TRADE OPENNESS, TRADE COSTS AND GROWTH:

WHY SUB-SAHARAN AFRICA PERFORMS POORLY

by

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1 Introduction

The principal aim of this paper is to identify, in the context of the relationship between openness and growth, factors that can account for the poor growth performance of sub-Saharan African (SSA) countries. We are specifically concerned with variables that have a policy interpretation, especially in relation to trade. Consequently, attention focuses on policy and non-policy barriers to trade, indicators of openness and resource endowments. The empirical analysis is in the context of the literature on inequality and growth, on the basis that a measure of the inequality in the distribution of income is itself a proxy for policy distortions. There has been a resurgence of interest in the nature of the relationship between inequality and growth in recent years, especially as research on the determinants of growth in developing countries has become concerned with possible linkages between policy reform, growth, inequality and poverty. This paper is a contribution to that empirical literature. We use data that has recently been made available in the World Income Inequality Database (WIID, 1999, compiled by UNDP and WIDER) to construct a panel of 44 developing countries, about a quarter from sub-Saharan Africa (SSA).

Income inequality is representative of distortions in the economy, and can be used as a proxy measure for these growth-retarding features of the economy. In an economy where power is concentrated, distortions are widespread and rent-seeking is prevalent, we may expect to observe relatively high levels of inequality (and relatively poor growth performance). Inequality may also have a direct effect in retarding growth. That is, an unequal distribution of income (or land) may mean that the majority of the population does not share in the benefits of growth, and the incentives to them to contribute to growth are muted (e.g. weaker incentives to invest or to work harder or be entrepreneurial). This is consistent with some of the evidence for East Asia – that 'shared growth' encourages dynamism and effort (Morrissey and Nelson, 1998).

Cross-country regressions based on period overall growth and averages for explanatory variables can be interpreted as capturing the 'long-run' aggregate relationship. Panel-data techniques, using sub-period values for variables, can capture the 'short-run' nature of the inequality-growth relationship. This follows Forbes (2000) who, in a sample including industrialised countries but with few low-income (and no sub-Saharan African) countries, found that inequality was negatively associated with growth in the long-run, but the association was positive in the short-run. We consider whether this holds for developing countries.

There is a general tendency for sub-Saharan Africa (SSA) countries to perform relatively badly (e.g. an 'SSA' dummy is negative and significant) in cross-country growth regressions. Africa's poor growth performance is only partly explained in terms of particular variables that are globally important for the growth process but are low in Africa' (Collier and Gunning, 1999: 65). This begs the question, why these variables are especially low in Africa, and whether there are omitted variables that explain why SSA performs relatively poorly. Does Africa suffer from specific growth-retarding features? We explore two candidates for this. First, SSA countries tend to be relatively well-endowed in natural resources with export dependency on primary commodities. Second, SSA countries tend to face natural barriers that increase the costs of trade, such as poor overland transport infrastructure to distant large markets. We hypothesise that these factors can explain SSA's relatively poor growth performance. We find that the combination of natural barriers (transport costs) and measures of trade openness (or, more accurately, the lack thereof) do in fact account for the negative SSA effect.

Section 2 presents a brief discussion of the data and specifications used in the analysis. Section 3 presents the results for the cross-section, or long-run, relationship, and finds evidence that inequality does appear to reduce growth and there is indeed a negative SSA effect. However, when we control for trade variables (particularly openness and natural barriers), the significant SSA effect is eliminated. Section 4 extends this analysis with panel estimates to explore the short-run aspects of the relationships. Openness is found to have a positive effect on growth, but inequality has no significant effect in the short-run. Section 5 concludes with a summary of the main findings and a discussion of the policy implications for African development.

2 Data and Empirical Specification

The analysis is based on data for 44 developing countries over the period 1970-95 (details on data and sources are provided in Appendix A). Our dependent variable is growth in per capita GDP (*GROWTH*). The growth literature points to the importance of initial values in explaining subsequent growth, and these are captured by the initial value of real GDP (*GDP0*). We began with a set of variables for initial endowments: physical capital measured as the initial stock (*K0*), the stock of human capital measured as initial average years of schooling (*H0*) and natural resource endowments measured as land per member of the labour force (*NRE*). In fact, these variables do not explain initial GDP levels well, so our base specification includes *GDP0* to capture initial effects. The explanatory variables will therefore be measures of the increases in the stock variables. The increase in the capital stock is captured by the average rate of investment (*INV*). Secondary school enrolment (*SEC,* the average over the whole period) is the proxy for investment in human capital. Inequality is measured by the initial gini coefficient,[1] drawn from WIID (1999). A larger sample may be generated by using the Deininger and Squire (1996) dataset, however, this is rather weak on Africa data and therefore our use of WIID is largely dictated by its larger coverage of Africa, a region at the heart of our analysis. Nonetheless we do check for the robustness of our fundamental results to the use of Gini modified by the Deininger and Squire (1996) modification.

[1] This is for 1970 or the nearest available.

As our concern is specifically with inequality, the basic specification estimated, similar to that used in most empirical work in this area (Perotti, 1996, Forbes, 2000), is:

$$GROWTH = \beta_0 + \beta_1 GINI + \beta_2 GDP0 + \beta_3 SEC + \beta_4 INV + \mu \quad (1)$$

Initial income (*GDP0*) captures convergence and the expected sign is negative. The coefficient on *GINI* is expected to be negative. The coefficients on *SEC* and *INV* are expected to have positive signs. The variables included above are widely accepted as core explanatory variables.

To this basic specification we then add other variables believed to be important in the inequality-growth relation. Obviously, the potential list is large,[2] but we limit the number included for reasons similar to those advanced by Forbes (2000) and Perroti (1996), namely; the need to maximise degrees of freedom given the limited availability of inequality data and to facilitate comparability between studies. We include a dummy variable for SSA to test if there is an 'Africa effect' in our sample. We then include our *NRE* variable, as this should capture important structural features of the economy.

A comment on the *NRE* variable is in order. The underlying hypothesis is that countries with relatively low endowments of natural resources, thus relatively high labour endowments, will need to industrialise to promote export growth and utilize their comparative advantage (Mayer and Wood, 2001). However, countries endowed with natural resources coupled with low skill levels will tend to have export dependence on unprocessed primary commodities. This can retard growth both because extractive industries have weak linkages with the rest of the economy (or agricultural exports are largely unprocessed) and because primary commodities tend to face deteriorating terms of trade. This may help, in particular, to explain Africa's poor growth performance[3]

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[2] Some authors have included variables capturing institutions (Knack and Keefer, 1995), tropicality (Sachs and Warner, 1997) and political instability (Sachs and Warner, 1997). Note that our sample size is largely restricted by data on the gini coefficient and it is imperative that the degrees of freedom are preserved. We do not include the tropicality variable as most countries including all of SSA countries are tropical. Political instability in our model may largely be captured by the SSA Dummy as several SSA economies were politically unstable.

[3] It may also help to explain Latin America's moderate growth as a failure to utilise higher skill endowments to process primary commodities.

(Wood and Mayer, 2001). Thus, while *NRE* does not capture the change in natural resource endowments, it does proxy for how comparative advantage relates to exports and growth. Countries with higher *NRE* values are predicted to exhibit slower growth.

Then we include an indicator of openness. There is a large literature on the relationship between openness and growth, and the difficulties of its measurement are well known (see Edwards, 1993, 1998; Greenaway *et al*, 1998; Milner and Morrissey, 1999; Rodrik, 1992, 1998, 1999, Rodriguez and Rodrik, 1999). Given the problems of measuring openness we use one of the more widely accepted measures, the proportion of years between 1965 and 1990 that an economy could be considered open (*OPEN*), from Sachs and Warner (1997). This measure has recently been criticised by Rodriguez and Rodrik (1999) on the grounds that it is largely driven by the black market premium and acts like the sub-Saharan Africa dummy. Although it may be an imperfect openness indicator we use it for four key reasons. First, the joint significance of the openness indicator and the SSADUM in our regressions implies that the criticisms do not apply to our sample. Second, our use of the Sachs and Warner indicator is justified by the very low correlation between the openness indicator and the black market premium. Third, this measure has demonstrated robustness in empirical studies (Harrison, 1996; Edwards, 1998).[4] Fourth, given its widespread use in the literature, our use of it facilitates comparability.

We also include a measure of natural barriers to trade (*NBT*), proxied by the ratio of cif unit import prices to fob prices.[5] There is recent evidence that high transactions costs to trade can be a constraint on growth, and in particular can limit the beneficial effects of trade liberalisation (Milner *et al*, 2000). While these variables may have independent effects on growth, our specific hypothesis is that they will capture the features of SSA

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[4] We also tried the Black Market Premium (defined as [black market rate/official rate]-1) which captures the deviation of the exchange rate from its market level. This has also been found to be a good indicator of the overall level of distortion in the economy, but was insignificant when included with *NRE*. Recall that there is a low correlation between BMP and the Sachs and Warner openness indicator.

[5] One could use measures of distance as these have been found to be significant determinants of slow growth in developing, especially SSA, countries. However, there are a number of reasons why we choose not to do so. First, distance is basically a fixed effect and does not change over time, therefore does not capture the fact that transport costs do change (and could only be used in cross section). Second, it is not obvious what distance measure is appropriate. Third, distance has no policy implications so it is better to find an indicator of transport costs. The cif/fob differential is not a perfect measure, but it will differentiate countries and can vary over time.

economies that tend to reduce their growth rates. Summary descriptive statistics are provided in Table 1.

It is likely that some of these variables will be correlated and, indeed, that there may be important interaction effects between some of them. Table 2 provides the correlation matrix for the principal variables in our analysis. One might expect a high correlation between initial GDP and inequality as it has often been argued that the more unequal countries are also the poorer countries. The data does not provide sufficient evidence for this proposition in our sample - the correlation coefficient is very low at –0.067. However, there is a relatively high correlation (above 0.5) between *SEC* and both *GDP0* and *INV*, suggesting these variables should not all be included together. As the correlation between *GDP0* and *INV* is relatively low (0.15), it is likely that the coefficient on *SEC* will not be significant. Similarly, there is a relatively high correlation between *NRE* and *NTB* (0.38), both of which tend to have growth-reducing effects. This is to be expected as countries with the highest NRE will tend to export unprocessed primary commodities for which transport costs are likely to be a higher share of value (hence NTB will be higher). We note from Table 1 that *NRE* has much higher variance.

Tables 1 & 2 About here

These correlations suggest that the cross-section results should be interpreted cautiously, especially given the limited sample size and potential for omitted variable bias. The possibility of interaction between variables is explored in the panel analysis. Specifically, we consider two hypotheses. First, it is possible that high natural barriers dampen the potential beneficial effects of openness. To test this we construct a ‘policy-transport cost’ interaction index (*PT*) bounded between zero and one, where zero represents no openness, low values represent openness with high natural barriers and unity is openness with no natural barriers. The coefficient on the index is expected to be positive. Second, inequality may dampen the beneficial effects of openness (as inequality prevents redistribution, so the incentive effects are not spread throughout the economy). To test this, we construct a ‘policy-redistribution’ index (*PR*), equal to zero for no liberalisation with increasing values as inequality falls, and unity for liberalisation under perfect equality. Again, the coefficient is expected to be positive. The next two sections present the cross section and panel results.

3. Cross-section (long-run) Results

Table 3 presents the results from estimating the basic specification of equation (1). Investment is the principal 'driver' of growth; neither initial GDP nor human capital is significant when both are included with investment (as expected given the high correlations between these variables). While growth may itself be a determinant of investment, implying potential endogeneity, our use of the average investment/GDP ratio implies that this should not be a serious problem for overall period growth rates,[6] nonetheless, this is an issue we investigate further in the panel analysis. The coefficient on *GINI* is found to be negative and significant, i.e. higher inequality results in lower growth. This result is quite robust in the three specifications reported.

We also find that the dummy for SSA countries (*SSA*) has a negative highly significant coefficient. The significance and value of the coefficient on *GINI* is reduced by the inclusion of *SSA*, suggesting that in the sample SSA countries may have relatively higher initial inequality, but there appears to be a negative SSA effect on growth that is independent of inequality. The coefficient on initial GDP is weakly significant only when *SSA* is included and *SEC* excluded, suggesting collinearity between these three variables.[7] As *SEC* is not significant, this is the variable we choose to drop (regression 3.3), in line with other studies, such as Clarke (1995) and Deininger and Squire (1996). This implies that the coefficient on *GINI* includes any indirect effect of income inequality on growth through its effect on education (Knowles, 2001).

Table 3 About here

Knowles (2001) notes that if the Gini is measured on an expenditure rather than an income basis, its significance tends to decline and he argues that empirical researchers should use a consistent definition of the Gini. Unfortunately, this would leave us with

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[6] We investigate the effect of initial investment but this, unsurprisingly, is not significant because this is highly correlated with initial income.
[7] The insignificance of widely accepted variables only points to the possible existence of collinearity. We explicitly test for this using the diagnostics proposed by Belsley *et al* (1980).

very small samples of countries with Gini measured on the same basis. Following Deininger and Squire (1998) and Forbes (2000) we adjusted the expenditure-based Gini to an income based measure using the Deininger and Squire (1996) adjustment. The estimated coefficients on *INV* and *GINI* are similar to those in Table 3.[8] However, the significance of the *GINI* is reduced, as posited by Knowles (2001), and both *GDP0* and *SSA* become insignificant. This reaffirms the collinearity and data quality problems in growth regressions for developing countries. Nevertheless, the estimated sign and coefficient on the inequality variable appears robust to alternative specifications.

Table 4 About here

The next step was to introduce the 'resource' variables (*NRE*[9] and NBT*)*, and the results are in Table 4. The first point to note is that each is negative and significant when included separately (on *NBT* see Table 5). However, if both are included together only *NRE* is significant; the most plausible explanation for this is that the correlation coefficient between them is reasonably high (0.38) and the *NRE* variable has a greater magnitude and much higher variance (Table 1). We experimented with interaction terms but these were not significant (see notes to Table 5). The second point to note is that the coefficient on *GINI* remains negative and significant. Finally, the SSA dummy remains negative and significant (and its inclusion reduces the value and significance of the coefficient on *GINI*).

In Table 5 we introduce an openness variable. For ease of comparison, (5.1) reproduces regression (4.2). The results in regressions (5.3) and (5.4) show that when *OPEN* is added the coefficient is positive and significant. Thus, openness appears conducive to growth. The inclusion of *OPEN* adds to the explanatory power of the regression and does not affect the coefficients on other variables, except that those on *INV* and *SSA* are smaller. This suggests that part of the positive effect of *INV* is due to openness, while part of the 'negative SSA effect' is due to those countries being closed. The negative coefficient on *GINI* remains significant although the magnitude is lower when *NRE* is

[8] As this adjustment is rather *ad hoc* we do not report the results (they are available on request).
[9] Admittedly, any measure of endowment of land will not take account of the differences that exist in land quality, see Wood and Mayer (1998), Wood and Berge (1997) and Owens and Wood (1997). We

included rather than *NBT*. Comparing (5.3) and (5.4), it appears that *NRE* captures some of the negative effects associated with inequality. This is consistent with the argument that inequality of ownership of resources, such as land, is greater than income inequality, and will tend to have a greater (negative) effect on growth when *NRE* is high.

Note that the SSA dummy remains negative and significant except in regression (5.4), in which the coefficient on *NBT* is large and highly significant. The SSA countries will all have low values of *OPEN*, although accounting for this alone does not eliminate the 'SSA effect'. Similarly, most SSA countries will tend to have high natural barriers, but this alone does not eliminate the negative effect. The two combined, however, appear to eliminate the significance of the SSA dummy. Although SSA countries have 'unfavourable' values of the standard explanatory variables for growth, relatively low investment and human capital and relatively high inequality, these are not sufficient to explain the poor growth performance. However, when the tendency of SSA countries to be relatively less open (low values of *OPEN*) and high trade costs (high *NBT*), are both included, the significance of the dummy is eliminated. Low openness levels compound the problem of natural barriers and both are significant factors in explaining poor growth in SSA. This fundamental result is subjected to a battery of robustness checks[10] and found to be robust.

Table 5 About here

There are three broad conclusions. First, within the sample, there is no evidence that poorer countries are more unequal; the correlation between initial income inequality and initial GDP per capita is –0.07. Second, inequality appears to have a robust negative effect on growth in the long run. This negative effect persists when we control for factors that promote growth (investment, education and openness), factors that retard growth (natural resource endowments and barriers to trade), and initial GDP (for which

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examined the effect of using arable land per worker but the key results in Table 4 are largely unaltered, confirming the view of Mayer and Wood (2001) that it does not matter what measure of land use is used.

[10] We examine whether the results are sensitive to sample selection by checking the results hold when only Botswana is excluded (outlier identified using Belsley *et al*, 1980) and when panel and cross sectional outliers are excluded. Additionally, the results are unaltered when Gini is modified by the

there is evidence of convergence). Third, Africa does appear to be different – even allowing for the other explanatory variables, SSA countries have a below average growth performance except when openness and natural barriers to trade are controlled for. The next section explores these results and relationships in greater detail, using a panel data analysis.

5. Panel Data (short-run) Estimates

We now turn to panel estimation methods to investigate the short-run effects of inequality on growth, and the relationship of this to trade liberalisation. A panel is constructed of five 5-year time periods running from 1970-74 to 1990-1994.[11] A sub-set of the countries in the cross-section analysis is used (determined by data availability).[12] Investment is Gross Domestic Investment as a percentage of GDP averaged over the five-year period (*GDIP*). The *GINI* is income inequality at the start of the five-year period, or as near to then as available (from WIID). A period dummy (*PDum*) is used for 1980-94, during which most of the sample was engaged in structural adjustment (including, for many, increased openness). Starting income is measured as the log of initial GDP (*GDP0*) in each period. Initial period *NRE* and *NBT* values were also calculated.[13] These variables constitute the base specification for the panel.

We are particularly concerned about the effect of openness, and include this having controlled for the other variables in the base specification. The indicator of the timing of openness used is the Sachs and Warner (1997) index, a dummy variable taking a value of 1 for each year beginning from the year when liberalisation is said to have occurred and 0 before this.[14] We augment the Sachs-Warner index (*SWaug*) to add another five

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Deininger and Squire (1996) Adjustment. A variable capturing institutions drawn from Sachs and Warner (1995) is excluded because of a dangerously high level of collinearity.

[11] The analysis is referred to as short-run because it is based on 'short' 5 –year panels.

[12] Results, however, are robust to the use of the same sample for both cross-sectional and panel data.

[13] Changes in *NRE* over time will be largely determined by population growth. While initial period values proxy for relative land abundance, large changes (ΔNRE) indicate increasing population pressure, which might have a negative effect on growth if economies fail to diversify (which is the case when Pooled Ordinary Least Squares (POLS) is used. This, however, is not efficient so we report the results from Fixed Effects Model (FEM)). This does confuse interpretation of the coefficient on *NRE* in the panel analysis. Interpretation of the coefficient on *NBT* is straightforward as it captures changes in relative transport costs (either because of increased efficiency or a change in the composition of exports).

[14] We also tried the World Bank and Dean indicators used in Greenaway, Morgan and Wright (1998), but the coefficients were insignificant in almost all specifications. We are grateful to Peter Wright for providing the data.

countries using our judgement of when they liberalised (see Appendix A).[15] A criticism of dating openness at a particular year is that it will take time for effects to occur, but note that we are concerned with the period of openness.

Table 6 About here

Results are reported in Table 6. The coefficient on *GINI* is positive but insignificant, which is not surprising given the demonstrated low variation of inequality (Deininger and Squire, 1998). This however is in contrast to Forbes (2000) who finds it to be positive and significant. The difference in the results can be attributed to several factors, notably differences in samples, data and estimation technique – Forbes (2000) used GMM estimators but our data are inadequate to avail of that particular technique. When *SWaug* is excluded, the coefficient on *GINI* is weakly significant; when included, the coefficient on *GINI* is insignificant. Reducing barriers to openness appears to offset the adverse effect of inequality. As previously, investment is a major determinant of growth, and there is evidence for convergence within the sample. We find robust evidence that openness, as proxied by the *SWaug* index, is associated with increased growth. Note that the period dummy (*PDum*) has a negative coefficient, implying that openness offsets some other negative effect on growth. This suggests that there is an unobserved effect that tended to reduce growth in the 1980s (failure to account for this may be a reason why other studies do not find a positive effect of liberalisation).

The coefficient on *NBT* (when included without *NRE and SWaug* (6.1)) is negative but not significant (6.2). When *SWaug* is included, the negative coefficient on *NBT* is significant. Controlling for openness, the growth-retarding effect of natural barriers may be even greater. To explore any interaction between openness and natural barriers further, we include the interactive term *PT* (see Section 2). However, this was insignificant (see Table 7). The insignificance of *NRE* in the panel may be because it is

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[15] Note that the augmented sample is drawn from the cross-sectional sample. Only results using *SWaug* are reported as this gives the largest sample. The smaller panel using *SW* was estimated and results were very similar: overall explanatory power was lower, as were some estimated coefficients, but variables had the same significance levels.

largely time-invariant (or relative rates of population growth were similar for countries in the sample) and other variables pick up any related country-specific effects.

The equation in Table 6 may be mis-specified as *GDIP* is likely to be endogenous, i.e. growth is a determinant of average investment rates during each period. To address this we replace *GDIP* with *SEC* (to proxy for the productivity of investment). Endogeneity of inequality does not appear to be a problem – the values of the Gini for each country change little over time, and growth does not appear to be a determinant of the change in inequality in our sample (results available on request). Furthermore, the coefficient on inequality is insignificant in Table 6. To explore the possibility that the growth-retarding effect of inequality may be conditional on liberalisation we construct an interactive term (*PR*). Where *P* is the *SWaug* index and *R* = (100-*GINI*)/100, *PR* is zero if a country has not liberalised and, once the country does liberalise, approaches one as inequality decreases. The hypothesis is that liberalisation dampens any adverse effects of inequality by removing distortions in resource allocation.

Table 7 About here

The results in Table 7[16] show that there is robust evidence of convergence, and that countries with higher levels of human capital tend to exhibit higher rates of growth (picking up the investment effect). There is also robust evidence that growth performance was generally poor in the 1980-94 period, due to factors not specified in our model (the coefficient on *PDum* is consistently negative and significant). The evidence on the effect of *NBT* shows that natural barriers tend to have a negative and significant influence on growth (except when *SWaug* excluded and *PR* included).

The coefficient on *GINI* is insignificant. The interactive term (*PR*) is only significant, and positive, when *SWaug* is excluded, suggesting that any effect on growth is due to liberalisation alone.[17] Higher values of *PR* imply liberalisation with less inequality, suggesting that conditional on liberalisation, countries with less inequality appear to

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[16] Although there are 140 observations in Tables 6 and 7, they are slightly different. Three missing observations (on *SEC*) for South Africa are replaced in Table 7 by three observations for Panama (for which data on *GDIP* is missing in Table 6).

[17] We estimated a number of specifications including *PR* and SW*aug*; in all cases, the coefficient on the former was positive but not significant and that on the latter was always positive and significant.

experience higher growth. This is consistent with the hypothesis that inequality dampens the pro-growth effects of liberalisation. As we are unable to explain the small changes in inequality in the sample over time, and many (especially those with high inequality) liberalised in the later periods, we cannot identify a clear interactive effect between liberalisation and inequality. Note that the results in (7.3) are unusual, as the coefficients on both *SEC* and *GDP0* are insignificant, suggesting that *PR* may introduce multicollinearity given that the estimation is fixed effects.[18]

The coefficient on *NBT* is negative and significant in all specifications except fixed effects. There is no evidence of interaction between natural barriers and openness – the coefficient on *PT* is generally insignificant. Higher values of *PT* imply openness with lower natural barriers. When *PT* is included (without *NBT)* but *SWaug* is *excluded,* the coefficient on *PT* is positive and significant (results not reported). This is probably only capturing the beneficial effects of openness (as this determines if *PT* is non-zero). When *SWaug* is included the coefficient on *PT* is positive but insignificant. The robust effects are that openness is associated with higher growth but natural barriers retard growth and these effects are independent of each other.

In summary, although some results are sensitive to specification, the pattern of results for panel estimates is similar to that for the cross section. Investment is the 'driver' of growth, and there is evidence for convergence in the sample. Openness tends to have a positive effect on growth, and appears to dampen any adverse effect on growth associated with high levels of inequality. High natural barriers to trade tend to be associated with lower growth, but there is no evidence that the benefits of openness are less when barriers are high. The contrasting result is that in the short-run inequality does not have a robust effect on growth and this lends support to the view that the inequality effect may mainly be a long-run phenomenon (Knowles, 2001). The X-efficiency channel of transmission may point to some detrimental medium-run effects, not captured by our short-run analysis.

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[18] The use of fixed effects, that seem to capture the significance due to *SECR*, *GDP0* and *NBT*, explains why (7.3) has the highest explanatory power. In this context, the significant coefficient on *PR* suggests that, controlling for country specific effects, openness has a greater pro-growth effect in countries with lower levels of inequality.

6. Conclusions

This paper uses cross-section and panel econometric techniques to investigate the links between growth, inequality and openness for a sample of developing countries. There are four broad conclusions. First, within the sample, there is no evidence that those countries that are initially poorer also exhibit higher levels of inequality; there is a low correlation between initial GDP and inequality. Second, inequality appears to have a robust negative effect on growth in the long run but not in the short run. In the long run, this negative effect persists when we control for factors that promote growth (investment and openness), factors that retard growth (natural resource endowments and barriers to trade), and initial GDP (for which there is evidence of convergence).

Third, we find consistent robust evidence that openness is positively associated with growth. There is also some evidence that liberalisation tends to offset or dampen the negative effect of inequality on growth. Finally, Africa does appear to be different, i.e. SSA countries have a below average growth performance, controlling for the 'usual' explanatory variables. This is an artefact of specification in the sense that the negative SSA dummy implies exclusion of factors specific to SSA. We do find that the specification combining transport costs and openness (which is low for SSA) accounts for this SSA effect. The especially poor SSA growth performance can be explained by low levels of openness combined with natural barriers to trade (especially high costs of transport to distant dynamic markets).

The poor performance of SSA countries is an issue of major concern for development policy (see Collier and Gunning, 1999). Our results suggest that the factors contributing to poor growth are in essence policy variables amenable to change. Although SSA countries are disadvantaged by natural barriers and distance from markets, interventions are possible that can reduce transport and transactions costs of trade. More generally, greater openness tends to promote growth, even in an environment of high natural barriers. Similarly, although SSA countries may have unfavourable resource endowments, resulting in over-dependence on unprocessed primary commodity exports, this is not a binding constraint on growth. Policies that encourage exports and diversification, and that reduce barriers to openness, can boost economic performance.

These policy interventions should be in addition to the 'standard' prescriptions – productive investment is a major determinant of growth.

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Table 1: Descriptive Statistics

	Mean	Std.Dev.	Minimum	Maximum
GDP0	1085.01	1116.77	92.23	5736.58
GINI	45.78	10.39	27.90	62.50
INV	21.45	5.24	10.56	34.16
SEC	39.30	18.14	3.90	72.45
NRE	14.48	19.65	0.062	99.09
NBT	1.121	0.046	1.044	1.265

Note: Summary statistics based on 42 observations. Two countries were excluded as outliers (more than two standard deviations from the mean based on Dalgaard and Hansen (2001): Zambia on *GINI* and Botswana on *NRE*. This test is complemented by results from the Belsley *et al* (1980) diagnostics, which clearly identifies Botswana as an outlier. Details available on request.

Table 2 Correlation Matrix

	GDP0	*GINI*	*INV*	*SEC*	*NRE*	*NBT*
GDP0	1.0000	-0.0669	0.1532	0.5138	0.0103	-0.1408
GINI	- 0.0669	1.0000	-0.1115	-0.0466	0.2246	-0.0299
INV	0.1532	-0.1115	1.0000	0.5477	-0.0604	-0.3492
SEC	0.5138	-0.0466	0.5477	1.0000	0.0595	-0.2050
NRE	0.0103	0.2246	-0.0604	0.0595	1.0000	0.3843
NBT	-0.1408	-0.0299	-0.3492	-0.2050	0.3843	1.0000

Table 3 Cross-section Regressions for Growth: Base Specification

	(3.1)	**(3.2)**	**(3.3)**
GINI	-0.050**	-0.040*	-0.039*
	(-2.41)	(-2.00)	(-1.91)
GDP0	-0.0005	-0.0004	-0.0004*
	(-1.56)	(-1.28)	(-1.70)
SEC	0.021	0.006	
	(0.98)	(0.26)	
INV	0.272***	0.262***	0.270***
	(6.53)	(6.44)	(7.02)
SSA		-1.298**	-1.387***
		(-2.53)	(-3.05)
R^2 (adj)	0.572	0.602	0.612
N	42	42	42
Breusch Pagan	3.951	6.987	6.280
Jarque-Bera	2.135	3.1295	1.586

Notes: Figures in parentheses are t-ratios: *** denotes significant at 1 percent level, ** significant at 5 percent and * significant at 10 percent. Outliers tested for using Belsley *et al* (1980) .The F-test supports the hypothesis that all coefficients are jointly significant (i.e. rejects the null that all are zero). *SEC* is not significant even if initial GDP omitted. Diagnostic tests (using the Breusch Pagan (BP) heterosecdasticity test and Jarque-Bera (JB) test on residuals for normality) reveal no evidence of heteroscedasticity and the normality assumption of the error term is not violated. Tests support the functional form used. The critical values of tests (for degrees of freedom) are BP $\sim \chi^2$ (critical value = 9.49 (4 DF) and 11.07 (5 DF), JB $\sim \chi^2_{(2)}$ = 5.99. The inclusion of $GINI^2$ does not provide evidence for a non-linear relationship.

Table 4 Cross-section Regressions with Resource Variables

	(4.1)	**(4.2)**	**(4.3)**	**(4.4)**
GINI	-0.033**	-0.025*	-0.023*	-0.024*
	(-2.40)	(-2.01)	(-1.94)	(-1.94)
GDP0	-0.0005**	-0.0004*	-0.0003**	-0.0003**
	(-2.35)	(-1.91)	(-2.05)	(-2.06)
SEC	0.027*	0.014		
	(1.89)	(0.79)		
INV	0.255***	0.247***	0.265***	0.262***
	(7.52)	(7.31)	(9.19)	(8.61)
NRE	-0.040***	-0.039***	-0.038***	-0.037***
	(-4.42)	(-5.00)	(-5.78)	(-4.60)
SSA		-1.158**	-1.363***	-1.342***
		(-2.70)	(-4.42)	(-3.98)
NBT				-1.105
				(-0.30)
R^2 (adj)	0.697	0.722	0.723	0.716
N	42	42	42	42
Breusch Pagan	5.2795	7.626	8.651	10.021
Jarque-Bera	0.636	3.1295	0.557	0.491

Notes: As for Table 3. Including *SEC* in (4.4) has little effect on the results: it is not significant, but the significance of *GDP0* and *SSA* is reduced. *NBT* is negative and significant only if included without *NRE*. Diagnostic tests reveal no evidence of heteroscedasticity and the normality assumption of the error term is not violated. Tests support the functional form used: BP ~ χ^2 with critical value = 11.07 (5 DF) and 12. 59 (6 DF), JB ~ $\chi^2_{(2)}$ = 5.99.

Table 5 Cross-section Regressions with Openness

	(5.1)	(5.2)	(5.3)	(5.4)
GINI	-0.025*	-0.045**	-0.027**	-0.048***
	(-2.01)	(-2.59)	(-2.16)	(-2.95)
GDP0	-0.0004*	-0.0004	-0.0005**	-0.0005**
	(-1.91)	(-1.50)	(-2.66)	(-2.19)
SEC	0.014	0.010	0.017	0.014
	(0.79)	(0.41)	(1.22)	(0.77)
INV	0.247***	0.236***	0.187***	0.160***
	(7.31)	(5.59)	(4.40)	(3.17)
SSA	-1.158**	-1.085**	-0.883**	-0.707
	(-2.70)	(-2.11)	(-2.48)	(-1.54)
NRE	-0.039***		-0.039***	
	(-5.00)		(-8.65)	
NBT		-8.485**		-11.149***
		(-2.57)		(-3.48)
OPEN			2.026***	2.292***
			(4.08)	(3.48)
R^2 (adj)	0.722	0.621	0.793	0.709
N	42	42	42	42
Breusch Pagan	7.626	10.987	7.77	8.274
Jarque-Bera	3.130	0.717	4.100	1.564

Notes: As for Table 3. We experimented with two interaction terms. The simple *NRE.NBT* term was almost perfectly correlated with *NRE* (being the variable of much higher value and variance). We created a variable *NRED* = 1 if *NRE* > its mean value, 0 otherwise, and interacted this with *NBT*. Neither interactive term was significant when included with *NRE*. Diagnostic tests reveal no evidence of heteroscedasticity and the normality assumption of the error term is not violated. BP $\sim \chi^2$ with critical value = 12.59 (6 DF) and 14.07 (7 DF), JB $\sim \chi^2_{(2)} = 5.99$. Tests support the functional form used.

Table 6 Panel Regressions with Trade Liberalisation

	(6.1)	(6.2)	(6.3)
GINI	0.0008*	0.00014	0.00004
	(1.776)	(0.498)	(0.156)
GDP0	-0.0193**	-0.0076**	-0.0065***
	(-2.168)	(-2.510)	(-2.635)
GDIP	0.0019***	0.0019***	0.0018***
	(3.315)	(4.554)	(4.499)
SWaug		0.0195***	0.0189***
		(4.083)	(4.041)
NRE			0.0053***
			(2.911)
NBT	-0.0925	-0.1245**	-0.0887*
	(0.880)	(-2.102)	(-1.685)
PDum	-0.0088*	-0.0203***	-0.0203***
	(-1.849)	(-4.730)	(-4.464)
R^2 (adj)	0.4034	0.3311	0.3423
N	140	140	140
Estimator	FEM	REM	POLS

Notes: As for Table 3. A Lagrange Multiplier test rejected the null hypothesis that the classical regression model is appropriate against an alternative of fixed or random effects. The Hausman test was used to choose between Random Effects (REM) and Fixed Effects (FEM) models (details avaiable on request). Variants of (6.1) and (6.2) were tested with *NRE* (always insignificant) in place of *NBT* but other coefficients were largely unaffected.

Table 7 Panel Regressions with Interactive Terms

	(7.1)	(7.2)	(7.3)	(7.4)	(7.5)
GINI	0.00004	-0.0001	0.0006	-0.0001	-0.0002
	(0.145)	(-0.400)	(1.368)	(-0.395)	(-0.644)
SEC	0.00053***	0.0004**	0.000002	0.0004**	0.0004**
	(2.962)	(2.574)	(0.007)	(2.609)	(2.536)
GDP0	-0.0077**	-0.0077**	-0.0112	-0.0077**	-0.0067**
	(-2.086)	(-2.500)	(-1.240)	(-2.490)	(-2.191)
SWaug		0.01781***		0.0181***	0.0198***
		(3.479)		(3.539)	(3.900)
NBT	-0.1407**	-0.1134**	-0.0425	-0.1127**	
	(-2.217)	(-2.010)	(-0.403)	(-1.996)	
PR		0.0025	0.0296***		
		(0.855)	(2.702)		
PT				0.0010	0.0010
				(0.654)	(0.643)
PDum	-0.0239***	-0.0293***	-0.0182***	-0.0294***	-0.0298***
	(-4.952)	(-5.861)	(-2.685)	(-5.858)	(-5.881)
R^2 (adj)	0.2064	0.2444	0.3753	0.2427	0.2257
N	140	140	140	140	140
Estimator	REM	POLS	FEM	POLS	POLS

Notes: As for Table 3. Lagrange Multiplier and Hausman tests were used to choose between POLS, FEM and REM. Further results available on request.

Appendix A: Variables and Data sources

GDP0 = GDP per capita in 1970
GROWTH = average real per capita growth rate over 1970-1995 period
INV = average investment to GDP ratio over 1970 – 1995 period
SEC = secondary school enrolment rate in 1970. We also tried using percentage of primary school complete in total population (LPC) and percentage in primary school complete in population greater than 15 years (LPC15).
GINI = Gini coefficient of income inequality
LandGini = Gini Land concentration Index
NRE = Total Land per worker
NBT = CIF/FOB factor
OPEN = Proportion of the years between 1965 and 1990 that the economy is considered to be open by the criteria set by Sachs and Warner (1995).
SSA = dummy variable with the value of unity for countries in Sub-Saharan Africa and zero for all others
SWAug = Augmented SW index using our judgement of when 5 countries liberalised.
P = SWAug taking a value of 1 for lib and 0 otherwise
T = reciprocal of natural barriers NBT
R = (100-G)/100
PT = P * T and approaches 0 as natural barriers increase; it increases as natural barriers fall.
PR = P * R and approaches 0 as inequality increases; it increases in 'equality'.
ICRGE80= Institutional variable drawn from Sachs and Warner (1997).

Sources are *World Development Indicators 1997 and 2000* (CD-ROM), Barro–Lee data set, World Income Inequality Database (WIID), Sachs and Warner (1997), IFAD (2001) for LandGini, International Financial Statistics Yearbook 1995 (CIF/FOB factor)

Table A.1: Augmented Sachs-Warner Index based on extending the original Sachs and Warner dataset by 5 countries drawn from the cross-sectional dataset.

	1970-74	1975-79	1980-84	1985-89	1990-94
Egypt	0	0	0	0	1
Nepal	0	0	0	0	1
Madagascar	0	0	0	1	1
Nigeria	0	0	0	1	0
Turkey	0	0	0	1	1