Does Export Concentration Cause Volatility?

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Abstract

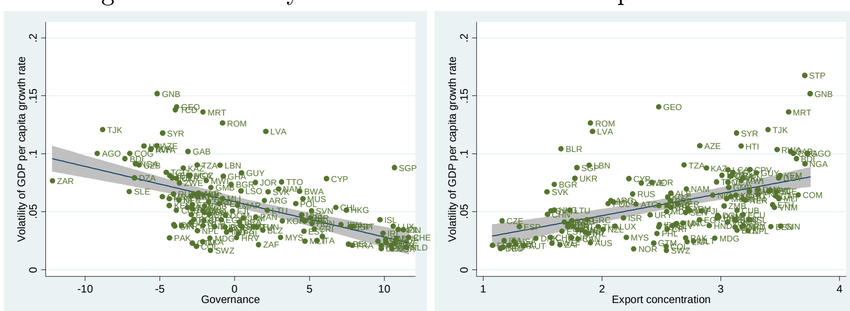
This paper investigates the relative contributions of institutions and export concentration in determining aggregate volatility of output, terms of trade, and exchange rates. Geographically disadvantaged countries often experience a concentrated export structure which makes them more vulnerable to external shocks. Based on a gravity regression, a measure of export concentration is constructed which is based entirely on countries' geographical characteristics. Since this measure is plausibly uncorrelated with other determinants of external volatility, it is used as an instrument for export concentration to obtain instrumental variables estimates of the effect of export concentration on volatility. We find that geographic characteristics are indeed strongly related with export concentration and a gravity equation describes the bilateral trade structure quite well. However, since export concentration ratios are not additively separable across countries we use an inequality decomposition method in order to obtain an aggregate measure of concentration. Results from instrumental variables regressions using constructed export concentration as an instrument for actual export concentration confirm that concentration has a particularly strong effect on volatility in terms of trade but less so on other measures of volatility.

1 Introduction

Fluctuations of macroeconomic aggregates are systematically larger in some countries than others. The consequences of these differences in volatility are potentially serious. In particular, developing countries which lack public insurance systems and well functioning credit markets to deal with these risks seem to be hit hardest by the instability in their macroeconomic environment. On the aggregate level, the uncertainty associated with larger volatility results in lower private investment, and, consequently leads to slower growth (see Malik and Temple (2008) for a discussion). Adverse consequences of volatility have not only been identified for growth rates of output but for other variables, such as variability in terms of trade or inflation rates as well.

The analysis of the determinants of aggregate volatility has advanced at a rapid pace in recent years. Most interestingly, it has shifted towards trying to identify causal determinants of volatility, and, much in line with the growth and development literature, has isolated institutions, trade, and geography as the most promising fundamental explanations.

Figure 1: Volatility versus Governance and Export Concentration



Volatility in growth rates, as an encompassing aggregate measure of economic instability, has received particular attention. The left-hand side panel in Figure 1 illustrates that the standard variation of output growth rates is strongly related with a composite indicator of the quality of institutions, taken from Kaufmann et al. (1999). This mirrors the findings by Acemoglu et al. (2003) and Yang (2008). The panel on the right hand side shows that trade structure is an equally important determinant. One reason for this relationship is that countries with an undiversified export structure are more severely exposed to external shocks and may, through this channel, feature a larger variation in growth rates. This influence has been explored by Malik and Temple (2008), and Bacchetta et al. (2007), among others.

Yet, while all of these factors are likely to contribute to an understanding of volatility, identifying their causal effects suffers the problems endogeneity, omitted variables, and attenuation biases. For instance, poor countries export a smaller variety of products, while the number of export sectors increases with income levels. Therefore, any attempt to isolate the influence of export concentration on outcomes such as growth in income or its volatility may simply capture an omitted influence that is correlated with the level of income (Acemoglu and Zilibotti (1997); Koren and Tenreyro (2004)).

Some geographic characteristics, such as distance from trading partners or size, have been identified as strong predictors of export structure across countries.

In this paper, we make use of these relationships and explore the variation of export concentration that can be explained by geographic determinants alone. We will show that this geographic component of export concentration is plausibly uncorrelated with institutions, thereby allowing the construction of a valid instrument for export concentration.

The paper is organized as follows. Section 2 discusses previous approaches to dealing with causal influence of institutions and geography on volatility. Section 3 summarizes the mechanisms linking geography to volatility through export concentration, which emerged from this literature. Section 4 theoretically derives the constructed export concentration measure. Section 5 presents gravity regressions used to construct this measure. Section 6 gives basic results from OLS and IV regressions for volatility, and Section 7 concludes.

2 Related Literature

There are three basic approaches to dealing with causality of the determinants of volatility and the uncertainty of the model specification. First, Acemoglu et al. (2003) separate institutional from other explanations by using an instrument for institutions that is plausibly orthogonal to any other omitted determinant of volatility. In particular, they exploit the "natural experiment" of colonialization. In places where European settlers faced high mortality rates, they only settled in small numbers and were more likely to set up extractive institutions. In places with favorable climate, on the other hand, European settlers implemented institutions resembling much more their European counterparts. As these institutional structures persisted to the present, using settler mortality rates faced by colonialists yields an intuitive instrument for present-day institutions. In Acemoglu et al. (2003), this instrument is used to analyze the separate roles of institutions and policies on volatility. Since there is no plausible instrument for policies, they do not account for the endogeneity of policies, thereby imposing a downward bias on institutions. This approach allows analyzing the causal effect of institutions, but does not establish whether the policy variables may have a truly independent effect. In effect, this approach does not allow separating institutional from other fundamental explanations. In particular, it ignores the very simple channel through which geography may as well influence volatility proposed in this paper: Geographically disadvantaged countries trade less with others and are, therefore, hampered in their abilities to diversify their export structure.

In particular, this paper is an extension of the work conducted in Malik and Temple (2008). They explore the separate effects that institutions and geography exert on output volatility and attempt to deal with model uncertainty by relying in Bayesian methods. Their findings support the view that both, institutions as well as geography exert strong effects on output volatility. Their approach allows dealing effectively with problems of omitted variables. However it does not solve issues of the direction of causation since they treat institutions as exogenous. Given that better institutions promote output stability, their institutional variables are likely to be biased away from zero. More importantly, they ignore the many channels through which their geographic variables may influence institutions and economic outcomes as will be described in the next section.

Finally, another common approach is to use dynamic panel data techniques, as in Yang (2008) and also in Acemoglu et al. (2003). These approaches are a valid alternative to establish causal influences, and we regard their results as complementing the evidence found in this paper by means of instrumental variables. Yet with regard to the issue of causality, panel data approaches should be interpreted with great caution. In particular, using lagged valued as internal instruments does not ensure that these are not direct determinants of the dependent variables or that they are uncorrelated with omitted determinants (see Durlauf et al., 2005 for a discussion).

This paper adds to the existing literature by constructing a measure of export concentration which is based entirely on countries' geographical characteristics, and thus plausibly uncorrelated with other determinants of volatility. The proposed measure is based on the Frankel and Romer (1999) approach to measure the effects of trade on income. To construct the variable for export concentration, we first estimate a gravity equation for bilateral export concentration based on bilateral trade flows. Using a decomposition procedure for the proposed concentration measure, we then aggregate the fitted values to obtain a geographic component of countries' overall export concentration. Since countries' geographic characteristics are not affected by volatility or by other factors that influence volatility, this constructed measure of concentration can then be used as a valid instrument to separate the influence of concentration on volatility from other influences, including institutions. Thus, in a second stage, this measure is used as an instrument for export concentration to obtain instrumental variables estimates of the effect of export concentration on volatility.

3 Geography and Export Concentration

The hypothesis that geography matters for the overall level of trade has been extensively analyzed, and the evidence seems almost overwhelming. Malik and Temple (2008) present a thorough discussion of the influence of geography on volatility. They argue that - although variation in world prices may be exogenous for a given country - the impact of external fluctuations on the domestic economy depends not only on countries' overall level of trade but on their export and import structures as well.

Natural barriers to trade, that emerge for countries that are remote from major trading partners, are landlocked, or have low-quality transport networks, induce high transport costs. The development of manufacturing sectors requires the use of additional input goods. However, intermediate goods may be too costly to import if countries face high transport costs which can render manufacturing production unprofitable at world prices. The existence of high transport costs may thus be an important constraint on the development of the manufacturing sector. Countries that are geographically disadvantaged may, therefore, become locked in the production of a narrow range of export goods.

Information about the distance from a country to other countries, therefore, offers a structural explanation for the export structure of a country. To measure proximity, we need a weighted average of the distance between countries. As in Frankel and Romer (1999), we choose the weights by estimating and aggregating an equation for bilateral concentration as a function of distance between trading partners, population, area, as well as dummy variables indicating whether a country is landlocked or an island state. We find a strong effect of geographic variables on export concentration, in line with the recent literature described above.

While the exclusion restriction seems reasonable for most competing explanations, there is one notable exception. It is clearly important to control for the overall level of trade in the empirical section. Countries' geographic characteristics apparently influence both, level and structure of trade. Remote countries may be exposed to a less diversified structure of exports, but also may trade less which reduces their exposure to external shocks.

The focus of our exploration lies on external measures of volatility rather than on the more common measure of growth volatility for the reason that our main variable of interest is the structure of exports rather than countries' overall structure of production. In addition, the exclusion restriction implied by the instrumental variables regression maintains that, conditional on the controls included, the constructed measure of export concentration has no effect on volatility other than through its effect on export concentration. Although we argued that export structures are likely to be the major channel through which the set of geographic characteristics affect volatility, this argument has more rationale if applied to external volatility. However, Easterly et al. (1993) argue that shocks to terms of trade play a major role in explaining output volatility. In addition, overall patterns of specialization depend largely on the extent of integration in the world economy. For these reasons, we also consider volatility of growth rates of output as a dependent variable in the empirical estimation. These regressions should be treated with greater caution, however.

In principle, there is a large variety of alternative, geography-based variables that can be used to explain export concentration, as has been done, for instance, in Malik and Temple (2008). Besides the geography-based measure of the natural propensity to trade as suggested by Frankel and Romer (1999), Malik and Temple use a variety of geographical dimensions, including proximity to markets, coastal access, and tropical characteristics. However, for the purpose of deriving an instrument for export concentration, these variables are flawed, as a variety of alternative channels for how these determinants may influence long-run growth rates, and through this channel volatility of growth, have been proposed in the literature. Sokoloff and Engerman, 2000 have shown that tropical location, or determinants affecting the structure of production in general, has shaped the institutional development. Also, tropical location is a strong determinant of the prevalence of Malaria, as shown by Sachs (2003). Acemoglu et al. (2005) argue that coastal access has amplified the rise of the bourgeoisie in Europe, and, by shifting the balance of power, led to sustained changes in the institutional environment. For these reasons, we limit the geographic determinants of export concentration to only a few variables that are unproblematic, as will be described in the next section.

4 Data and Variables

Our main measures of volatility are the standard deviations of the first log-differences of the terms of trade and of an index of real effective exchange rates. The terms of trade index measures the ratio of an export price index to the corresponding import price index relative to the base year 2000. The real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator. Both variables are calculated from the World Development Indicators.

Despite the words of caution stated above, we also consider the effects on volatility of growth in income per capita. Following Malik and Temple, 2008, volatility of growth is measured by the standard deviation of the annual growth rate of real GDP per capita, taken from the Penn World Tables. However, we use averages over the period 1980 to 2000, rather than from 1960 to 1999, in order to have the same sample period for all variables. Smaller countries often exhibit a more concentrated export structure, which makes them more vulnerable to external shocks. These external shocks feed through to domestic effects. The domestic effects of external shocks are likely to be amplified or mitigated by policy responses or institutional set-ups (Rodrik, 2000; Rodrik, 1999). Although we expect to find an important influence of export concentration on overall volatility as well, export concentration is likely to be responsible for only a small fraction of domestic volatility.

For export concentration, we use export data from 1980 to 2000 as in Malik and Temple (2008) which eases comparison and seems a reasonable confinement, given the fact that earlier data is less reliable and trade has increased rapidly over the second half of the 20th century. The data comes from the United Nation's Commodity Trade Statistics Database (Comtrade) which is the most capacious trade database available. In this database, sectors are classified according to the Standard International Trade Classication (SITC). The analysis is restricted to SITC revision 2 at the 4-digit level of disaggregation, resulting in 786 product categories. Given the choice of the sample period, the 4-digit level seems a reasonable compromise between sectoral resolution and data availability across countries.

The approach suggested by Frankel and Romer (1999) first decomposes trade into its bilateral components, derives fitted values of the trade share from a gravity equation and aggregates these over all bilateral trade flows to obtain a geographic component of a country's overall (predicted) trade share. Unfortunately, this procedure is not as straightforward for export concentration, because the most commonly used measures of concentration are not additively decomposable into their components across different subpopulations in an easy way (see Pyatt (1976) and Cowell (1980)).

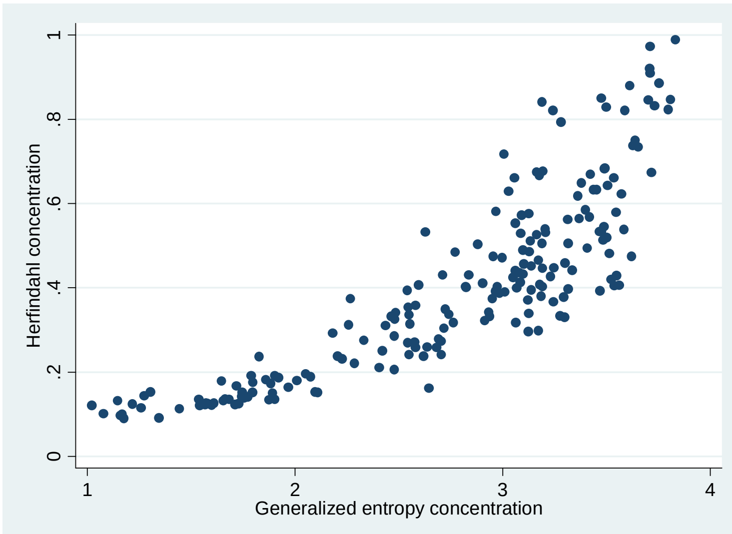
Only concentration measures of the class of generalized entropy measures allow for a perfect additive decomposition of concentration. The most commonly used and easy to handle generalized entropy measures include inequality weighting parameters of 1 or 0 (known as Theil's T and Theil's L). Although additively decomposable, these measures cannot be used here since they are not defined for sectors with zero values. Yet, export concentration is measured across all possible export sectors at the 4-digit level rather than across all actually observed export sectors for each country. It is essential to include zero-value sectors as otherwise countries with evenly distributed exports across only few sectors might be erroneously attributed a low value of concentration (see also Helpman, Melitz and Rubinstein, 2008). Therefore, the use of a more generalized - yet more difficult to handle - entropy measure of the following form is required (see Litchfield, 1999):

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{n}\sum_{h=1}^{n}\left(\frac{x_h}{\mu}\right)^{\alpha} - 1\right],$$

where n is the number of export sectors, x_h is the export volume of export sector h, μ is the average trade value across all sectors, and α is an inequality weighting parameter that is set to 0.5 for the calculation.

This measure has almost the same desirable properties as the more commonly used concentration indices. In addition, the bivariate correlation between the more common measures of concentration and the GE coefficients, calculated for the baseline sample is around 0.9 as depicted in Figure 2.

Figure 2: Measures of Concentration compared



As noted above, generalized entropy measures of concentration allow for a decomposition across subgroups according to

$$GE = GE_B + GE_W,$$

where is GE_W is the within group concentration, and GE_B is the between group concentration. In order to derive predicted export diversification, we first need to build GE concentration measures for each country pair i, j according to:

$$GE_{i,j} = \frac{1}{\alpha\left(\alpha-1\right)}\left[\frac{1}{n_{i,j}}\sum_{h=1}^{n_{i,j}}\left(\frac{x_{h,i,j}}{\mu_{i,j}}\right)^{\alpha}-1\right].$$

where $n_{i,j}$ is the total number of export sectors from country i to country j, x is the trade value of an individual sector and μ is the mean of bilateral trade values. In order to obtain an overall concentration ratio of country i's export sectors, the individual sectors can be aggregated to a "within" component, consisting of the concentration within each bilateral trade flow, and a "between" component, the concentration between different bilateral trade flows. The GE index is then simply the sum of these two components (see Conceição and Ferreira, 2000):

$$GE_i = \frac{1}{\alpha\left(\alpha+1\right)}\sum_j\left[1-\left(\frac{X_{i,j}/X_i}{N_{i,j}/N_i}\right)^{\alpha}\right]+\sum_j\frac{N_{i,j}}{N_i}\left(\frac{X_{i,j}/X_i}{N_{i,j}/N_i}\right)^{\alpha}GE_{i,j}. \quad (1)$$

X_j is the sum of exports in a bilateral trade flow, X_i are total exports of country i, and N represents the number of export sectors. The first term is the between concentration and the second term represents the within concentration. The within concentration gives the contribution of each bilateral export concentration ratio to country i's overall export concentration. For a weighting parameter of $\alpha = 1$, the weight of each subpopulation's within concentration is the subpopulation's export share, while for $\alpha = 0$ the weight derives from its population share (i.e. the number of export sectors as a share of total export sectors). Thus, in order to obtain a purely geographic estimate of export concentration, three components have to be estimated within gravity equations: $X_{i,j}$, $N_{i,j}$, and $GE_{i,j}$.

Finally, we also use a number of common control variables to substantiate the robustness of our findings. In particular, we are interested in the relative contributions of export concentration and institutions. We focus primarily on institutional measures capturing the constitutional constraints on arbitrary exercise of power by political elites (see Acemoglu et al. (2003)).

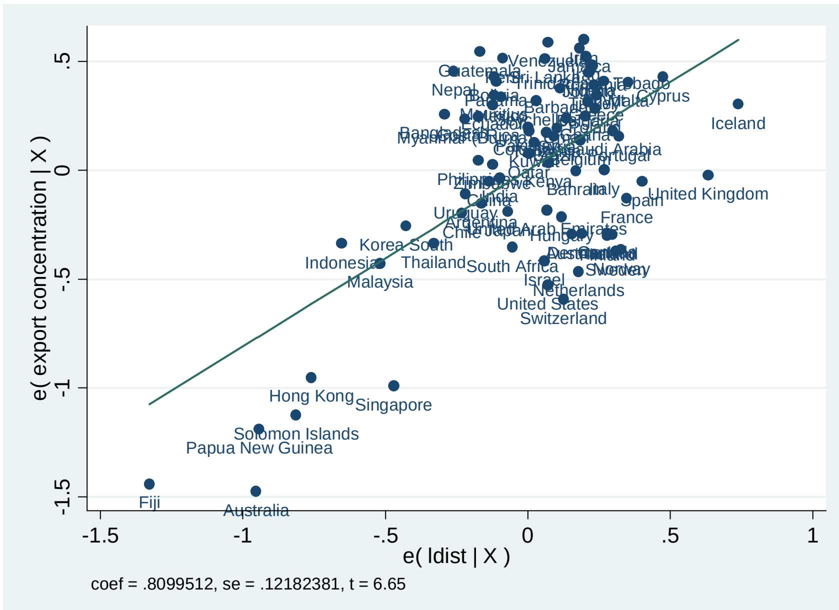
The first variable we will use is a measure of the number of institutional players with the ability to veto the legislative process from Henisz (2000). A similar variable we use is the constraint on the executive variable from the Polity IV dataset. The logic behind the use of constraints indices is that in institutionally weak societies, infighting between groups may lead to larger economic instability. We also consider a more encompassing measure of the institutional quality from Kaufmann et al. (1999) which averages six measures relating to voice and accountability, political stability, absence of violence, government effectiveness, regulatory burden, rule of law, and absence of graft. Finally, we use settler mortality rates as an instrument for institutions, as suggested by Acemoglu et al. (2001).

5 The Gravity Equation and Predicted Export Concentration

Frankel and Romer (1999) substantiate their argument of an influence of geography on trade levels with the example of New Zealand. The fact that New Zealand is far from most other countries reduces its trade with other countries considerably. Figure 3 illustrates this point nicely for bilateral export concentration. It plots New Zealand's bilateral export concentration ratios versus the partial effects of log distance from a gravity equation as described below. It clearly shows that New Zealand's export structure is biased towards a relatively concentrated structure due to its large distance to many trading partners.

Table 1 presents estimates for different variants of the gravity equation. The data for countries geographic characteristics comes from Frankel and Rose (2002).

Figure 3: Bilateral Export Concentration of New Zealand



All bilateral trade flows are averaged over the period 1980 to 2000. As the calculation of concentration ratios is more sensitive to changes in the number of sectors compared with the estimation of absolute trade values, I include only bilateral trade flows with at least 50 sectors available in Column (2). This will also be the benchmark estimation to be used below. As a comparison of Columns (1) and (2) indicates, both estimates yield similar results.

The first two rows of Table1show that indeed the geographic variables are major determinants of bilateral export concentration, explaining 35 percent of the variation with all export sectors included and still more than 30 percent with the restriction on the minimal number of sectors imposed. The results are generally as expected and confirm the findings in Malik and Temple (2008). Export concentration increases with distance and a larger population predicts a country to be more diversified.

The two columns in the center present results for predicted number of export sectors and predicted export values. Both variables are required to aggregate bilateral concentration ratios for each exporting country in order to obtain a fully exogenous export concentration measure as noted in the previous section. The geographic variables used as regressors on these two variables show effects comparable to standard gravity equation estimates with an exception for the exporting country's population sign. This difference stems from the exclusion of import data in the dependent variable.

Table 1: Gravity Equations

Dependent Variable	Bilateral export concentration		Bilateral exports		Bilateral trade flows	
	Number of sectors		ln Export	ln Number	Frankel/Romer	
	all	> 50	value	of sectors	original values	Comtrade values
ln distance	0.213***	0.212***	-0.583***	-0.243***	-0.85***	-1.225***
	(0.007)	(0.008)	(0.033)	(0.011)	(0.04)	(0.036)
ln population (country i)	-0.262***	-0.246***	0.663***	0.270***	-0.24***	-0.411***
	(0.003)	(0.005)	(0.020)	(0.006)	(0.03)	(0.030)
ln area (country i)	0.100***	0.094***	-0.164***	-0.094***	-0.12***	-0.012
	(0.003)	(0.003)	(0.016)	(0.005)	(0.02)	(0.023)
ln population (country j)	-0.042***	-0.025***	0.718***	0.085***	0.61***	1.400***
	(0.004)	(0.005)	(0.019)	(0.007)	(0.03)	(0.028)
ln area (country j)	0.010***	-0.005	-0.184***	-0.011**	-0.19***	-0.307***
	(0.003)	(0.004)	(0.016)	(0.005)	(0.02)	(0.023)
Landlocked dummy	0.107***	0.033**	-0.905***	-0.148***	-0.36***	-1.149***
	(0.011)	(0.014)	(0.060)	(0.021)	(0.08)	(0.103)
Common border dummy	-0.231***	-0.075**	0.426***	0.123***		
	(0.039)	(0.038)	(0.156)	(0.045)		
Constant	4.800***	4.275***	7.103***	3.120***	-6.38***	-7.725***
	(0.068)	(0.086)	(0.351)	(0.120)	(0.42)	(0.469)
R^2	0.358	0.304	0.319	0.226	0.360	0.455
Observations	12'503	6'773	6'773	6'773	3'220	6'284

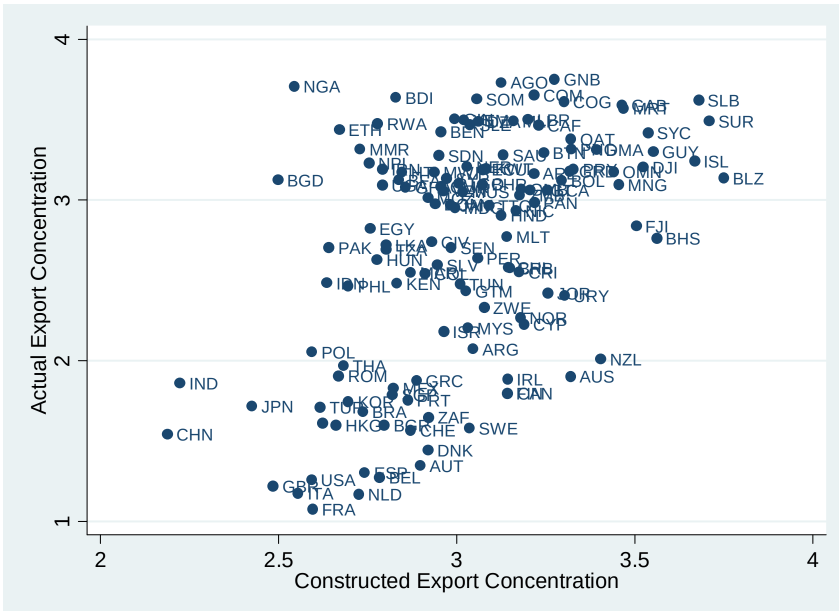
Levels of statistical significance indicated by: *** p<0.01; ** p<0.05; * p<0.1.
Numbers reported in parentheses are heteroscedasticity-robust standard errors.

The final two columns report the values from the original Frankel and Romer paper and the values obtained by re-estimating their gravity model with the Comtrade dataset. I reestimate the FR-predicted trade share as an additional control variable in the instrumental variables regression used below. The variation of bilateral trade flows that can be explained with the Comtrade data is much higher compared with the original dataset, even though a relatively large number of observations have been excluded. Considering the FR gravity model, it is not surprising that particularly the point estimates of the trading partner countries (distance to and size of country j) rise, as the Comtrade data is much richer along the lines of available bilateral data. Interestingly, the correlations for diversification are distinct from the estimates of the predicted trade share. This reassures that the diversification parameter does not simply proxy for the level of trade between countries.

The next step is to aggregate the fitted bilateral export concentration ratios across countries using fitted values for the number of export sectors and export volumes. Using the decomposition equation 1, we obtain an estimate of the geographic component a country's export concentration that explains actually observed export concentration fairly well.

Figure 4 shows a scatter plot of the true overall export concentration ratio GE against the constructed concentration ratio $\hat{GE}$. The figure shows that

Figure 4: Actual Versus Constructed Export Concentration



geographic variables account for a large share of the variation in actual concentration. The correlation between GE and $\hat{GE}$ is 0.5 and a regression of GE on $\hat{GE}$ and a constant yields a coefficient of 1.2 and a value of the t-statistics of 6.6.

6 Results

Table 2 presents OLS estimates of volatility measures regressed on export concentration, trade openness, and political constraints taken from the Henisz (2000) database as the preferred institutional measure. The results immediately show a strong influence of all three explanatory variables on all measures of volatility. Without conditioning for income per capita, only trade openness fails to significantly predict output volatility. This is surprising but confirms the intuition presented above that trade and export concentration may feed through on domestic volatility with opposite effects. For our main variable of interest, the volatility in terms of trade, these three determinants can account for almost 50 percent of the oberserved variation across countries.

Columns (4) to (6) add average income per capita as a control variable. In all cases, export concentration is a significant predictor out external volatility and

Table 2: OLS Regressions of Volatility

Dependent Variable	Terms of Trade Volatility (1)	Exchange Rate Volatility (2)	Output Volatility (3)	Terms of Trade Volatility (4)	Exchange Rate Volatility (5)	Output Volatility (6)
Export Concentration	0.053***	0.036***	0.011***	0.054***	0.018	0.012***
	(0.007)	(0.013)	(0.003)	(0.010)	(0.013)	(0.004)
ln Trade Openness	-0.044***	-0.062***	0.005	-0.044***	-0.051***	0.004
	(0.008)	(0.016)	(0.003)	(0.008)	(0.017)	(0.004)
Political Constraints	-0.088***	-0.105**	-0.066***	-0.091***	-0.048	-0.068***
	(0.032)	(0.052)	(0.012)	(0.035)	(0.061)	(0.014)
ln Income per capita				0.001	-0.017**	0.001
				(0.005)	(0.008)	(0.002)
Constant	0.173***	0.308***	0.021	0.168***	0.427***	0.017
	(0.042)	(0.073)	(0.016)	(0.057)	(0.085)	(0.020)
R^2	0.471	0.335	0.415	0.466	0.368	0.410
N	110	73	114	110	73	114

Levels of statistical significance indicated by: *** p<0.01; ** p<0.05; * p<0.1; two tailed.
Numbers reported in parentheses are heteroscedasticity-robust standard errors.

of volatility of output growth as well. The weak influence of income per capita in Column (4) stems mainly from the inclusion of trade openness. This indicates that export concentration and trade openness can in fact account for most of the explanation of external volatility. However, the fact that the regressions of exchange rate and output volatility perform quite poorly with the inclusion of income, indicates that collinearity between the regressors may be potentially problematic.

Results for the alternative institutional measures are similar. When using constraints on the executive, the concentration variable remains significant on the ten percent level of significance throughout all specifications, while the institutional variable is not significant in the exchange rate specification. With the use of the governance indicators, concentration becomes insignificant in both exchange rate regressions, while institutions turn insignificant with the inclusion of per capita income in this case.

As these results do not establish causal relationships, we next turn to instrumental variables regressions. The exclusion restriction implied by the instrumental variables regressions maintains that, conditional on the control variables included, the constructed measure of export concentration has no effect on volatility other than its effect through actually observed export concentration ratios. As argued above, the major concern is that the geographic components influence volatility through the level of trade, rather than through its structure. Therefore, trade openness is always included as a control variable. To be on the safe side, and because we are interested in the relative roles of geography and institutions we also include our preferred measure of political constraints in the

Table 3: IV Regressions of Volatility

Dependent Variable	Terms of Trade Volatility (1)	Exchange Rate Volatility (2)	Output Volatility (3)	Terms of Trade Volatility (4)	Exchange Rate Volatility (5)	Output Volatility (6)
Export Concentration	0.044*** (0.015)	0.012 (0.018)	0.013** (0.005)	0.051** (0.020)	0.083 (0.055)	0.022*** (0.008)
Trade Openness	-0.043*** (0.010)	-0.057*** (0.015)	0.005 (0.004)	-0.033* (0.017)	-0.100*** (0.035)	0.002 (0.006)
Political Constraints	-0.111** (0.047)	-0.158*** (0.059)	-0.061*** (0.017)	-0.100 (0.098)	-0.056 (0.225)	-0.030 (0.038)
Constant	0.200*** (0.060)	0.362*** (0.076)	0.015 (0.021)	0.141 (0.103)	0.335 (0.232)	-0.011 (0.036)
N	110	73	114	58	33	60
Excluded Instrument(s)	predicted concentration	predicted concentration	predicted concentration	predicted concentration, predicted trade share, settler mortality	predicted concentration, predicted trade share, settler mortality	predicted concentration, predicted trade share, settler mortality
F-statistics (first-stage)	63.13	60.18	65.69	5.07 26.53 36.91	7.42 20.76 24.41	9.42 28.70 43.78

Levels of statistical significance indicated by: *** p<0.01; ** p<0.05; * p<0.1; two tailed.
Numbers reported in parentheses are heteroscedasticity-robust standard errors.

regressions, although the same concern does not hold for institutions.

Columns (1) to (3) of Table 3 repeat the same estimates as in the corresponding columns of Table 2 using two-stage least squares. Export concentration is treated as endogenous, and the constructed export concentration ratio is used as an instrument. As expected, the lower IV coefficient in Column (1) indicates that reverse causality and omitted variables biases are potentially serious and OLS overstates the true effect of export concentration. The coefficient is much less precisely estimated under IV, with standard errors double the size compared with the OLS estimate. Nevertheless, the influence of export concentration remains surprisingly robust, which indicates a causal role of concentration. Such a causal influence cannot be found for volatility in the exchange rates, as depicted in Column (2). Other than that, the estimation results are remarkably similar to the ones obtained under OLS above.

The effects of export concentration on output volatility should be interpreted with caution, however. There may be influences from country characteristics on output volatility that work through domestic rather than through external factors. Still, to the degree that the argument that shocks to terms of trade play the major role in explaining output volatility, as proposed by Easterly et al. (1993) holds, these results are suggestive for an important role of export concentration.

Columns (4) to (6) of Table 3 account for endogeneity of all three regressors by excluding available instruments that have been suggested for trade openness and institutions from the regression. These results are somewhat exploratory. Dollar and Kraay (2003) used a similar approach with regard to the influence of trade and institutions on income levels. Their results indicate that the fitted values of institutions and trade from the first stage are highly correlated because the sets of instruments have high explanatory power for both endogenous variables. They conclude that instrumental variables are not very informative in this case. In addition, the sample size is reduced drastically by the inclusion of settler mortality reduces, further complicating any meaningful findings.

Nevertheless, and in contrast to Dollar and Kraay, our results indicate a strong role for export concentration that is not affected by accounting for the endogeneity of the other explanatory variables. Overall, these findings confirm that export concentration has considerable and causal influence on the volatility of terms of trade across countries.

7 Conclusion

Using a new instrument for export concentration, we confirm findings in the recent literature that export concentration has a strong effect on differences in aggregate measures of volatility across countries. Unlike previous research, we suggested a measure of export concentration that is derived entirely from countries' geographic characteristics, and therefore plausibly orthogonal to other determinants of volatility, such as institutions. We found that the suggested geographic determinants, including distance from trading partners, population and size are strong determinants of bilateral trade structures and export concentration. Using inequality decomposition methods allowed us to aggregate the estimated bilateral concentration ratios to an overall index of export concentration of countries.

Using the measure of predicted export concentration in two-stage least squares regressions of volatility measures confirmed a causal influence of export concentration on volatility in terms of trade. Evidence for other measures is mixed, however. In particular, additionally accounting endogeneity of institutions and trade openness yields an ambiguous picture, possibly due to collinearity of instruments.

References

Acemoglu, D., S. Johnson, and J. Robinson: 2005, 'The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth'. *American Economic Review* **95**(3), 546–579.

Acemoglu, D., S. Johnson, J. Robinson, and Y. Thaicharoen: 2003, 'Institutional causes, macroeconomic symptoms: volatility, crises and growth'. *Journal of Monetary Economics* **50**(1), 49–123.

Acemoglu, D., S. Johnson, and J. A. Robinson: 2001, 'The Colonial Origins of Comparative Development: An Empirical Investigation'. *American Economic Review* **91**(5), 1369–1401.

Acemoglu, D. and F. Zilibotti: 1997, 'Was Prometheus Unbound by Chance? Risk, Diversification, and Growth'. *Journal of Political Economy* **105**(4), 709–51.

Bacchetta, M., M. Jansen, R. Piermartini, and A. Amurgo-Pacheco: 2007, 'Export Diversification as an Absorber of External Shocks'. Unpublished Manuscript.

Conceição, P. and P. Ferreira: 2000, 'The Young Person's Guide to the Theil Index: Suggesting Intuitive Interpretations and Exploring Analytical Applications'. University of Texas Inequality Project, Working Paper Number 14.

Dollar, D. and A. Kraay: 2003, 'Institutions, trade, and growth'. *Journal of Monetary Economics* **50**(1), 133–162.

Durlauf, S. N., P. A. Johnson, and J. R. Temple: 2005, 'Growth Econometrics'. In: P. Aghion and S. Durlauf (eds.): *Handbook of Economic Growth*, Vol. 1. Elsevier B.V., Chapt. 8, pp. 555–677.

Easterly, W., M. Kremer, L. Pritchett, and L. H. Summers: 1993, 'Good policy or good luck?: Country growth performance and temporary shocks'. *Journal of Monetary Economics* **32**(3), 459–483.

Frankel, J. and A. Rose: 2002, 'An Estimate Of The Effect Of Common Currencies On Trade And Income'. *The Quarterly Journal of Economics* **117**(2), 437–466.

Frankel, J. A. and D. Romer: 1999, 'Does Trade Cause Growth?'. *American Economic Review* **89**(3), 379–399.

Henisz, W. J.: 2000, 'The Institutional Environment for Economic Growth'. *Economics and Politics* **12**(1), 1–31.

Kaufmann, D., A. Kraay, and P. Zoido-Lobaton: 1999, 'Aggregating governance indicators'. Policy Research Working Paper Series 2195, The World Bank.

Litchfield, J. A.: 1999, 'Inequality: Methods and Tools'. World Bank, Washington D.C.

Malik, A. and J. R. Temple: 2008, 'The geography of output volatility'. *Journal of Development Economics*. Forthcoming.

Rodrik, D.: 1999, 'Where Did All the Growth Go? External Shocks, Social Conflict, and Growth Collapses'. *Journal of Economic Growth* **4**(4), 385–412.

Rodrik, D.: 2000, 'Participatory Politics, Social Cooperation, and Economic Stability'. *American Economic Review* **90**(2), 140–144.

Sachs, J. D.: 2003, 'Institutions Don't Rule: Direct Effects of Geography on Per Capita Income'. NBER Working Papers 9490, National Bureau of Economic Research, Inc.

Sokoloff, K. L. and S. L. Engerman: 2000, 'Institutions, Factor Endowments, and Paths of Development in the New World'. *Journal of Economic Perspectives* **14**(3), 217–232.

Yang, B.: 2008, 'Does democracy lower growth volatility? A dynamic panel analysis'. *Journal of Macroeconomics* **30**(1), 562–574.