A CASE FOR MEASURING LOGISTICS COSTS ON A NATIONAL LEVEL: A SOUTH AFRICAN APPLICATION

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Abstract

This paper makes a case for macroeconomic logistics measurement and presents the results of the 2009 logistics cost model for South Africa. The major portion of logistics costs are attributable to road transport, of which the biggest cost driver is fuel, which, in turn, is determined by volatile oil prices and the exchange rate of the country's monetary unit. This poses a significant exogenous risk to logistics cost management in South Africa.

Keywords: exchange rate, freight transport, fuel price, logistics cost measurement, logistics cost model, long-term forecasting, macroeconomic logistics indicators

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1. Introduction

This paper endeavours to make a case for the macroeconomic relevance of freight logistics cost measurement, and shares the results of the latest South African national logistics cost model.

According to United Nations research (2002), effective cost reduction in the national logistics system can only be accomplished by measuring and tracking logistics cost components to inform appropriate government policy.

The impact of both sufficient and insufficient measurement of economic performance was illustrated in South Africa recently. Sound monetary and fiscal decisions, enabled by robust macroeconomic indicators, allowed the country to weather the global financial crisis of 2009 admirably. However, a lack of management information on the impact of high economic growth and equal access to South Africa's energy demand resulted in a severe backlog in electricity-generating infrastructure. A lack of information leads to similar challenges within the freight logistics sector, and in terms of efforts to holistically plan for national transport infrastructure renewal and extension (Havenga, 2010: 461).

This situation is not unique to South Africa: it is a global phenomenon. Anderson and Van Wincoop (2004: 692) found that direct measures of local distribution costs and international trade costs are 'remarkably sparse and inaccurate'. According to Hesse and Rodrigue (2004: 171), research on freight transport and related logistics is 'widely under-represented' and 'neglected'.

The development of South Africa's freight logistics cost model provides, therefore, an important contribution to the quantification of logistics costs in the national economy, and enables the first quantification of macroeconomic logistics indicators for South Africa. The model was developed to measure and track national freight logistics costs on an annual basis. Freight logistics for the purpose of the model's formulation is defined as:

'… that part of the supply chain process that deals with the transportation, warehousing, inventory administration and management of commodities between the origin (that is, where they are produced, mined or cultivated) and the destination (that is, the point of delivery to the consumer, either as input to further production processes or for consumption). By definition, this excludes the cost of passenger transport – transport, storage, packaging and handling of mail and luggage – and storage and transport tasks that occur during the production, mining or cultivation process.' (Botes et al., 2006: 4)

2. The macroeconomic relevance of measuring logistics costs

Logistics is an integral component of economics, enabling, *inter alia*, regional specialisation (and thereby economic growth) through the efficient and effective distribution of resources and outputs (Pienaar, 2009: 1).

A number of international studies highlight the important relationship between logistics and national competitiveness:

- According to the United Nations (2002: 22), the comparative efficiency of a country's product supply chains is of vital importance in enhancing

the competitiveness of its industrial and commercial sectors.

- Lakshmanan and Anderson (2002: 3) show that improved productivity in the freight transport sector enhances the productivity of the overall economy.
- The World Trade Organization (2004) reports that 'the effective rate of protection provided by transport costs is, in many cases, higher than that provided by tariffs'.
- In a technical study to determine the quantitative role of transport in international business cycles, Ravn and Mazzenga (2004: 657) found significant welfare effects resulting from changes in transport costs. The authors estimate that a reduction in transport costs from 20% to 15% of GDP is equivalent to a permanent increase in domestic consumption of just above 1,5%.
- Pienaar (2005) proposed a procedure by which the increase in regional income that emanates from economically justified road infrastructure provision can be estimated by applying multiplier and accelerator analyses respectively. His emphasis on *economically justified* roads indicates a focus on *quality* as opposed to *quantity*. Subsequent to further development of his 2005 regional income model, Pienaar applied it in 2008 in a real-life situation in the north-eastern part of Namibia (Pienaar, 2008). This work demonstrated how regional income can increase through improved business logistics services and greater accessibility. The work by Pienaar (2005; 2008), which is dependent on detailed regional cost measurement, confirms that economically justified and financially viable freight transport infrastructure and operations can contribute to the primary macroeconomic goal of improving the wealth of a nation. The work demonstrates that efficient and effective freight logistics operations support this macroeconomic goal through the enhancement of employment levels, economic growth and price stability. Through the judicious use of the appropriate information and economic indicators, the timeous implementation of economically justified transport infrastructure and financially viable freight transport operations, it is possible to significantly mitigate the potentially adverse effect of volatile economic cycles.

Nevertheless, even at the corporate level, strategic attention to logistics as a source of competitive advantage is a relatively new phenomenon. During the 1980s, competitive advantage meant delivering flawless product quality, whereas in the 1990s, the focus shifted to providing superior customer service. When these avenues were exhausted (mainly due to emulation by competitors), businesses became increasingly aware that a well-run logistics system could provide them with a sustainable competitive advantage (Gourdin 2001: 8). It is not surprising, therefore, that the macroeconomic shift towards strategic logistics management is still in its infancy.

As per the definition of logistics provided above, logistics costs can be broken down into three direct elements, namely, transport; storage and port handling; and management and administration costs, and one indirect element, namely, inventory carrying costs (i.e. time-based working capital to finance the cost of inventory in the supply chain).

The results from the first model (Botes et al., 2006) and subsequent discussions with government and industry stakeholders pointed to the need for further refinement to the following areas of the model (Havenga, 2010: 465):

- Firstly, transport was identified as the largest component of South Africa's logistics cost in the first model, and extensive refinements were, therefore, made to this cost component in subsequent annual models.
- Secondly, the initial model applied a static warehousing cost estimate based on an estimation of the average inventory level for one year. This required expansion to include a more robust year-on-year inventory-cost comparison.
- Lastly, whereas all the other elements of the model estimated full costs, inventory carrying costs (or the opportunity cost of capital) was based on value-added costs, which underestimated inventory carrying costs and did not enable industry-level benchmarking. This was adapted to enable calculation of the opportunity costs of capital employed in each stage of the value chain.

The logistics cost model employs a bottom-up approach for the computation of logistics costs by aggregating detailed commodity-specific data – relating the tons produced and imported (in other words, total supply) of a specific commodity to the costs of performing logistical functions with respect to that commodity.

The model provides:

- the only available national view of the state of logistics in South Africa;
- a bottom-up approach that enables a detailed modal view as well as the refinement of the measurement on a detailed scale;
- an understanding of the national state of affairs which (i) focuses the activities of all participants on the impact of individual activities on the broader logistics environment, and (ii) enables more strategic and collaborative decision making at an industry and government level; and
- a holistic view of the state of logistics that enables government to engage meaningfully with stakeholders to address the country's logistics challenges.

3. Discussion of model results relating to 2009

In the light of the global economic upheavals experienced in 2009, the importance of annual macroeconomic tracking of South Africa's logistics cost became increasingly important. As shown in Figure 1, the cost of logistics in relation to the GDP declined to 13,5% in 2009 from 14,7% in 2008. The significant decreases in the price of diesel and the interest rate, however, created the expectation that logistics cost in relation to GDP would decline even more. It would have been fair to have expected this percentage to drop to a level of closer to 12,5% given these major downward changes in the two most important cost drivers. Challenges within the transport and inventory carrying cost components, however, negated this, as discussed below.

If an economy declines by 1,7% in real terms, the crude oil price falls by 37,5% (the local price of diesel by 28,3%) and the average cost of capital in the economy by 28% based on the repo rate (or 21% based on the prime interest rate) a sizeable decrease in the cost of logistics relative to the GDP is expected. It is, however, easy to become misled if figures are not understood clearly. Without analysing the underlying cost factors, it is impossible to deduce how South Africa's logistics industry adjusted to changes in product demand compared to installed logistics capacity – in other words, how agile/effective and efficient/lean is the industry in periods of upheaval?

The reduction in transport costs of 9,2% was much less than the 28,3% decline in the price of diesel. This points either to an increase in other transport cost drivers or to changes within the structure of transport itself, such as higher demand relative to GDP. Ton-kilometres (the key indicator of transport demand), however, declined by 3,7% (i.e. less transport was required relative to the GDP), which means that other transport cost drivers did increase. Notably, the load factor is a challenge – as the recession deepened, it became increasingly difficult to achieve full loads or avoid empty back-haul, rendering transport less efficient.

The drop in the interest rate combined with lower transport volumes should also have led to a decrease in inventory carrying cost. This did not happen because more inventories were delayed in supply chains, and bottlenecks formed for prolonged periods of time, which led to a slight increase in storage costs.

Figure 1. Annual logistics costs for South Africa: 2003-2009

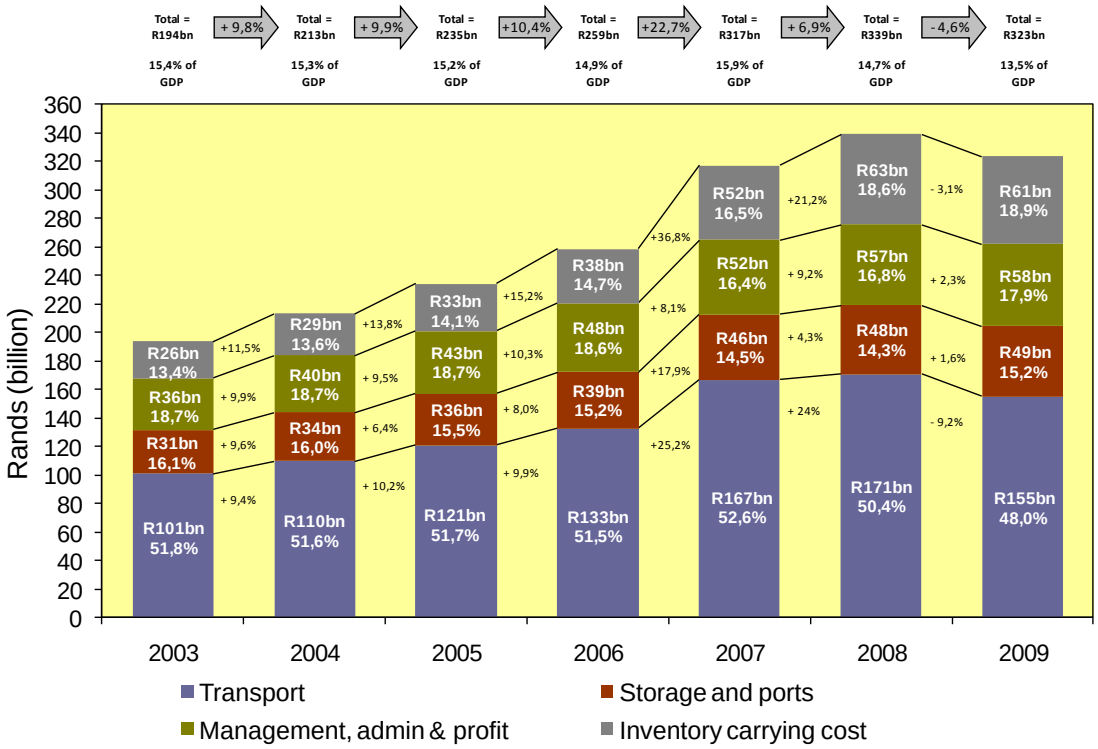
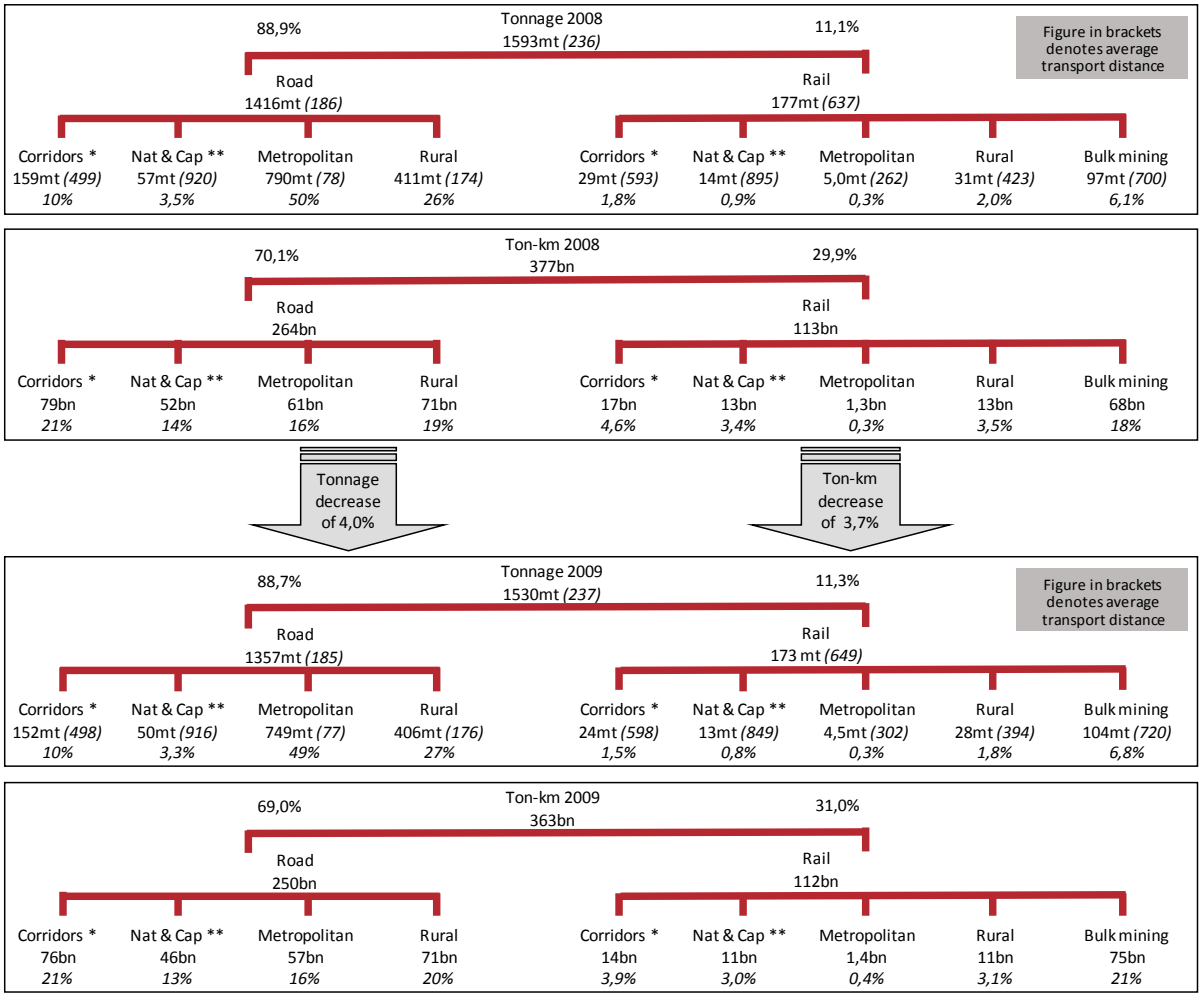


Figure 2. Modal distribution of road and rail freight in South Africa



Notes:
** Remaining corridors excluding the two main corridors*
***Nat & Cap represent the two main corridors of Gauteng – Natal (Nat) and Cape – Gauteng (Cap)*

3.1. Freight transport activity

Total freight transport activity in the South African economy is illustrated in Figure 2. Total tonnage and ton-km decreased by 4% and 3,7% respectively, with corridors being notably affected. This is the first time since the launch of the survey (which commenced in 2003) that there has been a decline in transport activity on all typologies except bulk mining, as depicted in Figure 3.

In the light of the decline on all other typologies, the change in bulk mining on rail transport deserves attention, i.e. the growth of 7,2% achieved in tonnage and 10,3% in ton-km. The growth is partly attributable to the fact that under normal conditions, rail transport struggles to meet transport demand in this sector due to insufficient capacity. A drop in transport demand from the mining industry during a recession (as experienced in 2009) is still most likely to result in a demand that is greater than the rail capacity.

3.2. Transport for reward

Statistics South Africa annually publishes survey results of the (professional) road transport industry, which provides interesting data for correlation with the two freight flow sub-models that are applied in the main logistics cost model. The research presented in this survey measures total freight transport activity. Using Statistics South Africa's data (SSA, 2011) the volume of freight that is not outsourced could, therefore, be determined (unfortunately, only in monetary terms for road), as shown in Table 1.

Figure3. Changes in transport volumes since the inception of the survey

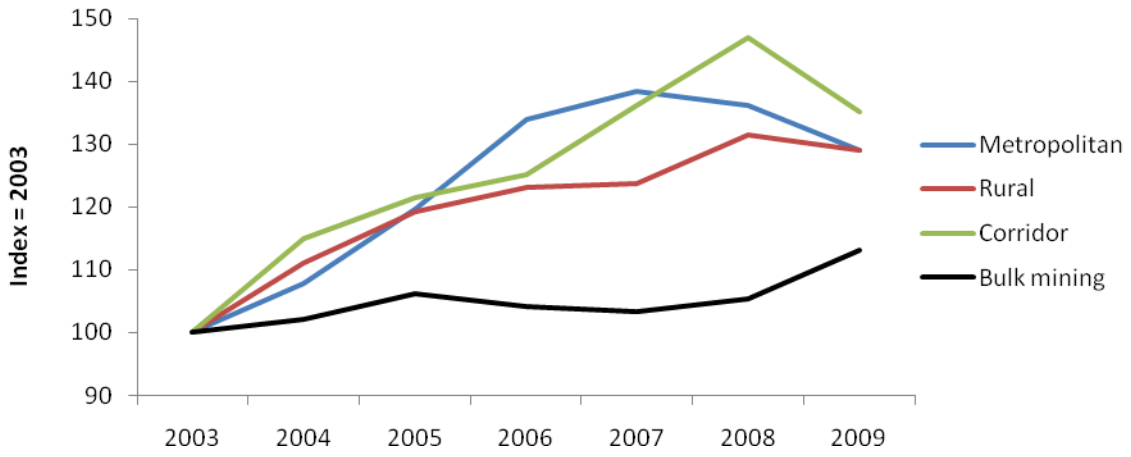


Table 1. In-house and outsourced road transport in monetary terms

	Total	Outsourced	In-house own account
2008	R155 billion	R54 billion	R101 billion
2009	R137 billion	R49 billion	R88 billion

According to this analysis, about one-third of road transport activity is outsourced to professional (for reward) carriers. The major growth opportunity for road carriers has still not been fully achieved by outsourcing this service component to for-reward carriers. Effective outsourcing of a proportion of the remaining two-thirds of road transport activity that is still conducted through ancillary (in-house) transport has the potential to reduce future logistics costs through greater efficiency, for example, by optimising and consolidating loads, orders and capacity.

3.3. Other logistics costs

The other logistics costs in the economy that should be considered are inventory carrying storage costs, and management and administration costs.

Inventory carrying cost

It has been suggested that the prime interest rate that is used to calculate the opportunity cost of investment in inventory (and which is applied in this study) is not strictly correct. The real investment cost for individual businesses is determined by their hurdle rate, which differs among business entities (Stock and Lambert, 2001: 194).

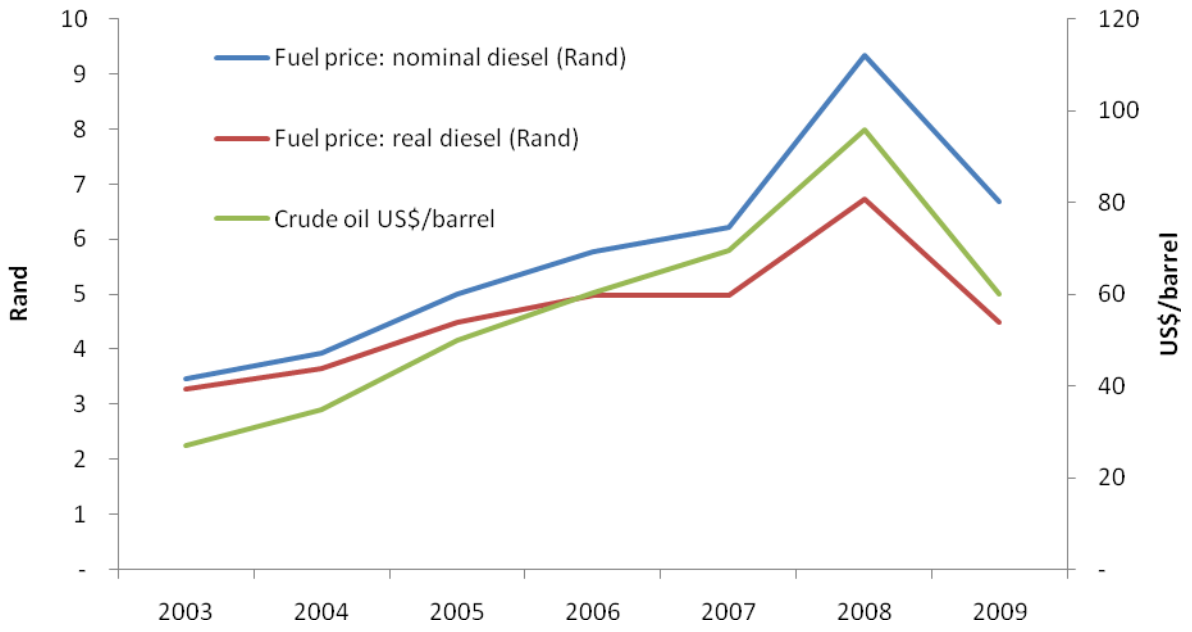
The average inventory that required financing increased in 2009 by 23,5% nominally from R416 billion to R513 billion – an increase of 15,2% in real terms. Table 2 indicates that inventories relative to output increased from 17% in 2007 to 21% in 2009. The reason for this is that as the recession deepened, inventories built up due to lower consumption. This, in turn, led to larger inventory holdings that needed to be financed and, as stated earlier, to less efficient transport due to lower volumes and more empty haulage.

Table 2. Value of inventories in South Africa

	Inventory at current prices (R billion)	Inventory at constant 2009 prices (R billion)	Inventory as percentage of GDP
2007	339,2	405,3	17%
2008	415,8	445,5	18%
2009	513,4	513,4	21%

In 2008 inventories built up due to the spike in the fuel price, which is displayed in Figure 4.

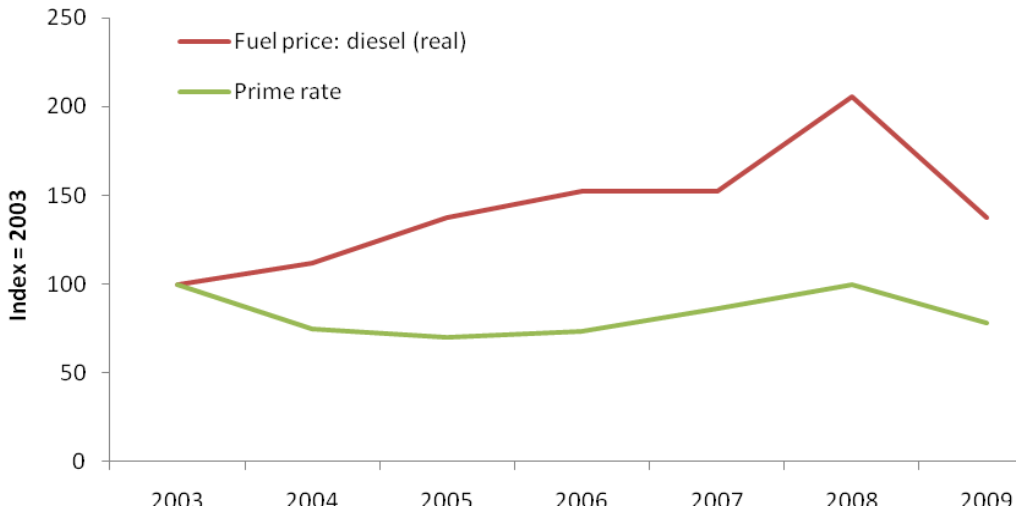
Figure 4. Fuel price history in South Africa: 2003-2009



These events highlight the difficulties experienced in the supply chain when adaptations to upheavals (such as fuel price spikes or deep recessions) are experienced. The point has often been made that South Africa's freight transport cost as a proportion of national logistics cost is much higher than the world average, but the indirect effect of this phenomenon is not always apparent. In trying to adapt to the more 'serious' issue – i.e. transport cost upheavals – lean inventory can also be a victim.

The increase in inventory holdings was, however, mitigated by the reduction in the prime interest rate from an average of 15,0% in 2008 to an average of 11,9% in 2009, as portrayed in Figure 5.

Figure 5. Prime interest rate and fuel price



The prime interest rate is also volatile and has been growing for the most part of the last century. The gradual decline over the last decade, however, should, be noted and the volatility of interest rates compared to the fuel price should be taken into account when long-term planning takes place.

Storage costs

The research indicated that average inventory carrying times increased from 12 to 15 days on a weighted average basis, leading to a rise in the average inventory level in supply chains.

The cost of storage, handling, stuffing and picking (at current prices) rose by less than the inflation rate (i.e. 3,6%), alleviating the cost impact of rising inventory levels to some extent and leading to an overall increase in storage cost of 1,2%. These costs are shown in Table 3.

Table 3. Storage costs within supply chains

	Weighted average days in storage	Cost of storage, stuffing and picking at current prices (R billion)	Cost of storage, stuffing and picking at 2009 constant prices	Storage, stuffing and picking as a percentage of GDP
2008	12	48	52	2,13%
2009	15	49	49	2,05%

4. Scenarios

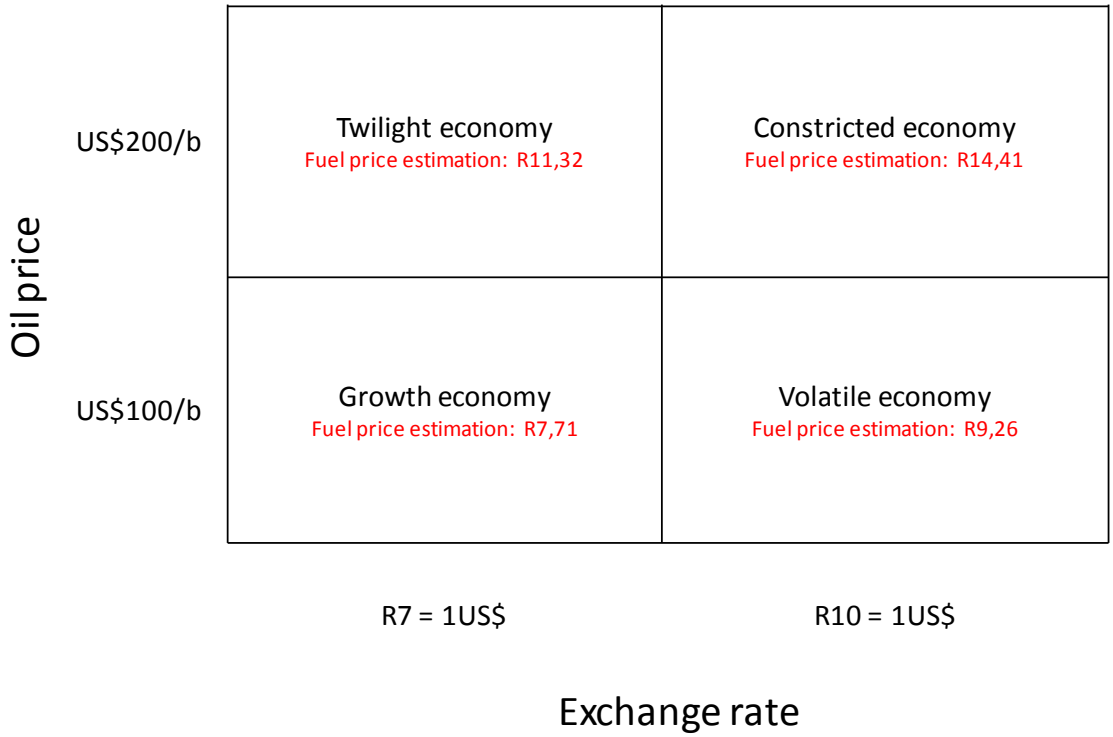
Scenario building is an important tool for the institutionalisation of change, and especially, for preparing a system to be more agile (De Geus, 1988).

For successful scenario building, the external risks (i.e. risks which are outside an entity's control) with the biggest impact as well as the highest likelihood of occurrence, must be identified. The crude oil price and the exchange rate (impacting on imports) are two of the biggest (and potentially most volatile) drivers of logistics cost in South Africa. In this survey, the emissions tax has been identified as another key cost driver that will very likely be introduced in the near future.

Firstly, Figure 6 outlines four scenarios whereby the impact of the international crude oil price and the effect of the exchange rate on the fuel price are considered. Subsequently, emission charges are added (which are currently an externality, but on the brink of becoming an internalised cost amidst huge uncertainty about the actual levels of these taxes).

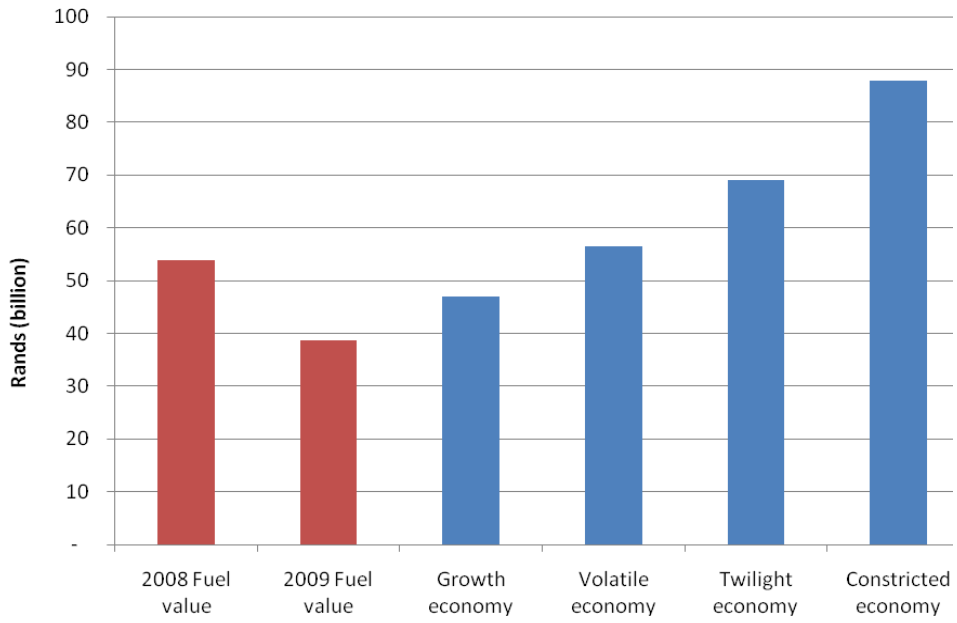
For this analysis, the worst-case scenario is assumed as an exchange rate of R10 to the US dollar and a crude oil price of US$200 per barrel; while the best case scenario is assumed around levels of R7 to the US dollar and US$100 per barrel of crude oil.

Figure 6. Fuel price scenarios



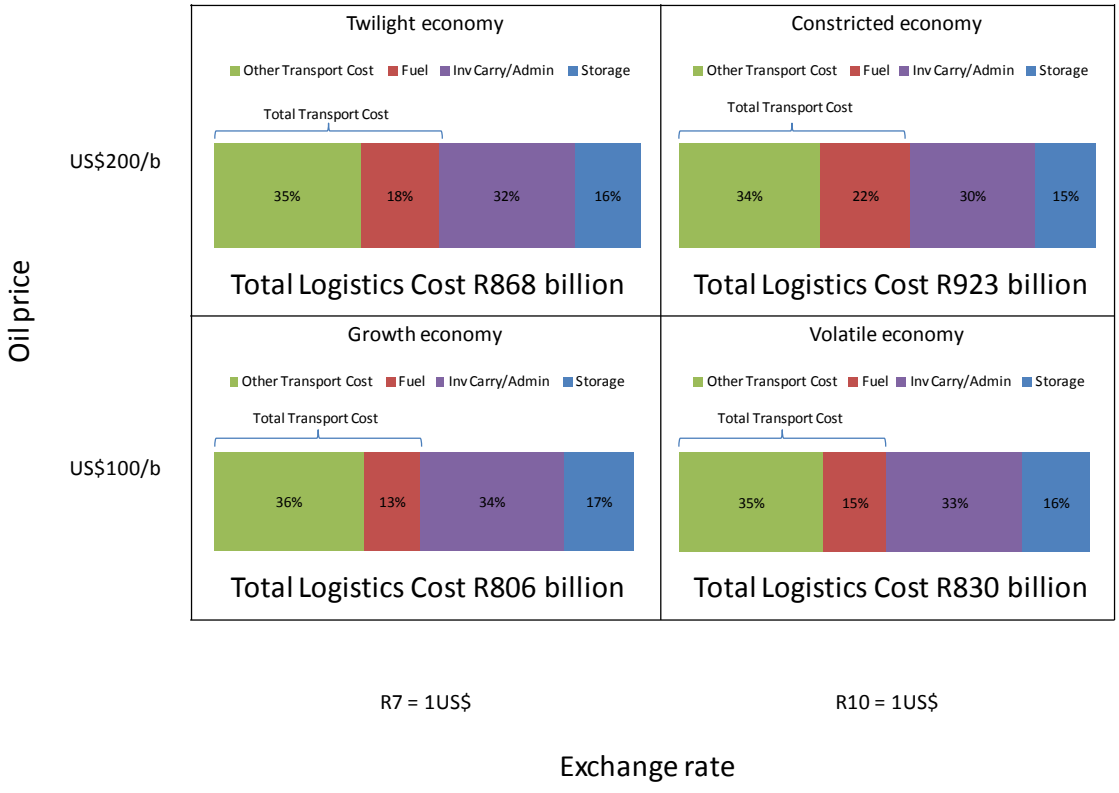
Clearly, the impact on South Africa's fuel price and the resulting logistics cost will be significant. If the constricted economy values were applied to South Africa's 2009 volumes shipped, transport costs would rise by R49 billion, transport as a percentage of logistics costs to 55% and logistics as a percentage of the GDP to 15,5% (see Figure 7).

Figure 7. Fuel costs for logistics given various scenarios



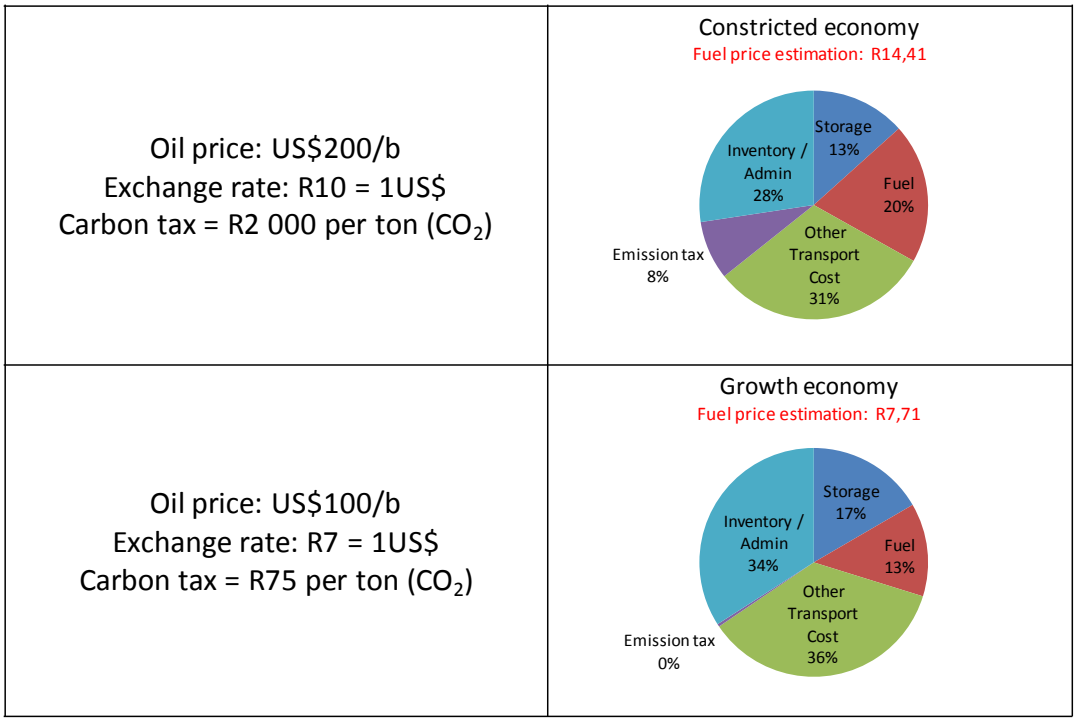
If the constricted economy values were applied to South Africa's 2040 transport volume (forecast at current prices), the difference between the logistics cost for the growth economy and constricted economy scenarios would be 14,5% (or R117 billion), as depicted in Figure 8. This means that the high fuel price in the constricted economy scenario would add an amount almost equal to the entire fuel bill of the growth economy scenario.

Figure 8. Scenarios for the future (freight demand: tonnage in 2040 at 2009 prices)



Finally, the outside limits of a possible emissions charge (being the tax rate or actual offset costs) can be added to the scenarios. This is illustrated in Figure 9 for the best- and worst-case scenarios.

Figure 9. Scenarios for the future with emission costs added



The two extreme limits of these scenarios indicate a difference of R197 billion. Broadly speaking, this indicates a 24,4% 'variance' in logistics costs due to unknown external risks. In 2009 terms, this equates to an increase in logistics costs to 16,8% of GDP (compared to the actual 13,5%).

5. Conclusion

During the recession of 2009, the two largest administered logistics cost components in South Africa (the fuel price and interest rate) each fell by almost a third. Therefore, a large decline of logistics costs relative to the GDP was expected and a ratio close to 12,5% was tentatively foreseen. This did not materialise: the actual outcome was a ratio of 13,5%. The discrepancy was mainly ascribable to less efficient transport (lower levels of load and more empty back-hauls) and higher inventory levels.

Businesses need to improve their long-term logistics forecasting and demand management abilities, and collaborate more in order to better contain costs in times of upheaval. At the same time, government policy should take into account the effect of unpredictability on the logistics system and consider steps to make the system less vulnerable to external risks, such as the fuel price, the interest rate and climate change.

Improved long-term forecasting and planning ability is a prerequisite to enhance lean, efficient logistic supply, and to remain logistically agile and service-effective during economic upheavals. Sound logistic resilience is an imperative for a nation's economic competitiveness. However, resilient supply chains will typically incorporate strategic buffers in the form of inventory and capacity. Managing the paradox encapsulated in striving towards logistics resilience, namely being both lean and agile, necessitates the performance of the logistics industry being continually monitored in order to facilitate the measurement of the industry's cost and productivity.

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The following paper on pages 632 - 644 was extracted

AUDITING AND EARNINGS MANAGEMENT IN BRAZILIAN HMOS

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Abstract

This paper examines whether external auditing minimizes the propensity for manipulation of accounting information (MAI) by health maintenance organizations (HMOs), with respect to financial information disclosed to the Brazilian Health Care Agency (ANS). The results of univariate and multivariate analyses and robustness tests indicated no statistically significant differences in the propensity to MAI between audited and unaudited financial reports in the analyzed information. The empirical regularities shown in this study provide useful insights to foreign regulators and international auditors. Our study sheds light on the effectiveness of the recent reporting and auditing regulations in Brazil, suggesting that – in regard to the HMO industry – auditing has not begun to play a more effective role yet.

Keywords: Earnings Management, Brazil, Auditing, Regulations

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1. INTRODUCTION

The Brazilian *Agência Nacional de Saúde Suplementar* (hereafter ANS), equivalent to the U.S. Federal Government's Office of Health Maintenance Organizations, requires that all Brazilian Health Maintenance Organizations (hereafter HMOs) prepare and submit their quarterly financial reports in accordance with accounting standards issued by the ANS.

Based on this information, the ANS assesses the performance and solvency of the HMOs. Based on analysis of the financial statements, the ANS rates each HMO's risk for insolvency. If an HMO does not break any pre-established threshold, it is classified as having a low insolvency risk. If a threshold is broken, its insolvency risk is classified as medium. The HMO would then be subject to more rigorous, ongoing reviews and could be asked to provide what is known as a recovery plan. The recovery plan is subject to