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Reshaping Economic Geography

BACKGROUND PAPER

NEIGHBORHOOD GROWTH EFFECTS: AN ANNUAL PANEL DATA APPROACH

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Neighbourhood growth effects: an annual panel data approach

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Contents

1 Introduction

In Uganda, tourism numbers are expected to drop 30% and coffee exporters are being forced to delay their shipments because of the election-related instability in Kenya.[1] As a landlocked country, Uganda ships many of its exports via Kenya, while Kenya is the final destination for almost 10% of Ugandan exports (Uganda Export Promotion Board , 2008). The events in Kenya are likely to affect its own growth, but also that of Uganda. These effects of Kenya on Uganda are a topical example of neighbourhood spillover effects, which many researchers have tried to quantify.

Easterly & Levine (1997) use world-wide pooled data to investigate the correlation between countries and those on their borders. They argue much of sub-Saharan 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 neighbourhood spillovers and shared neighbourhood effects. The first paragraph describes examples of a causal spillover, as would worries of a fall in German demand for Spanish exports. However, the simultaneous effects of monetary contraction across the Euro zone or booming commodity prices affecting neighbours with similar commodities would be a common neighbourhood shock.

Cross-country dependence can be extended beyond immediate neighbours. Arora & Vamvakidis (2005) use a panel 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. They also find evidence consistent with neighbourhood spillovers.[2]

We also investigate neighbourhood effects but extend the literature in a number of ways. The work we present here 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, where the neighbourhood is only countries that are sufficiently "close" to the country in question.

[1] Independent on-line (2008); Dow Jones News Wire (2008).

[2] Koch (2005) and Fingleton & Lopez-Baso (2006) offer a more structural and theoretically-founded approach to modelling interactions, which naturally lends itself to estimation using spatial econometrics.

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 shocks, which would not present themselves in a cross-section or in panels of five- or ten-year growth intervals.

The layout of this paper is as follows. First, we build our static model with spatial effects, showing how to test for net neighbourhood effects. We also introduce a number of neighbourhood concepts, which are based on borders and distance measures. We discuss some of the empirical issues encountered by this work before stating the assumptions and empirical strategy. We review some of the potential channels hypothesised for spillovers to occur and an empirical approach to investigating some of these channels.

We have a number of results, but we caution that, like other work in this field, we cannot conclusively state that these are spillovers rather than common neighbourhood shocks. However, we have some indirect evidence that some of it is genuine spillovers for a subset of our results.

There are small but significant net neighbourhood effects over and above regional and broader global trends. We also find evidence of regional disparities in these coefficients: Asia and the Americas have big neighbourhood effects. Europe and Africa have small or no neighbourhood effects but large regional effects. Bilateral exports and domestic investment appear to be a channel for spillovers, be they neighbourhood effects for the whole sample, the Americas or Asia, or regional effects in Europe. For Africa, it appears the resource-rich countries, especially those rich in oil, are very influencial on the continent. South Africa exudes a strong regional effect, but this is by virtue of its size: it does not have an effect over and above the rest of the continent.

We also have evidence of large asymmetries in neighbourhood effects. It appears that falls in neighbourhood per capita GDP are more correlated than rises.

The paper concludes with a summary and discussion of the implications of some of the results.

2 A static model with spatial effects

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

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

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[3] 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 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.

Our approach is described in Figure 2, where we have three discrete rings surrounding country i. The biggest circle represents the whole world. The 2nd biggest represents a region, like sub-Saharan Africa. The smallest circle represents the neighbourhood. The neighbourhood 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 a subset of R, for example commodity exporters in the region, but for the moment we proceed with the proximity interpretations. Sometimes, the neighbourhood is not in the region, as is the case for many European countries. An example of this is given in Figure 3. Most of the ensuing discussing ignores this possibility for convenience.

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

[3] Both f and g are likely to capture time invariant features of a country's neighbourhood that may be conducive to higher GDP or GDP growth.

follows:

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

$\lambda_N = \lambda_R = \lambda_G$ 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. Analagously, $\Omega_{it}^R = \frac{\sum_{j|j\in R}^n Y_{jt}}{\sum_{j|j\in R}^n L_j t}$ 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. With this modification, we have (with $y \equiv Y/L$):

$$\ln y_{it} = \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + \rho_N \ln \Omega_{it}^N + \rho_R \ln \Omega_{it}^R + \rho_G \ln \Omega_{it}^G \qquad (2)$$

Our specification nests those in studies by Easterly & Levine (1997) or Chua (1993), who only allow for $\rho_N \neq 0$. 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, $\rho_N = \rho_R = \rho_G \not\Rightarrow \lambda_N = \lambda_R = \lambda_G$ 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.

$\rho_N < \rho_G$ would suggest a 1% rise in global per capita GDP would have a bigger effect than a 1% rise in the neighbourhood's per capita GDP, but this would not be a surprise given their relative sizes. It would not imply $\lambda_N < \lambda_G$. More broadly, there is no straightforward mapping from the ranking of the rho coefficients to that of the lambda coefficients.

However, if we find the rho coefficients to be significant, we can compare the effects using an alternative specification. Defining $\Omega_{it}^{RN} = \frac{\sum_{j|j\in R\cup N}^n Y_j t}{\sum_{j|j\in R\cup N}^n L_j t}$

to be the per capita GDP of the entire region, including the neighbourhood but excluding country i, and $\Omega_{it}^{GRN} = \frac{\sum_{j \neq i}^{n} Y_j t}{\sum_{j \neq i}^{n} L_j t}$ to be the per capita GDP of the whole globe excluding country i, write:

$$\begin{aligned} \ln y_{it} &= \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + && \text{(3a)} \\ &\quad \rho^N \ln \Omega_{it}^N + \rho^R (\ln \Omega_{it}^{RN} - \ln \Omega_{it}^N) + \rho^G (\ln \Omega_{it}^{GRN} - \ln \Omega_{it}^{RN}) \\ &= \boldsymbol{\gamma}\mathbf{X}_{it} + f_i + g_i * t + && \text{(3b)} \\ &\quad (\rho^N - \rho^R) \ln \Omega_{it}^N + (\rho^R - \rho^G) \ln \Omega_{it}^{RN} + \rho^G \ln \Omega_{it}^{GRN} \end{aligned}$$

$\rho^N = \rho^R = \rho^G$ 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 $\ln \Omega_{it}^N$ in equation (3b) would therefore be evidence of neighbourhood effects outweighing broader regional effects: closer neighbours would matter more.

3 Empirical estimation

We have a panel of up to 25 years and up to 134 countries. Estimation is subject to potential problems of non-stationarity, which may lead to spurious correlations in the relationships of interest. Whether the data are integrated of order one or merely trend-stationary, differencing removes this source of spurious correlation. Furthermore, Wooldridge (2002) suggests that using a first difference estimator rather than a within groups estimator is a preferable form for acounting for fixed effects in the level of GDP (cf f_i) when the data exhibit autocorrelation. In addition, within group estimators are in most cases applied to the first-differenced specification to account for country-specific trends in GDP (cf g_i). Thus, the estimating equation for equation (2) is

$$\Delta \ln y_{it} = \boldsymbol{\gamma}\boldsymbol{\Delta}\mathbf{X}_{it} + \rho_N \Delta \ln \Omega_{it}^N + \rho_R \Delta \ln \Omega_{it}^R + \rho_G \Delta \ln \Omega_{it}^G + g_i + v_{it}, \quad (4)$$

while that for (3b) is

$$\Delta \ln y_{it} = \boldsymbol{\gamma}\boldsymbol{\Delta}\mathbf{X}_{it} + \beta_N \Delta \ln \Omega_{it}^N + \beta_R \Delta \ln \Omega_{it}^{RN} + \beta_G \Delta \ln \Omega_{it}^{GRN} + g_i + \omega_{it} \quad (5)$$

We note that this single equation framework effectively assumes that feedback effects are sufficiently small to be ignored, so we are not allowing for genuine spillovers to go from country i to the rest of the neighbourhood. To see this, consider a specification with neighbourhood and trend only, where we can think of country i as before and the neighbourhood as its only large neighbouring country j, such that we are assuming:

$$\Delta \ln y_{it} = \beta \Delta \ln y_{jt} + g_i + e_{it} \tag{6a}$$

$$\Delta \ln y_{jt} = g_j + e_{jt} \tag{6b}$$

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.[4]

A significant positive coefficient on β_N denotes neighbourhood effects over and above those for the broader region. In our specifications, 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 focus is on static specifications.[5] Furthermore, we do not report results including other "explanatory variables" as we are not trying to explain growth. In an annual context, many such variables are very slow moving, so we capture much of this using fixed effects (f_i or g_i) anyway. Furthermore, the potential of endogeneity of such variables has not convincingly

[4] Our results are robust to specifications where we omit those countries that are large relative to their neighbourhoods.

[5] 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 for growth regressions. This is likely to be subject to what are now well known problems associated with parameter heterogeneity in non-stationary panels (Pesaran & Smith, 1995).

been dealt with, and we would lose many observations.[6]

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

If part of the dependence comes in the form of neighbourhood, regional or world correlations in GDP, which is the essence of what we are trying to investigate, this correlation should be reduced by including terms in other countries' GDP, as we do. However, any remaining cross-sectional dependence can bias the coefficient upwards. To see this in the context of equation (6), 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 (6a) is:

$$(\Delta \ln y_{it} - \Delta \ln y_i) = \beta (\Delta \ln y_{jt} - \Delta \ln y_j) + (\alpha e_{jt} + u_{it}) \qquad (7)$$

$\Delta \ln y_i$ is the mean value of $\Delta \ln y_{it}$. This clearly results in a positive correlation between the error term and regressor. Furthermore, by construction, the neighbourhoods will be similar for many countries, resulting in more cross-section dependence across the panel and further loss of efficiency. This applies analagously to the regional variables. The problem can be mitigated if most of the remaining dependence is common to all cross-sectional units (Driscoll & Kraay, 1998) in the form of world shocks. These can adequately be captured and removed from the error term by replacing the globe variable with year dummies.

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.

[6] Our results are however robust to the inclusion of such variables.

4 Investigating sources of neighbourhood effects

A consistent estimate of β does not 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; Moreno & Trehan, 1997). (This point is different from the bias-inducing cross-sectional dependence issue discussed earlier.) 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. This issue is discussed as the "reflection problem" in a different context in Manski (1993). 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.[7]

Nonetheless, the realization of scale economies, markets for exports, sources of inputs, technological diffusion through trade or proximity, remittance income, investment, migration and knowledge flows are candidate channels for causal spillovers (Moreno & Trehan, 1997; Arora & Vamvakidis, 2005). Arora & Vamvakides (2005b) find significant correlations between the growth rates of countries and those of their trading partners, attributing part of the effect to longer term technology transfer as a convergence mechanism.

Manners & Behar (2008) contains a brief discussion of trade and investment spillovers. Alva & Behar (2008) discuss the role of regional integration agreements in Africa in promoting trade and other linkages. Nelson & Behar (2008) includes an introductory discussion of how natural resources can lead to cross-border spatial development initiatives. Easterly & Levine (1997) and Ades & Chua (1997) investigate the possibility of indirect spillovers via neighbourhood stability effects rather than directly through GDP.

We examine two potential sources of spillovers - trade and investment - by investigating the effect on the neighbourhood or regional coefficients of including measures of these two variables in $\boldsymbol{\gamma}\mathbf{X}_{it}$ in the regression. If these components of GDP are channels, then including such variables should reduce the coefficient given by ρ^N. In addition, if features of country i, for

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

example its trade openness, affect w_{ij}, then it would be appropriate to allow for this through separate regressions for subgroupings.

If the neighbourhood correlation is in part through the external effects of policies other than though GDP, then the policies in the neighbourhood should have an effect of y_i even after controlling for neighbourhood GDP per capita. This can be tested for by conducting 2SLS and testing for overidentifying restrictions / instrument exogeneity. Rejection of instrument exogeneity would be consistent with neighbourhood externalities. This approach was followed by Easterly & Levine (1997).[8]

5 Data

Moreno & Trehan (1997) estimate a single cross section using data from 1965 to 1989 for 93 countries. Ades & Chua (1997) construct a regional stability index for use in a single cross section between 1960 and 1985. Easterly & Levine (1997) pool average growth rates over the 1960s 1970s and 1980s. Arora & Vamvakidis (2004, 2005, 2005b) use a panel of 5-year growth periods between 1960 and 1999 or between 1980 and 1999 for papers on the effects of the USA on world growth and of South Africa on sub-Saharan African growth.

The focus of work we present here is on results from annual data, although we will briefly present some cross-sectional results. We take measures of bilateral distance from CEPII. We have two measures of distance. One is the distance between the capital cities of two countries, and the other 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. A) All countries within a 1500km radius (using weighted or unweighted distance); B) All countries within a 1000km radius (using weighted or unweighted distance); C) Countries with which it shares a bor-

[8] We followed a similar approach and, like Easterly & Levine, found evidence consistent with the view that the effects operate directly through GDP. Our instruments included country-specific commodity price indices sources from Collier & Goderis (2007). We are however not yet confident in the reliability of the results. This is in part because we have not established the validity of two-step methods in the presence of potentially large cross-section dependence.

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

der (the first ring); D) Countries with which bordering countries share a border, excluding those in (C) (the second ring). We usually include C and D together.

We construct regions based on the countries in our sample. For example, our sub-Saharan Africa region consists of all the sub-Saharan African 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.

GDP (in constant 2000 US Dollars) and population data are from the World Development Indicators and used to calculate aggregate GDP per capita for each country's neighbourhood for each year. Indicators of trade openess (the ratio of exports plus imports to GDP), gross fixed capital formation and secondary school enrolment (used for the cross-section) were also sourced from the WDI. We obtain bilateral trade data from the IMF's Direction of Trade statistics, using each neighbour's CIF imports measure to construct the neighbouhood's imports from the country, which we interpret as the country's exports to the neighbourhood.

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. We have followed two approaches to dealing with this problem. One approach is to set the neighbourhood variable to missing if a country in that neighbourhood is missing in one time period when it was not missing in the period before. Given most of our estimation is in differences, this would be satisfactory. Another approach is to keep all observations but to construct region specific dummies for that period rather than dropping the observation. After performing many exercises with both definitions, we have opted to present results for the latter approach because the results are more robust and consistent, although they are similar to those for the former definition.

We will present results based on two sets of samples. Our fuller sample contains up to 134 countries for the years 1980 to 2005, generally excluding island economies and others not considered to have neighbours: notable omissions are Japan and Australia. We also have a restricted sample, consisting of up to 75 countries for the years 1980 to 2004. The sample is retricted mainly because many of the 134 countries do not have data going back to 1980 - much of it starting only in 1990. The majority of these countries are former communist countries in Europe and Asia. A moderate number of countries omitted from the 75 are in Africa. In regressions, we have followed customary practice by omitting the 1st and 99th percentiles of observations (for the restricted sample) and or the 5th and 95th percentiles of observations (full sample).

The trade data also contains a number of missing observations, presenting issues similar to those for GDP. Even if the numbers are reported, bilateral trade data can be of poor quality and cause implausible annual variations. We feel the errors are reduced somewhat by the use of neighbourhood imports rather than individual countries. We omit the 10th and 90th percentiles of observations for neighbourhood imports as a further mitigation mechanism, but suggest the results based on this data be used for indicative purposes only.

Selected summary statistics are presented in Table B.

6 Results

6.1 Cross-sectional results

Our point of departure is a comparison with the cross-sectional results of Moreno & Trehan (1997), who as discussed in the theory section estimate the distance-weighted effects of other countries' growth in output per worker on each country. They estimate a single cross section using the change in the log of per capita GDP between 1965 and 1989. Table 1 presents our cross-sectional results using data between 1984 and 2004. The first column presents a highly significant border coefficient of 0.29. This means that a country whose neighbours grew 1% faster than the average per year grew approximately 0.29% faster each year. The most relevant point of comparison is with the coefficient for "gross" spillovers in Table 2 of Moreno & Trehan, which implies a border coefficient of about 0.15.[10]

Our higher coefficient suggests that the neighbourhood or border effects may have risen in recent time periods, which would be consistent with the

[10] Their coefficient of 0.83 should be multiplied by the average weighting for a bordering country of 0.18 (pg 404).

view that the world is becoming more integrated. It may also reflect the fact that OLS estimates will be biased upwards due to feedback effects relative to the Maximum Likelyhood methods used by Moreno & Trehan, although we have argued that such feedback effects should be small.

The second column of Table 1 includes broader regional effects. These are highly significant, but they knock out the bordering countries. This contradicts the suggestion that the long term growth of your close neighbours matters more than that of the more distant neighbours, which is assumed in the construction of a distance-weighted matrix. Columns 4 and 5 show that including control variables, which may be possible channels for spillovers, reduces the coefficients - as found by Moreno & Trehan. Notably, the finding that regional effects knock out neighbourhood effects is robust to the choice of control variable, the sample used, and neighbourhood definitions applied.

6.2 World-wide neighbourhood and regional effects

We now turn to the results based on annual data.

6.2.1 Gross vs net neighbourhood effects (time and fixed effects)

Table 2 provides an introductory 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, net of the region and neighbourhood (cf equation (4)), we see that ρ_N, ρ_R, and ρ_G are significant, so 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. In particular, if only the neighbourhood were to grow 1% faster, this would be associated with 0.106% faster growth 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 (5)). Unlike the cross-section, we find these are still highly significant. It means the correlation in GDP per capita in 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, note 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 estimations 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 full 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 in column 5 and remove common global shocks. This can also be interpreted as a specification where the world coefficient is allowed to vary in each time period. In this specification, we still interpret the regional coefficient as a net effect over and above any (unidentified) world coefficient. This specification yields an insignificant Pesaran test, 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.

6.2.2 Robustness to neighbourhood definition and sample

Table 3a uses the same sample to test the robustness of the findings across neighbourhood effect definition. Column 5 of Table 2 is replicated in Column 3 of Table 3a. All specifications have fixed effects and time dummies and show a small but significant effect of the neighbourhood over and above regional effects. If closer countries have a stronger effect, a small neighbourhood definition should have a bigger effect, *ceteris paribus*. However, the absolute sizes of GDP will be bigger for wider neighbourhood definitions. For example, GDP in the larger ring is about twice the size of that in the smaller ring.[11] The biggest net neighbourhood effect is given in column 2, where the neighbourhood is defined as all countries within a weighted distance of 1500km; the coefficient is about twice the size of the others and the regional effect is the smallest. However, the unweighted 1500km distance coefficient is similar to the 1000km distance coefficients.

Table 3b repeats Table 3a but uses the alternative full sample, which allows for more countries, even if they have limited observations. The coefficients are not quite as consistent across definition and are generally lower and/or less significant than those for the restricted sample. We believe some of this is due to attenuation bias caused by measurement error and changes in effective sample based on neighbourhood definition.

6.2.3 Comparison and components

In Table 2, we saw that allowing for some correlation in neighbourhood trends makes a small difference to the results. This does not allow for fixed effects in the level of GDP and hence could be ignoring correlations in the levels of GDP within a neighbourhood, which would capture accumulated growth rates prior to the sample period. The cross section results in Table 1 also difference out levels effects but naturally cannot control for country specific trends in GDP. The results are not directly comparable, but it seems that the cross section results yield higher regional effects while the annual data allow for neighbourhood correlations of higher frequency. Some of these may be business cycle effects driven by components of aggregate demand, like exports or investment. We proceed to investigate whether these

[11] According to the formula for the area for a circle (πr^2, where r is the radius of the circle), the larger neighbourhood should be 2.25 times as big. This is consistent with the ratios presented in Table A.

components play a role.

In column 3 of Table 1, which contains results from the cross-section regression, we see that growth in exports to the neighbourhood or investment (gross fixed capital formation) are insignificant and do not affect the other coefficients. Cyclical changes in imports should cancel over such a long period, but there has been growth in trade over the sample period, and perhaps export-to-neighbour led growth would be a driver, but it seems not. However we note the level of investment (column 4 or 5) does reduce neighbourhood and regional effects.

In Table 4, we investigate the effects of exports and investment using the annual data, keeping the sample constant for comparability. Column 1 has no controls, while column 2 has both exports and investment. We see that the neighbourhood effect is about 20% lower with both controls, as is the region coefficient. Columns 3 and 4, which only include exports and investment respectively, suggest that more of the effect is driven by investment. While this is not intended to be an accounting exercise, the evidence suggests that some of the neighbourhood effect is through trade and some is through investment. However, we note that column 1 has higher neighbourhood and regional coefficients than column 4 of Table 3a and the differences due to these sampling changes are of the same order of magnitude as those given by including the controls. Nonetheless, this effect is consistent for a variety of neighbourhood definitions and choice of sample.

We investigate the relationship between trade openess and spatial dependence by splitting the sample quartiles according to the ratio of imports plus exports to GDP. Table 4.5 reveals an interesting pattern. The most open countries (column 4) have the biggest correlation with world GDP per capita, while the second most open (column 3) have the biggest correlation with regional GDP per capita. Open countries have no significant correlation with their neighbours. Closed countries on the other hand have no correlation with world events yet significant correlations with their neighbours. The pattern with respect to the world and region is intuitive; more open economies tend to have a larger component of aggregate demand attributable to international trade, which makes it more sensitive to global demand patterns. Part of the explanation for closed economies having large neighbourhood effects is that much intra-neighbourhood and cross-border trade is not recorded.

We investigated potential differences in neighbourhood effects using variety of country characteristics - including country size, whether or not they are landlocked and the intensity of commodity exports - without any robust interesting differences to report.

6.3 Differences across regions

Estimating a single spillover coefficient for as many as 134 countries could mask large regional disparities. We therefore investigate neighbourhood effects for five regions, namely the Americas, Asia, Europe, Middle East & North Africa and sub-Saharan Africa. Table 5 contains a representative set of regressions, again using the 1000km ring as the neighbourhood measure and the restricted sample. Tests of cross-sectional dependence suggest this specification does not require the use of time dummies to address cross-sectional dependence.

In Table 5, the Americas have very large neighbourhood effects while Asia and Africa have small but significant neighbourhood effects. Table 6 uses the border definition. We see the same pattern as in Table 5, but Asia now has a large positive coefficient for the first border. Part of the discrepancy between Tables 5 and 6 is that China is generally not included in the 1000km (or 1500km) radius of most countries, so the border definition is arguably more appropriate for Asia.

When we use the full sample (results not presented), which includes former communist countries, we see changes in the results for Asia and Europe. The Europe region effect is replaced by a world effect and the Asia (1000km) neighbourhood effect is replaced by a region effect, although the larger border effect is still present.

6.3.1 Components: trade and investment in Asia, Europe and the Americas

We investigate whether the neighbourhood effects in Asia and the Americas are at least partly attributable to investment or exports. Focussing on the border definitions, where the Asian neighbourhood effects appear to be large (and the number of observations is higher), the full sample has significant first border effects only but significant import /export coefficients for both border definitions. This may be because exports, regardless of their destination, are correlated with GDP: comparison of columns 1 and 2 shows they do not have an effect on the insignificant second border coefficient. However, there is a sizeable reduction in the border1 coefficient from 0.337 to 0.229, a reduction of approximately one third. Inspection of columns 3 and 4 suggests trade is more important than investment, but this is not consistent across choice of sample or neighbourhood definition: many specifications in fact suggest investment has a bigger effect.

Turning to the Americas, Table 8 shows the coefficient on the net neighbourhood effect in column 2 is roughly half that of column 1, while columns 3 and 4 suggests exports and investment both play a roughly equal role. We record that using the weighted distance measure (not presented) produces higher neighbourhood effects, but that including exports and investment also halves the coefficient (from 0.406 to 0.220).

We saw Europe does not appear to have a large neighbourhood effect, but does seem to have a large regional effect. Table 9 suggests variations in investment and exports reduce the region effect, much as they reduce the neighbourhood effect in Asia and the Americas.

6.3.2 Africa: regional giants and commodity exporters

We found evidence of strong regional effects in sub-Saharan Africa. Results suggest that trade reduces the regional effect much as it does elsewhere, but we focus on the potential roles of two regional giants, namely Nigeria and South Africa. Thereafter, we investigate the potential roles of the commodity exporting countries, in particular oil exporters.

Table 10 is used to investigate the roles of South Africa and Nigeria using the restricted sample by defining the "neighbourhood" for each country as South Africa and/or Nigeria. In other words, we include their (unweighted)[12] change in log GDP per capita on the right hand side of the regressions. Column 1 shows a significant correlation between growth in South Africa and in other sub-Saharan African countries, while column 2 contains an insignificant correlation for Nigeria. When we use the fuller sample of countries, South Africa's coefficient is lower but still significant at 1%, while Nigeria's is higher and significant at 1%. Column 4 is consis-

[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.

tent with the other columns. However, regardless of the sample used, our main finding is that presented in column 5. 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.

Arora & Vamvakides (2005) focus on the role of South Africa in sub-Saharan Africa using 5-year growth intervals between 1960 and 1999 and between 1980 and 1999. They find evidence of a South Africa effect that is robust to specification, including time and fixed effects, a variety of controls, trading partners' growth and world effects. The effect for South Africa was stronger than for any other country.[13]

We have seen South Africa (and Nigeria) do not unseat the region as a whole, but Table 11 shows the resource rich countries do. We take the "neighbourhood" to be 13 commodity exporting countries (the 14 commodity exporters as identified in Collier & Goderis (2007b), excluding Equatorial Guinea). Column 1 is the regional effect (including commodity exporters in the region) on all the sub-Saharan African countries in the restricted sample excluding the commodity exporters.[14] Column 2 presents a correlation which is almost as high, even though the neighbourhood is only the commodity exporters. Column 3 presents the region, net of the commodity exporters, together with a world variable and the commodity exporter variable. It shows that the commodity exporters have a strongly significant effect while the non-commodity exporters do not. Thus it appears that much of the regional effect is driven by the commodity exporting countries.

In the restricted sample, commodity exporters make up about half the countries, leaving very few countries (about ten) from which to draw inference, but results are robust to use of the fuller sample with more countries. Next, we restrict the sample of commodity exporters to just the oil rich countries to see if this smaller group of countries also yields a major neighbourhood effect. This also increases the available sample of remaining countries.

[13] These results are also consistent with similar specifications we ran using newer data, but not robust to the use of GMM techniques. While their world effects are significant, ours are insignificant. Furthermore, they do not appear to have a variable equivalent to our regional variable, which is precisely the variable which knocks out the world and South Africa coefficients in Table 10.

[14] The results are robust to the exclusion of South Africa and the use of a fuller sample, which has almost twice the number of observations.

Using the countries identified as big oil exporters in Collier & Goderis (2007b), excluding Equatorial Guinea, we see strong correlations for both the whole region (including oil exporters) and just the oil exporters. Column 2 suggests a 1% point rise in GDP (per capita) in the oil exporters leads to a 0.43% point rise in the GDP (per capita) in the rest of sub-Saharan Africa. Unlike for the resource rich countries in Table 11, we see both the oil exporters and the rest of the region (which includes other commodity exporters) are significant in column 3. This means both produce neighbourhood effects. Column 4 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 being in sub-Saharan Africa. 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 0.349% that period. If that 1% rise includes oil exporters, the typical African country would grow by an additional (0.349+0.25) 0.599%. In other words, oil exporters are particularly important for the rest of the continent.[15]

6.4 Asymmetries

We conclude with an investigation into asymmetries. We check whether neighbourhood effects are bigger for positive or negative growth episodes. All specifications in Table 13 contain fixed effects and time dummies. The coefficient on posborder1 is very small (but significant) while that on negborder1 is large. This means the neighbourhood effects are much bigger when the countries on the border experience a drop in per capita GDP. The coefficient on posborder2 is zero while that on negborder2 is significantly positive, which means the neighbours' neighbours only affect country i if they experience a net drop in GDP per capita. Inspection of columns b through e show large discrepancies between positive and negative changes for all neighbourhood definitions.

The upward trend in per capita GDP across the world makes falls in per capita GDP a relatively extreme event, ocurring in roughly a quarter of cases in our sample. This could mean that the negative effect is picking up extreme

[15] These results are robust to the exclusion of South Africa and/or the use of the full sample.

deviations from the trend while the positive effect is part of ordinary growth experiences. To investigate this, we construct a variable for growth in per capita exceeding 3% per annum, rather than all positive growth episodes. Column f shows the same results as column a. Neighbours and neighbours' neighbours have very small effects even when they grow relatively fast, but produce large positive correlations (negative effects) when per capita GDP falls. This finding is also robust to choice of neighbourhood definition and sample.[16]

7 Summary and Discussion

Our results suggest that there are neighbourhood effects in the form of correlations between countries' growth and that of their neighbours, using a variety of different definitions and samples. Our annual data suggests closer countries - those with which country i shares a border or those within a smaller radius - are more correlated than the broader region or the rest of the world. We also discovered evidence of large asymmetries, with the correlation for falls in neighbourhood per capita GDP far exceeding that for rises in neighbourhood per capita GDP.

We do not yet wish to speculate on the causes of the asymmetries, but their implications are potentially enormous. If neighbourhood effects are spillovers and they are symmetric, then it is not clear what the policy implication is, because on average the deviation is zero. Allowing for country-specific trends shows a small correlation, so being in a good neighbourhood can help over the longer term. However, our single cross-section suggests the neighbourhood effect does not exceed the broader region. Having a bad neighbourhood refers to more than countries close by. However, if the effects are small for positive deviations and large for negative deviations, this suggests countries who experience negative shocks have particularly bad effects on their neighbours - bad policies can have serious large negative externalities. From the other point of view, it may be an appropriate policy response to insulate oneself from shocks to neighbours. Our evidence suggests more

[16] We have also tested for asymmetries formally with alternative (isomorphic) specifications, where we have a variable for changes in neighbourhood GDP per capita and for the absolute value of those changes: a signiffcant absolute value coefficient is statistical evidence in favour of the asymmetry. The message is however clearer in the format presented.

open economies tend to be less susceptible to neighbourhood effects - being more correlated with world events - but we have not yet compared asymmetries in open and closed economies. However, the evidence so far suggests one way to mitigate the effects of having bad neighbours is to try to open up the economy. Landlocked countries may not have this opportunity, so they may be particular victims of negative externalities.

We saw Europe and Africa have small or no neighbourhood effects but large regional effects. For Europe, this is arguably because the region as a whole is so integrated that being closer matters less - the number of borders is less important. Reflecting our results for the whole world, exports to the neighbourhood and gross domestic capital formation reduce the regional or neighbourhood effect in Europe and the Americas respectively. In a region as integrated as Europe, we would expect trade to have a large effect, but investment appears to reduce the regional coefficient by more. While the flow of capital across borders is also unencumbered, we suspect the investment variable is capturing more than actual investment, but broader macroeconomic events like confidence and Europe-wide interest rates. As discussed in Ades & Chua (1997) and Easterley & Levine (1997), policies that promote an investment-friendly environment can be a source of externalities or spillovers. The effect of trade on coefficients, particularly in the Americas, is certainly consistent with the view that trade explains part of the neighbourhood effect in terms of demand spillovers.

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.Thus, 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 neighbourhood as a whole. Nelson & Behar (2008) discuss the resource curse in the context of spatially-based development. Collier & Goderis (2007) find the short run windfall from a commodity boom is positive while the long-run effect is negative. Together with our findings, this implies that resource-poor countries on the continent experience a short run gain but a long run loss from the commodity booms in the resource-rich countries. More importantly, given our general evidence of asymmetries, any short run effects from a fall in commodity prices can have material adverse effects on the rest of the continent.

We briefly discussed some potential difficulties associated with this estimation. Nonetheless, our finding that some neighbourhoods are more integrated than others holds, no matter how much of this is a genuine spillover. Our evidence for massive asymmetries is interesting and important, regardless of their nature, and the policy implication that opening up your economy makes you less susceptible to being in a bad neighbourhood would still hold. Furthermore, it is hard to believe that the majority of shocks experienced by the oil rich countries - the commodity exporters for that matter - are the same as those experienced by other African countries. This correlation is arguably far more likely to be a genuine spillover.

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		Ratio of GDP in Country to Neighbourhood					
		Border1	Border2	Ring1000	RIng1000w	Ring1500	Ring1500w
restricted sample	p25	0.06	0.05	0.06	0.05	0.03	0.03
	p50	0.20	0.12	0.19	0.20	0.09	0.09
	p75	0.62	0.47	0.76	0.60	0.30	0.23
	N	1871	1771	1740	1567	1869	1792
unrestricted sample	p25	0.03	0.02	0.04	0.03	0.02	0.02
	p50	0.11	0.06	0.11	0.11	0.05	0.05
	p75	0.39	0.18	0.51	0.44	0.19	0.17
	N	3288	3128	3048	2822	3258	3087

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

		gdp	population	per capita growth	investment	exports per capita						trade openness
						Ring1000	Ring1000w	Ring1500	Ring1500w	Border1	Border2	
restricted sample	p25	7.37E+09	5301000	-0.006	0.173	0.647	1.053	0.803	0.845	0.659	0.203	0.456
	p50	3.91E+10	1.06E+07	0.018	0.205	6.374	6.751	5.428	5.376	4.250	1.430	0.621
	p75	1.40E+11	3.69E+07	0.035	0.240	45.272	50.978	34.264	27.600	35.699	8.681	0.856
	N	1871	1875	1796	1834	1750	1575	1875	1800	1875	1775	1831.000
unrestricted sample	p25	2.87E+09	3519850	-0.008	0.168	0.069	0.101	0.074	0.081	0.070	0.020	0.453
	p50	1.04E+10	8043324	0.018	0.205	1.599	1.929	1.557	1.603	1.345	0.409	0.645
	p75	8.13E+10	2.32E+07	0.039	0.246	14.521	14.521	12.229	11.950	11.200	2.839	0.955
	N	3288	3484	3154	3146	3250	3042	3458	3276	3484	3328	3153

Table B: Selected Summary Statistics

	-1	-2	-3	-4	-5	-6	-7	-8
	growth	growth	growth	growth	growth	growth	growth	growth
Border1	0.294***	-0.0168	-0.0108	0.192**	0.0104	-0.036	0.00188	0.0814
Region		0.554***	0.549***		0.345***	0.553***	0.373***	0.354**
Investment growth			0.0293					
Export growth			0.0152					
GDP per capita 1984				-0.0574*	-0.0393	0.0353		-0.0429
Average Investment				0.573***	0.454***		0.463***	0.509***
Average Enrolment				0.199**	0.144		0.0661	0.186*
Population, technology, depreciation				-0.566	-0.585		-0.541	-0.472
Average investment in neighbour								-0.383*
_cons	0.180***	0.0734	0.0438	1.124*	0.966*	-0.194	0.959*	0.192
N	75	75	68	75	75	75	75	70
(* 0.10 ** 0.05 *** 0.01)								

Table 1: Results based on a single cross section: 1984-2004

	-1	-2	-3	-4	-5
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.Ring1000W	0.111***	0.106***	0.0817***	0.0781***	0.0683***
D.Border1					
D.Border2					
D.Regionnet		0.136***			
D.Worldnet		0.216***			
D.Region			0.316***	0.426***	0.189**
D.World			0.179*	0.0761	
_cons	0.0104***	0.00453**	0.00367**	0.00387**	-0.00504
N	1390	1323	1390	1390	1390
Gross effect			0.577	0.58	
Fixed effects?	y	y	y	n	y
Time dummies?	n	n	n	n	y
Pesaran test?	0	0	0.069	n/a	1.939

Table 2: Net Regional Effects

	-1	-2	-3	-4	-5
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.border1	0.0494***				
D.border2	0.0224				
D.ring1500W		0.133***			
D.ring1000W			0.0683***		
D.ring1000				0.0525***	
D.ring1500					0.0678**
D.region	0.144**	0.116**	0.189**	0.156***	0.147***
_cons	-0.00672	-0.00442	-0.00504	-0.00193	-0.0103*
N	1571	1589	1390	1546	1660

Table 3a: Comparing neighbourhood definitions - restricted sample

	-1	-2	-3	-4	-5
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.border1					0.0128**
D.border2					0.0206
D.ring1500w		0.0344			
D.ring1500	0.0656**				
D.ring1000w				0.0148	
D.ring1000			0.0410***		
D.region	0.0953**	0.0870**	0.107***	0.0883*	0.106***
_cons	-0.00255	-0.00198	-0.00052	-0.00135	-0.00292
N	2512	2393	2357	2187	2400

Table 3b: Comparing neighbourhood definitions - full sample

	-1	-2	-3	-4
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.ring1000	0.0653***	0.0515***	0.0632***	0.0533***
D.Region	0.195*	0.152	0.163	0.183*
D.exportrsring1000		0.0262***	0.0272***	
D.investment		0.0557***		0.0565***
_cons	-0.00723	-0.00535	-0.00634	-0.0062
N	1036	1036	1036	1036

Table 4: The effects of exports and investment

	-1	-2	-3	-4
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
	vclosed	closed	open	vopen
D.ring1000	0.356***	0.0650**	0.0582	0.0466
D.region	0.136*	0.266**	0.500**	0.450***
D.world	0.0445	-0.0119	0.217	0.420*
_cons	0.00306	0.00557	-0.00352	0.00353
N	384	408	448	430

All specs have fixed effects but no time dummies and are net effects

* p<0.10, ** p<0.05, *** p<0.01

Pesaran test	ok	ok	ok	ok

Table 4.5: trade openness

	-1	-2	-3	-4	-5
	Americas	Asia	Europe	MENA	SSA
D.ring1000	0.306***	0.0342**	-0.00268	0.192	0.0342*
D.region	0.430**	0.154	0.528*	0.117	0.568***
D.world	-0.083	0.144	0.236	0.0327	0.0561
_cons	-0.000329	0.0237***	0.00563	0.00839	0.000699
N	312	193	435	196	410

Table 5: Neighbourhood effects by region. (Note many world and reg specs insig)

	-1	-2	-3	-4	-5
	Americas	Asia	Europe	MENA	SSA
D.border1	0.182***	0.468***	0.0157	0.0625	0.0251
D.border2	0.260***	0.0182	-0.0265	-0.0733	0.0800*
D.region	0.243*	0.0614	0.549**	0.189	0.489***
D.world	0.0261	0.194	0.209	0.00968	0.0526
_cons	0.000599	0.00119	0.00411	0.0108**	0.000604
N	400	176	389	196	410

Table 6: Neighbourhood effects by region.

	-1	-2	-3	-4
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.border1	0.337***	0.229***	0.237***	0.326***
D.border2	0.00677	0.00395	0.00496	0.00553
D.region	0.142*	0.106	0.109	0.138*
D.world	0.138	0.0984	0.081	0.157
D.exportsborder1		0.0195*	0.0203**	
D.exportsborder2		0.0339***	0.0343***	
D.investment		0.0345		0.0382
_cons	0.00649	0.0106*	0.00990*	0.0073
N	207	207	207	207

Table 7: Sources of neighbourhood effects: full sample Asia

	-1	-2	-3	-4
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.ring1000	0.307***	0.167*	0.249***	0.230***
D.Region	0.274	0.387	0.342	0.314
D.World	0.0771	-0.0244	-0.0197	0.0775
D.exportsring1000		0.0383***	0.0363**	
D.investment		0.0829***		0.0812***
_cons	-0.000882	-0.0016	-0.00169	-0.00075
N	204	204	204	204

Table 8: Sources of neighbourhood effects: full sample Americas

	-1	-2	-3	-4
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.ring1000	0.0177	-0.0104	0.017	-0.0103
D.Region	0.529***	0.281***	0.479***	0.300***
D.World		0.00741	0.0175*	
D.exportsring1000		0.232***		0.233***
_cons	0.00878***	0.0157***	0.00841***	0.0159***
N	404	404	404	404

Table 9: Sources of regional effects Europe

	-1	-2	-3	-4	-5
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.SA	0.382***			0.246**	-0.0519
D.Ni		0.0948		0.0711	-0.00832
D.Region			0.645***		0.712**
D.Regnet				0.325**	
D.Worldnet				0.0458	
_cons	0.00226	0.00133	0.00207	-0.0002	0.00207
N	365	365	365	365	365

Table 10: South Africa and Nigeria

	-1	-2	-3
	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.Region	0.456***		
D.Resource		0.378***	0.353***
D.Regionnet			0.0531
D.Worldnet			0.0953
_cons	0.00723***	0.00649***	0.00471
N	219	219	219

Table 11: Resource rich countries in Africa

	-1	-2	-3	-4
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
D.Region	0.625***			0.349*
D.Oil		0.434***	0.361***	0.250*
D.Regionnet			0.243*	
D.Worldnet			-0.0475	
_cons	0.00427**	0.00327	0.0046	0.00371*
N	285	285	285	285

Table 12: Oil rich countries in Africa

	a	b	c	d	e	f	g	h
	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap	D.lgdpcap
posborder1	0.0315*							
negborder1	0.130*					0.134*		
posborder2	-0.00416							
negborder2	0.184***					0.185***		
Posring1000		0.0212***						
Negring1000		0.314***					0.317***	
Posring1000w			0.0333					
Negring1000w			0.188**					
Posring1500				0.0404***				
Negring1500				0.246***				0.252***
Posring1500w					0.0882**			
Negring1500w					0.209***			
Extremering1000							0.0202**	
Extremering1500								0.0369***
extremeborder1						0.0299*		
extremeborder2						-0.00611		
D.Region	0.104*	0.130**	0.173**	0.126**	0.114**	0.106*	0.130**	0.128**
_cons	-0.00724	-0.0019	-0.00221	-0.00054	-0.00682	-0.00691	-0.00176	-0.00015
N	1571	1546	1390	1660	1589	1571	1546	1660

Table 13: Asymmetries

Figure 1: (Approximately continuous spatial lags)

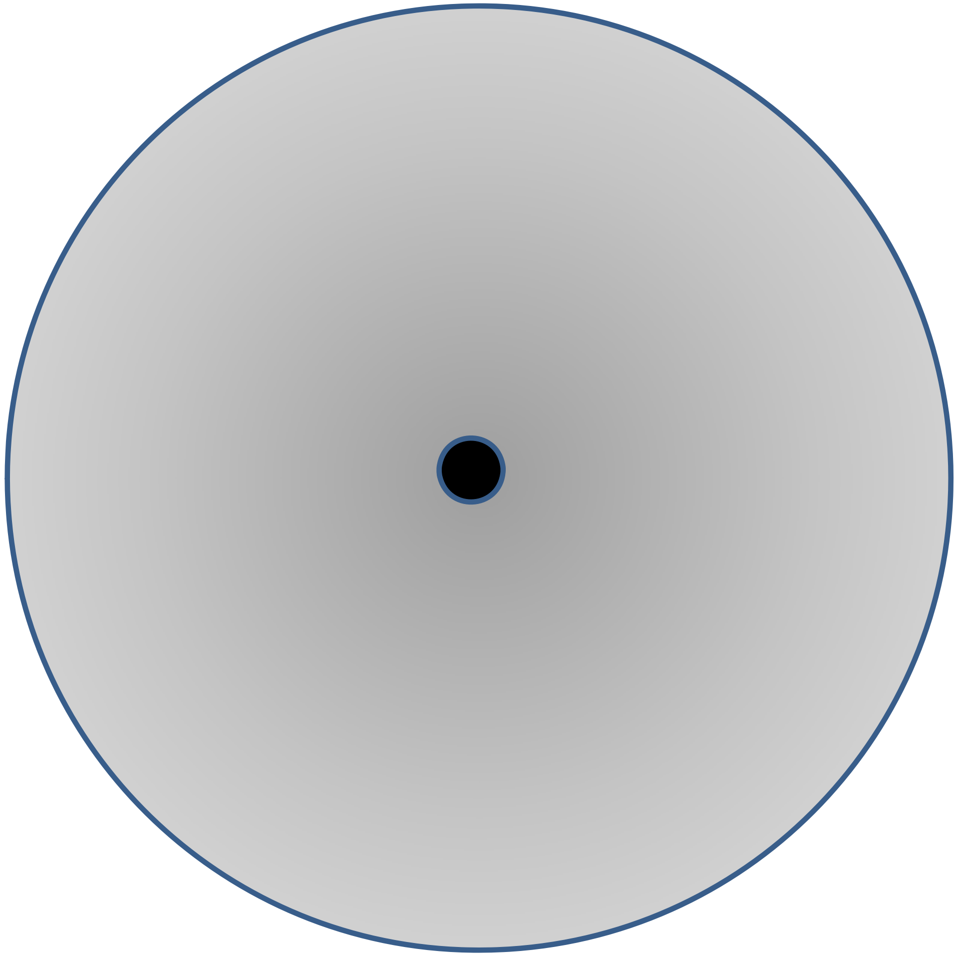

Figure 2: Stylized model with 3 discrete lags

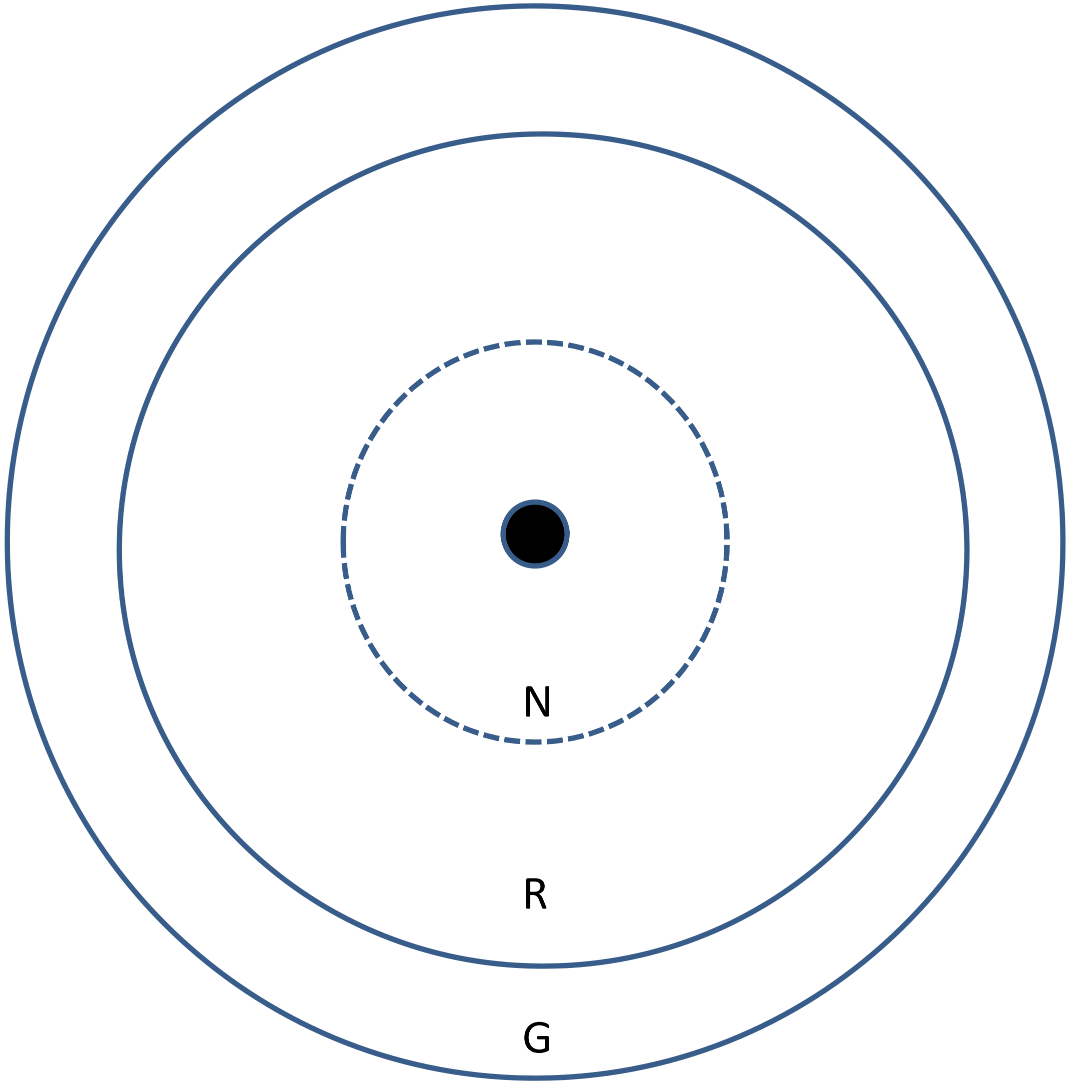

Figure 3: Model with 3 lags, with N not in R