Using Fractionalization Indexes: deriving methodological principles for growth studies from time series evidence

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ABSTRACT: Recent cross country growth studies have found that ethnolinguistic fractionalization is an important explanatory variable of long-run growth performance. This paper highlights some limitations of cross country studies by focusing on the time series evidence for South Africa. In presenting variation over time in a number of social, political and economic dimensions, this paper adds longitudinal evidence on a range of dimensions that have been linked to long run economic development. Given South Africa's history of ethnic and racial politics, it constitutes a useful case study to explore the dynamics of the possible effects of ethnolinguistic fractionalization on growth. We introduce three new sets of fractionalization indicators for South Africa and one set of political indicators. The results of this study provide important nuance to the existing body of evidence, for the use of fractionalization indices in growth studies.
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1 Introduction

The re-emergence of interest in the determinants of growth has focused attention on the puzzle of the apparent non-convergence of per-capita income between low and high-income countries. One response to this dilemma has been what has come to be known as 'endogenous growth' theory: which in various forms drops the assumptions of the exogeneity of technological change, and the homogeneity of investment opportunities across countries (see Romer 1986, 1990 and Lucas 1988 as seminal examples). The convergence prediction in Solow-Swan type growth models is of course conditional on homogeneity of the savings rate, the labour force growth rate, and the technology of production. Once the possibility of heterogeneity of countries in the relatively limited dimensions provided by Solow-Swan type growth models is recognised, the possibility that heterogeneity in other dimensions may be of significance to growth follows readily. Thus, to name a few, differences in the level of human capital (Barro 1991, Mankiw, Romer and Weil 1992), the depth of financial development (King and Levine 1993), the nature and quality of government intervention in economic processes (Barro 1990, Fischer 1991, King and Levine 1993), have all been controlled for in growth equations. Yet even after correcting for a wide variety of additional explanatory variables, many growth equations struggle to account for cross-country variation in growth, particularly in Africa and Latin America (see for example Barro 1991, and Easterly and Levine 1997).

Easterly and Levine (1997: 1205), in an influential article, drew attention to the potentially important role of ethnic diversity in influencing economic growth: "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. Central to Easterly and Levine's perspective is the question of whether the level of ethnic fractionalization bears on the potential for distributional conflict. Specifically, they hypothesize that, in the light of a significant body of recent literature, polarized societies will be prone to competitive rent-seeking that impedes agreement about the provision of public goods [1] and that creates positive incentives for growth-reducing poli-

[1] This does of course beg the question why rent-seeking mobilization should be along ethnic lines, rather than other forms of social distinction. In the current context we note only the obvious point that rent seeking does not exclusively take ethnic form, and also that

cies. This is attributed either to the pursuit of redistributive policies defined along ethnic lines,[2] or to the fact that ethnically diverse societies are more prone to war and unrest which in turn is bad for economic growth.[3]

A limitation of all these studies on fractionalization is that whilst they emphasize cross-country evidence, they do not provide a basis for exploring the dynamics of the process. That is, they do not provide a basis on which to establish how growth interacts with ethnolinguistic diversity. There are at least two dimensions to this question. The first is that in evidence such as that presented by Easterly and Levine (1997), what is not explicit is that African economic growth fell dramatically from the 1960's to 1970's, and has remained dismal subsequently - at least for most of the continent. This leaves one with the puzzle of how it is that a variable, which remains a constant for all countries (the ethnolinguistic measure employed in many studies is for the single year 1960), is to account for a series of growth rates that follow the shape of a step function - with the step occurring some considerable

there exists an extensive literature exploring why ethnic mobilization is easier than some others. Argument goes toward lower information and transaction costs, lower monitoring costs, and lower enforcement costs in ethnic groupings. See for instance Collier's (2001) discussion of Posner (1980).

[2]Easterly and Levine (1997) and Easterly (2001) cite a vein of literature in support of this view. Thus Mauro (1995) and La Porta et al. (1999) find that ethnic diversity predicts poor quality of government services. Rodrik (1999) notes that ethnically divided nations react more adversely to external terms of trade shocks. Svensson (2000) reports that more foreign aid proceeds are diverted into corruption in more ethnically diverse contexts. Knack and Keefer (1997) find that ethnic homogeneity raises social capital which is associated with higher growth and productivity. Annet (2001) claims that linguistic or religious diversity leads to greater political instability which in turn leads to higher government consumption. Lastly, Collier (2001: 141) mentions the Kenyan case where during the time of President Kenyatta, a Kikuyu, the main Kikuyu city grew very rapidly at the expense of other non-Kikuyu cities. When President Moi took over, a Kalenjin, he responded by building a new international airport in the heartland of his own minor tribe, and filled certain parts of the civil service with Kalenjin. Evidence for rent seeking along ethnic lines in South Africa is legion. For evidence demonstrating that the historic pattern is replicating itself, see Luiz (2003).

[3]There appear to be two alternative explanations regarding the ethnic roots of instability. The first is primordial, arguing that different group identities influence the way in which people relate and interact with each other -leaving mute the question of whether its root cause could be biological, psychological, historical, mythical or constructed. The alternate view suggests that ethnicity is not the real issue: conflict may come to be ethnically patterned, but not ethnically caused. Rather, ethnicity comes to be exploited, often for reasons of political expediency, rendering ethnicity a vehicle rather than a cause of conflict (see the discussion in Collier, 2001: 151).

time after the point of measurement of the ethnolinguistic measure generally employed in these studies.

The second dimension to the question addresses whether or not it is legitimate to view ethnolinguistic fractionalization as a constant over time. Is it instead not at least feasible that ethnolinguistic diversity changes with growth? If so, in what direction? And why might such a change occur? To answer these kinds of questions, a time series based study is needed.

South Africa constitutes an interesting case in which to explore the purchase of the claim concerning the (negative) impact of ethnolinguistic fractionalization on growth. In terms of the Ethnolinguistic Fractionalization Index (ETHNIC) 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). The most highly fractionalized country was Tanzania (score of 93) and the least fractionalized were Haiti, Japan and Portugal (score of 1). South African census data collected since 1910 provides historical evidence of this fractionalization. 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, at least in part, 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. That data also proves to be available for this case study renders it doubly interesting, since it becomes susceptible to rigorous analysis. This is reinforced by the fact that a number of studies have already demonstrated that the social, political and institutional variables (SPIVs) available for South Africa prove to be important in driving the long run economic performance of the economy.[4]

[4] On the impact of political instability on investment, see Fielding (2000), and Fedderke (2004). On the impact of political instability, and changes in political rights on short and long term capital flows as well as capital flight, see Fedderke and Liu (2001). On the impact of political instability on human capital production in black schooling in South Africa, see Fedderke and Luiz (2002). On the interaction of political instability, political rights and economic growth in South Africa see Fedderke, De Kadt and Luiz (2001b).

This paper introduces, describes and analyzes three new sets of societal indicators and one set of political indicators for South Africa from 1910 to 1997. The societal indicators are, respectively, linguistic, religious and racial fractionalization.[5] The political indicator measures political fractionalization as measured by the distribution of members of the legislature across political parties (developed in Fedderke et al, 2001a). The choice of these indicators was occasioned by the desire to establish whether, and if so in what degree, social and political diversity might help explain the long-run growth performance of the South African economy.[6] What is unique to the study is the use of time series data over an extended time frame in a wide range of institutional dimensions.

Section 2 of the paper notes a range of measurement issues relevant to the institutional variables employed in the study. Section 3 examines the significance of dynamics in measures of fractionalization. Section 4 explores the question of whether the level of aggregation in the fractionalization carries analytical significance. Section 5 further examines the magnitude of impact of measurement error. Section 6 concludes.

2 Fractionalization: reflecting on the significance of measurement problems

Measures of ethnolingusitic fractionalization have come to be widely used in growth studies. In addition, the literature has seen the introduction of at least two measures of such fractionalization.[7] Since the present study introduces a range of new measures of fractionalization, in a number of dimensions, we reflect briefly on some issues surrounding both the measurement and interpretation of linguistic and ethnic fractionalization.

The fractionalization indexes employed for the present study were con-

[5] A fractionalization index measures the probability that any two randomly selected members of a statistical population will possess different properties in the dimension that is being measured.

[6] This study is part of a larger project that has been concerned to address the institutional dimensions of long-term economic growth in South Africa. See Fedderke et al (1999, 2000, 2001a, 2001 b, 2002, 2003).

[7] The first, and most widely used in growth studies is the Atlas Narodov Mira (1964) measure, developed by Russian ethnological scholars. The second and more recent measure we are aware of, is the Alesina et al (2002) measure. Furthermore, Posner (2004) has developed a new fractionalization index but only for Africa.

structed 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 and various other official statistical yearbooks. Subsequently the Central Statistical Services Reports were our primary sources as well as various statistical reports of the apartheid-created 'independent homelands'.

We begin our discussion of fractionalization with a general methodological warning that applies repeatedly in what follows. Obtaining consistent and reliable data series on linguistic usage and other forms of fractionalization in South Africa was non-trivial. The scope and accuracy of coverage of different population groups has not been consistent over time. Particularly with respect to Africans, early years showed incomplete data collection, rendering data unreliable. Moreover, under Apartheid and the repeated creation, redefinition, and disappearance of supposedly ethnically defined "Homelands,"[8] significant portions of the African population disappeared, moved classification, and reappeared in statistical sources. Finding, reclassifying, reinserting such populations was not a trivial task. The implication is that the fractionalization data suffers substantially from data collection problems. After 1970 the active creation of Homelands for Africans under Apartheid policies shifted responsibility for census data collection away from Pretoria. For example, data collection on first language orientation by Homelands was negligible. The consequence is an error of measurement in any use of official data series, with a downward bias in the resulting linguistic fractionalization. Reported fractionalization indices in the present studies are corrected for any Homeland exclusion.

The general point here is that given the demands of this undertaking even for a country such as South Africa, which relative to many other developing countries has fairly extensive and sound data collection procedures, this raises significant questions concerning the quality of data for developing countries in general - where data collection frequently is even more problematic than in South Africa, in the presence of high levels of fractionalization which require high levels of accuracy.

For example, the highest levels of linguistic fractionalization reported in Alesina et al (2002) are for the Cameroon, Chad, the CAR, the DRC,

[8] Under Apartheid attempts were made to create "independent" political entities defined ethnically, officially referred to as "homelands." Only a small number of the projected homelands pursued the goal of independence to any extent.

Ethiopia, the Gambia, Guinea-Bisau, Kenya, Liberia, Mali, Mozambique, Nigeria, Philippines, South Africa, Tanzania, Uganda, and Zambia - all of which report a probability value of above 0.8. The countries with the highest levels of fractionalization are those most likely to have the most contentious data being employed in cross sectional growth studies. Furthermore, the data employed by Alesina et al for a wide range of countries rely on the Encyclopedia Britannica, the CIA World Factbook, Scarrit and Mozaffar (1999), Levinson (1998) and the World Directory of Minorities of the Minority Rights Group International (1997). The South African data comes out of the Levinson work and differs from that calculated in this paper from primary data. A cursory glance through these sources reveal some of the problems. For example, the CIA Factbook lists South African ethnic groups on the basis of the four racial population groups. While racial fractionalization in South Africa is undoubtedly important (and we deal with it in a separate section below), ethnic divisions cleave racial groupings also. This is well illustrated by the high degree of fractionalization within the African population group in South Africa, where linguistic grouping does correlate to some extent with ethnic identity. The CIA Factbook also lists the religious groups as follows: Christian, Muslim, Hindu, and Indigenous with no further differentiation, whereas for South Africa more detailed data is available. Note further that for other countries in the Alesina et al data set these categories are further disaggregated. An immediate question must therefore be whether like is being compared with like in international cross-country estimations.

In similar vein, Posner (2004) criticizes the ethnolinguistic fractionalization index used in growth studies based upon the Atlas Naradov Mira measures. He highlights the 'grouping problem' in which umbrella categories sometimes subsume groups that are clearly distinct and often highly antagonistic. He cites the Tanzanian example in which the Nyamwezi and Sukumo are collapsed into a single category despite the fact that these groups are very distinct (culturally, linguistically and geographically) and are keen political competitors. In fact both the Rwanda and the Burundi measures collapse the Hutus and Tutsis into a monolithic category which ignores a fundamental cleavage which played a role in the devastation faced by both countries towards the end of the twentieth century. On other occasions he points to the 'problem of inclusion' where distinct linguistic groups are produced in the Atlas study but which are irrelevant as political actors. Posner does not deny the importance of ethnic groups in the Atlas but rather claims that they are unimportant for the political measure that ethnolinguistic fractionalization

is trying to test namely the competition for power and resources.

Posner (2004) furthermore takes issue with the use of Herfindahl indexes more generally and questions whether they are the best means of capturing a country's diversity because it often is insensitive to a great deal of variation in the ethnic landscapes being compared. Two countries can both have a Herfindahl measure of 0.5 but with vastly different ethnic landscapes. One can have two groups of equal size whilst the second contains three groups containing two-thirds, one-sixth and one-sixth of the population respectively. The dynamic of inter-group competition would be very different but would not be captured by the formula. A further problem he highlights is that the index contains no information about the depth of the divisions between different groups. It also provides no information about the relative political weights to be assigned to various ethnic groups. So for example, the white proportion in South Africa does not capture the impact of this group on the country's political landscape. The final problem presented by Posner is that these single measures contain multiple ethnic and political cleavages which change over time. He cites the Indian example of a population which is divided along ethnic, religious, linguistic and caste lines and questions which group division is more relevant.

While issues of measurement are undoubtedly crucial, these extend beyond simple questions of accuracy of measurement. In the sections that follow in this paper we consider a range of additional questions that arise in the context of appropriate construction, and interpretation of measures of fractionalization. The intention of the discussion is to move beyond the consideration of static measures with wide geographic sweep. Instead, the object of the discussion is to consider questions that arise from the introduction of time, and questions of aggregation that arise from in-depth evidence to emerge from a specific case study.

3 Dynamics: do changes over time exist in measures of fractionalization, and do they carry analytical significance?

Data questions surrounding fractionalization extend beyond problems of measurement. An equally important set of considerations, to be explored over the course of the following sections, concern appropriate interpretation of the evidence that emerges from the data.

The first question arises due to the fact that studies employing measures of fractionalization, frequently do so on the basis of data that have an observation at a single time point (Atlas Naradov Mira, Alesina 2002). These observations bear a considerable analytical burden - as explanatory variables of dynamic processes in economic development, generally per capita GDP. Data sets have observations for distinct years across countries (the measure is not for the same year across countries). Implicit in the use of either set of fractionalization measures, is the presumption that measures of fractionalization are essentially static, and exogenous to processes of economic development. Only on this presumption would the time point of measurement and/or the time-invariant nature of the fractionalization measure be irrelevant to estimation of the fractionalization impact. The immediate question is then whether the presumption of an unchanging magnitude of the fractionalization measures employed in studies is justified.

Evidence from South Africa on first blush suggests that it may be. In Table 1 we report fractionalization measures on linguistic and religious fractionalization for the aggregate South African population, for available census years in South Africa.[9] The presumption that measures of fractionalization appear to be relatively invariant over time, appears to be vindicated, with both linguistic and religious fractionalization changing by relatively little in aggregate for South Africa over a period of more than half a century.

However, the same cannot be said of the measure of racial fractionalization also reported in Table 1. While the measure remained fairly constant over the 1911-1960 period (at a probability of approximately 0.49), from 1960-2001 fractionalization declined substantially in relative terms to end with a probability of 0.36 in 2001.

The distinction between the three measures of fractionalization is partic-

[9] 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. Symmetrically for religious fractionalization. Note that for linguistic fractionalization we suppressed the 1936 observation, and for religious fractionalization the 1921 observation. While available, data collection problems resulted in clear outlier observations relative to the rest of the series.

ularly important when placed into the context of the level of distributional conflict in South Africa. A number of studies have examined the impact of distributional conflict on growth in South Africa, including its impact on investment in physical capital stock. Results are unanimous in confirming a negative impact of a measure of political instability on either output directly, or on investment rates.[10]Yet, the measure is not readily tied to our measures of fractionalization in any manner that readily conforms to the priors that arise from the literature on fractionalization. In Figure 1 we depict the measure of political instability (as proxy for distributional conflict),[11] as well as the measures of fractionalization.

The measure of distributional conflict in South Africa identifies a number of periods of intense conflict - during the 1960s, the 1970s, and particularly the 1980s. This much is conventional wisdom about South Africa. But note that the aggregate linguistic fractionalization measure for South Africa remains virtually unchanged, both over periods of stability (1946-1964; the 1990's) as well as periods of relative instability. Similarly, the measure of religious fractionalization shows its period of increase *before* the periods of intense conflict, and remains virtually static over the period of intense conflict. [12]

[10]See Fielding (2000), Fedderke (2004), Mariotti (2002), Kularatne (2002), Fedderke and Luiz (2005a).

[11]The measure of political instability is obtained from Fedderke, De Kadt and Luiz (2001a). One objection might query whether the measure of political instability is indeed a measure of distributional conflict. Instead political conflict in South Africa may be conceived of as a conflict not over access to resources but over political rights. However, Fedderke and Luiz (2005a) demonstrate that the primitive here is property rights, which influence both growth and political conflict, while political rights are an outcome variable from the interaction of economic and property rights developments. Effectively the exclusion of most racial groupings in South Africa from access to resources by denying them relevant property rights renders questionable the suggestion that conflict was, at least exclusively, concerned with political rights, and not with rights over resources.

[12]We recognize that this might lead to the conjecture that rising religious fractionalization might have led to distributional conflict - though with a lag. Two reasons suggest that this is unlikely. Barro and McCleary (2003) find that religious beliefs do influence economic performance and certainly this association goes back to the seminal work of Max Weber. The decision to measure religious diversity was in part occasioned by the fact that South Africa has historically been characterized by a considerable diversity of religions. It should be noted that, notwithstanding this diversity of religions, the country does not have a history of significant conflict between religious communities. Instead religious communities and institutions have been mobilized around political issues, notably with respect either to supporting or criticizing Apartheid. In this regard, many religious organizations

Instead, the most likely source of distributional conflict, if such a source is to be found in a fractionalization measure, comes from the measure of racial fractionalization. This is the only fractionalization measure that demonstrates significant change from the period preceding significant distributional conflict, to the period in which distributional conflict rose dramatically.

That distributional conflict in South Africa might most plausibly be linked to racial divisions in the society does not seem a dramatic finding to have reached. After all, what could possibly constitute a more clichéd view of the South African political landscape? Indeed, it is precisely the racial fractionalization measure that Alesina et al (2002) employs for South Africa.

But there are at least four considerations in relation to the empirical evidence that nuance the findings from cliché to insight. *First*, note that in contrast to the measure employed by Alesina for fractionalization in South Africa, the measure of fractionalization most plausibly related to distributional conflict is not static, but strongly changes over the sample time frame. Indeed, it is this very change in the fractionalization measure that usefully might be said to distinguish between periods of relative stability and instability in South Africa.

Second, note that the *direction* of change in the racial fractionalization variable is the opposite to that predicted by the literature. It is not rising, but falling racial fractionalization that appears to be associated with rising political instability, though by the 1990s political instability quietens again despite a continued decline in racial fractionalization which continues to this day. One response to this finding is to conjecture that the association between fractionalization and distributional conflict is more non-linear than generally hypothesized in the literature. Very high fractionalization measures may reflect iso-sized groups, in stable equilibrium rather than in distributional struggle. The relative strength of each grouping may be such as to render the cost of conflict prohibitive to each. Instead, it is precisely the disturbance of such an equilibrium through increased pressure toward homogenization, brought about by a relative gain in one or another of societies constituent

came into conflict with the government. Some supported the Apartheid project and some were internally divided over the issue. The important point, however, is that these divisions were not primarily divisions between religious movements on specifically religious matters. They were divisions on the matter of the morality of Apartheid. See for instance the discussions in Research Institute for Theology and Religion (2000). We reflect further on questions of causality below.

groups, that may trigger distributional conflict - either through aggression (such as increased repression of a growing disadvantaged group), or as a defensive measure (such as rising political resistance in the face of legislative measures designed to disempower). Eventually, the relative preponderance of one group may become sufficiently large to once again render the cost of conflict prohibitive for other groups, such that sufficiently high homogeneity in turn leads once again to political accommodation and relative stability.[13]

A *third* consideration might concern the direction of causality between instability and the fractionalization measure. Racial fractionalization might well have fallen at least in part due to white emigration, in the face of rising opposition to the maintenance of white privilege. Under this interpretation of the evidence causality would run from instability to racial fractionalization, rather than vice versa. A further consideration here might be to question again the interpretation of the interaction between religious fractionalization and political instability - of whether rising religious fractionalization might have led to distributional conflict - though with a lag.

To investigate these questions we examine the interaction between the three measures of fractionalization and political instability, employing the bounds analysis of Pesaran, Shin and Smith (2001).[14] We report the resultant

[13]In South Africa, this resulted firstly in the Tricameral parliament of 1983 (which co-opted Coloureds and Asians into the formal legislative structures in the hopes of building new alliances and building critical mass) and then in 1989 in the unbanning of the African resistance movements (including the African National Congress and the Pan African Congress). The unbanning of these anti-apartheid movements in turn paved the way for the constitutional negotiations which led to democratic elections in 1994.

[14]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,$x_1, t, \ldots x_{n,t}$. Univariate time series 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:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{j=1}^{n} \sum_{i=1}^{p} \gamma_{j,i} \Delta x_{j,i} \Delta x_{j,t-i} +$$

$$\left(\delta_1 y_{t-1} + \sum_{k=2}^{n+1} \delta_k x_{k,t-1} \right) + \varepsilon_t$$

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

F-tests in Table 2.

The evidence is instructive. The causality tests unambiguously favor the direction of association to be *from* racial fractionalization *to* political instability, with no evidence in favor of the reverse direction of association.[15] Second, there is no evidence of religious fractionalization impacting on political instability - nor of religious fractionalization being influenced either by any other measure of social cleavage or by the political instability measure. Third, it is noteworthy that the different measures of fractionalization appear to hang together - with particularly linguistic fractionalization appearing as outcome variable flowing from other forms of social cleavage.

The *fourth* and final implication that follows from the evidence is that the trigger for distributional conflict in a society is at least not universally associated with a single measure of social cleavage. In South Africa linguistic fractionalization, at least at the aggregate level is difficult to associate with variations in political instability - while racial fractionalization is more readily so associated.

The general point thus is that while there may well be links between distributional conflict and measures of fractionalization, such links may prove to be contingent on history and social context. Appropriate measures of fractionalization to be associated with distributional conflict may thus be heterogeneous across societies.[16]

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.

[15]This direction of association is further favoured by the fact that emigration from South Africa accelerated during the 1980s and 1990s, considerably after the process of racial homogenization of the population began.

[16]A cursory examination of the international political landscape readily demonstrates 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. The long lasting conflict in Northern Ireland was 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. The Huntington (1997) hypothesis of the clash of civilizations supports a number of fundamental cleavages in world politics and these could easily be translated intra-country, although not his intention. The current conflict in the Sudan likewise reveals a complex network of cleavages including religious and racial. 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

4 Is Distributional Conflict a Problem Emergent at the Aggregate Level?

Thus far we have considered data only at the aggregate level for South Africa. Both the linguistic and the religious fractionalization measures ignored any information to emerge at more disaggregated levels - for racial groups, for instance.

Yet given the evidence to have just emerged on the impact of racial fractionalization on political instability, it is not clear that aggregate measures of fractionalization are appropriate for capturing distributional conflict, at least in South Africa. Instead, distributional conflict may be the expression of developments that are located at greater levels of disaggregation than can be captured by the simple summary measures reported thus far.

In order to examine the plausibility of this hypothesis we measure linguistic fractionalization, disaggregated so as to capture not only the overall level of fractionalization, but also the levels of fractionalization within the racial groups as they were officially designated in the period of segregation prior to 1948, and which became statutorily encoded after 1948 under Apartheid. In this way we are better able to capture dynamic processes and potentially interesting patterns of change that might not be observed if one were to focus only on the aggregate data.

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We have already noted that the aggregate measures of both linguistic and religious fractionalization in South Africa remain constant over protracted periods of time. By contrast, the *disaggregated* fractionalization indexes in both dimensions, when decomposed by race, show substantial variation over time. In effect, the aggregate evidence on linguistic and religious fractional-

race and religion.

[17] The study employs the Apartheid racial classificatory system of African, Asian, Coloured and White, given the prevalence of data collection under these categories.

ization in South Africa is misleading in the sense that it fails to reflect the substantial extent of social change that occurs within the society.

A number of features stand out from the evidence:

- Only two out of eight racially decomposed measures of linguistic and religious fractionalization show stability of the same order as the aggregate measures: African linguistic fractionalization and Coloured religious fractionalization. All other racially disaggregated measures in either dimension report relatively strong change over time.

- Of the four racial groupings in South Africa, the two smallest groupings, that of Coloureds and Asians, show the most dramatic change over time. Most spectacular of all, Asian linguistic fractionalization falls from a probability measure of 0.78 in 1970, to 0.10 in 1991, reflecting a switch from a range of Indian first languages to English over the twenty year period. While linguistic fractionalization amongst Coloureds has risen rather than fallen strongly from 0.21 to 0.29 over the same period, it also has done so by virtue of a linguistic switch to English first language, from Afrikaans in this instance. Over the period in which Asian linguistic fractionalization is falling dramatically, Asian religious fractionalization is increasing strongly, from 0.47 to 0.61.

- One of the two "dominant" racial groups of South Africa also shows instances in which a stable pattern of fractionalization is disturbed. Here however, the disturbance is relatively temporary, with a reversion to the former stable fractionalization pattern reemerging over time. Thus white linguistic fractionalization rises from 1970 -1980, with the entry of significant Portuguese immigration from the two former Portuguese colonies of Mozambique and Angola. However, the increase in fractionalization rapidly reverted to the former level of fractionalization by 1991, as the Portuguese immigrants were assimilated into the Anglophone white linguistic grouping.

Two general implications are suggested by this evidence.

The first is that aggregate measures of fractionalization may prove to be substantively misleading as indicators of underlying potential for distributional conflict. In South Africa, the aggregate measure of linguistic fractionalization simply hides substantial movement in the extent of cleavage that

emerges at more disaggregated levels, and which might conceivably have triggered distributional conflict. Linguistic fractionalization at the micro level appears considerably less stable, with dramatic and sustained change appearing over a relatively short time period. The corollary is that testing for the impact of fractionalization on instability, or growth, cannot necessarily simply have recourse to aggregate measures in any dimension, since the real change of relevance triggering the conflict might not be observable at the aggregate level.

The second implication is potentially both more interesting, but also of greater significance for estimation purposes. We have already noted that larger marginalized minorities in South Africa show a relatively rapid degree of acceptance of the language of trade and industry: English. The preceding evidence reports that the Coloured, Portuguese but particularly the Asian communities of South Africa show substantive tendencies to adopt English as their main language. Such changes may reflect decisions to improve employment and economic prospects by acquiring the linguistic currency of economic activity. In effect, this encompasses a choice to invest in more appropriate forms of both human and social capital in order to increase the prospects for both individual occupational mobility and the reduction of the transactions costs entailed in participation in the economy. [18]The suggestion is that at least larger, more significant minorities face considerable incentives to assimilate into dominant linguistic patterns. [19]By contrast, small minorities (such as the German and/or French speakers in the White population) may be able to retain linguistic identity longer since they are insignificant enough to be

[18]In the case of Asians, additional factors would have included the policy decision in 1948 to terminate immigration from India, and to decrease to the point of elimination funding for private Indian schools (see Fedderke, de Kadt and Luiz, 2000). Both measures prevented Indian linguistic usage from being sustained through investment in the stock of primary language users.

[19]Economic incentives toward linguistic assimilation need not be restricted to minorities. Sufficient economic pay-off may induce even majorities to change. A tempting means of independent verification lurks here. Currently the African population of South Africa has unprecedented access to schooling resources. A predicted change which follows from the interpretation of the data series presented above is that the African population too should come to manifest reduced levels of linguistic fractionalization, since the prevailing language of education, industry and commerce, and government in South Africa is English. This latent change in linguistic fractionalization would be hidden in current and past census data, since the primary language use of households is collected on heads of households. Only once the current population of school children and university students forms its own households, would the change become evident.

left alone and develop their own cultural enclaves within the broader society.

The net consequence of this may be that linguistic fractionalization at the micro level manifests the lack of stability noted above. Importantly, we note that the implication is that linguistic fractionalization is no longer an exogenous (constant), but becomes endogenous to the potential of distributional conflict. Those population groups most at risk from conflict (large minorities) have an incentive to assimilate, while either larger groupings and/or small minorities have the means to maintain their identity over time.

In turn, this carries a potential challenge for the notion that fractionalization necessarily leads to distributional conflict between linguistic groups. At the very least one would have to recognize that in the South African context minority groups had an incentive to integrate into the prevailing language of commerce and industry, and did so with alacrity. Perhaps this is true only of minorities, and in the presence of roughly equally sized groups (eg. Belgium) the story might be different. Indeed the lengthy stand-off between white and African population groups in South Africa would suggest that where "opponent" groups are of sufficient size or influence, distributional conflict may indeed be protracted and intense. Nevertheless, the evidence points to the importance and significance of nuance and clinical study as a valuable extension of aggregate or summary cross sectional evidence.

5 Accuracy and precision: just how key are these watchwords?

A substantial sub-theme in the debate surrounding the impact of ethnolinguisitic fractionalization on economic and social development has come to focus on questions of accuracy in the measurement of fractionalization. Indeed, section 2 of this paper itself added some additional reflections in this regard. Such deliberations are valuable. But they do beg the question of what practical significance errors of measurement might be in empirical work investigating the impact of fractionalization on economic growth, say. This question become all the more pressing if it is indeed true that fractionalization matters (in distributional conflict, say), and if the measurement problems the literature refers to are as widespread as this and other studies suggest.

We provide two initial sets of consideration from the South African case study that lend themselves to shedding some light on the practical question posed. From 1970 South Africa engaged in the creation of nominally inde-

pendent "homelands" that subsequently were excluded from official population census data for South Africa. Since the population of these homelands were essentially defined on linguistic grounds,[20] the corresponding linguistic groups in the official South African censuses were correspondingly under enumerated. In Table 4, we report the contrast between the uncorrected and the corrected census computations of Black and total South African linguistic fractionalization indexes for the 1980 and 1991 census observations (the only ones affected).[21] In addition, we also report the official census populations, the populations of the up to four homelands, and the proportion of the relevant linguistic grouping excluded by virtue of the non-enumeration of the homelands.

Note that the exclusion of the homeland populations from the official South African census resulted in a substantial under enumeration. Up to 50% of a set of linguistic groups that together constituted approximately 40% of South Africa's black population was thereby excluded from official census data (hence approximately 20% of the total population).

Unsurprisingly therefore, a divergence between uncorrected and corrected fractionalization indexes for the black population emerges. But given the size of the underlying measurement error (20% of the total population excluded), on the other hand the divergence is arguably surprisingly small: 0.78 on the uncorrected fractionalization index versus 0.83 on the corrected index constitutes the maximal divergence, for the black population in South Africa. Moreover, for the aggregate total population fractionalization index, the divergence between the corrected and the uncorrected index is negligible: 0.86 versus 0.85.

An immediate implication that follows is that while measurement error in the computation of fractionalization indexes is undoubtedly a serious concern, and should of course be minimized, the fractionalization indexes used in the literature might also be argued to be in fact fairly robust to measurement error. Of course bias emerges in the fractionalization indexes - but it appears that the error of measurement would have to be fairly substantial before a significant divergence between the true and the biased fractionalization

[20] Transkei and Ciskei were essentially Xhosa-, Bophutatswana Tswana-, and Venda Venda-speaking.

[21] The Homelands were created after 1970, and were reincorporated into official censuses after 1994. Thus only the 1980 and 1991 census years reported in this study were affected. Note: the remainder of the study reports only fractionalization indexes corrected for the under enumeration.

measure emerges.

There is a second sense in which the role of precision of measurement in fractionalization indexes can be investigated on South African data.

In Table 5 we report a measure of political fractionalization.[22] The index is computed on parliamentary representation - and only for the White House of Assembly, and reports the probability that two randomly chosen members of parliament would represent different political parties.[23] By its very construction, therefore, the measure cannot be said to capture the "true" political fractionalization that could properly be said to have prevailed in South Africa. But equally, the fractionalization measure nevertheless cannot be said to be devoid of informational content.

The correlation between our measure of political fractionalization and a range of measures of political rights, civil liberties, political instability and property rights is reported in Table 6. While for some measures of rights (Freedom House Political Rights), and political instability there is little correlation with the political fractionalization measure, for others the correlation proves more substantial (the Fedderke et al 2001a political freedoms and property rights measures, and the Freedom House Civil Liberties measure).

How might we interpret these correlations? We have just noted that these are imprecise measures, suffering from (potentially unknown) measurement error. For normally distributed data the observed correlation between two variables is equal to the "true" correlation between such variables if perfectly measured times the square root of the product of the reliability coefficients for each variable.[24] For many social data, reliability is not above 0.8 to 0.9. So observed correlation coefficients of 0.6 to 0.8 are high, given the unreliability of measurement. To illustrate, suppose that the rights variables of Table 6 are each measured with reliability of 0.8, while the parliamentary

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

[23] 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 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 of the first democratic South African parliament.

[24] A reliability coefficient of 1.0 would indicate perfect agreement and no measurement error, 0 would indicate pure measurement error and no agreement.

fractionalization measure is measured with no error at all (we can observe parliamentary composition without error). The implied "true" correlations are reported in the final row of Table 6. What emerges is that the parliamentary fractionalization measure, despite its clearly partial and unsatisfactory provenance, nevertheless holds substantial information concerning a range of other institutional dimensions. Putting it another way: we would be hard-pressed to say that these correlated variables are measuring very different things.

We draw two final implications from these explorations. First, partial measures, and even poorly measured variables still hold information. Second, the existence of dense webs of association between variables noted elsewhere,[25] suggests that a wide range of social indicators, even if at first sight relatively partial and incomplete, nevertheless may carry useful modeling opportunity, if employed with appropriate discretion.

We hasten to add that we do not mean to say that measurement error is a trivial concern. Much of the discussion in the preceding sections of this paper have pointed to the importance of measuring the right dimensions, at the right levels of aggregation, and accurately. But equally, measurement error is also just measurement error - it need not be the end of the analytical world.

6 Conclusion: implications for growth studies

The tenure of the discussion has been focused on the development of general methodological lessons associated with a specific time series case study. It remains to draw the general conclusions to emerge.

First, we note immediately that while many of the aggregate fractionalization indexes show considerable stationarity over time, this is not universally true (Racial Fractionalization), and even where it does hold, the aggregate stability hides substantial movement at the micro level. The implication we draw is that indicators of social cleavage may themselves be subject to substantial change over time, rendering the question of what drives such changes (particularly whether economic development indicators do so) germane.[26]

Second, the evidence presented above is suggestive of a more substan-

[25] See the extensive investigation in Fedderke and Klitgaard (1998).

[26] This is a question we explore in greater detail in a separate paper (Fedderke et al, 2005b).

tive hypothesis. We have observed that linguistic fractionalization in South Africa is subject to an (admittedly slight) downward trend, while religious fractionalization has been increasing. (The contrast is suitably dramatic for Asians). One possible interpretation of the evidence is that the movement in the two indexes is due not so much to changes in underlying cleavages in South African society, but to changes in the nature of identity formation. In particular, the evidence is consistent with a shift of identity formation that is based on "essentialist" linguistic (ethnic) roots, to one which is choice-based. Increased religious fractionalization might reflect the abandonment of religions of birth, in favour of religions of choice.

Third, we note the significant difficulties associated with data collection surrounding social cleavage. We note further that in cross sectional contexts this issue surely compounds. Consistency, as well as reliability of data compilation must play a role across wide geographical reaches, and periods of time. Countries with the highest levels of fractionalization are those most likely to have the most contentious data being employed in cross sectional studies.

But we also note that measurement difficulties surrounding fractionalization indexes are also not necessarily terminal. On the South African time series data we show that even relatively egregious problems of measurement do not necessarily bias fractionalization measures as much as one might have anticipated. Certainly the means of exploring the relationship between different measures of social and institutional context remains alive, even in the presence of measurement error.

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. Racial fractionalization may be mirrored in linguistic as well as religious diversity.

A further question that then arises in this regard relates to the importance of the intentional mobilization of social cleavage which may itself be inherently latent, often through political agency.[27] How and when such mobilization may come to be successful may depend substantially on the institutional context. For instance, South Africa's historical institutional em-

[27] See for instance the discussion in Hamilton and Wright (1993) on the South African context.

phasis on racial cleavage as a means of economic and political exclusion had the effect of exacerbating distributional conflict, here confirmed by bounds analysis, thus harming growth. By contrast, religious fractionalization may have had very little or no impact at all on economic activity.

Which particular line of social cleavage, when, how and why deserves close attention. With the suggestion that any one particular form of social cleavage may not be significant - what matters is the existence of cleavage, and the institutional means of exploiting such cleavage.

Given the conclusions that have been reached in terms of the potential impact of fractionalization on long run growth, it is essential that we ensure that we are using the right measures. This paper does not purport to have developed the "right" measures but it has raised important caveats about the way in which cross-sectional growth studies employ the fractionalization indexes currently available.[28] It also suggests that the use of time series data for individual country case studies may be a fruitful new route for social scientists interested in the development prospects of developing countries.

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[28] A caveat that Alesina et al (2002: 18) is conscious of.

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Table 1: Fractionalization Measures for available South African census years

	Fractionalization Measure		
Census Year	Linguistic	Religious	Racial
1911			0.49
1921			0.49
1936		0.82	0.48
1945	0.86	0.84	0.48
1951	0.87	0.86	0.49
1960	0.87	0.88	0.49
1970	0.86	0.89	0.46
1980	0.86	0.88	0.44
1991	0.86	0.87	0.39
1996			0.38
2001			0.36

Table 2: 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

	Religious Fractionalization	Linguistic Fractionalization	Political Instability	Racial Fractionalization
Religious Fractionalization	-	18.58*	3.95	5.73**
Linguistic Fractionalization	4.97	-	5.53**	8.54*
Political Instability	3.36	13.62*	-	0.59
Racial Fractionalization	3.57	210.97*	7.39*	-

Table 3: Fractionalization measures for available South African census years – the racial breakdown

Census	Linguistic Fractionalization					Religious Fractionalization				
Year	White	Coloured	Asian	African	Total	White	Coloured	Asian	African	Total
1945	0.52	0.19	0.80	0.81	0.86	0.75	0.83	0.48	0.74	0.84
1951	0.52	0.20	0.80	0.81	0.87	0.78	0.85	0.47	0.78	0.86
1960	0.52	0.20	0.80	0.82	0.87	0.77	0.84	0.47	0.83	0.88
1970	0.54	0.21	0.78	0.80	0.86	0.79	0.84	0.47	0.85	0.89
1980	0.58	0.29	0.46	0.83	0.86	0.79	0.85	0.51	0.82	0.88
1991	0.52	0.29	0.10	0.83	0.86	0.79	0.85	0.61	0.82	0.87

Table 4: Assessing Fractionalization Index Sensitivity to Error of Measurement

Year	South African Official Census			Homeland Census			Homeland Census			South African Total Population			Frac Index			
	Count			Count			Proportion of Total SA Population			Proportion of Linguistic Group in Total SA Population			Black		Total	
	Xhosa	Tswana	Venda	Xhosa	Tswana	Venda	Xhosa	Tswana	Venda	Xhosa	Tswana	Venda	Un-connected	Correc-ted	Un-corrected	Correc-ted
1970	3912680	1679920	359480	-	-	-	-	-	-	0.28	0.12	0.03	0.80		0.86	
1980	2791981	1346383	160135	2323650	1323315	315545	0.45	0.50	0.66	0.23	0.12	0.02	0.79	0.83	0.86	0.86
1991	2503967	1431573	114742	4279500	2403000	556100	0.63	0.63	0.83	0.22	0.12	0.02	0.78	0.83	0.86	0.86

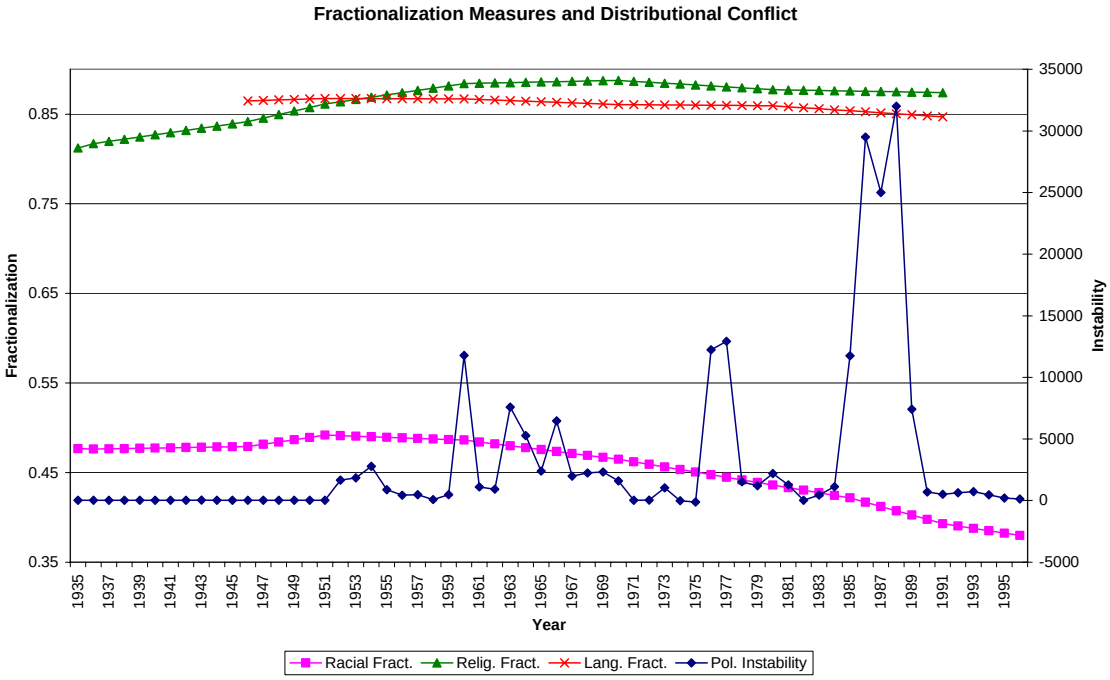
Table 5: Measure of Political Fractionalization

Year	Index	Year	Index
1910	0.59	1958	0.50
1915	0.69	1961	0.48
1920	0.74	1966	0.40
1921	0.54	1970	0.43
1924	0.61	1974	0.43
1929	0.58	1977	0.33
1933	0.59	1981	0.33
1938	0.44	1987	0.47
1943	0.58	1989	0.57
1948	0.61	1994	0.55
1953	0.52	1999	0.46

Table 6: Political Fractionalization Correlations

	Political Freedom (Fedderke et al 2001a)	Political Rights (Freedom House)	Civil Liberties (Freedom House)	Political Instability (Fedderke et al 2001a)	Property Rights (Fedderke et al 2001a)
Political Fractionalization	0.77	-0.02	0.69	-0.03	0.48
True Correlation	0.86	-0.02	0.77	-0.03	0.54

Figure 1


Fractionalization Measures and Distributional Conflict
Fractionalization
Instability
Year
0.85
0.75
0.65
0.55
0.45
0.35
35000
30000
25000
20000
15000
10000
5000
0
-5000
1935
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Racial Fract.
Relig. Fract.
Lang. Fract.
Pol. Instability