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Natural Resources, Export Concentration and Financial Development

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Abstract: Recent studies indicate that the natural resource curse, that is, the negative link between resource abundance and growth, may operate through a country's financial system. Scholars show that resource-abundant economies suffer from lower financial development, which may indirectly affect welfare. The present study provides an explanation for this financial channel. It argues that resource-rich countries are likely to have a concentrated export structure, causing a reduction of the financial system's size due to volatility and the associated high real interest rates. The paper shows empirically that export concentration tends to weaken private credit to GDP. The analysis builds on cross-sectional and panel data from 93 countries for the period 1970-2007. The direction of causality is tested with an instrumentation strategy using geographic and geospatial variables as well as dynamic panel techniques.

JEL classifications: F10, F40, G10, O13, O16

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1 Introduction

Recent research on the resource curse suggests that the negative association between resource abundance and growth is explained primarily by poor economic diversification and less by the exploitation of natural resources as such. Economic concentration is often connected to high volatility, which decreases welfare in a number of ways. Previous work indicates that one channel through which the curse might operate is finance. This paper seeks to identify a causal negative impact of concentration, in particular export concentration, on financial development, arguing that this indirectly affects economic growth.

The theoretical argument concerning the link between concentration and finance builds on a framework developed by Hausmann and Rigobon (2003). According to their model, resource-abundant countries are likely to specialize away from non-resource tradable goods (manufacturing). This lowers their ability to absorb demand shocks through movements in the allocation of production inputs, affects the relative prices of tradable and non-tradable goods and leads to higher exchange rate volatility. Thus, a concentrated economy is disrupted by volatility in yet another way than by fluctuating terms of trade. In the presence of financial frictions such as bankruptcy costs, volatility is associated with higher real interest rates since lenders call for a risk premium. I argue that higher real interest rates, by lowering investment, decrease the amount of credit and thus the level of financial and economic development.

In the following, I test the negative influence of concentration on financial development empirically. I expect to find a negative coefficient on the main explanatory variable, concentration, or more precisely, export concentration. I use the Herfindahl-Hirschman index as the preferred measure. The ratio of private credit to gross domestic product (GDP), a frequently used measure of financial development, serves as the dependent variable. The set of controls includes further determinants of finance such as income per capita, legal origin, the quality of institutions, the level of inflation and education, banking crises and exchange rate regimes. The regression equations are estimated using ordinary least squares (OLS) in a cross-section of 93 countries with averages from 1970

to 2007 in the basic sample. To ensure that unobserved heterogeneity is controlled for, the study also estimates a panel specification with country and time fixed effects.

Moreover, endogeneity may arise due to reverse causality, meaning that the level of financial development determines the export structure and thus export concentration. In order to avoid this problem, an instrumentation strategy based on exogenous geographic and geospatial variables is applied. This includes the construction of an instrument using sector-level gravity estimations with geographic determinants of trade such as bilateral distances and the trading partners' land area. Further instruments for export concentration are measures of a country's remoteness, coastal access as well as its exposure to geological and climatic conditions. These variables are believed to influence trade costs and, accordingly, the economy's sectoral composition. The instruments for export concentration are used in a two-stage least squares (2SLS) regression. In addition, dynamic panel techniques, in particular a difference generalized method of moments (GMM) approach following Arellano and Bond (1991), are adopted to test the findings. Robustness checks include the variation of finance and concentration measures and of control variables as well as different samples.

The empirical analysis provides evidence in favor of the hypothesis that export concentration may weaken a country's private credit to GDP. The coefficient on concentration is negative and significant in the cross-section with a large set of covariates. Controlling for reverse causality with 2SLS alters the coefficient's size, but leaves its sign and significance largely unaffected. The gravity-related instrument, the measure of remoteness as well as the share of a country's population in temperate climate zones prove to be acceptable instruments for export concentration. Both the OLS and dynamic panel analysis tend to confirm the findings—with the exception, however, that a significant correlation between concentration and finance cannot be observed when poor countries are included in the sample. A careful interpretation might be that the proposed interplay among specialization, volatility and real interest rates has a minor effect on economies at an early stage of development. For these economies, a general country risk, aside from concentration-induced risk premia, could be crucial. Furthermore, empirics suggest that the described mechanism applies mainly to bank-based finance,

as captured by private credit to GDP. Equity-related finance, that is, stock markets, are not affected by export concentration. This result might reflect the relatively high risk aversion of banks that issue debt contracts. In contrast, equity investors may be more capable of coping with risk since they are able to benefit to the full extent from potential profits.

The effect's size can be shown to be economically significant. With a conservative estimate, moving from the 25th to the 75th percentile in the distribution of export concentration, ceteris paribus, decreases private credit by around one standard deviation in cross-country finance. This is comparable to other determinants of financial development such as the quality of institutions.

Since poor financial development is assumed to diminish economic growth, the study thus advocates a policy of export diversification in resource-abundant countries.

The paper is structured as follows: Section 2 gives an overview of the relevant strands of literature. Section 3 presents a possible theory to explain the negative relationship between concentration and financial development. The empirical strategy and data are described in Section 4. The results are presented in Section 5. Section 6 concludes.

2 Literature

2.1 The Resource Curse and the Financial Channel

The negative relationship between a country's abundance in natural resources (oil, gas, mining) and economic growth, referred to as the resource curse, has been explored by a number of scholars. Empirical support for the hypothesis has been provided, for example, by Sachs and Warner (1995, 2001) using output- and trade-related measures of resource abundance such as the share of resource exports in GDP. Recent studies suggest the use of more exogenous indicators of actual subsoil wealth per capita and find that resource-rich countries do not necessarily suffer from lower economic development (see, e.g., Brunnschweiler 2008). Nevertheless, there is convincing evidence that many

countries do not benefit substantially from their natural resource wealth.

A variety of explanations for the phenomenon have been proposed. According to the "Dutch disease" approach, a resource boom may increase the real exchange rate of a country, thereby rendering the manufacturing sector less competitive (see Corden and Neary 1982, van Wijnbergen 1984, Stijns 2003). Other theories link resource abundance to a higher probability of armed conflicts (e.g., Ross 2004) as well as lower incentives to accumulate human capital (Gylfason 2001). Yet another mechanism discussed is the so-called institutional channel (see Mehlum, Moene and Torvik 2006, Tornell and Lane 1999, Sala-i-Martin and Subramanian 2003). Resource exploitation is believed to foster rent-seeking and corruption, which harms growth considerably. In recent debates on resource abundance, the aspects of concentration and volatility have been emphasized. Van der Ploeg and Poelhekke (2009) find that the indirect effect of resources on economic performance via the volatility of output growth is far more important than any direct effect. Similarly, Lederman and Maloney (2012, p.21) argue that the "curse is one of concentration, not resources" as such.

In addition, empirical work shows that resource-abundant, especially resource-dominated, countries tend to have a less developed financial system (Nili and Rastad 2007, Beck 2011, Kurronen 2012, Hattendorff 2014). A negative impact of resources on finance is likely to also affect the overall economy since financial development is considered a major determinant of growth (see, e.g., Levine 2005, Rajan and Zingales 1998).

Several possible explanations for the negative influence of resources on finance have been proposed in the literature. Nili and Rastad (2007) argue that the government is often heavily involved in investment, thus weakening the private sector and private lending. Berglöf and Lehmann (2009, p.199) assume a general "bulkiness of investment and a lack of demand for broader financial services."

Yuxiang and Chen (2011) propose four likely mechanisms. First, resource-abundant economies are often left with a relatively small tradable sector (manufacturing), which means that there is less support for liberal trade policies. Usually, this also weakens liberal financial reforms. Second, the enforcement and reliability of financial sector re-

forms requires high government credibility, which might be eroded by the rent-seeking and corruption that are typical of resource-based economies. In addition, rent-seeking can decrease the activity and credit demand of entrepreneurs. Third, if resource abundance is believed to weaken human capital, it might also reduce a society's general level of trust and thus the reliability of financial contracts. Fourth, the negative effect of resource dominance on productive investment may weaken the financial system as well.

Kurronen (2012) argues that local incumbents in resource sectors are likely to resist financial reforms in order to prevent competitors from market entry, since young firms are more reliant on external finance than mature companies. The author further points out that the macroeconomic volatility caused by fluctuating commodity prices may generally weaken financial development.

A paper by Hattendorff (2014) empirically investigates a further theory. It starts from the assumption that resource sectors have a systematically lower demand for short-term external finance due to persistent technological reasons. In resource-based economies, there might be less aggregate credit demand and, accordingly, a smaller financial sector. However, based on the empirical evidence, this hypothesis has to be rejected. The results suggest instead that export concentration plays an important role here.

2.2 Further Literature

The present paper establishes a link between natural resources, export concentration, volatility, finance and growth, referring to a vast body of economic literature.

The positive association between resource abundance and concentration is a standard assumption in the resource curse literature (see, among others, Bond and Malik 2009). This view is substantiated by the findings of Lederman and Maloney (2012, p.98) in a general study on the export structure, regressing an index of export concentration on net exports of energy and mining per worker. They control for real GDP per capita, which is generally negatively related to concentration (Acemoglu and Zilibotti

1997). The correlation between resource abundance and concentration is especially pronounced for trade-related measures of resource abundance, which—according to Lederman and Maloney—are "probably best interpreted as a proxy of export concentration" (p.22). This result also holds in my dataset. My analysis suggests that the positive correlation is relatively strong when the share of resource exports in total exports is used (correlation coefficient around 0.5). It is much weaker, however, for measures referring to actual subsoil wealth per capita, which are more exogenous to other determinants of development.[2] Examples include the United States, Australia and some Scandinavian countries, where general resource wealth is not associated with a concentrated export structure.

Furthermore, export concentration is shown to be correlated with volatility. Lederman and Maloney (2012, p.97) prove this for terms-of-trade volatility, which translates into volatility of income and consumption per capita, thus dampening welfare. This is in line with the results of a comprehensive econometric analysis by Malik and Temple (2009), who also associate concentration with high terms-of-trade and output volatility, as well as Busch (2011). Hausmann, Panizza and Rigobon (2006) find that poorly diversified exports help to explain why less developed countries suffer from a higher volatility of real exchange rates than industrialized countries. It is important to notice that export concentration as such, that is, a characteristic of sectoral composition, may lead to volatility, regardless of a sector-specific tendency towards volatile revenues. The detrimental effect of resources is thus not necessarily driven by higher intrinsic volatility of the resource sectors, which is frequently assumed in the literature.[3]

Both export concentration and volatility are believed to have a negative effect on economic growth. The idea that countries should specialize in few sectors in order to fully exploit their comparative advantage has been popular in international trade for some time. Recent studies contradict this view and suggest that sectoral diversification at the national level is welfare-increasing (see the surveys of this strand of literature

[2]Details are available on request.

[3]This assumption is criticized by Arezki, Lederman and Zhao (2011), who show that on average commodity prices are not more volatile than prices of individual manufacturing goods. Van der Ploeg and Poelhekke (2009), however, argue that resource sectors are more volatile because they exhibit low price elasticities of supply.

in Naudé, Bosker and Matthee 2010 and Hesse 2008).[4] The basic argument follows an assumption of portfolio theory, namely that risk-averse agents prefer diversification under uncertainty. Highly specialized countries are more vulnerable, for example, to fluctuations in goods prices or to changes in world demand. Furthermore, they cannot profit from knowledge spillovers between sectors (following Hausmann and Rodrik 2003). Naudé, Bosker and Matthee (2010) list a number of empirical studies that confirm the negative association between export concentration and growth, including Lederman and Maloney (2007), Agosin (2007), Hesse (2008) as well as Feenstra and Kee (2008), the latter of which showing a positive connection between export variety and productivity. Bond and Malik (2009) find that concentration tends to diminish private investment, thus also affecting economic growth.[5]

Similar findings are provided by the literature on the volatility-growth link. In a seminal paper, Ramey and Ramey (1995) show empirically that volatility of economic fluctuations is negatively related to long-run growth. They thus contradict a frequently assumed dichotomy in macroeconomics, as postulated, for example, by Lucas (1987). The detrimental effect of volatility is confirmed in a number of more recent works, including those by Imbs (2007), who refers to macroeconomic volatility at the national level, Blattman, Hwang and Williamson (2007), who analyze terms-of-trade volatility, and Aghion, Bacchetta, Rancière and Rogoff (2009), who detect a welfare-decreasing effect of exchange rate volatility. Accordingly, private investment is also found to correlate negatively with various measures of volatility (Aizenman and Marion 1999).

The present study suggests an indirect effect of concentration and volatility on growth, namely through the financial system. Little work has been done so far on this causal link. One of the few studies is by Ramcharan (2006), who finds that diversification of economic activity tends to increase a country's level of financial development. His analysis does not explicitly refer to resources and the export structure, however, and is confined to a cross-section of countries.

[4]Naudé, Bosker and Matthee (2010) show that specialization can, nevertheless, foster growth at the *local* level, which is in line with other empirical work.

[5]Imbs and Wacziarg (2003) find a slightly U-shaped pattern of concentration and wealth. For highly industrialized countries, it might be desirable to increase specialization, in particular towards high-tech production. For other countries, this does not hold.

3 Theory

The mechanism linking resources, concentration and finance investigated in the present paper builds on a model developed by Hausmann and Rigobon (2003), who offer an additional explanation for the resource curse that accounts for the interaction between sectoral specialization and financial market imperfections. They show that resource-abundant countries tend to specialize away from non-resource tradable goods, which leads to higher exchange rate volatility and, in the presence of bankruptcy costs, to higher real interest rates. Following Hausmann and Rigobon (2003), I argue that higher real interest rates, by making investment possibilities less attractive, decrease the amount of credit and thus the level of financial development.

Hausmann and Rigobon (2003) point out that terms-of-trade volatility alone, though not negligible, cannot explain the large negative impact of resource dominance on growth. They argue that the overall economy is disrupted by volatility in yet another way, supposing an interplay between concentration and financial frictions in a non-neoclassical setting.

Their model assumes an economy with three sectors: a resource sector, a non-resource tradable sector (e.g., manufacturing) and a non-tradable sector (e.g., services). Resources are produced without input use and, by construction, do not affect relative prices of the other goods. Tradables and non-tradables are produced using labor and capital, the latter of which is mobile internationally and owned by foreign investors, while labor is nationally fixed. Both inputs are allowed to move between sectors.

It is typical of resource-abundant countries to have a small non-resource tradable sector, being specialized in resources and non-tradables. Hausmann and Rigobon (2003, p.14) argue that this reduces their ability to absorb shocks in non-tradable demand, which may arise due to exogenous resource revenues. These shocks can usually be absorbed through labor movements between sectors. In a highly specialized economy, however, labor is almost fixed and almost fully employed in the non-tradable sector. To meet higher demand, the amount of capital per worker has to be increased, instead of simply drawing additional labor from the tradable sector. Accordingly, the produc-

tivity of each additional unit of capital has to fall. Since investors would not accept the associated loss in the rate of return on capital, the price of non-tradables is required to rise. The rising price causes expenditure-switching effects because consumers, now, buy fewer non-tradable goods. This affects the relative price of non-tradables and tradables or, in other words, the real exchange rate (p.15). Thus, Hausmann and Rigobon (2003) show that a specialized economy experiences a volatile real exchange rate. In contrast, a diversified economy, where shocks in the demand of non-tradables can be accommodated by movements in the allocation of capital and labor, has a constant real exchange rate.

Also, a more volatile real exchange rate may translate into higher real interest rates. Hausmann and Rigobon (2003) prove this to be the case in the presence of financial market imperfections, say costly bankruptcy or risk aversion of individuals (assuming that only debt contracts are available). Capital owners demand risk premia, thus increasing the cost of capital and decreasing investment. This affects the tradable sector most, where the price is exogenously set by world markets and firms' profits necessarily shrink (p.30). As a consequence, the economy specializes even further away from tradables. This gives rise to the idea of a vicious circle between concentration and volatility, a mechanism that multiplies the initial volatility. At the same time, specialization and the associated higher cost of capital also reduce the investment in non-tradables, albeit not as much as in tradables since the higher price in non-tradables ensures that a certain profitability is preserved. In sum, economies with high resource rents are likely to be very specialized and to suffer from high real interest rates and low investment.

While not the focus of Hausmann and Rigobon (2003), the above theory may also explain why resource-abundant countries tend to have a lower level of financial development, which is typically a measure of the financial system's size. Low investment of firms, caused by risk premia and high real interest rates, is equivalent to a low amount of credit demanded. Accordingly, the financial system's size will be relatively small, as measured, for example, by private credit to GDP. Following the finance literature, it is reasonable to surmise that the size of a financial system is connected to its quality, that

is, a smaller financial system will experience severe financial frictions. In the model, this might even intensify the detrimental multiplier process when bankruptcy costs are country-specific.

The mechanism notably applies to bank-based measures. For this reason, private credit to GDP is the preferred variable, while equity-related measures such as stock market capitalization are used for supplemental robustness checks (data description in Section 4.3). It is argued that local finance is an important determinant of economic activity, regardless of increasing international financial integration (Pagano, Randl, Röell and Zechner 2001, Guiso, Sapienza and Zingales 2004). In addition to concentration, financial development is likely to be influenced by further variables, including income per capita, trade openness, legal origin, the quality of institutions, the number of days it takes to enforce a contract and the level of inflation as well as education (e.g., Rajan and Zingales 2003, La Porta, Lopez-de-Silanes, Shleifer and Vishny 1998, Do and Levchenko 2007, Huang 2010). Financial distress, that is, banking crises, and the effective exchange rate regime might also play a role.

Although the theory refers to specialization in output, I have chosen to use measures of concentration in exports throughout my empirical analysis. This is relatively unproblematic because sectoral and export concentration are typically closely related. Export data are often more reliable and more easily available than sectoral GDP data, in particular for developing countries. Moreover, trade data are required for the geography-based instrumentation strategy.

4 Empirical Strategy and Data

The theory in Section 3 suggests that concentration, which is typical of resource-abundant countries, may hamper financial development. The following section presents the empirical strategy applied to identify this negative effect. The empirical part of the paper thus focuses on the direct relation between export concentration and financial development, while it does not explicitly address the intermediate steps of the proposed channel: volatility and real interest rates. This would require additional,

distinct econometric modeling and is beyond the scope of this paper. The literature review in Section 2 nonetheless indicates the plausibility of the channel from both a theoretical and an empirical perspective.

4.1 Financial Development and Export Concentration

First, the hypothesis is formally tested in a cross-section of countries, where variables are averaged over time. The regression equation, which I estimate with ordinary least squares (OLS), is:

$$FD_c = \alpha + \beta \ EXPCON_c + \boldsymbol{\gamma} X_c + \epsilon_c, \tag{1}$$

where FD_c denotes a measure of country c's financial development, $EXPCON_c$ is a measure of the degree of export concentration and $\boldsymbol{X}_c$ is a set of control variables. ϵ_c denotes the error term. The calculation of $EXPCON_c$ is varied, including the Herfindahl-Hirschman index, the concentration ratio of the four largest sectors and the Theil as well as the Gini index. Control variables are income per capita, trade openness, legal origin dummies, different measures of institutional quality, contract enforcement days, variables that capture the level of inflation and education as well as banking crises and the exchange rate regime. Robustness checks account for the variation in financial development measures and for different country samples. The regressions correspond to the literature on the determinants of financial development (e.g., Huang 2010, Do and Levchenko 2007). Details on the data are given in Section 4.3. Moreover, the above equation is estimated with two-stage least squares (2SLS).

In order to exploit the time variation in the variables, I estimate a panel specification with country and time fixed effects. Formally, this can be written as follows:

$$FD_{ct} = \alpha + \beta \, EXPCON_{ct} + \boldsymbol{\gamma} X_{ct} + \delta_c + \delta_t + \epsilon_{ct}, \tag{2}$$

with δ_c for country fixed effects and δ_t for time fixed effects. The OLS regression is done with a sample of non-overlapping five-year averages. This procedure mitigates

the problem of a somewhat unbalanced panel and reduces the influence of short-run fluctuations in the business cycle (see, e.g., Huang and Temple 2005, p.12).

4.2 Instrumentation Strategy

The estimations described above suffer from endogeneity because the regressor export concentration may be correlated with the error term. The direction of causality is a major concern of the empirical approach in this paper.

Various studies show that the level of financial development shapes the trade structure—and hence export variety—in a Heckscher-Ohlin sense. A good financial system may be interpreted as a country's endowment, which fosters financially intensive sectors, that is, sectors that rely on external finance (e.g., Beck 2002, Svaleryd and Vlachos 2005). Furthermore, Guriev, Plekhanov and Sonin (2009, p.15) argue that finance can help to reduce export concentration in a number of ways: by minimizing inequality, it gives more individuals access to credit, thus offering new investment opportunities. Also, it mitigates the effect of price volatility and increases incentives to invest. Similarly, van der Ploeg and Poelhekke (2009) argue that countries with a well developed financial sector experience lower output volatility, thereby stimulating investment.[6] According to Ramcharan (2006), financial development makes it possible to engage in risky but also more productive projects, having a direct effect on economic activity and the trade pattern. Svaleryd and Vlachos (2002) find that there is a positive interdependence between finance and liberal trade policies, which are believed to promote export diversification.[7]

These arguments underline the necessity of an instrumentation strategy to overcome the problem of reverse causality. In order to find a consistent coefficient estimate β, I use geographic and geospatial variables as instruments for the right-hand side variable export concentration. While this concept normally allows only for cross-sectional analysis, it brings with it an important advantage. Geographic determinants tend to be

[6] An overview of the general literature studying the effect of finance on volatility can be found in Malik and Temple (2009, p.167).

[7] Agosin, Alvarez and Bravo-Ortega (2012) are more skeptical and do not find an effect of financial development on export concentration.

exogenous since they are shaped over the long term and are unlikely to be influenced by medium- or short-term economic activity, including the financial system. The role of geography in the determination of financial development is analyzed, for example, by Huang (2010). Several approaches using geography for the identification of causality are presented in the following.

The first approach applies gravity equations to predict international trade—and thus indirectly export concentration—on the basis of geographical explanatory variables such as distance and land area. The idea builds on Frankel and Romer (1999) and has been further developed by Do and Levchenko (2007), who are able to predict the trade pattern rather than just the trade volume at the national level.[8] The regression equation comes from Hattendorff (2014), where resource endowment is also taken into account. It is estimated for each industry i:

$$\begin{aligned} LogEXP_{icd} = \alpha &+ \eta_i^1 ldist_{cd} + \eta_i^2 lpop_c + \eta_i^3 larea_c + \eta_i^4 lpop_d + \eta_i^5 larea_d \\ &+ \eta_i^6 landlocked_{cd} + \eta_i^7 border_{cd} + \eta_i^8 border_{cd} * ldist_{cd} \\ &+ \eta_i^9 border_{cd} * pop_c + \eta_i^{10} border_{cd} * area_c + \eta_i^{11} border_{cd} * pop_d \\ &+ \eta_i^{12} border_{cd} * area_d + \eta_i^{13} border_{cd} * landlocked_{cd} \\ &+ \eta_i^{14} subsoilintotalwealth_c + \eta_i^{15} subsoilintotalwealth_d + \epsilon_{cd}. \end{aligned} \tag{3}$$

$LogEXP_{icd}$ is the log of exports from country c to d relative to GDP in sector i.[9] The regressors include the log of bilateral distance between the two countries' major cities $ldist_{cd}$, the log of country c's population $lpop_c$, the log of its land area $larea_c$ and both variables for trade partner d, respectively. The dummy variable $landlocked_{cd}$ indicates whether none, one or both of the countries are landlocked by taking the value of zero, one or two. $border_{cd}$ is a dummy indicating a common border. Since the presence of a common border will most likely alter the effect of all previous variables, there are interaction terms with $border_{cd}$. $subsoilintotalwealth$ denotes the subsoil in total wealth for both countries (see the data description 4.3). The obtained sector

[8] Busch (2011) also uses the idea of Frankel and Romer (1999) to construct an instrument for export concentration, but deviates from Do and Levchenko (2007), whose approach is central to my analysis.

[9] "Log" refers to the natural logarithm in this paper.

coefficients are then used to predict the log of exports to GDP in sector i from country c to d, $\widehat{LogEXP_{icd}}$.[10] The exponential of $\widehat{LogEXP_{icd}}$ is taken and summed over all trade partners ($d = 1, ..., D$):

$$\widehat{EXP_{ic}} = \sum_{d=1}^{D} e^{\widehat{LogEXP_{icd}}}, \qquad \text{where} \qquad d \neq c. \tag{4}$$

The predicted sectoral trade shares are obtained in the following manner:

$$\widehat{\omega}_{ic} = \frac{\widehat{EXP_{ic}}}{\sum_{i=1}^{I} \widehat{EXP_{ic}}}. \tag{5}$$

With these predicted sectoral shares in total trade $\widehat{\omega}_{ic}$, it is possible to construct the instrument for export concentration ($\widehat{EXPCON}$). The estimated gravity coefficients η_i^{1-15} vary across sectors because the gravity regression is estimated for each sector i separately. This ensures that the predicted exports to GDP by sector $\widehat{EXP_{ic}}$ differ within a country, although the right-hand side variables in the gravity equation refer to the aggregate national level. The underlying reasoning is that the export volume of industries is unequally affected by, say, distance, thus showing different coefficients on this regressor. The literature suggests that this may be due to trade costs or the elasticity of substitution between product varieties within an industry (see Do and Levchenko 2007).

The role of trade costs caused by distance may be captured by a further and far simpler instrument. Agosin, Alvarez and Bravo-Ortega (2012) show that remote countries tend to have less diversified exports. They argue that remoteness operates as a cost on trade, for example, for the transportation of goods. According to Melitz (2003), higher trade costs reduce export opportunities and the number of firms capable of selling abroad and thus also the variety of exporting industries. Remoteness is calculated as the log of minimum distance to one of the three large markets Europe, the U.S. or Japan (definition similar to Malik and Temple 2009). Details on the data can be found below.

The argument of higher trade costs also applies to landlocked countries without direct

[10] Hats indicate predicted values.

access to the sea. Following Bond and Malik (2009), a simple landlocked dummy variable serves as possible instrument for export concentration.[11] More sophisticated measures of coastal access are the proportion of a country's population within 100 km of the coastline (variable $POP100C$) as well as the proportion of the population within 100 km of the coastline *or* ocean-navigable river (variable $POP100CR$, from Gallup, Sachs and Mellinger 1999, Malik and Temple 2009).

Yet another type of geospatial information may be considered to construct an instrument for economic concentration: the proportion of the population living in the so-called Koeppen-Geiger temperate zone, which is defined by moderate climatic conditions (Gallup, Sachs and Mellinger 1999, Bond and Malik 2009). The temperate zone is believed to be favorable for economic activity, in contrast to regions with a more extreme climate associated with disease burdens and lower agricultural productivity. The Koeppen-Geiger temperate zone basically consists of world regions with a mild, humid climate or a snowy forest climate, excluding tropical, steppe and other rough climates (Cf + Cs + Df + DW in Appendix Figure 2). The lower this variable, the higher the expected export concentration.

Ramcharan (2006) proposes a further method based on geospatial data. He uses variation in the terrain grade and in bioclimatic conditions to construct an instrument for economic diversification. First, he argues that a concentrated distribution of land area by elevation leads to lower costs and thus to lower sectoral concentration. The argument builds on the assumption that a smoother (concentrated) surface of the country, for example, because of low-lying plains or high elevation plateaus, lowers costs for the transportation of goods and for traffic infrastructure. This facilitates the realization of economies of scale and the exploitation of regional labor markets, thereby fostering goods production and economic diversification. It is important to note that the measure captures the country's elevation *structure* and not whether it is mountainous or flat (Ramcharan 2006, p.8). The Netherlands may serve as an example of concentration in low elevation classes, while South Africa's land area is concentrated on a rather high elevation level. In contrast, Pakistan's land area is quite equally distributed over all

[11] Van der Ploeg and Poelhekke (2009) find that landlocked economies experience higher volatility.

elevation classes, which—according to the theory—leads to high sectoral concentration.

Second, Ramcharan (2006) finds that a concentration of land area by bioclimatic (biome) classes is associated with increased economic concentration.[12] This is motivated by the supposed link between the variety of natural endowments and production. The higher the concentration of a country's land area in only few biome zones, the less diversified the economy. Indonesia, for example, has a very unequal distribution of land area with basically only tropical and subtropical broadleaf forest, which leads to a predominant role of paper- and pulp-processing-related sectors in manufacturing (p.11). Both instruments by Ramcharan (2006) are applied as an additional robustness check in the cross-section.[13]

All instruments described above are used in regression equation (1) with two-stage least squares (2SLS). While the 2SLS approach might be an appropriate way to identify causal direction, it does not capture omitted variables, which are another common cause of endogeneity.

Omitted variables can be controlled for using panel estimations with fixed effects. Unfortunately, geographical instruments typically do not exhibit time variation and cancel out of the regression equation. Nevertheless, there have been attempts to translate geographical characteristics into a panel setup. For example, Felbermayr and Gröschl (2013) find that natural disasters interact with geography, and develop a time-varying instrument for trade openness based on the gravity approach of Frankel and Romer (1999). A similar instrument is proposed by Feyrer (2009), who exploits improvements in aircraft technology and the corresponding increase in the trade volume brought about largely by increased air travel in recent decades. Tests show, however, that both methods fail to provide sufficient data for gravity equations at the sectoral level, which are necessary to construct an instrument for export concentration rather than simple trade openness. Thus, they cannot be applied in the present analysis.

A standard procedure to account for causality as well as omitted variables is to use dy-

[12] Contrary to the climate zones used by the Koeppen-Geiger measure, biome classes refer to terrestrial ecosystems, that is, the habitats of plants and animals.

[13] Notice that Ramcharan (2006) uses the elevation and biome measures to instrument economic diversification in manufacturing (value added), not export concentration.

namic panel data techniques, in particular the generalized method of moments (GMM) approach of Arellano and Bond (1991). The corresponding regression equation is:

$$FD_{ct} = \alpha_1 FD_{c,t-1} + \alpha_2 FD_{c,t-2} + \beta EXPCON_{ct} + \boldsymbol{\gamma} X_{ct} + \epsilon_{ct}. \quad (6)$$

In addition to export concentration $EXPCON_{ct}$ and a set of controls $\boldsymbol{X}_{ct}$, financial development is explained as a function of its lagged values at time $t-1$ and $t-2$. The Arellano-Bond (1991) difference GMM approach uses first differences to transform the above equation into:

$$\Delta FD_{ct} = \alpha_1 \Delta FD_{c,t-1} + \alpha_2 \Delta FD_{c,t-2} + \beta \Delta EXPCON_{ct} + \boldsymbol{\gamma} \Delta X_{ct} + \Delta \epsilon_{ct}. \quad (7)$$

First differencing ensures that the country fixed effects are controlled for. In order to overcome reverse causality, the method uses lagged levels of the regressors as instruments to obtain predetermined variables, which are less likely to be correlated with the error term in regression (7).[14] The difference GMM estimator is generally recommended in a situation where the number of time periods is smaller than the number of countries.

4.3 Data Description

This section describes the data used in the analysis. It presents the measures of financial development, the indices of export concentration, the various geography-based instruments, the control variables as well as the different samples used. Summary statistics are depicted in Appendix Table 6.

4.3.1 Financial Development

The finance literature proposes various measures to capture a country's level of financial development. A frequently used measure is the ratio of private credit to GDP, that is,

[14]Notice that these instruments are only contemporaneously exogenous, not strictly exogenous as assumed for the geography-based approach.

the amount of credit by banks and other private financial institutions to the private sector as a share of GDP (e.g., Rajan and Zingales 1998, p.569). It is assumed that the size of the financial sector is an appropriate proxy for its quality (Do and Levchenko 2007, p.799). Private credit to GDP accounts particularly well for the standard loans from private lenders to private borrowers, as described in the model in Section 3. The ratio of liquid liabilities to GDP (M2/GDP) is a broader measure. In contrast to private credit, it additionally includes activities of central banks and other public authorities. Alternative measures focus on equity-based finance, for example, the stock market capitalization or stock market trade value relative to GDP. The stock market turnover ratio, which is defined as the value of total shares traded divided by the average real market capitalization, is a proxy for the stock market's activity rather than its size. All indicators exclude bond markets and are positively but not perfectly correlated. Data come from Beck and Demirgüç-Kunt (2009).

4.3.2 Export Concentration

The measures of export concentration are calculated on the basis of international export data taken from both the World Trade Database (Feenstra, Lipsey, Deng, Ma and Mo 2005) for the time period 1970 to 2000 as well as UN Comtrade for 2001 to 2007. Agricultural, resource and manufacturing exports are considered. The trade flows, which were originally classified in four-digit SITC Rev. 2, are converted to three-digit ISIC Rev. 2, partly with the help of a correspondence table developed by Muendler (2009). This procedure ensures that the applied classification provides a reasonable aggregation level, that is, 41 different sectors, five of which are agricultural, four are resource and 32 are manufacturing sectors. If the industry classification were too disaggregated, there would be a risk of measuring minor product variation instead of the broader economic concentration (Agosin, Alvarez and Bravo-Ortega 2012, p.298).

Various indices of export concentration are applied. A commonly used measure is the Herfindahl-Hirschman index, which is the sum of squared export shares $\omega_{i(ct)}$ of all

sectors i (in country c in t):

$$HHI_{(ct)} = \sum_{i=1}^{I} \omega_{i(ct)}^{2}. \tag{8}$$

The index increases with concentration in few sectors. Bond and Malik (2009, p.680) propose using a modified version of the Herfindahl-Hirschman index from the UNCTAD. It is calculated as:

$$Modified \;\; HHI = \frac{\sqrt{\sum_{i=1}^{I} {\omega_i}^2} - \sqrt{\frac{1}{I}}}{1 - \sqrt{\frac{1}{I}}}, \tag{9}$$

where I denotes the total number of export sectors. The index is normalized to lie between zero and one, and the values across countries are slightly more dispersed than above. This modified index is used as the preferred measure of export concentration in the present analysis.

A very simple alternative is the concentration ratio. It sums up the country's largest exporting industries. Here, four sectors are chosen:

$$CR(4) = \sum_{i=1}^{4} \omega_i. \tag{10}$$

The index captures less information than the previous ones because it does not consider the remaining sectors. In the paper, it is treated as inferior.

For sensitivity analysis, Agosin, Alvarez and Bravo-Ortega (2012, p.298) suggest using the Theil and the Gini index. Both are suitable to indicate a lack of diversity. The Theil index is computed in the following manner:

$$Theil = \frac{1}{I} \sum_{i=1}^{I} \left[\frac{x_i}{\mu} \; \log \frac{x_i}{\mu} \right] , \qquad \text{where} \quad \mu = \frac{1}{I} \sum_{i=1}^{I} x_i. \tag{11}$$

I is again the total number of industries, x_i is the export value of sector i and μ is the corresponding mean value of all sectors. If all parameter values are close to the mean,

there is high equality, that is, low concentration. The construction of the Gini index is standard. Sectors are arranged in increasing order, such that i denotes the sector's rank as determined by its share in total exports:

$$Gini = \frac{2 \sum_{i=1}^{I} i \; x_i}{I \sum_{i=1}^{I} x_i} - \frac{I+1}{I}. \tag{12}$$

All presented indices will be expressed in natural logs. As expected, they show high correlation with each other (correlation coefficients larger than 0.9).

4.3.3 Instruments for Export Concentration

The same trade data as in Section 4.3.2 are used for the dependent variable of the gravity equation EXP_{icd}. The required sectoral GDP data are taken from the United Nations Industrial Development Organization's database INDSTAT4 and the UNIDO publication "World Statistics on Mining and Utilities" (2010).[15] As before, data are converted to three-digit ISIC Rev. 2. Due to data limitations or, in one case, small inconsistencies in the matching of sector classifications, the sectors agriculture and livestock production (ISIC Rev. 2 no. 111), hunting (113), forestry (121), logging (122), fishing (130) as well as plastic products (356) have to be dropped. The geographical variables, that is, bilateral distances between two countries' major cities, land area as well as information on whether one or both trading partners are landlocked and whether two countries share a border, come from Centre d'Etudes Prospectives et d'Informations Internationales CEPII (Head, Mayer and Ries 2010). Data on population are taken from the World Bank's "World Development Indicators." Subsoil wealth in total wealth is explained below. On the basis of the predicted trade shares $\widehat{\omega}_{ic}$, both Herfindahl-Hirschman indices and the concentration ratio are calculated as described above. The Theil and the Gini index are excluded, however, since the procedure does not allow for predicting the required export values x_i.

[15]The paper benefits from previous work in Hattendorff (2014).

The instruments remoteness, that is, the log of minimum distance to one of the three large markets Europe (the Netherlands as geographic center), the U.S. or Japan, as well as the simple landlocked dummy are constructed using the CEPII database (Head, Mayer and Ries 2010).[16] Data on the proportion of a country's population within 100 km of the coastline as well as the proportion of the population within 100 km of the coastline *or* ocean-navigable river come from Gallup, Sachs and Mellinger (1999).

These authors also provide information on a country's proportion of people living in the Koeppen-Geiger temperate zone. A map in the appendix gives an overview of the climate zones (Appendix Figure 2). Statistics on land area by elevation and biome classes are sourced from the Center for International Earth Science Information Network (CIESIN). The distribution of the data is summarized using the Theil and the Gini index, similar to equations (11) and (12). Elevation is classified in 12 levels (from below 5 meters, 5 to 10 meters, 10 to 25 meters, up to above 5,000 meters). Bioclimatic characteristics are captured by 16 categories, ranging from tropical and subtropical moist broadleaf forest to rock and ice (see also Ramcharan 2006).

How are actual export concentration and the instrumental variables correlated? The gravity-based predicted $\widehat{EXPCON}$ shows a weak positive correlation with the actual $EXPCON$ index, while it shows virtually no correlation with the other instruments. Actual export concentration is positively correlated with remoteness and the landlocked dummy, and negatively with the two other measures capturing access to the sea as well as the proportion of people living in the Koeppen-Geiger temperate zone. Accordingly, the latter three instruments are positively associated with each other and negatively with remoteness and the landlocked dummy. The measure of coastal access that additionally accounts for ocean-navigable rivers ($POP100CR$) seems to be more meaningful than the one omitting this factor ($POP100C$). Contrary to expectations, a concentrated distribution of land area by elevation is positively rather than negatively correlated with export concentration. The measure of biome concentration shows a very weak correlation with export concentration. Selected correlations are presented in Appendix Table 7.

[16] In contrast to the "bilateral" $landlocked_{cd}$, this landlocked dummy just takes the values zero or one.

4.3.4 Further Variables

The control variables real GDP per capita (PPP adjusted) and trade openness (sum of imports and exports as a share of GDP) come from the Penn World Tables (Heston, Summers and Aten 2011). Data on legal origin are taken from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). Measures of institutional quality include: the property rights index by the Heritage Foundation, which captures the protection of private property on a scale from 0.1 to 1; the size of government, proxied by government consumption spending to GDP (from Penn World Tables) and having a negative association with institutional quality; the Polity IV index (Marshall, Jaggers and Gurr 2011), capturing the degree of democracy on a scale from -10 to 10; and finally, the Economic Freedom of the World Index (Gwartney, Lawson and Hall 2012), which is a composite with 42 components of the categories government size, legal system, property rights, sound monetary policy, freedom to trade as well as flexible regulations (e.g., labor market). Cross-country data on the number of days it takes to enforce a debt contract are provided by Djankov, McLiesh and Shleifer (2007). Inflation rates as an indicator of monetary policy come from Boyd, Levine and Smith (2001), who compute an OLS measure of average inflation over time in order to mitigate the impact of extreme values. The countries' level of education is captured by the average years of secondary schooling in the total population above age 25 and is available in a panel with five-year averages (Barro and Lee 2001). Additional robustness checks require an index of banking crises, that is, a dummy variable indicating the starting point of financial turmoil (Laeven and Valencia 2012) as well as a measure of exchange rate flexibility, which is based on four classifications of exchange rate regimes, ranging from a pegged to a freely floating currency (Ilzetzki, Reinhart and Rogoff 2008).

In some sections, the present study refers to measures of resource abundance. A standard measure is the share of natural resources (coal, oil and gas, metal ores and other mining) in total exports, which I calculate on the basis of the aforementioned trade data. Purer measures of resource endowment are subsoil wealth per capita and subsoil wealth in total national wealth provided by the World Bank (2006), where subsoil wealth refers to the actual deposits of coal, oil, natural gas and minerals, while to-

tal wealth includes all natural assets (e.g., forests) as well as produced capital and intangible capital.

4.3.5 Samples

Several samples are applied in the analysis. The basic sample includes 93 countries and covers the time period from 1970 to 2007. A supplementary sample is from 1992 to 2007, which allows inclusion of a number of former socialist economies and is therefore somewhat larger (110 countries). The expectation is that, due to transition, these countries tend to be outliers in the data. The sample used for the geography-based gravity approach is significantly smaller. Because of limited GDP data at the sectoral level, it is confined to 33 countries from 1992 to 2007. The list of countries is depicted in Appendix Table 18.

5 Results

The empirical results of the paper are presented in the following section. In order to assess the hypothesis of a negative association between export concentration and financial development, a variety of econometric tests are applied. The first part refers to a cross-section of countries, including OLS regressions and the instrumentation strategy with 2SLS. The second part shows the panel-data results using fixed-effects estimations and the GMM approach.

5.1 Cross-sectional Analysis

5.1.1 Ordinary Least Squares (OLS) Regression

The basic sample for the cross-sectional OLS regressions consists of 93 countries, where variables are averaged over the time period 1970 to 2007. Table 1 shows the estimation

Figure 1: Financial Development (private credit to GDP) and Export Concentration (log of the modified Herfindahl-Hirschman index, where low values indicate low concentration).

results obtained from equation (1). Robust standard errors are in parentheses. Column 1 presents a bivariate regression of private credit to GDP (FD) on the measure of export concentration $EXPCON$, which is the log of the modified Herfindahl-Hirschman index (see also Figure 1). The corresponding coefficient β is -0.365 and significant at the 1% level, R^2 is 0.41. β remains negative and significant when the number of control variables is increased (Columns 2 to 6), although its magnitude shrinks (around -0.2). As usual, R^2 rises with controls. Income has the expected positive association with the level of financial development. Trade openness, however, is only weakly correlated with the dependent variable. Most legal origin dummies are insignificant, with the exception of the socialist dummy, which shows a clearly negative coefficient (Columns 3 to 5). The quality of institutions, which is captured by the property rights index, is significant in the specification in Column 4, but insignificant when education is added to the regression (Column 6). It does not come as a surprise that private credit is

Financial Development and Export Concentration
OLS Cross-section, Averages, 1970-2007

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP
EXPCON						
Log(Modified HHI)	−0.365***	−0.215***	−0.229***	−0.192***	−0.210***	−0.161**
	(0.046)	(0.045)	(0.043)	(0.044)	(0.053)	(0.069)
Log(Income)		0.122***	0.099***	0.074***	0.107***	0.074**
		(0.022)	(0.019)	(0.021)	(0.028)	(0.037)
Log(Trade Openness)		0.094	0.095*	0.083*	0.112	0.025
		(0.061)	(0.050)	(0.050)	(0.067)	(0.057)
British Legal Origin			−0.003	0.022	0.115	0.056
			(0.095)	(0.099)	(0.124)	(0.101)
French Legal Origin			−0.118	−0.052	−0.071	−0.003
			(0.087)	(0.100)	(0.119)	(0.110)
Socialist Legal Origin			−0.430***	−0.337***	−0.316***	
			(0.087)	(0.106)	(0.117)	
German Legal Origin			0.309*	0.324**	0.323*	0.280
			(0.162)	(0.163)	(0.166)	(0.171)
Property Rights				0.306**		0.248
				(0.149)		(0.195)
Log(Contract Enf. Days)					−0.068**	
					(0.031)	
Inflation						−0.003**
						(0.001)
Education						0.044
						(0.051)
Constant	0.027	−1.225***	−0.985***	−0.908***	−0.778	−0.687**
	(0.041)	(0.218)	(0.246)	(0.234)	(0.547)	(0.301)
Observations	93	93	93	93	61	71
R^2	0.41	0.61	0.74	0.75	0.72	0.78

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1970-2007. The measure of financial development (FD) is private credit to GDP. The index of export concentration $EXPCON$ is the log of the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP (both from Penn World Tables). The legal origin dummies come from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). The quality of institutions is measured by the property rights index (Heritage Foundation). Log(Contract Enf. Days) is the log of days it takes to enforce a debt contract (Djankov, McLiesh and Shleifer 2007). The level of inflation comes from Boyd, Levine and Smith (2001). Education refers to secondary schooling (Barro and Lee 2001).

Table 1

decreasing in the number of days necessary to enforce a debt contract (Column 5). This is also true for a high level of inflation (Column 6).

To control for robustness, the measure of export concentration is varied. Instead of the modified Herfindahl-Hirschman index, the basic Herfindahl-Hirschman index, the concentration ratio as well as the Theil and Gini indices are used (Appendix Table 8). In a specification similar to Column 4 above, all coefficients on $EXPCON$ remain

negative and significant at the 1% level. The coefficients differ in size. Appendix Table 9 depicts the results of estimations with alternative measures of financial development. This includes liquid liabilities to GDP, stock market capitalization to GDP, the stock market trade value to GDP and the stock market turnover ratio. Again, export concentration is negatively correlated with finance, but with lower R^2s. In addition, I estimate equation (1) using a sample with more countries (110) covering a shorter time period (1992 to 2007). The results generally support the previous findings, albeit with somewhat lower t-statistics and lower coefficients (not depicted in the tables).

In sum, the simple OLS cross-section hints at a negative association between export concentration and financial development, as suggested by the theory. Since the problem of endogeneity remains unsolved here, a solid test of the hypothesis requires further econometric methods. This is done in the remainder of the paper.

5.1.2 Geography-based Instrumentation Strategy

In the following, the results of the instrumentation strategy with 2SLS are presented. As indicated in Section 4.2, export concentration $EXPCON$ may be endogenous because of reverse causality, meaning that financial development itself could influence the trade structure.

a. Gravity Approach

By nature, the proposed instrumentation strategy with geographical determinants is confined to cross-sectional analysis. When export concentration is predicted with gravity equations, the sample consists of 33 countries with averages from 1992 to 2007. The gravity equation (3) is estimated for each ISIC sector separately. The Appendix Tables 10 to 13 demonstrate the coefficients on the geographical right-hand side variables by sector.[17] Bilateral trade is negatively associated with, for example, distance and the landlocked dummy, while a common border as well as a large population of the importing country foster exports. As outlined in Section 4.2, the regressors refer to geographic

[17] These results correspond to Hattendorff (2014).

Financial Development and Export Concentration
Gravity, 2SLS Cross-section, Averages, 1992-2007

	(1)	(2)	(3)	(4)	(5)	(6)
				- JPN	- JPN	- JPN
Panel A: 2nd Stage						
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP
EXPCON						
Log(Modified HHI)	0.244	−0.216	−0.244	−0.353*	−0.411**	
	(0.431)	(0.202)	(0.239)	(0.188)	(0.197)	
Log(HHI)						−0.410**
						(0.187)
Log(Income)	0.452***	0.237**	0.312***	0.152	0.296***	0.326***
	(0.133)	(0.112)	(0.076)	(0.097)	(0.088)	(0.103)
Log(Trade Openness)	−0.121	0.001	0.037	0.125	0.198**	0.234**
	(0.108)	(0.117)	(0.142)	(0.098)	(0.090)	(0.094)
British Legal Origin		0.141	0.154	0.064	0.087	0.089
		(0.187)	(0.170)	(0.163)	(0.153)	(0.170)
French Legal Origin		−0.111	−0.171	−0.148	−0.264	−0.277
		(0.158)	(0.236)	(0.171)	(0.220)	(0.234)
Socialist Legal Origin		−0.317	−0.393	−0.450**	−0.601**	−0.645**
		(0.197)	(0.300)	(0.196)	(0.241)	(0.257)
German Legal Origin		0.290	0.300	0.110	0.123	0.123
		(0.191)	(0.190)	(0.208)	(0.219)	(0.221)
Property Rights			−0.463		−0.897	−1.110
			(0.815)		(0.694)	(0.749)
Constant	−2.766***	−1.925**	−2.504***	−1.795**	−2.913***	−3.372***
	(0.926)	(0.840)	(0.721)	(0.824)	(0.757)	(0.913)
Panel B: 1st Stage						
Dep. Var.	EXPCON	EXPCON	EXPCON	EXPCON	EXPCON	EXPCON
$\widehat{EXPCON}$						
Log($\widehat{Modified\ HHI}$)	0.436**	0.812**	0.688**	0.769**	0.643**	
	(0.192)	(0.360)	(0.262)	(0.371)	(0.267)	
Log($\widehat{HHI}$)						1.019***
						(0.344)
Partial F-Test	5.16	5.29	7.18	4.48	6.08	9.20
Partial R^2	0.07	0.18	0.18	0.15	0.15	0.14
Observations	33	33	33	32	32	32

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1992-2007. The measure of financial development (FD) is private credit to GDP. The indices of export concentration $EXPCON$ are the logs of the basic Herfindahl-Hirschman index and the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP (both from Penn World Tables). The legal origin dummies come from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). The quality of institutions is measured by the property rights index (Heritage Foundation). $\widehat{EXPCON}$ is the predicted $EXPCON$ index based on a gravity approach with geographical data. The specifications 4 to 6 exclude the strong outlier Japan (JPN).

Table 2

characteristics at the aggregate national level. Thus, using the Frankel-Romer method for predicting the trade *structure* rather than just the trade volume requires that the coefficients η_i^{1-15} differ across sectors. The results show that this condition is met. With the help of these fifteen estimates, the predicted indices of export concentration $\widehat{EXPCON}$ are constructed.

Table 2 shows the 2SLS regression results with six different specifications (Columns 1 to 6). In all columns, the right-hand side variable $EXPCON$ is instrumented by $\widehat{EXPCON}$ and the corresponding control variables. In most cases, the log of the predicted modified Herfindahl-Hirschman index is applied. As in the OLS cross-section, the number of controls is varied. While the estimation in Column 1 only includes the log of real GDP per capita and of trade openness, Columns 2 and 3 add legal origin dummies as well as the property rights index. Columns 4 to 6 present similar specifications, with the exception that the strong outlier Japan is excluded from the analysis.

The bottom panel B refers to the first stage of the 2SLS estimation. The coefficient on $\widehat{EXPCON}$ is significant at the 5% level, and with the basic Herfindahl-Hirschman index even at the 1% level (Column 6). In this case, the coefficient's magnitude is near one, while it is somewhat lower in Columns 1 to 5 (from 0.436 to 0.812). The partial R^2s are between 0.07 and 0.18. The partial F-statistics range from rather low 4.48 to an acceptable 9.20. In Columns 3, 5 and 6, where most controls are included, the instrument's quality is highest.

The top panel A of Table 2 depicts the outcome of the second-stage regressions. In the simple specification, the coefficient on export concentration is positive and highly insignificant (Column 1). With an increasing number of control variables, β turns negative, but remains insignificant in the standard set of countries (Columns 2 and 3). The results are sensitive to the variation of the sample. When Japan is excluded, export concentration enters significantly in the regression, in particular in Columns 5 and 6.[18] The exclusion of Japan can be justified with the argument that it constitutes a strong outlier in comparison to other observations. β is again insignificant when

[18] Using the concentration ratio as an index of export concentration delivers weaker results.

another outlier, Australia, is removed from the sample instead of Japan, as demonstrated in Appendix Table 14 (Column 1). In this case, however, the weak instrument diagnostics (F-statistic) are worse and the second-stage results are less reliable. The poor robustness may be caused partly by the small sample size. Using a sample without some former socialist countries (Russia, Bulgaria, Georgia, Estonia) or using a limited sample with countries having a per capita income higher than $4,500$ USD delivers results similar to the estimations in Columns 2 and 3 of Table 2. Overall, the control variables behave roughly the same as in the OLS cross-section. In particular, income is positively and socialist legal origin negatively related to the level of financial development.

Even with a large set of controls, tests with the variance inflation factor indicate that multicollinearity is not a major concern here. Adding contract enforcement days, inflation and education does not alter the above findings substantially. The same is true for alternative measures of the quality of institutions (not depicted in the tables). A further robustness check is the variation of financial development measures. Appendix Table 14 shows a selection with liquid liabilities and stock market capitalization to GDP (Columns 4 and 5). In both cases, export concentration is highly insignificant. Generally, it seems that the results are stronger for the bank-based measure private credit to GDP (discussion in Section 5.2.1).

So, the instrumentation strategy with predicted export concentration based on gravity equations shows mixed results, which are quite sensitive to sample variation. This requires careful interpretation. However, there is some evidence that export concentration might decrease (bank-based) financial development.

b. Further Instruments

As outlined in Section 4.2, further geography-based variables may be suitable to instrument export concentration and mitigate the problem of endogeneity. In contrast to the gravity approach, the following specifications all apply to the full set of sectors as in the OLS cross-section. Furthermore, the sample covers the entire time period from 1970 to 2007 with 93 countries.

The 2SLS regression results are demonstrated in Table 3. The vector of control variables is similar to Column 3 in the previous Table 2, including income, trade openness, legal origin and property rights. In Column 5, the latter variable is dropped. $EXPCON$ is the log of the modified Herfindahl-Hirschman index. In Column 1, export concentration is instrumented by the log of remoteness, that is, the country's distance from one of the three large markets (Europe, U.S., Japan). The variable enters significantly in the first-stage regression, showing a good partial F-statistic of 12.31 and a partial R^2 of 0.12. Thus, a remote location is associated with a higher export concentration. In the second stage, the coefficient on $EXPCON$ is negative and significant at the 10% level, comparable in size to the previous findings of the gravity approach (-0.316). This confirms the main hypothesis of the paper. Generally, the outcome for the coefficients on the controls (Columns 1 to 6) is similar to that from Table 2 (mainly not depicted in Table 3).

The following three columns present specifications where a measure of coastal access is used as an instrumental variable. As expected, the simple landlocked dummy is positively correlated with $EXPCON$, while the proportion of a country's population within 100 km of the coastline ($POP100C$) and the proportion of the population within 100 km of the coastline *or* ocean-navigable river ($POP100CR$) are negatively associated with export concentration. Obviously, $POP100C$ is a very poor instrument (partial F-statistic of just 1.76) and delivers useless second-stage results (Column 3). For all three instruments, partial R^2s are lower than in the other specifications. The coefficients on $EXPCON$ in the top panel using the landlocked dummy and $POP100CR$ (with ocean-navigable rivers) are negative, but quite low and clearly insignificant (Columns 2 and 4, Panel A). These results suggest that an instrumentation strategy with coastal access fails to support the theory.

In Columns 5 and 6, the proportion of people living in the Koeppen-Geiger temperate zone ($KGTEMP$) serves as the instrument. As can be seen in the bottom panel, the variable is negatively and significantly correlated with export concentration (coefficients of -0.710 and -0.535). Specification 5, which excludes property rights, shows a high F-statistic (15.34) and a partial R^2 of 0.21. $KGTEMP$ appears to be an appro-

priate instrument. Both statistics are lower in Column 6. The second-stage regressions indicate a negative impact of export concentration on private credit to GDP, with βs whose magnitude is similar to many of the previous findings (around -0.3). Thus, the results are in line with the stated hypothesis. Using both remoteness and $KGTEMP$ in the same 2SLS regression does not change this outcome.

The measures proposed by Ramcharan (2006), that is, the distributions of land area by elevation and biome classes, are poor instruments for export concentration (not depicted in the tables). They deliver very low partial F-statistics and partial R^2s in the first stage. As for elevation, a reason for this result might be the classification of the terrain, where the first nine classes capture elevation levels below 1,500 meters and the tenth class captures levels between 1,500 and 3,000 meters. A country like Germany, which is quite equally distributed over the first classes, is rather unlikely to, ceteris paribus, experience higher export concentration than a mountainous country, whose land area is concentrated in the tenth class. The method of Ramcharan would suggest the opposite. Concerning land area by biome classes, it seems that the supposed link between natural endowment and production is less strong than expected. A central European country, for example, is concentrated in few biome zones (mostly temperate broadleaf and mixed forests). Here, there is good reason to believe that the mild and temperate climate zone ($KGTEMP$) is more important for shaping the export structure than the mere concentration of ecosystems.

A number of robustness checks are conducted to assess the above findings. The variation of the index of export concentration, for example, using the Theil or Gini index, does not alter the outcome substantially. In some cases, F-statistics in the first stage as well as size and significance of the coefficients on $EXPCON$ are even higher than with the modified Herfindahl-Hirschman index. Appending the controls contract enforcement days, inflation and education or a variation of institutional quality measures leaves the results essentially unaffected. This is also true when excluding potential outliers such as Switzerland for the landlocked dummy. Using a sample from 1992 to 2007 with 110 countries leads to similar, but somewhat weaker results. Again, merely private credit to GDP as measure of financial development results in significant coef-

Financial Development and Export Concentration
Further Instruments, 2SLS Cross-section, Averages, 1970-2007

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 2nd Stage						
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP
EXPCON						
Log(Modified HHI)	−0.316*	−0.053	0.059	−0.006	−0.307***	−0.279**
	(0.171)	(0.188)	(0.381)	(0.171)	(0.096)	(0.137)
Property Rights	0.130	0.518	0.588	0.494*		0.096
	(0.267)	(0.335)	(0.589)	(0.292)		(0.234)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies					
Constant	−0.888***	−0.930***	−0.779***	−0.765***	−0.718***	−0.706***
	(0.250)	(0.252)	(0.282)	(0.252)	(0.245)	(0.236)
Panel B: 1st Stage						
Dep. Var.	EXPCON	EXPCON	EXPCON	EXPCON	EXPCON	EXPCON
Log(Remoteness)	0.193***					
	(0.055)					
Landlocked		0.254**				
		(0.102)				
POP100C			−0.173			
			(0.131)			
POP100CR				−0.348***		
				(0.128)		
KGTEMP					−0.710***	−0.535**
					(0.182)	(0.219)
Partial F-Test	12.31	6.31	1.76	7.49	15.34	6.03
Partial R^2	0.12	0.04	0.02	0.07	0.21	0.11
Observations	92	93	90	90	90	90

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1970-2007. The measure of financial development (FD) is private credit to GDP. The index of export concentration $EXPCON$ is the log of the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP (both from Penn World Tables). The legal origin dummies come from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). The quality of institutions is measured by the property rights index (Heritage Foundation). Log(Remoteness) is the log of the minimum distance to one of the three large markets (Europe, U.S., Japan). Landlocked is a simple landlocked dummy (both from CEPII). $POP100C$ captures the proportion of a country's population within 100 km of the coastline and $POP100CR$ the proportion of the population within 100 km of the coastline *or* ocean-navigable river; $KGTEMP$ denotes the proportion of people living in the Koeppen-Geiger temperate zone (all from Gallup, Sachs and Mellinger 1999).

Table 3

ficients on export concentration. Alternative measures, in particular those referring to equity-based finance, fail to do so throughout the 2SLS analysis (not depicted in the tables).

In sum, the instrumentation strategy, designed to overcome the problem of reverse causality, provides ambiguous results. However, when the instruments' quality is acceptable, the gravity approach as well as the application of other geographical instrumental variables seem to support the hypothesis of a negative impact of export concentration on (bank-based) finance.

5.2 Panel Analysis

5.2.1 Fixed-effects Estimation

This section reports the results of the analysis with panel data, where in addition to the cross-section, a time-series dimension of variables is exploited. This makes it possible to capture potentially omitted variables that were not considered in the OLS or 2SLS cross-section above. The Hausman specification test suggests that fixed-effect estimation should be preferred to a random-effects model. As described in Section 4, both country and time fixed effects enter the regression equation (2). This ensures that country-specific characteristics that remain constant over time as well as global determinants that change over time (oil price, etc.) are controlled for.

The analysis is based on data from 1970 to 2007 with non-overlapping five-year averages (1970-1974, 1975-1979 etc., where the last average covers only three years, 2005-2007). This procedure reduces the impact of missing observations in the unbalanced panel and eliminates short-run fluctuations in the business cycle. Heteroskedasticity and autocorrelation are accounted for using standard errors clustered at the country level.[19]

[19] Applying panel-corrected standard errors (PCSE) following Beck and Katz (1995) or the Driscoll-Kraay standard errors (Driscoll and Kraay 1998), which are additionally robust to cross-sectional dependence, does not alter the overall findings.

Financial Development and Export Concentration
OLS Panel Estimation, 5 Year Averages, 1970-2007

	(1)	(2)	(3)	(4)	(5)	(6)
				> 4,500 USD	> 4,500 USD	> 4,500 USD
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP
EXPCON						
Log(Modified HHI)	−0.076	−0.050	−0.065	−0.153*	−0.197**	−0.149**
	(0.051)	(0.043)	(0.044)	(0.090)	(0.088)	(0.071)
Log(Income)		0.347***	0.347***		0.450***	0.486***
		(0.057)	(0.065)		(0.145)	(0.117)
Log(Trade Openness)		0.123**	0.095*		0.004	−0.042
		(0.054)	(0.052)		(0.128)	(0.101)
Government Size		−0.001	−0.001		−0.003	−0.003
		(0.005)	(0.005)		(0.013)	(0.011)
Education			0.008			−0.072
			(0.044)			(0.056)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	679	673	524	385	379	311
No. of Countries	93	93	83	57	57	55
R^2	0.80	0.84	0.87	0.78	0.80	0.85

Standard errors clustered at the country level are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Non-overlapping five-year averages from 1970 to 2007. The measure of financial development (FD) is private credit to GDP. The index of export concentration $EXPCON$ is the log of the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP. The quality of institutions is measured by government size (all three from Penn World Tables). Education refers to secondary schooling (Barro and Lee 2001). Columns 4 to 6 only include countries where real GDP per capita is higher than 4,500 USD.

Table 4

Table 4 shows selected results of the fixed-effects regressions. The first three columns make use of the full sample with basically all countries available. Column 1 presents a simple bivariate regression of private credit to GDP on export concentration, which is the log of the modified Herfindahl-Hirschman index. The coefficient is negative, but statistically insignificant. Columns 2 and 3 add various control variables: real GDP per capita, trade openness, the size of government and the level of education. Here, a country's institutional quality is proxied by government size (government consumption spending to GDP) since other measures, for example, the property rights index, provide less variation over time. A considerable variation over time is necessary for a meaningful implementation of the fixed-effects method. This argument also applies to the exclusion of other covariates such as the legal origin dummies. With controls, the coefficients on $EXPCON$ are again negative and insignificant (-0.05 and -0.065), which seems to contradict the hypothesis. In contrast, income and trade openness show positive and significant estimators. Not surprisingly, the (overall) R^2s are relatively high in the fixed-effects specifications.

The regressions in Columns 4 to 6 are similar to those above, but use a sample that is limited to observations where countries have a real GDP per capita higher than $4,500$ USD. This is true for roughly 60% of all observations. The sample primarily excludes poor developing countries. As for the controls, the level of wealth remains significant, while trade openness as well as government size and education appear to be uncorrelated with financial development. Compared to the full sample, the coefficients on export concentration are now larger in magnitude (around -0.15) and statistically different from zero at the 5% and 10% level. This outcome is in line with the theory. The different results for β may indicate that the mechanism described in Section 3 is appropriate for emerging and developed countries, while it is not for countries in an early stage of development. It seems that a perceivable interplay among concentration, volatility and real interest rates requires a certain minimum level of economic development. Tests show that this threshold is approximately $4,500$ USD per capita (not depicted in the tables). To justify the conclusion, it may be argued that, for a poor country, general country risks such as political uncertainty and the absence of a favorable investment climate matter more than a lack of industrial diversity and

the risk premia involved.

The findings are further validated by a large variety of robustness checks. Appendix Table 15 presents regressions with country and time fixed effects using alternative indices of export concentration. The sample and the corresponding number of observations as well as the control variables are the same as in Column 5 of Table 4, excluding less developed economies. The coefficients on $EXPCON$ are all negative and range from -0.153 to -0.694. Significance differs across indices. The basic Herfindahl-Hirschman and the Theil index show estimates which are significant at the 5% level, as above. The β for the concentration ratio is significant only at the 10% level. It should be kept in mind, though, that this measure is inferior from a theoretical perspective. The Gini index, having a p-value of 0.107, is at least very close to significance at the 10% level.

The variation of financial development measures delivers a similar outcome as in the cross-section with instrumental variables. As can be seen in Appendix Table 16, the coefficient on export concentration loses significance when other measures than private credit to GDP are applied. Except for the dependent variable, the selected specifications equal those in Column 5 of Table 4, including the modified Herfindahl-Hirschman index, income, trade openness and the quality of institutions. The number of observations is considerably lower for the three equity-based measures (Columns 2 to 4). While Column 1 with liquid liabilities to GDP at least provides a negative β, the coefficients on $EXPCON$ with stock market capitalization and stock market trade value to GDP as well as the stock market turnover ratio are strikingly weak. Thus, a negative association between equity-based finance and export concentration is rejected. However, this does not necessarily contradict the main hypothesis of the paper since the theory from Section 3 refers to bank-based finance, best captured by private credit. The finding that bank-based finance is affected by concentration as opposed to equity-based finance might reflect the relatively high risk aversion of banks that issue debt contracts. The credit business cannot sustain large losses and requires low default rates to be profitable. By contrast, equity investors may be more capable to cope with risk, for example, caused by volatility, since they can benefit to the full extent from potential profits. This fundamental difference between loans and equity might offer an

explanation for the different estimation results. Nevertheless, a precise answer would require additional research, which is beyond the scope of this paper.

The proposed mechanism might be influenced by financial distress or the exchange rate regime in a country. Therefore, an additional sensitivity test includes banking crises and a measure of exchange rate flexibility as control variables. Banking crises are captured by a dummy variable, which indicates the starting point of financial turmoil. Exchange rate flexibility refers to four classifications of exchange rate regimes, ranging from a pegged to a freely floating currency. The regressions of financial development show that the inclusion of these measures leaves the coefficient on export concentration essentially unaffected (not depicted in the tables).

Appendix Table 17 demonstrates a selection of regressions using only country fixed effects. The results are generally in accordance with the previous ones, albeit with higher significance of the coefficients on $EXPCON$. The estimations including time effects (see above) add some relevant information and should be given preference over those that only cover country-specific characteristics.

As expected, a sample that is confined to the time period 1992 to 2007 with a number of former socialist countries does not provide evidence supporting the hypothesis. Transition economies are strong outliers and have a tendency to distort the results (not depicted in the tables).

Overall, the panel analysis with OLS fixed effects appears to confirm a negative association between export concentration and bank-based finance. This finding seems to be valid for countries with income per capita higher than $4,500$ USD.

5.2.2 GMM Approach

While the above fixed-effects estimation allows control for omitted variables, it remains silent on the endogeneity problem arising from the potential impact of the financial system on the trade structure. As outlined before, an instrumentation strategy referring to geography is usually limited to a cross-section. An alternative approach, which

Financial Development and Export Concentration
Difference GMM, Dynamic Panel Analysis, 5 Year Averages, 1970-2007

	(1)	(2)	(3)	(4)	(5)	(6)
	Two-Step	Two-Step	Two-Step Robust SE	Two-Step Robust SE	Two-Step Robust SE	One-Step Robust SE
	> 7,000 USD	> 7,000 USD	> 7,000 USD	> 7,000 USD	> 7,000 USD	> 7,000 USD
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP
$FD_{c,t-1}$	0.486***	0.529***	0.520***	0.529***	0.567**	0.570***
	(0.072)	(0.100)	(0.125)	(0.123)	(0.224)	(0.152)
$FD_{c,t-2}$		−0.253***	−0.244***	−0.253***	−0.315**	−0.208***
		(0.055)	(0.077)	(0.080)	(0.138)	(0.080)
EXPCON						
Log(Modified HHI)	−0.117**	−0.165***	−0.165**	−0.165**	−0.184***	−0.154**
	(0.046)	(0.063)	(0.071)	(0.076)	(0.064)	(0.078)
Log(Income)	0.411***	0.545***	0.522***	0.545***	0.585***	0.388*
	(0.086)	(0.123)	(0.155)	(0.154)	(0.171)	(0.206)
Log(Trade Openness)	0.010	0.009	0.030	0.009	0.000	0.034
	(0.057)	(0.082)	(0.094)	(0.107)	(0.123)	(0.095)
Government Size	−0.010	−0.006		−0.006	−0.009	−0.023
	(0.015)	(0.018)		(0.041)	(0.049)	(0.027)
Education					−0.012	
					(0.079)	
Observations	229	192	192	192	137	192
No. of Countries	50	49	49	49	41	49
AR(1) p-value	0.459	0.204	0.288	0.297	0.053	0.363
AR(2) p-value	0.002	0.132	0.154	0.197	0.862	0.065
Sargan Test p-value	0.215	0.755	.	.	.	.

The corresponding standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Non-overlapping five-year averages from 1970 to 2007. The measure of financial development (FD) is private credit to GDP. The index of export concentration $EXPCON$ is the log of the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP. The quality of institutions is measured by government size (all three from Penn World Tables). Education refers to secondary schooling (Barro and Lee 2001). Columns 1 to 5 use the two-step estimator, 6 the one-step estimator. Column 1 only includes the first lagged value of the dependent variable, the remaining specifications use the first and the second lag of FD. In contrast to Columns 1 and 2, specifications 3 to 6 apply standard errors robust to heteroskedasticity. The sample is confined to observations where countries have a real GDP per capita higher than $7,000$ USD. The Sargan test is not available in STATA with the usual commands when robust standard errors are included.

Table 5

also considers the time-series dimension, is the Arellano-Bond (1991) difference GMM estimator.[20]

The results are presented in Table 5. The sample covers a time period from 1970 to 2007 with non-overlapping five-year averages and is limited to observations where countries have a real GDP per capita of more than 7,000 USD. As in the OLS panel analysis, the mechanism seems to be less important for poor countries (not depicted in the tables). Compared to a threshold of 4,500 USD, the sample includes slightly fewer countries: around 50 (instead of 57). Most specifications calculate two-step GMM estimators, where the moment conditions are weighted by a consistent estimate of their covariance matrix (see, e.g., Windmeijer 2000). Nevertheless, using a one-step GMM estimator with weight matrices independent of estimated parameters does not change the outcome substantially (Column 6). Column 1 shows an estimation with only the first lagged value of the dependent variable financial development. The AR(2) p-value is close to zero, suggesting second-order autocorrelation, which makes the GMM estimator inconsistent. This problem is accounted for in the remaining specifications by adding the second lag of FD. Here, the null hypothesis of no second-order autocorrelation cannot be rejected. The test of overidentifying restrictions (Sargan test), indicating whether the instruments as a group are uncorrelated with the error process, shows acceptable p-values (0.215 and 0.755).[21] The standard errors in Columns 1 and 2 might be biased due to heteroskedasticity. Therefore, the following columns apply robust standard errors. Regardless of the exact specification, the coefficient on export concentration is negative and significant at the 1% or 5% level. The magnitude corresponds to those in Section 5.2.1, ranging from -0.117 to -0.184. Real income enters positively and significantly, while the other control variables trade openness, government size and education are largely insignificant. The composition of the set of controls (Columns 3 to 5) plays a minor role.[22]

Varying the indices of export concentration generates very similar results, in particular

[20] Difference GMM is preferred to system GMM developed by Blundell and Bond (1998) because the restrictions for the latter method are not satisfied (mean stationarity of variables and validity of moment conditions).

[21] It is not available in STATA with the usual commands when robust standard errors are included. Nevertheless, the overidentifying restrictions are likely to be valid.

[22] In all specifications, the STATA option `maxldep(3)` is applied.

a negative and significant β. As in previous sections, this is not the case for other measures of financial development, most notably not for the equity-based measures. Hence, the findings of the difference GMM estimations are well in line with the OLS panel analysis.

6 Conclusion

Previous work indicates that the natural resource curse, that is, the negative link between resource abundance and growth, may operate through a country's financial system. Scholars show that resource-based economies suffer from lower financial development, which may indirectly affect welfare. The present study provides an explanation for this financial channel. It argues that resource-rich countries are likely to have a concentrated export structure, causing a reduction of the financial system's size due to volatility and the associated high real interest rates.

The mechanism builds on a model of Hausmann and Rigobon (2003), who show that resource-abundant countries specialize away from non-resource tradable goods, which reduces their ability to absorb shocks in non-tradable demand through movements in the allocation of capital and labor. This causes more volatile relative prices, that is, a more volatile exchange rate. A concentrated economy is thus disrupted by volatility in yet another way than by fluctuating terms of trade. In the presence of non-neoclassical financial frictions, high volatility raises real interest rates. This study assumes that the associated higher cost of capital harm investment, thereby decreasing the amount of credit and financial development.

The supposed negative impact of (export) concentration on a country's financial development is tested empirically with cross-sectional and panel data from 93 countries covering the time period from 1970 to 2007. In order to overcome reverse causality, an instrumentation strategy with geography-based instruments for export concentration is applied. A difference GMM approach completes the analysis.

The results generally support the hypothesis. The OLS estimations in the cross-section

show negative and significant coefficients on the index of concentration. They are robust to the variation of concentration indices and control variables such as income, trade openness, legal origin, institutional quality and education. The instrumentation strategy mainly supports the findings. When the substitute for export concentration qualifies as a suitable instrument, it generally shows a negative and significant coefficient in the second stage of the 2SLS regression (with private credit to GDP as dependent variable). This is basically the case for the gravity-related instrument $\widehat{EXPCON}$, the measure of remoteness as well as the share of a country's population in temperate climate zones. The panel estimations with country and time fixed effects, which control for omitted variables, are generally in line with the findings from the cross-section. They strengthen the interpretation that the proposed mechanism seems to apply to bank-based finance, in particular to private credit to GDP. Stock market indices, that is, equity-based finance, appear to be unaffected by export concentration. Furthermore, coefficients on the main explanatory variable are found to be insignificant in the panel analysis when poor countries are included. An explanation might be that real interest rates in these countries are primarily driven by high general political or economic risks, and less by the volatility-induced risk premia proposed in this paper. This conjecture should be investigated more comprehensively in future work. The difference GMM approach, which controls for both reverse causality and omitted variables, corroborates the outcome from the OLS panel regressions. The results do not change when banking crises or the exchange rate regime are being controlled for.

The effect's size appears to be economically significant. Even with a conservative estimate, for example, $\beta = -0.165$ (as in Table 5, Column 4), moving from the 25th to the 75th percentile in the distribution of export concentration, ceteris paribus, decreases private credit by around 30 percentage points, which is a bit less than one standard deviation in cross-country finance. As an example, consider the well-diversified Denmark, which is roughly in the 25th percentile (modified Herfindahl-Hirschman index of 0.185 averaged from 1970 to 2007). Private credit to GDP is 0.563. If the country moved to the 75th percentile, equivalent to an increase in export concentration by 188%, it would have a modified Herfindahl-Hirschman index at the level of the Côte d'Ivoire (0.532). According to the estimate β, this implies that private credit to GDP would

decline by 0.310 units (or 31 percentage points) to 0.253. In other words, if Denmark had the concentrated export structure of the Côte d'Ivoire, the Danish financial system would be half its current size. Similarly, Ireland, which is also barely in the 25th percentile in the distribution of export concentration, would see its relatively large financial sector shrink by one-third. It might be argued that moving from the 25th to the 75th percentile is somewhat extreme. Consider, therefore, a situation in which Denmark had an equal export concentration to Norway near the median (modified Herfindahl-Hirschman index of 0.365). This is twice as high as the actual Danish value and corresponds to a rise of almost one standard deviation in cross-country export concentration. The estimate β implies that, all else equal, this is associated with a decrease in private credit of 16 percentage points. So, in this case, Denmark's financial development would decline by roughly one-third.

The effect's magnitude is comparable to the impact of other determinants of financial development. Beck, Demirgüç-Kunt and Levine (2003) find that colonies with French legal origin tend to have a ratio of private credit to GDP that is 17 to 27 percentage points lower than that of colonies with British legal origin. They further suggest that a change of one standard deviation in the quality of institutions, proxied by settler mortality, leads to a decrease in private credit of 14 to 17 percentage points (see also Do and Levchenko 2007 and Huang 2010).

In sum, export concentration can be shown to be a possible and sizeable impediment to bank-based financial development. For resource-abundant countries, which are often highly specialized, this gives cause for concern.

The proposed influence of concentration on finance provides an explanation for the financial channel of the resource curse, that is, the negative association between resources and financial development. When finance is regressed on both export concentration and a trade-related measure of resource abundance, the coefficient on concentration remains significantly negative, while the coefficient on resource abundance (e.g., the share of resources in total exports) loses significance (not depicted in the tables). It seems that concentration, which accompanies resource dominance, is more important for a country's level of financial development than resource wealth as such. Accord-

ingly, Hattendorff (2014) shows that the link between finance and the measure of pure subsoil wealth per capita is far less pronounced than the link between finance and endogenous trade-related measures.

These insights are in line with recent work on the resource curse. Sectoral concentration and the associated volatility appear to be main explanations of the welfare-decreasing effect of resources that can be observed in many countries. In contrast, resource wealth in itself—as seen in the United States, Australia and some Scandinavian countries—does not necessarily diminish economic growth when an economy is diversified (see, e.g., Lederman and Maloney 2012). Van der Ploeg and Poelhekke (2009) further point out that the "volatility" curse is less pronounced when a country's financial system is well developed. My analysis suggests that there is a feedback effect at work, with finance being endogenous to concentration and volatility.

It is therefore advisable for resource-abundant countries with high export concentration—such as Russia or Venezuela—to pursue a policy of diversification.[23] Prior neoclassical advice to fully exploit comparative advantage and allow high aggregate specialization ignores the above problems and may be welfare-decreasing. However, governments should be careful with traditional industrial policy, which is prone to misallocation. Scholars have presented a number of further options to promote diversification, such as improving the business environment, strengthening human capital, supporting innovation, prudent macroeconomic management and establishing fiscal rules (EBRD 2012, Lederman and Maloney 2012, p.106). Knowing that concentration may weaken private credit, governments should ensure that other determinants of financial development are particularly accounted for, such as financial regulation, finance-related jurisdiction or contract enforcement.

Future research might scrutinize why the proposed effect can hardly be observed in poor countries, and it might develop further mechanisms explaining the connection between economic concentration, finance and development. Empirical evidence should be validated using within-country analysis, which exploits the heterogeneity of sub-

[23]The policy advice does not necessarily refer to a limited number of small Gulf states that are, in a way, naturally specialized due to their enormous resource wealth per capita (see Hausmann and Rigobon 2003).

national entities, for example, different regions. This may ensure that unobserved country-specific factors are fully taken into account.

7 Appendix

Summary Statistics
Selected Variables, Averages, 1970-2007

	Obs.	Mean	Std. Dev.	Min	Max
Private Credit/GDP	93	0.421	0.335	0.037	1.457
M2/GDP	93	0.458	0.310	0.110	2.081
Stock Market Capitalization/GDP	76	0.449	0.480	0.009	2.714
Stock Market Trade Value/GDP	75	0.270	0.373	0.000	1.802
Stock Market Turnover Ratio	75	0.389	0.361	0.001	1.382
Herfindahl-Hirschman Index (HHI)	96	0.300	0.205	0.059	0.851
Modified HHI	96	0.407	0.212	0.101	0.904
Concentration Ratio (4)	96	0.737	0.189	0.367	0.983
Theil Index	96	1.564	0.608	0.589	3.097
Gini Index	96	0.796	0.101	0.577	0.956
Remoteness (km)	95	4,076.52	2,480.16	76.96	9,693.59
Landlocked	96	0.167	0.375	0	1
POP100C	93	0.476	0.364	0	1
POP100CR	93	0.583	0.360	0	1
KGTEMP	93	0.343	0.430	0	1
Elevation	96	0.634	0.137	0.375	0.904
Biome	96	0.883	0.054	0.671	0.938
Income (Real GDP per capita, USD)	96	9,960.42	10,327.68	228.86	39,924.61
Trade Openness (%)	96	62.781	42.822	14.233	327.360
Property Rights	96	0.554	0.220	0.1	0.9
Government Size (%)	96	9.632	5.407	2.032	33.564
Polity IV	93	1.791	6.177	-10	10
Economic Freedom of the World Index	91	6.256	1.025	3.584	8.836
Contract Enforcement Days	62	359.032	269.012	27	1,459
Inflation (%)	79	14.677	15.820	3.629	90.783
(Secondary) Education (Years)	86	1.460	1.108	0.070	4.813
Resource Share in Total Exports	96	0.185	0.241	0.000	0.919
Subsoil Wealth per capita (USD)	83	3,221.27	7,671.54	0	49,839.00
Subsoil in Total Wealth	83	0.096	0.287	0	2.143

The summary statistics include the number of observations, the mean, the standard deviation as well as the minimum and the maximum value of the distribution. Abbreviations: gross domestic product (GDP), liquid liabilities (M2), the proportion of a country's population within 100 km of the coastline ($POP100C$), the proportion of the population within 100 km of the coastline *or* ocean-navigable river ($POP100CR$) and the proportion of people living in the Koeppen-Geiger temperate zone ($KGTEMP$). Data are explained in Section 4.3.

Table 6

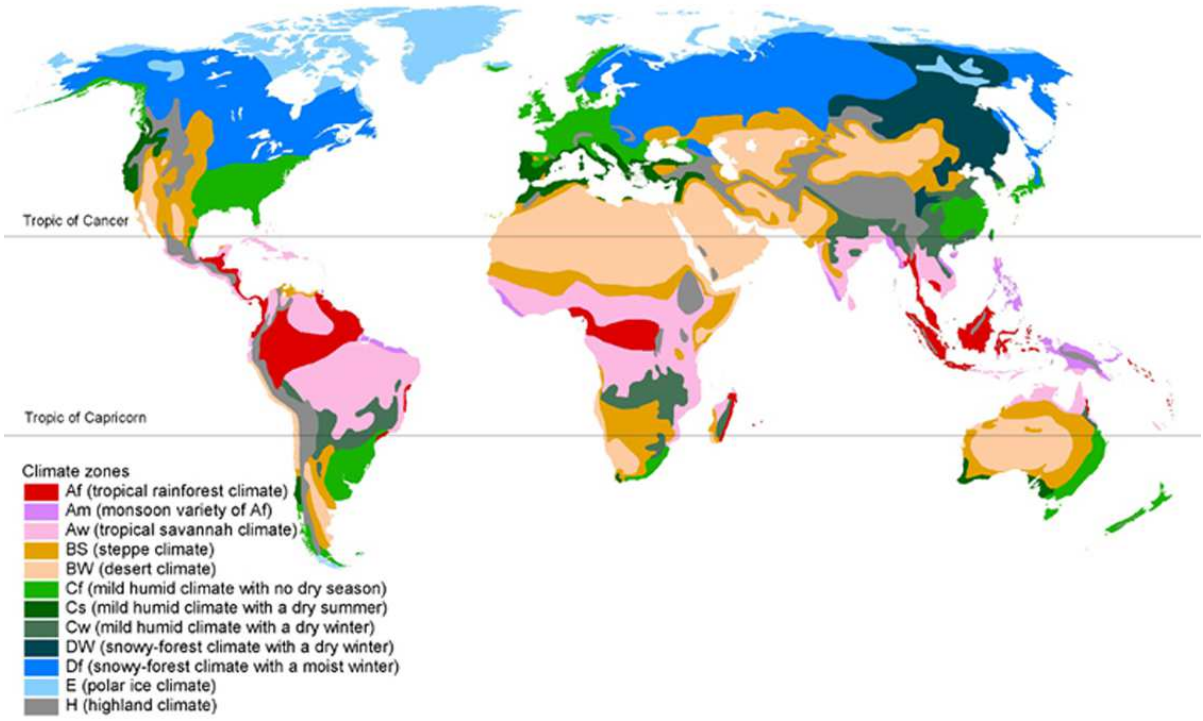

Figure 2: The Koeppen-Geiger Temperate Zones (Cf + Cs + Df + DW). Based on Gallup, Sachs and Mellinger (1999). Map sourced from *www.cid.harvard.edu/ciddata/geog/GISfiles/kgzones lrg.jpg* (30. August 2013).

Selected Correlations between Export Concentration and Instrumental Variables
Averages, 1970-2007

	Log (M. HHI)	Log (Remot.)	Landlocked	POP100C	POP100CR	KGTEMP	Log (Elev.)	Log (Biome)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(Mod. HHI)	1							
Log(Remoteness)	0.64***	1						
Landlocked	0.23**	0.17*	1					
POP100C	−0.21**	−0.23**	−0.60***	1				
POP100CR	−0.48***	−0.50***	−0.53***	0.83***	1			
KGTEMP	−0.73***	−0.68***	−0.22**	0.23**	0.44***	1		
Log(Elevation)	0.29***	0.11	0.46***	−0.50***	−0.47***	−0.03	1	
Log(Biome)	0.04	−0.19*	−0.10	0.27***	0.31***	0.07	0.22**	1

***, ** and * indicate significance at the 1%, 5% and 10% level. Log(Mod. HHI) is the log of the modified Herfindahl-Hirschman index (averaged over the period 1970-2007). Log(Remoteness) is the log of the minimum distance to one of the three large markets. Landlocked is a simple landlocked dummy (both from CEPII). $POP100C$ captures the proportion of a country's population within 100 km of the coastline and $POP100CR$ the proportion of the population within 100 km of the coastline *or* ocean-navigable river; $KGTEMP$ denotes the proportion of people living in the Koeppen-Geiger temperate zone (all from Gallup, Sachs and Mellinger 1999). Log(Elevation) is the log of the Gini index, which summarizes the distribution of land area by elevation classes. Log(Biome) is similar, but refers to bioclimatic zones (both from CIESIN).

Table 7

Financial Development and Export Concentration
Robustness, Other Measures of Export Concentration, OLS Cross-section, Averages, 1970-2007

	(1)	(2)	(3)	(4)
Dep. Var. (FD)	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP
EXPCON				
Log(HHI)	-0.154^{***}			
	(0.033)			
Log(CR(4))		-0.432^{***}		
		(0.108)		
Log(Theil)			-0.243^{***}	
			(0.060)	
Log(Gini)				-0.726^{***}
				(0.218)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies, Property Rights			
Constant	-0.917^{***}	-0.822^{***}	-0.727^{***}	-0.974^{***}
	(0.234)	(0.229)	(0.234)	(0.242)
Observations	93	93	93	93
R^2	0.75	0.75	0.74	0.73

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1970-2007. The measure of financial development (FD) is private credit to GDP. The indices of export concentration $EXPCON$ are the Herfindahl-Hirschman index, the concentration ratio using the four largest sectors, the Theil index and the Gini index (all in logs). Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP (both from Penn World Tables). The legal origin dummies come from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). The quality of institutions is measured by the property rights index (Heritage Foundation).

Table 8

Financial Development and Export Concentration
Robustness, Other Measures of Financial Development, OLS Cross-section, Averages, 1970-2007

	(1)	(2)	(3)	(4)
Dep. Var. (FD)	M2/GDP	Stock Market Capitalization /GDP	Stock Market Trade Value /GDP	Stock Market Turnover Ratio
EXPCON				
Log(Modified HHI)	-0.151^{***}	-0.217^{**}	-0.162^{**}	-0.235^{***}
	(0.050)	(0.096)	(0.068)	(0.080)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies, Property Rights			
Constant	-0.988^{***}	-2.115^{***}	-1.192^{***}	0.013
	(0.324)	(0.523)	(0.375)	(0.383)
Observations	93	76	75	75
R^2	0.52	0.53	0.48	0.50

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1970-2007. The measures of financial development (FD) are liquid liabilities (M2) to GDP, the stock market capitalization to GDP, the stock market trade value to GDP and the stock market turnover ratio (from Beck and Demirgüç-Kunt 2009). The index of export concentration $EXPCON$ is the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP (both from Penn World Tables). The legal origin dummies come from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). The quality of institutions is measured by the property rights index (Heritage Foundation).

Table 9

Gravity Approach
Sector-level Gravity Estimations, 1992-2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sector (ISIC Rev.2)	210	220	230	290	311	313	314	321	322
Dep. Var.	Log of bilateral exports to GDP $LogEXP_{icd}$								
$ldist_{cd}$	-1.031^{***}	-1.921^{***}	-0.865^{***}	-1.564^{***}	-1.496^{***}	-1.171^{***}	-1.452^{***}	-1.677^{***}	-1.998^{***}
	(0.203)	(0.190)	(0.162)	(0.077)	(0.061)	(0.075)	(0.094)	(0.057)	(0.072)
$lpop_c$	-1.602^{***}	-1.243^{***}	-0.473^{***}	0.242^{***}	-0.190^{***}	-0.217^{***}	-0.409^{***}	0.356^{***}	0.592^{***}
	(0.138)	(0.170)	(0.118)	(0.058)	(0.047)	(0.059)	(0.083)	(0.044)	(0.056)
$larea_c$	1.330^{***}	1.021^{***}	0.124	-0.032	0.045	-0.238^{***}	0.071	-0.318^{***}	-0.490^{***}
	(0.163)	(0.151)	(0.141)	(0.062)	(0.047)	(0.057)	(0.077)	(0.044)	(0.056)
$lpop_d$	0.613^{***}	0.435^{***}	0.800^{***}	0.849^{***}	0.527^{***}	0.151^{***}	-0.041	0.687^{***}	0.458^{***}
	(0.174)	(0.154)	(0.123)	(0.059)	(0.044)	(0.056)	(0.073)	(0.041)	(0.053)
$larea_d$	-0.081	0.258^{*}	-0.002	0.071	0.126^{***}	0.276^{***}	0.278^{***}	0.193^{***}	0.323^{***}
	(0.172)	(0.151)	(0.117)	(0.056)	(0.042)	(0.053)	(0.071)	(0.039)	(0.049)
$landlocked_{cd}$	-0.485	-2.183^{***}	-1.052^{**}	-1.133^{***}	-1.602^{***}	-0.761^{***}	-0.580^{**}	-1.235^{***}	-0.904^{***}
	(0.892)	(0.702)	(0.476)	(0.203)	(0.140)	(0.175)	(0.276)	(0.122)	(0.160)
$border_{cd}$	8.917	17.822^{***}	3.409	-2.687	5.394^{*}	6.477^{*}	6.223^{*}	-2.598	0.287^{*}
	(5.748)	(6.278)	(5.775)	(3.486)	(3.056)	(3.598)	(3.585)	(2.856)	(3.545)
$border_{cd} * ldist_{cd}$	0.040	0.756	-0.907	-0.052	0.924	0.583	0.344	1.247^{**}	0.810
	(0.984)	(1.258)	(1.000)	(0.643)	(0.564)	(0.662)	(0.660)	(0.528)	(0.654)
$border_{cd} * pop_c$	0.569	0.422	-0.059	-1.200^{***}	0.258	-0.082	0.268	-0.556	-0.701
	(0.604)	(0.765)	(0.690)	(0.428)	(0.381)	(0.447)	(0.448)	(0.356)	(0.441)
$border_{cd} * area_c$	-0.349	-1.113	0.291	1.024^{**}	-0.794^{**}	-0.405	-0.605	-0.132	-0.105
	(0.610)	(0.770)	(0.694)	(0.433)	(0.391)	(0.460)	(0.471)	(0.366)	(0.454)
$border_{cd} * pop_d$	0.824	0.073	0.236	0.452	-0.260	0.012	-0.135	0.214	-0.232
	(0.597)	(0.742)	(0.587)	(0.372)	(0.332)	(0.391)	(0.392)	(0.311)	(0.386)
$border_{cd} * area_d$	-0.747	-0.791	-0.044	-0.522	-0.020	-0.287	-0.024	-0.074	-0.041
	(0.675)	(0.770)	(0.613)	(0.400)	(0.354)	(0.415)	(0.423)	(0.331)	(0.410)
$border_{cd} * landl._{cd}$	0.569	-0.253	0.596	1.722^{**}	1.350^{**}	0.860	-0.843	1.560^{***}	1.154
	(1.284)	(1.342)	(1.126)	(0.749)	(0.637)	(0.750)	(0.773)	(0.594)	(0.738)
$lsubsoilintotalwealth_c$	-0.149	-0.099	-0.259^{***}	0.002	0.016	-0.160^{***}	-0.039	-0.049^{**}	0.117^{***}
	(0.095)	(0.076)	(0.067)	(0.029)	(0.021)	(0.027)	(0.035)	(0.020)	(0.026)
$lsubsoilintotalwealth_d$	-0.054	-0.238^{***}	-0.237^{***}	-0.187^{***}	-0.163^{***}	-0.207^{***}	-0.121^{***}	-0.199^{***}	-0.319^{***}
	(0.069)	(0.066)	(0.054)	(0.025)	(0.194)	(0.025)	(0.032)	(0.018)	(0.023)
Constant	-14.86^{***}	-8.785^{***}	-5.383^{**}	-0.246	-0.149	-2.044^{**}	-1.884	3.504^{***}	6.079^{***}
	(3.126)	(2.701)	(2.462)	(1.092)	(0.829)	(1.022)	(1.312)	(0.779)	(0.987)
Observations	350	631	834	1749	2403	2101	1221	2442	2286
R^2	0.39	0.29	0.24	0.40	0.40	0.31	0.32	0.50	0.44

Standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1992-2007. Each column shows the results of a sector-level gravity estimation. The left-hand side variable $LogEXP_{icd}$ denotes the log of exports from country c to d relative to GDP in industry i. The geographical variables at the right-hand side include the log of bilateral distance between the two countries' major cities $ldist_{cd}$, the log of country c's population $lpop_c$, the log of its land area $larea_c$ and both variables for trade partner d, respectively. The dummy variable $landlocked_{cd}$ indicates whether none, one or both of the countries are landlocked by taking the value of zero, one or two. $border_{cd}$ is a common-border dummy. The following variables are interaction terms with $border_{cd}$. $lsubsoilintotalwealth$ is the log of subsoil wealth in total wealth for both the exporter and importer.

Table 10

Gravity Approach
Sector-level Gravity Estimations, 1992-2007

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Sector (ISIC Rev.2)	324	331	332	341	342	351	352	3522	353
Dep. Var.	Log of bilateral exports to GDP $LogEXP_{icd}$								
$ldist_{cd}$	-1.783^{***}	-1.843^{***}	-1.527^{***}	-1.974^{***}	-1.750^{***}	-1.432^{***}	-1.610^{***}	-1.290^{***}	-1.573^{***}
	(0.075)	(0.068)	(0.072)	(0.064)	(0.065)	(0.053)	(0.061)	(0.065)	(0.086)
$lpop_c$	0.437^{***}	-0.063	0.291^{***}	-0.140^{***}	0.674^{***}	0.154^{***}	0.257^{***}	0.191^{***}	-0.117^{*}
	(0.058)	(0.052)	(0.056)	(0.049)	(0.050)	(0.041)	(0.047)	(0.050)	(0.068)
$larea_c$	-0.394^{***}	0.133^{**}	-0.152^{***}	0.144^{***}	-0.481^{***}	-0.351^{***}	-0.400^{***}	-0.403^{***}	-0.553^{***}
	(0.059)	(0.053)	(0.057)	(0.048)	(0.049)	(0.039)	(0.046)	(0.052)	(0.062)
$lpop_d$	0.345^{***}	0.635^{***}	0.397^{***}	0.846^{***}	0.586^{***}	0.963^{***}	0.701^{***}	0.707^{***}	0.608^{***}
	(0.056)	(0.051)	(0.055)	(0.046)	(0.048)	(0.039)	(0.045)	(0.048)	(0.067)
$larea_d$	0.329^{***}	0.156^{***}	0.286^{***}	0.046	0.255^{***}	0.133^{***}	0.146^{***}	0.120^{***}	0.249^{***}
	(0.053)	(0.047)	(0.052)	(0.044)	(0.045)	(0.037)	(0.042)	(0.045)	(0.064)
$landlocked_{cd}$	-1.197^{***}	1.024^{***}	-0.685^{***}	-1.016^{***}	-1.111^{***}	1.453^{***}	-1.292^{***}	-0.752^{***}	-1.856^{***}
	(0.171)	(0.159)	(0.168)	(0.143)	(0.144)	(0.115)	(0.134)	(0.142)	(0.227)
$border_{cd}$	-0.163	3.672	5.390	-1.204	-4.523	-1.647	-4.488	0.086	-0.789
	(3.373)	(3.260)	(3.337)	(3.135)	(3.229)	(2.681)	(3.061)	(3.480)	(3.864)
$border_{cd} * ldist_{cd}$	0.999	1.398^{**}	0.439	0.972^{*}	0.665	0.405	0.717	0.302	-0.322
	(0.616)	(0.601)	(0.616)	(0.578)	(0.596)	(0.495)	(0.565)	(0.631)	(0.712)
$border_{cd} * pop_c$	-0.290	-0.456	-0.197	-0.662^{*}	-1.185^{***}	-0.668^{**}	-0.751^{**}	-0.123	-0.533
	(0.416)	(0.405)	(0.418)	(0.390)	(0.402)	(0.334)	(0.381)	(0.416)	(0.480)
$border_{cd} * area_c$	-0.472	-0.279	-0.502	0.303	0.753^{*}	0.372	0.256	-0.129	0.546
	(0.426)	(0.417)	(0.428)	(0.401)	(0.413)	(0.343)	(0.392)	(0.433)	(0.480)
$border_{cd} * pop_d$	-0.710^{**}	-0.060	-0.461	-0.116	0.209	-0.295	-0.277	-0.577	0.266
	(0.363)	(0.354)	(0.370)	(0.341)	(0.351)	(0.292)	(0.333)	(0.415)	(0.415)
$border_{cd} * area_d$	0.334	-0.533	0.098	-0.494	-0.406	-0.138	0.058	0.187	-0.193
	(0.385)	(0.377)	(0.391)	(0.363)	(0.374)	(0.310)	(0.354)	(0.392)	(0.447)
$border_{cd} * landl._{cd}$	1.499^{**}	0.911	1.479^{**}	1.421^{**}	1.628^{**}	1.628^{***}	1.549^{**}	0.818	2.119^{***}
	(0.696)	(0.680)	(0.696)	(0.653)	(0.672)	(0.557)	(0.637)	(0.682)	(0.794)
$lsubsoilintotalwealth_c$	-0.010	0.111^{***}	0.048^{*}	-0.152^{***}	-0.264	0.037^{**}	-0.157^{***}	-0.013	0.186^{***}
	(0.028)	(0.024)	(0.027)	(0.022)	(0.023)	(0.018)	(0.021)	(0.024)	(0.028)
$lsubsoilintotalwealth_d$	-0.240^{***}	-0.225^{***}	-0.234^{***}	-0.098^{***}	-0.182^{***}	-0.167^{***}	-0.122^{***}	-0.119^{***}	-0.158^{***}
	(0.024)	(0.022)	(0.023)	(0.020)	(0.021)	(0.017)	(0.020)	(0.021)	(0.029)
Constant	3.776^{***}	0.471	-2.206^{**}	2.192^{**}	2.208^{**}	3.703^{***}	4.689^{***}	2.967^{***}	5.415^{***}
	(1.034)	(0.933)	(1.006)	(0.866)	(0.887)	(0.718)	(0.829)	(0.918)	(1.168)
Observations	1853	2173	1967	2304	2339	2477	2384	2145	1643
R^2	0.41	0.44	0.35	0.49	0.46	0.56	0.48	0.39	0.44

Standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1992-2007. Each column shows the results of a sector-level gravity estimation. The left-hand side variable $LogEXP_{icd}$ denotes the log of exports from country c to d relative to GDP in industry i. The geographical variables at the right-hand side include the log of bilateral distance between the two countries' major cities $ldist_{cd}$, the log of country c's population $lpop_c$, the log of its land area $larea_c$ and both variables for trade partner d, respectively. The dummy variable $landlocked_{cd}$ indicates whether none, one or both of the countries are landlocked by taking the value of zero, one or two. $border_{cd}$ is a common-border dummy. The following variables are interaction terms with $border_{cd}$. $lsubsoilintotalwealth$ is the log of subsoil wealth in total wealth for both the exporter and importer.

Table 11

Gravity Approach
Sector-level Gravity Estimations, 1992-2007

	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Sector (ISIC Rev.2)	354	355	356[a]	369	371	372	381	382	3825
Dep. Var.	Log of bilateral exports to GDP $LogEXP_{icd}$								
$ldist_{cd}$	-0.436^{***}	-1.489^{***}		-1.617^{***}	-1.688^{***}	-1.571^{***}	-1.786^{***}	-1.364^{***}	-1.545^{***}
	(0.167)	(0.060)		(0.063)	(0.062)	(0.074)	(0.058)	(0.051)	(0.066)
$lpop_c$	-0.981^{***}	0.476^{***}		0.438^{***}	0.013	-0.242^{***}	0.491^{***}	0.147^{***}	-0.165^{***}
	(0.134)	(0.045)		(0.049)	(0.048)	(0.057)	(0.045)	(0.039)	(0.049)
$larea_c$	0.249^{*}	-0.463^{***}		-0.237^{***}	-0.098^{**}	0.037	-0.357^{***}	-0.170^{***}	-0.195^{***}
	(0.127)	(0.045)		(0.049)	(0.046)	(0.059)	(0.044)	(0.038)	(0.050)
$lpop_d$	0.168	0.461^{***}		0.538^{***}	0.768^{***}	1.042^{***}	0.593^{***}	0.719^{***}	0.693^{***}
	(0.142)	(0.044)		(0.046)	(0.045)	(0.055)	(0.042)	(0.036)	(0.048)
$larea_d$	0.178	0.305^{***}		0.208^{***}	0.124^{***}	0.092^{*}	0.200^{***}	0.180^{***}	0.219^{***}
	(0.140)	(0.041)		(0.044)	(0.042)	(0.052)	(0.040)	(0.035)	(0.046)
$landlocked_{cd}$	-1.527^{**}	-1.099^{***}		-0.978^{***}	-2.123^{***}	-1.461^{***}	-1.538^{***}	-1.418^{***}	-0.865^{***}
	(0.660)	(0.132)		(0.144)	(0.140)	(0.174)	(0.126)	(0.109)	(0.141)
$border_{cd}$	0.849	-2.089		-0.596	-1.343	2.683	-3.964	-2.308	1.926
	(5.047)	(2.904)		(3.030)	(3.052)	(3.508)	(2.961)	(2.614)	(3.209)
$border_{cd} * ldist_{cd}$	-1.500	0.670		1.139^{**}	0.637	0.934	0.954^{*}	0.939^{*}	0.714
	(0.957)	(0.551)		(0.559)	(0.563)	(0.646)	(0.547)	(0.483)	(0.613)
$border_{cd} * pop_c$	0.720	-0.752^{**}		-0.490	-0.716^{*}	-0.605	-0.826^{**}	-0.471	-0.409
	(0.604)	(0.363)		(0.377)	(0.380)	(0.436)	(0.369)	(0.326)	(0.401)
$border_{cd} * area_c$	-0.190	0.186		-0.101	0.134	-0.150	0.241	0.016	-0.283
	(0.635)	(0.382)		(0.387)	(0.391)	(0.448)	(0.379)	(0.335)	(0.425)
$border_{cd} * pop_d$	0.007	-0.100		-0.327	-0.119	0.043	-0.263	-0.387	-0.084
	(0.600)	(0.320)		(0.329)	(0.332)	(0.381)	(0.322)	(0.285)	(0.355)
$border_{cd} * area_d$	0.729	-0.070		-0.156	-0.101	-0.302	-0.103	-0.058	-0.059
	(0.601)	(0.346)		(0.350)	(0.353)	(0.405)	(0.343)	(0.303)	(0.384)
$border_{cd} * landl._{cd}$	1.902^{*}	1.337^{**}		1.330^{**}	2.362^{***}	1.236^{*}	1.849^{***}	1.756^{***}	1.347^{**}
	(1.151)	(0.604)		(0.632)	(0.636)	(0.732)	(0.616)	(0.543)	(0.667)
$lsubsoilintotalwealth_c$	0.245^{***}	-0.126^{***}		-0.124^{***}	-0.022	0.052^{*}	0.040^{**}	-0.117^{***}	-0.009
	(0.062)	(0.021)		(0.023)	(0.021)	(0.028)	(0.020)	(0.017)	(0.024)
$lsubsoilintotalwealth_d$	-0.104^{*}	-0.133^{***}		-0.158^{***}	-0.083^{***}	-0.256^{***}	-0.134^{***}	-0.061^{***}	-0.197^{***}
	(0.060)	(0.019)		(0.020)	(0.020)	(0.024)	(0.019)	(0.016)	(0.021)
Constant	-6.939^{***}	2.405^{***}		-0.128	3.182^{***}	0.126	5.460^{***}	0.085	2.912^{***}
	(2.381)	(0.808)		(0.863)	(0.837)	(1.049)	(0.792)	(0.689)	(0.898)
Observations	612	2217		2183	2303	2172	2466	2542	2201
R^2	0.19	0.46		0.42	0.48	0.47	0.48	0.50	0.46

Standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1992-2007. Each column shows the results of a sector-level gravity estimation. The left-hand side variable $LogEXP_{icd}$ denotes the log of exports from country c to d relative to GDP in industry i. The geographical variables at the right-hand side include the log of bilateral distance between the two countries' major cities $ldist_{cd}$, the log of country c's population $lpop_c$, the log of its land area $larea_c$ and both variables for trade partner d, respectively. The dummy variable $landlocked_{cd}$ indicates whether none, one or both of the countries are landlocked by taking the value of zero, one or two. $border_{cd}$ is a common-border dummy. The following variables are interaction terms with $border_{cd}$. $lsubsoilintotalwealth$ is the log of subsoil wealth in total wealth for both the exporter and importer. [a] The plastic products sector (356) must be dropped due to inconsistencies in the matching of sector classifications ISIC Rev. 2 and 3 for sectoral GDP data.

Table 12

Gravity Approach
Sector-level Gravity Estimations, 1992-2007

	(28)	(29)	(30)	(31)	(32)	(33)
Sector (ISIC Rev.2)	383	3832	384	3843	385	390
Dep. Var.	Log of bilateral exports to GDP $LogEXP_{icd}$					
$ldist_{cd}$	-1.557^{***}	-1.511^{***}	-1.232^{***}	-1.524^{***}	-1.252^{***}	-1.480^{***}
	(0.058)	(0.067)	(0.071)	(0.060)	(0.061)	(0.066)
$lpop_c$	0.188^{***}	-0.107^{**}	0.219^{***}	0.222^{***}	0.086^{*}	0.302^{***}
	(0.044)	(0.051)	(0.054)	(0.046)	(0.046)	(0.051)
$larea_c$	-0.165^{***}	-0.183^{***}	-0.266^{***}	-0.397^{***}	-0.073	-0.407^{***}
	(0.044)	(0.051)	(0.053)	(0.046)	(0.048)	(0.051)
$lpop_d$	0.848^{***}	0.688^{***}	0.720^{***}	0.477^{***}	0.792^{***}	0.668^{***}
	(0.042)	(0.049)	(0.052)	(0.044)	(0.044)	(0.049)
$larea_d$	0.091^{**}	0.211^{***}	0.147^{***}	0.258^{***}	0.158^{***}	0.235^{***}
	(0.040)	(0.047)	(0.050)	(0.042)	(0.042)	(0.046)
$landlocked_{cd}$	-1.182^{***}	-1.355^{***}	-0.653^{***}	-1.206^{***}	-1.101^{***}	-1.323^{***}
	(0.125)	(0.145)	(0.163)	(0.132)	(0.132)	(0.149)
$border_{cd}$	-4.490	-1.379	-0.373	-1.371	-2.089	-0.524
	(2.929)	(3.326)	(3.445)	(2.987)	(3.040)	(3.302)
$border_{cd} * ldist_{cd}$	0.810	0.890	0.136	-1.051^{*}	0.821	0.686
	(0.541)	(0.614)	(0.635)	(0.551)	(0.561)	(0.610)
$border_{cd} * pop_c$	-0.664^{*}	-0.385	-0.874^{**}	-0.898^{**}	-0.537	-0.409
	(0.365)	(0.414)	(0.429)	(0.372)	(0.379)	(0.411)
$border_{cd} * area_c$	0.199	-0.142	0.467	-0.009	0.041	-0.061
	(0.375)	(0.426)	(0.441)	(0.382)	(0.389)	(0.423)
$border_{cd} * pop_d$	-0.368	-0.072	0.235	-0.055	-0.294	-0.360
	(0.319)	(0.362)	(0.375)	(0.325)	(0.331)	(0.359)
$border_{cd} * area_d$	0.026	-0.053	-0.281	-0.103	-0.026	0.013
	(0.339)	(0.385)	(0.398)	(0.346)	(0.352)	(0.382)
$border_{cd} * landl._{cd}$	1.581^{***}	1.392^{**}	1.433^{**}	1.003	1.656^{***}	1.462^{**}
	(0.609)	(0.691)	(0.718)	(0.621)	(0.632)	(0.688)
$lsubsoilintotalwealth_c$	-0.198^{***}	0.068^{***}	0.047^{*}	-0.128^{***}	-0.068^{***}	-0.040^{*}
	(0.020)	(0.024)	(0.025)	(0.021)	(0.023)	(0.024)
$lsubsoilintotalwealth_d$	0.116^{***}	-0.189^{***}	-0.126^{***}	-0.161^{***}	-0.147^{***}	-0.214^{***}
	(0.019)	(0.022)	(0.023)	(0.019)	(0.019)	(0.021)
Constant	2.011^{**}	2.219^{**}	0.763	2.719^{***}	-1.717^{**}	2.707^{***}
	(0.789)	(0.920)	(0.959)	(0.822)	(0.855)	(0.909)
Observations	2437	2294	2207	2324	2371	2355
R^2	0.49	0.42	0.33	0.46	0.42	0.42

Standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1992-2007. Each column shows the results of a sector-level gravity estimation. The left-hand side variable $LogEXP_{icd}$ denotes the log of exports from country c to d relative to GDP in industry i. The geographical variables at the right-hand side include the log of bilateral distance between the two countries' major cities $ldist_{cd}$, the log of country c's population $lpop_c$, the log of its land area $larea_c$ and both variables for trade partner d, respectively. The dummy variable $landlocked_{cd}$ indicates whether none, one or both of the countries are landlocked by taking the value of zero, one or two. $border_{cd}$ is a common-border dummy. The following variables are interaction terms with $border_{cd}$. $lsubsoilintotalwealth$ is the log of subsoil wealth in total wealth for both the exporter and importer.

Table 13

Financial Development and Export Concentration
Robustness, Gravity, 2SLS Cross-section, Averages, 1992-2007

	(1)	(2)	(3)	(4)	(5)
	- AUS	- Socialist	> 4,500 USD		
Panel A: 2nd Stage					
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	M2/GDP	Stock Market Capitalization /GDP
EXPCON					
Log(Modified HHI)	−0.035	−0.286	−0.283	0.032	−0.183
	(0.395)	(0.242)	(0.274)	(0.341)	(0.200)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies, Property Rights				
Constant	−2.250***	−2.771***	−2.499**	−1.184	−0.361
	(0.800)	(0.730)	(1.153)	(1.060)	(1.051)
Panel B: 1st Stage					
Dep. Var.	EXPCON	EXPCON	EXPCON	EXPCON	EXPCON
$\widehat{EXPCON}$					
Log($\widehat{Modified\ HHI}$)	0.686*	0.725**	0.663**	0.688**	0.813**
	(0.348)	(0.278)	(0.289)	(0.262)	(0.353)
Partial F-Test	4.05	7.15	5.53	7.18	5.52
Partial R^2	0.13	0.22	0.16	0.18	0.17
Observations	32	29	31	33	34

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1992-2007. The measures of financial development (FD) are private credit to GDP, liquid liabilities (M2) to GDP and stock market capitalization to GDP. Log(Modified HHI) is the log of the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP (both from Penn World Tables). The legal origin dummies come from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). The quality of institutions is measured by the property rights index (Heritage Foundation). $\widehat{EXPCON}$ is the predicted $EXPCON$ index based on a gravity approach with geographical data. Specification 1 excludes Australia. Column 2 applies a sample without the former socialist economies Russia, Bulgaria, Georgia and Estonia. And Column 3 only includes countries where real GDP per capita is higher than 4,500 USD.

Table 14

Financial Development and Export Concentration
Robustness, Other Measures of Export Concentration, OLS Panel Estimation, 5 Year Averages, 1970-2007

	(1)	(2)	(3)	(4)
	> 4,500 USD	> 4,500 USD	> 4,500 USD	> 4,500 USD
Dep. Var. (FD)	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP
EXPCON				
Log(HHI)	-0.153^{**}			
	(0.074)			
Log(CR(4))		-0.347^{*}		
		(0.200)		
Log(Theil)			-0.272^{**}	
			(0.130)	
Log(Gini)				-0.694
				(0.424)
Other Controls	Log(Income), Log(Trade Openness), Government Size			
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Observations	379	379	379	379
No. of Countries	57	57	57	57
R^2	0.80	0.80	0.80	0.80

Standard errors clustered at the country level are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Non-overlapping five-year averages from 1970 to 2007. The measure of financial development (FD) is private credit to GDP. The indices of export concentration $EXPCON$ are the Herfindahl-Hirschman index, the concentration ratio using the four largest sectors, the Theil index and the Gini index (all in logs). Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP. The quality of institutions is measured by government size (all three from Penn World Tables). All specifications apply a sample that is limited to countries where real GDP per capita is higher than 4,500 USD.

Table 15

Financial Development and Export Concentration
Robustness, Other Measures of Financial Development, OLS Panel Estimation, 5 Year Averages, 1970-2007

	(1)	(2)	(3)	(4)
	> 4,500 USD	> 4,500 USD	> 4,500 USD	> 4,500 USD
Dep. Var. (FD)	M2/GDP	Stock Market Capitalization /GDP	Stock Market Trade Value /GDP	Stock Market Turnover Ratio
EXPCON				
Log(Modified HHI)	−0.027	0.033	0.058	0.085
	(0.056)	(0.114)	(0.157)	(0.115)
Other Controls	Log(Income), Log(Trade Openness), Government Size			
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Observations	375	256	258	256
No. of Countries	57	55	55	55
R^2	0.88	0.85	0.72	0.69

Standard errors clustered at the country level are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Non-overlapping five-year averages from 1970 to 2007. The measures of financial development (FD) are liquid liabilities (M2) to GDP, stock market capitalization and the stock market trade value relative to GDP as well as the stock market turnover ratio (from Beck and Demirgüç-Kunt 2009). Log(Modified HHI) is the log of the modified Herfindahl-Hirschman index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP. The quality of institutions is measured by government size (all three from Penn World Tables). All specifications apply a sample that is limited to countries where real GDP per capita is higher than 4,500 USD.

Table 16

Financial Development and Export Concentration
Robustness, Country Fixed Effects, OLS Panel Estimation, 5 Year Averages, 1970-2007

	(1)	(2)	(3)	(4)	(5)	(6)
			> 4,500 USD	> 4,500 USD	> 4,500 USD	> 4,500 USD
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	M2/GDP	Stock Market Capital-ization /GDP
EXPCON						
Log(Modified HHI)	−0.074*	−0.083**	−0.214***		−0.070	−0.051
	(0.039)	(0.041)	(0.061)		(0.048)	(0.086)
Log(Theil)				−0.323***		
				(0.101)		
Log(Income)		0.348***	0.534***	0.567***	0.257***	0.295
		(0.057)	(0.101)	(0.101)	(0.087)	(0.246)
Log(Trade Openness)		0.103**	0.015	0.013	0.063	0.261*
		(0.046)	(0.087)	(0.083)	(0.058)	(0.142)
Government Size		−0.002	−0.005	−0.005	0.004	−0.038***
		(0.004)	(0.009)	(0.009)	(0.009)	(0.014)
Education		0.044	0.022	0.016	0.012	0.162***
		(0.032)	(0.039)	(0.039)	(0.029)	(0.053)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	No	No
Observations	673	524	311	311	307	199
No. of Countries	93	83	54	54	54	52
Within R^2	0.38	0.42	0.44	0.44	0.27	0.43

Standard errors clustered at the country level are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Non-overlapping five-year averages from 1970 to 2007. The measures of financial development (FD) are private credit, liquid liabilities (M2) and stock market capitalization relative to GDP (from Beck and Demirgüç-Kunt 2009). The indices of export concentration $EXPCON$ are the logs of the modified Herfindahl-Hirschman index and the Theil index. Log(Income) is the log of real GDP per capita, and Log(Trade Openness) is the log of total trade to GDP. The quality of institutions is measured by government size (all three from Penn World Tables). Education refers to secondary schooling (Barro and Lee 2001). Columns 3 to 6 only include countries where real GDP per capita is higher than 4,500 USD.

Table 17

List of Countries

Sample 1970-2007

Algeria	Egypt[b]	Kenya[b]	Rwanda[b]
Argentina	El Salvador	Republic of Korea (IV)	Saudi Arabia
Australia (IV)	Ethiopia[b]	Kuwait	Senegal[b]
Austria (IV)	Finland (IV)	Madagascar[b]	Sierra Leone[b]
Bahrain	France (IV)	Malawi[b]	Singapore
Bangladesh[b]	Gabon	Malaysia	South Africa (IV)
Belgium and Lux. (IV)	Gambia[b]	Mexico (IV)	Spain (IV)
Bolivia[b]	Germany (IV)	Morocco[b]	Sri Lanka[b]
Brazil (IV)	Ghana[b]	Nepal[b]	Sudan[b]
Burkina Faso[b]	Greece (IV)	Netherlands (IV)	Sweden (IV)
Burundi[b]	Guatemala	New Zealand	Switzerland and Liecht.
Cameroon[b]	Haiti[b]	Nicaragua[a,b]	Syria[b]
Canada	Honduras[b]	Niger[b]	Thailand[b]
Central African Rep.[b]	Hungary	Nigeria[b]	Togo[b]
Chile	Iceland	Norway (IV)	Trinidad and Tob. (IV)
China[a,b]	India[b] (IV)	Pakistan[b]	Tunisia[b]
China (Hongkong)	Indonesia[b]	Panama	Turkey (IV)
Colombia	Iran (IV)	Papua New Guinea[b]	United Kingdom (IV)
Congo[b]	Ireland (IV)	Paraguay[b]	United States
Costa Rica	Israel	Peru (IV)	Uganda[b]
Côte d'Ivoire[b]	Italy (IV)	Philippines[b]	Uruguay
Denmark (IV)	Jamaica	Poland	Venezuela
Dominican Republic	Japan (IV)	Portugal (IV)	Zambia[b]
Ecuador (IV)	Jordan[b]	Romania (IV)	Zimbabwe[a,b]

Sample 1992-2007, Additional Countries

Albania	Estonia (IV)	Latvia	Russia (IV)
Armenia	Georgia (IV)	Lithuania	Slovakia
Bulgaria (IV)	Hungary (IV)	TFYR Macedonia	Slovenia
Czech Republic	Kazakhstan	Republic of Moldova	
Croatia	Kyrgyzstan	Mongolia	

The exact number of countries included in the regressions depends on the data available and may vary. (IV) indicates that the country is included in the gravity approach of the instrumentation strategy, which exploits the time period 1992-2007. [a] Not included in basic regressions with private credit to GDP. [b] Countries where real GDP per capita is lower than 4,500 USD (averages, 1970-2007).

Table 18

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