A Note on Infrastructure Quality in South Africa

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ABSTRACT

The emphasis, both in research and in policy making, seems to be on more infrastructure, rather than better infrastructure. This research note aims to critically analyse the lack of quality indicators in infrastructure empirics and to redirect attention to improving infrastructure quality in its various forms in South Africa.

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1. INTRODUCTION

Infrastructure is currently a hot topic in both the academic and popular literature. Various reasons are postulated for higher infrastructure investment: 1) research on infrastructure investment, both local and international, suggests a positive (sometimes causal) relationship between higher infrastructure investment and higher economic growth (Chandana, 2006, Fedderke and Bogetic, 2006, Perkins, Fedderke and Luiz, 2005, Calderon and Serven, 2004), 2) South Africa is lagging behind the rest of the world in terms of a number of infrastructure variables (Bogetic and Fedderke, 2006), and 3) the coming 2010 Soccer World Cup would require additional investment and is therefore an important catalyst in increasing government investment in infrastructure (Fourie, 2006).

Infrastructure investment seems to be the politically prescribed prophylaxis of the South African economy. The reason for the investment in infrastructure seems to have shifted from primarily that of redistribution to that of encouraging higher economic growth. In the 2006 Medium Term Expenditure Framework, R409.7 billion has been allocated over the next three years for infrastructure investment, which includes expenditure estimates by national and provincial departments, municipalities, public private partnerships and public enterprises (Treasury, 2006).

Yet, the emphasis, both in research and in policy making, still seems to be on *more* infrastructure, rather than *better* infrastructure. This research note aims to critically analyse the lack of quality indicators in infrastructure empirics and to redirect attention to improving infrastructure quality in its various forms in South Africa.

2. THE QUALITY OF INFRASTRUCTURE

2.1 Why infrastructure quality?

The distinction between infrastructure quantity, also called the volume of infrastructure (Calderón and Chong 2004), and infrastructure quality is a vague one. Usually, infrastructure quantity is thought of as increasing the size of infrastructure stock – i.e. more roads and railways, a larger electricity grid, more telephone lines or homes with access to water and sanitation. Infrastructure quality would be defined as improving the performance of existing infrastructure stock – i.e. paving and patching roads, maintaining electricity distribution networks or improving the sanitation services from an outdoor pit latrine to a flush toilet connected to a sewer system. However, overlap is unavoidable: Is an extension to an airport (another runway) increasing the quantity or quality of infrastructure? Or what about increasing the container capacity at a sea port?

Yet, the distinction seems to be of no great importance: both quantity and quality are said to have a positive impact on economic growth. Admittedly, some studies, when discussing the impact of infrastructure, argue for better quality infrastructure, although they are implicitly referring to both improving the size and the performance of infrastructure stock. So why worry about separating the two?

Not all infrastructure investment benefits society in the same way; the distinction between quantity and quality of infrastructure and the services it provides is important to evaluate the transmission mechanism from infrastructure investment to economic growth. For example, to alleviate poverty and encourage redistribution, providing basic services is of critical importance, i.e. extending the volume of infrastructure (infrastructure quantity). To increase economic growth, however, investments in transport, telecommunication and electricity infrastructure are needed, not only providing these services but *improving* the current services, i.e. improving the quality of infrastructure.

Infrastructure quality is a catch-all phrase that includes all performance enhancing improvements both of the physical infrastructure and of the services it provides. Quality of transport infrastructure, for example, would include the condition of roads and airport runways, the timeliness of port services, and the safety of trains (railway services). The quality of electrical utilities may be determined by the reliability of electricity supply and the quality of telecommunications infrastructure by the speed of connectivity.

Why would one expect a different impact from infrastructure quality than quantity? Theoretically, infrastructure investment benefits growth in two ways. Through the direct effect the costs of inputs into the production process are reduced and through the indirect effect productivity improves. Furthermore, various positive externalities are created through infrastructure investment, improving competitiveness, international trade and regional integration

initiatives (Fourie, 2006). Intuitively, both infrastructure quantity and quality would have an impact on the direct and indirect effect. Calderón and Serven (2004), testing over different measures of infrastructure and using different estimation techniques over a sample of 121 countries, find that both the quantity and quality of infrastructure have a positive effect on economic growth[2]. More locally, using an array of infrastructure measures for South Africa, Fedderke, Perkins and Luiz (2006) find a positive and significant impact of infrastructure on growth, by improving labour productivity and by raising the marginal productivity of capital. A more recent study confirms their results (Fedderke and Bogetic 2006).

2.2 International trade

Yet, an increasing pool of evidence suggests that an important impact of improved infrastructure quality is on international trade (Limão and Venables 2001, Clark, Dollar and Micco 2004, Nordås and Piermartini 2004). Why is this? In essence, higher quality infrastructure and services from infrastructure reduce trade costs. According to Nordås and Piermartini (2004:5), trade costs can be divided into search costs, the cost of enforcing contracts, transport costs, tariffs and the cost of delays and uncertainties of delivery.

Infrastructure investment impacts on all of these trade costs. Telecommunications infrastructure can reduce search costs and increase trade; Fink, Matoo and Neagu (2002) find that including the cost of a telephone call in a gravity model has a negative and significant impact on bilateral trade flows. Nordås and Piermartini (2004) argue that "the cost of not being able to place a telephone call or access the internet may be just as important as the cost of making the call". They include a variable for telecommunications in a more sophisticated gravity model and find that it has a positive and significant impact on predicting trade flows.

According to Nordås and Piermartini (2004:6), the quality of transport infrastructure is an important determinant of the transport costs and the cost of time in transit. Because of the substantial increase of air freight relative to sea freight over the past decades and the increasing need for Just In Time-logistics, Hummels (2001) argues that cost of time in transit may exceed the transport costs, a view shared by Nordås and Piermartini (2004:6). Hummels (2001:21), for example, finds that a 1-day increase in ocean transit between two countries will reduce trade by 1 per cent for all goods and 1.5 per cent for manufactured goods. This suggests that the average ocean voyage of 20 days implies a tariff of 16 per cent. Time is therefore an important competitive factor and hence also a trade barrier in its own right (Nordås, Pinali and Grosso 2006:43). According to Nordås, Pinali and Grosso (2006:43), it "not only affects the volume of trade, it more importantly also affects the ability of enterprises to enter export markets at all". Port efficiency and transport networks connecting ports and industry are therefore a crucial determinant of exports, not only of monetary outlays but also of the opportunity foregone to reach markets where fast delivery is essential[3].

Uncertainty is another important trade cost. According to Nordås and Piermartini (2004), this uncertainty not only includes the cost of delays but also the cost of the cargo not arriving in the same condition (insurance costs). Quality of transport infrastructure – both of the physical infrastructure (roads) and of the services it provides (timely trains) – can reduce the costs of uncertainty associated with trade.

These costs, if added together, form a significant part of total trade. Although the tariff-effect of trade costs have come down over the last few decades (Hummels (2001) estimates that it has been reduced from 20 per cent in 1950 to 5.5 per cent in 1998), Hummels (2001) suggests that these costs have become more significant in explaining trade patterns around the world over the last few decades. Therefore, according to Nordås and Piermartini (2004), since timeliness and reliability have become very important in international trade, the "quality of transport infrastructure might have become a more important determinant of trade than in the past".

A further impact of the quality of infrastructure on trade is described by Yeaple and Golub (2002). They find that the quality of infrastructure can help to explain the absolute and comparative advantages of countries through its impact on total factor productivities. Therefore, specialisation in international trade does not only depend on factor endowments but – increasingly – on the quality of public infrastructure provision (Yeaple and Golub,

[2] The quality measures are, however, not as robust as the quantity measures. Calderón and Serven (2004) argue that this may reflect the poor measures of infrastructure quality or the fact that quality and quantity infrastructure are strongly correlated.

[3] Although fast delivery is usually relevant for the perishables market segment only, Nordås and Piermartini (2004) note that time is also relevant in the clothing industry, particularly in the segments characterised by rapidly changing styles. Given that clothing is a labour-intensive industry but most labour-intensive countries have poor infrastructure, countries closer to major world markets may benefit at the expense of the distantly located, but cheaper, exporters (as found by Evans and Harrigan, 2005).

2002:31).

Increasing the size of the infrastructure stock will, of course, also reduce trade costs. Yet, the quality of the infrastructure and the services it provides seem to be as important as determinant of a country's ability to trade with the rest of the world, one that should be included when analysing the impact of infrastructure investment.

Of course, international trade is not the only beneficiary of better quality infrastructure. Fourie (2006) notes several other important economic and social indicators that depend on the quality of infrastructure, including poverty, inequality and gender measures. In a panel study by Calderón and Chong (2004) assessing the impact of infrastructure on the income distribution, they find that both the quantity and quality of infrastructure are important in reducing income inequality, with causality running from the former to the latter. Furthermore, their results suggest quality issues are particularly important in industrial and emerging market countries and relatively less important in poorer countries (Calderón and Chong 2004), again suggesting that providing basic services may be more important in poor countries whereas an *improvement* of the services in developed countries may be of more significance.

3. INFRASTRUCTURE QUALITY IN SOUTH AFRICA

3.1 Measuring quality

Unfortunately, these important effects of infrastructure quality are extremely difficult to measure. Perkins (2003), published in Perkins, Fedderke and Luiz (2005), compiled data of South African infrastructure since 1875. However, none of the 19 infrastructure variables can be considered to measure purely the quality of infrastructure[4]. Time-series studies using this data (including Perkins, Fedderke and Luiz 2005, Fedderke, Perkins and Luiz 2006, Fedderke and Bogetic 2006) are handicapped by the lack of adequate measures of infrastructure quality and may not represent the full benefit of infrastructure investment.

Some cross-country evidence is available that provides a look at how South Africa's infrastructure quality compares to the rest of the world. The data, compiled by Estache and Goicoechea (2004), lists a number of infrastructure quality measures across countries[5]. Table 1 presents the results.

Table 1: Quality measures of South Africa's infrastructure performance

	Electric transmission and distribution losses (% of total output)	Phone faults (reported / 100 main-lines)	Travel time to work, main cities (minutes/one way work trip)	Paved roads (% of total roads)
South Africa	8	48	35	21
Sub-Saharan Africa	19	57	34	25
Middle East and North Africa	14	23	25	56
South Asia	22	97	27	38
East Asia and Pacific	12	39	36	32
Latin America & Caribbean	18	24	29	36
Europe and Central Asia	18	34	29	76
Low-income	22	64	33	30
Middle-income	15	25	29	52
Upper middle-income	14	18	29	57
High-income	6	11	32	82
World	14	37	31	50

Source: Estache and Goicoechea (2004)

Electric transmission and distribution losses in South Africa seem to perform relatively well against comparable areas and income-groups of the world. However, the data was last updated in 2002, before the electricity supply

[4] At best proxies can be used to measure the quality of infrastructure. Kilometers of paved road is one variable that can be transformed to measure some type of quality when divided by total kilometers of paved roads. However, the series was discontinued by Statistics South Africa in 1994, which render any future analysis impossible.

[5] A more comprehensive investigation into South Africa's cross-country infrastructure performance is done by Bogetic and Fedderke (2006).

shortages in South Africa of 2005 and 2006 materialised. One reason for these supply shortages was the apparent neglect of maintenance of the transmission lines (although Eskom claimed it to be as a result of more fires and mist in the Western Cape) (Eskom 2006).

Phone faults per 100 mainlines is the only measure of the quality of telecommunications infrastructure, although it obviously does not measure the quality of all telecom infrastructure[6]. South Africa (48) is significantly worse than the world average (37) and the average of middle-income countries (25).

Probably the most important measure of infrastructure quality is the travel time to work in the main cities (measured in minutes of a one-way work trip). South Africa (35) performs very poorly compared to all other income-groups (even higher than low-income countries at 33) and the world average at 31.

Paved roads as a percentage of total roads is another transport measure of infrastructure quality. South Africa (21%) is significantly below the world average (50) and of all other income-groups. Bogetic and Fedderke (2006) argue that this figure might be too extreme. Using Perkins' (2003) data paved roads are calculated to be 31% of total roads. However, even given this improved figure, South African road quality is far below par.

A further measure of the quality of transport infrastructure is the logistics costs of South Africa compared to its trading partners. Logistics costs in South Africa make up 15% of GDP while similar costs of the country's trading partners is only 8.5% of GDP on average (Kularatne 2006).

Given the poor performance of indicators of infrastructure quality in South Africa, one would expect poor South African export performance. According to Edwards and Alvin (2006), this is exactly the case. They argue that South African exports are not hampered by foreign export demand, but rather by supply constraints, especially transport infrastructure investment (Edwards and Alvin 2006:43).

Even if one only considers the impact of infrastructure quality on trade, the increasing importance of fast logistics to ensure contracts for local manufacturers in time-constrained international markets makes a strong case for improving infrastructure quality and infrastructure services in South Africa, primarily port and related transport infrastructure.

3.2 Addressing the issue

One way to address the poor quality infrastructure and infrastructure services is to build more of it. More ports (like the new deep-sea port at Coega) will alleviate some of the burden of container traffic at other South African ports, only if the domestic transport infrastructure (roads and railways) are aligned to service the new port. Similarly, adding more locomotives to the railway system and more flush toilets to the sewer system will improve the performance of the current stock of infrastructure.

Yet, adding more infrastructure is not the only way to address the problem, and probably a very inefficient way of using current resources. Addressing key constraints in the logistics network, eliminating red tape, speeding up services, getting prices right and increasing private initiative may be important alternatives to a simple cash-spending, fiscal exercise. However, such attempts are not easy to undertake – and rather more difficult than putting out a tender and signing a contract for a new project. Such projects require local level managerial capacity which is often lacking in areas where the constraints are more severe. Furthermore, politicians and bureaucrats who make the decisions may lack the political will to improve quality projects (Fourie 2006). For example, a new bridge or port facility is far more appealing and marketable than removing potholes or reducing red tape, even if the former is less efficient than the latter (Robinson and Torvik 2005). It is important that incentives for bureaucrats not be set according to the amount of resources spent on infrastructure provision, but rather, that incentives be set on infrastructure performance criteria, i.e. higher turnover at ports, shorter waiting times for trains.

4. CONCLUSION

Infrastructure investment is a binding constraint in South Africa and is being addressed within the government's ASGI-SA framework. Yet, empirical analysis of infrastructure's impact on growth does not consider the impact of infrastructure quality, broadly defined. South Africa is not doing very well on infrastructure quality measures. One impact of poor infrastructure quality is increasing trade costs, restraining exports. Furthermore, this may be

[6] The average speed of internet services would be an important addition.

an even more serious constraint in South African export performance in the years to come.

More investment is required. But more infrastructure investment is too vague a statement. Academics need to put flesh to it. To do this, better measures of infrastructure quality, over a longer time span, are required. To direct attention to the key binding constraints, we need to know where they are.

These directives should then be used to make the proper adjustments. Unfortunately, politicians and bureaucrats do not always follow the script. The political economy tends to be decisive. But maybe policy-makers need to redirect their attention to improving the quality of infrastructure and the services it provides – improving port efficiency and timeliness, railway security, internet speed and physical road quality – rather than thinking that more is necessarily better.

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