Chapter 4

Methodology

4.1 Introduction

To assess whether the JSE Securities Exchange has been merely a burgeoning casino where more and more players come to place bets or whether it is importantly linked to economic growth, this study conducts a time series based cointegration analysis to provide empirical evidence. In terms of the literature that has been reviewed in the previous chapters it may be argued that stock markets provide services that boost economic growth. Greenwood & Smith (1997) have shown that large stock markets[74] lower the cost of mobilizing savings and so-doing facilitate investment in the most productive technologies.

Bencivenga *et. al.* (1996) and Levine (1991) had previously argued that market liquidity, the ability to trade easily, was important for growth. Although many profitable investments, especially those involving late industrialization, require long term capital commitments, savers do not like to give up control of their savings for a long time. Liquid equity markets solve this dilemma by providing an asset that can quickly and quite inexpensively be sold, while firms retain permanent access to the cash they raise through equity issues. Associated with this liquidity aspect, Kyle (1984) and Holmstrom & Tirole (1993) have shown that such markets increase incentives for investors to get information about firms and improve corporate governance. Obstfeld (1994) in final support of the thesis showed that international risk sharing through integrated stock markets improves resource allocation and consequently economic growth rates.

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[74] And in 1995, the JSE Securities Exchange was the tenth largest stock market in the world, bigger than any of the other markets defined as "emerging" by the IFC, accounting for more than 14 percent of the total market capitalisation of those markets. In fact, Johannesburg's market capitalisation exceeded that of Italy's by a wide margin. See Table 4.1 overleaf.

Table 4.1: Market Capitalisation's for selected African Stock Markets

Country	Mkt Cap/Emerging Mkt Cap.		Mkt Cap/All Mkt Cap	
	1991	1995	1991	1995
Sub-Saharan Africa				
Botswana	0.031	0.020	0.002	0.002
Cote d'Ivoire	0.063	0.025	0.005	0.003
Ghana	0.009	0.006	0.001	0.001
Kenya	0.053	0.161	0.004	0.017
Mauritius	0.036	0.080	0.003	0.009
Namibia	0.002	0.009	0.000	0.001
Nigeria	0.220	0.143	0.017	0.15
South Africa	19.712	11.907	1.492	1.269
Swaziland	0.003	0.006	0.000	0.001
Zimbabwe	0.163	0.033	0.012	0.004
North Africa				
Egypt	0.310	0.427	0.023	0.045
Tunisia	0.083	0.135	0.006	0.014
Morocco	0.179	0.101	0.014	0.011
Other Emerging Markets				
India	5.584	6.727	0.423	0.717
Thailand	4.190	6.936	0.317	0.739
Malaysia	6.858	10.512	0.519	1.120
Korea	11.274	10.116	0.854	1.078
Brazil	5.002	9.985	0.379	1.064
Mexico	11.485	6.871	0.870	0.732
Advanced Country Markets				
Italy	18.585	21.073	0.893	1.013
United Kingdom	115.576	141.581	5.554	6.804

Market capitalisation for each country is shown relative to all emerging markets and all markets for 1991 and 1995.

Source: IFC Factbooks (various issues)

As with much in economics, theoretical disagreement on this view exists. Mayer (1988) has shown that even large stock markets in developed countries have been unimportant sources of corporate finance. While Stiglitz (1985, 1994) wrote that stock market liquidity would not enhance incentives for acquiring information about firms or exerting corporate governance. In fact, Devereux & Smith (1994) provided contrary evidence that emphasized greater risk sharing through internationally integrated stock markets could actually reduce saving rates and thus slow economic growth. Lastly, the analyses of Shleifer & Summers (1988) and Morck *et. al.* (1990a, 1990b) suggest that by easing counterproductive takeovers, stock market development could actually hurt economic growth.

Although there has been some attempt at using simultaneous equations (*c.f.,* Fry, 1997) the empirical literature testing these two views utilizes primarily two different econometric methodologies: cross country regressions (*c.f.,* Barro, 1991) and time series regressions. Many investigators share a great deal of scepticism in relation to cross-country regressions. The users of the technique acknowledge the sensitivity of the results themselves (Levine & Renelt, 1992; Levine & Zervos, 1996). There are problems which stem from heterogeneity of slope coefficients across countries (Evans, 1995). Convergence tests obtained from cross-country regressions are likely to be misleading because the estimated coefficient on the convergence term contains asymptotic bias (Lee *et al.,* 1996). The technique is predicated on the existence of stable growth paths and, recent research (Quah, 1993) shows that long-run growth patterns are unstable, making variations in results difficult to interpret. Moreover, cross-country regressions can only refer to the "average effect" of a variable across countries. In the context of the causality testing being proposed here, this limitation is particularly severe as differences in causality patterns across countries is likely (Arestis & Demetriades, 1996), and this study is concerned with South Africa only.

These criticisms also apply to the use of simultaneous equations because systems are normally estimated by pooling data across countries. Moreover, such systems may suffer from the problem of dynamic heterogeneity (Pesaran & Smith, 1995) inevitably leading to inconsistent parameter estimates.

This study contends therefore, that a time series analysis may yield deeper insights into the relationship between financial development and real output than either of the other methods. Section 4.2 briefly recaps the literature that has been presented thus far on the functioning of stock markets and economic growth, enabling an appropriate and testable hypothesis to be advanced. Section 4.3 turns to the data and shows which variables will be used, how indexes will be constructed and, for each of them, clarifies their validity. Section 4.4 discusses the empirical framework that will be followed beginning with an illustration of cointegration, error correction and vector auto-regression and then specifies how these techniques will be applied in the causality testing. Section 4.5 overviews more of the general limitations involved with causality testing, the specific ones being referred to as they arise. Section 4.6 concludes.

4.2 The Supporting Theoretical Base

Two lines of research have emerged to answer the question of whether the financial system is important for economic development. On the one hand there is literature that contends it is unimportant while the other stresses the importance of the financial system in mobilizing savings, allocating capital, exerting corporate control and easing risk management. There are even theories to believe, conceptually, that large more efficient stock markets boost economic growth.

Stern (1989) in a recent survey of development economics does not mention the impact of the financial system for growth. In fact, although at the end of his review he does list various issues that he did not have sufficient space to cover, finance is not even one of them. Likewise, a recent collection of essays by pioneers in development economics (three of them Nobel prize winners) does not once describe the role of the financial system in economic growth (Meier & Seers, 1984). Apparently, for these economists, the financial system plays an inconsequential role in economic development. In fact, the 1995 Nobel prize-winner has argued that economists frequently exaggerate the role financial factors play in economic development (Lucas, 1988). This view does not arise from the recent excessively volatile emerging market history, but rather can be traced all the way back to Robinson (1952) who argued that the financial system does not spur economic growth. Rather, it simply responds to developments in the real sector. Chandavarkar (1992) in surveying the writings of several influential economists show that many of them gave a very minor role (if any) to the financial system in economic growth.

In contrast, a prominent and growing body of research stresses the role of the financial system for growth. Bagehot (1962), Schumpeter (1932), Cameron *et. al.*

(1967), Goldsmith (1969) and McKinnon (1973) have provided conceptual descriptions of how and empirical examples of when, the financial system affects economic growth. Building on these seminal contributions Gelb (1989), Ghani (1992), King & Levine (1993a, 1993b) and De Gregorio & Guidotti (1995) have shown that measures of banking development are strongly correlated with economic growth in a broad cross-section of countries. This vein of research posits that a well-functioning financial system is critical for sustained economic growth.

Besides evaluating the general importance of the financial system this study seeks to provide empirical evidence regarding the growing debate concerning the specific role of stock markets for economic growth, by looking at evidence from South Africa. The theoretical literature suggests that the functioning of equity markets affects liquidity, risk diversification, acquisition of firm-specific information, corporate control and savings mobilization. By altering the quality of these services, stock markets alter economic growth rates. The debate that exists is one of the sign of this effect. Some models in particular hold that stock market development has a negative effect on growth, while others suggest a positive relationship between stock market development and economic growth.

The literature reviewed thus far suggests that stock markets may affect economic activity through liquidity. Many high-return projects often require long-run capital commitments. Surplus units are however generally hesitant to relinquish control over their savings for such periods. Thus, without stock markets or other liquidity promoting financial arrangements, less investment may occur in high-return projects. Within this context Levine (1991) and Bencivenga *et. al.* (1996) have shown that stock markets arise in order to provide liquidity: savers receive liquid assets (such as equity) while corporations get permanent use of the capital they raise through equity issues. The downside risk as well as the cost of investing in projects that will not pay off for a long time, typical of late industrialization, are reduced by these liquid stock markets. Having a liquid equity market allows initial investors to access their savings at anytime during the project as they can confidently sell their stakes in the company quickly and cheaply. The more liquid the stock market the easier it will be to attract investors into long-run potentially more profitable projects thus improving capital allocation and thereby enhancing long-term growth prospects. When it comes to the effect of greater liquidity on growth, the theory is unclear. Bencivenga & Smith (1991) have shown that greater liquidity may in fact reduce saving rates enough to slow growth through uncertainty reductions.

Another vehicle that has been offered as a way for stock market development to influence economic growth has been through risk diversification. Saint-Paul (1992), Devereux & Smith (1991) and Obstfeld (1994) have all demonstrated this aspect of stock market development. Their models show that greater risk diversification may influence growth by shifting investment into higher-return projects. Intuitively as projects with high-expected returns would tend to be comparatively risky, better risk diversification through internationally integrating stock markets should foster investment in projects with higher returns. Here again, there is conjecture-suggesting circumstances where greater risk sharing would actually slow growth. Devereux & Smith (1994) and Obstfeld (1994) have shown that reducing risk through internationally integrating stock markets could actually depress saving rates, slow growth and reduce economic welfare.

The acquisition of firm-specific information is also promoted by stock markets. Grossman & Stiglitz (1980), Kyle (1984), Holmstrom & Tirole (1993) have posited that in larger more liquid markets an investor who has gotten information will find it easier to trade at posted prices. The investor will be able to profit from this information before it becomes widely available and prices change. The ability to profit in this way provides an incentive for investors to research and monitor firms. Better information on the corporations would thus improve resource allocation so spurring economic growth. Still, opinions on the importance of stock markets in stimulating information acquisition differ. Stiglitz (1985, 1994) for instance, argues that well functioning stock markets would quickly reveal information through price changes. Hence, quick public revelation would tend to reduce rather than enhance incentives for expending private resources to obtain information. This means that even on the importance of stock markets for information enhancement, debate exists.

Stock market development may also impact the market for corporate control. Diamond & Verrecchia (1982) and Jensen & Murphy (1990) have suggested that efficient stock markets help mitigate the principal-agent problem. Efficient stock markets make it easier to link manager compensation to stock performance, the closer the link the greater the interests of managers and owners are aligned. Moreover, Laffont & Tirole (1988) and Scharfstein (1988) have contended that the threat of a takeover induces managers to maximize the corporation's equity price. In this sense, well functioning stock markets are able to mitigate the principal-agent problem and promote efficient resource allocation and through it growth by easing corporate takeovers. Even on this issue opinions differ. Stiglitz (1985) has argued that outsiders would be reluctant to take over the firm as they generally have poorer information than the owners do. Hence takeover treats would not be a useful mechanism for exerting corporate control and correspondingly stock market development would not significantly improve that control. Further, Shleifer & Vishny (1986) and Bhide (1993) have maintained that greater stock market development would encourage more diffuse ownership and that this diffuse ownership could actually impede effective corporate governance. As a final knock on the takeover mechanism Shleifer & Summers (1988) held that as stock market development simplifies the activity it may well stimulate welfare-reducing changes in ownership and management.

Greenwood & Smith (1997) have demonstrated that large, liquid and efficient stock markets ease savings mobilization. Through agglomerating savings, stock markets enlarge the set of feasible investment projects. As some worthy projects require large capital injections and others enjoy economies of scale, stock markets have the ability to boost economic efficiency and thereby accelerate long-run growth, by easing resource mobilization. Disagreement on the importance of stock markets for raising capital exists here as well. Mayer's (1988) survey, for instance, revealed that new equity issues account for a very small fraction of corporate investment.

Chapter 3 ended by calling out for empirical evidence to show what effect the expansion of the JSE Securities Exchange has had on the country's economic development. Within the context of the view proposed by the International Financial Institutions, summarized in this section, that financial deepening through stock market expansion would have a positive impact on the country's economic growth, the following hypotheses were framed:

As far as the financial architecture in South Africa is concerned -

H_0: The development of the JSE Securities Exchange has stimulated the country's economic growth.

H_A: The development of the JSE Securities Exchange has not stimulated the country's economic growth.

4.3 Model Specification

The discussion thus far suggests that a general empirical model explaining the relationship between financial development and real output could have the following form:

$$Y = f(BC, SMV, MDEV) + error \qquad (4.1)$$

The system will make use of four explanatory variables. Following standard practice (*e.g.,* Gelb, 1989; Roubini & Sala-i-Martin, 1992; King & Levine, 1993a,b) real GDP per capita (denoted Y) will measure economic development. It is known that national accounting procedures, especially in developing countries, are not free from errors and inconsistencies. Srinivasan (1994) holds that in some cases these errors may be so large that they make intertemporal comparisons of even basic indicators such as GDP problematic. However, it appears that GDP per capita figures are prone to fewer errors than total GDP figures. Heston (1994) posits that this may be because some of the errors affecting GDP-level estimates also affect population estimates and as such they may be offsetting. Additionally such national accounts estimates are typically less unreliable than other indicators of development such as those on health and education (Srinivasan, 1994).

The other explanatory variables are, first, the development of the banking system. It has been common in the literature to base financial development measures on a ratio of some broad measure of money stock (usually M2) to the level of nominal GDP. Although this approach fits in well with McKinnon's outside money model in which the accumulation of lumpy real money balances is necessary before self-financed investment takes place, it is less congruent with the Gurley & Shaw (1955) and Shaw (1973) debt-intermediation approach. As well as the M-S school (Kapur, 1976a; Galbis, 1977; Mathieson, 1980) and the endogenous growth literature (Greenwood & Jovanovic, 1990; Bencivenga & Smith, 1991; King & Levine, 1993a,b). This is because a large component of the broad money stock in developing countries is currency held outside the banking system. The latter has more to do with the extent of transaction monetization than with the degree of financial intermediation. In principle, a ratio of broad money to GDP may reflect more extensive use of currency as opposed to an increase in the volume of bank deposits. While this may be common at an early stage of economic development in which barter transactions are being replaced by market exchange, a more representative measure of financial development would therefore exclude currency in circulation from the broad money stock.

In fact, the ratio chosen for this study provides more direct information on the extent of financial intermediation. It is the ratio of bank credit to the private sector to GDP (denoted BC). The ratio may yield additional insights pertaining to the hypothesis of interest than that afforded by any ratio of bank deposit liabilities to GDP. It is, for instance, possible that bank deposit liabilities are rising while the supply of credit to the private sector remains stagnant because the government apportions the increase in private financial savings through higher reserve requirements. According to the M-S inside money model, as it is the supply of credit to the private sector that is ultimately responsible for the quantity and quality of investment and, in turn, for economic growth, this variable may be expected to exert a causal influence on real GDP per capita. The ratio is still indicative of the stage of financial development at a particular point in time. Any change in the stage of financial development may be expected to be reflected by it. Thus an increase in the ratio may be interpreted as "financial deepening". As this ratio is different to that used in previous studies it should be able to provide comparatively more refined information regarding competing theoretical explanations[75].

Aware of the possible speculative pressures that are generated in the market, and as the next explanatory variable, it is important that an index of stock market volatility be included. Large changes in the *ex ante* volatility of market returns have important negative effects for risk-averse investors. And changes in the level of market volatility may have important effects on capital investment, consumption and other business cycle variables. Several researchers have studied movements in aggregate stock market volatility. Officer (1973) related these changes to the volatility of macroeconomic variables. Black (1976) and Christie (1982) argued that the phenomenon could be partially explained by financial leverage. Merton (1980), Pindyck (1984), Porteba & Summers (1986), French *et. al.* (1987), Bollerrrslev *et. al.* (1988) and Abel (1988) have all attempted to relate changes in stock market volatility to changes in expected stock returns although all found that stock prices were more volatile than could be explained by their standard constant-expected return models. Schwert (1989) for instance, analyzed many factors related to stock volatility but could not completely account for its causes. He found *inter alia* that the average level of volatility was much higher during recessions. This was particularly true for financial assets and measures of real economic activity showing the effect

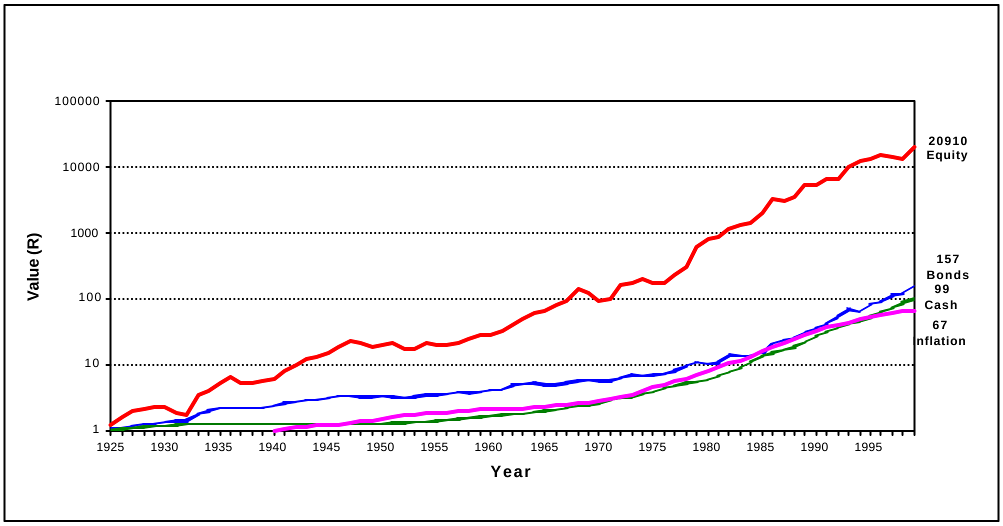
[75] That is on the McKinnon outside money model vis Shaws debt intermediation hypothesis and M-S vis post Keynesian views.

increasing operating leverage may have. He found that there was weak evidence that macroeconomic volatility could help predict stock and bond return volatility although there was stronger evidence for the reverse. This finding is not surprising considering that speculative assets should quickly react to new information about economic effects. He also found that when firms issue new debt securities in larger proportion to new equity than in their prior capital structure, stock volatility increased. Over time this could however explain only a small portion of the volatility recorded. Finally, he found that stock volatility was positively related to the number of trading days in a month as well as to share trading volume growth.

Demirguc-Kunt & Levine (1996b) hold that greater volatility is not necessarily a sign of more or less stock market development. Indeed, greater volatility as far as revelation of information necessitates it, in a well functioning market, may actually be an indicator of development (*c.f.,* Bekaert & Harvey, 1994). Still "for simplicity" they refer to volatility as being negatively correlated with stock market development. Considering that risk diversification and reduction in barriers should both lower levels of volatility, this intuition is appealing. In this study volatility is measured by the sixteen-quarter moving standard deviation of the end-of-quarter change of stock market prices and represented by SMV. It is calculated by working out the logarithmic first differences of the end-of-quarter stock market price index. The 16-term moving standard deviations are then computed from these quarter price changes, using as the mean the average rate of price change over a centred 4-year period. See Pagan (1986) for a discussion of the limitations of these sorts of volatility measures however.

As the final explanatory variable it was important that a defendable indicator be chosen to represent stock market development.

Fig. 4.1: SA Capital Markets Growth of R1, 1925-1999



Source: Ross *et. al.* (2001)

Theory does not suggest that there is one particular measure that uniquely points to stock market development. However it does suggest that stock market size, liquidity and integration with world capital markets may effect economic growth. Thus subsection 4.3.1 describes the construction of a conglomerate index, similar to that used by Demirguc-Kunt & Levine (1996b), as a measure of overall stock market development. It is symbolized by MDEV.

4.3.1 An Index of Stock Market Development

The size of the stock market is measured using the ratio of market capitalisation to nominal GDP, where market capitalisation equals the total value of all listed shares. This variable is included in the stock market development index based on the assumption that stock market size is positively correlated with the ability to mobilize capital and diversify risk.

The liquidity of the stock market is measured in two ways. First, the ratio of the total value of trades to GDP is computed. This ratio measures the value of equity transactions relative to the size of the economy. It complements the measure of stock market size because markets may be large and still inactive. Second, the ratio of the total value of trades to market capitalisation is taken. This ratio, commonly called the turnover ratio, also complements the stock market size ratio allowing for those cases where markets (compared with the economy as a whole) may be small but liquid. Of course, these liquidity measures do not directly measure the ease at which agents can buy and sell securities at posted prices. However, they do measure the degree of trading compared with both the size of the economy and the market. Because liquidity may significantly influence growth by easing investment into large, long-term projects and promote the acquisition of information about firms and their managers, the mean of these two ratios is included in the stock market development index. Table 4.2 shows several stock market development indicators from a comparative developing country perspective.

Table 4.2: Selected Emerging Market Development Indicators

Country	Mkt. Cap (US$ m)		Mkt. Cap - % of GDP		Trading Val. (US$ m)		Average P/E Ratio	
	1991	1994	1991	1994	1991	1995	1991	1995
Sub-Saharan Africa								
Botswana	261	377	7.54	9.78	8.5	38.4	10.5	9.9
Cote d'Ivoire	541	483	5.69	4.75	6.8	14.1	n/a	12
Ghana	76	118	1.09	1.99	0.3	22.3	n/a	8
Kenya	453	3052	5.63	43.88	11.0	65.0	5.2	12.4
Mauritius	312	1514	11.43	43.61	5.1	69.8	7	11.1
Namibia	21	174	0.76	6.03	0.0	3.0	10	11
Nigeria	1882	2711	5.77	6.52	9.0	14.0	10.6	12.5
South Africa	168 497	225 718	156.19	185.21	8051.0	17 048.0	13.2	18.8
Swaziland	27	111	3.09	11.13	n/a	0.4	n/a	7.4
Zimbabwe	1394	628	24.46	11.93	8.5	38.4	7	7.3
North Africa								
Egypt	2651	8088	7.41	13.37	76	677	n/a	n/a
Tunisia	711	2561	5.49	16.06	30.3	662.9	n/a	26
Morocco	1528	1909	5.76	6.64	49.2	2426	n/a	21.5
Other Emerging Markets								
India	47 730	127 515	17.67	44.14	24 295.0	13 738.0	25.4	14.2
Thailand	35 815	131 479	38.96	91.59	30 089.0	57 000.0	12	21.7
Malaysia	58 627	199 276	124.41	275.24	10 675.0	76 822.0	21.3	25.1
Korea	96 373	191 778	32.70	49.59	85 464.0	185 197.0	21.3	19.8
Brazil	42 759	189 281	10.51	34.02	13 373.0	79 186.0	15.5	36.3
Mexico	98 178	130 246	34.24	34.54	31 723.0	34 377.0	14.1	28.4

Source: IFC Factbooks (various issues)

If markets were financially integrated capital would flow across borders to ensure that the price of risk[76] is equalized across assets. Thus in the presence of capital controls or other barriers to the free movement of capital across borders it is probable that different economies demand different levels of compensation for risk. In some markets direct measures of the severity of capital controls are available. For instance, some countries have dual classes of common equity where restricted equity can only be held by domestic residents while unrestricted equity may be held by both domestic and foreign residents. Hietala (1989) and Bailey & Jagtiani (1994) have used the price differential between restricted and unrestricted shares that have identical payoffs as a direct measure of the effect of capital controls. Likewise Bosner-Neal *et. al.* (1990) have used the differences between the official and black market exchange rates, between official and offshore interest rates and the difference between the market price and net asset value of closed-end country mutual funds as measures of the effects of capital controls. No doubt a similar argument could have been made for the difference between the commercial and financial Rand in South Africa. Indeed Farrell (2001) has provided some evidence that the financial Rand system did, to some extent, insulate the commercial Rand exchange rate from volatility in non-resident inflows of portfolio capital during the period 1985 to 1995.

The present exchange control system in South Africa was introduced by the Exchange Control Regulations Orders and Rules (SARB, 1961). In terms of these regulations the Minister of Finance has delegated almost all the powers, functions, and obligations, assigned to and imposed on the South African Treasury under them, to certain officials of the Reserve Bank. For all intense purposes the regulations are applied and enforced by the Bank's Exchange Control Department in liaison with the National Treasury. The system is used primarily to control capital movements by South African residents in countries outside the Common Monetary Area (CMA) consisting of South Africa, Lesotho, Namibia and Swaziland. Capital movements within the CMA are unregulated. Exchange control approval is required for *inter alia*:

[76] Or better stated: the compensation investors receive for bearing risk.

- outward capital transfers by residents above certain limits;
- outward loan transfers by residents;
- loans from non-residents to residents;
- local financial assistance to foreign controlled companies; and
- transfers by emigrants above certain levels.

Although it is anticipated that exchange controls will continue for the foreseeable future, the government has committed itself to gradually relaxing these controls. This is illustrated by the relaxation of controls that have occurred in the recent past. In 1995 as a result of the termination of the financial Rand system all exchange controls over non-residents[77] were abolished. Non-residents are now freely allowed to acquire South African assets, provided such persons receive no financial assistance from residents in relation to that acquisition. Non-residents are also free to dispose of these assets and may transfer the proceeds thereof from the CMA unhindered, provided that the disposal is for fair value and at arm's length and that the non-resident has discharged any liabilities to CMA residents that may relate to this.

Since July 1997 individuals have been allowed to invest a limited amount of their savings abroad or in fixed property in the South African Development Community (SADC) countries. Alternatively they have been allowed to hold foreign currency deposits with authorized South African foreign exchange dealers or with foreign banks outside South Africa. While the amount that was allowed to be invested abroad was set at R200 000 it is annually examined in the Minister's money bill and currently stands at R500 000. The only requirements for South Africans wishing to invest abroad in this way is that they be taxpayers in good standing over the age of 18. South African corporates investing abroad are currently allowed to transfer R50m from South Africa per new approved investment or R250m in respect of new investments made in the SADC.

[77] Excluding emigrants subject to blocked account procedures.

Of course, the most significant relaxation in exchange controls that has occurred since 1995 is the approval given to South African institutional investors[78] to exchange, through approved asset swaps, part of their South African portfolios for foreign securities. The original limit placed on the value of these swaps being five percent of total assets. Since 1996 these investors were also allowed to transfer a limited percentage of their net inflow of funds accruing during the previous year abroad. In 1997 the categories of persons considered institutional investors was increased. In March, to include fund managers registered with the Financial Services Board (FSB) and in July, portfolio managers registered with the FSB, as well as stockbroking firms that are members of the JSE Securities Exchange, the Bond Exchange of South Africa or the South African Futures Exchange who have been approved to offer private client asset management services.

Presently, qualifying institutional investors are permitted to do asset swaps with a value up to 15 percent of their total South African employed assets or those South African employed assets they manage. They are also permitted to effect foreign currency transfers of up to five percent of their net inflow of funds accruing during the year, subject to the overall 15 percent limit. In addition these institutions are, on application, permitted to effect foreign currency transfers of up to ten percent of their net inflow of funds accruing during the year to be invested in registered stock exchanges in the SADC countries, again subject to the 15 percent limit.

With regard to stock market development, barriers to international capital flows, such as the restrictions described, may impede investor's ability to diversify risk internationally. This would reduce capital market integration and prevent arbitrageurs from equalizing the price of risk across markets. In attempting to make intercountry comparisons of capital control severity, difficulties arise as different countries adopt different mechanisms for restricting capital movements. For instance, a country that prohibits all foreign investment would not have

[78] Defined as long-term insurers, pension funds and unit trusts.

unrestricted shares whose prices may be compared with those of restricted shares. Similarly, a country without any formal restrictions against foreign investment will not have restricted share trading. However, while at face value it may appear that the former case is one of segmented markets while the latter one of integrated markets. It may still happen that in the former case methods by which to circumvent restrictions are widely known while in the latter informal barriers (such as less stringent accounting standards or insider trading regulations) that lead to actual segmentation exist. Given this difficulty, Korajczyk (1996) uses the International Arbitrage Pricing Theory (IAPT) to measure the deviation of asset returns from this equilibrium model of returns constructed assuming market integration. Of course, such an approach brings with it the disadvantage of having to rely on a particular specification of the asset-pricing model. If the model is incorrect, then pricing errors will be observed even when markets are integrated. Further, regime shifts, such as those that would occur when an economy moves from being segmented to integrated would lead to changes in the asset pricing relation and to short term deviations from the Law of One Price.

Fortunately, as this study is concerned with South Africa alone such a difficulty may be avoided and, as Chapter 3 has shown, examining whether integration is important for economic development requires measures of degree of integration that are country specific. Table 3.9 summarized results that suggested that while stock return volatility was raised immediately after capital control liberalisation, in the long term such volatility is lower in those countries with more open capital markets.

While Chapter 3 also reviewed the paper by Claessens *et. al.* (1996) which found no significant differences between the time-series properties of short and long-term portfolio flows, this admittedly remains an unorthodox view. Considering that the paper examined just ten countries and only half of those were developing ones, there might be an argument that such results reflect a small sample bias.

The conventional wisdom is still that of Reisen (1993) that short-term flows, and portfolio flows to developing countries in particular, are inherently unstable. Gridlow (2001), Principal of the South African Reserve Bank College put it this way: "Developing countries in the 1980s and early 1990s had been led to believe that foreign investment in equities and bonds traded on local markets was more long term in nature than the foreign bank lending they attracted in the 1970s. However, the huge flight of capital from the emerging markets at times in recent years has exploded that myth". Still, in the same paper, he maintains that the government intends removing the remaining exchange controls, influenced in part by the desire not to be left behind by other countries which are progressively eliminating such controls "as well as the desire to make South Africa more investor friendly *and therefore better able to tap some of these huge flows of international capital*" (emphasis added). Thus it seems acceptable to proxy integration with world capital markets by a ratio of foreign portfolio investments to nominal GDP and tentatively accept that this proxy would be positively correlated with both stock market development and economic growth.

Stock market data (end-of-quarter price indexes and capitalisation) is obtained from the computerized information system BFA-McGregor. GDP and bank credit figures come from IMF publications of *International Financial Statistics* as well as from the Reserve Bank's *Quarterly Bulletins*, the latter providing data denominated in South African currency. The review period runs from the first quarter of 1989 to the last quarter of 2001, a total of thirteen years of data. The computer software Easy Regression International (Bierens, 2001), which in its latest version is able to handle data in both Metric and Imperial format, will handle the data manipulation.

4.4 Empirical Framework

The drunkard's walk has been used for many years by statistics teachers to introduce non-stationary processes. Recently, Murray (1994) has adapted that walk to clarify the latterly introduced notion of cointegration (Granger, 1981) as well as to concretize the link between cointegration and error-correction (Engle &

Granger, 1987). This section attempts to make the mathematics of cointegration and error correction, which are highly sophisticated a little more accessible to readers not so familiar with the techniques so that their application to this study (dealt with in Subsection 4.4.1) is better understood. To do this Murray's (1994) extension of the drunkard's walk is briefly reviewed.

To begin with it is offered that drunks are not the only creatures whose behaviour follows random walks. Puppies when unleashed also wander around aimlessly, with each new scent crossing its nose dictating the direction for its next step, the last scent being forgotten as soon as the new one arrives. The meanderings of both drunk (x_t) and dog (y_t) can be modelled by the random walk:

$$x_t - x_{t-1} = u_t \qquad (4.2)$$

and

$$y_t - y_{t-1} = w_t \qquad (4.3)$$

where u_t and w_t are stationary white-noise steps that each of them take each period.

A key trait of random walks is that the best forecaster of future values is the most recently observed value of the variable. If a man comes out of a bar with a friend who asks him where the puppy they saw out there earlier has gotten to, he might likely answer, "Well, he was right over there when I went in". The same discussion about a drunk seen earlier may also occur. The second key random walk trait is that the longer the men are in the bar the more likely it is that the puppy and the drunk have wandered far from where they were last seen. If the men had been in the bar for some time, the man would probably continue with "but only heaven knows where they've gotten to by now". It is this growing variance in location that gives rise to the nonstationarity of random walks.

But what happens if the dog's owner is the drunk? The drunk leaves the bar, wandering aimlessly in random-walk fashion although calling out periodically "Snoopy, where are you?" who interrupts his aimless wandering to bark. They hear each other, with him thinking that he can't let her get too far off or he will be locked out and she not wishing to let him get too far off lest she be woken at the middle of the night by his barking. Each, assessing how far the other is, moves to partially close the gap. Now neither of them truly follows a random walk, each having added an error-correction mechanism to their steps. Still, if one were to follow either of them, one would still find them wandering seemingly aimlessly in the night and as time goes on the chance that both would have wandered far from the bar grows. Their paths are therefore still non-stationary. Importantly however, despite the nonstationarity of their paths, the man might tell his friend "If you find the lady, her dog isn't likely to be very far away". If this is right then the distance between the two paths is stationary and the walks of the drunk and her dog are said to be cointegrated of order zero. Understanding what this means requires knowledge of what an integrated series is. When a nonstationary series is differenced n times to become stationary, it is said to be integrated of order n. The term cointegration is used when each member of a set of series is integrated on the same order n. A set of series, all integrated of that order n, will be cointegrated if and only if some linear combination of the series (considering non-zero weights only) is integrated of an order less than n. This linear relationship is what Engle & Granger (1987) refer to as a cointegrating relationship.

Cointegration is essentially a probablistic concept. The dog is not on a leash which would ensure a fixed difference between it and the drunk. Instead the distance is a random variable but a stationary one despite the nonstationarity of the two paths. The woman's and dog's cointegrated meanderings may be modelled:

$$x_t - x_{t-1} = u_t + c(y_{t-1} - x_{t-1}) \qquad (4.4)$$

and

$$y_t - y_{t-1} = w_t + d(x_{t-1} - y_{t-1}) \qquad (4.5)$$

where u_t and w_t are still the woman's and dog's stationary white-noise steps. The second terms on the right sides are the error-correction terms by which the two wanderers probably stay close together; $(x_{x-1} - y_{t-1})$ is a cointegrating relationship between x and y. If the error-correction terms were not stationary, then the woman's and the dog's steps would also not be stationary, the two probably growing further apart over time despite their efforts to get together. If this were the case, despite the man's expectation when he left the bar, the paths of the woman and the dog would not be cointegrated of order zero. In their proof, Engle & Granger (1987) showed that if the drunk and dog follow similar paths, both integrated of order one, and consistent with the behaviour modelled by Equations 4.4 and 4.5, then the paths must be cointegrated. In the case of the drunk and her dog, the difference in location is stationary. Cointegration generally does not require differences between variables to be stationary. Were the drunk and the dog circus performers trying, despite her stupor and his impetuousness, to balance a teeter-totter while still wobbling along the real line, given each other's movements, their error-correction device would press them to moving into opposite directions as they sought to re-establish balance. In such a case the sum of their positions would be a stationary variable with a mean of zero. Further, as the woman and her dog have different weights, balancing the teeter-totter would require that the dog (the lighter actor) be further away from the fulcrum point. In that case, rather than being simply the sum of the two, the stationary variable would be a weighted average of their positions. This complexity arising from the rule that two nonstationary variables are cointegrated if there exists any linear combination of the variables that are stationary.

Nonstationary variables present two difficulties for conventional regression analysis. The first arising with unrelated nonstationary variables that are random walks. Regressing two unrelated random walks against each other results in regression coefficients that are small in relation to their standard errors much less often than the theory of stationary regressors predicts. Hence, using standard distributions when variables are unrelated and non-staionary will lead to too-frequent rejections of the null of no relationship. Granger & Newbold (1974) recommend that regressions among nonstationary variables be conducted as regressions among changes in those variables in order to guard against such spurious regressions. In contrast, the cointegration analysis being conducted here averts this type of error by avoiding standard distributions, applying the correct distributions instead. The second difficulty arises with truly related nonstationary variables that are integrated of order one. If Granger & Newbold's (1974) recommendations were to be followed here a misspecified regression model would result. As the story of the drunk and her dog clarifies, specifying a regression model in terms of changes in variables only, would bypass the error-correction mechanism that connects cointegrated variables. Engle & Granger (1987) emphasized that while regressions involving the changes of cointegrated variables should involve lagged levels of those variables the constraints of the cointegrating relationship had to be imposed. If the data are generated by Equations 4.4 and 4.5, once the cointegrating relationship is accounted for, changes in x and y have no further effect on each other and with it lagged changes of these variables would have no further effect on current changes. Omitting the cointegrating relationship however, would cause both these sorts of spurious effects to be observed.

Murray's (1994) tale of the drunk and her dog, in addition to illustrating cointegration and error correction, offers a reminder to applied econometricians that the cointegrating relationship is not just a statistical convenience lacking behavioural content. If the cointegrating relationship for the drunk and her dog were estimated by regression as (x_t - $13y_t$), the reliability of that result could immediately be questioned. Requiring either a different behavioural story that would make the 13 in the cointegrating relationship plausible be advanced or, a return to the drawing board. Sims (1980) and others in a similar vein have therefore argued that economic theory tells us too little about the dynamics of economic relationships to impose many useful restrictions on dynamic equations such as those that describe the steps of the drunk and her dog. Fortunately for the current study it may be argued that economic theory does tell us more about the long-run relationships that hold among economic variables. Hence they are a suitable way of determining what should be found in cointegrating relationships[79].

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[79] Hall *et. al.* (1992), Johansen & Juselius (1990) and Murray (1993) all test long-run hypotheses about the coefficients in particular cointegrating relationships.

Murray (1994) posits that no discussion of nonstationary variable regressions is complete without a discussion of what he calls the "bad companions rule". This rule is based on the instructions thoughtful parents of teenagers give to their children when dropping them off at a mall for an outing with their friends. Such teenagers are often ordered not to leave the mall until their parents return for them at a specified time. The thinking being to keep the child from associating with unruly ones who may go who knows where and do who knows what. Children who are confined to the mall avoid associating with such bad influences. In econometric analysis this rule reappears. Stationary variables (like stationary children) tend not to be associated with those that are nonstationary. This has enabled Stock & Watson (1988) to show that if one regresses a stationary variable against a nonstationary variable, the observed association will, in large samples, tend to zero as the variation in the stationary variable grows even smaller in relation to the variation in the nonstationary variable. The current study returns to this idea when the variance of long differences of shocks to stock market development is investigated.

4.4.1 Approach for Causality Testing

Based on the seminal work of Wiener (1956) and Granger (1963), an economic time series x_{1t} may be described as "causing" another series x_{2t} if $E[x_{2t+1} | J_t] \neq E[x_{2t+1} | J_t^{'}]$ where J_t is the information set containing all available information whilst $J_t^{'}$ excludes the information in past and present x_{1t}. This implies that x_{2t+1} is forecast better (*i.e.,* with a smaller forecast error variance) if the information in x_{1t-j} is used than if it is not. The standard Granger causality test involves specifying a bivariate *k*th order vector autoregression (VAR) as follows:

$$x_{1t} = \mu_1 + \pi_{11}(L)\, x_{1t-1} + \pi_{12}(L)\, x_{2t-1} + \varepsilon_{1t} \quad (4.6)$$

$$x_{2t} = \mu_2 + \pi_{21}(L)\, x_{1t-1} + \pi_{22}(L)\, x_{2t-1} + \varepsilon_{2t} \quad (4.7)$$

where μ_1 and μ_2 are constant drifts and $\pi_{ij}(L)$ are polynomials of order k -1 in the lag operator L. The null hypothesis that x_{1t} does not Granger cause x_{2t} is actually a zero polynomial $\pi_{21}(L)$ that can be tested by standard methods (*e.g.,* by an F-test). The testing procedure grows in importance when (as is common in macroeconomic time series) the variables have unit roots. In that case the model has to be reparameterized in its equivalent error correction (ECM) form as follows (*c.f.,* Hendry *et. al.,* 1984; Engle & Granger, 1987; Johansen, 1988):

$$\Delta x_{1t} = \mu_1 + \gamma_{11}(L)\,\Delta x_{1t-1} + \gamma_{12}(L)\,\Delta x_{2t-1} + (\pi_{11}(1) - 1)\,x_{1t-1} + \pi_{12}(1)\,x_{2t-1} + \varepsilon_{1t} \quad (4.8)$$

$$\Delta x_{2t} = \mu_2 + \gamma_{21}(L)\,\Delta x_{1t-1} + \gamma_{22}(L)\,\Delta x_{2t-1} + \pi_{21}(1)\,x_{1t-1} + (\pi_{12}(1) - 1)\,x_{2t-1} + \varepsilon_{2t} \quad (4.9)$$

where γ_{ij} now become polynomials of order k - 2. More succinctly the ECM model may be written as:

$$\Delta X_t = \mu + \Gamma(L)\,\Delta X_{t-1} + P_0 X_{t-1} + \varepsilon_t \quad (4.10)$$

where $X_t = (x_{1t}, x_{2t})'$, $\mu = (\mu_1, \mu_2)'$, $\Gamma(L) = \{\gamma_{ij}\}$, $P_0 = (\Pi(1) - I_2)$, $\Pi(1) = \{\pi_{ij}(1)\}$ and $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})'$.

Within this context the number of unit roots in the characteristic polynomial becomes crucial in determining the stability of the system. If there are no unit roots the VARs in Equations 4.6 and 4.7 are stable and $\{X_t\}$ is a stationary process. Thus, conventional Granger causality tests are only valid in a levels VAR framework. If there are two unit roots, then however $\Pi(1) = I_2$ and the system is nonstationary. In that case causality tests may be carried out only once the VAR has been first differenced (*i.e.,* the lagged level (error correction) terms in Equations 4.8 and 4.9 must be omitted by standard methods). Unfortunately, this makes the economic interpretation of these tests problematic since there is no longer a stable linear relationship between the variables in levels. The most interesting case of one unit root corresponds to the definition Engle & Granger (1987) have advanced of cointegration, where x_1 and x_2 are integrated processes of order 1 but where a linear combination exists, $\beta' X_t$, that is stationary. In that case $P_0 = \alpha\beta'$ and the 2 X 1 vectors α and β are both different from 0. Equation 4.10 can then be rewritten as follows:

$$\Delta X_t = \mu + \Gamma (L) \Delta X_{t-1} + \alpha (\beta' X_{t-1}) + \varepsilon_t \tag{4.11}$$

This means that if x_1 and x_2 are I(1) and cointegrated causality tests may be carried out using the ECM representation in Equation 4.10. Note that there are now two sources of causation of x_{2t} by x_{1t}, either through the lagged dynamic terms Δx_{1t}, if $\gamma_{21}(L) \neq 0$, or through the lagged cointegrating vector $\beta' X_{t-1}$, if $\alpha_2 \neq 0$[80]. As was argued in the previous subsection, failure to include the error correction term when modelling cointergrated I(1) processes will result in models that are misspecified in which case such causality testing will lead to erroneous conclusions. The ECM-based causality tests offer the further advantage of being able to identify the source of the causation as stemming either from short-run dynamics or a disequilibrium adjustment.

Sims *et. al.* (1990) have argued that it may be unnecessary to difference I(1) variables before carrying out Granger causality tests. They used a trivariate system to show that when variables are cointegrated the conventional Wald test statistic actually converges to a chi-square (*k*) distribution under the null hypothesis of non-causality. Toda & Philips (1993) have more recently however, raised considerable doubts over the usefulness of causality tests based in unrestricted levels VAR's due to uncertainties regarding the relevant asymptotic theory and potential nuisance parameters in the limit. They suggest rather that Johansen-type ECMs would provide a more sound basis for causality testing, even though the sequential nature of the procedure proposed (*i.e.,* the rank of the cointergrating matrix as well as the loading coefficient matrix must first be determined, then the ECM estimated and finally causality tested for) may involve some loss of efficiency. In view of the unsettled state of the econometrics literature regarding causality testing, this study performs a variety of causality

[80] The test for $\alpha_2 \neq 0$ is also a test for weak exogeneity of x_2 with respect to the parameters in β in the sense of Engle *et. al*. (1983) (*c.f.,* Johansen, 1992).

tests between the financial development indicator as well as the stock market development index and real GDP per capita using both the levels VAR and the ECM representation. These tests are preceded by unit root tests that aim to establish the order of integration of each variable as well as cointegration testing as this has important implications for causality testing.

The well known Dickey-Fuller (Dickey & Fuller, 1981) procedure is used for the unit root testing. However, since augmented Dickey-Fuller tests tend to be sensitive to the order of augmentation, the latter is automatically determined following the general-to-specific procedure Cambell & Perron (1991) have recommended. Both the procedures of Engle & Granger (1987) as well as that of Johansen (1988) for cointegration testing are utilized. The Engle-Granger test involves testing the null hypothesis of non-cointegration between x_1 and x_2 as follows:

H_0: a = 1 against H_1: a < 1 where:

$$\Delta u_t = au_{t-1} + c_1\Delta u_{t-1} + \ldots + c_k\Delta_{t-k} + v_t \qquad (4.12)$$

and $u_t = x_{1t} - b_1^{OLS} - b_2^{OLS} x_{2t}$.

The degree of augmentation (*k*) in the Engle-Granger residuals is also determined automatically following Campbell & Perron's (1991) general-to-specific procedure. The Johansen procedure focuses on the rank matrix P_0, that determines the number of distinct cointegrating vectors. Johansen & Juselius (1990) have described two likelihood ratio tests. The first test is based on the maximal eigenvalue being designed to test the hypothesis H(r): Rank(P_0) = r - 1 against the alternative H(r-1). The maximal eigenvalue test is given by $J_{ME} = -T \ln(1 - \lambda_r)$, where T is the number of observations and λ_r the maximal eigenvalue. The second likelihood ratio test is based on the trace of the stochastic matrix and defined as $J_T = -T\Sigma_i \ln(1 - \lambda_i)$. In a bivariate system the maximum number of cointegrating vectors is one so that the null hypothesis holds that there is no cointegrating vector while the alternative is that there is.

Having found cointegration, the vectors (residuals) obtained from each technique are used in ECM based causality tests. Three types of tests are performed, depending on the source of causation. The first relates to the joint significance of lagged dynamic terms (*i.e.,* Δx_{1t-i} in the Δx_2 equation and Δx_{2t-i} in the Δx_1 equation). The second is a test of statistical significance of the lagged cointegrating vector in each of the two equations (*i.e.,* $\alpha_2 = 0$ in the x_2 equation and $\alpha_1 = 0$ in the x_1 equation). This aims to shed light on error correcting behaviour and is also a test for weak exogeneity. The third test is one of joint significance of lagged dynamic and error correction terms, which according to Charemza & Deadman (1992) is also a test for strong exogeneity.

Given that a wide range of causality tests is being performed, the results obtained from different techniques may in some cases be contradictory. In those cases where the ECM based tests produce results which are different from those obtained from the levels VAR approach, this study recommends that greater weight be attached to the former. This is because, as Toda & Philips (1993) have pointed out, Wald tests based on the levels VAR approach are, at best, only asymptotically valid. Also whenever there is conflict between the Engle-Granger and Johansen based ECMs this study recommends that greater cognizance is taken of the latter. This is because it is now know (*c.f.,* Banerjee *et. al.,* 1986; Inder, 1993) that the Engle-Granger technique suffers from poor finite sample properties which may result in large bias in the OLS cointegrating vector estimates.

4.5 General Limitations of Causality Testing

Quite early in the study of statistics, when the interpretation of correlation coefficients or regressions are being discussed, most texts warn that such an observed relationship does not allow one to say anything about the causation of the variables. These admonitions, although having much to recommend them, almost never go on with a positive statement of the form: "the correct procedure to test for causality is ...". Although, admittedly a few do say that causality may be detected from a properly conducted experiment. Granger (1980) accounts for the lack of such positive statements by pointing out that there is no generally accepted procedure for causality testing, partly due to the absence of a definition of the concept that is universally accepted. Attitudes towards causality, he suggests, differ widely from the defeatist one that it is impossible to define causality (let alone test for it) to the populist one that as everyone has their own personal definition it is unlikely that a generally acceptable definition exists.

Looking to the writings of philosophers for definitions and discussions of causality has proven unfruitful. Although Bunch (1963) for instance, provided an extensive review of their work, he still could not end with a consensus or even a definition that a majority of philosophers were prepared to accept. Simply, when discussing causation, philosophers know what they do not like but very few know what they do. The issue of causation has been important for the legal profession as well, who have attempted through Hart & Honorè (1959), to provide an operational definition by taking the viewpoint that "the cause is a difference to the normal course which accounts for the difference in the outcome". As well to point out that legally such a difference can be not doing something "as the driver did not put on the brakes, the train crashed". Neither group has produced much that is useful to practicing scientists. In fact the legal definition that requires a difference to the normal may indeed obviate the need for causality altogether. This is because the use of proper information sets, that is sets including the past and present values of a series to be forecast, brings with it an important implication:

- it is impossible to find a cause for a series that is self deterministic, that is, a series that can be forecast without error from its past.

The basic idea of causal definitions is that knowledge of the causal variable helps forecast the variable being caused. If a variable is perfectly forecastable from its own past (*i.e.,* has a normal course) then clearly no other variable can improve matters.

For economic research three central difficulties to causality testing emerge. The first is the missing variable problem. Sometimes if a missing variable is found and added to an information set then leading indicators which would otherwise have been thought to be causal will cease to be so. In the majority of cases where one is either unsure of whether there is such a missing variable or when such a variable is unobservable, doubt will always remain as to whether a variable is a causing or merely a leading indicator. The second problem stems from the use of predetermined lag lengths in economic data. It is usually by no means clear what the natural length of the step is and thus studies just pragmatically use the data period of the publicly available data, in this study quarterly observations. This may lead to an apparently instantaneous causal or feedback relationship. In such a case while unique models may be put together to test causality, it would only result in a conditional test of causality. The third problem arises when the same data is used for both the modelling and evaluation processes leading to spurious causation due to data mining. The current study does not divide the data into separate pools due to the fact that there may be important economic forces that are continually changing (the gradual relaxation of exchange controls is a quintessential example). By maintaining the integrity of the complete data pool, statistical tests are able to retain their power despite the occurrence of important structural changes, the axiom being that all causal relationships remain constant in direction throughout time.

The definition of causation proposed for this study says essentially that X_{n+1} consists of a part that can be explained by some proper information set, excluding Y_{n-j} ($j \geq 0$) plus an unexplained part. If the Y_{n-j} can be used to partly forecast the unexplained part of X_{n+1}, then Y may be said to be a *prima facie* cause of X. In practice the quality of the answer one gets from a test is related to the sophistication of the analysis used in deciding what is explained by what. Given that information sets used in practice will always be limited in extent, this study has reviewed the literature on the link between stock market development and economic growth and having found sufficient support in the cross-sectional analyses advanced the current hypothesis. The tests used must then simply be seen as linear *prima facie* causality testing, seeking operationally not to advance an absolute truth but rather to find corroboration for the hypothesis imposed by the theory. If the theory is correct conditional causality testing will be helpful, however, if it is incorrect one could conceivably be worse of by its use. This is the rock and hard place any causality test that is conditional upon the truth of some specific economic theory places scientists between.

4.6 Summary

In answer to the research question that asks what effect the expansion of the stock exchange has had for South Africa's economic development, this chapter began by recapping the literature surveyed in the previous ones. Several theoretical and empirical studies conducted thus far have shown that despite a well-functioning financial system, in general, being crucial for sustained economic growth:

- large stock markets lower the cost of mobilizing savings and by so doing facilitate investment into the most productive technologies;
- market liquidity solves the dilemma between surplus units who may be uneasy with giving up their savings for the considerable amount of time late industrialization requires and deficit units who need permanent access to capital raised through equity issues;
- liquid equity markets increase the incentives for investors to get firm-specific information and improves the corporate governance of publicly quoted companies; and
- the international risk sharing that comes about through stock market integration improves resource allocation and thereby the rate of economic growth.

This enabled the hypothesis that, development of the JSE Securities Exchange has stimulated the country's economic growth, to be advanced, for which empirical testing is now required.

A model that incorporates indicators for economic, banking sector and stock market development as well as stock price volatility was built. It is proposed that a battery of tests such as the Engle-Granger ordinary least squares and Johansen maximum likelihood tests of causality be executed on these indicators within a bivariate framework in order that directionality and causality be assessed. The mechanics of cointegration, error correction, and vector autoregression having been explained in this chapter.

The literature surveyed and the hypothesis advanced, together suggest a reasonable basis for believing that a causal relationship between stock market development and economic growth does exist. Thus, despite the attendant difficulties of incomplete variables, finite data sets, lag length arbitrariness and data mining, Granger causality may still adequately, though conditionally, be assessed from the indicators proposed. Chapter 5 presents the results of the statistical analysis.