



China's Success in FDI: Why South Africa Can Learn from It

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By

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Abstract

Following economic reforms in 1978, the growth of Foreign Direct Investment (FDI) into China has been dramatic. The massive FDI inflows greatly benefited China's economy and contributed to its steady and rapid economic growth. Most FDI empirical studies use panel data as it solves the problem of data limitation, but it also produces 'average' effects for the results of the group of countries under study. Thus, individual countries in the group may generate different results when tested separately with the same model. This study uses an alternative approach that focuses on finding a Vector Error Correction Model with similar macroeconomic determinants of FDI for South Africa and for China. For both countries, larger market size and more advanced technology have a positive effect on FDI inflows, whereas higher labour cost affects FDI negatively. For the China model, infrastructure has a positive influence on its FDI inflows, whereas for the South African model worker strikes have a significant negative impact on FDI. Furthermore, we find remarkable similarities regarding the sectoral composition of FDI inflows in both countries, which further highlights the potential lessons that South Africa could learn from China regarding their highly successful FDI experience.

Keywords: FDI inflows; Johansen Cointegration; VECM

JEL Classification: C22; F21

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1. Introduction

Foreign direct investment (FDI) plays a substantial role in economic development, especially in developing countries, emerging economies, and countries in transition. According to the World Investment Report (2016), developing countries attract altogether about half of global FDI inflows in 2015. Multinational corporations continue to increase investment in market-seeking and efficiency-seeking projects in emerging economies due to the world production shifting to these countries. Because of this, developing countries play a more important role in the world economy – for instance, the GDP of developing countries as a share of total GDP of the world increased from 17.74% to 36.08% in the period 2000 to 2015. In OECD's¹ forecast, they are likely to account for 60% of the world GDP by 2030 (Global Development, 2010).

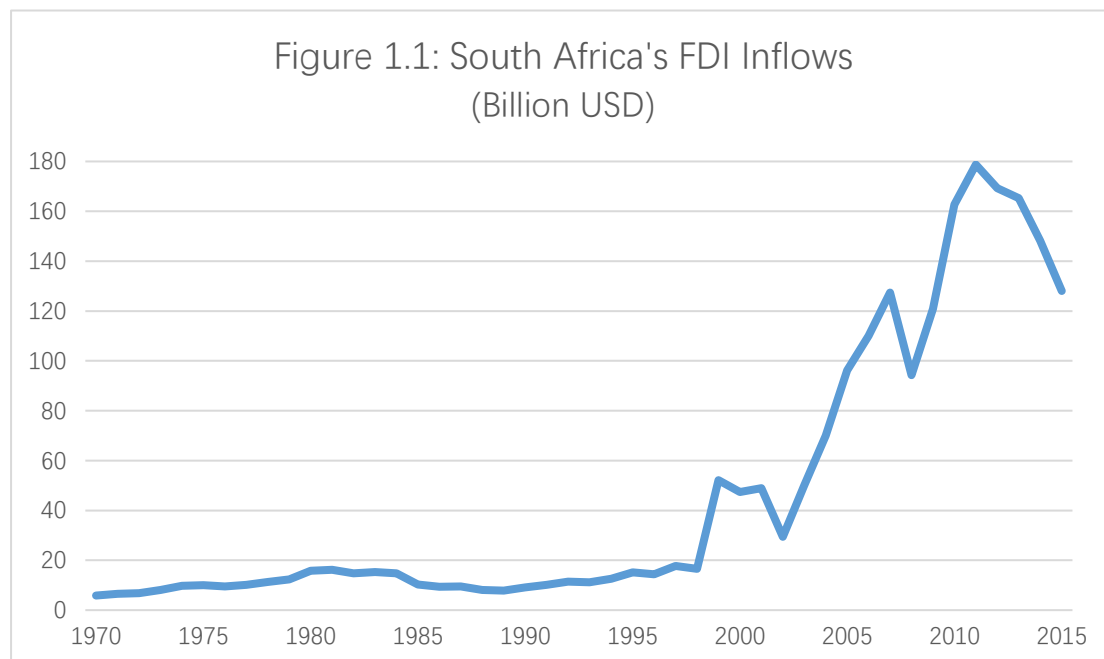
Many empirical studies have shown the positive impact of FDI on economic growth (Adhikary 2011; Thangamani et al. 2011; Azam 2010). It not only raises the level of investment and capital stock in host countries but also increases productivity by introducing new technology and management skills (Ho and Rashid 2011). Thus, many countries compete to offer favourable conditions to attract more FDI into their economies.

Most of the FDI studies in South Africa have shown that increase in FDI generally benefits the economy. Strauss (2013) finds a positive effect of FDI on economic growth in South Africa by estimating the impact from the period 1994 to 2013. Similarly, Tshepo's study (2014) suggests that FDI boosts long-term economic growth. FDI should also be considered as a mechanism to boost the long-term employment rate and productivity in South Africa, as foreign-owned service companies have significant spillover effects on the domestic business sectors. For example, the efficiency of South Africa's financial sector has been improved thanks to the entry of foreign banks. It

¹ The Organisation for Economic Cooperation and Development

enforces healthy competition within the banking sector, which is essential to long-term economic development. (World Bank Report, 2003; Business Day, 2006).

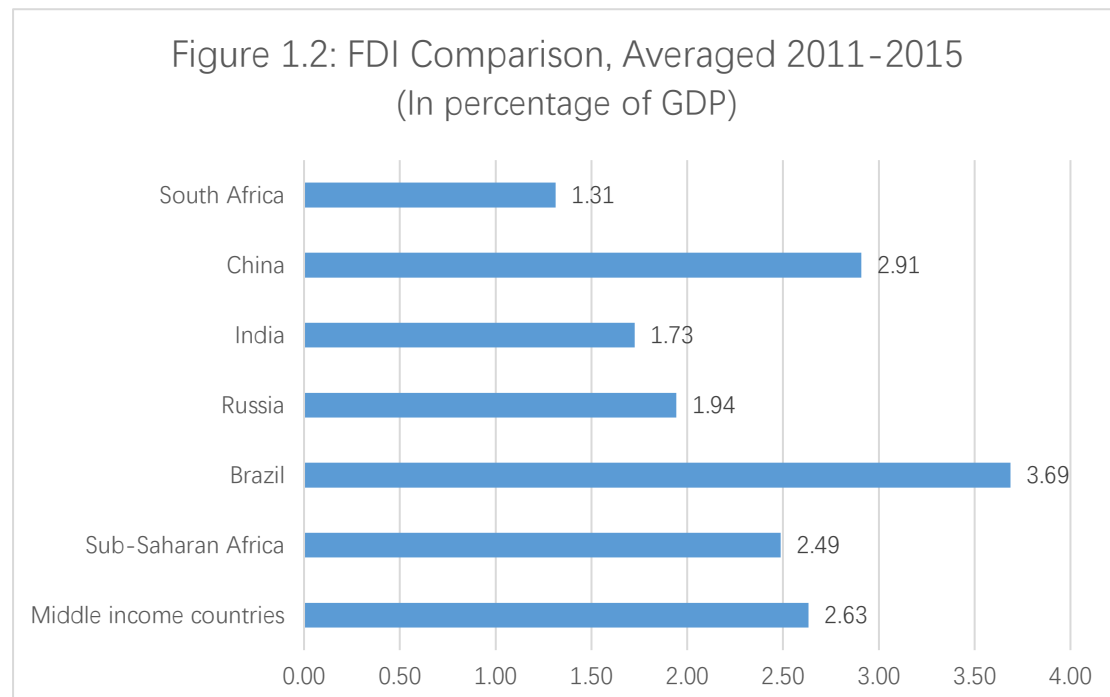
FDI inflows in South Africa have experienced an upward trend since 1970 (Figure 1.1). Before 1998, South Africa's FDI inflows were very low, but in the years after, they have grown by 19.71% per annum. There were three downturns in FDI inflows in South Africa after 1998. One happened in 2008 as a result of the global financial crisis, when FDI decreased by 20.26% globally. The other two, in the periods from 1999 - 2002 and 2011 - 2015 were both affected by continuous currency depreciation, even though FDI inflows in rand terms increased by 1.61% and 6.65% per annum respectively.



Data Source: South African Reserve Bank

Even though FDI inflows to South Africa have increased significantly in the last 20 years, there is still ample room for it to grow. In the last five years, FDI as a share of GDP averaged just 1.31%, which was low for both the Sub-Saharan Africa (2.49%) region and the sector of Middle-income countries (2.63%) (Figure 1.2). Also, South Africa still did not receive a significant amount of FDI compared to other important

emerging markets, particularly BRICS². Despite its smaller economic size, South Africa's FDI as a share of GDP was less than that of Russia and India. Meanwhile, Brazil and China received a large amount of FDI - 3.69% and 2.91% of GDP respectively. Owing to its large economic size, China received the highest amount of FDI, exceeding the sum of FDI inflows of the other four BRICS members.



Data Source: IMF - Balance of Payment Statistics

The growth of FDI in China has been dramatic since the economic reforms began in 1978. It has been the largest FDI recipient amongst developing countries since 1992 and the second largest recipient in the world (after the US) since 1993 (Cheng and Kwan 2000). The expansion of FDI in China has been accompanied by rapid economic growth and increasing openness to the rest of the world.

It is important to understand how China became one of the largest FDI beneficiaries in the world, what determinants drive the growth of FDI in China and what policies contribute to it. South Africa, as the second biggest economy on the African continent

² Five major emerging economies: Brazil, Russia, India, China and South Africa

and a member of BRICS, has some similarities to China. Can China's success story in attracting FDI inspire South African policy-makers?

The aim of this research is to find similarities between South Africa and China in regards to FDI by applying a similar model to each country and identifying some applicable lessons from China's experience which may be helpful to apply to South Africa's FDI policies. The remaining parts of this paper are organised as follows: Section 2 first provides an overview of FDI development and related policies after the 1978 economic reforms in China and then motivates potential FDI determinants by examining the previous studies in both China and South Africa. Section 3 specifies the FDI model for both China and South Africa and discusses why these determinants are included, and what are the expected results. Section 4 provides the empirical results along with the motivation of the methodology. After finding one cointegration relationship, the model is estimated for both China and South Africa by VECM (Vector Error Correction Model). Section 5 begins with the explanation of the results of the regression, comparing the differences between the common FDI determinants in South Africa and China. Then, a sectoral analysis explains why the determinants of FDI inflows in both countries are similar. Section 6 concludes this study and based on South Africa's economy, recommends strong FDI policies in China, which may help South Africa to promote its FDI inflows.

2. Literature Review

2.1 Foreign Direct Investment in China: An Overview

Before 1979, because of the frequent foreign invasion into China since 1840, the Chinese government viewed foreign-owned companies with suspicion, restricting foreign investment by strict supervision. Due to prior disastrous economic performance, new Chinese leader Deng Xiaoping started an economic reform in 1979, inspired by the success of Japan and Four Asian Tigers³. One important reform was to lift the prohibition of FDI that had been in place since the People's Republic of China was established in 1949 (Wei, 1995). He acknowledged that China was able to attract advanced technology and develop products for export by introducing FDI (Harding, 1987). In 1979, the new FDI law limited the establishment of foreign-owned companies to Special Economic Zones⁴, and the industries allowing investment were restricted to hotel, construction, and energy extraction. These restrictions were removed over time, and FDI was allowed to flow in every region and industry in China.

Although China started to open for FDI in 1979, the growth rate of FDI was quite modest. The number of projects only increased from 230 to 396 from 1979 to 1983, and the value of investments just rose from 0.5 billion USD to 1.5 billion (Dees 1998). Although foreign investors showed interest in China after 1977, large FDI inflows still did not occur because of the poor infrastructure. Some investors threatened to withdraw their investment projects away from China if the investment environment did not improve. Other potential foreign investors took a wait-and-see attitude, looking for more information before investing in China (OECD, 2000).

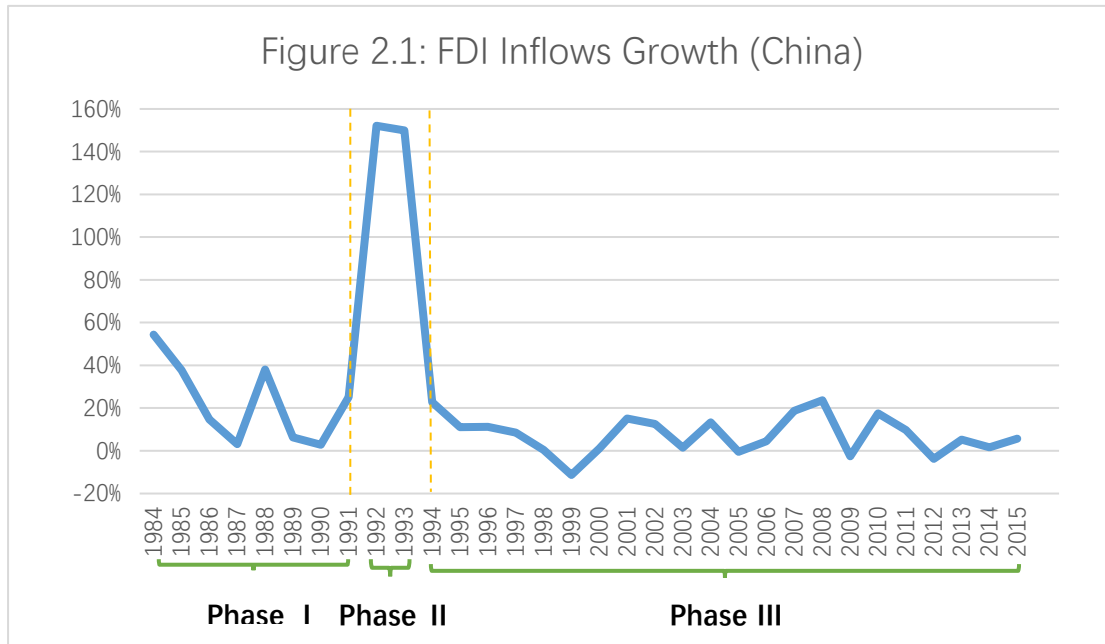
After 1983, the FDI inflows in China could be subdivided in three different phases (Figure 2.1). In the first phase, from 1983 to 1991, the Chinese government focused on

³ Hong Kong, Singapore, South Korea and Taiwan

⁴ Shenzhen, Zhuhai, Xiamen and Shantou

building infrastructure to improve the investment environment. Meanwhile, the special economic zones expanded from four to fourteen cities. In this phase, FDI inflows experienced a rapid and steady growth, which on average, increased by 22.77% per annum. During this phase, China also attempted to improve its bureaucratic efficiency (particularly in foreign investment project authorisations). Foreign investors' decisions on production, export, import, and employment became more flexible than before. Moreover, in 1986, the Chinese government started to offer tax incentives to foreign investors. While the corporate tax rate for domestic companies remained at 33%, the government made it just 15% for the foreign-owned companies (Harding, 1987). The general improvements within the investment environment, tax incentives, and cheap labour created favourable conditions for foreign investors. In 1992 and 1993, the large-scale expansion of FDI made China the second largest recipient of FDI in the world. The growth of FDI inflows in both years exceeded 150%. From 1994, the FDI inflows entered an adjustment period, but the amount still increased steadily (7.53% per annum). As China joined the WTO in 2001, the economy became more closely intertwined with the rest of the world. In the third phase, FDI inflows experienced negative growth in three different years. From 1997 to 1999, the growth of FDI inflows continued to decrease from 11.20% to -11.31%, which was caused by the Asian Financial Crisis in July 1997. The FDI inflows from Asia accounted for 70.04% of the total inflows, and the decrease reached 9.32% per annum⁵. Similarly, the 2008 global financial crisis hurt the FDI inflows in China, which caused growth to drop from 23.58% to -2.56% in 2009. From 2010, China started to equalise the corporate tax rate gap between domestic and foreign-owned companies to create a fairer competitive environment. The corporate tax for foreign-owned companies increased to 22% in 2010 and 24% in 2012. The new tax law came to effect in 2013, which prescribed the rate of 25% corporate tax for both types of companies. Because of it, some inefficient foreign investors withdraw their invested projects, which reflected on the decrease of FDI from 17.44% (2010) to -3.70% (2012).

⁵ Data Source: National Bureau of Statistics of China



Data Source: National Bureau of Statistics of China

2.2 Foreign Direct Investment in China and South Africa: Empirical Research

There are two types of studies on the determinants of FDI inflows. A single country model identifies the FDI determinants in an individual country, whereas a panel data model captures the average effects of the FDI determinants for a group of countries.

China and South Africa were frequently studied as a panel of BRICS. Vijayakumar, Sridharan and Rao (2010) investigated the factors determining FDI inflows by analysing panel data of the BRICS countries from 1975 to 2007. The results suggested that market size and infrastructure had a positive effect on FDI inflows, while labour cost affected it negatively. The results of most of the empirical studies on BRICS are consistent. Another panel analysis on BRICS for the period 1989 – 2012 not only confirmed the significant effects of the market size, infrastructure, and labour cost but also found the positive influence of technology clustering on FDI inflows (Oliveira 2014). Similarly, Labes (2015) found the market size and labour cost were significant determinants of FDI in BRICS from 1992 to 2012.

As for the individual country FDI studies, FDI determinants in China have been investigated intensively in the 1990s and 2000s. Studies have shown that market size and the market growth prospects, measured by GDP and GDP growth respectively, had significant positive effect on FDI inflows in China (Wang & Swain 1997; Zhang 2000; Wei & Liu 2001; Zhang 2002). Infrastructure plays a major role in attracting FDI, especially in the 1980s and 1990s. Many studies have shown that better infrastructure attracts more FDI inflows (Ali and Guo 2005; Cheng and Kwan 2000; Chen 2011). Foreign-owned companies take advantage of low labour cost in China, and the increase of the labour cost have a negative impact on FDI inflows (Liu et al. 1997; Zhang & Yuk 1998; Zhang 2000). Following the development of the National High-Tech Industrial Development Zones in China, technology becomes more important to foreign investors. It has a positive effect on FDI inflows since the foreign investor can benefit from the spillover effect of industry agglomeration (Dees 1998; Chen 2011).

There is limited empirical research on the determinants of FDI inflows in South Africa, but the findings confirm the results of panel analysis in BRICS. Hlongwana (2015) found that market size and positive long-term growth prospects have a favourable effect on FDI inflows in South Africa by examining time series data from 2003 to 2013. Likewise, Arvanitis, Nowak and Ricci (2005) tested the determinants of South Africa's FDI inflows from 1980 to 2002. The results confirmed a positive effect of market size to FDI.

The results of both the BRICS panel and the individual country studies confirmed that the market size, wage, infrastructure, and technology were the significant determinants of FDI inflows. Thus, these variables are considered to be included in the FDI models in this study.

By reviewing the literature, the FDI empirical studies mainly focus on the panel analysis of a group of countries and one individual country. We have not found any research comparing FDI models in different countries. It is harder to find the similar significant results for different countries by analysing these countries individually than testing all the country as a group of panel. This study focuses on finding the similarities between South Africa and China in regards to FDI by testing a similar model for both countries, which is which is a new approach to the FDI empirical research. As the FDI inflows have been studied intensively in China, the results may help to build an FDI model for South Africa. Since China successfully attracted a significant amount of FDI after its economic reforms, attempting to apply a similar form of Chinese FDI models may help to promote FDI inflows in South Africa.

3. Model and Data

3.1 Model Specification

The basic model is specified in log-log form so that the estimated parameters are elasticities. Both models contain three main explanatory variables: GDP, labour cost and patent. The China model (Equation 1) does not include strikes, and the South Africa model (Equation 2) does not include rail kilometres. Further explanation will be given in section 3.2.

The model for China is specified as follows:

$$\begin{aligned} \log(FDI_t) = & \beta_0 + \beta_1 \log(GDP_t) + \beta_2 \log(Labour_cost_t) + \beta_3 \log(Rail_t) \\ & + \beta_4 \log(Patent_t) + \varepsilon_t \end{aligned} \quad (1)$$

The model for South Africa is specified as follows:

$$\begin{aligned} \log(FDI_t) = & \beta_0 + \beta_1 \log(GDP_t) + \beta_2 \log(Labour_cost_t) + \beta_3 \log(Strike_t) \\ & + \beta_4 \log(Patent_t) + \varepsilon_t \end{aligned} \quad (2)$$

where *FDI* is nominal FDI (USD), *GDP* is nominal GDP (USD), *Labour_cost* is the labour cost index (USD, 2010 = 100), *Patent* is the number of technology patents, *Rail* is the total route of rail line (kilometres), and *Strike* is the total number of strike activities in a country.

3.2 Variables and Data

The model variables in this study were selected according to FDI theories in literature. As was discussed in the literature review, market size, labour cost, infrastructure, and technology are generally used to explain FDI in China. The frequency of strikes is included in South Africa's model as it has severely affected the economy. Importantly, these strikes are in sectors that receive significant FDI inflows. Since FDI inflows data are only available annually, data for above variables from 1983 to 2015 are used in the estimation for China and from 1980 to 2015 for South Africa.

FDI inflows

There are two ways to measure the FDI inflows, the FDI net inflows⁶ and inward FDI⁷. For smaller economies, FDI net inflows could be highly volatile and negative in certain years. South Africa is an example of this. As negative values cannot be transformed into log forms, it causes difficulties in analysing South African FDI net inflows in these years. In this study, the inward FDI is used to measure FDI inflows in South Africa. As for China, FDI inflows are measured by the utilised FDI inflows⁸.

Data source: National Bureau of Statistics of China & South African Reserve Bank

Table 3.1: FDI Definitions

	Inward FDI	FDI Net Inflows	
+	Non-residents investment	Non-residents investment	+
+	Residents disinvestment	Non-residents disinvestment	-
	Outward FDI	FDI Net Outflows	
-	Resident investment	Residents investment	-
-	Non-residents disinvestment	Residents disinvestment	+

Note: (+) means money flows into the reporting economy; (-) means money flows out of the reporting economy.

⁶ The FDI net inflows are calculated by non-resident investment minus non-resident disinvestment in reporting economy (Table 3.1).

⁷ Inward FDI is recorded as credit in the Balance of Payments, which captures the total amount of foreign direct investment flowing into the reporting economy (i.e. the non-resident investment in reporting economy and the resident disinvestment in external economies) (Table 3.1).

⁸ IMF – Balance of Payment Statistics has the most complete database for FDI. However, the data of FDI in the reporting economy is only available for China back to 2004, which is insufficient for the regression analysis. Moreover, the National Bureau of Statistics of China annually report the actually utilised FDI inflow. It is a better measurement for the FDI inflows since it is part of the non-resident investment in China, which excludes the resident disinvestment in external economies.

Market Size

China is the third geographically largest country with the largest population in the world. There is great potential for developing China's market. According to the product cycle theory, market extension is the critical factor considered by the multinational corporations. (Dunning 2012). Larger market size indicates larger domestic consumption potential, which attracts benefit-oriented foreign investors. Countries with larger market size as measured by Gross Domestic Product (GDP) should attract more foreign investment than those with smaller market size. The elasticity of FDI with regards to GDP is expected to be greater than one in an expanding market.

Data source: World Bank

Labour cost

One important motivation for FDI is to achieve overall lower production costs in the host country (Cushman 1987). Lower labour cost is one of the key determinants attracting more FDI in China (Ali and Guo 2005; Chen 2011; Zhao 2003; Dees 1998), as China has lower labour cost compared to other large Asian economies such as Japan, South Korea, and Singapore. Labour cost, measured by the labour cost index in US dollar is expected to be negatively related to FDI.

Data source: National Bureau of Statistics of China & OECD – Economic Outlook

Technology

Foreign investors may invest in a region with a high level of innovation to take advantage of the environment. Since 1988, National High-Tech Industrial Development Zones have been developed in China. By 2015, there were 145 National High-Tech Industrial Development Zones spreading over the country⁹. Each of them attracts thousands of corporates domestically and internationally. Multinational corporates not only benefit from the spillover effect of the industry agglomeration but also from the tax incentives to the high-tech industry. Thus, technology, measured by the number of

⁹ Data source: National Bureau of Statistics of China

technology patents registered is expected to have a positive effect on FDI inflows.

Data Source: World Intellectual Property Organisation

Infrastructure

Established and quality infrastructure is important to foreign investors. Since 1978, China has developed infrastructure like railroads and highways, vastly improving China's overall infrastructure. Electricity production and fixed telephone subscriptions have been growing as well. Entering the 21st century, fixed broadband and mobile cellular subscriptions have been increasing dramatically. Less than 1% of the Chinese population used the internet and mobile phones before 1990, but in 2015, the internet users per 100 people reached 50.3, and the mobile cellular subscriptions per 100 people become 93.1¹⁰. The development of this infrastructure provides a better business environment for foreign investors. Studies have shown it is a key factor attracting FDI in China (Ali & Guo 2005; Chen 2011; Zhao 2003). Many analysts use the rail line (total route kilometres) as the proxy because the rail line has been continually constructed since 1970, whereas the internet and mobile phone subscriptions only started to develop since the late 1990s. This study also applies rail line (total route kilometres) as proxy. Its elasticity with regards to FDI is expected to be positive and around 1 in the long run.

In South Africa, the total route of rail line was volatile after 1987 since, in certain years, more rail line was abandoned and dismantled than was built. In 2011, the rail line was 3096 thousand kilometres less than it was in 1981 (by 23596 thousand km) and no new rail was built after 2011. Thus, it is not an appropriate proxy for infrastructure as it has not developed as FDI has grown. A similar proxy, highway (total route kilometres) is restricted because of the limited period of data. The internet and mobile phone subscriptions have the same issue. Other proxies such as electricity and water have already been developed, the growth of which is so modest that it cannot represent the

¹⁰ Data source: World Bank – World Development Indicators

development of infrastructure. Moreover, according to the World Bank Global rankings for 2016, South Africa ranks 20th in level of infrastructure throughout the world, which is higher than some of the developed countries such as Denmark and Ireland. Thus, as South Africa already has quality infrastructure, it should theoretically play a limited role in attracting more FDI in the future. Therefore, infrastructure is excluded in South Africa's model.

Data source: National Bureau of Statistics of China & World Bank

Strikes

Strikes have been a problem in South Africa historically. Moreover, it has become a more severe problem since the Labour Relations Act was passed in 1995, regulating organisational rights of trade unions to promote collective bargaining and ensure the right to strike as well as recourse to lockouts. In 2015, more than 900 000 working days were lost mainly due to disputes relating to wages, bonuses, and other compensation. The social impact of labour disputes in 2015 is estimated around R116 million in the South African economy (Annual Industrial Action Report, 2015). Protests frequently happen in mining and manufacturing sectors which are both sectors that FDI typically flows into. Thus, it can be concluded that these frequent strikes discourage foreign investors in coming to South Africa since strikes suspend manufacturing and severely hurt corporate operations. Regarding strikes in China, there are limited strike reports before 2010, and there is no database for any relevant strike indicator before 2011. In recent years, more strikes have been reported but most of them happen in domestic manufacturing industries due to unpaid wages. Moreover, in terms of the economic scale, the effect of strikes is relatively small compared to South Africa, and are insignificant to the overall economy in China. Thus, it is not as relevant to investigate the effect of strikes in China as it is in South Africa. The strike variable is measured by the frequency of strikes in a year and is expected to have a negative effect on FDI inflows in South Africa.

Data Source: International Labour Organisation.

4. Methodology and Empirical Results

In this section, all of the time series variables are firstly tested for the order of integration. After determining the lag order of the VAR, the Johansen cointegration test is performed to examine the number of cointegration relationships. The variables are then estimated by the Vector Error Correction Model (VECM), and lastly, a few diagnostic tests are run to check robustness. The relevant methodology is presented in Appendices.

4.1 Unit Root Test

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test (Appendix A2.1) are used to examine whether a time series is stationary, and if the time series is not stationary, what the order of integration it is. Nonstationary variables in a traditional time series model may generate spurious results. Researchers manage to solve this problem by differencing the series until it becomes stationary or using cointegration methods.

Table 4.1: Unit Root Test (China)

Variable	ADF Test		PP Test		Order of Integration
	Level	First Difference	Level	First Difference	
Log(FDI)	-1.574	-3.692***	-1.412	-2.644***	I(1)
Log(GDP)	-2.305	-3.378**	-1.624	-3.453**	I(1)
Log(Labour_cost)	-2.414	-5.258***	-2.991	-5.229***	I(1)
Log(Rail)	0.307	-4.573***	0.591	-4.443***	I(1)
Log(Patent)	-0.375	-6.182***	0.049	-8.637***	I(1)

()[***] Significant at a 10(5)[1]% level.*

Table 4.2: Unit Root Test (South Africa)

Variable	ADF Test		Phillips-Perron Test		
	Level	First Difference	Level	First Difference	Order of Integration
Log(FDI)	-1.987	-6.244***	-1.892	-6.270***	I(1)
Log(GDP)	-1.391	-4.299***	-2.250	-4.129***	I(1)
Log(Labour Cost)	0.427	-4.735***	-2.782	-3.988***	I(1)
Log(Strike)	-2.712	-5.447***	-2.720	-5.419***	I(1)
Log(Patent)	-2.786	-8.585***	0.805	-8.733***	I(1)

()[***] Significant at a 10(5)[1]% level.*

The results of the ADF and PP tests are summarised in Table 4.1 and 4.2. Both tests show that all the variables are non-stationary at levels but become stationary after taking the first difference. Therefore, these variables are integrated of order one, which further suggests the possibility of cointegration relationship.

4.2 Lag Length Selection

Before testing for the existence of cointegration relationships, it is necessary to determine the optimal lag length for both models. According to most of the VECM studies using annual data, two lags are included in the tests to avoid losing too many degrees of freedom in the estimation of the VECM structure. The optimal lag length is one for the model for China and two for South Africa, based on the AIC, SC and HQ criterion (Table A3 and A4, Appendix 3).

4.3 Cointegration Test

Since the variables are integrated of order one, the Johansen cointegration test (Appendix A2.2) is applied to investigate whether there are cointegration relationships. The test results of five sets of assumptions for both countries' models indicate that under most of the assumptions, there is one cointegration relationship for both models (Table A5 and A6 in Appendix 4). In most of the analysis, a constant should be included in both cointegration equation and VAR in the VECM estimation. Regarding this case, both the trace and maximum eigenvalue tests confirm there is one cointegration relationship for China's and South Africa's model respectively.

4.4 The Long-run Relationship

This study applies VECM (Appendix A2.3) as a tool to identify the long-run factors determining FDI by using annual data. It is more important to investigate the long-run determinants of FDI because for a country, the improvement of FDI is based on the long run, regardless of any short-run adjustment factors present. They will eventually converge to the long-run equilibrium as long as the error correction mechanism works.

The results of the long-run cointegration relationship are presented in Table 4.3 and 4.4. The cointegration equation for China includes five variables, FDI, GDP, Labour Cost, Rail and Patent. In South Africa's model, the explanatory variables are GDP, Labour Cost, Patent and Strike. The significance levels for the long-run relationship will not be discussed due to the non-standard distributions resulting from the use of non-stationary data. All that is important is to note that all the signs of estimated coefficients are in line with our priori expectations based on economic theory for both China and South Africa. GDP, infrastructure, and technology have a positive impact on FDI inflows, while labour cost and strikes influence it negatively. The summary of all the long-run relationships is shown in Table 4.5.

Table 4.3 Estimation of the Long-run Relationship (China)

Dependent Variable: Log(FDI)

Variable	Coefficients	Standard Error	t-statistic
C	14.54127	-	-
Log(GDP)	2.80056	0.21594	-12.9689
Log(Labour_cost)	-3.63476	0.16611	21.8819
Log(Rail)	1.18956	0.77768	-1.52962
Log(Patent)	0.54474	0.03598	-15.1381

*t-statistics are evaluated on 1% (± 2.52), 5% (± 1.72) and 10% (± 1.32) critical values***Table 4.4 Estimation of the Long-run Relationship (South Africa)**

Dependent Variable: Log(FDI)

Variable	Coefficients	Standard Error	t-statistic
C	7.329187	-	-
Log(GDP)	1.652556	0.17205	-9.60530
Log(Labour_cost)	-1.14843	0.27976	4.10511
Log(Strike)	-0.39659	0.06456	6.14316
Log(Patent)	0.678492	0.39300	-1.72644

*t-statistics are evaluated on 1% (± 2.55), 5% (± 1.73) and 10% (± 1.33) critical values***Table 4.5 Summary of Long-run Relationship**

Variable	China	South Africa
Log(GDP)	+2.800	+1.653
Log(Labour_cost)	-3.635	-1.148
Log(Patent)	+0.545	+0.678
Log(Rail)	+1.190	N.S
Log(Strike)	N.S	-0.397

Notes: N.S means not studied; (+) means positive relationship; (-) means negative relationship.

4.5 Short-run Dynamics

The error correction terms for both models have negative signs, and they are significant at 5% level, confirms that both systems are stable and able to converge to their long-run equilibrium. According to Table 4.6, the error correction term is -0.3946 in China's model, and it is -0.5749 in South Africa's, indicating that adjustment towards the equilibrium takes place by 39.46% and 57.49% per annum for China and South Africa respectively. The results of the full short run dynamics from the VECM are shown in Table A7 and A8 in Appendix 5. Since this study applies annual data and focuses on the long-run effects, it is not necessary to discuss the short-run results further.

Table 4.6 Summary of Short-run Error Correction Terms

Variable	Coefficients	Standard Error	t-statistic
ECT (China)	-0.394632**	0.20926	-1.88587
ECT (South Africa)	-0.574908**	0.33049	-1.73958

()[***] Significant at a 10(5)[1]% level.*

4.6 Robustness Checks

Certain diagnostic tests are performed on the residuals to ensure that the model yields robust estimates. The results are presented in Table A9 and A10, Appendix 6. Heteroskedasticity, autocorrelation and normality are tested by using the White Heteroskedasticity, Breusch-Godfrey, and Jarque-Bera (Appendix A2.4) tests respectively. The results suggest the residuals are homoscedastic, free from autocorrelation and normally distributed for the model of both countries. Thus, diagnostic tests indicate that the model selected is parsimonious and yields robust estimates.

5. Results Discussion

This section first compares the differences between the common FDI determinants in South Africa and China. Then, sectoral analysis explains why the determinants of FDI inflows in both countries are similar.

5.1 Comparison: Impacts of the FDI Determinants in South Africa and China

Market Size

The results suggest that market size has a strongly positive effect on FDI inflows in both countries, while its impact is somewhat smaller in South Africa. It is expected since one essential type of FDI is market-seeking investments that focus on countries with large markets and promising growth prospects, which implies an increasing return of market size to FDI inflows. The market size in China is, on average, 13.15 times bigger than it is in South Africa for the period 1980 - 2015. Also, the growth of the Chinese market is over 6.9% in the last decade, while it is rather unstable in South Africa, which fluctuates between -1.5% and 5.5%¹¹.

Labour Cost

To attract FDI, even though low labour cost is not a key factor for capital-intensive economies (e.g. the US), it plays a significant role for labour-intensive economies with proper infrastructure for production such as China and South Africa. As one of the principal motivations to invest overseas is to lower production costs, the results of the negative impact of labour cost on the FDI inflows confirm this theory. The effect in South Africa is less sensitive than it is in China. One essential reason is that, during the examined period¹², the increase of average wages in South Africa was relatively slow (268%), whereas it rose dramatically in China (2382%). There is a non-linear negative relationship between labour cost and FDI inflows. As the speed of the growth of labour

¹¹ Data Source: World Bank

¹² South Africa: 1980-2015, China:1983-2015

cost increases, labour cost will have a larger negative impact on FDI inflows. The labour cost in China, therefore, no longer gives the country as large an advantage as it used to. Much labour intensive manufacturing has already been moved to other Asian countries such as Vietnam due to their cheaper labour costs. The rapid increase of labour cost in China results in the negative growth of FDI in low-end manufacturing, which is an important part of China's manufacturing sector. This explains why labour cost has a large negative impact on FDI inflows in China.

Technology

The findings suggest technology positively influences FDI inflows and has almost the same impact in both countries. Regarding the number of patents, innovation activity is more prevalent in China, which implies that the ICT market in China should be more attractive to foreign investors as they could benefit from the spillover of technology. However, the results suggest no difference between their influences on FDI inflows in both countries. One significant reason could be the Intellectual Property Rights problem. Foreign investors in China face problems with enforcing intellectual property rights and those selling branded products have often had to deal with counterfeits. The violation of intellectual property rights is an impediment to FDI in China. By contrast, South Africa has a relatively well-established law for intellectual property rights. According to the research on technology industry across the African continent (KPMG, 2013), South Africa has an established technology market and its ICT market ranks the 1st in Africa. In this regard, South Africa ICT market is more attractive to foreign investors.

5.2 Sectoral Analysis of FDI inflows

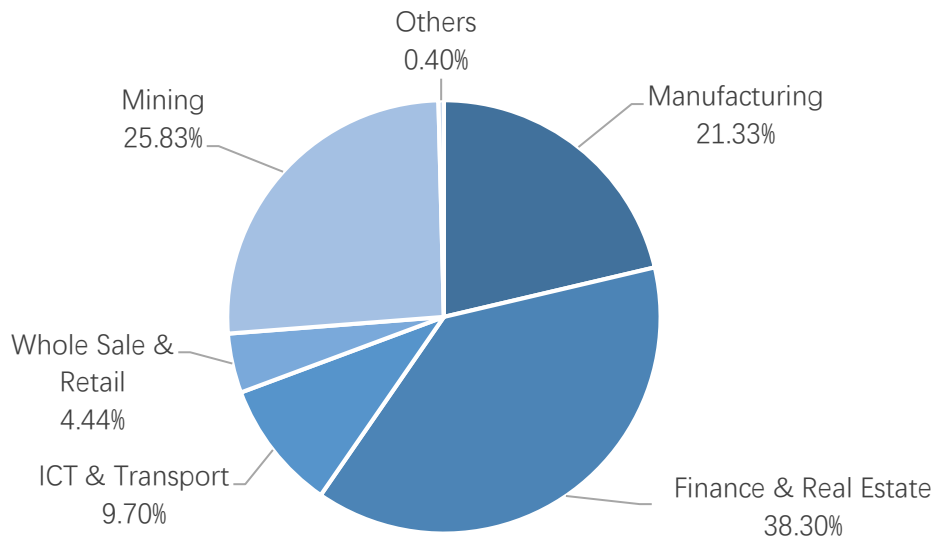
Besides the aforementioned factors of what commonly drives FDI in both countries, another interesting factor is the FDI composition. Figures 5.1 and 5.2 display five sectors that attract massive FDI inflows in South Africa and China, based on the average of data from 2011 to 2015. Regarding South Africa, Finance and Real Estate are the sectors that foreign investors are most interested in, absorbing 38.30% of the total FDI

inflows. Mining and manufacturing sector are also popular. 25.83% of FDI flows in the mining sector and 21.33% is in the manufacturing sector. The fourth and fifth broad sectors are ICT (Information, Communication and Technology) & Transport (9.70%) and Wholesale & Retail (4.44%). These five sectors together attract 99.60% of FDI inflows, representing the vast majority of foreign investors' interest in South Africa.

The big five FDI sectors in China are strikingly similar to those in South Africa. They are Manufacturing (38.23%), Finance & Real Estate (28.58%), ICT and Transport (8.65%), Wholesale & Retail (8.61%), and Business Service (8.37%), which combine for 92.34% of the total FDI inflows in China. The rest of the sectors receive 7.56% of the total FDI but each of them less than 1% respectively.

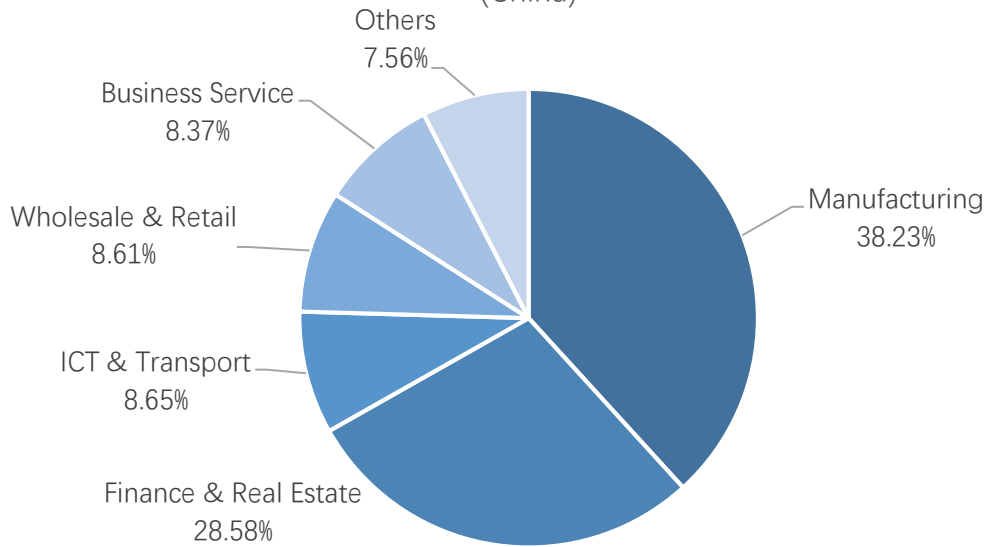
The remarkable similarities regarding sectoral FDI inflows highlight that not only the determinants of FDI inflows in both countries are similar, but their compositions are also similar. The Finance & Real Estate and Manufacturing sectors are both vital, together accounting for more than half of the FDI inflows for both countries. The Wholesale & Retail and ICT & Transport sectors also attract significant FDI inflows. The difference is that mining sector plays an essential role in South Africa, while the business services sector is attractive to foreign investors in China. It is necessary to discuss these sectors further to find out the rationale behind the determinants.

Figure 5.1: FDI Inflows by Sectors, Averaged 2011-2015
(South Africa)



Data Source: South African Reserve Bank

Figure 5.2: FDI Inflows by Sectors, Averaged 2011-2015
(China)

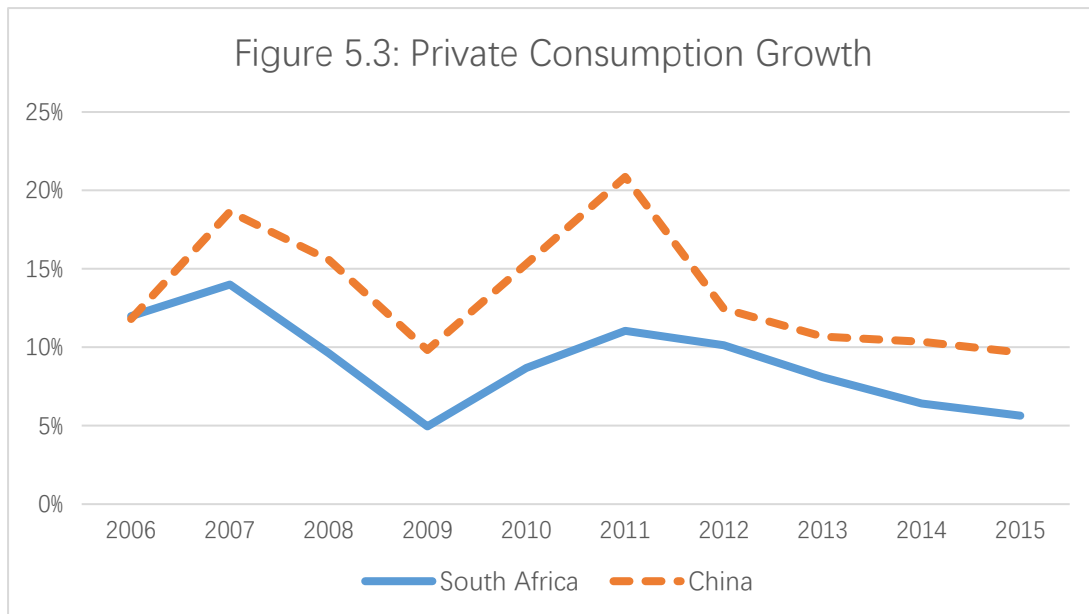


Data Source: National Bureau of Statistics of China

5.2.1 Manufacturing Sector

Large market size, based on the expenditure method of GDP calculation¹³, implies significant domestic consumption. In last decade, private consumptions, on average, accounted for 60.34% (South Africa) and 36.79% (China) of total GDP. Moreover, they experienced a steady growth in both countries (Figure 5.3). The average growth was 9.06% and 11.82% in South Africa and China respectively. The growth of domestic market size, specifically domestic consumption, motivates investors' interest in the manufacturing sector as domestic demand increases. By establishing factories in targeted markets, foreign investors can reduce their cost of imports such as the tariffs and transportation fees. Additionally, export-orientated FDI in manufacturing sector requires cheap labour to reduce cost the labour-intensive assembling process. As the manufacturing industries in both countries are still labour-intensive, cheap labour also plays an essential role in attracting foreign investment. However, although the labour cost in South Africa is still low compared to the rest of the world, its manufacturing sector suffers severely due to frequent strikes. South Africa, on average, has lost 284,109 working days per year in the manufacturing sector in past three years (Annual Industrial Action Report, 2015). The strikes cause uncertainty within the manufacturing sector and increase the cost of production, which is a significant impediment to FDI in South Africa.

¹³ $GDP = Consumption + Investment + Government\ Expenditure + Net\ Exports$



Data Source: National Bureau of Statistics of China & SARB

5.2.2 Finance and Real Estate Sector

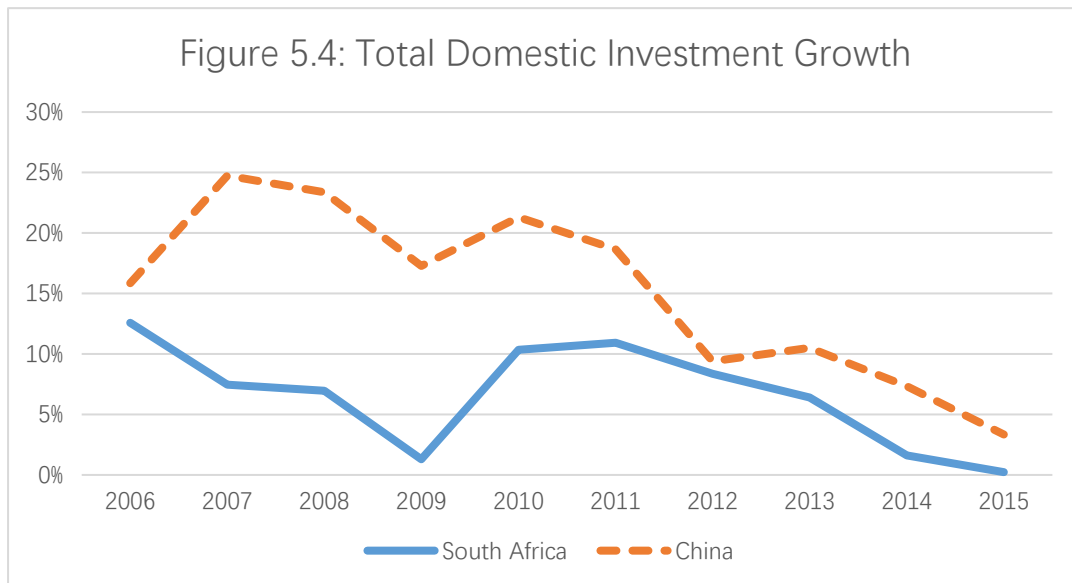
Unlike the manufacturing sector, which is partially export-orientated, the Finance and Real Estate sectors are both non-tradable. Large market size, based on the expenditure method of GDP calculation, also implies an active domestic investment market. In the past ten years, total domestic investment, on average, accounted for 23.42% (South Africa) and 45.32% (China) of total GDP. Moreover, both experienced a continual growth in this period (Figure 5.4). The average growth was 6.62% and 15.18% in South Africa and China respectively. The active domestic investment market attracts foreign investors to finance domestic investment. From 2011 to 2015, the total credit granted¹⁴, on average, rose by 10.72% and 2.58% in South Africa and China respectively. Additionally, active domestic investment drives the revenue within real estate investment as well. The revenues of real estate activities¹⁵ experienced a per annum increase of 25.52% (South Africa) and 11.26% (China) from 2006-2015. Also, the average housing price grew at an average rate of 5.36% and 8.11% in the past decade in South Africa and China respectively, excepting the years of global financial crisis

¹⁴ Data Source: South African National Credit Regulator & National Bureau of Statistics of China

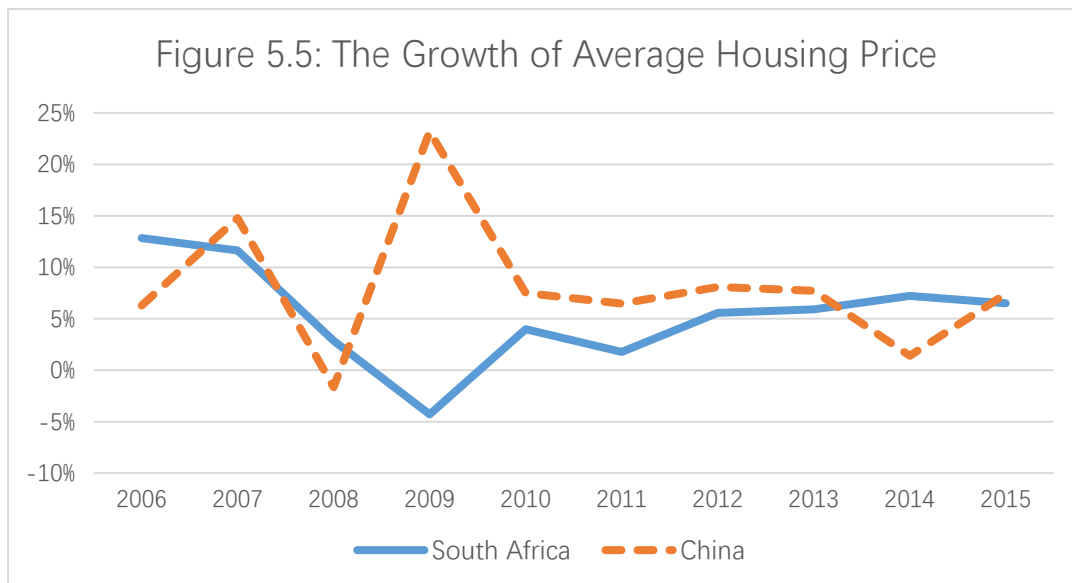
¹⁵ Real estate activities include the selling, reselling, renting and administering the real estate.

Data source: Statistics South Africa & National Bureau of Statistics of China

(Figure 5.5). Both the continual increase of revenue and housing price attract increasing FDI into the real estate sector.



Data Source: National Bureau of Statistics of China & SARB

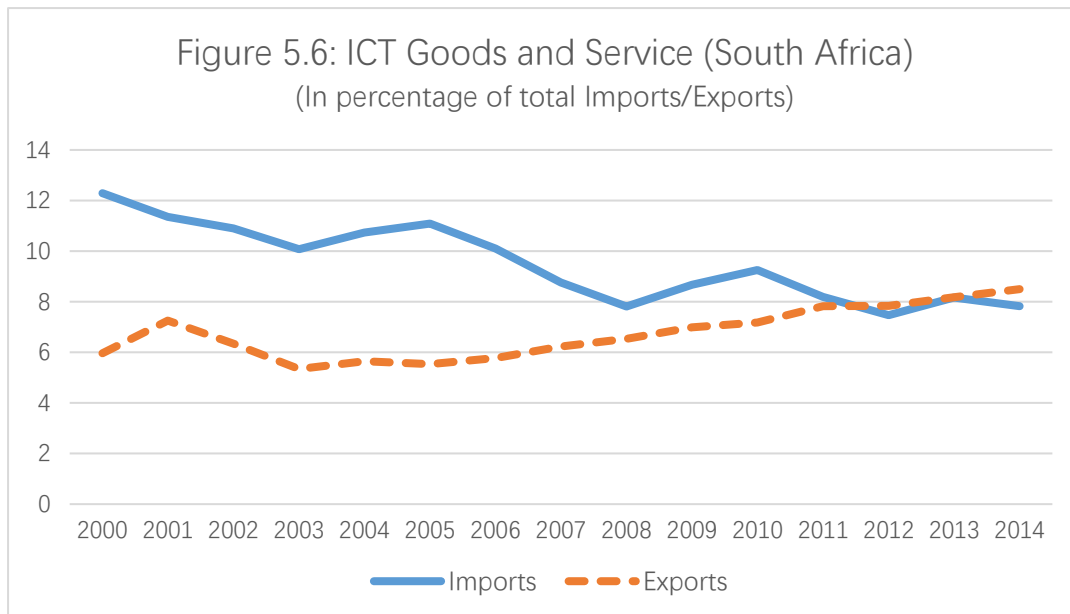


Data Source: First National Bank House Price Index & National Bureau of Statistics of China

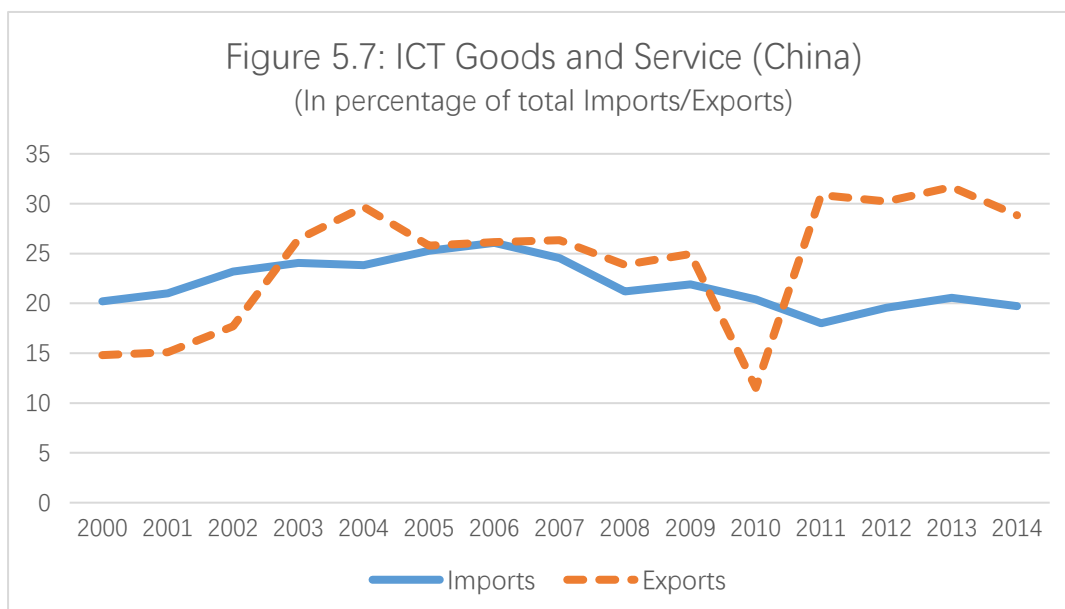
5.2.3 ICT and Transport Sector

The ICT and Transport markets in both South Africa and China are not large but have a significant contribution to their economies, which, on average of the recent five years, accounted for 9.22% and 4.42% in South Africa and China respectively. Moreover, there is great potential of the markets as they experienced an average growth of 9.22% and 10.22% respectively in recent five years, which is attractive to foreign investors.

In China, 145 National High-Tech Industrial Development Zones had been built by 2015. Each attracts thousands of corporates domestically and internationally. These zones are attractive to foreign investors as they receive benefits from the spillover effect of industry agglomeration. South Africa also attracts significant FDI inflows in ICT industries because of its improvement in technology. Rather than industry agglomeration, High-Tech industries in South Africa were developing by importing ICT goods and services. As South Africa has a tax incentive policy that ICT companies could deduct 150% of its R&D spending when determining their taxable income, the technology level improved through intensive research on advanced ICT goods imports and the spillover effect of ICT service imports. Because of technological improvements, South Africa was able to export more ICT goods and services. In 2000, ICT goods and service imports were 6.33% higher than the exports (Figure 5.6). Over the next 14 years, the number of ICT exports and imports grew closer to each other, and in 2014, South Africa was able to export a higher number of ICT goods and services than it imported for the first time. Moreover, the FDI inflows to ICT sectors increased in the same period, which confirms that the improvement of the technology promotes FDI inflows in South Africa. In 2014, ICT exports in China were 9.12% higher than the imports (Figure 5.7), while the surplus was only 0.67% in South Africa (Figure 5.6), which confirmed that the technology level in China was higher.



Data Source: World Bank



Data Source: National Bureau of Statistics of China

5.2.4 Wholesale and Retail Sector

Wholesale and retail are two major ways of selling manufacturing products in the domestic market. Thus, they are also driven by the market size, specifically, the domestic consumption, as we previously discussed in the manufacturing sector. Foreign investors are more interested in a market with large domestic demand and demand growth prospects. From 2006 to 2015, the growth of GDP in wholesale and retail sector

experienced a continual growth, averaging 10.04% and 17.03% growth respectively in South Africa and China (Figure 5.8). The increasing demand in both countries managed to attract more FDI in these sectors. Moreover, the wholesale and retail market and their growth prospects in China are larger than those in South Africa. Because of the increasing return of market size to FDI inflows, market size in China should have a larger impact on FDI inflows in these sectors than South Africa.



Data Source: National Bureau of Statistics of China & SARB

5.2.5 Mining Sector

Unlike the wholesale and retail sectors, the mining sector in South Africa is export-orientated. In the last decade, exports of the mining sector, on average, accounted for 4.97% of the total GDP in South Africa, which implies a significant overseas market for South African minerals and related products. Moreover, the growth of the overseas demand averaged 18% during this period¹⁶. Because of this, foreign investment increased to flow in the mining sector to meet the growing market demand. Similarly to the manufacturing industry, it also requires intensive labour. The gradual wage rate

¹⁶ Data Source: Department of Trade and Industry, South Africa

increase in South Africa is attractive to the foreign investors. However, the mining industry suffers more from strikes than all other industries. In the most recent three years of available data, 48.80% of strikes happened in the mining sector, which, on average, caused 3.45 million working days lost in South Africa per year (Table 5.1). As the whole industry is operated by 24 big companies, each of stoppage of a company would significantly hurt the mining industry. Thus, the strikes have been a cause for foreign investors' concerns about increasing investment in mining in South Africa.

Table 5.1: Distribution of Working Days Lost by Sector

Industry	2013	2014	2015	Average
Agriculture	64442	21187	50155	45261
Mining	515971	9611452	224348	3450590
Manufacturing	343222	467513	41594	284109
Utilities	3232	14466	742	6146
Construction	250243	10776	97287	119435
Wholesale, Retail	47216	40120	74461	53932
Transport	477355	25309	244893	249185
Finance	20415	3062	-	11738
Community services	124910	70890	170441	122080
Total	1847006	10264775	903921	4338567

Data Source: Department of Labour, Strikes Statistics database

6. Conclusions and Policy Recommendation

Most FDI empirical studies apply panel data as it solves the problem of data limitation. However, they only produce ‘average’ effects for the results of group of countries under study. Individual countries in the group may generate different results when tested separately with the same model. This study uses an alternative approach that focuses on finding a Vector Error Correction Model with similar macroeconomic determinants of FDI for South Africa and for China, which is a new approach to FDI empirical research.

6.1 Conclusions

The research applies the Johansen Cointegration Procedure and VECM to investigate the long-run determinants of FDI inflows in China and South Africa respectively. After finding one cointegration relationship, the model for China and South Africa is estimated respectively by VECM.

The results of the estimations confirm our expectations. Market size has a strongly positive effect on FDI inflows in both China and South Africa, while its impact is somewhat smaller in South Africa. This was expected since both market size and its growth prospects in China are both greater than South Africa’s. The negative effect of labour costs in South Africa is less sensitive than it is in China, owing to the relatively slow increase of wages in South Africa. Technology has positive influences on FDI inflows, and its impact on South Africa is almost the same as its impact on China. The relatively well-established technological market in South Africa and its law protecting intellectual property rights appear attractive to foreign investors, even taking into account its lower technology level relative to China. Besides, the results also suggest that better infrastructure has a positive influence on China’s FDI inflows, while frequent strikes have a negative impact on South Africa’s.

The remarkable similarities regarding sectoral FDI inflows highlight that not only the determinants of FDI inflows in both countries are similar, but their compositions are also similar. Both the Finance & Real Estate and Manufacturing sector are vital, together accounting for more than half of the FDI inflows for both countries. The Wholesale & Retail and ICT & Transport sectors also attract significant FDI inflows in both countries. The difference is that Mining sector plays an essential role in South Africa, while the Business Services sector is attractive to foreign investors in China. We conclude and discuss the following effects on sectoral FDI inflows (Table 6.1), which confirms the similarities between China and South Africa at the sectoral level, by taking the FDI determinants into account.

Table 6.1 Sectoral Influences

	Manufacturing	Finance and Real Estate	ICT and Transports	Wholesale and Retails	Mining
China					
Market Size	+	+	+	+	N.S
Labour Cost	-				N.S
Technology			+		N.S
Infrastructure	+	+	+	+	N.S
South Africa					
Market Size	+	+	+	+	+
Labour Cost	-				-
Technology			+		
Strikes	-				-

Notes: N.S means not studied; (+) means positive relationship; (-) means negative relationship.

6.2 Policy Recommendation

As the sectoral FDI inflows and the determinants of FDI inflows in both countries are similar, some FDI policies used to promote FDI in China would help South Africa. Considering South Africa's current economy and FDI policies, the following policies are recommended.

6.2.1 Improve the Efficiency of Special Economic Zones (SEZs)

Even though South Africa established the IDZs (Industrial Development Zones) in 2000, its performance in attracting FDI was still poor, mainly because of the lack of incentives and targeted investment promotion (The DTI, 2012). By learning experience from the successful SEZs in other countries such as China, Singapore, South Korea, the SEZs in South Africa were established as the new SEZ Acts came into effect. Similar to China, the policies provide incentives to companies operating in SEZs, which includes the reduction of corporate tax (15%), employment incentives, and building and tax allowances. Also, the SEZ fund is open to these companies for financing purposes. These policies provide a favourable investing environment for foreign investors. However, similar to the SEZs in China before its reform, project authorisation is inefficient because of the inefficiency of bureaucratic systems, which result in delays and frustrations. Since more than one institution is involved in the process of authorisation, it may take a long time to coordinate these institutions and get authorisation from all of them. Once problems occur, it is hard to distinguish responsibilities. Both of these cause inefficiency in project authorisation, which discourages foreign investment. To address these issues, the Chinese central government authorises the city government, where the SEZs settle in, to take the responsibility of all the problems relating to SEZs in the city, such as project authorisation, funding, and incentives. South Africa may attempt to apply a similar policy as it improves the efficiency of SEZs and has successfully attracted more FDI following its implementation in China.

6.2.2 Establish High-Tech Industrial Development Zones

The policy of establishing High-Tech Industrial Development Zones in China has benefited the development of industry and successfully attracts increasing FDI inflows into the High-Tech industry. In the 1980s, innovation activities in China were inactive, and many industries were inefficient because of poor technology. This situation started to change after the first High-Tech Industrial Development Zone were established in 1988. Though foreign-owned companies already had lower corporate tax rate than domestic companies, these zones offered a further tax incentive to the ICT companies, which successfully attracted significant foreign investment into the High-Tech industry. Because of it, the High-Tech zones quickly developed as more advanced technology was introduced. More foreign investors were interested in establishing ICT companies in the High-Tech zones to take advantage of the spillover effect of industry agglomeration. Also, domestic ICT companies were developed and gradually started to contribute to the High-Tech industry. The foreign investment first improved the technology level, followed by the improved technology level attracting more foreign investment, creating a beneficial cycle between FDI and technological improvements. Compared to China, the technological level in South Africa is still low, at least regarding the number of technology patents granted per year. With the advantage of well-established law for intellectual property rights, establishing the High-Tech zones with certain incentive policies could improve industry agglomeration and develop local High-Tech industry, which would promote its FDI inflows in the long run.

6.2.3 Establish a Strike Record System

The labour cost in South Africa is still low compared to the rest of the world, but the frequent strikes, to some extent, increase labour costs and become the significant impediments to FDI inflows. Illegal strikes have accounted for 55% of the total strikes in South Africa, which should be controlled to build foreign investors' confidence in South African labour. Even though China did not have much experience in dealing with strikes, it established a database to record all the strikes happened in China in 2011, which included details such as the reason for the strikes and the people involved. Similarly, South Africa could establish a strike record system that keeps the record of the people involved in every legal and illegal strike. In this system, the employers are able to check a worker's strike background and measure the risk involved in hiring a worker. As employment opportunity and wage are linked to the worker's background, workers will be warier of striking illegally, which will effectively control the frequency and the scale of illegal strikes. Moreover, foreign investors are able to hire "efficient" workers according to the system, which can reduce the negative effect of strikes on the investment decision.

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8. Appendices

Appendix 1: Descriptive Statistics and Data

Table A1: Variables Definitions and Summary Statistics (China)

Variable	Definition	Obs	Mean	Dev	Min	Max
FDI	FDI Inflows utilised (Billion USD)	33	49.63	41.04	0.92	126.27
GDP	Nominal GDP (Billion USD)	33	2645.14	3249.29	228.95	10866.44
Labour cost	Wage Index in USD (2010=100)	33	45.37	52.82	7.13	184.56
Rail	Rail lines (total route - km)	33	71.87	16.86	54.60	113.10
Patent	Number of Patents by Technology	33	34716.15	61476.32	23.00	249222

Table A2: Variables Definitions and Summary Statistics (South Africa)

Variable	Definition	Obs	Mean	Dev	Min	Max
FDI	FDI Inflows (Billion USD)	36	56.63	57.86	7.79	178.74
GDP	Nominal GDP (Billion USD)	36	185.62	105.49	67.06	416.59
Labour Cost	Wage Index in USD (2010=100)	36	71.55	16.65	39.42	105.47
Strike	Number of Strike Activities	36	398.05	381.58	242	1324
Patent	Number of Patents by Technology	36	1232.02	322.34	520	1676

Figure A1: Time Series Variables (China)

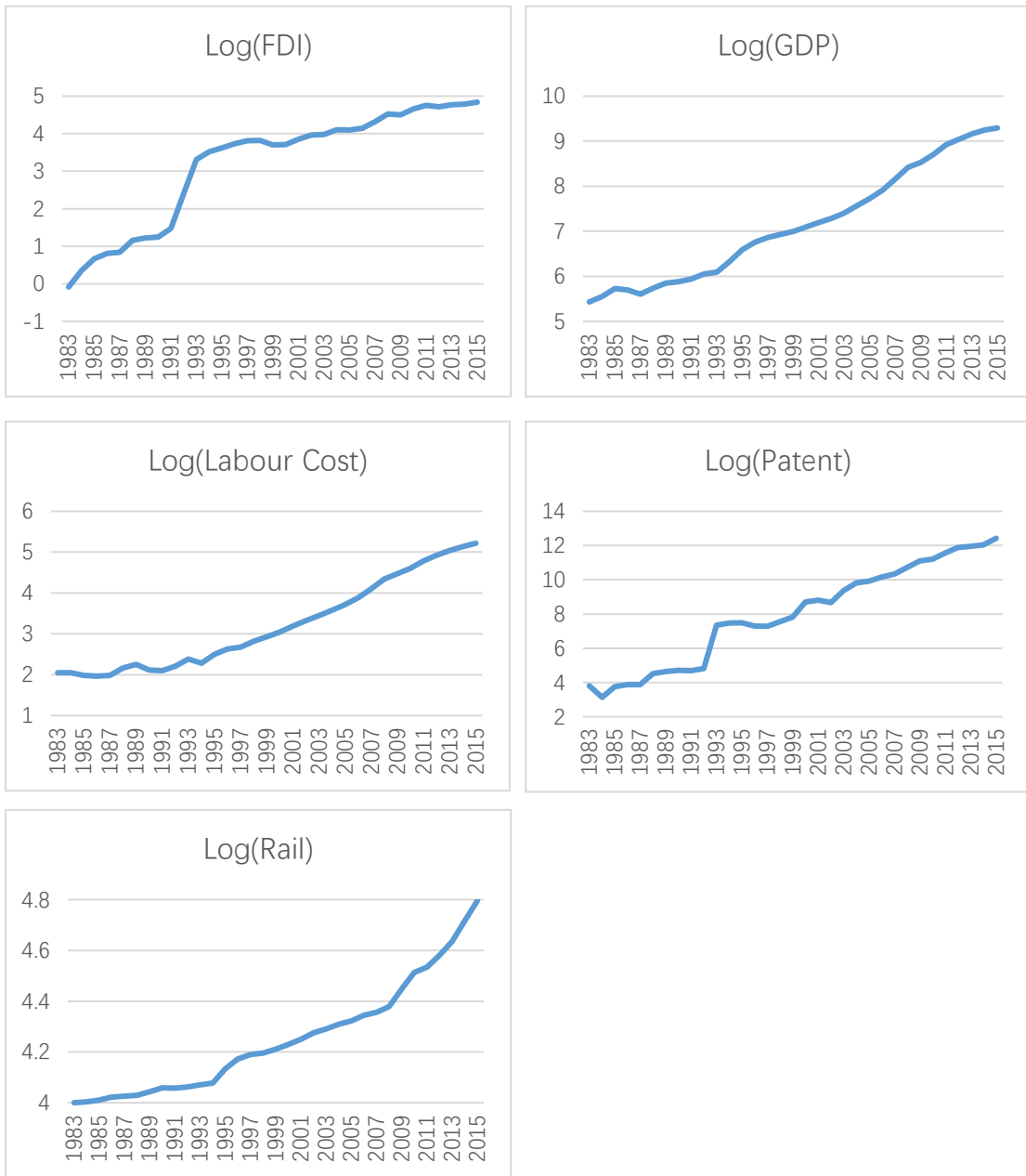
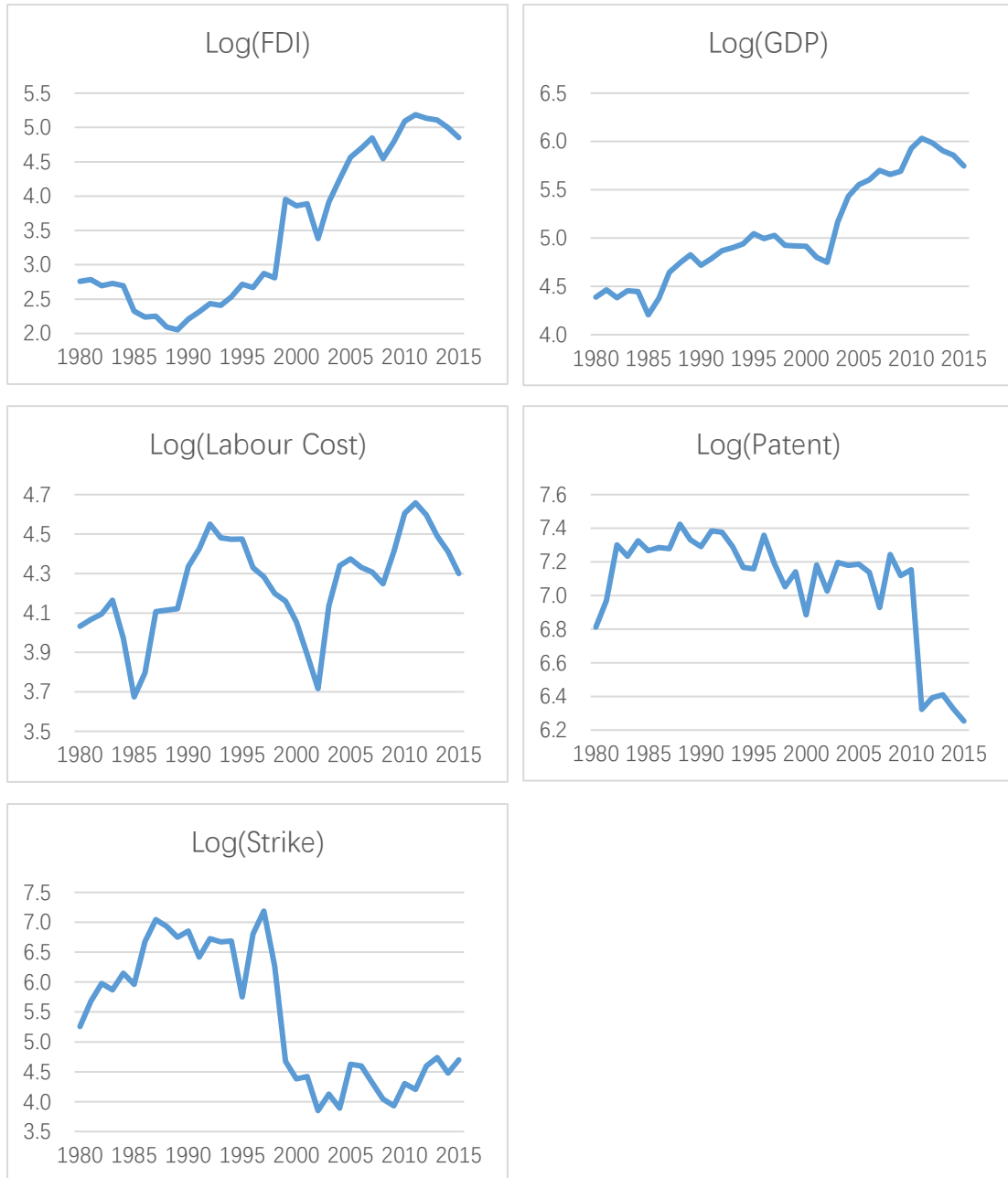


Figure A2: Time Series Variables (South Africa)



Appendix 2: Methodology

A2.1 Unit Root Test

The augmented Dickey-Fuller (ADF) test is a test for a unit root in a time series sample. It is an augmented version of the Dickey-Fuller test, where the augmentation is intended to ensure that the residual of the test regression is white noise. The ADF test statistic is a one-sided test. The more negative the test statistic is, the stronger the rejection of the null hypothesis that the series contains a unit root. The test regression is specified as follows:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \quad (3)$$

where α is a constant, β is the coefficient on the time trend, and p is the lag order of the autoregressive process. When $\alpha = 0$ and $\beta = 0$, it is assumed that no intercept or trend is present in the underlying data generating process of the time series. When $\alpha \neq 0$ and $\beta = 0$, it assumes that the underlying data generating process of the series contains an intercept term only. When both α and β are non-zero, this assumes that the underlying data generating process of the series contains both intercept and trend.

The Phillips-Perron (PP) test builds on the Dickey-Fuller test. It tests the null hypothesis $\rho = 0$ in $\Delta y_t = \rho y_{t-1} + \varepsilon_t$. The PP test addresses the issue that the data generating process for y_t might have a higher order of autocorrelation than is admitted in the test equation. While the ADF test resolve this issue by introducing the lag of Δy_t , the PP test makes a non-parametric correction to the t-test statistic. The test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation.

A2.2 Johansen Procedure

The Johansen procedure allows for the determination of multiple cointegrating vectors in cases where the model has more than two variables. Johansen (1988) established a method for determining the number of eigenvalues, which is commonly applied in macroeconomic research. The order of the eigenvalues should be organised as $\hat{\lambda}_1 > \hat{\lambda}_2 > \dots > \hat{\lambda}_n$, where $\hat{\lambda}_1$ is the first eigenvalue. The null hypothesis is that there are at most r cointegrating vectors.

$$H_0: \hat{\lambda}_i = 0 \text{ for } i = r + 1, \dots, n \quad (4)$$

where only the first r eigenvalues are non-zero.

To calculate the estimate for the number of cointegrating vectors, Johansen (1988) describes two test statistics, the trace statistic and the maximum eigenvalue statistic.

The trace statistic specifies the null hypothesis, H_0 , for r cointegration relations as,

$$\lambda_{trace} = -T \sum_{i=r+1}^n \log(1 - \hat{\lambda}_i) \quad r = 0, 1, 2, \dots, n - 1 \quad (5)$$

where the alternative hypothesis is that the cointegration relationships are more than r .

The maximum eigenvalue statistic for the null hypothesis of at most r cointegration relationships is calculated as,

$$\lambda_{max} = -T \log(1 - \hat{\lambda}_{r+1}) \quad r = 0, 1, 2, \dots, n - 1 \quad (6)$$

where the alternative hypothesis is that there are $r + 1$ cointegration relationships.

The asymptotic distribution for both tests is non-standard and depends on the deterministic components. The critical values can be found in Johansen (1988) and Osterwald-Lenum (1992). In both cases, the test statistics must be larger than the critical

values to reject the null hypothesis.

A2.3 Vector Error Correction Model (VECM)

Once variables are cointegrated, they will adjust towards the equilibrium values, even though they do not reach the equilibrium at a particular time. For example, if there is one cointegration relationship, VECM will produce the results of only one long-run relationship with short-run dynamics with p lags. In the short run, the variables may not reach the long-run equilibrium, but they will converge towards the equilibrium as long as the error correction term is between negative 1 and 0. Engle and Granger (1978) formalised this in the Engle-Granger representation theorem. The deviation of a cointegrated variable from the path of equilibrium may be modelled with the aid of an error correction model (ECM). Allowing dynamic interactions between more than two variables, the vector error correction model (VECM) is developed, which adds error correction mechanism to a multi-factor model known as vector autoregression (VAR). The general form of VECM with one cointegration relationship can be specified as,

$$\begin{aligned} \Delta y_{1,t} = & \gamma_0 + \alpha_1(y_{1,t-1} - \beta_1 y_{2,t-1} - \dots - \beta_{n-1} y_{n,t-1}) + \sum_{i=1}^P \varphi_{11,i} \Delta y_{1,t-1} \\ & + \sum_{i=1}^P \varphi_{12,i} \Delta y_{2,t-1} + \dots + \sum_{i=1}^P \varphi_{1n,i} \Delta y_{n,t-1} + \varepsilon_{y_1 t} \end{aligned} \quad (7)$$

$$\begin{aligned} \Delta y_{2,t} = & \gamma_0 + \alpha_2(y_{1,t-1} - \beta_1 y_{2,t-1} - \dots - \beta_{n-1} y_{n,t-1}) + \sum_{i=1}^P \varphi_{21,i} \Delta y_{1,t-1} \\ & + \sum_{i=1}^P \varphi_{22,i} \Delta y_{2,t-1} + \dots + \sum_{i=1}^P \varphi_{2n,i} \Delta y_{n,t-1} + \varepsilon_{y_2 t} \end{aligned} \quad (8)$$

.....

$$\begin{aligned} \Delta y_{n,t} = & \gamma_0 + \alpha_n(y_{1,t-1} - \beta_1 y_{2,t-1} - \dots - \beta_{n-1} y_{n,t-1}) + \sum_{i=1}^P \varphi_{n1,i} \Delta y_{1,t-1} \\ & + \sum_{i=1}^P \varphi_{n2,i} \Delta y_{2,t-1} + \dots + \sum_{i=1}^P \varphi_{nn,i} \Delta y_{n,t-1} + \varepsilon_{y_n t} \end{aligned} \quad (9)$$

where there are n variables and p lags. α are the error-correction terms (ECM), β are the coefficients of the long-run relationship and φ are the coefficients of the short-run dynamics. If the ECM is significant and between negative 1 and 0, then the short-run dynamics will converge towards the long run relationship and a cointegrating relationship exists.

A2.4 Diagnostic Tests

Jarque–Bera Test

The Jarque–Bera test is a goodness-of-fit test which determines whether sample data have the skewness and kurtosis matching a normal distribution. The test statistic JB is defined as:

$$JB = \frac{n - k + 1}{6} \left(S^2 + \frac{1}{4} (C - 3)^2 \right) \quad (10)$$

where n is the number of observations (or degrees of freedom in general); S is the sample skewness; and C is the sample kurtosis. If the data is normally distributed, the JB statistic asymptotically has a chi-squared distribution with two degrees of freedom. Thus, it can be used to test the null hypothesis that the data follow the normal distribution.

Breusch-Godfrey LM Test

Breusch and Godfrey (1988) established a method testing the presence of autocorrelation in the errors in a regression model. It makes use of the residuals from the model being considered in a regression analysis, and the test statistic is derived from these. The null hypothesis is that there is no serial correlation.

White Test

A widely used method to test whether the variance of the errors in a regression model is constant (i.e. homoscedasticity) was established by White (1980). The null hypothesis is that the residuals are homoscedastic. The test undertakes an auxiliary

regression analysis and regresses the squared residuals from the original regression model onto a set of variables that contain the original regression along with their squares and cross-products. The next step is to inspect the R^2 . The Lagrange multiplier (LM) test statistic is the product of the R^2 value and sample size:

$$LM = nR^2 \quad (11)$$

It follows a chi-squared distribution, with degrees of freedom equal to $P - 1$, where P is the number of estimated parameters in the auxiliary regression.

Appendix 3: Lag Length Selection

Table A3: Lag Length Selection (China)

Lag	AIC	SC	HQ
1	-9.797632*	-8.641190*	-9.420661*
2	-9.761172	-7.448289	-9.007230

** indicates lag order selected by the criterion; AIC: Akaike information criterion; SC: Schwarz information criterion HQ: Hannan-Quinn information criterion*

Table A4: Lag Length Selection (South Africa)

Lag	AIC	SC	HQ
1	-2.817321	-0.572674	-2.051832
2	-2.903920*	-1.781596*	-2.521175*

** indicates lag order selected by the criterion; AIC: Akaike information criterion; SC: Schwarz information criterion HQ: Hannan-Quinn information criterion*

Appendix 4: Johansen Cointegration Test

Table A5: Johansen Cointegration Test (China)

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	2	1	2	1
Max-Eig	1	1	1	1	1

Critical values are based on MacKinnon-Haug-Michelis (1999)

For each model, the number of cointegrating vectors is based on a 95% confidence

Table A6: Johansen Cointegration Test (South Africa)

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	0	1	1	1	1
Max-Eig	0	1	1	1	1

Critical values are based on MacKinnon-Haug-Michelis (1999)

For each model, the number of cointegrating vectors is based on a 95% confidence

Appendix 5: VECM Full Results

Table A7 Estimated Vector Error Correction Model (China)

Error Correction:	D(LFDI)	D(LL_COST)	D(LPATENT)	D(LRAIL)	D(LGDP)
CointEq1	-0.394632 (0.20926) [-1.88587]	-0.131166 (0.10416) [-1.25927]	0.702527 (0.45869) [1.53159]	0.012810 (0.02222) [0.57664]	0.157840 (0.08965) [1.76064]
D(LFDI(-1))	0.935632 (0.21537) [4.34428]	-0.005183 (0.10720) [-0.04835]	0.860240 (0.47209) [1.82218]	-0.024555 (0.02286) [-1.07396]	-0.118463 (0.09227) [-1.28390]
D(LL_COST (-1))	0.523219 (0.58046) [0.90139]	0.518411 (0.28893) [1.79425]	0.250004 (1.27236) [0.19649]	-0.017080 (0.06162) [-0.27717]	-0.205387 (0.24868) [-0.82592]
D(LPATENT(-1))	-0.203438 (0.07600) [-2.67680]	-0.046187 (0.03783) [-1.22091]	-0.402656 (0.16659) [-2.41701]	0.006000 (0.00807) [0.74366]	0.045305 (0.03256) [1.39144]
D(LRAIL(-1))	-0.546806 (1.66508) [-0.32840]	-0.485960 (0.82882) [-0.58633]	-1.547443 (3.64986) [-0.42397]	0.326625 (0.17677) [1.84773]	-0.047653 (0.71335) [-0.06680]
D(LGDP(-1))	-0.936143 (0.49342) [-1.89726]	0.125716 (0.24560) [0.51186]	-1.027133 (1.08157) [-0.94967]	0.122815 (0.05238) [2.34457]	0.563071 (0.21139) [2.66368]
C	0.127468 (0.07765) [1.64156]	0.059351 (0.03865) [1.53553]	0.408636 (0.17021) [2.40077]	0.004687 (0.00824) [0.56859]	0.079561 (0.03327) [2.39159]

Table A8 Estimated Vector Error Correction Model (South Africa)

Error Correction:	D(LFDI)	D(LGDP)	D(LCOST)	D(LPATENT)	D(LSTRIKE)
CointEq1	-0.574908 (0.33049) [-1.73958]	-0.225312 (0.14504) [-1.55343]	-0.483385 (0.12154) [-3.97726]	0.264366 (0.11441) [2.31067]	-0.557374 (0.54808) [-1.01695]
D(LFDI(-1))	0.202921 (0.38192) [0.53131]	0.037925 (0.16762) [0.22626]	0.127044 (0.14045) [0.90453]	-0.506881 (0.13222) [-3.83369]	0.013985 (0.63338) [0.02208]
D(LFDI(-2))	0.500200 (0.36647) [1.36492]	0.079613 (0.16083) [0.49500]	0.182585 (0.13477) [1.35479]	-0.036971 (0.12687) [-0.29141]	0.219251 (0.60776) [0.36076]
D(LGDP(-1))	-0.989906 (0.77646) [-1.27490]	-0.103283 (0.34077) [-0.30309]	-0.390271 (0.28554) [-1.36677]	0.389987 (0.26880) [1.45084]	1.310966 (1.28768) [1.01808]
D(LGDP(-2))	-0.088971 (0.76907) [-0.11569]	-0.194895 (0.33753) [-0.57742]	-0.381600 (0.28283) [-1.34923]	0.214210 (0.26625) [0.80456]	-0.757319 (1.27544) [-0.59377]
D(LCOST(-1))	1.119780 (0.62592) [1.78902]	0.438100 (0.27470) [1.59484]	0.570865 (0.23018) [2.48006]	0.453586 (0.21669) [2.09329]	-0.749540 (1.03803) [-0.72208]
D(LCOST (-2))	-0.494966 (0.69648) [-0.71067]	-0.250801 (0.30567) [-0.82051]	-0.324975 (0.25613) [-1.26878]	-0.044517 (0.24111) [-0.18463]	0.581882 (1.15505) [0.50377]
D(LPATENT(-1))	-0.206650 (0.46243) [-0.44687]	0.108744 (0.20295) [0.53582]	0.133403 (0.17006) [0.78444]	-0.415184 (0.16009) [-2.59344]	1.136423 (0.76691) [1.48183]
D(LPATENT(-2))	0.011588 (0.41625) [0.02784]	0.165764 (0.18268) [0.90740]	0.187327 (0.15308) [1.22376]	-0.078203 (0.14410) [-0.54270]	1.878870 (0.69031) [2.72179]

D(LSTRIKE(-1))	-0.018670 (0.15378) [-0.12141]	0.018568 (0.06749) [0.27512]	0.059439 (0.05655) [1.05102]	-0.137167 (0.05324) [-2.57653]	-0.045663 (0.25503) [-0.17905]
D(LSTRIKE(-2))	0.116299 (0.14671) [0.79269]	0.028851 (0.06439) [0.44807]	0.062694 (0.05395) [1.16198]	-0.101062 (0.05079) [-1.98977]	-0.219345 (0.24331) [-0.90150]
C	0.060595 (0.06795) [0.89180]	0.041768 (0.02982) [1.40066]	0.015003 (0.02499) [0.60040]	0.008745 (0.02352) [0.37178]	-0.132871 (0.11268) [-1.17914]

Appendix 6: Robustness Check

Table A9: Diagnostic Tests for VECM (China)

Test	Null Hypothesis	Statistic	P-Value
Normality Jarque-Bera	Normal Distribution	1.207448	0.5468
Heteroskedasticity White Heteroskedasticity	No Heteroskedasticity	195.5841	0.2022
Autocorrelation Breusch-Godfrey	No Autocorrelation	24.85038	0.4708

Table A10 Diagnostic Tests for VECM (South Africa)

Test	Null Hypothesis	Statistic	P-Value
Normality Jarque-Bera	Normal Distribution	0.032067	0.9841
Heteroskedasticity White Heteroskedasticity	No Heteroskedasticity	361.7757	0.1103
Autocorrelation Breusch-Godfrey	No Autocorrelation	23.12093	0.5705