

Growth and Institutions II

J.W. Fedderke, R.H.J. de Kadt, and J.M Luiz

A number of new political rights and property rights measures are used to explore the link between institutions and economic activity for South Africa over the 1935-97 period. The study uses cointegration analysis to establish the importance of property rights and political instability both as determinants of the level of the desired per capita capital stock, and of investment expenditure. Political freedoms are established as an outcome variable, in a perverse modernization link with per capita output. Some conclusions on the nature of the investment function for South Africa also follow.

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1 Introduction

Modernization theory postulates a link from economic development to democratization, such that “good things go together”. Political freedom is effectively viewed as a luxury good whose high income elasticity ensures emergence of democratization only at high levels of per capita income. The development of strong forms of associational life with economic growth is further held to reinforce the emergence and sustainability of democratic institutions. However, since the postulated causality runs from economic to political development, and since the link is viewed as existing between the *levels* of economic and political development, modernization theory in its initial format has little to say concerning the impact of political and social institutions on economic growth¹. An extension to modernization theory is thus an investigation of the possibility of a link from political and social institutions to economic growth. One possibility might be that political freedoms might have positive externalities in reinforcing economic freedoms, strengthening both the demand for and the defensibility of the latter². An alternative proposition might be that externalities are not positive but negative, particularly at low levels of development, since democracy is subject to populist pressure for redistributive policies, with negative consequences for savings rates, relative price distortions and uncertainty³. If institutions do matter in the determination of economic growth, it follows as corollary that their efficiency will also in turn come to matter for economic growth⁴.

A crucial question concerns the reason for the existence of a link from

¹The seminal contribution is Lipset (1959). For further supporting evidence see Bilson (1982), Bollen (1979), Bollen and Jackman (1985), Burkhart and Lewis-Beck (1994), Cutright (1963), Helliwell (1992), Inglehart (1995), Theil (1979). Bilson (1982) indicates the possibility of a non-linearity. Sirowny and Inkeles (1990) and even more comprehensively Diamond (1992) provide reviews of the empirical evidence. Both Diamond (1992) and Burkhart and Lewis-Beck (1994) reject the possibility of political institutions influencing the level of economic development on the basis of empirical evidence.

²This might be termed the Hayek-Friedman perspective. Empirical evidence in support is provided by Grier and Tullock (1989) and Kormendi and Meguire (1985). The latter find political institutions impact on growth not directly, but also indirectly via the investment rate. Scully (1988, 1992) notes a positive association between political rights and economic growth, though it is subject to a threshold effect.

³See the discussion in Landes (1990). Barro (1994) provides some evidence of a potential negative impact of democracy on economic development at low levels of per capita GDP, as does Marsh (1979) with qualification, and Weede (1983).

⁴See Mauro (1995), but also Murphy, Schleifer and Vishny (1991, 1993), Rama (1993).

political institutions to long run economic performance - i.e. just why we might expect externalities to be present. One suggestion has been that the credibility of political dispensations is critical if political institutions are to avoid time-inconsistency problems, and that credibility is vital to maintaining private sector and foreign investor confidence (the argument is analogous to those surrounding the credibility of stabilization policy)⁵. Property rights are also frequently advanced as the institutions of greatest significance to economic growth, lowering uncertainty and transactions costs associated with economic activity⁶. An analogous but broader conception is that of social capital, viewed as consisting of a range of formal and informal cultural practices which increase the probability of cooperative solutions to problems of collective action, and again viewed as lowering transactions costs and uncertainty, and hence as beneficial to economic growth⁷.

The basic proposition of a possible link between economic and political development has also received a number of extensions. Thus, for instance, political instability has generally been viewed as lowering economic growth by raising uncertainty, and by reducing the quality of economic policy formulation⁸. However, where political instability disrupts rent-seeking activities it may have a positive impact on growth⁹, and some authors have suggested the presence of simultaneity between growth and stability by pointing to the possibility that growth may disrupt traditional social forms¹⁰. Some studies go further in identifying income inequality as a specific cause of the growth inhibiting political instability or redistributive policies noted in the pre-

⁵See Borner, Brunetti and Weder (1995), who see credibility as of far greater significance than the level of political rights.

⁶See Knack and Keefer (1995), North and Thomas (1970, 1973), North (1981, 1990), Scully (1988, 1992).

⁷See Coleman (1988, 1990), Putnam (1995), Fukuyama (1995a, 1995b), and Fedderke, De Kadt and Luiz (1998).

⁸Alesina and Perotti (1993), Barro (1991), Londregan and Poole (1990), Knack and Keefer (1995), Venieris and Gupta (1986) all report empirical findings confirming both a direct and indirect (via the investment or savings rate) impact of political instability on growth. See Olson (1993) on the link between political stability and the quality of economic policy formulation. On the link between instability and excessive foreign debt burdens and capital flight see Alesina and Tabellini (1989) and Ozler and Tabellini (1991).

⁹Olson (1982), who argues that (severe) political instability may disrupt the hold of rent-seeking interest groups on the state, thereby raising economic growth rates.

¹⁰See Olson (1963). Londregan and Poole (1990) confirm the presence of simultaneity between economic growth and political instability, but find growth lowering instability.

ceding discussion¹¹.

While the literature has gone some way toward introducing a number of distinct links between social and political institutions and economic growth, empirical evidence is as yet inconclusive in the sense that a number of the postulated, but alternative and occasionally contradictory links have found empirical support. Fedderke and Klitgaard (1998)¹² demonstrate that the presence of strong webs of association amongst social indicators, makes an empirical distinction between the theoretical propositions outlined above difficult. Moreover, it is shown that simultaneity between institutional dimensions and economic growth finds empirical support, and carries significant implications for the reliability of standard statistical estimation results. The extent of our theoretical understanding of the link between institutions and economic growth is limited, such that the relative importance of the various institutional dimensions cited, their mutual interaction, the lags with which they may be said to operate, and the functional form in which they impact on growth are all as yet incompletely determined. Under such conditions both structural and reduced form statistical modeling is fraught with danger.

In Fedderke (1999) the limitations identified in Fedderke and Klitgaard (1998) were explored further. In particular, the paper demonstrated that very simple alternative assumptions concerning the nature of the link between institutions and economic activity, led to quite different steady state characteristics. Three cases were explored:

1. “Simple” modernization theory in which economic development drives the evolution of political and social institutions. Under such circumstances long run economic development remains unaffected by institutional developments. Assuming Cobb-Douglas technology under homogeneity of degree one, and adopting a simple exponential association

¹¹See Alesina and Perotti (1993) and Persson and Tabellini (1994). Clarke (1995) finds not only indirect effects of income inequality on economic growth (such as the investment channel noted above), but a direct negative effect of inequality on growth, for both democratic and autocratic regimes. However, some studies find no systematic relationship at all (see Papanek and Kyn 1986).

¹²For additional explorations of the link between social indicators and economic growth see Fedderke and Klitgaard (1996), and Klitgaard and Fedderke (1994, 1995).

between “rights” or institutions¹³ and per capita output gives:

$$R = y^\gamma = k^{\alpha\gamma} \quad (1)$$

where R denotes the rights dimension, y denotes per capita output, k the capital labour ratio, and α the elasticity of output with respect to capital.

2. The possibility of simultaneity between rights and economic activity provides the postulate that:

$$Y = R(\bullet) Q(\bullet) \quad (2)$$

$$Q(\bullet) = K^\alpha L^{1-\alpha} \quad (3)$$

assuming Cobb-Douglas technology under homogeneity of degree one. This left two possible cases to be distinguished:

- (a) Where rights impact on output, and *rights were held to be determined by the technology of production* available. Continuing with the analytically tractable case of an exponential association between “rights” or institutions and technology of production gives:

$$R = q^\gamma = k^{\alpha\gamma} \quad (4)$$

so that per capita output is given by:

$$y = k^{\alpha(1+\gamma)} \quad (5)$$

and the growth rate of per capita output would now be:

$$\dot{y} = \alpha(1 + \gamma) \dot{k} \quad (6)$$

Here the rights-technology nexus exercises an influence on the growth rate of per capita output (in contrast to simple modernization theory), and the logical possibility of unbounded (endogenous) growth emerges where $\gamma > \frac{1}{\alpha} - 1$, though this remains a fairly unlikely occurrence given standard α -parameter values (the γ -parameter would have to be large, > 2 for most estimates of α).

¹³We use rights and institutions interchangeably. The literature has used the Freedom House indicators of political rights and civil liberties as proxies for a wide range of institutional dimensions. Hence the interchangeable if somewhat confusing usage. For the remainder of the present discussion we use *rights* to denote institutions more generally. For a fuller discussion of these measurement issues see Fedderke, De Kadt and Luiz (1999).

- (b) Where rights impact on output, and *rights were held to be determined by per capita output*. Continuing with the analytically tractable case of an exponential association between “rights” or institutions and per capita output gives:

$$R = y^\gamma \tag{7}$$

so that given equations 2 and 3:

$$y = k^{\frac{\alpha}{1-\gamma}} \tag{8}$$

and hence:

$$\dot{y} = \left(\frac{\alpha}{1-\gamma} \right) \dot{k} \tag{9}$$

Again the rights-output nexus exercises an influence on the growth rate of per capita output, and the possibility of unbounded growth arises for $1 - \alpha < \gamma < 1$ (a much weaker requirement than $\gamma > \frac{1}{\alpha} - 1$). Interestingly, the case of $\gamma > 1$ also brings with it the possibility of low level institutional traps.

Two important conclusions were drawn in Fedderke (1999). The first was that the possibility of heterogeneity between countries in terms of the relationship of institutions and economic activity arose at an elemental theoretical level. Simple changes in theoretical specification brought about fundamental changes in steady state characteristics (witness the low level institutional trap point)¹⁴. Second, empirically the possibility of heterogeneity was borne out for a sample of 86 countries for which the three cases above were tested. Not only did evidence emerge that some countries fell into each of the three theoretical cases identified, but the values of the γ -parameter estimated in each of the three cases covered diverse magnitudes.

The implication is that country specific studies of the link between output and institutions is not only justified, but imperative if the link is to be fully understood. It is as a contribution toward this objective that the current study is to be understood. In Fedderke, De Kadt, and Luiz (1999) we note a number of limitations of the Freedom House rights indicators that have

¹⁴The implication is a reinforcement of the warnings contained in Fedderke and Klitgaard (1998) concerning blithe inclusions of rights and other institutional variables into growth equations - there is good reason for the sensitivity of estimation results to specification in this context.

become standard usage in the literature. The Freedom House indicators not only show relatively infrequent change, but the scale of the measures (1 to 7) does not allow more fine-grained changes in rights to be noted with ease. In Fedderke, De Kadt, and Luiz (1999) we therefore developed a series of alternative rights measures, which have the advantage of:

- Being available over a much longer time span.
- Having a number of distinct measures for rights, including political and civil liberties (as a single measure) as well as property rights, in addition to a measure for political instability.
- Being represented on scales that allow for far more fine-grained distinctions than the Freedom House measures.

In the present paper we examine the three cases developed in Fedderke (1999) and outlined above for each of the two new rights measures, and the instability measure, in order to examine the question of whether heterogeneity exists *between alternative rights and institutional measures* for South Africa. In this sense, therefore, the investigation of possible sources of heterogeneity is extended beyond those identified in Fedderke (1999).

But the investigation is extended in another important sense. In Fedderke (1999) the empirical methodology is that of Johansen ML cointegration estimation. In the first part of the present paper this is emulated, and comparisons are drawn. But in the second part of the present paper we draw on the work of Pesaran (1997), Pesaran and Shin (1995a, 1995b) and Pesaran, Shin and Smith (1996) to investigate in greater detail empirically the nature of the patterns of association between the rights indexes and economic variables such as per capita GDP and investment rates. We further extend the empirical investigation by employing the ARDL cointegration techniques developed by Pesaran et al in order to gain greater insights into the dynamic lag structures that exist between the rights and instability indicators and economic variables.

Both contributions of the present paper, therefore represent a significant extension on the current state of the international debate on the link between institutions and economic growth.

2 Revisiting the Rights - Growth Nexus for South Africa

In Fedderke (1999) South Africa did not report significant association between rights and economic output for any of the three cases investigated. A number of reasons might account for this lack of significant association. First, the relationships investigated are simple, and may not capture equilibrium (cointegrating) relationships. Second, the data run for which the Freedom House data is available may not cover a sufficient time span for equilibrium (cointegrating) relationships to become apparent. Third, the Freedom House data, by virtue of its relatively undifferentiated scale, may make the identification of equilibrium (cointegrating) relationships difficult.

The present paper thus repeats the exercise using the new rights indexes, as well as the new political instability index for South Africa. The series are obtained from Fedderke, De Kadt, and Luiz (1999).

None of the cases identified in Fedderke (1999) commits us to modernization theory. The positive association between economic development and rights implied by modernization theory in any of the cases investigated requires that $\gamma > 0$, such that economic development issues in greater political and civil rights of citizens. But it is of course possible that rights are simply not influenced by the level of economic development at all, $\gamma = 0$, a proposition which is consistent with arguments that relatively authoritarian regimes have been capable of economic development without associated pressures for political and social liberalization. It is also logically feasible that there is a negative association between the state of economic and institutional development, $\gamma < 0$. This might capture cases of social and political forms which are sustainable only if they become increasingly repressive - which might represent the experience of polities of the apartheid South Africa variety.

Furthermore, nothing commits us to the proposition that for all rights and other institutional indicators the association need be uniform. The alternative rights and instability indicators used in the present study allow us to question whether heterogeneity in the association between rights and economic activity is supported *between* alternative rights indicators for a single country, as well as between countries as suggested by Fedderke (1999).

2.1 The Econometric Methodology

Johansen¹⁵ techniques of estimation are now standard, so that the discussion here can be brief. We employ a vector error-correction (VECM) framework, for which in the case of a set of k variables, we may have cointegrating relationships denoted r , such that $0 \leq r \leq k - 1$. This gives us a k -dimensional VAR:

$$z_t = A_1 z_{t-1} + \dots + A_m z_{t-m} + \mu + \delta_t \quad (10)$$

where m denotes lag length, and δ a Gaussian error term. While in general z_t may contain $I(0)$ elements, given our bivariate association, as long as non-stationary variables are present we are exclusively restricted to $I(1)$ elements. Reparametrization provides the VECM specification:

$$\Delta z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta z_{t-i} + \Pi z_{t-k+1} + \mu + \delta_t \quad (11)$$

The existence of r cointegrating relationships amounts to the hypothesis that:

$$H_1(r) : \Pi = \alpha \beta' \quad (12)$$

where Π is $p \times p$, and α, β are $p \times r$ matrices of full rank. $H_1(r)$ is thus the hypothesis of reduced rank of Π . Where $r > 1$, issues of identification arise¹⁶. In our case this may arise where rights and output may interact (equations 4, 5; equations 7, 8). In this case we expect $r = 2$, and for the long run parameters:

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \end{bmatrix} \begin{bmatrix} y \\ k \\ r \end{bmatrix}_{t-k+1} \quad (13)$$

Cointegrating relationships are provided by $\varepsilon_i = \beta_{i1}y + \beta_{i2}k + \beta_{i3}r$ (where r denotes rights), with the α_{ij} providing the error correction terms. In the absence of *a priori* theory problems of identification attach to equation 13, since any linear combination of ε_i will themselves be stationary and hence

¹⁵See Johansen (1991) and Johansen and Juselius (1990).

¹⁶See Wickens (1996), Johansen and Juselius (1990, 1992), Pesaran and Shin (1995a, 1995b), Pesaran, Shin and Smith (1996).

cointegrated. Exact identification requires r^2 restrictions, for the expectation that $r = 2$ thus 4. On the basis of the discussion above we specify:

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{12} & 0 \\ 0 & -\beta_{22} & 1 \end{bmatrix} \begin{bmatrix} y \\ k \\ r \end{bmatrix}_{t-k+1} \quad (14)$$

for both Case 2.A though the γ parameter would have to be explicitly solved for from $-\widehat{\beta}_{12}$ and $-\widehat{\beta}_{22}$. For Case 2.B, we specify:

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{12} & 0 \\ -\beta_{21} & 0 & 1 \end{bmatrix} \begin{bmatrix} y \\ k \\ r \end{bmatrix}_{t-k+1} \quad (15)$$

where $\widehat{\beta}_{21}$ provides a direct estimate of the γ parameter.

While our chief concern here is with the existence of cointegrating, hence the possibility of long-run equilibrium relationships contained in $\beta' z_t$, we are also interested in the possibility of heterogeneity between countries in terms of the *nature* of the link between economic activity and rights (i.e. whether Case 1, Case 2.A or Case 2.B is most likely to apply), and in terms of the *strength* of that link (as measured by γ).

In all instances we test for the presence of a link by means of the standard reduced rank Johansen procedure, and verify the presence of the relevant link(s) between rights and output by means of both overidentifying restrictions, and in terms of tests for weak exogeneity.

2.2 Results

Cointegration analysis proves useful in the current context. The bivariate associations implied by most of the current relationships under investigation allows straightforward estimation where cointegration proves to be present. The one limitation to consider is that, given the simplicity of the relationship between economic activity and rights under consideration, the absence of cointegration cannot be held to be conclusive evidence of association between rights and economic activity, since the association may be subject to misspecification. The requirement here imposed for the presence of a long run equilibrium relationship is demanding, given the simplicity of the models under investigation. The conclusions drawn are thus not to be understood as a definitive identification of the nature of the link between economic activity

Variable	ADF	Variable	ADF
$\ln y$	-0.51	$\Delta \ln y$	-7.88*
$\ln RPF$	-0.73	$\Delta \ln RPF$	-4.69*
$\ln RPR$	0.27	$\Delta \ln RPR$	-7.14*
$\ln INST$	-2.78	$\Delta \ln INST$	-5.08*
$\ln k$	-1.57	$\Delta \ln k$	-1.84
		$\Delta^2 \ln k$	-4.97*

Table 1: Univariate Time Series Characteristics: ADF tests

and rights, but they do serve to support methodological conclusions. These are strong and informative in their own right.

2.2.1 Univariate Time Series Characteristics of the Data

In Table 1 we report the univariate time series characteristics of the data employed for the present study¹⁷. As indicated, all variables are in log transform¹⁸, Δ denotes first, Δ^2 second differences. Variables in lower case notation are in per capita format. Thus y denotes real per capita GDP, and k the capital-labour ratio. For the institutional measures, RPF denotes the political freedom measure, RPR the property rights measure, and $INSTB$ the political instability measure¹⁹. * denotes statistical significance in terms of standard McKinnon (1991) response-surface critical values. It follows from the evidence presented in Table 1 that all variables are $\sim I(1)$, except for $\ln k \sim I(2)$.

The implication is that while the simple modernization theory case (equation 1) is plausibly cointegrated, both of the cases for which simultaneity between rights/institutions and output is recognized (equations 4, 5; equations 7, 8), cointegration is no longer feasible²⁰. Despite the fact that it represents a change in specification, we therefore proceed on the basis of testing for

¹⁷The order of augmentation for the Augmented Dickey-Fuller test statistics was determined by means of Akaike Information Criteria applied to a range of alternative lag lengths.

¹⁸This is a necessary consequence of our theoretical specifications.

¹⁹The RPF variable corresponds to *PolFree*, RPR to *Propert*, and $INST$ to *Instabil* in Feddereck, de Kadt and Luiz (1999).

²⁰Since we would have two variables $\sim I(1)$, and one which is $I(2)$. This would destroy the balance of estimation.

	<i>VAR</i>	χ^2 (<i>d.f.</i>)	JML_{EV} JML_T	γ (<i>s.e.</i>)	ECM (<i>p-value</i>)	$\gamma = 0$ restr. χ^2 (<i>d.f.</i>)
$\ln y, \ln RPF$	4	0.73 (2)	24.55* 25.22*	-0.46 (0.19)	+0.01 (1.15)	1.11 (1)
$\ln y, \ln RPR$	5	3.78 (2)	10.88* 14.62*	-0.96 (0.27)	-0.05* (0.02)	0.81 (1)
$\ln y, \ln INST$	2	2.75 (2)	15.24* 17.56*	-1.42 (0.12)	-0.53* (0.00)	12.81* (0.00)

Table 2: The case for simple modernization theory for South Africa

cointegration between $\ln y$, $\Delta \ln k$, and each of $\ln RPF$, $\ln RPR$, $\ln INST$ in order to restore balance to the estimation.

2.2.2 The Case for Simple Modernization Theory

Table 2 presents the evidence gathered for each of the institutional variables in terms of the specification provided by equation 1. VAR indicates the VAR-order as determined by the appropriate Akaike Information Criterion tests. The χ^2 test statistics reports on the significance of a 0-restriction on the inclusion of the deterministic element of an intercept in the VAR. JML_{EV} reports the Johansen eigenvalue test statistic for reduced rank, JML_T reports the Johansen trace test statistic for reduced rank in order to establish the number of cointegrating vectors present in the data. Given the concern with bivariate associations the maximum number of cointegrating vectors in this instance is 1. γ reports the estimated value of the γ -parameter with its estimated standard error. ECM reports the parameter on the error correction term²¹ with its probability value, and the final χ^2 test statistic reports the significance of an overidentifying 0-restriction on the γ -parameter. As always, * denotes statistical significance.

The evidence of Table 2 is clear. While the VAR-order differs among the three cases, none favours the inclusion of deterministic components in the VAR. In all three cases, moreover, Johansen reduced rank criteria identify the presence of a cointegrating vector. However, for the two rights measures

²¹The full dynamic specification is available from the authors on request.

the estimated γ -parameter is of the *opposite* sign to that implied by simple modernization theory. Instead of improving per capita GDP improving rights in South Africa, the association is negatively signed. One interpretation of this evidence is that since a large portion of the sample gathered for this study falls under the Apartheid regime, the political dispensation was sustainable only if it become increasingly repressive. However, the more coherent explanation is that the relationship between rights and economic output in South Africa does not fulfil the simple modernization theory characterization.. This is evident from the fact that for the case including the political freedom measure, $\ln RPF$, not only is the error correction term of the incorrect sign, but it is insignificant, implying the absence of a reliable equilibrium relationship running from $\ln y$ to $\ln RPF$. This is further confirmed by the acceptance of the 0-restriction on the γ -parameter. In the case of the property rights measure, $\ln RPR$, while the error correction term is not only of the correct sign, but significant (though it implies very slow adjustment to equilibrium), the 0-restriction on the γ -parameter is again accepted, suggesting the absence of an association running from $\ln y$ to $\ln RPR$.

The one exception here is the political instability variable, $\ln INST$. Not only is there evidence in favour of cointegration, but the error correction term is not only statistically significant and of the correct sign, but the 0-restriction on the γ -parameter is rejected. In this case the negative sign on the γ -parameter is intuitively appealing, in the sense that it implies that rising output levels are negatively associated with political instability levels in South Africa. Economic success is thus a precondition for political stability on this evidence. We also note that the implied elasticity parameter is strong: a 1% improvement in output leads to a 1.42% decrease in instability on the estimated γ -parameter.

With regard to the two rights measures, our findings thus confirm those of Fedderke (1999) for South Africa, viz. of little support for simple modernization theory for South Africa. However, in the case of the political instability measure, support for an association between output and instability does emerge.

	<i>VAR</i>	χ^2 (d.f.)	<i>JMLEV</i> <i>JMLT</i>	γ (s.e.)	<i>ECM</i> (p-value)	$\gamma = 0$ restr. χ^2 (d.f.)
$\ln y, \Delta \ln k, \ln RPF$ <i>Equations 4,5</i>	3	5.69 (3)	11.43* 12.56*	-0.03	-0.03 (0.21)	$0.75E - 3$ (1)
$\ln y, \Delta \ln k, \ln RPF$ <i>Equations 7,8</i>				-0.03 (1.09)	-0.03 (0.21)	$0.75E - 3$ (1)
$\ln y, \Delta \ln k, \ln RPR$ <i>Equations 4,5</i>	5	11.51* (3)	8.99 11.25			
$\ln y, \Delta \ln k, \ln RPR$ <i>Equations 7,8</i>						
$\ln y, \Delta \ln k, \ln INST$ <i>Equations 4,5</i>	6	20.90* (3)	16.22* 19.69*	-1.32	-2.08* (0.00)	2.31 (1)
$\ln y, \Delta \ln k, \ln INST$ <i>Equations 7,8</i>				-4.12 (3.17)	-2.08* (0.00)	2.31 (1)

Table 3: The case for two possible forms of simultaneity between institutional dimensions and economic output for South Africa

2.2.3 The Case for Simultaneity between Institutional and Economic Dimensions

We have already noted the impossibility of a cointegrated relationship between the institutional dimensions included in the present study, per capita output and the capital labour ratio. This precludes the estimation of a symmetrical set of relationships to those estimated in Fedderke (1999). Instead, we investigate the possibility of cointegration between $\ln y$, $\Delta \ln k$, and each of $\ln RPF$, $\ln RPR$, $\ln INST$, recognizing that this represents a respecification of equations 4, 5, and 7, 8.

Table 3 reports the results of the estimations. Notation is as defined for Table 2, though the *JMLEV*, *JMLT* test statistics are now for the presence of two instead of one cointegrating relationship. For each set of variables two sets of results are reported, one for each of the two possible form of simultaneity postulated.

Results for the estimations including $\ln RPF$, while favouring the presence of two cointegrating vectors between variables, does not establish either a stable equilibrium error correction term for the relationship with the rights variable as the outcome variable, nor does it reject the 0-restriction on the γ -parameter. As such, neither of the two forms of simultaneity postulated at the outset finds support for the political freedom variable.

For the property rights variable, $\ln RPR$, the Johansen reduced rank test statistics do not support the presence of more than one cointegrating vector among the variables included in estimation. The presence of the forms of simultaneity postulated in equations 4, 5, and 7, 8, is thus not feasible on the present data set. However, the test statistics do support the presence of a single cointegrating vector²². Normalizing on $\ln y$, provides us with:

$$\ln y = 4.96 \Delta \ln k - 0.46 \ln RPR$$

(3.93) (0.30)

where figures in parentheses denote standard errors, and which has an ECM _(p-value) of -0.06 , though a 0-restriction on the γ -parameter proves to provide the insignificant χ^2 test statistic of 2.42. The implication thus appears to be that _(d.f.) ₍₁₎ the cointegration found is that expected on the basis of simple production theory between per capita output and the capital labour ratio²³.

For the political instability variable there is again evidence favouring two cointegrating vectors, and in this instance the error correction term is of the correct sign and statistically significant. However, the term is also < -2 , implying an unstable correction to equilibrium, and the 0-restriction on the γ -parameter is not rejected. Thus the evidence in favour of an equilibrium relationship between either the capital labour or per capita GDP and the political instability variable as outcome variable proves inconclusive where the possibility of simultaneity between rights and economic activity is recognized²⁴.

²² $JMLEV = 28.12^*$, $JMLT = 39.38^*$ respectively.

²³ Though we would expect misspecification given the lack of sophistication concerning function form in the production function.

²⁴ On possible explanation of the second cointegrating vector in the system of equations, is that investment ($\Delta \ln k$) could be influenced by the political instability variable. Imposing the appropriate identifying restrictions on the cointegrating space, provides a parameter of -0.02 on the $\ln INSTAB$ variable, though the parameter on the error cor- _(0.009)

rection term is both statistically insignificant and of the incorrect sign $\left(\begin{matrix} +0.03 \\ (0.66) \end{matrix} \right)$. Again, therefore, it is difficult that the simple specifications we are investigating here are sufficient in order to identify equilibrium relationships for investment (hardly a surprising conclusion, since political instability is unlikely to be the only determinant of investment).

2.2.4 Summary of Results

There is thus very little evidence in the case of South Africa, and on the present data set, that the simple forms of simultaneity explored by the two systems of equations given by 4, 5, and 7, 8 find support. Indeed, on the basis of the findings of the present section, the only relationship that finds robust empirical support is of a link between per capita output and political instability.

We are the first to recognize that the relationships here investigated are simple, and unlikely to capture the full complexity of any association between rights and economic output. As such, equilibrium (cointegrating) relationships between the narrow sets of variables here employed are perhaps unlikely. But this finding in itself reinforces the importance of the methodological lessons already drawn in different ways in Fedderke and Klitgaard (1998) and Fedderke (1999). The interaction between institutional, social and economic spheres are unlikely to be simple. If this is correct, the importance of clear and above all properly understood theoretical specifications on which to base empirical investigation is imperative.

Fortunately, we are able to extend the present study a step further, in order to investigate the nature of the association between the institutional variables and economic variables included in the present study. In particular, in the following section we investigate the structure of association between the variables, and the possibility of more complex forms of association (with more than one institutional variable included in any one estimation).

3 A More Detailed Investigation of Patterns of Association in the Institutions-Output Nexus

Hsiao (1997) lays the foundations for the use of conventional estimation techniques where the forcing variables are strictly exogenous, regardless of whether the variables are $I(0)$ or $I(1)$. Hsiao demonstrates that where forcing variables are strictly exogenous, conventional Wald statistics are asymptotically distributed (under the null of reduced rank cointegration). This allows for the restriction of the parameter space at the most general stage, economizing on degrees of freedom. Pesaran and Shin (1995b) advocate the use of autoregressive distributed lag models for the estimation of long run relations, suggesting that once the order of the ARDL has been established, estimation

and identification can proceed by OLS. While the presence of a long run relationship between variables remains critical to valid estimation and inference. Pesaran and Shin (1995b) demonstrate that valid asymptotic inferences on short- and long-run parameters can be made under least squares estimates of an ARDL model, provided the order of the ARDL model is appropriately augmented to allow for contemporaneous correlations between the stochastic components of the data generating processes included in estimation. Hence ARDL estimation is applicable even where the explanatory variables are endogenous, and, since the existence of a long run relationship is independent of whether the explanatory variables are $I(0)$ or $I(1)$, ARDL remains valid irrespective of the order of integration of the explanatory variables. The ARDL methodology thus has the advantage of not requiring a precise identification of the order of integration of the underlying data.

The PSS approach begins by estimating the error correction model given by:

$$y_t = \alpha_0 + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \sum_{j=1}^k \sum_{i=1}^p \gamma_{ji} \Delta x_{j,t-i} + \left(\delta_1 y_{t-1} + \sum_{j=1}^k \delta_{j+1} x_j \right) \quad (16)$$

and estimating by means of an F-test (henceforth referred to as PSS F-tests) the significance of a joint zero restriction on the δ 's of the error correction model. The distribution of the F-test is non-standard, and critical values are provided by Pesaran, Shin and Smith (1996). The test is further subject to potential ambiguity, in the sense that the test has an upper and lower critical bound value. As long as the computed statistic exceeds the upper bound, the null of no association can be unambiguously rejected. Similarly, as long as the computed statistic falls below the lower bound, the null of no association cannot be rejected. However, where the test statistic falls between the upper and lower bounds, it is indeterminate.

What remains critical, is the need to establish the existence of a unique long run relationship (i.e. that the F-tests confirm only one of the variables included in estimation as an outcome variable, and that all other variables act as forcing variables), and that an appropriate order to the ARDL is selected. We follow Pesaran and Shin (1995b) in a two step strategy, selecting the ARDL orders on the basis of the Akaike Information criterion (AIC), then estimating the long and short run coefficients on the basis of the selected model. Estimation can be shown to be feasible on the basis of the ‘‘Bewley

	<i>F</i> – test		<i>F</i> – test		<i>F</i> – test		<i>F</i> – test
$\ln RPF$	3.56	$\ln RPF$	4.88	$\ln RPF$	1.63	$\ln RPR$	1.09
$\ln RPR$	1.23	$\ln RPR$	0.33	$\ln INST$	3.85	$\ln INST$	3.42
$\ln INST$	1.71						

Table 4: PSS F-tests for patterns of association between institutional variables; * denotes significance

regression”:

$$y_t = \zeta + \eta t + \sum_{i=1}^k \theta_i x_i + \sum_{j=0}^{p-1} \gamma_j \Delta y_{t-j} + \sum_{m=0}^{q-1} \delta_m \Delta x_{t-m} \quad (17)$$

by the instrumental variables method, where $1, t, \sum_{i=1}^k x_i, \sum_{j=0}^{p-1} \Delta y_{t-j}, \sum_{m=0}^{q-1} \Delta x_{t-m}$, serve as instruments²⁵.

In the present context the methodology has the advantage of providing a means of testing for the patterns of association between the variables employed for the present study (by means of the PSS F-tests). In particular we have the means of identifying which variables are exogenous, which endogenous in various specifications including one or more of the institutional variables employed for the present study.

We begin with a brief investigation of possible patterns of association between the rights and instability variables included in the study. Table 4 reports the PSS F-tests for patterns of association. The absence of association between variables suggests that the variables are independent of one another, as is appropriate given the methodology by which the variables were constructed²⁶.

We employ a general to specific methodology, beginning with a specification incorporating all the institutional variables as well as the two “economic” variables (per capita GDP and the capital labour ratio), before moving on to more simple specifications.

²⁵The methodology outlined presumes that the x_i and ϵ are uncorrelated. where they are correlated, the methodology remains valid, but the “Bewley regression” requires augmentation.

²⁶See Fedderke, De Kadt, and Luiz (1998).

	<i>F - test</i>
$\ln y$	0.26
$\ln k$	11.76*
$\ln RPF$	9.35*
$\ln RPR$	4.26*
$\ln INST$	5.99*

Table 5: PSS F-test for independent and dependent variables. * denotes significance of the F-test defined on the null that the relevant variable is not an outcome variable; ? denotes an ambiguous test statistic that lies between the upper and lower critical value bounds.

<i>Null</i>	<i>Alternative</i>	<i>JML_{EV}</i>	<i>JML_T</i>
$r = 0$	$r = 1$	139.68*	212.60*
$r \leq 1$	$r = 2$	31.35*	72.92*
$r \leq 2$	$r = 3$	24.72*	41.57*
$r \leq 3$	$r = 4$	15.97*	16.84*
$r \leq 4$	$r = 5$	0.87	0.87

Table 6: Johansen Reduced Rank Tests

3.1 The case of linear associations

In Table 5 we present results for PSS F-tests for the direction of association between the variables included in the present study²⁷. The test does not allow for the identification of a unique outcome variable, and hence rejects the possibility of a unique cointegrating relationship. Under such circumstances the ARDL approach to cointegration is no longer available. One response might be the use of the Johansen methodology. The Johansen reduced rank criterion confirms the presence of multiple cointegrating vectors in the data set, as reported in Table 6. Estimation by means of Johansen ML methods thus requires the specification of identifying restrictions on the cointegrating space²⁸. At present the requisite theory required for the provision of such restrictions is not available, given the use of both strictly economic as well as institutional variables such as rights indexes and political instability variables.

²⁷Lag length in the F-test was based on the application of AIC criteria.

²⁸The requirement here would be for 16 restrictions.

	<i>F</i> – test		<i>F</i> – test		<i>F</i> – test
$\ln y$	2.96	$\ln y$	0.82	$\ln y$	1.25
$\ln k$	4.19 [?]	$\ln INST$	7.54*	$\ln RPF$	6.87 [?]
$\ln RPR$	2.68				
<i>C</i>				<i>C, T</i>	

Table 7: PSS F-tests; notation defined as before; C, T denote inclusion of constant, time trend respectively.

In the present paper we therefore pursue a data-driven inquiry into possible patterns of association between variables, by employing simpler specifications between variables than that considered in Tables 5 and 6. We proceeded by testing for statistically significant association between variables contained in the vectors $\{\ln y, \ln k, R\}$, where R denotes each of the three institutional variables in log transform in turn, and subsequently in the vector $\{\ln y, R\}$. In doing so we test for the appropriateness of including deterministic components in the form of a constant and time trend in the estimation²⁹. Lastly, following the lead from a prior literature, we consider the possibility that the association between rights and output is non-linear³⁰.

We report results for which significant associations between variables was identified. Table 7 reports significant PSS F-tests for the class of linear models tested.

In the class of linear models results are not conclusive. Both the PSS F-test indicating $\ln k$ as a possible outcome variable, and that indicating $\ln RPF$ as outcome variable, are inconclusive since the statistic is not unambiguously above the upper critical limit of the test. Nevertheless, Table 8 reports the outcome of an ARDL cointegration approach to estimation, assuming $\ln k$, $\ln INST$ and $\ln RPF$ as unique outcome variables respectively³¹.

The error correction term in all instances confirms the presence of a stable equilibrium relationship, and the forcing variables are statistically significant. However, ARDL diagnostics for the $\ln INST$ relationship are poor, though

²⁹We employ an unrestricted VAR in doing so, testing zero restrictions on the deterministic components.

³⁰See Scully (1988) and Fedderke and Klitgaard (1996, 1998) on this point.

³¹We report only the implied long run equilibrium relationship, the error correction term, and some diagnostics of the ARDL specification. Full results are available from the authors on request.

	$\ln k$		$\ln INST$		$\ln RPF$
$CONST$ (<i>t-ratio</i>)	2.54* (3.00)	$\ln y$ (<i>t-ratio</i>)	-1.44* (15.98)	$CONST$ (<i>t-ratio</i>)	-28.31* (18.67)
$\ln y$ (<i>t-ratio</i>)	1.53* (14.68)			$TIME$ (<i>t-ratio</i>)	0.07* (14.43)
$\ln RPR$ (<i>t-ratio</i>)	0.26* (2.40)			$\ln y$ (<i>t-ratio</i>)	-5.60* (21.43)
ECM (<i>p-value</i>)	-0.06 (0.00)	ECM (<i>p-value</i>)	-0.59 (0.00)	ECM (<i>p-value</i>)	-0.62 (0.00)
\overline{R}_{ARDL}^2	0.999	\overline{R}_{ARDL}^2	0.13	\overline{R}_{ARDL}^2	0.98
AR_{ARDL}	2.42	AR_{ARDL}	0.87	AR_{ARDL}	0.63
$RSET_{ARDL}$	0.014	$RSET_{ARDL}$	5.17*	$RSET_{ARDL}$	1.71
NRM_{ARDL}	0.018	NRM_{ARDL}	19.22*	NRM_{ARDL}	83.44*
$HETR_{ARDL}$	3.49	$HETR_{ARDL}$	9.79*	$HETR_{ARDL}$	0.44

Table 8: ARDL results: AR, RSET, NRM, HETR are tests for serial correlation, misspecification, non-normality of residuals, heteroskedasticity respectively; * denotes significance.

the negative sign on the $\ln y$ variable carries the intuitive appeal of falling political instability with rising per capita incomes.

The positive sign on $\ln y$ for the equation for the capital labour ratio is justifiable on accelerator grounds, and the positive sign on property rights in the same equation is in accordance with prior expectations. ARDL diagnostics are acceptable, and though implying slow adjustment to equilibrium values, the error correction term is both significant and of the correct sign.

Lastly, the equation for the $\ln RPF$ variable implies the presence of a perverse modernization link between per capita GDP and political freedoms, with the rising per capita GDP being associated with deteriorating political freedoms, though the trend in political freedoms is benevolent. Again, ARDL diagnostics for this equation are not entirely satisfactory, with residuals again proving to be non-normally distributed.

3.1.1 Summary of results for linear associations between variables

The results obtained from linear associations between variables are thus not altogether convincing. While for the ARDL with $\ln k$ as outcome variable,

results appear satisfactory in the sense that all forcing variables are significant and of intuitively appealing sign, the error correction term is satisfactory, and the ARDL diagnostics are adequate, the PSS F-test on which the specification is based is not conclusive. Indeed, only for the $\ln INST$ is the PSS F-test conclusive, though in this case not only are ARDL diagnostics poor, but the negative sign on the $\ln y$ variable requires some justification. Lastly, for the $\ln RPF$ ARDL estimation, the non-normality of residuals under the ARDL estimation is cause for concern. The negative sign on the $\ln y$ forcing variable suggests a perverse modernization link for South Africa, though the sign could conceivably be justified on the grounds that the Apartheid state required increasing repressive powers as per capita access to resources of the population increased.

We thus have reservations about the quality of the results for linear associations between variables. But we also note that two important methodological lessons emerge to reinforce those already noted in Fedderke (1999) and Fedderke and Klitgaard (1998). First, institutional and economic variables are caught in “webs of association” in which identification questions become crucial to legitimate estimation. But second, the directions of association between variables are by no means unambiguous, and in the case of the ARDL estimation of the relationship for the political freedom variable, we note that at least for the case of South Africa, it is not possible to take an unalloyed lead from modernization theory, for instance.

Once again therefore, identification issues are crucial to a legitimate empirical engagement of the institutional-economic developmental nexus.

3.2 Possible non-linear associations between variables

The limitations of the linear associations reported above suggest an obvious extension of the estimations to non-linear model specifications. Table 9 reports the significant associations found in the presence of nonlinear variable specifications. In contrast to the linear specifications above, the identification of a unique outcome variable by means of PSS F-tests is unambiguous in each instance, with the capital labour ratio being the outcome variable in each instance. Moreover, the non-linearity attaches to the per capita GDP variable.

We therefore proceed by means of ARDL estimation with somewhat greater confidence than for the class of linear models. Table 10 reports the

	<i>F - test</i>		<i>F - test</i>
$\ln y$	1.97	$\ln y$	2.77
$(\ln y)^2$	1.94	$(\ln y)^2$	2.68
$\ln k$	4.46*	$\ln k$	5.08*
$\ln RPF$	1.58	$\ln RPR$	3.33
$\ln RPR$	2.67	$\ln INST$	2.08
$\ln INST$	1.82		
C, T		C, T	

Table 9: PSS F-tests: non-linear specifications; notation as before

	$\ln k$		$\ln k$
<i>CONST</i> (<i>t-ratio</i>)	62.93* (5.57)	<i>CONST</i> (<i>t-ratio</i>)	66.03* (6.49)
$\ln y$ (<i>t-ratio</i>)	25.36* (5.77)	$\ln y$ (<i>t-ratio</i>)	26.46* (6.49)
$(\ln y)^2$ (<i>t-ratio</i>)	2.38* (5.52)	$(\ln y)^2$ (<i>t-ratio</i>)	2.48* (6.14)
$\ln RPF$ (<i>t-ratio</i>)	-0.05 (0.77)	$\ln RPR$ (<i>t-ratio</i>)	0.12* (2.19)
$\ln RPR$ (<i>t-ratio</i>)	0.18** (1.86)	$\ln INST$ (<i>t-ratio</i>)	-0.02* (3.54)
$\ln INST$ (<i>t-ratio</i>)	-0.03* (3.05)	<i>D64</i> (<i>t-ratio</i>)	0.07 (1.36)
<i>D64</i> (<i>t-ratio</i>)	0.08 (1.38)		
<i>ECM</i> (<i>p-value</i>)	-0.08 (0.00)	<i>ECM</i> (<i>p-value</i>)	-0.08 (0.0)
\overline{R}^2 <i>ARDL</i>	0.999	\overline{R}^2 <i>ARDL</i>	0.999
<i>AR</i> <i>ARDL</i>	0.73	<i>AR</i> <i>ARDL</i>	0.55
<i>RSET</i> <i>ARDL</i>	1.47	<i>RSET</i> <i>ARDL</i>	1.46
<i>NRM</i> <i>ARDL</i>	0.68	<i>NRM</i> <i>ARDL</i>	0.97
<i>HETR</i> <i>ARDL</i>	3.89*	<i>HETR</i> <i>ARDL</i>	4.46*

Table 10: ARDL results: AR, RSET, NRM, HETR are tests for serial correlation, misspecification, non-normality of residuals, heteroskedasticity respectively; * denotes significance at the 5 percent level.

ARDL results for the three cases identified above³². Both ARDL estimations have acceptable diagnostics, despite the weak tendency toward heteroscedasticity, and the error correction term is of the correct sign and is significant.. The non-linearity in per capita output is confirmed for both estimations, as is the inclusion of the property rights index and the political instability index. On the other hand, the political liberties index does not prove to be statistically significant, and its exclusion does not negatively affect the quality of results. The preferred result must thus be the parsimoniously specified equation excluding the political freedom variable.

The signs of both the significant institutional variables are intuitively appealing, with improving property rights leading to higher, and greater instability leading to lower capital labour ratios. The positive link from output to the per capita capital stock conforms to standard accelerator principles, while the non-linearity in per capita GDP carries the implication of increasing returns in output for the capital stock. Increases in output bring with them increases in the capital stock at an increasing rate³³.

In the case of the preferred ARDL specification, the error correction specification carries interest in its own right, since it provides some insight into per capita investment behaviour in South Africa³⁴. The error correction equation is given by:

$$\begin{aligned} \Delta \ln k_t &= \underset{(5.46)}{5.4909} + \underset{(1.42)}{0.01} D64 + \underset{(4.37)}{0.42} \Delta \ln k_{t-1} + \underset{(5.51)}{2.20} \Delta \ln y_t \\ &+ \underset{(5.32)}{0.21} \Delta (\ln y)_t^2 + \underset{(2.00)}{0.10} \Delta \ln RPR_t - \underset{(1.40)}{0.001} \Delta \ln INST_t \quad (18) \\ &+ \underset{(2.21)}{0.001} \Delta \ln INST_{t-1} - \underset{(8.05)}{0.08} ecm_{t-1} \\ \overline{R}^2 &= 0.96, F(8, 36) = 129.08, \sigma = 0.004 \end{aligned}$$

(σ denotes the standard error of the regression, figures in round parentheses denote t-statistics) While the adjustment to equilibrium appears slower than might appear appropriate for an investment equation, the underspecification of the investment relationship readily accounts for this. The accelerator relationship continues to be evident for investment as well as the level of the per capita capital stock. Moreover, improvements in the level and quality of

³²The time trend proves insignificant in each instance, and is therefore omitted from ARDL estimation.

³³A result we might expect under a declining marginal product of capital.

³⁴Though of course a comprehensive explanation of investment expenditure would require a more complete specification.

property rights increases per capita investment, and changes in the level of political instability also exercises an influence on investment expenditure in South Africa. Consideration of the lag structure of the political instability measure, suggests that the impact of political instability appears to be of postponing investment expenditure.

3.2.1 Summary of non-linear results

Results that allow for potential non-linearity in the association between per capita GDP and the capital labour ratio appear to be statistically sounder than linear associations. Reported results confirm the presence of an accelerator-type association between output and the per capita capital stock in South Africa. Moreover, we establish a positive link running from property rights to the capital labour ratio, and a negative impact of political instability on the capital labour ratio.

The accelerator relationship transfers readily to investment expenditure in the error correction model estimated, and both political instability and changes in property rights exercise an influence on investment expenditure. Improvements in property rights appear to increase investment, while heightened political instability has the effect of deferring investment expenditure.

4 Conclusions and Evaluation

We note that the results obtained through the investigation of section 3 of this paper do suggest patterns of association between the institutional and economic variables incorporated in the present study. We summarize the findings in Figure 1. Thus our results suggest the capital labour ratio as the outcome variable associated with per capita GDP (positively and non-linearly associated), property rights (positively associated), and political instability (negatively associated). With somewhat less confidence we also report results suggesting political freedoms and political instability as an outcome variable of per capita GDP, though in both instance the negative association suggests a perverse modernization process. We suggest that the nature of the apartheid state can account for this result in at least some measure.

It is of interest to note that the link between output and capital conforms to accelerator principles, and applies both to the equilibrium *level* of the

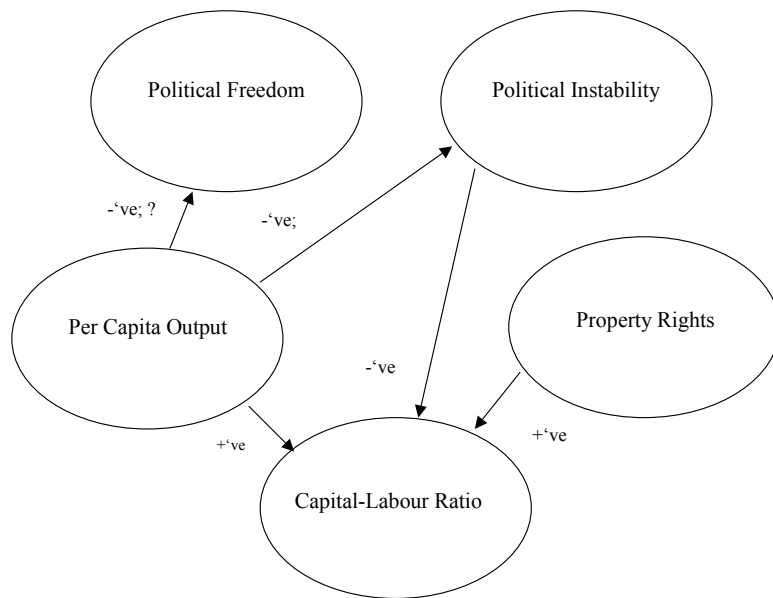


Figure 1: Patterns of association

capital stock, as well as to the investment rate.

The present study was also able to advance our understanding of the nature of the institutions-output nexus. The use of new rights and political instability indicators was crucial in this regard, since it allowed the use of current time series (cointegration) analysis in order to investigate the link between output, capital and institutional dimensions. A further advantage of the institutional measures used for the present study is their finer nuance, that allowed for greater variation in the rights indexes than in those measures currently used in the literature (essentially Freedom House data).

Conclusions to emerge concerning the institutional data, are that property rights and political instability serve as forcing variables of the capital labour ratio in South Africa over the post war era. By contrast, political freedoms appears to be (at most) an outcome variable, linked to per capita output in a perverse modernization link. Rising output lowered political liberties in South Africa, though this may be an expression of the repressive requirements of the apartheid state.

Above all we suggest that the present study serves to illustrate two important methodological points. First, we suggest that the merits of detailed country-specific time series studies is illustrated by the present study. Detailed investigation of patterns of association between variables is possible in a way that is unavailable to the cross-country studies that have informed the literature thus far. Second, the use of nuanced and differentiated rights and political instability indexes not only represents an advance over the current state of the empirical debate concerning the association between economic and political dimensions, but shows the importance of differentiating between the alternative rights dimensions.

We believe that further studies on alternative case studies (other countries) would serve to deepen our understanding of the growth-institutions nexus even further.

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