Fractionalization and Long-Run Economic Growth: Webs and Direction of Association between the Economic and the Social – South Africa as a Time Series Case Study

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Fractionalization and Long-Run Economic Growth: Webs and Direction of Association Between the Economic and the Social - South Africa as a Time Series Case Study

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ABSTRACT: Recent cross sectional growth studies have found that ethnolinguistic fractionalization is an important explanatory variable of long-run growth performance. In the present paper we follow the call of earlier studies to conduct a more detailed clinical analysis of the growth experience of a specific country. South Africa constitutes an interesting case in which to explore these questions. The results of this study provide important nuance to the existing body of evidence. We find that fractionalization is subject to strong change over time. In addition, we find strong evidence of webs of association between the various social, political and institutional dimensions. Thus various forms of social cleavage tend to go hand in hand which presents the danger of spurious inference of association. Further, the direction of association in the preponderance of cases runs from economic to social, political and institutional variables, rather than the other way around. However, there remain significant impacts from some, but only some fractionalization indexes on economic growth. Which social cleavage, when, how and for what period of time will depend on the historical path of specific societies.
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1 Introduction

The lack of convergence in the growth patterns of developing versus developed countries has led to a plethora of research examining this apparent anomaly. New growth theorists have pointed to the role of technology, human capital, and institutions besides the more traditional economic variables. Easterly and Levine (1997), in an influential article, drew attention to the potentially important role of ethnic diversity in influencing economic growth. They examined the hypothesis that "cross-country differences in ethnic diversity explain a substantial part of the cross country differences in public policies, political instability, and other factors associated with long-run growth." They find that ethnic diversity is an important predictor of economic performance, and of the African growth experience. (Easterly and Levine, 1997: 1205). Central to Easterly and Levine's perspective is the question of whether the level of ethnic fractionalization bears on the potential for distributional conflict.[1]

International studies have been constrained by the cross sectional (and single time point) nature of the data on many institutional and social characteristics - particularly fractionalization. The first extension that the present study permits is the examination of a single clinical case study, over an extended time horizon. For South Africa the long standing policy concern with race, ethnicity and language has led to the availability of long running time series in the social, political and institutional (SPI) dimensions. This allows us to pose a number of questions that have not yet been addressed in the literature.[2] To what extent are the various SPI-dimensions stationary over time?

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[1]Also see Alesina et al (2002), Collier (2001), Knack and Keefer (1997), and Posner (2004).

[2]South Africa constitutes an interesting case in which to explore these questions. In terms of the Ethnolinguistic Fractionalization Index cited by Easterly and Levine, South Africa in 1960 ranked 6th out of 66 countries covered by this index with a value on the measure of 88 (that is a probability of 88% that two randomly chosen individuals are of different ethno-linguistic origin). Important, too, in the South African case is that from 1948 through to the demise of Apartheid, a major attempt was made to socially and politically "engineer" South Africa along the lines of supposedly "essentialist" ethnic identities. At least with regard to the "African" community these ethnic divisions were meant to coincide with linguistic identities. That South Africa continues to be linguistically highly fractionalized is registered by the fact that the present (post 1994) Constitution acknowledges linguistic diversity through the legal recognition of eleven official languages. If fractionalization is an important explanatory variable in the long run growth process of a country, South Africa is ideal to test this hypothesis.

Attributing long term economic performance to an ethno-linguistic fractionalization index measured at one point in time (typically 1960), presumes that the index is relatively unchanging over time, precipitating the economic performance that we observe subsequently. The availability of time series data allows us to assess the plausibility of this assumption - at least for the case of South Africa.

Time series data also allows us to assess the patterns of association between variables in greater detail. Is it the case that the various SPI variables available for this study are independent of one another? Do some move together over time, if they move at all? Which do so move together? Are the social, political and institutional dimensions being measured variables that drive the economic characteristics of the economy, or does the economy in turn have the capacity to change social, political and institutional features of the society? English, for instance, has become the principal language of communication among scientists and technologists. Similarly, English is the *lingua Franca* of airline pilots and air traffic controllers. The outcome of individual rational action under these circumstances might well be a shift toward greater aggregate linguistic homogeneity. Economic growth, and the policies and choices that are associated with it, might be as important in creating linguistic homogeneity as linguistic homogeneity is in favouring growth. By using statistical tests designed to establish the direction of association between variables, we are able to examine these questions in greater detail.[3]

This raises an important question which has not been addressed sufficiently by the cross sectional growth literature on fractionalization, namely the direction of association between fractionalization and growth. Although numerous studies have concluded that social fractionalization does indeed retard economic growth, there is an older literature which argues that the direction of association runs from the economic to the social and political. This modernization hypothesis developed by Lipset (1959) posits the evolution of social and political institutions, and democracy in particular, as a consequence of economic development.[4] The implication is that economic growth, and the evolution of per capita GDP is not only the source of social and political development, but as a necessary corollary it will entail signif-

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[3] The possibility of associations between and amongst SPI variables themselves, raises the additional concern that the introduction of any one of the SPI-dimensions into any growth equation for estimation, may generate spurious results. Analysis of the webs of association between the SPI variables should improve our understanding of this danger

[4] For a South African perspective, see Fedderke, de Kadt and Luiz (2001b).

icant disruption of established political order in the process of realising the change. One author states the link as follows:

> Social and economic change ... extend political consciousness, multiply political demands, broaden political participation. These changes undermine traditional sources of political authority and traditional political institutions ... The result is political instability and disorder. The primary problem of politics is a lag in the development of political institutions behind social and economic change (Huntington, 1968:5).

On this view therefore, economic development can be identified as a (if not the) source of political instability.[5] Given the context of the fractionalization literature which posits its potential for distributional conflict, it is surprising that economists have not examined the possibility of reverse causation through a modernization-type effect. It is possible that it is economic growth which unleashes social and political change both through choice and through conflict, along the lines proposed by modernization theory. If this is the case, then ethnolinguistic fractionalization could very well be endogenously determined though economic progress rather than an exogenous and deterministic cause of economic outcomes. In fact in this paper we find some evidence supporting a modernization effect with economic development driving political rights and affecting ethnolinguistic fractionalization. We find that fractionalization matters for economic growth but not ethnolinguistic fractionalization as has been posited in the literature. In the South African case it is racial fractionalization which impacts on growth. We conclude that it is unlikely that the default cleavage for distributional conflict will necessarily be ethnolinguistic rather than other forms of social and political cleavages including those of race, politics, religion and class - clinical country case studies will reveal which fractionalization index represents the defining cleavage for *that* society.

Section 2 presents various social, political and institutional fractionalization variables (SPIVs) for South Africa. Section 3 examines the interaction

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[5] In traditional South African growth debates, this view underpins the interpretation of the South African growth path that is present in the contributions of O'Dowd (1974, 1978), and Bromberger (1974, 1978), for instance. Presentation of international evidence is myriad with both affirmative (see for instance Muller (1997) and more sceptical views present in the literature (see for instance Huntington (1984), though the scepticism is revised somewhat in (1991).

effects of these SPIVs and the webs of association between them. Section 4 provides a structural model employing a vector error-correction mechanism (VECM) framework of estimation, and section 5 concludes.

2   The South African Data[6]

The fractionalization indexes presented below were constructed by consulting official South African government statistical sources which are based on census data. Between 1910 and 1960 our principal source has been the Union Statistics for 50 Years. Subsequently the Central Statistical Services Reports were our primary sources. Given that data is frequently collected only in census years, the data series below were constructed by means of interpolation between these years. In addition, not all variables were available over the full 1910-2000 timeframe considered for this study. We note these limits where relevant.

The study reports more than just the degree of linguistic fractionalization in South African society. A list of variables and their definition is provided in Appendix A.

Linguistic fractionalization was measured from 1946 through to 1993.[7] The broad pattern that emerges is the following: from 1946 through to 1991, the overall level of linguistic fractionalization remains high in the 0.8-0.9 range with a downward trend over the long term. Note that the measurement of linguistic fractionalization is subject to measurement error. This arises above all because the scope and accuracy of coverage of different population groups has not been consistent over time. Particularly with respect to Africans, early (but also subsequent) years showed incomplete data collection, rendering data unreliable. Moreover, under Apartheid and the re-

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[6]A more comprehensive discussion of the fractionalization indexes and methodological questions surrounding their construction is presented in Fedderke, Luiz and De Kadt (2005).

[7]We follow the standard measure given by

$$F = 1 - \sum_{i=1}^{n} \left(\frac{n_i}{N}\right)\left(\frac{n_i - 1}{N - 1}\right)$$

where n_i denotes the number of members of households that cite the $i'th$ language as the principal medium of communication within the household, N denotes the number of members in the population. F thus computes the probability that two randomly chosen individuals speak different first languages.

peated creation, redefinition, and disappearance of supposedly ethnically defined Homelands, significant portions of the African population disappeared, moved classification, and reappeared in statistical sources. After 1970 the active creation of Homelands for Africans under Apartheid policies shifted responsibility for census data collection away from Pretoria. Data collection on first language orientation by Homelands was negligible. Note that we have corrected for the Homeland population in the fractionalization series presented here, except in the case of religion where it was not possible.[8]

We also examine fractionalization in a number of additional dimensions. One of these is provided by an index of diversity of religious affiliation.[9] Our approach to the construction of an index of religious fractionalization followed that of the approach to the construction of the index of linguistic fractionalization. In the case of religious fractionalization, we capture data from 1920 through to 1991.[10] The level of total religious fractionalization increases through the period for which we have data, from just below 0.8 to close to 0.9. As for linguistic fractionalization, religious fractionalization suffers substantially from data collection problems. In the case of the African population group, religious fractionalization may have increased at least in part because of increased diversity of categories under which religious affiliation was collected over time, rather than any underlying change in religious belief structure. After 1970 data collection on religious affiliation by Homelands was negligible.

We have also included a measure of political fractionalization.[11] The index is computed on parliamentary representation - and only for the White House of Assembly, except for the 1994 and 1998 data points which are for the first democratic parliaments.[12] A number of caveats need to be mentioned

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[8] A general point that emerges for studies employing measures of linguistic fractionalization, is that given the data problems even for a country such as South Africa, which amongst developing countries has relatively extensive and sound data collection procedures, this raises significant questions concerning the quality of data for developing countries in general.

[9] On a prior analysis of religious fractionalization and its economic impacts, see Barro and McCleary (2003).

[10] Again the time frame was dictated by data availability.

[11] The measure was first introduced in Fedderke et al (2001a).

[12] From 1910-1983 South Africa had only the House of Assembly as its formal legislative chamber. It essentially represented Whites, though even prior to 1983 representation of Africans, Coloureds and Asians existed under the Representation of Natives Act (1936), and the Separate Representation of Voters Act (1955). Such representation was more

here. First, given the nature of South Africa's political history, with high levels of repression and the formal banning of political parties and organizations, any measure of political fractionalization will be partial. To attempt to measure overall political party support or membership would have been impossible. The only parties for which such data might have been reasonably reliably obtained would have been the legally recognized, mostly white, parties. Our approach, therefore, was to measure the level of fractionalization within the legislature which is the body in which policies that bore upon the performance of the economy were formulated. The bias that results is obvious. Surprisingly, however, the correlation between this clearly biased measure of political fractionalization and alternative measures of civil and political rights, the CIVLIB measure from Freedom House, and the PolFree measure from Fedderke, De Kadt and Luiz (2001a), deliver correlation coefficients of 0.69 and 0.77 respectively. The surprising finding is thus that the political fractionalization of what is clearly a very partial parliamentary system nevertheless reflected in surprising degree the state of rights structures in the society as a whole. At least some information is contained in the measure therefore.

In South Africa, during the course of the twentieth century, a major attempt was made to socially and politically engineer the country along ethnic lines. However, the dominant *de facto* cleavage was and continues to be one of race. Accordingly we also computed a racial fractionalization measure along the established Apartheid classificatory systems of Whites, Coloureds, Asians and Africans. Racial fractionalization in South Africa fell from 0.49 in 1911 to approximately 0.36 in 2001 as the population became increasingly African and racially homogeneous. Since the populations of the Homelands was almost entirely African, correction of the aggregate South African racial fractionalization index was straightforward, by simple inclusion of the aggregate Homeland populations in the African population series.

We conclude the data section with a number of brief general observations about the data structure.

First, we note that while many of the *aggregate* fractionalization indexes show considerable stationarity over time, this is not universally true (for in-

notional than real. From 1983 South Africa introduced a three chamber parliament, with a White House of Assembly, the Asian House of Delegates, and the Coloured House of Representatives. Africans had no representation (outside of the notionally independent ethnically defined homelands), until 1994 and the introduction and the first democratic South African parliament.

stance for racial fractionalization), and even where it does hold, the aggregate stability often hides substantial movement at the subcomponent population group level.[13]

Second, we emphasize the significant difficulties associated with data collection surrounding social cleavage.[14] Consistency, as well as reliability of data compilation must play a role across wide geographical reaches, and periods of time. In fact, the countries with the highest levels of fractionalization are those most likely to have the most contentious data being employed in cross sectional studies.

Finally, the evidence on various fractionalization indexes reported above presents the suggestion that various social cleavages (for instance religious and linguistic fractionalization) show a strong correspondence. Where the society is fractionalized in one, it is tempting to conclude that it will be fractionalized in other dimensions also. For instance, racial fractionalization will be mirrored in linguistic as well as religious diversity. An immediate implication is that the significance of the any statistical evidence must be carefully considered for the possibility of spurious associations.

3 Interaction Effects: deepening and developing the web of association between the SPIV's and economic development

Thus far we have focused our discussion on the introduction of a range of social, political, and institutional variables available in South Africa (henceforth SPIV's). The first question concerns the presence of any systematic association between the SPIV's themselves, or between the SPIV's and economic dimensions of interest to economic growth.

In order to explore the directions of association between the variables included in this study, we consider the use of the test statistic proposed by Pesaran, Shin and Smith (1996, 2001) (hereafter PSS) F-statistics.[15]

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[13]See Fedderke, Luiz and De Kadt (2005) for a more detailed exposition

[14]At this point we do not develop this point further - but note that in cross sectional contexts this issue surely compounds - see Fedderke, Luiz and De Kadt (2005) for a more detailed exposition

[15]See also the discussion in Pesaran (1997) and Pesaran and Shin (1995a, 1995b) and Pesaran, Shin and Smith (2001). Suppose that the question is whether there exists a long run relationship between the set of variables $y_t, x_1, \ldots x_{n,t}$. Univariate time series

In Table 1 we present the results of the application of the PSS F-test methodology to the variables included in this study, in a series of bivariate applications.[16] In keeping with the international evidence, we consider the possibility of associations between all the variables in levels, except for growth in real output and the time rate of change in the real capital stock, which are by definition already flows.

The general conclusion that there exist patterns of associations between the SPIV's is confirmed by the test statistics, and we summarize the findings from the bivariate tests in Figure 1 below, and the results from ARDL and VECM[17] (as appropriate) cointegrating estimations are reported in Tables

characteristics of the data are not known for certain. The PSS approach to testing for the presence of a long run relationship proceeds by estimating the error correction specification given by:

$$\Delta y_t = a_0 + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + \sum_{j=1}^{n} \sum_{i=1}^{p} \gamma_{j,i} \Delta x_{j,t-i} +$$
$$\left(\delta_1 y_{t-1} + \sum_{k=2}^{n+1} \delta_k x_{k,t-1} \right) + \varepsilon_t$$

The test proceeds by computing the standard F-statistic for the joint significance of $\delta_1 = \delta_2 = \ldots = \delta_{n+1} = 0$, under all feasible alternative LHS variables. While the distribution of the test statistic is non-standard, with $x_{i,t} \sim I(0) \forall i$ providing a lower bound value, $x_{i,t} \sim I(1) \forall i$ an upper bound value to the test statistic. The test is analogous to a Granger causality test, but in the presence of non-stationary data. This renders the PSS F-test suitable in the current context.

[16] We also examined correlation coefficients. Appendix B reports the results. In particular, we find that: high religious fractionalization is associated with lower political fractionalization, and lower political rights; high religious fractionalization is associated with higher output; high linguistic fractionalization is associated with lower property rights; high linguistic fractionalization is associated with lower output and capital stock, but with higher investment in capital; high political fractionalization is associated with higher political rights; high political fractionalization is associated with lower output; there is a positive association between political and property rights; property rights are negatively associated with racial fractionalization; property rights are positively associated with output, capital and investment; instability does not appear to be strongly associated with any other dimension; racial fractionalization is negatively associated with output and capital stock, and positively associated with investment.

[17] The vector error correction approach to cointegration is now standard, and requires little elaboration. See Johansen (1988), and Johansen and Juselius (1990, 1992).

2a, 2b and 2c.[18]

We draw seven central conclusions from the evidence presented in these tables.

Conjecture 1 *Conjecture 1: Social cleavage does hang together.*

This follows immediately from noting that the various fractionalization indexes included in the study do show strong patterns of mutual association amongst one another. Linguistic, religious, political and racial fractionalization appear to move together, with linguistic fractionalization being the outcome variable reflecting changes in political fractionalization, religious fractionalization and racial fractionalization (see column 2 of Table 1, in contrast to columns 1, 3, and 10). Moreover, in bivariate ARDL cointegration estimations the sign of association between all of the fractionalization indexes proves positive - see columns 1 through 3 of Table 2a. The first implication of the "causality" tests therefore appears to be that use of linguistic fractionalization as an indicator of (common) underlying social cleavages, may be justified for South Africa.

Conjecture 2 *Conjecture 2: In general, social cleavage does not impact on economic growth - instead social cleavage responds to economic growth.*

Generally the fractionalization indexes included in the study do not emerge as forcing variables for the economic development indicators - see columns 7, 8, and 9 of Table 1. Instead, it appears as if economic variables drive social fractionalization - see columns 1, 2 and 3 of Table 1. Higher levels of real

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[18]The PSS ARDL approach to cointegration does allow for some flexibility in the use of both I(0) and I(1) data, and we proceed with the analysis on this basis. Consideration of the stationarity properties of the data implied by augmented Dickey-Fuller test statistics, precludes the possibility of systematic association between at least some variable groups. Some variables are I(0) (LANGFRAC, GROWTH), some I(1) (POLFRAC, INSTAB, POLRGHT, PROPRGHT, LNRGDP, dK/dt), and in two cases the variables are I(2) (RELFRAC, RACE). The implication is immediately that at least some of the associations suggested by the F-tests for direction of association of Table 1 are likely to be spurious. Instead, the univariate time series structure of the data suggests that associations between the variables included in this study may have to be found between transformed variables. We note at the outset that where the univariate time series characteristics of the data are rigorously adhered to, the implied associations between variables becomes between levels, changes in variables, as well as rates of change. Problems of interpretation compound.

output appear to result in lower levels of linguistic fractionalization - consistent with the social integration we might expect from modernization theory - though an acceleration of economic growth is associated with an increase in linguistic fractionalization - see columns 4 through 6 of Table 2a.

Conjecture 3 *Conjecture 3: There is one form of social cleavage that does appear to impact on economic growth*

The only exception to the finding that fractionalization does not force growth emerges with respect to religious fractionalization, and racial fractionalization - see columns 7 and 8 of Table 1. That racial fractionalization in South Africa may influence economic growth is not in itself surprising. However, for both fractionalization indexes the sign with respect to growth is positive, and only racial fractionalization proves to carry a statistically significant impact (see columns 1 and 2 of Table 2b).

The surprising implication is therefore that higher racial fractionalization increases economic growth.

Conjecture 4 *Conjecture 4: The interpretation of the impact of social cleavage suggests the importance of distributional conflict and its impact on economic growth.*

The preceding result carries some general substantive lessons.

We find that higher racial fractionalization led to higher levels of political instability - significant at the 10% level (see column 2 of Table 2c). In this sense, the results of our study are consistent with the Easterly-Levine finding. But it should be emphasized that what is confirmed by the South African evidence is that the impact on economic growth emerges from distributional conflict, organized along very particular lines of social cleavage which are neither ethnic nor linguistic in the first instance, but race-defined instead.

The arguments on either side of the debate on the relevance of ethnolinguistic fractionalization for development thus may both carry merit. Ethnolinguistic fractionalization may indeed correlate with economic development. But this correlation could be spurious, in the sense that the ethnolinguistic fractionalization really captures the impact of another social cleavage along which distributional conflict is organized (recall that the different fractionalizations hang together). Its impact may also really capture the impact of distributional conflict, rather than of ethnic or linguistic fractionalization

per se. What comes to matter is whether social cleavage comes to be mobilized, how social cleavage comes to be mobilized, by which political agents, and for what ends. Because what really matters is not the cleavage, but that it comes to serve as a political tool in distributional conflict. The particular cleavage is largely immaterial, and may be different in different societies, and even different in a specific society at different times in its history.

The particularities of the histories of specific societies are crucial, including in terms of how to interpret the empirical evidence that emerges. Thus the emergence of a positive sign between racial fractionalization and growth in South Africa does not reflect a rejection of the negative impact of distributional conflict - instead it reflects the dynamics of the political process in South Africa, with a sharpening of the battle lines of distributional conflict prior to its (at least institutional) resolution. Viewing the evidence in terms of its dynamic evolution over time, therefore may well preclude simple monotonic associations between fractionalization and economic development outcomes: things may often get worse before they get better.

Finally, the policy implications are also important: since what is required is the management of distributional conflict, not the management of any particular form of social cleavage per se (racial, or ethnic, or linguistic - it could be any one or any combination of these that serves as the catalyst for distributional conflict). Vigilance has to be general, and perhaps assume the form of institutional checks and balances.

Conjecture 5 *Conjecture 5: Path dependence carries further methodological lessons: we need more clinical evidence to deepen our general understanding*

The findings surrounding the impact of racial fractionalization are unlikely to generalize beyond the South African case. An immediate methodological lesson that follows is that the need for clinical studies that afford the opportunity of exploring possible path dependencies and unique characteristics of growth paths already noted in this and other studies is reaffirmed. A cursory examination of the international political landscape reveals great complexities around distributional conflict and demonstrate that it is unlikely that ethnolinguistic fractionalization is *necessarily* the defining social fault line. Whilst ethnolinguistic fractionalization may be *the* social cleavage which resulted in conflict in Rwanda and Burundi, it is not clear that this is the case in other conflicts.[19] The long lasting conflict in Northern Ireland was

[19]A countervailing view on the conflict in Rwanda argues that it was less about ethnicity

ostensibly waged between Protestants and Catholics and was thus driven by a religious cleavage. The balkanization of Yugoslavia and the Soviet Union had many dimensions including ethnolinguistic and religious cleavages. It is simplistic therefore to assume that the default cleavage for distributional conflict will necessarily be ethnolinguistic rather than other forms of social and political cleavages including the most obvious of race and religion.

Conjecture 6 *Conjecture 6: The rights structure proves largely irrelevant - though improved property rights lower political instability.*

Association between political instability and property rights is ambiguous on the PSS F-tests, with the possibility of simultaneity between the variables (see columns 5 and 6 of Table 1). We therefore tested for the direction of association by means of weak exogeneity tests in a VECM framework, and found the direction of association to run from property rights to political instability (see column 7 of Table 2c).[20] The implication of the long run coefficient obtained from the estimation of the relevant cointegrating vector just identified on property rights, suggests a negative association between political instability and property rights. Improved property rights are thus associated with lower political instability.

Neither political rights nor property rights appear to impact on any of the fractionalization indexes (see columns 1,2 and 3 of Table 1). However, both linguistic fractionalization and racial fractionalization does appear to impact on political rights in South Africa (see column 4 of Table 1) - a plausible result given South Africa's history of racial and ethnic politics. However, ARDL cointegration estimation of these relationships returns statistically insignificant coefficients - of positive sign (suggesting higher fractionalization improves political rights) - and the error correction process is of the incorrect sign, suggesting the absence of an equilibrium relationship between the variables (see columns 3 and 4 of Table 2b).

Conjecture 7 *Conjecture 7: There are further webs of association - which are not always easy to understand.* [21]

and rather an outcome of the unbearable stress on the land as a result of a Malthusian population trap (see Andre and Platteau, 1998).

[20] This emerges form the fact that in the loading matrix of the VECM structure, both elements of the loading matrix associated with political instability reject the presence of an equilibrium relationship for political instability. By contrast, the loading matrix confirms the presence of an equilibrium relationship for property rights.

[21] Also see Fedderke and Klitgaard (1998).

There are further associations among the SPIV's, and between the SPIV's and the indicators of economic development, which are difficult to interpret in the absence of clear theoretical guidance.

Thus political instability appears to force linguistic fractionalization (see column 2 of Table 1). However, ARDL cointegration estimation suggests the sign of association to be negative - such that rising political instability *lowers* linguistic fractionalization (see column 6 of Table 2a).

Political instability is an outcome variable relative to a number of other variables, including political and racial fractionalization, property rights, output, growth and the change in the capital stock (see column 6 of Table 1). However, of these only two are statistically significant. Moreover, increasing output proves to have a positive impact on instability, while political fractionalization carries a positive sign (and is significant only at the 10% level) (see Table 2c).

The impact of growth on property rights proves statistically insignificant, while none of the SPIV variables prove to have a significant impact on the time rate of change of the aggregate capital stock.[22]

Some final comments

The implication of the baseline evidence from "causality" tests is therefore that there exists a web of association between the alternative fractionalization indexes. Different forms of social cleavage tend to go together.

Only some fractionalization indexes impact on economic growth in South Africa, however. It is racial, not linguistic fractionalization which matters in the South African context- despite the positive association between the two indexes. The impact of racial fractionalization suggests that what really drives growth is distributional conflict, and that the mobilization of social cleavage in its support renders the particular form of cleavage chosen contingent.

The implication is also that path dependence matters - both in identifying which form of social cleavage matters, and in interpreting the evidence.

Thus the relationships that are widely investigated and employed in cross sectional studies do receive support from the time series evidence - though the approach required to the evidence requires additional nuance.

Finally, what is perhaps interesting about evidence such as that presented

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[22]Though note that both Fielding (2000) and Fedderke (2004) find political instability to be a significant and powerful driver of investment in the South African manufacturing sector.

on the link between fractionalization and output is that it lends itself to some tentative hypotheses. For instance, the evidence might be read as consistent with the hypothesis on identity formation we voiced earlier. The negative link between output and linguistic fractionalization, and the positive link between religious fractionalization and output might be construed as evidence in favour of changing patterns of identity formation - from roots-based to choice based identity formation. Of course, the direction of association runs *from* religious fractionalization *to* output, not the other way round. But broadly speaking the interpretation might remain one of modernization: economic development dissolves traditional identity structure, to be replaced by new identity formation processes that prove to be selected in for their congruence with the requirements of economic development.

We note this hypothesis here not because we believe the evidence proves its truth - or necessarily because we believe it plausible. Instead, the point here is to illustrate the difficulty of interpreting SPIV's in standard growth regressions. Inclusion of the alternate fractionalization indexes might leave one with a variable on the right hand side of the expression being estimated, which is *either* an outcome variable, *or* a forcing variable; it might enter *either* with positive *or* negative sign; and they might or *might* not be linked to a latent variable. Understanding the precise meaning of such results is non-trivial.

4   A Structural Model

Perhaps the most obvious inference to draw from the exploratory data analysis is that the formulation of a structural model surrounding social cleavage is complex. We nevertheless proceed with parsimonious representations of the general lessons that have emerged from the exploratory data analysis. The objective of the exercise is to explore whether the most central of the broad conjectures outlined above are robust to a multivariate framework, which allows for feedback effects to be present in the data.

The key propositions we explore here are those formulated under conjectures 3, 4, and 6 above. In particular, the first suggestion is that it is racial fractionalization that has a growth impact in South Africa. Second, that the channel of influence through which racial fractionalization exercises its influence is through its impact on distributional conflict rather than directly on growth through poor policymaking, say. Thus, racial fractionalization

impacts on political instability, thence on growth. Finally, the role of rights is more differentiated. The impact of property rights is held to be on political instability; while we explore the possibility that political rights are an outcome variable of a range of institutional and economic development indicators.

Estimation of the structural system is by standard time series techniques, with variables that are first-difference stationary. Johansen[23] techniques of estimation are now standard, so that discussion of estimation methodology here can be brief. We employ a vector error-correction mechanism (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:

$$z_t = A_1 z_{t-1} + \cdots + A_m z_{t-m} + \mu + \delta_t \qquad (1)$$

where m denotes lag length, μ a set of deterministic components and δ a Gaussian error term. Reparameterization provides the VECM specification:

$$\Delta z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta z_{t-i} + \Pi z_{t-k+1} + \mu + \delta_t \qquad (2)$$

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

$$H_1(r) : \Pi = \alpha \beta' \qquad (3)$$

where Π is pxp, and α, β are pxr matrices of full rank. $H_1(r)$ is thus the hypothesis of reduced rank of Π. Where $r > 1$, issues of identification arise.[24] Estimation is by VECM cointegration.

We postulate a labour intensive output (denoted LYPC) equation which loads on the investment rate (IY), the user cost of capital (UC) and political instability (INSTAB).[25] We further incorporate the insight of Fedderke and Luiz (2005) that crime rates (CRIMPOP) impact both on South African growth processes, as well as on through its impact on political instability.

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[23] See Johansen (1991) and Johansen and Juselius (1990).

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

[25] The first difference specification is driven by the iI(2) structure of racial fractionalization in South Africa. Inclusion into the Johansen VECM framework thus requires the first difference transformation.

Political instability (INSTAB) is driven by the change in racial fractionalization (DRACE), per capita output (LYPC), and property rights (PROP). Finally, political rights (POL) are determined by instability (INSTAB), property rights (PROP) and real per capita GDP (LNYPC). Hence:

$$\Pi z_{i-k+1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} \\ \alpha_{71} & \alpha_{72} & \alpha_{73} \\ \alpha_{81} & \alpha_{82} & \alpha_{83} \\ \alpha_{91} & \alpha_{92} & \alpha_{93} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & 1 & \beta_{14} & \beta_{15} & \beta_{16} & \beta_{17} & \beta_{18} & \beta_{19} \\ \beta_{21} & 1 & \beta_{23} & \beta_{24} & \beta_{25} & \beta_{26} & \beta_{27} & \beta_{28} & \beta_{29} \\ \beta_{31} & \beta_{32} & \beta_{33} & 1 & \beta_{35} & \beta_{36} & \beta_{37} & \beta_{38} & \beta_{39} \end{bmatrix} z_{t-k+1} \quad (4)$$

$$where \; z'_{t-k+1} = DRACE \; LNYPC \; INSTAB \; POL \; PROP \; IY \; UC \; CRIM \; T$$

in which T denotes a time trend, and identification proceeds by $\beta_{14} =; \beta_{16} = \beta_{17} = \beta_{19} = 0; \beta_{21} = \beta_{24} = \beta_{25} = 0; \beta_{31} = \beta_{36} = \beta_{37} = \beta_{38} = 0$. In addition, we impose weak-exogeneity restrictions on racial fractionalization and the property rights dimension, such that, $\alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{51} = \alpha_{52} = \alpha_{53} = 0$.[26]

The specification therefore incorporates the three core conjectures we are concerned with: an impact of racial fractionalization on political instability, and from political instability on output; an impact of property rights on instability, and political rights emerging as an outcome variable.

Table 3 reports the trace statistics on the number of cointegrating vectors present in the data. The test reveals the presence of three cointegrating vectors at the 5% level of significance. We therefore proceed on the assumption of three CV's.

We report estimation results in column (1) of Table 4.

Findings generally are consistent with the priors to have emerged from our conjectures. We find that increasing racial fractionalization and rising

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[26]The exogeneity restrictions were extensively tested. Results that justify the restrictions under which estimation proceeds here have been presented more extensively elsewhere - see Fedderke and Luiz (2005). Exogeneity of the racial composition of a population has immediate intuitive purchase. While property rights exogeneity may be more controversial, note that the restriction is merely on contemporaneous feedback effects. Moreover, that property rights might lead political rights has additional support in the literature (Sened, 1997; Weimer, 1997; Schultz, 1992), and is justifiable on the grounds that rights over property might be granted in an attempt to lower the danger of political change that might widen access to rights over setting the fundamental rules of the game.

crime rates raise, while rising real per capita output and property rights serve to lower political instability.[27] Investment rates raise, while political instability and the user cost of capital lower output. Political instability also serves to raise political rights, as do property rights.

Unfortunately two features of the results prove fatal to the specification of column (1). First, results suggest that crime rates impact on output positively (and statistically significantly), while real per capita output has a negative impact on political rights. Both signs are not readily supported theoretically. Second, and most crucially, as cointegrating relationships the three equations do not show error correction behaviour - with explosive rather than equilibriating behaviour being implied by the relevant coefficients from the loading (a) matrix for the instability, output and political rights equations.

As a second specification we therefore postulated a zero restriction on the direct impact of crime on output. Thus identification proceeds by $\beta_{14} = \beta_{16} = \beta_{17} = \beta_{19} = 0; \beta_{21} = \beta_{24} = \beta_{28} = 0; \beta_{31} = \beta_{36} = \beta_{37} = \beta_{38} = 0$, while the weak-exogeneity restrictions on racial fractionalization and the property rights dimension, $\alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{51} = \alpha_{52} = \alpha_{53} = 0$, remained unchanged.

Results are reported in column (2) of Table 4.

Findings are again consistent with priors - with the signs of associations remaining unchanged from those encountered under the specification of column (1). We note that implied elasticities (at the joint mean values of the

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[27]One interpretation of the sign of the association between racial fractionalization and instability is that it is a reflection of a minority elite that responded to a challenge of its authority through two mechanisms. First, as the (White) ruling elite came to constitute an ever smaller proportion of the total population, its response to the rising challenge to its monopoly on power (see the political instability index reported in Fedderke et al 2001a) was first to increase repression, and secondly to increase attempts at buying off portions of the majority of the population (for instance through the creation of homelands). Or conversely: higher racial fractionalization meant less need to buy off the largest section of the population, hence higher growth. The sign on the relationship between fractionalization and growth is not stable across alternative specifications. For instance, Fedderke and Luiz (2005) in an alternative specification find contrary evidence on the sign of the association. A possible reason for the lack of stability may be the presence of non-linearities in the association - necessitating the use of threshold autoregressive estimation methodologies. Unfortunately limited degrees of freedom preclude the use in the present context. Our discussion suggests the possibility of non linearity - as the ruling elite came to constitute an ever smaller proportion of the total population, its response to the rising challenge was first to increase repression, and then, once it became too small to resist further, it resorted to accommodation through a negotiated settlement.

associated variables) in the output equation are stronger under the zero restriction on crime rates than in the first specification, with 0.23 for the investment rate, 0.074 for instability, and 0.30 for the user cost of capital. Implied mean elasticities of the first cointegrating vectors are also considerably larger than under the first specification. Two problems remain with the specification. First, the error correction characteristics of the specification remains poor, with explosive elements present in the instability equation. Second, the impact of real per capita output on political rights remains negative, and difficult to justify.

As a final specification we therefore estimated the system of three equations, under an additional zero restriction on real per capita output in the political rights equation. Identification is given by, $\beta_{14} = \beta_{16} = \beta_{17} = \beta_{19} = 0; \beta_{21} = \beta_{24} = \beta_{25} = \beta_{28} = 0; \beta_{31} = \beta_{32} = \beta_{36} = \beta_{37} = \beta_{38} = 0$, while the weak-exogeneity restrictions on racial fractionalization and the property rights dimension, $\alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{51} = \alpha_{52} = \alpha_{53} = 0$, remained unchanged.

Results are reported in column (3) of Table 4.

For the specification of column (3), all variables have the prior anticipated signs. Thus an increase in racial fractionalization raises our proxy for distributional conflict (elasticity of 0.51), as does an increase in crime rates (mean elasticity of 0.62). By contrast, rising real per capita income and property rights lower political instability (mean elasticities of 17.46 and 0.76 respectively). Both instability and user cost of capital lower real per capita output (mean elasticities of 0.06 and 0.05 respectively), while the investment rate exercises a positive impact (mean elasticity of 0.04). Finally, the impact of property rights on political rights is positive, and approximately proportion (mean elasticity of 1.01). Political instability exercises positive pressure on political rights (mean elasticity of 0.18), presumably reflecting pressure for change under conditions of poor rights. The only remaining cause for concern is that evidence in favor of error correction behaviour is relatively weak in the three equation structure investigated.[28]

The principal implication of the structural model estimations is that the core features of the conjectural deliberations that emerged from the exploratory data analysis find confirmation, even in a multivariate setting with feedback loops. In summary, the findings confirm an impact of racial frac-

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[28]Impulse response analysis confirms equilibrating behaviour in the system, though stability emerges over a relatively long period of time.

tionalization on growth, but indirectly through its impact on distributional conflict (political instability). Property rights exercise a similar impact via political instability. Finally, political rights appear as an outcome variable rather than as a determinant of economic, social or other political dimensions.

5   Conclusions and Evaluations

The cross sectional growth literature makes bold claims about the effects of fractionalization on the long run growth prospects of countries.

What this paper has served to highlight is that the use of time series evidence on the growth experience of a particular country adds considerable nuance to the evidence.

The first general conclusion to emerge is that measures of social fractionalization show strong signs of change over time - and in a number of different dimensions.

Second, we find that there exists evidence suggesting that the different forms of social cleavage for which we have measures of fractionalization hang together. The various social, political and institutional dimensions that this paper controls for show signs of strong association amongst one another. An immediate point that follows is that in the presence of such webs of association spurious interpretation is an ever-present danger.

Third, not all measures of social cleavage impact on economic development. In South Africa it is racial fractionalization that appears to matter, while other forms of fractionalization have little impact on measures of economic development. We infer from the evidence that it is distributional conflict that impacts on economic growth - though distributional conflict may be patterned along particular social cleavages. Which social cleavage, when, how and for what period of time will depend on the historical path of specific societies.

Fourth, there is some evidence to suggest that economic development in turn can also impact on social fractionalization - without clear signs of association. Economic development appears to increase fractionalization in some dimensions, and to homogenize in others. Moreover, during the course of the paper we have repeatedly pointed to the possibility that the links we have found between economic development and social fractionalization relates readily to the literature on modernization.[29] This is something that

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[29]See Rodrik et al (2004) and Glaeser et al (2004) for evidence of the association between

has not been seriously considered in the cross sectional growth literature, namely that the association being reported between social fractionalization and economic growth may be as a result of the causality running in the opposite direction. In other words, fractionalization indexes may be endogenous to economic development as agents choose to respond to signals and incentives being transmitted through economic progress. In the South African case we have demonstrated that language fractionalization does not appear to drive economic growth but in fact responds to it as people amend their language preference to better participate in the economic modernization process.

Fifth, political institutions in South Africa appear to be to some extent endogenous to other social, political and economic dimensions which again supports a modernization process. Economic and institutional development appears to drive political rights. The implication is that forcing political rights prematurely may prove problematic if the underlying institutions are not readily able to sustain it. This is clearly contentious but is not unsubstantiated. Barro (1996) makes a similar point in his cross sectional study about countries that democratize prematurely and face perverse consequences and he does in fact make such a claim regarding South Africa.

The conclusions of the paper suggest that the inclusion of SPIV's in growth regressions might benefit from less *hubris*. What the literature has suggested about ethnolingusitic fractionalization is that *it matters*. This is plausible. It may even be true. But the evidence of this paper suggests that the "it" that matters is really distributional conflict, which may be organized along a number of alternative (society- perhaps historically-specific) lines of social fractionalization. All social cleavage holds the potential danger of being mobilized in a manner that is disruptive of economic development - for purposes of economic growth we should guard against the mobilization of them all.

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Appendix A: Key to Variable Names

	Description
LANGFRAC	Linguistic fractionation: based on national census information.
RELFRAC	Religious fractionation: based on national census information.
POLFRAC	Political fractionation: based on representation in national parliament.
INSTAB	Political instability: based on measure reported in Fedderke et al. (2001a).
RACEFRAC	Racial fractionation: based on national census information.
lnRGDP	Log of real GDP.
GROWTH	Growth in real GDP.
lnRGDPCAP	Log of real per capita GDP.
POLRGHT	Political rights: based on measure reported in Fedderke et al. (2001a).
PROPRGHT	Property rights: based on measure reported in Fedderke et al. (2001a).
Capstock	Total real capital stock.
dK/dt	Change in real capital stock.

Appendix B: Simple Correlation Coefficients

	RelFrac	Lang-Frac	Pol-Frac	Pol-Rght	Prop-Rght	Insta-b	RGDP	RGD-PCAP	GRO-WTH	Cap stock	dKdt
RelFrac	1										
LangFrac	-0.19	1									
PolFrac	-0.65	0.19	1								
PolRght	-0.77	0.09	0.84	1							
PropRght	-0.29	-0.86	0.48	0.80	1						
Instab	0.26	-0.45	-0.15	-0.24	0.10	1					
RGDP	0.71	-0.93	-0.55	0.06	0.74	0.35	1				
RGDP-CAP	0.88	-0.73	-0.73	-0.42	0.24	0.33	0.91	1			
GROWTH	-0.06	0.55	0.03	-0.11	-0.42	-0.20	-0.31	-0.21	1		
Capstock	0.30	-0.95	-0.26	0.20	0.80	0.31	0.99	0.77	-0.56	1	
dKdt	-0.16	0.71	-0.14	-0.46	-0.86	-0.37	-0.70	-0.33	0.44	-0.77	1
RaceFrac	-0.40	-0.15	0.49	0.16	-0.83	-0.47	-0.89	-0.68	0.32	-0.98	0.70

Correlation Matrix

Table 1: PSS F-tests for direction of association. Row headings denote forcing variables. Column headings outcome variables. * denotes unambiguous significance of the test statistic, allowing the rejection of the null of no association. ** denotes an indeterminate test statistic.

	(1) RelFrac	(2) LangFrac	(3) PolFrac	(4) PolRght	(5) PropRght	(6) Instab	(7) lnRGDPCAP	(8) GROWTH	(9) dKdt	(10) Race
RelFrac	-	18.58*	5.89*	0.89	4.62	3.95	6.97*	6.11*	1.50	5.73**
LangFrac[1]	4.97	-	1.98	6.71*	3.25	5.53**	2.74	1.54	1.19	8.54*
PolFrac	4.39	27.20*	-	1.99	2.88	7.48*	2.14	7.86*	0.49	1.33
PolRght	3.05	0.30	5.47**	-	1.97	4.59	4.64	3.90	1.50	1.86
PropRght	2.89	0.28	2.80	4.19	-	5.86*	3.98	2.36	0.57	1.02
Instab	3.36	13.62*	1.02	2.32	5.79*	-	2.05	0.68	0.47	0.59
lnRGDPCAP	2.90	45.32*	3.31	2.69	2.97	6.22*	-	2.96	2.84	1.69
GROWTH	2.14	14.95*	1.60	1.86	6.79*	8.38*	2.99	-	1.88	1.26
dKdt	0.52	3.61	2.55	2.51	2.44	5.81*	2.70	1.05	-	2.91
RaceFrac	3.57	210.97*	2.69	7.54*	4.46	7.39*	2.09	7.10*	1.67	-

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[1] Language fractionalization was restricted to the post 1946 period, given the absence of data on linguistic fractionalization in the African race group prior to the 1946 census.

Table 2a: ARDL Cointegrating Estimations. * denotes statistical significance at the 5%, ** at the 10% level. Round parentheses denote standard errors. Square parentheses denote probability levels. Curly parentheses denote the relevant test statistic distributed chi-square.

	(1)	(2)	(3)	(4)	(5)	(6)
Outcome Variable:	LangFrac ARDL	LangFrac ARDL	LangFrac ARDL	LangFrac ARDL	LangFrac ARDL	LangFrac ARDL
Forcing Variable:						
Constant	0.85*	0.62*	0.77*	0.97*	0.86*	0.86*
	(0.004)	(0.12)	(0.002)	(0.01)	(0.001)	(0.001)
PolFrac	0.04*					
	(0.01)					
RelFrac		0.27**				
		(0.13)				
RaceFrac			0.19*			
			(0.01)			
Output				-0.01*		
				(0.001)		
Growth					0.003*	
					(0.0006)	
Instab						$-0.10 \times 10^{-5*}$
						0.20×10^{-6}
VAR	4 {2,4}	4 {2,2}	4 {1,0}	4 {3,1}	4 {2,4}	4 {2,4}
η_{AR}	4.95	0.26	39.66	19.06	0.59	1.17
	[0.03]	[0.61]	[0.00]	[0.00]	[0.44]	[0.28]
η_H	0.08	0.10	7,20	3.40	1.31	1.68
	[0.77]	[0.76]	[0.01]	[0.07]	[0.25]	[0.20]
Φ	-0.61*	-0.44*	-0.95*	-0.64*	-0.44*	-0.45*
	(0.09)	(0.09)	(0.03)	(0.07)	(0.08)	(0.08)
Adj-R^2	0.76	0.71	0.96	0.83	0.73	0.69
Info Crit:	AIC	AIC	AIC	AIC	AIC	AIC

Table 2b: ARDL and VECM Cointegrating Estimations, * denotes statistical significance at the 5%. ** at the 10% level. Round parentheses denote standard errors. Square parentheses denote probability levels. Curly parentheses denote the relevant test statistic distributed chi-square.

	(1)	(2)	(3)	(4)
Outcome Variable: Forcing Variable:	Growth ARDL	Growth ARDL	PolRight ARDL	PolRight ARDL
Constant	-12.13	-17.01*	-15987.0	-1266.6
	(30.55)	(7.42)	(30107.0)	(1931.2)
LangFrac			18590.5	
			(34955.3)	
RaceFrac		40.62*		2809.9
		(16.16)		(4201.1)
RelFrac	14.79			
	(34.81)			
VAR	4 {2,1}	4 {2,0}	4 {1,0}	4 {1,0}
η_{AR}	0.32	0.73	0.004	0.01
	[0.57]	[0.39]	[0.95]	[0.91]
η_H	0.07	0.02	1.60	1.31
	[0.79]	[0.90]	[0.21]	[0.25]
Φ	-0.71*	-0.74*	0.03	0.04
	(0.14)	(0.13)	(0.06)	(0.06)
Adj-R^2	0.29	0.30	0.33	0.31
Info Crit:	AIC	AIC	AIC	AIC

Table 2c: ARDL and VECM Cointegrating Estimations. * denotes statistical significance at the 5%, ** at the 10% level. Round parentheses denote standard errors. Square parentheses denote probability levels. Double square parentheses the critical values of the relevant test statistic. Curly parentheses denote the relevant test statistic distributed chi-square.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome Variable:	Instab	lnInstab	Instab	Instab	Instab		lnInstab VECM
Forcing Variable:							
Constant	10.90*	-1.54	-6.27	7.09*	7.86*	λ_{MAX}	26.21*
	(2.40)	(4.28)	(5.41)	(0.49)	(0.66)		[[14.88]]
PolFrac	-8.43**					λ_{TRACE}	27.41*
	(4.95)						[[17.86]]
RaceFrac		15.90**					
		(8.99)					
lnOutput			1.11*				
			(0.46)				
Growth				-0.22			
				(0.18)			
dK/dt					-0.14		
					(0.14)		
PropRght							-0.03*
							{3.94}
VAR	4 {4,0}	2 {2,1}	4 {4,0}	4 {4,0}	4 {4,0}		2
η_{AR}	0.43	3.13	1.33	1.91	2.76		
	[0.51]	[0.08]	[0.25]	[0.17]	[0.10]		
η_{H}	0.01	0.88	0.05	0.28	1.48	$\Phi_{PropRght}$	1.24*
	[0.92]	[0.35]	[0.83]	[0.60]	[0.20]		(0.004)
Φ	-0.40*	-0.69*	-0.53*	-0.36*	-0.65*	$\Phi_{lnInstability}$	-0.62*
	(0.12)	(0.14)	(0.16)	(0.12)	(0.18)		(0.14)
Adj-R^2	0.30	0.27	0.30	0.27	0.34	Adj-R^2	0.27
Info Crit:	AIC	AIC	AIC	AIC	AIC		

Table 3: Trace statistics; VAR=2; *denotes rejection of the null at the 5%

Null	Alternative	Trace Statistic	Probability Value
r=0	r=1	285.98*	0.00
r≤1	r=2	181.20*	0.00
r≤2	r=3	129.23*	0.007
r≤3	r=4	88.099	0.054
r≤4	r=5	62.350	0.065
r≤5	r=6	39.028	0.116
r≤6	r=7	20.562	0.202
r≤7	r=8	8.2330	0.240

Table 4: Structural Equation Estimation Result

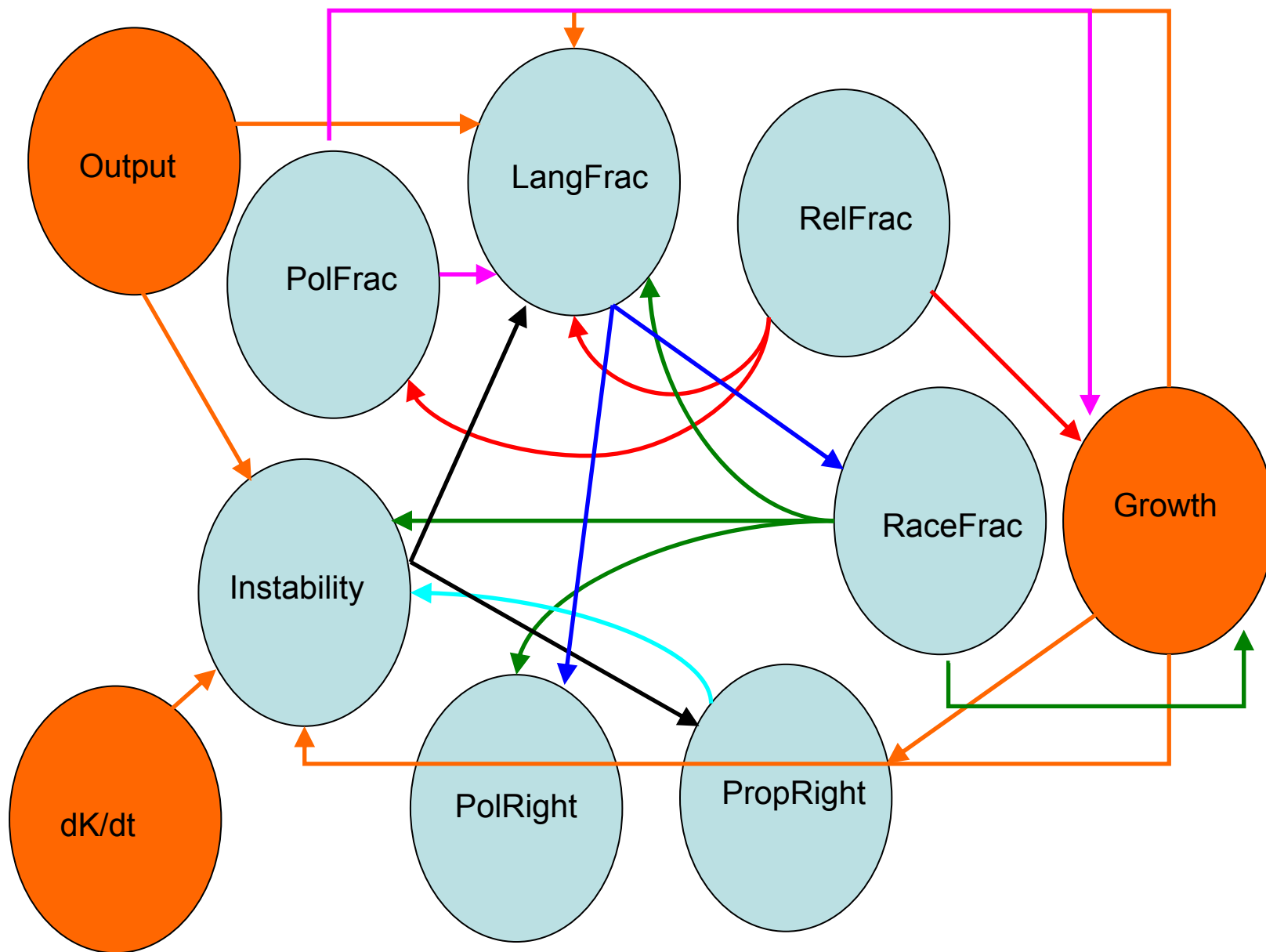|	(1)			(2)			(3)		
	CV1	CV2	CV3	CV1	CV2	CV3	CV1	CV2	CV3
DRACE	1734.2 (309.44)	0.00	0.00	3418.8 (668.26)	0.00	0.00	1079.5 (211.25)	0.00	0.00
LYPC	57.61 (5.12)	1.00	70.39 (12.25)	62.60 (8.46)	1.00	70.57 (11.99)	55.08 (3.66)	1.00	0.00
INSTAB	1.00	0.02 (0.001)	-0.21 (0.07)	1.00	0.02 (0.003)	-0.07 (0.07)	1.00	0.02 (0.0005)	-1.43 (0.07)
POL	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00
PROP	0.09 (0.04)	0.00	-0.49 (0.10)	0.21 (0.09)	0.00	-0.57 (0.11)	0.06 (0.03)	0.00	-0.55 (0.07)
INVRAT	0.00	-0.35 (0.21)	0.00	0.00	-1.03 (0.83)	0.00	0.00	-0.16 (0.15)	0.00
UC	0.00	0.01 (0.001)	0.00	0.00	0.02 (0.01)	0.00	0.00	0.004 (0.001)	0.00
CRIM	-190.32 (74.59)	-3.78 (1.58)	0.00	-119.39 (69.50)	0.00	0.00	-35.15 (23.05)	0.00	0.00
T	0.00	0.004 (0.002)	-0.70 (0.25)	0.00	0.02 (0.01)	-0.51 (0.25)	0.00	0.003 (0.002)	-0.51 (0.15)
ECM1(-1)	-2.21 (0.93)	0.002 (0.002)	-0.53 (0.47)	-0.98 (0.47)	-0.001 (0.001)	-0.14 (0.24)	-1.11 (0.997)	-0.003 (0.003)	-1.07 (0.78)
ECM2(-1)	95.09 (36.82)	-0.31 (0.08)	28.10 (18.73)	22.21 (9.17)	-0.05 (0.02)	6.95 (4.63)	37.36 (33.55)	-0.32 (0.12)	37.94 (27.43)
ECM3(-1)	0.07 (0.38)	-0.01 (0.001)	-0.24 (0.19)	0.05 (0.37)	-0.005 (0.001)	-0.28 (0.19)	-0.06 (0.25)	-0.005 (0.001)	-0.24 (0.19)
	Elasticities at Means:			Elasticities at Means:			Elasticities at Means:		
DRACE	-0.83			-1.63			-0.51		
LYPC	18.27		2.83	19.85		2.84	17.46		
INSTAB		0.06	-0.03		0.07	-0.01		0.06	-0.18
POL									
PROP	1.26		-0.90	3.04		-1.04	0.79		-1.01
INVRAT		-0.08			-0.23			-0.04	
UC		0.07			0.30			0.05	
CRIM	-3.34	-0.21		-2.10			-0.62		

Figure 1: Implication of Bivariate PSS F-tests for Direction of Association between SPIV Variables.