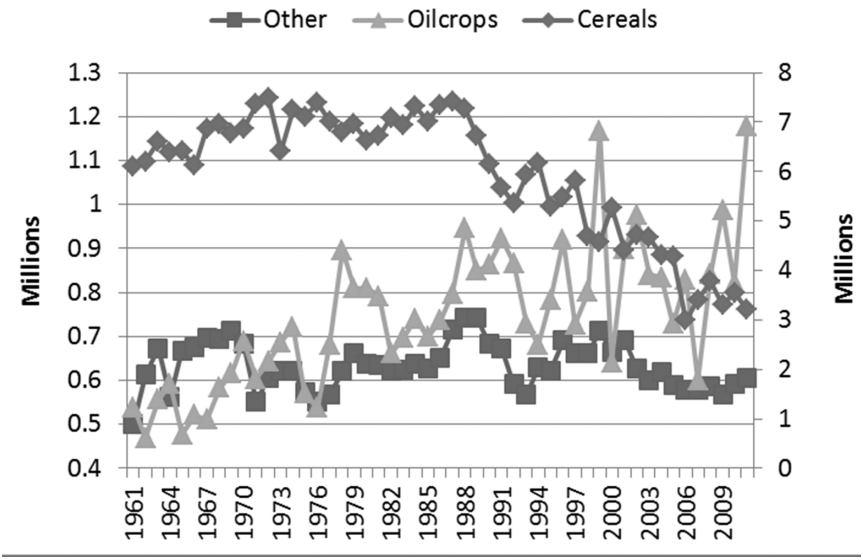

Figure 2: Arable land use in South Africa, 1961–2011

Note: Cereals measured on the right axis. Other = Fruit, vegetables, tree nuts, fibre crops, pulses, and roots and tubers

Source: FAOSTAT, 2013

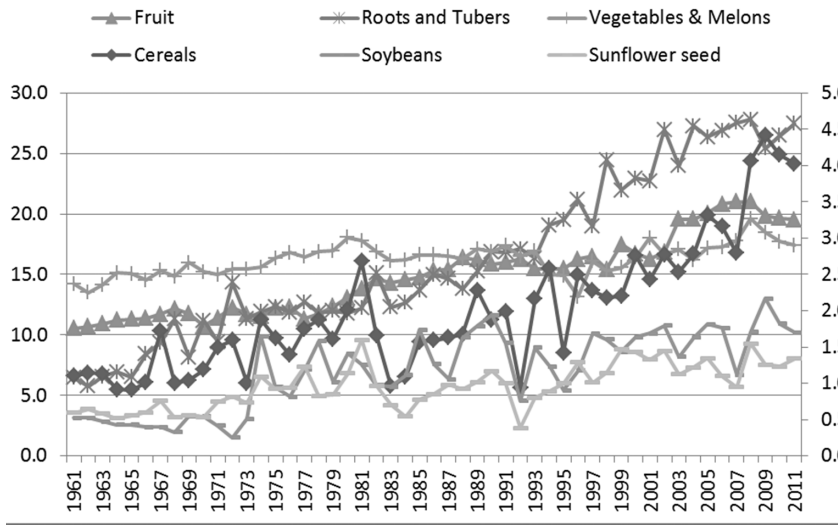

Figure 3: Crop yields in South Africa, 1961–2010 (tons per hectare)

Note: Roots and tubers, fruit and vegetables measured on the left axis
Source: FAOSTAT, 2013

In the research conducted by BFAP for South Africa's National Planning Commission (BFAP, 2011), the availability of arable land for expansion in South Africa was analysed. As could be expected, there is not much potential for the expansion of dryland production (a reported 3 million hectares at most), but there is the potential to expand the irrigated area by a third, from 1.5 million hectares to 2 million hectares under fairly conservative assumptions.

In South Africa, deregulation of agricultural markets in the late 1990s resulted in a contraction in arable land use and large changes in the location of production, but these were accompanied by increases in total output. These opportunities have been exhausted, and future increases in production will mostly have to come from an expansion in irrigation if employment in agriculture is to be increased. At face value, there do not seem to be many lessons that can be learned here from the Brazilian experience, although finer lessons from the timing and sequencing of policy implementation for the expansion of soybean production, the technology and infrastructure requirements for that expansion and the placing of processing facilities should be explored in greater depth.

4.2 Labour productivity and farm wages

Martha and Ferreira Filho (2012) emphasise the direct link between the national system of innovation and the capacity of farmers to absorb the knowledge that is generated. In their view, the institutional system in Brazil produces such knowledge, but it is up to the farmers to invest in their own skills and to absorb this public knowledge. This is a medium to long term process, and the creation of EMBRAPA in the 1970s set the first part of this process in motion. They consider that more needs to be done to transfer this applied knowledge in the agricultural sector, and Brazil must lift the absorptive capacity of producers by improving education and at the same time reducing dependence on imported technologies.

This same argument applies to the training of farm workers: the gains from new technology will be dissipated if farm workers are not well trained (e.g. Ponte and Ewert, 2009). Yet farm wages in South Africa have always been low, and farm work does not provide many avenues for promotion for illiterate workers, a legacy that South Africa carries as a result of what Trapido (1971) called the "alliance between green (maize) and gold" – the subjugation of black workers to ensure a ready supply of cheap labour to the mines and the farms.

It is therefore not surprising that in South Africa there is a mismatch between labour productivity and the wages that are earned in agriculture, despite recent increases in labour productivity. Figure 4 shows the value added per farm worker in the BRICS countries. Brazil and South Africa are well ahead of Russia, and workers in these two countries are around seven times more productive than workers in China and India. Table 7 shows that the unit cost of labour in South African agriculture declined by almost half between 1993 and 2007, from 19 cents for every R1.00 of output, to 11 cents, providing support to the relatively high levels of value added per worker in South Africa. However, Table 8 shows that agricultural wages in South Africa were lower than in Brazil in 2009. The agricultural minimum wage in Brazil in 2009 was the equivalent of 37 per cent of GDP per capita measured at purchasing power parity as opposed to South Africa's 24 per cent.

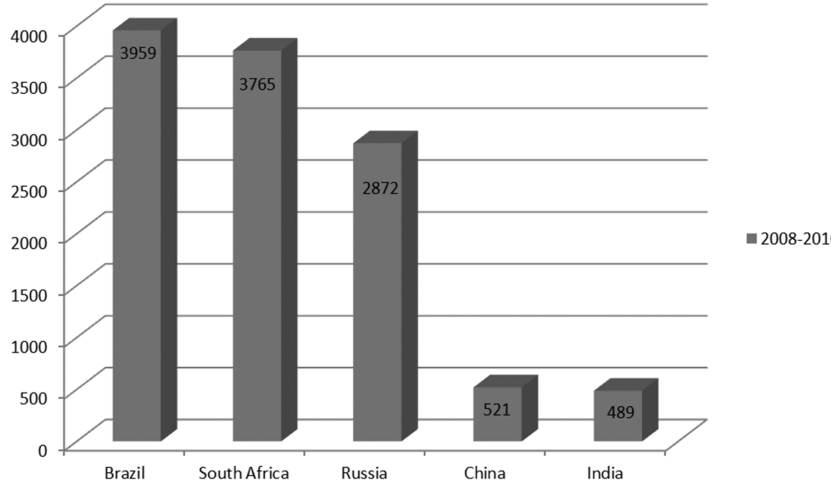

Figure 4: Value added per farm worker in the BRICS countries, 2008-2010
Source: World Bank, 2012

Table 7: The unit cost of labour in South African agriculture

	2007	2002	1993
Employees' remuneration (R000)	8 611 231	6 215 583	3 637 620
Gross farming income (R000)	79 543 814	53 329 052	19 620 180
Unit cost of labour (cent per R1.00 output)	0.11	0.12	0.19

Source: StatsSA, 1993, 2002 and 2007

Table 8: Minimum wages in agriculture, 2009

Country	Minimum wage[1]	Gross annual wage (International dollars)[2]	% of 2009 GDP per capita[2,3]
Brazil	$322.59 or 622.00 reals per month	3,916	37
China	Set locally within national framework	—	—
India	Varies by state and sector; separate minimum wage for agriculture by state		
Russia	4,330 roubles per month	1,558	19
South Africa	R1,041 a month	2,471	24

Notes:

[1] Data are for the lowest minimum wage in the event that there is differentiation between sectors (as is the case in South Africa). For South Africa, the 2012 minimum wage in square brackets.

[2] GDP (PPP) per capita and PPP conversion rate for all IMF member countries, from the IMF's World Economic Outlook Database, October 2010 Edition. This PPP conversion rate was also used to convert the annual wage from national currency to international dollars.

[3] Percentages were calculated by dividing the annual wage in local currency by the country's 2009 gross domestic product per capita, obtained from the IMF's World Economic Outlook Database, October 2010 Edition.

Source: Adapted from Wikipedia, 2012

4.3 The rural economy and poverty alleviation

Agriculture and the rural economy are often seen as a pathway out of poverty, yet there is no automatic link between rural economic performance and poverty alleviation as its growth depends on a set of supply, demand and transactions cost variables (Jonasson and Helfand, 2010) that both define the prior conditions for development and are a result of policy choices. Hence gains in poverty alleviation will depend on factors such as the source of growth in farm output (i.e. from the particular combination of area, location, cropping pattern and yield effects), the path of technological change in agriculture (Bustos *et al.*, 2013), the strength of the rural nonfarm economy (Haggblade *et al.*, 2010), and locational characteristics (Jonasson and Helfand, 2010).

Yet gains in poverty alleviation also depend on history. Ravallion (2011) characterised the pathways out of poverty followed by Brazil, China and India, three countries that have had some success with poverty reduction. In his view, China made substantial but uneven progress in poverty alleviation, accompanied by economic growth, Brazil succeeded in poverty reduction, but without sustained economic growth, and India achieved growth but with relatively less poverty

reduction. He ascribes China's relative success at least partly to "favourable initial conditions", which meant that because there was less inequality to begin with, the poor had greater opportunities to participate when the economy was opened.

South Africa has seen some poverty alleviation, and has had some economic growth, but neither have been strong enough to alleviate the worst manifestations of poverty, namely in the rural areas, and especially in the former homeland areas. In this regard, the country can learn a number of lessons from the Brazilian experience:

1. History matters. As with Brazil, economic reforms that create opportunities favour those who already own land (especially in the absence of farmer support services) and those who have higher levels of human capital.
2. Geography matters. South Africa has a large domestic market for agricultural products, but access to the market is constrained. The former homeland areas are geographically removed from the core economy in Gauteng, and the land reform programme has failed to bring emerging farmers closer to this core. Spatial distortions need to be taken into account in policy development.
3. The development path matters. Agriculture and manufacturing development are often seen as antithetical processes in development. Brazil's agricultural renaissance was started so that the manufacturing sector could be stimulated to play its proper role in development, and there is a growing consensus that this is an appropriate path for other countries to follow (e.g. Whitfield, 2012; Bustos *et al.*, 2013).
4. Agricultural policy matters. South Africa and Brazil share similar levels of support to agriculture when measured by instruments such as the PSE and the NRA. This is largely because both countries largely succeeded in achieving macroeconomic stability and the removal of market distortions over the past two decades. However, there are also two distinct differences. First, South Africa removed virtually all direct support to commercial farmers, and failed to replace this with effective support to emerging farmers or to small scale farmers in the former homelands, despite compelling evidence of the need for such support (e.g. Chang, 2009). Second, South Africa has lost the ability to adapt modern technologies to local circumstances as the research system of the country is more focussed on basic research and less on the needs of emerging farmers (Sandrey and Vink, 2009).

5 CONCLUSIONS

The analysis presented here shows that there are at least five important lessons for agricultural development in South Africa.

First, agricultural development requires macroeconomic stability. This is

a lesson that South Africa has learned well, and one that it would do well to remember in the face of persistent calls to decrease the power of the Reserve Bank and of the Treasury.

Second, the evidence shows that Brazil followed a unique path to agricultural success, characterised by a vision of what the world would look like in the future. The natural resources of the *cerrado* were unsuited to crop production because of the acidity of the soil, so they started applying lime on a large scale. Farmers in that area were not used to field crop production, so they supported the in-migration of crop farmers from other parts of the country. Soybeans were unsuited for tropical climates, so they embarked on breeding programmes to change that – and all because they had a vision of high demand for especially poultry meat and dairy products in China, at a time when that market was only starting to expand. The tendency in South Africa has been to take human and natural resources as well as technology and infrastructure at face value, and hence to be conservative in imagining a greater role for agriculture. If South Africa were to successfully expand the frontier of irrigation, especially in the Eastern Cape as envisaged in the National Development Plan (NDP), it is important that the potential interplay between these factors in the future be better understood.

Third, South Africa does not have the luxury of surplus arable land as is the case with Brazil. Brazil was able to increase employment in agriculture by converting rangeland into relatively more employment intensive field crop farming and by expanding the area under field crops rapidly. While this path to employment creation is not open to South Africa, the continent of Africa does have unused arable land, and much of it is in relatively close proximity to South Africa. Regional agricultural policy should gain greater priority for South African policy makers. Expansion of employment in agriculture in the region will benefit South Africa as it will impact on migration flows to South Africa, and it creates opportunities for South African farmers.

Fourth, South Africa needs to find ways of increasing the yields of oilseeds such as sunflowers and soybeans in the same way that maize yields have been increased in the last two decades.

Fifth, context matters. South Africa must learn from the successes and mistakes of others, but must ultimately follow its own development path.

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