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Does proximity matter more than wealth? Neighbourhood and regional growth effects in Africa

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Abstract

Unlike some other parts of the world, neighbouring countries in sub-Saharan Africa do not generate large spillovers over and above the rest of the region, whether we define neighbours in terms of borders or distance. Broader regional effects dominate on the continent. South Africa can account for part of this, but the regional effects appear to be driven by the resource-rich countries, where a 1% point rise in their GDP per capita is associated with a 0.36% point rise in the rest of the continent. Therefore, the appropriate use of natural wealth could generate positive growth externalities for other countries.

1 Introduction

In Uganda, tourism numbers are expected to drop 30%, coffee exporters are being forced to delay their shipments, fuel imports have been disrupted, tax receipts have been delayed and inflation is expected to rise because of the election-related instability in neighbouring Kenya. As a landlocked country, Uganda ships exports via Kenya, while Kenya is the final destination for almost 10% of Ugandan goods.[1] These effects of Kenya on Uganda are a topical example of neighbourhood growth spillovers, which many researchers have tried to quantify.

Easterly & Levine (1997) use a pooled panel to investigate the growth relationship between countries and those on their borders. They argue much of Africa's poor growth performance can be accounted for by realising they have "bad neighbours". They are cautious to point out that it is hard to distinguish between causal growth spillovers and shared neighbourhood effects. The Kenya-Uganda example is one of a causal spillover, but a drought affecting many countries simultaneously would be an example of a common shock.

Cross-country dependence can be extended beyond immediate or proximate neighbours. Arora & Vamvakidis (2005) use a panel at 5-year intervals to argue South African growth affects the rest of the African continent more than any other country or the rest of the world. Moreno & Trehan (1997) allow for every other country in the world to be in the "neighbourhood", but use a weights matrix, which deflates the effect of a country by bilateral distance. Their cross-section results produce evidence consistent with neighbourhood effects. Furthermore, there is

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[1] Independent on-line (2008); Dow Jones News Wire (2008); Suruma (2008); Uganda Export Promotion Board (2008).

evidence that the resource-rich countries are experiencing short run windfalls from the recent rise in commodity prices (Collier & Goderis, 2007ab). While much work continues on what effects natural resources may have on a country's growth,[2] it is a logical extension to begin to consider what effects the resource-rich countries in Africa may have on their neighbours.

Our investigation of neighbourhood effects builds on the spatial weights matrix approach of Moreno & Trehan (1997). However, rather than using a single matrix and estimating a single spillover coefficient, we have three matrices for neighbourhood, regional and world effects. The region can be thought of as a continent, like sub-Saharan Africa. The neighbourhood is a subset of the region, for example (but not necessarily) only countries that are sufficiently "close" to the country in question. An advantage of this approach is that it enables us to test whether there are neighbourhood effects *over and above* those of the rest of the region or world. Our work is based on a large panel of annual data, controlling for country-specific GDP levels and country-specific growth rates. It is thus aimed at capturing more of the shorter-term correlations, which would not present themselves in a cross-section or in panels of five- or ten-year growth intervals.

We use this approach to address a number of questions. First, we check to see whether your closer neighbours matter more; in other words, whether there are neighbourhood effects over and above the rest of the region or world. We do this for an international sample of countries before focussing on sub-Saharan Africa (SSA). We then address the relative importance of close neighbours, regional giants like South Africa and Nigeria, and the resource-rich countries.

The layout of this paper is as follows. First, we present a static model with spatial effects, showing how to find net neighbourhood effects. We also introduce a number of neighbourhood concepts, which are based on borders and distance measures (being close) on the one hand and based on other criteria (like being large or resource-rich) on the other. We discuss some of the empirical issues encountered by this work before stating the assumptions and empirical approach. Thereafter, we describe our data.

Our results section reveals there are small but significant net neighbourhood effects over and above regional and broader global trends. We also find evidence of disparities across continents. Being closer does not seem to matter that much in SSA. Instead, broader regional effects are important. Defining the "neighbourhood" as resource-rich countries, it appears they are very influential on the continent, especially those rich in oil. We argue that these neighbourhood effects include genuine spillovers because the resource-rich are directly affected by commodity prices and the rest are not. Defining South Africa as the "neighbour" shows it exudes a strong effect, but this is by virtue of its size: it does not have a special influence over and above the rest of the continent. We conclude with a summary of the results and suggest that making good use of natural resources is not only important for those who have them, but for their neighbours too.

[2] For a discussion of the literature in a spatial context, see Nelson & Behar (2008).

2 A static model with spatial effects

In a time series setting, a general model with spatial effects takes the form:

$$\ln(\frac{Y}{L})_{it} = c + \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + \rho \ln \Omega_{it} \quad (1)$$

where Y is GDP, L is population, c is a constant, $\boldsymbol{\gamma}$ is a vector of coefficients on a vector of explanatory variables / controls, f_i is a country-specific fixed effect for the level of income, g_i is a country-specific coefficient on trend t and ρ captures spatial dependence. $\Omega_{it} = \frac{\sum_j^n w_{ij} Y_{jt}}{\sum_j^n w_{ij} L_j t}$, where n is all countries in the world (our dataset). Ω_{it} is a scalar. The numerator (denominator) premultiplies the vector of GDP (population) in all countries in the world by a weighting matrix $\mathbf{W}$, with w_{ij} giving the weight. This weight might represent the inverse of the geodesic distance between countries i and j, as done by Moreno & Trehan (1997). Thus, those countries closer to country i would be thought to have a bigger effect if $\rho \neq 0$.

Figure 1 (Panel A) would capture the effects of this model, with country i in the centre and the (approximately continuous) concentric shades representing the spatial lags in the effect of a given country j according to its distance from country i.

Our approach is described in Panel B of Figure 1, where we have three discrete rings surrounding country i. The biggest circle represents the whole world. The second biggest represents a region, like SSA. The smallest circle represents the neighbourhood, which can be those countries "near by". Being "near by" can be defined in a variety of ways. We use measures of geodesic distance, countries with which country i shares a border, and/or countries that are two borders away. Thus, N is the neighbourhood, R is the region excluding the neighbourhood, and G is the rest of the globe. More generally, we can think of N as any subset of R, for example commodity exporters in the region or a particular country like South Africa.

If we partition the set of n countries in Ω_{it} into those which are in the neighbourhood (subset N), the broader region, but not in the neighbourhood (subset R), and the rest of the globe (subset G), we could populate $\mathbf{W}$ as follows:

$$\begin{aligned} w_{ij} &= \lambda_N \text{ if } j \in N \\ &= \lambda_R \text{ if } j \in R \\ &= \lambda_G \text{ if } j \in G \\ &= 0 \text{ if } i = j \end{aligned} \quad (2)$$

$\lambda_N = \lambda_R = \lambda_G$ would imply all countries in the world have the same effect ρ. However, rather than these weights, we replace Ω_{it} with three scalars representing the neighbourhood, the region and the rest of the globe. For the neighbourhood, $\Omega_{it}^N = \frac{\sum_{j|j\in N}^n Y_j t}{\sum_{j|j\in N}^n L_j t}$.

In other words, we add up the GDPs of all countries in the neighbourhood, add up all their populations, and divide the one by the other to get a neighbourhood per capita GDP. Analogously, $\Omega_{it}^R = \frac{\sum_{j|j\in R}^n Y_{jt}}{\sum_{j|j\in R}^n L_j t}$ and $\Omega_{it}^G = \frac{\sum_{j|j\in G}^n Y_{jt}}{\sum_{j|j\in G}^n L_j t}$. This approach allows for the testing of separate effects by subset, rather than imposing a priori weightings, which is implicitly done when deflating by distance. With this modification, we have (with $y \equiv Y/L$):

$$\ln y_{it} = \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + \rho_N \ln \Omega^N_{it} + \rho_R \ln \Omega^R_{it} + \rho_G \ln \Omega^G_{it} \tag{3}$$

By looking at coefficients ρ_N, ρ_R and ρ_G individually, we can test for whether λ_N, λ_R or $\lambda_G = 0$. $\rho_N > 0$ would indicate the presence of neighbourhood effects.

$\rho_N = \rho_R = \rho_G$ would mean that a 1% change in per capita GDP would have the same effect everywhere. However, because the specification is in logs, $\rho_N = \rho_R = \rho_G \nRightarrow \lambda_N = \lambda_R = \lambda_G$ in general: it does not mean that, holding a country's size (GDP) constant, a rise in its per capita GDP would have the same effect on country i, regardless of its location. However, defining $\Omega^{RN}_{it} = \frac{\sum^n_{j|j \in R \cup N} Y_j t}{\sum^n_{j|j \in R \cup N} L_j t}$ to be the per capita GDP of the entire region, *including* the neighbourhood but excluding country i, and $\Omega^{GRN}_{it} = \frac{\sum^n_{j \neq i} Y_j t}{\sum^n_{j \neq i} L_j t}$ to be the per capita GDP of the whole globe excluding country i, write:

$$\begin{aligned}
\ln y_{it} &= \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + \qquad\qquad \text{(4a)} \\
&\quad \rho^N \ln \Omega^N_{it} + \rho^R (\ln \Omega^{RN}_{it} - \ln \Omega^N_{it}) + \rho^G (\ln \Omega^{GRN}_{it} - \ln \Omega^{RN}_{it}) \\
&= \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + \qquad\qquad \text{(4b)} \\
&\quad (\rho^N - \rho^R) \ln \Omega^N_{it} + (\rho^R - \rho^G) \ln \Omega^{RN}_{it} + \rho^G \ln \Omega^{GRN}_{it}
\end{aligned}$$

$\rho^N = \rho^R = \rho^G$ implies there is only a global effect; there is no additional spillover from being in the same region as another country, nor is there one from being in the same neighbourhood. In other words, $\rho^N = \rho^R = \rho^G \iff \lambda_N = \lambda_R = \lambda_G$. $\rho^N > \rho^R = \rho^G$ would imply an extra effect for being in the neighbourhood. A significant coefficient on $\ln \Omega^N_{it}$ in equation (4b) would therefore be evidence of neighbourhood effects outweighing broader regional effects: closer neighbours would matter more. Under a different interpretation of N, we could use this to test whether the resource-rich countries have an effect over and above the rest of the region.

3 Empirical issues

Our global dataset is an annual panel from 1980-2004 and up to 75 countries. Estimation is thus subject to potential problems of non-stationarity, which may lead to spurious correlations. Whether the data are integrated of order one or merely trend-stationary, differencing removes this potential source of spuriousness. Furthermore, Wooldridge (2002) suggests that using a first difference estimator rather than a within groups estimator is a preferable form for accounting for fixed effects in the level of GDP (*cf* f_i) when the data exhibit autocorrelation. In addition, we apply within groups estimators to the first-differenced specification to account for country-specific trends in GDP (*cf* g_i). Thus, the estimating equation for equation (3) is:

$$\Delta \ln y_{it} = \boldsymbol{\gamma}\boldsymbol{\Delta}\mathbf{X}_{it} + \rho_N \Delta \ln \Omega^N_{it} + \rho_R \Delta \ln \Omega^R_{it} + \rho_G \Delta \ln \Omega^G_{it} + g_i + v_{it}, \tag{5}$$

while that for (4b) is:

$$\Delta \ln y_{it} = \boldsymbol{\gamma}\boldsymbol{\Delta}\mathbf{X}_{it} + \beta_N \Delta \ln \Omega^N_{it} + \beta_R \Delta \ln \Omega^{RN}_{it} + \beta_G \Delta \ln \Omega^{GRN}_{it} + g_i + \omega_{it} \tag{6}$$

In the absence of cross-section dependence, which we discuss below, v_{it} or ω_{it} are assumed to be IID error terms containing unexplained drivers of growth in a particular period. This single equation framework effectively assumes that feedback effects are sufficiently small to be ignored, so we are not allowing for any genuine spillovers to go from country i to the rest of the neighbourhood.[3] Consider a specification with neighbourhood and trend only, where we think of country i as before and the neighbourhood as its only large neighbouring country j, such that we are assuming:

$$\Delta \ln y_{it} = \beta \Delta \ln y_{jt} + g_i + e_{it} \tag{7a}$$

$$\Delta \ln y_{jt} = g_j + e_{jt} \tag{7b}$$

We will have more to say about the error terms e_{it} and e_{jt} shortly, but for now note that the assumption there is no output term in the second row is harmless under the null hypothesis of $\beta = 0$. Under the alternative, there may be upward bias if $\beta > 0$. A finding of significant net neighbourhood effects is not hampered by this assumption, although the size of the coefficient may be overestimated. However, the descriptive statistics in Table A show that country i is small relative to the rest of its neighbourhood such that any feedback and hence bias is minimal. This should be even less of an issue when considering the size of South Africa, Nigeria or the sum of the resource-rich economies.

A significant positive coefficient on β_N denotes neighbourhood effects over and above those for the broader region. In our specifications, particularly because we use annual data, neighbourhood effects given by ρ_N or β_N are deviations from country-specific growth rates associated with those in the rest of the neighbourhood. These are short term effects in the sense that they are temporary deviations from the trend in GDP. In these specifications, this effect will not die out and hence be a permanent (long run) effect on the level of GDP, but can also be interpreted as short-run impacts on the growth rate that period.

Our analysis is based on static specifications.[4] Furthermore, we do not focus on results including other "explanatory variables" as we are not trying to "explain" growth. In an annual context, many such variables are missing or interpolated, even from official data sources. Others are slow moving, so we capture much of this using fixed effects (f_i or g_i) anyway. Also, the potential of endogeneity of such variables has not been dealt with to general satisfaction.

Furthermore, we have issues of cross-sectional dependence to consider. Cross sectional dependence is present if the correlation between the error terms across countries is not zero. Theoretical work shows cross-sectional dependence, which in some cases is attributable to spatial dependence, can adversely affect efficiency and the reliability of standard error estimates. Monte Carlo simulations suggest even small spatial dependence can cause large standard error

[3] For a single cross-section, Moreno & Trehan (1997) develop a maximum likelihood estimator to account for this potential source of inconsistency.

[4] A full dynamic specification using an Autoregressive Distributed Lag approach is a fruitful area for further research. A subset of this would include a lagged values of GDP per capita, which in some circumstances can be interpreted as a convergence term. Estimation is likely to be subject to what are now well known problems associated with parameter heterogeneity in non-stationary panels (Pesaran & Smith, 1995). Less well known, except in the context of panel co-integration tests, is how this problem interacts with the issue of cross-section dependence, which we discuss in a static context in the body of the text.

bias when N is large (Driscoll & Kraay, 1998).[5] Temple (1999:131) therefore suggests standard error estimates in growth regressions "should be treated with a certain degree of mistrust".

Spatial effects are naturally a subset of cross-sectional dependence. If part of the dependence comes in the form of neighbourhood, regional or world correlations in GDP, which is after all the essence of what we are trying to investigate, this correlation should be reduced by including terms in other countries' GDP. However, somewhat ironically, any remaining positive cross-sectional dependence can bias the *coefficients* on these terms upwards, making the problem arguably more serious. In the context of system (7), assume we capture the remaining cross-sectional dependence between the country and its neighbourhood through the projection $e_{it} = \alpha e_{jt} + u_{it}$, where $\alpha > 0$ and u_{it} is IID. The within groups estimator for equation (7a) is:

$$(\Delta \ln y_{it} - \Delta \ln y_i) = \beta (\Delta \ln y_{jt} - \Delta \ln y_j) + (\alpha e_{jt} + u_{it}) \tag{8}$$

$\Delta \ln y_i$ is the mean value of $\Delta \ln y_{it}$. This clearly results in a positive correlation between the error term and regressor. The problem can be mitigated if most of the remaining dependence is common to all cross-sectional units (Driscoll & Kraay, 1998). If so, it can be removed from the error term by including year dummies. When limiting the regressions to SSA, the common shocks might be adequately captured by the regional variable or a dominant set of "neighbours".

In summary, our coefficient estimate is only reliable if our model of spatial dependence and/or the inclusion of year-specific time dummies can remove enough of this common correlation from the error terms such that v_{it} and ω_{it} are IID. We conduct a Pesaran (2004) test of cross-sectional dependence for this purpose. Without leaning on this test too heavily, we take absence of significant cross-sectional dependence as supportive of an adequate specification of spatial effects.

A consistent estimate of β does not necessarily mean it can be interpreted as a genuine spillover from the neighbourhood to country i; it can be a shock common to the neighbourhood (Temple, 1999; Easterly & Levine, 1997; Manski, 1993). Identifying how much of ρ^N is attributable to genuine spillovers as opposed to common shocks is a fundamental difficulty which to our knowledge has not been satisfactorily resolved. Moreno & Trehan (1997) do an indirect study by comparing information criteria in specifications with neighbours' GDP against those with neighbours' error terms. One can use methods of unobserved components on a limited number of countries and with higher frequency data to conduct a plausible decomposition into shocks and spillovers.[6] Nonetheless, it is arguable that the kinds of shocks driving some country groupings differ from those of others. Thus, it is in some cases likely that any observed correlations are genuine spillovers. One example of this is neighbourhood effects involving resource-rich countries, because they are likely to face shocks in the form of commodity prices, which should have no direct effects on their neighbours.

[5] See Hoechle (2007) for a discussion of the issue as well as implementation of the remedies suggested by Driscoll & Kraay (1998).

[6] Monfort, Renne, Rueffer & Vitale (2003) use Kalman filter techniques on G7 business cycle data.

4 Data

Moreno & Trehan (1997) estimate a single cross section using data from 1965 to 1989 for 93 countries. Easterly & Levine (1997) pool average growth rates over the 1960s 1970s and 1980s. Arora & Vamvakidis (2005) use a panel of 5-year growth periods between 1960 and 1999 or between 1980 and 1999 for work on the effects of the USA on world growth and of South Africa on SSA growth.

Our core sample consists of up to 75 countries for the years 1980 to 2004.[7] This relatively new data can capture South Africa's increased post-isolation growth and part of the rise in commodity prices, especially the oil price. Amongst our African sample, we have nineteen countries in most years while the minimum number is sixteen in 1980. In 2004, the GDP captured by these countries amounted to 96% of the figure reported for sub-Saharan Africa in the WDI. We use Collier & Goderis (2007b) to identify thirteen countries rich in non-agricultural commodities, of which five are oil exporters.[8] As explained in section 2, these thirteen (five) countries are used to construct resource-rich (oil-rich) neighbourhoods.

In our sample of nineteen SSA countries, we have South Africa, Nigeria plus eight other resource-rich countries and nine others. Figure 2 shows the proportions of SSA's GDP contributed by South Africa, Nigeria, the thirteen resource-rich countries excluding Nigeria and the remaining countries. It shows South Africa's GDP is 39% of SSA GDP while the resource-exporters account for a further third. Together with Table A, these figures suggest and feedback effects should be too small to affect our estimates. Selected summary statistics for the whole sample are presented in Table B.

We take two measures of bilateral distance from CEPII. One measure is the distance between the capital cities of two countries and the other emasure is a weighted distance based on numerous major cities within each country.[9] Data on which countries are bordered with which is also from CEPII. This was used to construct the neighbourhoods. We discuss up to six neighbourhood definitions. All countries within a 1500km radius (using weighted or unweighted distance, denoted *Ring1500W* and *Ring1500*); all countries within a 1000km radius (using weighted or unweighted distance, denoted *Ring1000W* and *Ring1000*); countries with which country i shares a border (*Border1*); countries with which bordering countries share a border, excluding those with which country i shares a border (*Border2*). We include the border definitions together in one specification.

We construct regions based on the countries in our sample. For example, our SSA region consists of all the SSA countries in our sample, excluding country i and in some cases the countries in country $i's$ neighbourhood. It is not the aggregate figure available from existing sources. Similarly, our measures of the globe are constructed manually based on the countries in the sample. When the region includes the neighbourhood (Ω_{it}^{RN}), this is referred to as *Region* in

[7] A wider sample of 134 countries was also used but not all have data going back to 1980 - much of it starting only in 1990. Many did not have commodity price data and/or other controls. Our results are nonetheless robust to use of the wider sample. The majority of the omitted countries are former communist countries in Europe and Asia. A moderate number of countries omitted from the 75 are in Africa.

[8] Equatorial Guinea is not included by us. South Africa is not part of their list. Their basis for identification is exports as a percentage of GDP, not total exports.

[9] Data accessed from http://www.cepii.fr/anglaisgraph/bdd/distances.htm
The weighted distance measure used is distw.

the regression output. When it excludes the neighbourhood (Ω_{it}^{N}), it is referred to as *Regionnet*. The same applies to global definitions including the region (*World*) and excluding the region (*Worldnet*).

GDP (in constant 2000 US Dollars) and population data are from the World Development Indicators (April 2007 edition) and used to calculate aggregate GDP per capita for each country's neighbourhood for each year. A number of control variables are sourced from the WDI. We also make use of non-agricultural commodity price data constructed and used by Collier & Goderis (2007a). One distinct advantage of this data is that it has been constructed to be country specific according to the relative importance of each commodity in that country.

Missing observations can be problematic because neighbourhood GDP would rise or fall merely because one country in the neighbourhood has a missing value. Setting a neighbourhood value to missing if one country is missing is unsatisfactory because this method can result in many omitted observations. Our approach is to keep all observations but to construct region specific dummies for that period.

5 Results

We begin with an analysis of the entire sample, where we find evidence of small but significant neighbourhood effects over and above those for the rest of the region. We also find evidence that the size of the net neighbourhood effect varies by region. In SSA, the neighbourhood effect is small but the regional effect is large. Focussing on SSA, we offer opportunities to South Africa, Nigeria, the resource-exporters and the subset consisting of oil-exporters to explain the regional effect.

5.1 World-wide results

5.1.1 Gross and net neighbourhood effects

Table 1 provides an indication of the relative strengths of regional, neighbourhood and global effects, where the neighbourhood is all countries within a weighted distance of 1000km. Column 1 allows only for neighbourhood effects, which are highly significant. In column 2, where we include measures for the rest of the region and the globe (cf equation (5)), we see that ρ_N, ρ_R, and ρ_G are significant, which means all three weight matrices should have non-zero weights. Thus, events in countries in close proximity, the rest of the continent, and the rest of the globe are all related to those in country i.

Column 3 is the specification that models the net effects of the neighbourhood over and above the rest of the region (cf equation (6)). It means the relationship between two countries is higher if they are in the same neighbourhood rather than merely in the same region. Similarly, the significant regional coefficient means the correlation is higher for two countries in the same region than for any two countries across the globe.

These are net effects. To capture the gross effects, we would sum the relevant coefficients. If there was a 1% rise in the world's GDP per capita, which was evenly spread across the globe, the effect would be given by the sum of the three coefficients: a rise in GDP per capita of 0.577%. If that 1% rise in world GDP was somehow to exclude the region and neighbourhood (ie the rest of the world grew faster than 1% but the overall rise was still 1%), then the effect would be given by a coefficient of only 0.179. Were it to be everywhere excluding the neighbourhood, the relevant effect would be 0.495.

Column 4 does not allow for country-specific trends; it uses OLS rather than the within groups estimator. This allows for possible upward "bias" caused by correlations between countries' trends in GDP. Comparison with column 3 suggests there is some correlation in regional trends in GDP, a correlation that we are neglecting by using the within-groups estimator. However, the neighbourhood effect is virtually unmoved - in fact it is slightly lower in column 4. The world coefficient is no longer significant.

The within group estimates in columns 1-3 have been tested for cross-sectional dependence. The tests are significant, suggesting that the extent of cross-sectional dependence is not fully captured by this model, which may produce upward bias and efficiency losses. Also, it is hard to distinguish the world GDP coefficient from general global events affecting all countries.

We therefore use time specific dummies to account for some of the cross sectional correlation and remove common global shocks (column 5). In this specification, we still interpret the regional coefficient as a net effect over and above any (unidentified) world coefficient. The Pesaran test is insignificant, which suggests much of the cross-sectional dependence is common to all countries and adequately accounted for by the time dummies. This reduces the neighbourhood coefficient slightly, but has quite a big effect on the regional coefficient. Over and above an (unidentified) world coefficient, the combined region and neighbourhood effect is between 0.2 and 0.25 in the restricted sample. Our main conclusion that there are small but significant neighbourhood effects over and above those elsewhere still holds.

Behar (2008) presents more results based on alternative neighbourhood definitions and a wider sample of countries, with the message that there are small net neighbourhood effects. Close neighbours appear to be more important, but not by much.

5.1.2 Differences across regions

Estimating a single spillover coefficient for many countries could mask large regional disparities. We therefore investigate neighbourhood effects for five regions, namely the Americas, Asia, Europe, Middle East & North Africa and SSA. Table 2 contains a representative set of regressions, using the 1000km ring as the neighbourhood measure. Tests of cross-sectional dependence are significant without the use of time dummies.

The Americas have very large neighbourhood effects while Asia and Africa have small but significant neighbourhood effects. Behar (2008) reports results based on the border definition, which we mention here because Asia has a large positive coefficient for the first border.[10] All other effects are again robust to neighbourhood definition. Europe and Africa have large regional effects. For Europe, this is arguably because the region as a whole is so integrated that being closer is not important - distance or the number of borders does not matter because there are no hurdles. For Africa, the opposite explanation may apply: close countries are not necessarily more important because there are still high physical and political barriers between them. Thus,

[10] The reason for the distinction is that, on the border deifnition, China is the neighbour of many countries. Defined according to distance, China is not.

it remains to be determined whether particular countries or groups of countries not necessarily "near by" are influential.

5.2 Africa results

5.2.1 Close neighbours

Table 3 provides a comprehensive analysis of neighbourhood effects using a variety of neighbourhood definitions. Without controlling for regional or global effects, it shows that there is a robust significant neighbourhood effect, but it is generally small. Columns 1-5 allow for country-specific growth rates (GDP trends) under a variety of neighbourhood definitions. For example, column 2 shows a 1% point rise in GDP per capita in neighbours within a 1000km radius is associated with a 0.0563% point rise in country i's GDP per capita, with a significance level of 1%. Note that the coefficients within a 1500km radius are bigger than for those within a 1000km radius. *If* all countries in the 1500km neighbourhood are equally influential, then one would expect the coefficients in columns 4 & 5 to be roughly double those in columns 2 & 3 because the area (and hence GDP) would be about 2.25 times the size. The fact the coefficients are more than double the size is indicative of some countries further afield being more influential. In column 1, the Border2 coefficient exceeds the Border1 coefficient, which supports this view. Note the tests for cross-section dependence are all highly significant. This suggests the coefficients may be overestimated and that we have not adequately controlled for sources of cross-country dependence.

By controlling for country-specific growth rates, we have not allowed for correlations between these fixed effects and those of their neighbours, which means we may be ignoring the relationship between their trends. OLS[11] results in columns 5-10 show the coefficients do not rise relative to those with fixed effects. For example, column 7 has a coefficient of 0.0436 while that for column 2 is 0.0563. There is thus no overwhelming evidence that we are underestimating neighbourhood effects by focusing on deviations from the trend.

We proceed to interrogate our findings that there are small net neighbourhood effects and that regional effects tend to dominate. In Table 4, column 2 reproduces our result from column 5 of Table 2: A 1% point rise in regional GDP per capita contributes a 0.568% point rise to country i's GDP per capita. The coefficient of 0.0342 means the effect is bigger if part of that regional rise takes place within a 1000km radius - there are net neighbourhood effects - so the gross effect of an evenly spread rise in regional GDP of 1% is 0.602%. The rest of the table serves to confirm the results are robust to neighbourhood definition. Columns 6-10 omit trends but include a number of correlates often included in growth regressions. We also note that the Pesaran tests are now insignificant.

Thus, while we find some net neighbourhood effects, these are not overwhelmingly large. The fortunes of a particular country seem to be more closely tied to the region as a whole or to some groupings of countries who are not necessarily close by. The next subsection proceeds to investigate who those groupings might be.

[11] Recall that, as for all specifications, we allow for country specific fixed effects in the level of GDP by estimating in first differences.

5.2.2 South Africa and Nigeria

We define the "neighbourhood" for each country as South Africa and/or Nigeria. In other words, we include their change in log GDP per capita on the right hand side of the regressions.[12] Table 5, column 1 shows a significant correlation between growth in South Africa and in other SSA countries, while column 2 contains an insignificant one for Nigeria. Column 3 allows for separate effects from the rest of the region (excluding South Africa and Nigeria) and the rest of the world - *cf* equation (5). In line with previous results, the rest of the world is not important. Furthermore, a role for the rest of the continent remains. These results are consistent with those in Arora & Vamvakidis (2005).

Our main finding is that presented in column 4, which estimates net neighbourhood effects using equation (6). The insignificant coefficients of close to zero in the first two rows suggests that South Africa (and Nigeria) produce no neighbourhood effects over and above those for the rest of the continent. Clearly, South Africa is important because of its sheer size, but it does not appear to have a special influence.

5.3 Resource-rich countries

We have seen South Africa (and Nigeria) do not unseat the region as a whole, but Table 6 shows the resource-rich countries do. Glancing across the first row indicates a 1% point rise in the GDP per capita in resource-rich countries (including Nigeria) leads to a statistically significant rise in the other[13] countries' GDP per capita of about 0.36% points. This coefficient is robust to a variety of specifications. We also report that the resource-rich countries appear to produce insignificant cross-section dependence, even if included on their own. Column 1 has resource-rich countries alone, column 2 shows South Africa appears to have no role, while columns 3 and 4 assign no role to the rest of the continent or the wider world either.

Columns 5-10 simultaneously include close neighbours and the resource-rich countries. There is overlap - some but not all countries next door are resource rich - so the coefficients should not necessarily be interpreted as in equation (6). The results indicate that the close neighbours have an even smaller effect than in previous tables. Tellingly, there is a stark difference between the coefficients for the resource-rich and for the close neighbours. Although the resource-rich contribute a large proportion to GDP in SSA, we recall from Figure 2 that it is not an overwhelming contribution (33%).

We now turn to a sub-set of the resource-rich countries, namely the big oil exporters. Not controlling for other effects, column 1 of Table 7 shows a large correlation with the GDP per capita of oil exporters. Unlike for the resource-rich countries, we see both the oil exporters and the rest of the region (which includes other commodity exporters) are significant in column 2. This means both produce neighbourhood effects, which is not surprising given our earlier results for the resource-rich. Column 3 is thus used to see whether there are net effects from the oil exporters over and above the rest of the region. The significant coefficient of 0.25 suggests there are neighbourhood effects attributable to the oil exporters over and above those attributable to

[12] We also used distance weighted measures of these: for each country, South Africa or Nigeria's change in GDP per capita was weighted by bilateral distance. This does not change the findings.

[13] South Africa is included in this list but our results are robust to its exclusion.

being in SSA as a whole. If a 1% rise in African GDP (per capita) is sourced in those countries who do not export oil, the typical African country would grow by an additional 0.362% that period. If that 1% rise includes oil exporters, the typical African country would grow by an additional 0.362+0.25= 0.612%. In other words, while they do not account for the regional effect completely, the oil exporters are particularly important for the rest of the continent. Column 4 has a variable for the resource-rich countries and for the subset of oil exporters. The high colinearity between the two variables is a likely reason why they are not individually significant yet jointly significant at 1%. Thus, while oil exporters seem to be particularly influential, they do not drive the resource-rich result.

6 Summary and discussion of results

Our data suggests the economic performances of closer countries - those with which country i shares a border or those within a given distance - are more related than those of the broader region or the rest of the world: we find significant net neighbourhood effects. However, the size of these effects varies across the world. In SSA, these net effects are not large, and the continent as a whole is more influential. The rest of the world is not significant for a country in sub-Saharan Africa.

South Africa forms part of the sub-Saharan regional effect but does not explain it completely. In other words, the neighbourhood effect is by virtue of South Africa's size, not necessarily some special sphere of influence. Regardless of the reason, if these effects are genuine spillovers, policies that lead to improved growth trajectories in that country could have big benefits for the rest of the continent.

We discovered that the resource-rich countries in Africa, especially the oil exporters, exude strong effects over and above the rest of the region. A 1% point rise in their GDP per capita leads to a 0.36% point rise in GDP per capita elsewhere on the continent. In fact, natural resource exporters dominate the region effect, virtually removing any role for South Africa, close neighbours or the region as whole.

Using world-wide data, Collier & Goderis (2007) find the short run windfall from a commodity boom is positive while the long-run effect on GDP is negative. In a very simple alternative specification,[14] we briefly investigate the effects of commodity prices. In Table 8, we find a rise in commodity prices has a positive effect on GDP per capita for the commodity exporters in SSA but has no significant effect on the rest of the SSA sample. Thus, a fair proportion of the shocks affecting the resource-rich - namely commodity prices - do not directly affect the other countries. Therefore some of these measured neighbourhood effects are arguably genuine spillovers from resource-rich countries to the rest of the continent.

What makes the resource-rich so special? A lot of GDP changes in Africa are at or near the subsistence level and are unlikely to involve major changes in spending patterns or movements of money/goods beyond isolated spheres, let alone across borders. However, the windfalls generated by a resource discovery or commodity boom invoke large sums of money, substantial mobilization of resources and restructuring in the economy. These changes are often more than

[14] Our sample size does not permit a meaningful and reliable dynamic specification.

an individual country can contain. The potential linkages associated with natural resources may exhaust domestic capacity constraints and thus have ripple effects for other countries.

Whatever the reasons, our results imply that commodity prices affect not just those who have commodities, but those countries on the rest of the continent via cross country spillovers. Being able to undo any adverse effects of a potential resource curse - indeed the ability to maximise the benefits from high commodity prices - is important not just for the resource-rich countries themselves, but for the continent as a whole.

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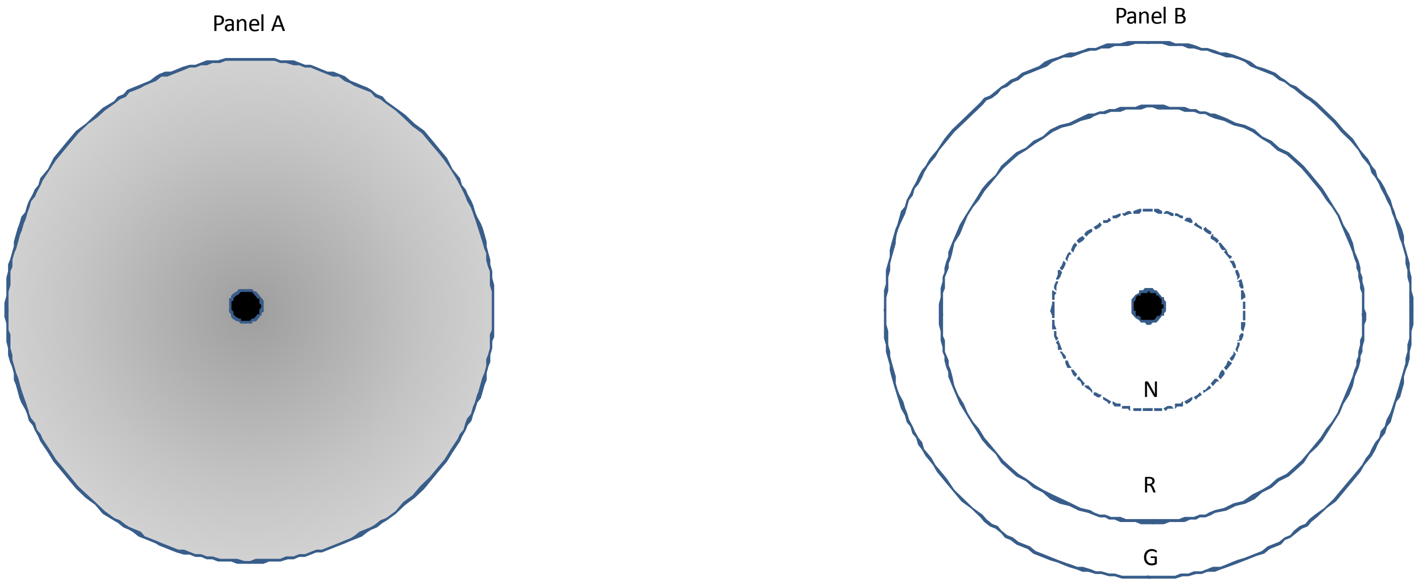

Figure 1: Spatial model with approximately continuous lags. The dot represents the country while the big circle is the globe. In Panel A, the concentric circles represent increasingly distant other countries in the world. In Panel B, the dashed circle encloses the neighbourhood N. The middle circle encloses the broader region, with the region excluding the neighbourhood denoted by R. The remaining section labeled G is the rest of the globe.

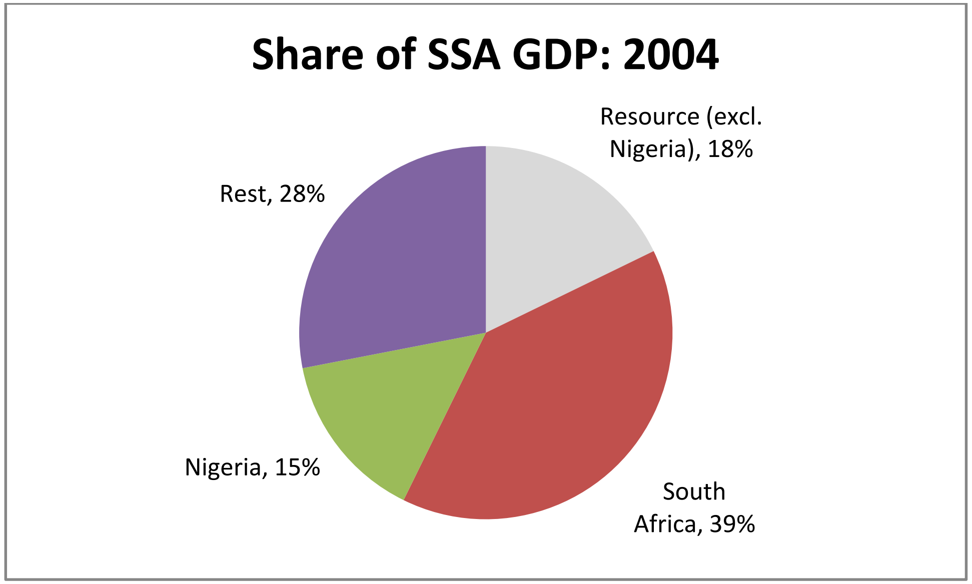

Figure 2: South Africa has a dominant share of sub-Saharan African GDP (measured in 2000 US Dollars). The resource rich countries including Nigeria (33%) and the other countries (28%) roughly share the remainder of GDP.

	Ratio of GDP in Country to Neighbourhood					
	Border1	Border2	Ring1000	RIng1000W	Ring1500	Ring1500W
p25	0.06	0.05	0.06	0.05	0.03	0.03
p50	0.2	0.12	0.19	0.2	0.09	0.09
p75	0.62	0.47	0.76	0.6	0.3	0.23
N	1871	1771	1740	1567	1869	1792

Table A: Countries are generally small relative to their neighbourhoods, as measured by GDP.

	GDP (Constant 2000 USD)	population	Per Capita growth rate per annum
p25	7.37E+09	5301000	-0.006
p50	3.91E+10	1.06E+07	0.018
p75	1.40E+11	3.69E+07	0.035
N	1871	1875	1796

Table B: Selected Summary Statistics for the global cross section

	-1	-2	-3	-4	-5
	GDP	GDP	GDP	GDP	GDP
Ring1000W	0.111***	0.106***	0.0817***	0.0781***	0.0683***
Regionnet		0.136***			
Worldnet		0.216***			
Region			0.316***	0.426***	0.189**
World			0.179*	0.0761	
_cons	0.0104***	0.00453**	0.00367**	0.00387**	-0.00504
N	1390	1323	1390	1390	1390
Gross effect	n/a	n/a	0.577	0.58	n/a
Fixed effects?	Y	Y	Y	N	Y
Time dummies?	N	N	N	N	Y
Pesaran test	11.817***	3.845***	1.817*	n/a	-1.87

Table 1: There is evidence of neighbourhood effects and that these exist over and above regional effects. * p<0.10 ** p<0.05 *** p<0.01

	-1	-2	-3	-4	-5
	Americas	Asia	Europe	MENA	SSA
Ring1000	0.306***	0.0342**	-0.00268	0.192	0.0342*
Region	0.430**	0.154	0.528*	0.117	0.568***
World	-0.083	0.144	0.236	0.0327	0.0561
_cons	-0.00033	0.0237***	0.00563	0.00839	0.000699
Pesaran Test	0.588	2.035	1.343	-1.821	-1.257
N	312	193	435	196	410
GROWTH FE?	Y	Y	Y	Y	Y

Table 2: The size and significance of neighbourhood and regional effects varies by region. * p<0.10 ** p<0.05 *** p<0.01

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	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP
Border1	0.0654**					0.0342				
Border2	0.154***					0.127***				
Ring1000		0.0563***					0.0436**			
Ring1000W			0.0298*					0.0224		
Ring1500				0.145***					0.102***	
Ring1500W					0.137***					0.105***
_cons	0.00109	0.00144	0.0016	0.00112	0.00162	0.00125	0.00151	0.00162	0.0013	0.00164
N	410	410	387	410	410	410	410	387	410	410
GROWTH FE?	Y	Y	Y	Y	Y	N	N	N	N	N
Pesaran test	2.499**	5.237***	5.276***	3.704***	3.782***	n/a	n/a	n/a	n/a	n/a

Table 3: Comparing neighbourhood effects for Africa by neighbourhood definition shows the results are robust to definition and to use of OLS. * p<0.10 ** p<0.05 *** p<0.01

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP
Region	0.489***	0.568***	0.554***	0.521***	0.540***	0.357**	0.414***	0.436***	0.380***	0.384***
World	0.0526	0.0561	0.108	0.0612	0.0604	0.218	0.224	0.238	0.223	0.227
Border1	0.0251					0.0305				
Border2	0.0800*					0.0557				
Ring1000		0.0342**					0.0368**			
Ring1000W			0.0093					0.0126		
Ring1500				0.0769**					0.0664**	
Ring1500W					0.0536*					0.0591*
Deflator[1]						-8.6E-05	-5.7E-05	-5E-05	-7.3E-05	-6.9E-05
Openess[2]						0.00961	0.00891	0.00645	0.00991	0.00912
Saving[3]						0.0221***	0.0225***	0.0237***	0.0224***	0.0226***
PopTechDep[4]						-0.0146	-0.0142	-0.0146	-0.0137	-0.0144
Financial depth						-4.2E-05	-3.3E-05	-4.3E-05	-3.1E-05	-3.9E-05
_cons	0.000604	0.000699	-0.00016	0.000443	0.000746	-0.0094	-0.0073	-0.00489	-0.00712	-0.0076
N	410	410	387	410	410	379	379	365	379	379
GROWTH FE?	Y	Y	Y	Y	Y	N	N	N	N	N
Pesaran test	-1.27	-1.257	-0.869	-1.201	-1.198	n/a	n/a	n/a	n/a	n/a

Table 4: There are small net neighbourhood effects. Regional effects dominate for Africa, regardless of neighbourhood definition and/or the use of specifications with growth fixed effects or OLS with controls. * p<0.10 ** p<0.05 *** p<0.01. [1] GDP deflator, [2] trade:GDP ratio, [3] log(gross fixed capital formation:GDP), [4] log(population growth + 0.05), representing population growth rate and estimates of depreciation and technological progress, [5] ratio of m2 money supply to gdp.

	-1	-2	-3	-4
	GDP	GDP	GDP	GDP
South Africa	0.382***		0.246**	-0.0561
Nigeria		0.0948	0.0711	-0.00859
Regionnet			0.325**	
Worldnet			0.0458	
Region				0.713**
World				0.0174
_cons	0.00226	0.00133	-0.0002	0.00175
N	365	365	365	365
GROWTH FE?	Y	Y	Y	Y
Pesaran test	1.905*	4.024***	-1.371	-1.182

Table 5: South Africa has no net effect over and above the region as a whole. * p<0.10 ** p<0.05 *** p<0.01

	-1	-2	-3	-4	-5	-6	-7	-8	-9
	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP
Resource	0.378***	0.385***	0.357***	0.353***	0.321***	0.363***	0.367***	0.353***	0.358***
South Africa		-0.00812							
Regionnet			0.0662	0.0531					
Worldnet				0.0953					
Border1					0.0328				
Border2					0.0479				
Ring1000						0.0252*			
Ring1000W							0.0172		
Ring1500								0.0423	
Ring1500W									0.0366
_cons	0.00649***	0.00745***	0.00658***	0.00471	0.00613***	0.00629***	0.00631***	0.00619***	0.00639***
N	219	196	219	219	219	219	219	219	219
GROWTH FE?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pesaran test	-0.836	-0.855	-1.161	-1.149	-1.047	-0.872	-0.828	-0.885	-0.921

Table 6: The resource-rich leave have a dominant effect in Africa; South Africa, close neighbours, the rest of the region and the world contribute little extra explanatory power. * p<0.10 ** p<0.05 *** p<0.01

	-1	-2	-3	-4
	GDP	GDP	GDP	GDP
Oil	0.434***	0.361***	0.250*	0.0538~
Regionnet		0.243*		
Worldnet		-0.0475		
Region			0.362*	
World			-0.0616	
Resource				0.328~
_cons	0.00327	0.0046	0.00484	0.00747***
N	285	285	285	196
GROWTH FE?	Y	Y	Y	Y
Pesaran test	0.52	-1.006	-1.006	-0.848

Table 7: Oil rich countries exude significant neighbourhood effects but do not account for all of them. ~ Joint test p value < 0.01; * p<0.10 ** p<0.05 *** p<0.01

	-1	-2
	GDP	GDP
Resource Rich?	Y	N
Commodity Index	0.0274**	-0.00491
_cons	-0.00724**	0.00551**
N	191	219
GROWTH FE?	Y	Y
Pesaran test	3.257***	3.981***

Table 8: Commodity prices are significant for the resource-rich. * p<0.10 ** p<0.05 *** p<0.01