The Resource Curse Revisited: Three Essays on Resource Abundance and Financial Development

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Overview

In the last several decades, economists have observed that on average resource-rich countries tend to grow at slower rates than countries with few natural resources. This finding gives rise to the idea that resources, in particular oil, natural gas and mining products, might be a curse rather than a blessing.

Researchers have presented a number of explanations for the phenomenon of the "resource curse." One that has been popular in the literature is the "Dutch disease." It states that a resource boom may increase the real exchange rate of a country, thereby rendering the manufacturing sector less competitive. Other theories link resource abundance to a higher probability of armed conflicts. Parts of West Africa could serve as an example here. A further mechanism discussed is the "institutional channel": resource exploitation is believed to foster rent-seeking and corruption, which are harmful to economic growth. In turn, strong institutions that prevent this behavior may help a country to benefit from its resource wealth. Recent research has highlighted some of the problems resulting from economic concentration and volatility. Empirical evidence suggests that resource abundance is most detrimental in countries like Nigeria and Russia, whose economies are based largely on the extraction and export of natural resources. In these countries, resources often account for more than two-thirds of total export revenue. In contrast, countries with highly diversified economies and rich subsoil resource deposits—for example, the United States, Australia and some Scandinavian countries—can usually escape the curse.

Furthermore, it is sometimes argued that the resource curse operates through the financial channel. Empirical work shows that resource abundance, in particular resource

dominance, is associated with less developed financial systems. A negative impact of resources on financial development is likely to also affect the overall economy since the financial system is considered a major determinant of growth. The literature has proposed several possible explanations for the negative impact of resource abundance on the financial sector. Some studies show that a dominant role of the government in investment and a weak private sector lead to a less developed financial system. Other studies find that resource abundance weakens a country's willingness and ability to implement financial sector reforms. This may be due to a small manufacturing sector—since manufacturing tends to be more reform-friendly—or to a corrupt government's lack of credibility. Corruption and rent-seeking might also reduce a society's general level of trust and thus the reliability of financial contracts.[1]

While plausible, the explanations for the financial channel offered by these theories are relatively broad. In this thesis, I propose and empirically investigate two further explanations for the negative link between resources and finance. The first is based on the assumption that firms' dependence on and thus demand for external financing determines the size of the financial sector. If natural resource firms relied less on external finance—as has been suggested widely in the literature—there would be less credit demand in the economy and, therefore, a smaller and less developed financial system. This approach is addressed in the first and the second essay. The third essay argues that export concentration, which is typical of resource-rich countries, causes a reduction in the size of the financial system due to volatility and the associated high real interest rates. The thesis thus contributes to the literature on the resource curse as well as to that on the determinants of financial development.

In the following, I briefly review the essays contained in this thesis, all of which are written without co-authors.

[1] For references, see the following chapters.

Chapter 1: Do Natural Resource Sectors Rely Less on External Finance than Manufacturing Sectors?[2]

As stated above, the first explanation for the financial channel deals with firms' dependence on external finance. This essay presents various measures of financial dependence as well as the figures that will be discussed in the subsequent chapter. It is thus an essential foundation for the empirical analysis that follows. My own calculations proved necessary because, so far, the finance literature has focused on the financial dependence of manufacturing sectors. This study also includes the resource sectors crude petroleum and natural gas production, coal mining, metal ore mining and other mining.

The concept that industrial sectors differ in their dependence on external finance is based on Rajan and Zingales (1998). According to these authors, this systematic difference is caused by persistent technological factors, such as those relating to project scale, the gestation and cash harvest period as well as the need for continual investment. That is, some industries rely less on the financial system than others. Financially independent firms need minimal external finance because they can use internal cash flow for investment instead.

The need for external finance can be measured with different methods. My essay includes the measure applied by Rajan and Zingales (1998), which relates capital expenditures to operative cash flow, as well as related indices in which the exact composition of cash flow is varied. Alternative measures are the research and development (R&D) intensity, the ratio of inventories to sales and the ratio of short-term debt to sales.

It is often hypothesized in the literature that natural resource firms, especially oil and gas companies, do not require as much external financing as other industries. In contrast, this essay presents a rather mixed picture, arguing that the degree to which resource sectors rely on the financial system depends on the type of measure used. In particular, measures of the ratio of investment to cash flow show high external dependence, whereas measures that account for more short-term liquidity need (e.g., the ratio of inventories to sales) indicate that resource sectors are characterized by a

[2]This chapter is based on the working paper "Do Natural Resource Sectors Rely Less on External Finance than Manufacturing Sectors?", which is published in the Discussion Papers series (Economics) of the School of Business & Economics, Freie Universität Berlin, No. 2012/17.

rather low level of external dependence. These results do not change considerably over time or across countries.

Chapter 2: Natural Resources, Demand for External Finance and Financial Development

The second essay reassesses and confirms the negative association between resource abundance and financial development. Moreover, it presents the explanation I propose for this observation. It builds on the concept that industrial sectors systematically differ in their financial dependence, as demonstrated in the previous chapter. In an economy with many financially independent firms, credit demand may be low, resulting in less need to develop a large financial system providing external credit. This consideration is based on the belief that financial development is at least partly influenced by the demand for external finance. If resource sectors were financially independent, resource-dominated countries would have a less developed financial system as a consequence. Chapter 1 shows that resource sectors rely less on external finance when the measure of financial dependence refers to short-term liquidity needs.

In order to formally address the problem, the essay applies a model developed by Do and Levchenko (2007) that studies the relationship between financial development and sectoral financial dependence in the presence of international trade. I follow essentially the same empirical strategy, while adjusting it to the purposes of natural resources analysis. An economy's aggregate (short-term) credit demand is proxied by the external finance need of exports, where the financial dependence of a sector is multiplied by its share in the country's total exports. This measure thus captures the credit demand that arises from the country's export structure. It is used as the main right-hand side variable in the regression equation, while the dependent variable is a measure of financial development—for example, the ratio of private credit to GDP. Estimation is done with ordinary least squares (OLS) in a cross-section of countries and in a panel specification that includes time and country fixed effects and that also exploits the time variation in the variables. I control for other determinants of financial development such as income per capita, trade openness and legal origin. As the literature

suggests, financial development might, in turn, influence the export structure, which is embodied in the external finance need of exports. In order to handle this endogeneity problem, I construct an instrument for the country's aggregate credit demand. The actual trade flows are predicted with the help of sector-level gravity estimations with exogenous geographic determinants of trade such as distance and land area. The obtained instrument is used in a two-stage least squares (2SLS) regression.

At first glance, the results appear ambiguous. In the cross-section with both OLS and 2SLS, there is evidence in favor of the proposed channel. In contrast, the panel specification does not support this hypothesis, which could be due to omitted variables in the cross-section. Further analysis suggests export concentration as a probable omitted variable. The hypothesis that low (short-term) credit demand of resource firms may explain the negative link between resource abundance and finance is rejected.

Chapter 3: Natural Resources, Export Concentration and Financial Development

Chapter 3, the third essay in the thesis, elaborates the role of export concentration. The results presented in Chapter 2 indicate that poor diversification might be far more important for explaining the financial channel of the resource curse than low external dependence of resource firms. Chapter 3 seeks to identify the negative impact of concentration, in particular export concentration, on financial development.

The theoretical argument behind 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), which lowers their ability to absorb demand shocks through movements in the allocation of production inputs. This affects 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.

Furthermore in Chapter 3, the negative influence of concentration on financial development is tested empirically. According to the theory, I expect to find a negative coefficient on the main explanatory variable, concentration, or more precisely, export concentration. The preferred measure is the Herfindahl-Hirschman index. The ratio of private credit to GDP serves as the dependent variable. Estimation methods, the set of controls as well as the instrumentation strategy partly resemble those in Chapter 2. In addition to the gravity-based instrument, I also apply measures of a country's remoteness, coastal access as well as its exposure to geological and climatic conditions as instruments for export concentration. These variables are believed to influence trade costs and, accordingly, the economy's sectoral composition. Also, I use dynamic panel techniques to test the findings. Robustness checks include the variation of concentration and finance measures and of control variables as well as different samples.

The empirical analysis provides evidence in favor of the hypothesis that export concentration negatively affects private credit to GDP. However, 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 plays a minor role in economies at an early stage of development. Furthermore, empirics suggest that the described mechanism applies more to bank-based finance, as captured by private credit to GDP. Stock markets, that is, equity-related finance, appear not to be affected by export concentration. This result might reflect the relatively high risk aversion of banks as opposed to equity investors. The effect of concentration on private credit is 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.

In sum, the results show that export concentration is a possible explanation for the financial channel of the resource curse. Consequently, the study advocates a policy

that fosters diversification in resource-abundant countries. This advice is in line with previous work in the field.

1

Do Natural Resource Sectors Rely Less on External Finance than Manufacturing Sectors?

1.1 Introduction

The seminal work by Rajan and Zingales (henceforth: RZ, 1998) finds that industries differ systematically in their need for external financing provided by the financial sector. That is, some industries rely more heavily on the financial system than others. The communication-equipment sector, for example, is known to be rather dependent on external finance since it has a limited ability to finance its investment needs through its own funds. Hence, different industries benefit to varying degrees from the level of a country's financial development. Rajan and Zingales assume that the ranking of sectors according to their level of financial dependence is relatively stable over time and across countries. This observation has served as a key element in a vast literature combining finance with growth and trade issues.[1] The concept will be a building block in the second essay of the present thesis, as stated in the overview.

So far, the analysis of financial dependence has been limited to manufacturing sectors.[2] However, the analysis in Chapter 2 requires to include natural resource sectors such

[1] See among others Rajan and Zingales (1998), Beck (2002) and Svaleryd and Vlachos (2005).

[2] Calculations of manufacturing sectors' external dependence have been made, for example, by Rajan and Zingales (1998), Kroszner, Laeven and Klingebiel (2007) and Eichengreen, Gullapalli and Panizza (2011).

as oil, gas and mining. Cross-sectoral financial heterogeneity could play an important role in resource-oriented economies. The aim of this essay is to compare the financial dependence of natural resource sectors with that of manufacturing. It is therefore an essential foundation for the analysis in the following chapter.

It is often hypothesized that natural resource firms, especially oil and gas companies, do not require as much external financing as other industries (Guriev, Plekhanov and Sonin 2009, p.15). In contrast, this essay presents a rather mixed picture, arguing that the degree to which resource sectors rely on the financial infrastructure depends on the type of measure used. In particular, measures relating investment and cash flow show high external dependence, whereas measures that account for more short-term liquidity needs indicate that resource sectors are characterized by a rather low level of external dependence. The essay further supports the view that these results do not change substantially over time or across countries.

The chapter is structured as follows: Section 1.2 briefly defines what is meant by natural resources. Section 1.3 presents the different measures of financial dependence and how they are calculated. In Section 1.4, the empirical results are presented. Section 1.5 examines whether the two crucial assumptions regarding stability over time and across countries hold. This is then followed by the conclusion in Section 1.6.

1.2 Natural Resources

For the purposes of this analysis, natural resources generally constitute "stocks of materials that exist in the natural environment that are both scarce and economically useful" (World Trade Report 2010, p.5). Such materials are either used in a raw state or after a minimal amount of processing. Most natural resources are exhaustible in cases of mismanagement, including renewable resources such as fish and forests (ibid.). The present essay focuses on non-renewable resources, like fossil fuels and metallic ores, because of the greater availability of data. The forestry and fishing sector, by contrast, allow comparatively few observations to be made. For similar reasons, agricultural sectors are excluded from the analysis in Chapter 1 and 2. A main characteristic of non-

renewable natural resources is their extremely uneven distribution among countries. Most are so-called point resources with high concentrations in certain regions of the world. This leads to over-specialization in some countries, which, for example, are abundantly endowed with oil and minerals (World Trade Report 2010, p.51). For these countries, an assessment of the natural resource sectors' role in the national economy is of particular importance.

1.3 Measures of Financial Dependence

In the following, various approaches are presented for measuring the degree of a firm's financial dependence. This includes the methodology applied by Rajan and Zingales (1998), which relates capital expenditures to operative cash flow. Here, I vary the exact composition of cash flow. Alternative measures proposed in the finance literature include the research and development (R&D) intensity, the ratio of inventories to sales and the ratio of short-term debt to sales.

1.3.1 General Assumptions

All measures seek to identify a company's need for external finance, which is also to say liquidity. Since there are no available data on the *actual* continuous amount of liquid funds a firm uses to finance its operations, the measures are considered to be proxies (Rajan and Zingales 1998). Thus, they generally constitute a compromise between economic logic and data availability. A firm that cannot finance its investment with internal cash flow needs to find external investors. This need for external financing is believed to be systematically different across industries. According to Rajan and Zingales (1998), the concept of financial dependence relies on two assumptions.

First, the differences between industries are assumed to be relatively stable over time because of persistent technological factors, such as those relating to project scale, the gestation and cash harvest period as well as the need for continual investment (Rajan and Zingales 1998, p.563). Von Furstenberg and von Kalckreuth (2006, p.543) further

identify these rather vague characteristics of structural determinants. They include properties of the production function, like the specification of human capital, the level of technological progress, scale effects and factor intensity, as well as characteristics of input use such as the depreciation rate, materials intensity and the degree of dependence on external inputs. Other relevant features might be an industry's general degree of risk as well as the leverage and collateralization potential.[3] These characteristics are not specific to an individual firm, but are typical of the industry as a whole. Accordingly, the sectors' ranking of external dependence is expected to be stable over time.

Moreover, the technological argument leads to the assumption that the sectors' ranking of external dependence is similar across countries. Differences between industries are said to be more significant than differences across countries. In a sense, this rules out the possibility of "factor intensity reversals": the mining sector in the United States, for example, is as financially intensive as the one in Australia and elsewhere (relative to other sectors). The analysis, therefore, can be limited to U.S. data, which—in addition to data availability and simplifying the approach—brings with it some further advantages. Due to strict disclosure requirements, using financial data from publicly listed U.S. firms, although not fully representative of all U.S. firms, ensures that data are comprehensive. Moreover, it is reasonable to assume that in the highly developed U.S. financial market, the behavior of these companies captures their optimal asset structure and, thus, their unbiased demand for external financing (Manova, Wei and Zhang 2009, p.9). Hence, a relatively pure proxy of liquidity needs can be demonstrated where the reported amount of the firms' external financing is equal to the desired amount.[4]

Whether these two assumptions hold is tested in this essay.

[3]This essay does not explicitly examine the relation between these particular characteristics and firms' financial dependence. This has been done, for example, by von Furstenberg and von Kalckreuth (2006) who find a rather weak correlation.

[4]Using the U.S. sectors' external dependence as a concept in the growth and trade literature, the data can easily be extrapolated to other countries, thereby avoiding the problem that the firms' financial dependence is endogenous to the country's specific financial development (Kroszner, Laeven and Klingebiel 2007).

1.3.2 Calculation of Measures

(1) The original external dependence measure by Rajan and Zingales (1998) captures the share "of desired investment that cannot be financed through internal cash flows generated by the same business" (p.564). It is calculated as capital expenditures minus operative cash flow divided by capital expenditures. Capital expenditures are gross investment in fixed capital (von Furstenberg and von Kalckreuth 2006, p.546). Acquisitions are excluded in order to obtain a ratio that mainly refers to the production process of a firm capturing more sound technological characteristics. The values for sectors' financial dependence in the 1980s (except natural resources) taken from the original paper by Rajan and Zingales (1998) serve as a benchmark for the following variations.[5]

(2) Using the same financial database as Rajan and Zingales (1998), specifically, Standard & Poor's Compustat North America, I aim to reproduce their results. In Compustat, the item for capital expenditures is $CAPX$. The composition of cash flow is more complicated, however. Adhering as closely as possible to Rajan and Zingales (1998), I use total funds from operations ($FOPT$) plus decreases in inventories ($INVT$) and receivables ($RECT$) plus increases in payables (AP).[6] This is basically in line with standard calculation of cash flow in the finance literature, where outstanding payables increase a firm's liquidity, while increasing inventories and receivables diminish it. Since the year-on-year changes of these positions are not available as own variables in the 1980s, the changes of year-on-year absolute levels are calculated. The formula for a firm in year t is $(CAPX_t - [FOPT_t - (INVT_t - INVT_{t-1}) - (RECT_t - RECT_{t-1}) + (AP_t - AP_{t-1})])/CAPX_t$, where $INVT$, $RECT$ and AP refer to the stocks at the end of the period. I call this measure RZ modification no. 1.

(3) For periods after 1990, it is necessary to modify the above calculation of the operative cash flow.[7] Again following Rajan and Zingales (1998), total funds from operations

[5]For some three-digit sectors, values are taken from Kroszner, Laeven and Klingebiel (2007) because Rajan and Zingales (1998) sometimes use a more disaggregate sector classification.

[6]Rajan and Zingales (1998) do not indicate which exact Compustat variable (item) they take for inventories, receivables and payables.

[7]In 1987, firms started to report according to the Financial Accounting Standards No. 95 (FAS 95) and in 1992, companies introduced the International Accounting Standards (IAS) 7 format for

$FOPT$ are calculated as the sum of income before extra items IBC, depreciation DPC, deferred taxes $TXDC$, equity in net loss $ESUBC$, sale of fixed assets and investments loss $SPPIV$ and funds from other operations $FOPO$. Decreases in inventories and receivables as well as increases in payables now have own Compustat items. The formula for this RZ modification no. 2 is: $(CAPX_t - [IBC_t + DPC_t + TXDC_t + ESUBC_t + SPPIV_t + FOPO_t + INVCH_t + RECCH_t + APALCH_t])/CAPX_t$.

(4) A Compustat variable that is very close to the cash flow I calculated for the previous measure is the net cash flow from operative activities $OANCF$. This aggregate figure has also been available since the early 1990s, but is reported by a larger number of U.S. companies and, therefore, leads to a dataset with more observations. The calculation for this RZ modification no. 3 contains only two items: $(CAPX_t - OANCF_t)/CAPX_t$. The RZ modifications no. 2 and no. 3 will prove to deliver very similar results.

(5) In addition to the method used by Rajan and Zingales (1998), a firm's dependence on external finance can also be captured by other measures. An alternative measure applied in the finance literature is the R&D intensity of a firm, calculated as the share of expenses for research and development $XRDS$ in total sales $SALE$ (Manova, Wei and Zhang 2009, p.9). As before, the ratio refers to the technological aspects of a firm's production process. It should be noted, however, that oil and gas companies typically do not report R&D expenses. Therefore, for the oil and gas as well as the refineries sector, I use exploration expenses $OGXPX$ instead.[8]

(6) Raddatz (2006) proposes another measure of a firm's need for external finance: the ratio of inventories to sales (in Compustat $INVT/SALE$). It captures the part of inventory investment that can be financed with ongoing sales. The ratio "proxies the delay between manufacturing and sales and [thus] the working capital [that] firms require in order to maintain inventories and meet demand" (Manova, Wei and Zhang 2009, p.9). A high value represents, ceteris paribus, a rather high dependence on external finance, because only a small part of inventory investment can be financed

cash flow statements (Meyer 2007, p.3).

[8] The use of this proxy is somewhat critical because its value depends on whether companies use the successful efforts or full cost accounting method. $OGXPX$ can only be used for firms that apply the successful efforts method and represents only expenses toward unsuccessful investment (Bryant 2003, p.12).

with ongoing sales (Raddatz 2006, p.685). Generally, firms try to avoid having a lot of inventory for a long time since storage can be costly and ties up cash. Among the components of working capital investment, Raddatz (2006) considers inventories to be particularly well-suited to capture the technological characteristics of finance needs—more so, specifically, than liquid assets. He assumes that the inventory stock is renewed in each period, and that the longer the production process, the larger the value of inventories (p.685). This measure of financial dependence differs from the method used by Rajan and Zingales (1998). It captures the short-term finance needs of a company rather than its long-term requirements like the RZ measure.

(7) A further measure of external dependence with a rather short-term focus is the ratio of short-term debt to sales (Raddatz 2006, p.686). As short-term debt is represented by notes payable, the calculation in Compustat items denotes $NP/SALE$. It captures the use of external finance and the ability of the company to pay its debt with ongoing earnings.

1.3.3 Sector Classification and Aggregation

I follow Rajan and Zingales (1998) in using the International Standard Industrial Classification Revision 2 (ISIC Rev. 2). This allows my results to be compared to other results—that is, not only to those of Rajan and Zingales (1998) but to most of the works on finance that calculate measures of financial dependence. Since the Compustat database does not support ISIC Rev. 2, data classified by the North American Industrial Classification System (NAICS 2002) available in Compustat are converted to ISIC Rev. 2. This requires putting together a detailed correspondence table where six-digit NAICS codes are matched with four-digit ISIC Rev. 3.1 codes and then with three-digit ISIC Rev. 2 codes (see Appendix Table 1.5). In some cases, a four-digit ISIC Rev. 2 code, for example, for the motor-vehicles sector (3843), is used. This subsector is, therefore, not part of the three-digit code that denotes, for example, transport equipment (384). A total of 2,627 publicly listed U.S. firms across the natural resource and manufacturing sectors is included in the analysis. The fishing and forestry industry

as well as the pottery and leather industry have been excluded since they provide only few observations.

The above measures of external dependence are calculated for each firm in each period. Aggregation is then done in the following manner: the means of the annual figures within the desired period are taken, that is, 1980-1989, 1990-1999, 2000-2009, 1980-2009 and 1990-2009.[9] Using these ten- or twenty-year means of companies, I then take the median across firms for each sector. As a result, there is one coefficient per sector for each ten- or twenty-year period. Rajan and Zingales (1998) apply a similar method in order to avoid large fluctuations over time (p.564) and to obtain a measure that is representative for the industry and not too heavily influenced by outliers.

1.4 Results

Table 1.1 shows three out of the seven different measures of financial dependence in selected time periods: the original RZ measure (Column 1), the RZ modification no. 3 (Column 2) and inventories to sales (Column 3). Obviously, the sectors differ significantly in their need for external finance. For example, the tobacco industry (ISIC Rev. 2 no. 314) is largely independent of the financial infrastructure: a value of -5.11 (Column 2) indicates that operative cash flow by far exceeds capital expenditures. In contrast, the communication-equipment sector (3832) relies more heavily on external finance. With a value of 0.41 (Column 2), its capital expenditures are higher than its operative cash flow. The sectors' ranking of financial dependence differs to a notable extent across the measures. The natural resource sectors seem to be relatively dependent on the financial system in Column 2, but rather independent in Column 3, which denotes inventories to sales. This becomes even more obvious in Appendix Table 1.3, where all measures and sectors are depicted. It is, therefore, necessary to analyze in more detail how the different measures are correlated.

In the following, a possible monotonic relationship between the different measures,

[9] As stated above, the specific use of a certain period depends on the measure of external dependence.

characterized by the correlation coefficient for linear correlation, is of primary interest, rather than absolute levels. First, the original RZ measure is compared with the RZ modification no. 1. Both measures should be highly correlated since they are constructed in a very similar way. Using the same sample for the 1980s (excluding the natural resource sectors), gives a correlation of 0.59, which is less than expected. Presumably, this is due to a different method of calculating the change in inventories, payables and receivables—where Rajan and Zingales (1998) remain silent on the details—and due to a slightly different sector correspondence. The correlation between the original RZ measure (1980s) and the RZ-like variables for the 1990s is a bit smaller (not depicted in the tables).

Financial Dependence across Sectors
Selected Measures and Sectors

ISIC Rev. 2	Sector	Original RZ Measure 1980-1989	RZ Modification No. 3 1990-2009	Inventories to Sales 1990-2009
		(1)	(2)	(3)
210	Coal mining	.	−0.24	0.05
220	Crude petroleum and natural gas production	.	0.58	0.00
311	Food products	0.14	−0.68	0.11
314	Tobacco	−0.45	−5.11	0.17
321	Textile	0.19	−1.04	0.16
353	Petroleum refineries	0.04	−0.45	0.06
371	Iron and steel	0.09	−0.44	0.16
383	Electric machinery	0.77	−0.37	0.18
3832	Communication equipment	1.04	0.41	0.16
3843	Motor vehicles	0.39	−0.21	0.12

(1) Original RZ measure from Rajan and Zingales (1998) and for some sectors from Kroszner, Laeven and Klingebiel (2007). (2) RZ modification no. 3 is calculated as $(CAPX_t - OANCF_t)/CAPX_t$, where $CAPX$ denotes capital expenditures and $OANCF$ net cash flow from operative activities (in Compustat items). (3) The ratio of inventories to sales is calculated as $INVT/SALE$. Sector classification is ISIC Rev. 2.

Table 1.1

Next, I compare the measures that can be applied for the time period 1990-2009: RZ modifications nos. 2 and 3, R&D intensity, inventories to sales and short-term debt to sales. Correlations are shown in Appendix Table 1.2. The RZ modifications nos. 2 and 3, which differ in the exact calculation of the operative cash flow, show a high correlation of 0.97. Both measures are highly correlated with the ratio of R&D expenses to sales (0.99). It should be kept in mind, however, that the latter measure

relies on significantly fewer observations than the previous ones and that exploration expenses are only a rough proxy for the R&D intensity in the oil and gas production. The high correlations above are partly driven by the outlier sector 3522 (drugs), which shows very high values here of financial dependence. Nevertheless, the positive and significant results generally hold, even if the drugs sector is excluded. In contrast, the ratio of inventories to sales is not correlated with one of the previous three measures (insignificant values of -0.20, -0.16 and -0.18). The same is true for the ratio of short-term debt to sales. Furthermore, inventories to sales and short-term debt to sales are not correlated either (not significantly different from zero with a value of 0.13). In the latter case, at least, the resource sectors' order in the ranking is relatively similar (Appendix Table 1.4).

How should these mixed results be interpreted? All measures claim to indicate a sector's dependence on external finance. While the RZ modifications and R&D intensity deliver similar results, inventories to sales and short-term debt to sales tend to contradict those measures. The ranking of the natural resource sectors, in particular, depends heavily on the measure applied. As can be seen in Appendix Table 1.4, the first measures indicate that these sectors are rather dependent on external finance in comparison to manufacturing industries. This finding contradicts the widespread opinion that natural resource sectors—notably crude oil and natural gas production—rely less on the financial system. However, measured by inventories to sales or short-term debt to sales, the mining, oil and gas sectors tend to be financially independent. Kroszner, Laeven and Klingebiel (2007) propose a possible explanation for the difference: the RZ-like variables are broader measures of financial requirements, which are appropriate for capturing the *long-term* dependence on external finance (p.203). In contrast, inventories to sales and notes payable to sales measure the *short-term* financing of working capital. Thus, when using financial dependence as a building block in growth and trade analysis, one should carefully distinguish between long-term and short-term dependence.

With regard to natural resources, there is another aspect that needs to be considered. Although mining sectors play an important role (e.g., in South Africa, Chile and Peru),

the crude petroleum and natural gas production is the most interesting resource sector. A number of countries such as Saudi Arabia, Russia and Venezuela rely heavily on this specific export sector. Where do oil and gas show up in this analysis? In principle, they are captured by the ISIC Rev. 2 sector 220 called crude petroleum and natural gas production. Firms that produce crude oil and also have refineries are instead captured by the ISIC sector petroleum refineries (353). In my U.S. sample, the 353 industry includes companies such as ExxonMobil, Chevron and ConocoPhillips. As Appendix Tables 1.3 and 1.4 show, this sector is less dependent on the financial infrastructure than sector 220, regardless of the measure. A factor that may drive this result is the well-known phenomenon of a life cycle in firms' financing (Rajan and Zingales 1998, p.565). Generally, young (and small) firms are more prone to rely on external investors than more mature and larger companies. Normally, this fact would not affect the above analysis since all sectors consist of both small and large firms. The firms captured by sector 353, however, can be considered to be larger than the companies in sector 220, which makes industry 353 relatively independent of external finance. Consequently, one has to keep in mind that a part of the oil and gas production in the United States shows up in the manufacturing sector petroleum refineries (353).

1.5 Testing the Assumptions

a. Variation over Time

An important question to be answered is whether the period chosen matters. Does the ranking change over time? Since the original RZ measure and the RZ modification no. 1 are available for the 1980s only, they are excluded here. The correlations of time periods 1990-1999, 2000-2009 and 1990-2009 for the remaining five measures indicate that the ranking of industries is relatively stable (see Appendix Table 1.6). The RZ modification no. 3 and R&D intensity, in particular, show high and significant correlations between time spans.[10] The weakest correlation, showing up in the comparison between short-term debt to sales measured from 1990 to 1999 and 1990 to 2009, is 0.59.[11] Therefore,

[10]Correlations are lower when the drugs sector (3522) is excluded from the sample.

[11]In case of inventories to sales, Kahn, McConnell and Perez-Quiros (2001) argue that the measure

Rajan and Zingales (1998) seem to be correct in their assumption that the sectors' ranking of external dependence does not change considerably over time.

b. Variation across Countries

As stated in Section 1.3, the argument that the sectors' financial dependence differs due to inherent technological factors leads to another assumption: the results found for U.S. industries should be representative for industries in other countries. In other words, the order of the sectors ranked by their external dependence should not change considerably if non-U.S. data are used instead. This is done in the following. Since Compustat North America provides only limited data for the rest of the world, the database Worldscope by Thomson Reuters is used.

There is only a limited number of countries that satisfy the necessary criteria for an analysis that resembles the one in the previous sections. In order to obtain the companies' unbiased demand for external finance, these countries should have a well-developed financial system with a sufficient supply of credit. Typically, this applies to countries in the Western hemisphere. Furthermore, there should be a considerable number of companies active in resource sectors. And, finally, the overall number of listed firms in the economy should be high, which is especially true in countries with a considerable equity-based financial system. These criteria are satisfied by the United Kingdom, Australia and Canada.[12] In addition, an aggregate is constructed that merges the companies of these economies into a single sample. This ensures that small sectors also consist of a more appropriate number of firms.

Due to limited data availability in Worldscope, only two measures of financial dependence are used here: RZ modification no. 3 (with aggregate operative cash flow) and inventories to sales, with the former representing rather long-term and the latter rather short-term finance needs. Both measures are calculated exactly as before. RZ modification no. 3 is capital expenditures minus net cash flow from operations divided by

has been decreasing in recent decades because companies in all sectors have economized their inventory holdings. However, this does not affect the ranking itself.

[12] The company lists are obtained in Worldscope with the items $FBRIT$, $FAUS$ as well as $FCDNX$ and $FTORO$.

capital expenditures (in Worldscope depicted by the items $WC04601$ and $WC04860$), and the ratio of inventories to sales is total inventories divided by net sales ($WC02101$ and $WC01001$). Following the previous procedure, the measures are calculated for each firm, taking the means of the annual figures and, finally, determining the median of each sector for the time periods 1990-1999, 2000-2009 and 1990-2009. The 1980s are excluded here since Worldscope provides only limited data before the early 1990s. Sector classifications are converted from the Standard Industrial Classification (SIC) to ISIC Rev. 2. The final dataset used in the analysis consists of 29 sectors.[13] The sample size is 454 companies for the United Kingdom, 403 for Australia, 690 for Canada, and, accordingly, $1,547$ for the aggregate.

As a first robustness check, I test how the figures found with Compustat data correspond to those found with Worldscope data for the United States itself (Worldscope item $FUSA$, 630 firms). RZ modifications no. 3 from 1990 to 2009 from both databases show a significant correlation of 0.77 (not depicted in the tables). The two corresponding ratios of inventories to sales are significantly correlated with 0.78. These results are basically supported when the time period is varied (1990-1999 and 2000-2009). One might argue that the correlations should be even higher since the variables theoretically present the same measurement. However, Compustat and Worldscope do not provide entirely equal data. Both databases use insider information in addition to regular company reports and set up own unique consolidation standards. Besides, covered markets and time periods can differ. Especially for the 1990s, Compustat provides more data than Worldscope (Ulbricht and Weiner 2005). Compustat results may also differ from those obtained in Worldscope because NAICS data are matched to ISIC Rev. 2 data for the former, and SIC data are matched to ISIC Rev. 2 data for the latter. It can nevertheless be concluded that measures obtained from Compustat and Worldscope are comparable.

With this result in mind, it is now possible to turn to the comparison between the measures of financial dependence across countries. Appendix Table 1.7 shows how RZ modification no. 3 (1990-2009) from Compustat for the United States is correlated

[13]The sectors tobacco (314), footwear (324), petroleum and coal products (354) as well as rubber products (355) provide only few data and are excluded here.

with the corresponding Worldscope measure in the other countries: correlation with the United Kingdom is 0.53, with Australia 0.57, with Canada 0.84 and with the aggregate 0.80. All values are significant at the 1% level. The outcome for correlations between U.S. inventories to sales (1990-2009) from Compustat and the corresponding Worldscope measures is similar: with the United Kingdom 0.62, with Australia 0.29, with Canada 0.64 and with the aggregate 0.75. Except for Australia, all values are significant. For both measures, correlations among these countries are weaker, but they largely support the positive and significant results.[14] Changing the time period to 2000-2009 shows no remarkable deviations from the previous outcomes. As expected, correlations for the period 1990-1999 are mixed due to poor data availability (not depicted in the tables). Also, it does not come as a surprise that Australia generally shows the least clear-cut results since the least amount of data is available for this country. In contrast, the aggregate with about 1,500 British, Australian and Canadian firms in one sample shows a high correlation with the U.S. Compustat data. As indicated above, the high number of companies ensures that smaller sectors such as wood products (331) also have a more representative value for their sectoral external dependence.[15]

As one can see, the overall ranking of sectors according to their level of financial dependence is similar across countries. Is this also true for the relative position of natural resource sectors? As in Section 1.4, natural resource sectors tend to be dependent on external finance when the measure relating capital expenditures and operative cash flow (RZ modification no. 3) is applied. In contrast, when measuring the more short-term liquidity needs with inventories to sales, these sectors appear to be far less dependent on external finance (not depicted in the tables). These results are essentially consistent with those from Section 1.4.

[14] Correlations are lower when the drugs sector (3522) is excluded from the sample. However, the overall results still hold.

[15] While the order of sectors appears to be positively correlated across countries, the absolute values may vary considerably.

1.6 Conclusion

The finding of Rajan and Zingales (1998) that industries differ systematically in their reliance on the financial infrastructure has been widely applied in the growth and trade literature. However, the analysis has been restricted so far to manufacturing sectors. Arguing that natural resource sectors also play a role in the finance and trade/ growth analysis, this essay calculates these sectors' degree of financial dependence.

In addition to the original RZ measure, six variables have been constructed: three RZ modifications, which differ in the exact calculation of operative cash flow, as well as R&D intensity, inventories to sales and short-term debt to sales. It is shown that the different measures of external dependence are not perfectly correlated. While the RZ-like measures and R&D intensity deliver relatively similar results, the ratios of inventories to sales and short-term debt to sales show no correlation with the other variables. This is also true for the order of the natural resource sectors compared to manufacturing industries. The first five measures, which capture long-term finance needs, find that mining, oil and gas sectors are rather financially dependent. In contrast, the last two measures, which capture short-term liquidity needs, indicate that these industries rely less on the financial system. Thus, the results contradict the widespread opinion of researchers that natural resource sectors in particular are *generally* financially independent.

Furthermore, two major assumptions have been tested, which follow from the argument that sectoral external dependence is related to inherent technological characteristics. The study confirms that the order of the sectors ranked by their financial dependence appears to be relatively stable over time and across countries.

1.7 Appendix

Correlations between Measures of Financial Dependence
Compustat

	RZ Modification No. 2 1990-2009	RZ Modification No. 3 1990-2009	R&D Intensity 1990-2009	Inventories to Sales 1990-2009	Short-term Debt to Sales 1990-2009
	(1)	(2)	(3)	(4)	(5)
RZ-Modification No. 2	1				
RZ-Modification No. 3	0.97***	1			
R&D Intensity[a]	0.99***	0.99***	1		
Inventories to Sales	−0.20	−0.16	−0.18	1	
Short-term Debt to Sales	−0.08	−0.06	−0.10	0.13	1

The table reports the correlations between selected measures of financial dependence. *** indicates significance at the 1% level. (1) In Compustat items, RZ modification no. 2 is $(CAPX_t - [IBC_t + DPC_t + TXDC_t + ESUBC_t + SPPIV_t + FOPO_t + INVCH_t + RECCH_t + APALCH_t])/CAPX_t$, where IBC denotes income before extra items, DPC depreciation, $TXDC$ deferred taxes, $ESUBC$ equity in net loss, $SPPIV$ sale of fixed assets and investments loss, and $FOPO$ funds from other operations. $INVCH$, $RECCH$, $APALCH$ are the changes in inventories, receivables and payables. (2) RZ modification no. 3 is calculated as $(CAPX_t - OANCF_t)/CAPX_t$, where $OANCF$ denotes net cash flow from operative activities. (3) R&D intensity is the share of expenses for research and development $XRDS$ (or exploration expenses $OGXPX$ for sector 220 and 353) in total sales $SALE$. (4) The ratio of inventories to sales is calculated as $INVT/SALE$. (5) The ratio of short-term debt to sales is $NP/SALE$ with notes payable NP. [a] Correlations are lower when the drugs sector (3522) is excluded from the sample (around 0.8).

Table 1.2

Financial Dependence across Sectors, All Measures, Compustat

ISIC Rev. 2	Sector	Original RZ Measure	RZ Modification No. 1	RZ Modification No. 2	RZ Modification No. 3	R&D Intensity	Inventories to Sales	Short-term Debt to Sales
		1980-1989	1980-1989	1990-2009	1990-2009	1990-2009	1990-2009	1990-2009
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
210	Coal mining	.	−0.23	0.22	−0.24	0.099	0.05	0.007
220	Crude petroleum and nat. gas prod.	.	0.23	0.73	0.58	0.056	0.00	0.005
230	Metal ore mining	.	0.40	2.59	4.79	.	0.16	0.011
290	Other mining	.	−0.20	−0.32	−0.30	.	0.14	0.005
311	Food products	0.14	−0.44	−0.62	−0.68	0.004	0.11	0.018
313	Beverages	0.08	−0.14	−0.06	0.02	.	0.08	0.004
314	Tobacco	−0.45	−0.96	−1.17	−5.11	0.014	0.17	0.018
321	Textile	0.19	0.42	−1.29	−1.04	0.012	0.16	0.002
322	Apparel	0.03	−1.04	−1.68	−1.25	0.005	0.17	0.012
324	Footwear	−0.08	−0.60	−2.57	−2.34	0.009	0.20	0.016
331	Wood products	−0.76	.	−0.45	−1.33	0.007	0.10	0.015
332	Furniture	0.24	−0.87	−1.67	−2.24	0.007	0.11	0.006
341	Paper and products	0.17	−0.40	−1.00	−1.00	0.013	0.11	0.009
342	Printing and publishing	0.20	−1.23	−2.05	−2.06	0.011	0.05	0.002
351	Industrial chemicals	0.25	−0.70	−0.44	−0.38	0.015	0.10	0.011
352	Other chemicals	0.22	−0.33	−0.93	−0.92	0.026	0.13	0.030
3522	Drugs	1.49	1.11	31.37	38.16	2.560	0.08	0.002
353	Petroleum refineries	0.04	−0.41	−0.35	−0.45	0.009	0.06	0.002
354	Petroleum and coal products	0.33	−1.48	0.13	7.75	0.315	0.17	0.040
355	Rubber products	0.23	−0.26	−0.02	−0.01	0.026	0.15	0.164
356	Plastic products	1.14	0.19	−0.44	−0.37	0.011	0.12	0.160
369	Nonmetal products	0.06	−0.27	−0.24	−0.11	0.012	0.13	0.011
371	Iron and steel	0.09	−0.73	−0.23	−0.44	0.009	0.16	0.011
372	Nonferrous metal	0.01	0.42	−0.43	−0.19	0.009	0.14	0.015
381	Metal products	0.24	−0.60	−1.65	−1.45	0.008	0.14	0.011
382	Machinery	0.45	−0.53	−1.18	−0.84	0.024	0.18	0.015
3825	Office and computing	1.06	−0.25	0.41	1.11	0.156	0.13	0.009
383	Electric machinery	0.77	−0.28	−0.08	−0.37	0.053	0.18	0.014
3832	Communication equipment	1.04	0.41	0.33	−0.41	0.160	0.16	0.011
384	Transportation equipment	0.31	0.06	−0.35	−0.16	0.031	0.17	0.008
3843	Motor vehicles	0.39	0.39	−0.09	−0.21	0.023	0.12	0.011
385	Professional goods	0.96	0.34	1.87	0.54	0.139	0.19	0.016
390	Other industries	0.47	−0.35	−0.03	0.07	0.038	0.17	0.025

(1) Original RZ measure essentially from Rajan and Zingales (1998). (2) In Compustat items, RZ modification no. 1 is $(CAPX_t - [FOPT_t - (INVT_t - INVT_{t-1}) - (RECT_t - RECT_{t-1}) + (AP_t - AP_{t-1})])/CAPX_t$, where $CAPX$ is capital expenditures, $FOPT$ total funds from operations, $INVT$ inventories, $RECT$ receivables and AP payables. (3) RZ modification no. 2 is $(CAPX_t - [IBC_t + DPC_t + TXDC_t + ESUBC_t + SPPIV_t + FOPO_t + INVCH_t + RECCH_t + APALCH_t])/CAPX_t$, where IBC denotes income before extra items, DPC depreciation, $TXDC$ deferred taxes, $ESUBC$ equity in net loss, $SPPIV$ sale of fixed assets and investments loss, and $FOPO$ funds from other operations. $INVCH$, $RECCH$, $APALCH$ are the changes in inventories, receivables and payables. (4) RZ modification no. 3 is $(CAPX_t - OANCF_t)/CAPX_t$, where $OANCF$ denotes net cash flow from operative activities. (5) R&D intensity is the share of expenses for research and development $XRDS$ (or $OGXPX$ ISIC 220 and 353) in total sales $SALE$. (6) The ratio of inventories to sales is $INVT/SALE$. (7) The ratio of short-term debt to sales is $NP/SALE$ with notes payable NP.

Table 1.3

Ranking of Sectors, Selected Measures of Financial Dependence, Compustat

RZ Modification No. 3 (1)	R&D Intensity (2)	Inventories to Sales (3)	Short-term Debt to Sales (4)
Tobacco	Food products	**Crude petroleum and natural gas**	Textile
Footwear	Apparel	Printing and publishing	**Petroleum refineries**
Furniture	Furniture	**Coal mining**	Drugs
Printing and publishing	Wood products	**Petroleum refineries**	Printing and publishing
Metal products	Metal products	Beverages	Beverages
Wood products	Iron and steel	Drugs	**Crude petroleum and natural gas**
Apparel	Nonferrous metal	Industrial chemicals	**Other mining**
Textile	**Petroleum refineries**	Wood products	Furniture
Paper and products	Footwear	Furniture	**Coal mining**
Other chemicals	Printing and publishing	Paper and products	Transportation equipment
Machinery	Plastic products	Food products	Office and computing
Food products	Textile	Plastic products	Paper and products
Petroleum refineries	Nonmetal products	Motor vehicles	Communication equipment
Iron and steel	Paper and products	Nonmetal products	Industrial chemicals
Industrial chemicals	Tobacco	Office and computing	Metal products
Plastic products	Industrial chemicals	Other chemicals	Nonmetal products
Electric machinery	Motor vehicles	Metal products	**Metal ore mining**
Other mining	Machinery	**Other mining**	Iron and steel
Coal mining	Rubber products	Nonferrous metal	Motor vehicles
Motor vehicles	Other chemicals	Rubber products	Apparel
Nonferrous metal	Transportation equipment	**Metal ore mining**	Electric machinery
Transportation equipment	Other industries	Iron and steel	Nonferrous metal
Nonmetal products	Electric machinery	Textile	Wood products
Rubber products	**Crude petroleum and natural gas**	Communication equipment	Machinery
Beverages	**Coal mining**	Other industries	Footwear
Communication equipment	Professional goods	Apparel	Professional goods
Other industries	Office and computing	Tobacco	Food products
Professional goods	Communication equipment	Transportation equipment	Tobacco
Crude petroleum and natural gas	Petroleum and coal products	Petroleum and coal products	Other industries
Office and computing	Drugs	Machinery	Other chemicals
Metal ore mining	Beverages	Electric machinery	Petroleum and coal products
Petroleum and coal products	**Other mining**	Professional goods	Plastic products
Drugs	**Metal ore mining**	Footwear	Rubber products

The table reports the ranking of natural resource and manufacturing sectors for selected measures of financial dependence (in ascending order). (1) RZ modification no. 3 is calculated as $(CAPX_t - OANCF_t)/CAPX_t$, where $CAPX$ denotes capital expenditures and $OANCF$ net cash flow from operative activities (in Compustat items). (2) R&D intensity is the share of expenses for research and development $XRDS$ (or exploration expenses $OGXPX$ for sector 220 and 353) in total sales $SALE$. (3) The ratio of inventories to sales is calculated as $INVT/SALE$. (4) The ratio of short-term debt to sales is $NP/SALE$ with notes payable NP. Sector classification is ISIC Rev. 2.

Table 1.4

Correspondence Table
Compustat, Natural Resource Sectors

ISIC Rev. 2 3-digit	Sector	NAICS 2002 6-digit	Sector
210	Coal mining	212111	Bituminous coal surface mining
		212112	Bituminous coal underground mining
		212113	Anthracite mining
		213113	Anthracite coal recovery from culm banks and other contract or fee services to coal mining
		324199	Hard-coal fuel briquettes
		212111	Lignite surface mining
		324199	Lignite fuel briquettes
		2121	Coal mining
		21211	Coal mining
220	Crude petroleum and natural gas production	211111	Liquefying and extracting coal
		211111	Extraction of crude petroleum and natural gas
		211112	Extraction of natural gas liquids
		488999	Liquefaction and regasification of natural gas for transport
230	Metal ore mining	212210	Iron ore mining and/or beneficiating
		212291	Uranium mining and/or beneficiating
		212299	Thorium mining and/or beneficiating
		212221	Gold mining and/or beneficiating
		212222	Silver ore mining and/or beneficiating
		212231	Lead and zinc ore mining and/or beneficiating
		212234	Copper and nickel ore mining and/or beneficiating
		212291	Vanadium and radium mining and/or beneficiating
290	Other mining	212311	Mining or quarrying or building or monument stone, mining or quarrying slate
		212312	Crushed and broken limestone, dolomite, and chalk
		212313	Crushed or broken granite
		212319	Crushed or broken marble, slate, or stone (except bituminous limestone, bituminous sandstone, and mica schist)
		212321	Quarrying sand or gravel for construction
		212322	Mining or quarrying industrial sand
		212324	Mining or kaolin and ball clay
		212325	Mining of ceramic and refractory clays including bentonite
		212399	Gypsum, alabaster, pulpstone, millstone, and grindstone mining, other crushed stone
		212391	Quarrying or mining of potash, soda, and borite minerals
		212392	Quarrying or mining of phosphate rock
		212393	Quarrying or mining other chemical or fertilizer minerals, such as lithium, arsenic and barium
		311942	Mining and processing of table salt
		212399	Peat mining, digging or beneficiating in combination with mining

Six-digit NAICS 2002 codes are matched with four-digit ISIC Rev. 3.1 and then with three-digit ISIC Rev. 2 codes. This list only includes natural resource sectors. A similar correspondence table was established for the 29 manufacturing sectors (available on request).

Table 1.5

Test of Assumption 1
Variation over Time, Compustat

	1990-1999	2000-2009	1990-2009
	(1)	(2)	(3)
RZ Modification No. 3			
1990-1999	1		
2000-2009	0.96***	1	
1990-2009	0.96***	0.99***	1
R&D Intensity			
1990-1999	1		
2000-2009	0.99***	1	
1990-2009	0.99***	0.99***	1
Inventories to Sales			
1990-1999	1		
2000-2009	0.93***	1	
1990-2009	0.96***	0.97***	1
Short-term Debt to Sales			
1990-1999	1		
2000-2009	0.84***	1	
1990-2009	0.59***	0.70***	1

The table reports the correlations between the time periods for which the selected measures of financial dependence are calculated. *** indicates significance at the 1% level. (1) RZ modification no. 3 is calculated as $(CAPX_t - OANCF_t)/CAPX_t$, where $CAPX$ denotes capital expenditures and $OANCF$ net cash flow from operative activities. (2) R&D intensity is the share of expenses for research and development $XRDS$ (or exploration expenses $OGXPX$ for sector 220 and 353) in total sales $SALE$. (3) The ratio of inventories to sales is calculated as $INVT/SALE$. (4) The ratio of short-term debt to sales is $NP/SALE$ with notes payable NP.

Table 1.6

Test of Assumption 2
Variation across Countries, Compustat and Worldscope

	United States	United Kingdom	Australia	Canada	Aggregate (UK, Australia, Canada)
	Compustat 1990-2009	Worldscope 1990-2009	Worldscope 1990-2009	Worldscope 1990-2009	Worldscope 1990-2009
	(1)	(2)	(3)	(4)	(5)
RZ Modification No. 3					
United States	1				
United Kingdom	0.53***	1			
Australia	0.57***	0.30	1		
Canada	0.84***	0.41**	0.64***	1	
Aggregate (UK, Australia, Canada)	0.80***	.	.	.	1
Inventories to Sales					
United States	1				
United Kingdom	0.62***	1			
Australia	0.29	0.29	1		
Canada	0.64***	0.47**	0.45**	1	
Aggregate (UK, Australia, Canada)	0.75***	.	.	.	1

The table reports the correlations between the regions' values for sectors' external dependence. *** and ** indicate significance at the 1% and 5% level. RZ modification no. 3 is calculated in Compustat as $(CAPX_t - OANCF_t)/CAPX_t$, where $CAPX$ denotes capital expenditures and $OANCF$ net cash flow from operative activities. In Worldscope, it is calculated as $(WC04601 - WC04860)/WC04601$. The ratio of inventories to sales is $INVT/SALE$ in Compustat and $WC02101/WC01001$ in Worldscope.

Table 1.7

2

Natural Resources, Demand for External Finance and Financial Development

2.1 Introduction

The observation that resource-based economies experienced rather low growth rates in the last 60 years compared to other nations suggests that resources might be a curse rather than a blessing. Various explanations for this phenomenon have been proposed: for example, harmful exchange rate effects, exposure to conflicts or a weak institutional framework. This essay investigates whether financial systems are less developed in resource-abundant economies due to lower external credit demand, assuming an indirect effect on growth.

The following discussion builds on the literature's finding that finance is an important determinant of growth. In order to evaluate the effect of natural resources on welfare, it is crucial to explore a potential financial channel. I find a significant negative link between resource abundance, in particular resource dominance, and financial development, which confirms previous empirical studies.

The present essay further contributes to the literature by investigating in detail a potential explanation for this negative relationship. Its approach emphasizes the demand-side effect in the determination of financial markets. It follows the finding that indus-

trial sectors systematically differ in their dependence on the financial sector, as discussed in Chapter 1. Financially independent firms need less external finance because they can use internal cash flow for investment instead. In an economy with many financially independent firms, credit demand may be low, resulting in less need to develop a large financial sector providing external credit. This consideration is based on the belief that financial development is at least partly influenced by the demand for external credit. If resource sectors were financially independent—as has been suggested by many researchers—resource-dominated countries would have a less developed financial system as a consequence. Chapter 1 shows that resource sectors rely less on external finance when the measure of financial dependence refers to short-term liquidity needs.

In order to formally address the problem, the essay applies a model developed in the trade and finance literature by Do and Levchenko (2007) that studies the relationship between financial development and sectoral external dependence in the presence of international trade.

I follow essentially the same empirical strategy, while adjusting it to the purposes of the natural resources analysis. An economy's aggregate (short-term) credit demand is proxied by the external finance need of exports (abbr. $EFNX$), where the financial dependence of a sector is multiplied by its share in the country's total exports. This measure thus captures the credit demand that arises from the country's export structure. It is used as the main right-hand side variable in the regression equation, while the dependent variable is a measure of financial development. Estimation is done with ordinary least squares (OLS) in a cross-section of 93 (110) countries with averages from 1970 to 2007 (1992 to 2007). Control variables include other determinants of financial development such as income per capita, trade openness and legal origin. In addition, I estimate a panel specification with both time and country fixed effects in order to capture omitted variables.

As the literature suggests, financial development (as an endowment) might, in turn, influence the export structure, which is embodied in the proxy $EFNX$. In order to handle this important endogeneity problem, I construct an instrument for the country's aggregate credit demand. The actual trade flows are predicted with the help of sector-

level gravity estimations with exogenous geographic determinants of trade such as distance and land area. Estimations for each sector make it possible to predict the export pattern rather than just the trade volume. The obtained instrument is used in a two-stage least squares (2SLS) regression.

At first glance, the results appear ambiguous. In the cross-section with both OLS and 2SLS, there is evidence of a resource curse operating via the proposed demand-side effect in the financial system. In contrast, the panel analysis does not support this hypothesis, which could be due to omitted variables in the cross-section. Following the literature on resources, the quality of a country's institutions may play a role in this context. Robustness checks, however, show that measures of institutional quality are unlikely to be an omitted variable. Further analysis suggests that most resource-based countries show high export concentration. A poorly diversified economy rather than low credit demand of resource firms may explain the negative link between resources and finance.

The chapter is structured as follows: Section 2.2 gives an overview of the resource curse literature. Section 2.3 sheds light on a possible financial channel and explains the application of the theory in detail. The empirical strategy and data are described in Section 2.4. The results are presented in Section 2.5. Section 2.6 concludes.

2.2 The Natural Resource Curse

In the last several decades, economists have observed that on average resource-rich countries, especially many African, Latin American and Arab nations such as Nigeria, Sierra Leone, Venezuela and Saudi Arabia, tend to grow at slower rates than countries with few natural resources. While resource abundance was considered unambiguously positive until World War II, economic literature later started to analyze this "paradox of plenty" (Karl 1997) more closely. The phenomenon is usually referred to as the "resource curse" (Auty 1994), where the resources of interest are point resources with a high concentration in certain regions of the world such as oil, natural gas and mining products.

A number of empirical studies have tried to validate the resource curse hypothesis, including the work of Sachs and Warner (1995, 2001), who apply resource exports relative to gross domestic product (GDP) as a measure of a country's resource abundance. These studies, however, have been challenged by recent publications. The measure of abundance is criticized in particular because output- and trade-related variables suffer from endogeneity problems. These variables might just represent low economic diversification, which is a common characteristic of poor countries, and not the actual resource abundance. Brunnschweiler (2008), for example, proposes alternative measures such as subsoil wealth per capita, which are more appropriate to capturing the actual natural resource endowment of an economy. Alexeev and Conrad (2009) point out that most empirical papers do not consider economic booms in the early years of extraction prior to the 1970s, thereby underestimating the role of resource depletion over time. These authors are more skeptical towards the presence of a resource curse. Nevertheless, there is still an ongoing and lively debate on the detrimental effect of resource abundance on a country's development that is far from reaching consensus.

In order to explain the mechanisms through which the resource curse may operate, economists have presented a variety of theories. One explanation that has been popular among researchers is the so-called "Dutch disease," based on the supposed experience of the Netherlands after a resource boom in the 1960s. It states that the rents obtained from resource exports can render a country's manufacturing sector less competitive by raising the real exchange rate (see Corden and Neary 1982, van Wijnbergen 1984, Stijns 2003). Another theory suggests that resource abundance might foster armed conflicts and civil war through the "looting" of resources by rebel groups and "grievances" in local communities due to mineral extraction (e.g., Ross 2004). Gylfason (2001) finds that natural capital deteriorates public and private incentives to accumulate human capital. Recent work emphasizes that a national economy dominated by resource extraction is heavily exposed to welfare-decreasing macroeconomic volatility (van der Ploeg 2010).

Yet another explanation that has gained prominence in recent years is that the resource curse operates through the institutional channel (Mehlum, Moene and Torvik 2006). On the one hand, differences in the quality of institutions, including the legal and

political system, the rule of law as well as property rights, determine whether resources are advantageous or disadvantageous for an economy. On the other hand, resource extraction may, in turn, affect a country's institutions. Researchers show that both private agents and politicians tend to engage in rent-seeking in order to benefit from the available resource income, thereby crowding out profit-oriented entrepreneurship and fostering corruption among bureaucrats (see, e.g., Tornell and Lane 1999, Sala-i-Martin and Subramanian 2003). Resource dominance has been associated with a lack of democracy and a tendency towards autocratic political systems (see, e.g., Ross 2001). The institutional hypothesis is important because institutions are considered to play a crucial role for the development of an economy (Acemoglu, Johnson and Robinson 2001). Furthermore, the theory can explain why some resource-rich countries such as Australia, Canada, Norway and Botswana have been very successful economically in recent decades. These countries were able to avoid or overcome the resource curse due to their strong institutional environment, and they show that resource abundance does not necessarily lead to lower economic growth.[1]

Given the importance of the institutional setting, it is surprising that there has been relatively little research on finance as a possible channel of the resource curse. Indeed, growth economists have identified financial development as a major determinant of growth (see, e.g., Levine 2005, Rajan and Zingales 1998).[2] Thus, resource abundance could indirectly affect economic growth through a country's financial system.

2.3 The Financial Channel

Do resource-rich economies show less developed financial systems? Figure 2.1 suggests that this indeed seems to be the case.[3] Countries with a high share of resources in total exports tend to have a smaller financial sector measured by private credit to

[1] For an overview of the resource curse literature, see, e.g., the World Trade Report (2010).

[2] In the wake of the financial crisis of 2008 and 2009, more recent studies claim that exceedingly large financial sectors may be bad for growth (Arcand, Berkes and Panizza 2011). However, in a broad cross-section of countries, many with developing and emerging economies, higher financial development may generally be considered advantageous, in particular in the long run.

[3] Here, the export share of resources is depicted as $log[\text{share}/(1 - \text{share})]$. "Log" refers to the natural logarithm in this chapter. Data averages from 1970 to 2007.

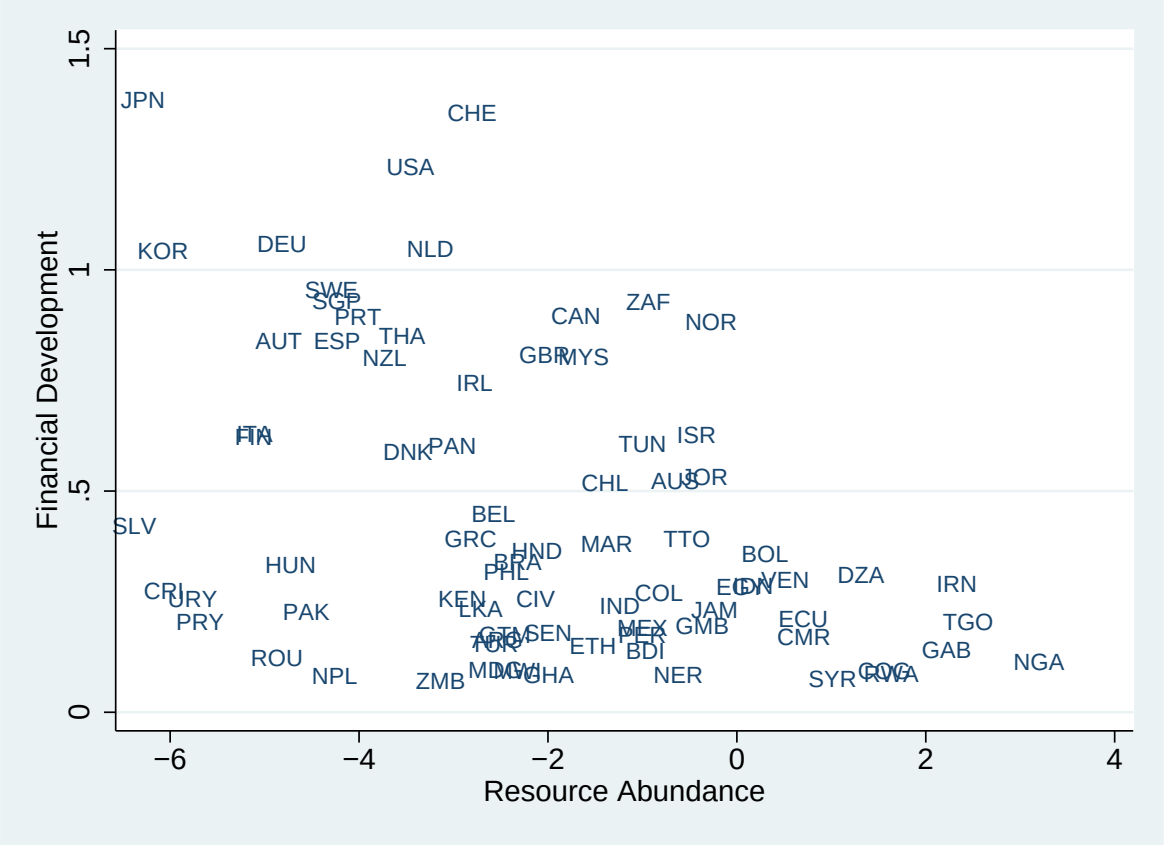

Figure 2.1: Financial Development (private credit to GDP) and Resource Abundance (export share of resources).

GDP. Section 2.5.1 shows in more detail that this holds true when controlling for other determinants of financial development such as real GDP per capita and trade openness. This is in line with recent papers' findings (Nili and Rastad 2007, Beck 2011, Kurronen 2012).

2.3.1 Literature

There are several explanations for this negative relationship. Nili and Rastad (2007) identify a dominant role of the government in investment and a weak private sector as the main drivers of relatively low financial development. Berglöf and Lehmann (2009, p.199) argue that "bulkiness of investment and a lack of demand for broader financial services" might play a role, but remain silent on the details or empirical underpinning.

Yuxiang and Chen (2011) name four possible mechanisms: first, a resource boom of-

ten weakens the tradable sector of an economy. Accordingly, there is less support for liberal trade policies, which are generally positively correlated with financial development. Second, rent-seeking and corruption in resource-based economies undermine a government's credibility and thus its ability to promote reliable financial sector reforms. Opportunities for rent-seeking may also reduce the activity and credit demand of entrepreneurs. Third, the detrimental effect of resource abundance on human capital (see Section 2.2) may weaken the social capital of an economy, that is, its level of trust. Since trust plays an important role for financial contracts, financial development may shrink as well (Guiso, Sapienza and Zingales 2004b). Fourth, the finding of Gylfason and Zoega (2006) that resource abundance negatively affects productive investment may also have implications for the financial sector.

Another argument is that the macroeconomic volatility caused by cyclical and highly uncertain commodity prices generally weakens financial development, as has been suggested by Kurronen (2012). The author further points out that local incumbents, especially in the resource sectors, tend to prevent financial reforms in order to deter competitors from market entry, who typically rely more on external finance at the beginning (see also Rajan and Zingales 2003). However, the aforementioned studies are confined to making rather broad suggestions, without explicitly investigating the theories.

2.3.2 Financial Development and Demand for External Finance

This essay proposes and empirically investigates another channel by which the resource curse may operate. The approach follows the assumption that firms' financial dependence and thus demand for external finance, ceteris paribus, determines the size of the financial sector. If resource firms relied less on external finance, there would be less credit demand in the economy and, therefore, a smaller and less developed financial system.[4]

[4]Kurronen (2012) hints at a similar explanation, without exploring the idea further.

2.3.2.1 Theory

As discussed in Chapter 1, Rajan and Zingales (henceforth: RZ, 1998) show that industries systematically differ in their need for external financing provided by the financial sector. The finding has become an important building block for studies conducted on both growth and trade. In particular, Do and Levchenko (2007) apply the concept in order to explain that demand in external finance may shape an economy's financial development.

They present a model with one factor, labor, and two goods (p.800). One good is financially dependent (F), the other is not (A). Entrepreneurs in the economy can choose between the production of either of these goods. The simple good A uses a linear technology with one unit of labor for one unit of A, while the production of F is more complicated due to additional financial constraints. In each period, the investment project of an entrepreneur producing F experiences a liquidity shock that may be either positive or negative. In order to fulfill possible liquidity need, agents can borrow on a spot credit market, where capital is provided by entrepreneurs with excess liquidity (p.801). The model finds that the probability of a firm's liquidation shrinks with an increase of the number of agents engaged in the F sector, indicating positive spillovers and a "positive relation between the financial system's size and its quality" (p.802). Furthermore, this leads to less volatility in the total output of the constrained sector. The authors show that in an autarky equilibrium the credit market is linear in the size of this sector.

In a trade equilibrium, however, the outcome is different. Trade between two countries, say "North" and "South," emerges due to comparative advantage other than financial development. We may assume here that there is a Ricardian productivity difference with North having an advantage in the financially dependent sector. As a consequence, North produces only good F and South, in contrast, only the simple good A. According to the logic of the model, credit demand and lending in South decline to zero. This also affects the financial system's quality since a marginal entrepreneur can no longer insure against liquidity shocks through borrowing (p.804). By contrast, North's financial system's size and quality increase. Thus, the model is able to explain how the trade

pattern may influence a country's financial development. Do and Levchenko (2007) test this hypothesis empirically and, indeed, find a significant positive association.[5] Their analysis, however, is limited to manufacturing sectors.

The close relationship between the financial sector's size and financial depth is in line with empirical finance literature (e.g., Do and Levchenko 2007, Levine and Schmukler 2006). Suitable and commonly used measures such as private credit to GDP and stock market capitalization are discussed in the following sections. In addition, one may question whether national financial markets still matter with increasing internationalization since companies may just borrow on foreign capital markets. Evidence from the finance literature suggests the opposite, however. Pagano, Randl, Röell and Zechner (2001) analyze firms' cross-listing decisions at international stock exchanges, and find that local financial development remains to be an important determinant of a region's economic well-being. This view is supported by Guiso, Sapienza and Zingales (2004a), who show that in the financially well-integrated Italian regions, a higher regional level of financial development enhances the economic activity of local individuals.

The present essay does not claim that financial markets are only shaped by the industry's credit demand. An economy's general level of wealth (income per capita), legal origin, financial regulation and trade openness play an important role as well (La Porta, Lopez-de-Silanes, Shleifer and Vishny 1998, Mayer and Sussman 2001, Rajan and Zingales 2003).

2.3.2.2 Applying the Theory to the Resource Curse

How does the theory of Do and Levchenko (2007) apply to the natural resource curse? The answer relates to the external dependence of resource firms. A resource-dominated economy with a high concentration of economic activity in few resource sectors may be similar to country South (see 2.3.2.1) if resource sectors were financially independent. Indeed, researchers have often supposed that resource companies such as oil and gas producers rely less on external financing than others (Guriev, Plekhanov and Sonin 2009, Beck 2011). Chapter 1 takes a closer look at the resource sectors' finance need in

[5] They apply the RZ-type measure of external dependence.

different countries by comparing various measuring approaches. This particular study shows that the resource sectors' financial dependence relative to manufacturing differs with the measure used. Table 2.1 again shows that the resource sectors coal mining, crude petroleum and natural gas production, metal ore mining as well as other mining (ISIC Rev. 2) are rather financially dependent when the measure captures long-term financing need. An example is the RZ-type measure, which is calculated as capital expenditures minus operative cash flow divided by capital expenditures. In contrast, resource sectors rely less on external finance when the ratio of inventories to sales, which accounts for short-term liquidity need, is used (see Chapter 1).[6] This is true for oil and gas, in particular. A meaningful financial channel of the resource curse is therefore linked to a scenario where a country's aggregate finance need measured by inventories to sales has a significant influence on financial development. It seems reasonable to surmise that short-term (and medium-term) credit in particular is provided by local banks. In contrast, long-term finance could be assumed to come mostly from equity markets. In the following empirical analysis, I will concentrate on short-term credit demand and bank-based measures of financial development such as private credit to GDP. Stock market measures will be used for robustness checks. This approach takes into consideration that my samples include developing and emerging countries, which are less suitable for investigating more sophisticated equity-based financing relations.

A list of resource and manufacturing sectors ranked by their financial dependence is depicted in Appendix Table 2.8 (see also Chapter 1). Since external dependence of sectors is relatively stable over time and across countries, figures based on U.S. data may be used for the calculation of each country's finance need. High financial development in the United States ensures that data are reliable and comprehensive. Applying these figures to other countries' industries also avoids the problem that firms' financial dependence is endogenous to the country's specific financial development (Kroszner, Laeven and Klingebiel 2007).

[6]The RZ modification no. 3 and the ratio of inventories to sales are taken because they are based on a larger number of observations than other measures from Chapter 1. Using the figures of sector 353 instead of 220 for the match with oil exports below does not alter the regression results in Section 2.5 substantially.

Financial Dependence across Sectors

ISIC Rev. 2	Sector	RZ-type Measure 1990-2009	Inventories to Sales 1990-2009
		(1)	(2)
210	Coal mining	−0.24	0.05
220	Crude petroleum and natural gas production	0.58	0.00
230	Metal ore mining	4.79	0.16
290	Other mining	−0.30	0.14
311	Food products	−0.68	0.11
313	Beverages	0.02	0.08
314	Tobacco	−5.11	0.17
321	Textile	−1.04	0.16
322	Apparel	−1.25	0.17
324	Footwear	−2.34	0.20
331	Wood products	−1.33	0.10
332	Furniture	−2.24	0.11
341	Paper and products	−1.00	0.11
342	Printing and publishing	−2.06	0.05
351	Industrial chemicals	−0.38	0.10
352	Other chemicals	−0.92	0.13
3522	Drugs	38.16	0.08
353	Petroleum refineries	−0.45	0.06
354	Petroleum and coal products	7.75	0.17
355	Rubber products	−0.01	0.15
356	Plastic products	−0.37	0.12
369	Nonmetal products	−0.11	0.13
371	Iron and steel	−0.44	0.16
372	Nonferrous metal	−0.19	0.14
381	Metal products	−1.45	0.14
382	Machinery	−0.84	0.18
3825	Office and computing	1.11	0.13
383	Electric machinery	−0.37	0.18
3832	Communication equipment	−0.41	0.16
384	Transportation equipment	−0.16	0.17
3843	Motor vehicles	−0.21	0.12
385	Professional goods	0.54	0.19
390	Other industries	0.07	0.17
Correlation		1	-0.16^{a}

(1) The RZ-type measure is calculated as $(CAPX_t - OANCF_t)/CAPX_t$, where $CAPX$ denotes capital expenditures and $OANCF$ net cash flow from operative activities (in Compustat items). (2) The ratio of inventories to sales is calculated as $INVT/SALE$. Sector classification is ISIC Rev. 2. See Chapter 1. ^{a} Insignificant value.

Table 2.1

2.4 Empirical Strategy and Data

There are two hypotheses to be tested: first, a general negative relationship between financial development and resource abundance, as supposed in Figure 2.1; second, in order to find an explanation for this phenomenon, a positive association between financial development and a country's aggregate short-term credit demand.

2.4.1 Financial Development and Resource Abundance

As mentioned in Section 2.3, many resource-rich countries seem to have a less developed financial sector. The essay investigates this relationship more formally by examining a cross-section of countries with averages over time. The estimating equation is:

$$FD_c = \alpha + \beta \ RESOURCES_c + \boldsymbol{\gamma} X_c + \epsilon_c, \tag{2.1}$$

where FD_c is a measure of country c's financial development, $RESOURCES_c$ is a measure of resource abundance and $\boldsymbol{X}_c$ is a vector of control variables. ϵ_c denotes the error term. The controls include the country's level of income per capita, its trade openness and dummies for legal origin. More information on the data will be given in Section 2.4.4. Estimations are done with ordinary least squares (OLS). The expectation is to find a negative coefficient β. Robustness checks include alternative measures of financial development and of resource abundance. In particular, potentially endogenous measures such as resource exports to total exports are substituted by measures that are more exogenous to other economic variables and refer to the pure natural endowment. Furthermore, I control for the quality of institutions.

2.4.2 Financial Development and External Finance Need of Exports

The theoretical model presented above suggests that countries whose industries show less credit demand tend to have a less developed financial sector. This may include

resource-abundant countries when we look at short-term financial dependence. To show this empirically, I follow the strategy proposed by Do and Levchenko (2007) and adjust it to the purposes of the resource curse analysis.

An economy's aggregate credit demand is proxied by its external finance need of exports. This measure is constructed according to Almeida and Wolfenzon (2005):

$$EFNX_{ct} = \sum_{i=1}^{I} \omega_{ict} \; ED_i. \tag{2.2}$$

Subscript c indexes countries, i industries and t time periods. ω_{ict} denotes the share of sector i's exports in total exports from country c in t, including both manufacturing and natural resources. ED_i is the measure of sector i's financial dependence. Due to data availability and the instrumentation strategy applied, I use export data instead of output data for calculating a country's aggregate credit demand. An analysis of the aggregate external finance need in manufacturing calculated with trade data (Do and Levchenko 2007, p.826) and output data (Almeida and Wolfenzon 2005, p.149) shows that both measures are, indeed, highly positively correlated (correlation coefficient of 0.72).

I estimate the following equation with OLS in a cross-section of countries:

$$FD_c = \alpha + \beta \, EFNX_c + \boldsymbol{\gamma} X_c + \epsilon_c, \tag{2.3}$$

where the left-hand side variable is again the measure of financial development. Control variables are the same as in regression equation (2.1), that is, income per capita, trade openness and legal system. The variables are averaged over several time periods. In this regression, predictions from Section 2.3 are supported if the coefficient β is significantly larger than zero. Sensitivity analysis includes alternative measures of financial development, a variation of country samples as well as measures of institutional quality and export concentration as additional control variables.

In order to control for omitted variables, I use a panel specification with country and time fixed effects. This is possible since most variables change over time. More

precisely, I run the following estimation with OLS:

$$FD_{ct} = \alpha + \beta\, EFNX_{ct} + \boldsymbol{\gamma} X_{ct} + \delta_c + \delta_t + \epsilon_{ct}, \tag{2.4}$$

with δ_c for country fixed effects and δ_t for time fixed effects. The panel specification is estimated on a sample of non-overlapping five-year and ten-year averages.[7]

2.4.3 Causality

The estimations presented in the two previous subsections are prone to endogeneity problems since financial development may affect the right-hand side variables as well. It is thus important to carefully identify the direction of causality.

Concerning the relationship between financial development and natural resource abundance, the problem can be solved by using pure geographical measures of resource endowment. Financial markets are rather unlikely to affect measures that refer to the actual subsoil wealth.

However, in the case of estimating equations (2.3) and (2.4), which relate financial development to the external finance need of exports, it is more complicated to control for endogeneity. A country's level of financial development will certainly influence its trade structure. This view has been supported by a number of studies in the finance and trade literature. They show that in the presence of credit constraints, quality and size of financial markets may be a source of comparative advantage, thereby offering an additional explanation for international trade patterns. Among others, Beck (2002) as well as Svaleryd and Vlachos (2005) find empirical evidence that a high level of financial development fosters exports in financially dependent industries.

In order to identify a causal link between the external finance need of a country's exports and the financial system, it is therefore necessary to accurately address the endogeneity problem. This is done with an instrumentation strategy that follows Do and Levchenko (2007, p.806). To overcome endogeneity, we need a variable that is

[7] Standard econometrics refers to Wooldridge (2002, 2009) in the present thesis.

highly correlated with the original one, that is, the external finance need of exports, but uncorrelated with the error term. More precisely, this means finding an instrument for the trade structure, which is done with the gravity approach that has been proposed by Frankel and Romer (1999). These authors predict trade as a share of GDP on the basis of a gravity regression of bilateral trade volumes on merely geographical explanatory variables like distance and land area. The obtained coefficients are used to predict bilateral trade between country pairs. These figures are then summed up over all trading partners of a country in order to get the predicted total trade relative to GDP. While the analysis by Frankel and Romer (1999) is limited to the national level, Do and Levchenko (2007, p.806) modify the approach by also considering the sectoral level. Thus, they are able to predict a country's trade structure rather than just its general ratio of trade to GDP. Relying on Frankel and Romer (1999), the following regression equation is estimated for each sector i:

$$\begin{aligned} LogEXP_{icd} = \alpha &+ \eta_i^1 ldist_{cd} + \eta_i^2 lpop_c + \eta_i^3 larea_c + \eta_i^4 lpop_d + \eta_i^5 larea_d \\ &+ \eta_i^6 landlocked_{cd} + \eta_i^7 border_{cd} + \eta_i^8 border_{cd} * ldist_{cd} \\ &+ \eta_i^9 border_{cd} * pop_c + \eta_i^{10} border_{cd} * area_c + \eta_i^{11} border_{cd} * pop_d \\ &+ \eta_i^{12} border_{cd} * area_d + \eta_i^{13} border_{cd} * landlocked_{cd} \\ &+ \eta_i^{14} subsoilintotalwealth_c + \eta_i^{15} subsoilintotalwealth_d + \epsilon_{cd}. \end{aligned} \tag{2.5}$$

The left-hand side variable $LogEXP_{icd}$ denotes the log of exports from country c to d relative to GDP in industry i.[8] Relating trade to sectoral GDP ensures that we control for a country's size. This is important since large countries tend to trade less with their neighbors, in relative terms, than small ones. For example, Germans surely engage extensively in trade with Germans, while Belgians trade comparatively less with their own countrymen as they have fewer fellow citizens to trade with (Frankel and Romer 1999, p.380). The geographical explanatory 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

[8] See also di Giovanni and Levchenko (2009).

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. Since the presence of a common border will most likely alter the effect of all previous variables, the right-hand side also consists of interaction terms with $border_{cd}$. In addition to Do and Levchenko (2007), this essay adds $subsoilintotalwealth$, which denotes the subsoil in total wealth for both the exporter c and importer d (see Data Description 2.4.4).

The coefficients I obtain from these regressions by sector are then used to predict the log of exports to GDP in sector i from country c to d, $\widehat{LogEXP_{icd}}$.[9] Since the construction of the finance need of exports requires the sectoral export share in total exports, not sectoral bilateral exports, I take the exponential of $\widehat{LogEXP_{icd}}$, and sum over all trade partners $(d = 1, ..., D)$:

$$\widehat{EXP_{ic}} = \sum_{d=1}^{D} e^{\widehat{LogEXP_{icd}}}, \qquad \text{where} \qquad d \neq c. \tag{2.6}$$

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

$$\widehat{\omega}_{ic} = \frac{\widehat{EXP_{ic}}}{\sum_{i=1}^{I} \widehat{EXP_{ic}}}. \tag{2.7}$$

With predicted rather than actual trade shares of sectors, it is now possible to construct the instrument for the main right-hand side variable, external finance need of exports (Do and Levchenko 2007, p.807). Analogous to equation (2.2), the instrument is:

$$\widehat{EFNX_c} = \sum_{i=1}^{I} \widehat{\omega}_{ic}\ ED_i. \tag{2.8}$$

While trade literature shows that gravity approaches deliver astonishingly good predictions of actual trade volumes at the national level, one might be more reluctant towards a strategy predicting countries' trade structures with the corresponding sectoral disaggregation. In particular, it could be argued that the geographical determinants used as explanatory variables refer to the national level and do not vary across industries. However, since the gravity regression is estimated for each sector i, the estimated gravity

[9] Hats indicate predicted values.

coefficients η_i also differ across sectors and thus the predicted exports to GDP $\widehat{EXP_{ic}}$ within a country. The supposition is that goods with a highly negative coefficient on distance, for example, will be traded less with trading partners that are far away from the home country than other products. Other export goods might react sensitively to whether there is a common border between country c and d. That is, the sectors' export behavior is differently affected by the geographical determinants in the gravity equation (2.5). Obviously, significant variation of the gravity coefficients across industries is important for the instrumentation strategy to work. Whether this is indeed the case, is tested in Section 2.5. Do and Levchenko (2007) list both theoretical and empirical studies that support the view that these coefficients differ across sectors. Anderson and van Wincoop (2003, 2004) show, for example, that coefficients on distance and border depend on trade costs and the elasticity of substitution between product varieties within an industry. Both factors may well differ across sectors according to empirical literature.

Another potential objection to the approach might be the presence of zero trade observations when two countries do not trade in a particular sector. There is a high probability that two small countries that are far away from each other do not trade in every sector. Do and Levchenko (2007) find that this phenomenon is less of a problem. One reason is that trade patterns rather than volumes are estimated, and country pairs with no bilateral trade at all can be easily ignored. Nevertheless, the instrument may still be biased since the procedure predicts zero trade when it observes zero trade. The authors conduct a number of robustness checks to avoid this problem and find convincing evidence that zero trade observations are not a major concern for the instrumentation strategy.[10]

The instrument for the external finance need of exports is used in regression equation (2.3) with two-stage least squares (2SLS). While the approach is able to account for several important issues of endogeneity, two common restrictions, which apply to instruments, remain: a potential measurement error in regressors and the omitted-variable bias. The latter is captured in the panel analysis.

[10] Among others, they estimate the gravity equation in levels applying a Poisson pseudo-maximum likelihood estimator with zero trade observations.

2.4.4 Data Description

In the following section, data and data sources are described in more detail. It presents the measures of financial development and resource abundance, the data to construct the external finance need of exports, the control variables as well as the different samples used.

2.4.4.1 Financial Development

The present essay exploits the cross-country variation in finance. It is, therefore, crucial to use an appropriate measure of an economy's level of financial development. The most commonly used measure in the finance literature is the ratio of private (domestic) credit to GDP, that is, the amount of credit by banks and other private financial institutions to the private sector as a share of GDP (Rajan and Zingales 1998, p.569). As mentioned above, there is reason to assume that the quality of a financial system is a function of its size (Do and Levchenko 2007, p.799). A similar measure is the ratio of liquid liabilities to GDP (M2/GDP). Alternatively, it is possible to use a country's stock market trade value or stock market capitalization relative to GDP. While neither stock market measure reflects the *actual* amount of funding obtained by borrowers, these composites are considered to be suitable proxies for general financial development. In contrast, the stock market turnover ratio, defined as the value of total shares traded divided by the average real market capitalization, is a proxy for the stock market's activity and not for its size. The net interest margin, which is the accounting value of banks' net interest revenue as a share of interest-bearing assets, is another possibility for avoiding using the financial sector's size (Do and Levchenko 2007, p.821). Generally, the measures presented here are positively correlated, with the exception of the net interest margin, where a low value suggests a well-developed financial system. All measures are taken from Beck and Demirgüç-Kunt (2009).

2.4.4.2 Resource Abundance

Measures of resource abundance include the share of natural resources—that is, coal, oil and gas, metal ores and other mining products—in total (manufacturing and natural resources) exports. Alternatively, I use the share of oil and natural gas exports in total exports. I calculate both measures on the basis of the below trade data. Also, more pure measures of a country's resource endowment are used. These are subsoil wealth per capita and subsoil wealth in total national wealth provided by the World Bank (2006). Subsoil wealth includes oil, natural gas, coal and mineral resources, while total wealth includes all natural assets (e.g., forests) as well as produced capital and intangible capital.[11]

2.4.4.3 External Finance Need of Exports

Data for the sectors' financial dependence, that is, inventories to sales and the RZ-type measure, come from Chapter 1.

International trade data are taken from both the World Trade Database (Feenstra, Lipsey, Deng, Ma and Mo 2005) for the time period 1970 to 2000 and UN Comtrade for 2001 to 2007. These databases capture a large majority of bilateral trade flows and provide data classified by the four-digit Standard International Trade Classification (SITC) Revision 2. Since financial dependence data are classified by ISIC Rev. 2, trade data are converted to (three-digit) ISIC Rev. 2 as well. This is partly done with a correspondence table developed by Muendler (2009). The convergence allows for constructing the measure of external finance need of exports $EFNX$. In addition, these data are used to calculate the export concentration variables for robustness checks.

The same sources of trade data are used for the left-hand side variable of the gravity equation, where the additionally required GDP data at the sectoral level come from the United Nations Industrial Development Organization's database INDSTAT4 and the UNIDO publication "World Statistics on Mining and Utilities" (2010). Data are again

[11] Van der Ploeg and Poelhekke (2010) argue that measures of subsoil wealth could also be endogenous in growth regressions due to specific assumptions made for their calculation. Wealthy countries tend to have higher values of subsoil wealth per capita according to World Bank figures.

converted to three-digit ISIC Rev. 2. Due to small inconsistencies in the matching of the sector classifications ISIC Rev. 2 and 3, the plastic products sector (356) has to be dropped here. A database from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) provides geographical data for the right-hand side variables that reflect bilateral distances between two countries' major cities, land area as well as information on whether a country is landlocked and whether two countries share a border (Head, Mayer and Ries 2010). Data on population come from the World Bank's "World Development Indicators."

2.4.4.4 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 the legal system are based on La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998).

Further robustness checks require measures of institutional quality. This information is provided by the Polity IV index (Marshall, Jaggers and Gurr 2011), which captures the strength of democracy on a scale from -10 to 10. Second, the size of government, which is proxied by government consumption spending to GDP (from Penn World Tables), and where a high value indicates a low quality of institutions. Third, the property rights index by the Heritage Foundation capturing the protection of private property on a scale from 0.1 to 1. And fourth, the Economic Freedom of the World Index (Gwartney, Lawson and Hall 2012), which is a composite including 42 components of the categories government size, legal system, property rights, sound money (among others, inflation), freedom to trade internationally as well as flexible regulations (credit market, labor market, doing business).

2.4.4.5 Samples

Different samples are used in the analysis. The first sample for the regression of financial development on natural resource abundance consists of 78 countries for the time

period 1970 to 2007, while the second one covers 84 countries. The latter captures a shorter time period, from 1992 to 2007, which makes it possible to include a number of former socialist economies. The corresponding samples for the regression of financial development on the external finance need of exports are somewhat larger: 93 and 110 countries. The sample used for the 2SLS estimation consists of only 33 countries from 1992 to 2007 due to limited sectoral GDP data, especially for figures on resources. A list of countries is depicted in Appendix Table 2.14.

2.5 Results

This section presents the empirical results. The first part deals with the relation between a country's level of financial development and its natural resource abundance. The second part relates financial development and the aggregated credit demand of a country in a cross-section and in a panel specification, and it reports the results of the instrumentation strategy. As indicated in Section 2.3, I focus on a scenario where firms' financial dependence is measured by inventories to sales. Further robustness checks test whether institutional quality or export concentration are important for the analysis.

2.5.1 Financial Development and Resource Abundance

As outlined in Section 2.3, it is reasonable to test empirically whether there is a negative relationship between resource abundance and a country's financial system before investigating a possible mechanism of the financial channel in more detail. I run cross-sectional OLS regressions with a sample of 78 countries, estimating equation (2.1) with various measures of financial development and resource abundance. In order to mitigate the problem of an unbalanced panel, averages of all variables from 1970 to 2007 are taken. The results are reported in Table 2.2 with robust standard errors in parentheses and where the columns represent different specifications. The first specification is a simple bivariate regression of financial development on resource abundance

Financial Development and Resource Abundance
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
Resource Abundance Measure	Export Share of Resources	Export Share of Resources	Export Share of Resources	Export Share of Resources
Resource Abundance	-0.463^{***}	-0.245^{**}	-0.173^{**}	-0.239^{***}
	(0.092)	(0.075)	(0.072)	(0.081)
Log(Income)		0.183^{***}	0.156^{***}	0.175^{***}
		(0.019)	(0.021)	(0.024)
Log(Trade Openness)		0.039	0.040	0.030
		(0.056)	(0.047)	(0.047)
British Legal Origin			0.013	0.426^{***}
			(0.107)	(0.080)
French Legal Origin			-0.112	0.282^{***}
			(0.102)	(0.069)
Socialist Legal Origin			-0.354^{***}	
			(0.096)	
German Legal Origin			0.378^{*}	0.785^{***}
			(0.135)	(0.139)
Scandinavian Legal Origin				0.414^{***}
				(0.111)
Polity IV				-0.008
				(0.005)
Constant	0.555^{***}	-1.224^{***}	-0.971^{***}	-1.446^{***}
	(0.053)	(0.230)	(0.258)	(0.217)
Observations	78	78	78	77
R^2	0.14	0.57	0.71	0.70

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1970-2007. In all specifications, financial development (FD) is measured by private credit to GDP, while resource abundance is captured by the export share of resources. 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 index Polity IV measures the strength of democratic institutions (Marshall, Jaggers and Gurr 2011).

Table 2.2

measured by private credit to GDP and the export share of resources, respectively. The coefficient on resource abundance is -0.463 and significant at the 1% level. The following specifications add other variables suited for explaining a country's level of financial development such as income per capita and trade openness (Column 2). It does not come as a surprise that wealth is positively correlated with a large private credit market. Trade openness appears to be insignificant. The coefficient on resource abundance remains significantly negative. This is also true in Column 3, including legal origin dummies, where the R^2 is 0.71.

In the context of the resource curse, it is often argued that institutions play an im-

portant role (see Section 2.2). For this reason, I control for institutional quality using the Polity IV index, which is frequently applied in the literature. As can be seen in Column 4, however, this variable does not have a significant effect on the left-hand side variable.[12] It seems that the negative relationship between financial system and resources cannot simply be explained by institutional shortcomings. The coefficient on resource abundance remains significant when government size as a measure of institutional quality is used. With a measure of economic freedom or of property rights, the results are ambiguous, but do not generally contradict the negative link between finance and resources (not depicted in the tables).

Furthermore, I check the robustness of these results using alternative measures of resource abundance. The results of a specification with control variables income per capita, trade openness and legal origin are depicted in Table 2.3. When resource abundance is measured by the export share of just oil and natural gas without mining products, the negative relationship found above is stronger (Column 1). As indicated in the description of methods, it is even more important to vary the resource variable using a pure, exogenous measure such as subsoil wealth per capita or the share of subsoil in total wealth in order to overcome the simultaneity problem of the export shares of resources used so far. Both coefficients on the main right-hand side variable (Column 2 and 3) are negative and significant, as before. The magnitude of the coefficient on pure subsoil wealth per capita, however, is very low.

In addition, the measures of financial development are varied. In detail, these are the ratios of liquid liabilities, stock market trade value and stock market capitalization to GDP, the stock market turnover ratio and the net interest margin. Selected results using two of them, the stock market trade value to GDP and the stock market turnover ratio, are depicted in Table 2.3, with wealth, trade openness and legal origin dummies as control variables. Still, coefficients on resource abundance are negative and significantly different from zero with values of -0.196 and -0.315. However, other combinations of financial development and resource abundance measures deliver less significant results and R^2 tends to shrink (not depicted in the tables).

[12] It remains insignificant when the legal origin dummies are dropped.

Financial Development and Resource Abundance
Robustness, OLS Cross-section, Averages, 1970-2007

	(1)	(2)	(3)	(4)	(5)
Dep. Var. (FD)	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP	Stock Market Trade Value/GDP	Stock Market Turnover Ratio
Resource Abundance Measure	Export Share of Oil and Gas	Subsoil Wealth p.c.[a]	Subsoil in Total Wealth	Export Share of Resources	Export Share of Resources
Resource Abundance	-0.217^{***}	$-1 * 10^{-5***}$	-0.172^{**}	-0.196^{**}	-0.315^{**}
	(0.062)	$(3.2 * 10^{-6})$	(0.073)	(0.092)	(0.132)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies				
Constant	-0.998^{***}	-1.534^{***}	-1.074^{***}	-0.825^{*}	0.578
	(0.257)	(0.237)	(0.256)	(0.433)	(0.594)
Observations	78	77	78	65	65
R^2	0.72	0.71	0.71	0.46	0.44

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 resource abundance measure is varied using the export share of resources (4 and 5), the export share of oil and gas (1), subsoil wealth per capita (2) and subsoil in total wealth (3). Selected measures of financial development (FD) are private credit to GDP (1 to 3), the stock market trade value to GDP (4) and the stock market turnover ratio (5). 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). [a] Without Norway, which is a strong outlier.

Table 2.3

The same analysis is conducted for a sample covering the period 1992 to 2007, which includes a number of former Soviet countries. Appendix Table 2.9 shows the specifications as in Column 3 of Table 2.2, with income per capita, openness and legal origin as controls. Again, measures of resource abundance and financial development are varied. Overall, the results are in line with the findings from above.

Thus, we can state that resource-abundant countries tend to have a less developed financial system. In the majority of regressions, the size of the effect does not appear to be negligible. Generally, measures of resource abundance that refer to the export structure show a stronger negative correlation with financial development than measures of pure subsoil wealth. Resource dominance as opposed to general resource wealth seems to harm finance. These results are basically in line with Yuxiang and Chen (2011), Beck (2011) and Kurronen (2012).[13]

[13]The presented analysis is confined to a cross-section of countries here. The above literature, which

2.5.2 Financial Development and External Finance Need of Exports

Armed with this finding, we can now turn to an empirical investigation of a mechanism that is able to explain why resource-rich and, in particular, resource-dominated countries tend to have a less developed financial system. As described in Section 2.3, the external dependence of resource sectors may play a role. The hypothesis to be tested is whether credit demand by sectors, proxied by the (short-term) external finance need of exports, affects a country's financial development.

2.5.2.1 Cross-sectional Analysis

a. Ordinary Least Squares (OLS) Regression

The first cross-sectional OLS regressions are conducted with a sample of 93 countries and data averages over 38 years, that is, from 1970 to 2007. The results are shown in Table 2.4, with robust standard errors in parentheses. In Column 1, financial development (private credit to GDP) is regressed on the external finance need of exports, that is, on the economy's aggregate credit demand of firms. Firms' financial dependence ED_i from equation (2.2) is measured by inventories to sales. The coefficient on the right-hand side variable $EFNX$ is 1.900 and significant at the 1% level. The R^2, however, is rather low. Columns 2 and 3 present the results of specifications including the control variables income per capita, trade openness and legal origin dummies. As expected, wealth is positively related to the size of the credit market. Trade openness, however, is insignificant in all specifications. Column 3 shows that especially a socialist legal origin negatively affects the financial system. Here, the $EFNX$ variable is still significant at the 1% level ($\beta = 1.976$), and R^2 is much higher than in the first specification.

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also uses panel data, suggests that resources are essentially associated with lower bank-based financial development, as captured by private credit to GDP. The negative link between resources and stock markets is less pronounced.

Financial Development and External Finance Need of Exports
OLS Cross-section, Averages, 1970-2007

	(1)	(2)	(3)	(4)
Dep. Var. (FD)	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP	Stock Market Capitalization/GDP
EFNX	1.900***	2.500***	1.976***	2.693**
	(0.686)	(0.526)	(0.501)	(1.164)
Log(Income)		0.188***	0.171***	0.219***
		(0.018)	(0.019)	(0.036)
Log(Trade Openness)		0.079	0.075	0.220**
		(0.056)	(0.050)	(0.090)
British Legal Origin			0.049	0.328**
			(0.106)	(0.161)
French Legal Origin			−0.041	−0.052
			(0.098)	(0.121)
Socialist Legal Origin			−0.249***	−0.057
			(0.093)	(0.184)
German Legal Origin			0.372***	0.071
			(0.139)	(0.294)
Constant	0.198***	−1.787***	−1.568***	−2.774***
	(0.066)	(0.266)	(0.321)	(0.723)
Observations	93	93	93	76
R^2	0.05	0.61	0.70	0.52

Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level. Variables are averaged over the period 1970-2007. In specifications 1 to 3, financial development (FD) is measured by private credit to GDP, while 4 uses stock market capitalization to GDP. $EFNX$ is the external finance need of exports, which is calculated using inventories to sales. 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).

Table 2.4

In order to check these estimates for robustness, alternative measures of financial development are applied instead of private credit to GDP. As in Section 2.5.1, this includes the ratios of liquid liabilities, stock market trade value and stock market capitalization to GDP, the stock market turnover ratio and the net interest margin. The regression result with stock market capitalization is demonstrated in Table 2.4 in Column 4. Overall, the results are mixed. With liquid liabilities and stock market capitalization to GDP, the coefficients on $EFNX$ are positive and significant as above, even though the R^2 is only at around 0.50. The coefficients are insignificant, however, when the financial system's quality is proxied by the other three measures (not depicted in the tables).

Nevertheless, in the cross-section, there is some evidence that the external finance need of exports measured by short-term financial dependence might be correlated with

financial development. This result would, indeed, suggest a credit demand channel of the resource curse.[14]

Furthermore, I run all regressions and robustness checks described above with a sample including more countries (110) at the expense of a shorter time period covered (1992 to 2007). The results obtained from these estimations are strongly in line with those from the 1970-2007 sample. Again, the external finance need of exports with inventories to sales is significantly related to financial development.

b. Instrumentation Strategy

As outlined in Section 2.4.3, the external finance need of exports, the main right-hand side variable, may be endogenous. That is, the trade structure could be influenced by financial development itself. The results of the instrumentation strategy are presented below.

The approach allows only cross-sectional analysis, and limited availability of data leads to a smaller sample covering fewer countries over a shorter time period. More precisely, I use a sample with 33 countries from 1992 to 2007. First, I estimate the gravity equation (2.5) at the sectoral level, that is, for each of the 32 sectors. The data are averaged over the whole period. The estimation results with all relevant variables are depicted in the Appendix Tables 2.10 to 2.13, where each column represents an industry. The number of observations differs across the sector-level gravity regressions, ranging from 350 (coal mining) to $2,542$ (machinery). The R^2s are between 0.19 and 0.56.

How can we interpret the sectors' coefficients on the geographical determinants? As expected, distance clearly mitigates the ratio of bilateral exports to GDP. The farther away countries are, the less they trade with each other. According to Frankel and Romer (1999, p.384), the coefficients on the exporter's population and area are supposed to be negative, too, since agents in large countries, such as the United States,

[14] $EFNX$ is clearly insignificant in all specifications when it is calculated with the Rajan-Zingales-type measure instead of inventories to sales. This result continues to hold when the exact calculation of cash flow is varied, as proposed in Chapter 1.

have more opportunities to trade with their fellow citizens and are farther away from customers beyond their own border. This distance argument is also applied to explain why the importer's land area negatively affects bilateral trade to GDP. These predictions are only partly supported by the data from my gravity estimation. On the other hand, a large population of the importer provides good market opportunities and increases bilateral exports significantly. Not surprisingly, landlocked countries trade considerably less. A common border tends to increase bilateral trade, whereas this is less obvious when border interaction terms are included in the regression. Overall, the coefficients' size and signs correspond rather well to those obtained by Frankel and Romer (1999) at the aggregate national level.

Do and Levchenko (2007) point out that the gravity coefficients have to differ across industries. Since all geographical right-hand side variables are the same in the set of industry-level estimations, predicted trade values would just be the same, too, if η^{1-15} were equal across sectors. However, comparing the coefficients in Appendix Tables 2.10 to 2.13 shows that they differ significantly in magnitude. For example, η^1 on $ldist_{cd}$ (log of bilateral distance) ranges from -1.998 to -0.436. Thus, expanding the Frankel-Romer approach to a sector-level analysis is possible. Armed with the fifteen estimates on the geographical variables, I predict bilateral exports as a share of GDP for each industry and country, and calculate the predicted external finance need of exports as described in Section 2.4.

The 2SLS regression results are presented in Table 2.5, where $EFNX$ calculated with inventories to sales is instrumented by $\widehat{EFNX}$ and the corresponding controls. Column 1 reports a simple bivariate regression, while the other columns add the set of control variables that are known from above. The bottom panel refers to the first stage of the estimation. The coefficient on $\widehat{EFNX}$ ranges from 1.754 to 2.585 and is significant at the 10% level or at the 5% level. The partial R^2s are between 0.14 and 0.22. The partial F-statistics range from rather low 2.89 to 4.82. The second-stage outcomes are presented in the top panel of Table 2.5. The coefficient on $EFNX$ is clearly insignificant in the bivariate regression (t-statistics of 0.39). With the additional control variables income per capita and trade openness, it is significant at the 1% level

Financial Development and External Finance Need of Exports
2SLS Cross-section, Averages, 1992-2007

	(1)	(2)	(3)	(4)	(5)
Panel A: 2nd Stage					
Dep. Var. (FD)	Pr.Credit /GDP	Pr.Credit /GDP	Pr.Credit /GDP	Stock Market Capitalization /GDP	Stock Market Trade Value/GDP
EFNX	1.482	5.467***	7.138**	6.431**	6.231**
	(3.763)	(1.968)	(2.970)	(3.370)	(3.005)
Log(Income)		0.351***	0.233**	0.123	0.139**
		(0.067)	(0.095)	(0.117)	(0.069)
Log(Trade Openness)		−0.035	0.087	−0.039	−0.102
		(0.100)	(0.116)	(0.126)	(0.121)
British Legal Origin			−0.011	0.742***	0.275
			(0.188)	(0.237)	(0.307)
French Legal Origin			−0.270*	0.197	0.052
			(0.156)	(0.134)	(0.269)
Socialist Legal Origin			−0.545**	0.020	−0.085
			(0.212)	(0.228)	(0.299)
Scandinavian Legal Origin			−0.170	0.446**	0.313
			(0.210)	(0.163)	(0.272)
Constant	0.491	−3.231***	−2.579**	−1.588	−1.401
	(0.445)	(0.732)	(0.973)	(1.083)	(1.080)
Panel B: 1st Stage					
Dep. Var.	EFNX	EFNX	EFNX	EFNX	EFNX
$\widehat{EFNX}$	1.754*	1.857*	2.540**	2.585**	2.585**
	(1.033)	(0.915)	(1.157)	(1.181)	(1.181)
Partial F-Test	2.89	4.12	4.82	4.79	4.79
Partial R^2	0.14	0.15	0.22	0.22	0.22
Observations	33	33	33	34	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. In specifications 1 to 3, financial development (FD) is measured by private credit to GDP, while 4 uses stock market capitalization, and 5 the stock market trade value. $EFNX$ is the external finance need of exports, which is calculated using inventories to sales. 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). $\widehat{EFNX}$ is the predicted $EFNX$ based on a gravity approach with geographical data.

Table 2.5

and very high in magnitude (5.467). Including legal origin dummies increases the coefficient even further, but lowers significance. The variation of financial development measures does not alter this finding substantially (the specifications with stock market capitalization and the stock market trade value are depicted in the table).[15] So, by and large, the external finance need of exports calculated with inventories to sales seems

[15]When $EFNX$ is calculated with the RZ-type measure, the instrumentation strategy fails, as indicated by the weak instrument diagnostics.

to increase a country's financial development. This corresponds to the outcome of the cross-sectional OLS analysis above.

2.5.2.2 Panel Analysis

In the following, the results of the panel analysis are presented. The procedure makes it possible to add a time-series dimension to the data and to control for omitted variables that have not been considered in the cross-sectional estimation. As outlined in Section 2.4, both country and time fixed effects are applied. Hence, it is possible to control for unobserved time-invariant characteristics that are specific to a country, and for changes over time in the global environment (Do and Levchenko 2007, p.824). A robust version of the Hausman specification test shows a high chi-squared statistic with a p-value close to zero. This means a fixed-effects approach is preferred to random effects. Obviously, the assumption that random effects are orthogonal to the regressors does not hold here. Due to limited data, regression equation (2.4) is estimated with OLS only.

Table 2.6 reports the regression results with a sample from 1970 to 2007 with non-overlapping five-year averages, that is, 1970-1974, 1975-1979 etc., where the last average covers only three years, 2005-2007. Taking five-year averages mitigates the problem of an unbalanced panel and filters out short-run business cycle fluctuations (see, e.g., Huang and Temple 2005, p.12). In order to control for both heteroskedasticity and autocorrelation, standard errors clustered at the country level are applied. In contrast to the previous estimations, only controls that vary over time can be used. This excludes the variables capturing legal origin. Columns 1 and 2 show the estimations with private credit to GDP. As expected, the log of income per capita is again significant with a coefficient of 0.351. Trade openness is significant now, too. It does not come as a surprise that the (overall) R^2s are relatively high in all fixed-effects regressions. Remarkably, the coefficient on the external finance need of exports with inventories to sales is insignificant here.[16]

[16]The coefficient on the RZ-type $EFNX$ is positive and significant at the 1% level, which corresponds to the one obtained by Do and Levchenko (2007).

Financial Development and External Finance Need of Exports
OLS Panel Estimation, 5 Year Averages, 1970-2007

	(1)	(2)	(3)	(4)
Dep. Var. (FD)	Pr.Credit/GDP	Pr.Credit/GDP	M2/GDP	Stock Market Capitalization /GDP
EFNX	0.546	0.268	0.566	1.059
	(0.687)	(0.650)	(0.446)	(1.788)
Log(Income)		0.351***	0.189***	0.235*
		(0.055)	(0.044)	(0.133)
Log(Trade Openness)		0.122**	0.062*	0.128
		(0.050)	(0.034)	(0.129)
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Observations	679	673	671	369
No. of Countries	93	93	93	76
R^2	0.80	0.84	0.90	0.84

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. In specifications 1 and 2, financial development (FD) is measured by private credit to GDP, while 3 uses liquid liabilities to GDP, and 4 stock market capitalization to GDP. $EFNX$ is the external finance need of exports, which is calculated using inventories to sales. 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).

Table 2.6

Varying the measures of financial development using the ratios of M2, stock market trade value and stock market capitalization to GDP, the stock market turnover ratio and the net interest margin rather confirms this finding (selected measures in Table 2.6 in Column 3 and 4).[17] The above panel analysis is repeated with ten-year averages instead of five-year averages. It turns out that these outcomes generally support the ones previously obtained. The same is true for specifications with five-year averages and lagged regressors using first and second lags (not depicted in the tables).[18] As in the cross-section, I also use a sample covering the period from 1992 to 2007 that includes many of the former socialist countries. This allows only five-year averages to be taken. The results, which are not reported in the tables, basically correspond to those from before.[19]

[17] In particular, there is no evidence that $EFNX$ calculated with the short-term measure is more correlated with credit market indices, or RZ-type $EFNX$ with stock market indices, or vice versa.

[18] A GMM (generalized method of moments) approach following Arellano and Bond (1991) fails to provide valid instruments.

[19] Some financial development variations provide too few observations to conduct meaningful estimations.

In summary, we can say that controlling for omitted variables brings with it a considerable change of results. When a country's external finance need is calculated with inventories to sales, it does not have a significant influence on financial development. This contradicts the finding from 2.5.2.1.[20]

2.5.2.3 Interpretation of Results

As indicated above, the estimations deliver different results with regard to the link between financial development and external credit demand. In the cross-sectional analysis, the external finance need of exports ($EFNX$) calculated with inventories to sales enters significantly in basically all specifications. This is true for both ordinary least squares and two-stage least squares, and seems to confirm the hypothesis that resource-based economies have lower financial development due to lower credit demand. By contrast, the panel estimations in 2.5.2.2 show that $EFNX$ calculated with the short-term measure is clearly insignificant. This points to omitted variables in the cross-section, which are partly controlled for in the fixed-effects estimation. Several variables could come into question.

As in the regression of financial development on natural resource abundance in 2.5.1, one may argue that institutions matter (see also Section 2.2). In order to control for institutional quality, several measures are applied: the Polity IV index for the strength of democracy, the size of government, the property rights index by the Heritage Foundation and the Economic Freedom of the World Index, which is a composite of the categories government size, legal system, property rights, sound money, freedom to trade internationally and flexible regulations. Table 2.7 reports the estimation results in the cross-section with private credit to GDP on the left-hand side. The right-hand side variables are $EFNX$, the measures of institutional quality and the standard set of controls, that is, national wealth, trade openness and legal origin. Variables are averaged over the period 1970 to 2007. Sample size and R^2 are similar to those above. Except from the Polity IV index, all institutional variables are significant and have the expected signs (Columns 1 to 4). Private property and the index of economic freedom

[20] The exclusion of poor countries does not alter the results.

Financial Development and External Finance Need of Exports
Quality of Institutions 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
EFNX	1.632***	2.078***	1.435***	0.362	0.602	0.402
	(0.417)	(0.497)	(0.517)	(0.502)	(0.555)	(0.593)
Polity IV	−0.0002					
	(0.005)					
Government Size		−0.008**				
		(0.004)				
Property Rights			0.425**			
			(0.165)			
Economic Freedom Index				0.145***		
				(0.038)		
Concentration Ratio (4)					−0.686***	
					(0.175)	
Log(Herfindahl-Hirschman Index)						−0.172***
						(0.044)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies					
Constant	−1.283***	−1.456***	−1.309***	−1.018***	−0.405	−1.114***
	(0.264)	(0.298)	(0.316)	(0.285)	(0.416)	(0.325)
Observations	90	93	93	88	93	93
R^2	0.71	0.71	0.72	0.74	0.74	0.74

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. $EFNX$ is the external finance need of exports, which is calculated using inventories to sales. 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 Polity IV index (Marshall, Jaggers and Gurr 2011), government size (government consumption spending to GDP, Penn World Tables), the property rights index by the Heritage Foundation as well as the Economic Freedom of the World Index (Gwartney, Lawson and Hall 2012). Export concentration is measured by the concentration ratio, which sums up the export shares of the four largest export sectors, as well as the log of the Herfindahl-Hirschman index, which sums up the square of export shares of all export sectors.

Table 2.7

enter positively, government size negatively. In particular, I am interested in the change of the coefficient on $EFNX$ in comparison to the estimations without the quality of institutions. Using Polity IV, government size or the property rights index, the external finance need of exports variable is still positive and significant. This result does not hold with the composite Economic Freedom Index (Column 4). However, if the index is substituted by the sub-composites of its categories, $EFNX$ is again significant (not depicted in the tables). All estimation results are generally robust to the variation of the financial development measure. Using the larger sample with averages from 1992 to

2007 as well as including institutional quality in the instrumentation strategy delivers similar outcomes. Thus, institutions are unlikely to be the omitted variable.

Countries with low external finance need of exports often have only few export sectors. This gives rise to the idea that export concentration—rather than short-term external credit demand—may negatively affect financial development. To control for this possible effect, two measures of export concentration are used: the concentration ratio, which sums up the export shares of the four largest export sectors, as well as the log of the Herfindahl-Hirschman index, which sums up the square of export shares of all export sectors (see, e.g., Agosin, Alvarez and Bravo-Ortega 2012). The effect of export concentration on financial development is estimated in a regression with the standard set of controls and $EFNX$ (with inventories to sales) as the main right-hand side variable (see Table 2.7, Columns 5 and 6). The sample covers 93 countries, variables are averaged over the period 1970 to 2007. Tests show that multicollinearity is not an issue here. Both coefficients on export concentration are negative and significant, that is, lower diversification of exports is correlated with weaker financial markets. Furthermore, the proxy for short-term credit demand $EFNX$ is insignificant in both specifications. This corresponds to the findings of the panel analysis. The results basically hold when the measure of financial development or the sample (110 countries from 1992 to 2007) are varied. They continue to hold by and large when the equation is estimated with 2SLS, applying the predicted $EFNX$ as an instrument (not depicted in the tables).

Hence, export concentration might be the omitted variable, which was partly controlled for in the fixed-effects panel estimation. This additional result suggests that the hypothesis of lower credit demand causing weaker financial development in resource-based economies has to be rejected.

2.6 Conclusion

This essay argues that natural resource abundance might weaken a country's financial system. Since finance is considered to be important for economic growth, we can,

therefore, say that the natural resource curse, among others, operates through the financial channel. I find a significant negative link between resource abundance, in particular resource dominance, and financial development, which confirms previous results found by the literature.

Furthermore, the study seeks to offer an explanation for this negative relationship between resources and finance. It assumes that a country's financial development is partly shaped by the external credit demand of its industry. According to the finance literature, sectors systematically differ in their dependence on the financial system due to technological characteristics in the production process. In particular, resource sectors appear to be financially independent when external dependence is calculated with inventories to sales, a measure that captures short-term dependence. Thus, resource-based economies are expected to have lower (short-term) aggregate credit demand. If short-term credit demand influenced financial development, there would be good reason to believe that the resource curse operates through this channel.

The hypothesis is tested with an OLS regression in a cross-section of countries and in a panel specification with time and country fixed effects that also exploits the time variation in the variables. Furthermore, I estimate a 2SLS regression where aggregate credit demand is predicted using a gravity estimation with exogenous geographic determinants in order to overcome the endogeneity problem.

In a cross-section of 93 (110) countries with averages from 1970 to 2007 (1992 to 2007), the external finance need of exports ($EFNX$), the proxy for an economy's aggregate credit demand, is positively related to the level of financial development. This result is supported by the instrumentation strategy. When estimating panel specifications with similar samples, the opposite is true. $EFNX$ calculated with inventories to sales appears not to be significant. The results are robust to the variation of financial development measures, and robust to the inclusion of different control variables such as real GDP per capita and trade openness.

Thus, in the cross-section, there is evidence for a resource curse operating via a demand-side effect in the financial system. In contrast, the panel analysis does not support this hypothesis. This points to important omitted variables in the cross-section. While the

consideration of a country's institutional quality does not alter the results, external finance need of exports is insignificant in all specifications when export concentration is included. This contradicts the main hypothesis and indicates that export concentration rather than credit demand of resource firms might explain the negative link between resources and finance.

Further research on the financial channel of the resource curse should concentrate on alternative explanations. Suggested theories such as interest groups preventing reforms will have to be explored in more detail. Also, explanations linked to export concentration and to a lack of economic diversity seem to provide an answer. Chapter 3 will elaborate this issue.

2.7 Appendix

Financial Dependence
Ranking of Sectors

RZ-type Measure	Inventories to Sales
(1)	(2)
Tobacco	**Crude petroleum and natural gas**
Footwear	Printing and publishing
Furniture	**Coal mining**
Printing and publishing	**Petroleum refineries**
Metal products	Beverages
Wood products	Drugs
Apparel	Industrial chemicals
Textile	Wood products
Paper and products	Furniture
Other chemicals	Paper and products
Machinery	Food products
Food products	Plastic products
Petroleum refineries	Motor vehicles
Iron and steel	Nonmetal products
Industrial chemicals	Office and computing
Plastic products	Other chemicals
Electric machinery	Metal products
Other mining	**Other mining**
Coal mining	Nonferrous metal
Motor vehicles	Rubber products
Nonferrous metal	**Metal ore mining**
Transportation equipment	Iron and steel
Nonmetal products	Textile
Rubber products	Communication equipment
Beverages	Other industries
Communication equipment	Apparel
Other industries	Tobacco
Professional goods	Transportation equipment
Crude petroleum and natural gas	Petroleum and coal products
Office and computing	Machinery
Metal ore mining	Electric machinery
Petroleum and coal products	Professional goods
Drugs	Footwear

The table reports the ranking of natural resource and manufacturing sectors for both measures of financial dependence (in ascending order). (1) The RZ-type measure is calculated as $(CAPX_t - OANCF_t)/CAPX_t$, where $CAPX$ denotes capital expenditures and $OANCF$ net cash flow from operative activities (in Compustat items). (2) The ratio of inventories to sales is calculated as $INVT/SALE$. Sector classification is ISIC Rev. 2. See Chapter 1.

Table 2.8

Financial Development and Resource Abundance
OLS Cross-section, Averages, 1992-2007

	(1)	(2)	(3)	(4)	(5)
Dep. Var. (FD)	Pr.Credit/GDP	Pr.Credit/GDP	Pr.Credit/GDP	Stock Market Trade Value/GDP	Stock Market Turnover Ratio
Resource Abundance Measure	Export Share of Resources	Subsoil Wealth p.c.	Subsoil in Total Wealth	Export Share of Resources	Export Share of Resources
Resource Abundance	-0.302^{***}	$-1 * 10^{-5**}$	-0.260^{**}	-0.337^{***}	-0.532^{***}
	(0.090)	$(4.3 * 10^{-6})$	(0.118)	(0.116)	(0.162)
Other Controls	Log(Income), Log(Trade Openness), Legal Origin Dummies				
Constant	-1.294^{***}	-1.495^{***}	-1.508^{***}	-0.707	0.784
	(0.330)	(0.349)	(0.323)	(0.497)	(0.659)
Observations	84	84	84	71	71
R^2	0.71	0.70	0.71	0.49	0.41

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 resource abundance measure is varied using the export share of resources (1, 4 and 5), subsoil wealth per capita (2) and subsoil in total wealth (3). Selected measures of financial development (FD) are private credit to GDP (1 to 3), the stock market trade value to GDP (4) and the stock market turnover ratio (5). 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).

Table 2.9

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 2.10

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 2.11

Gravity Approach
Sector-level Gravity Estimations, 1992-2007

Sector (ISIC Rev. 2)	(19) 354	(20) 355	(21) 356[a]	(22) 369	(23) 371	(24) 372	(25) 381	(26) 382	(27) 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 2.12

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 2.13

List of Countries

Sample 1970-2007

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

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 instrumentation strategy, which focuses on the time period 1992-2007. [a] Not included in basic regressions with private credit to GDP.

Table 2.14

3

Natural Resources, Export Concentration and Financial Development

3.1 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. As indicated in Chapter 2, one channel through which the curse might operate is finance. This essay 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.[1] 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. As in Chapter 2, 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.

[1] Chapter 2 hints at a similar result in a simple OLS cross-section (see Table 2.7). The present study is far more comprehensive.

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, especially in resource-abundant countries.

The essay is structured as follows: Section 3.2 gives an overview of the relevant strands of literature. Section 3.3 presents a possible theory to explain the negative relationship between concentration and financial development. The empirical strategy and data

are described in Section 3.4. The results are presented in Section 3.5. Section 3.6 concludes.

3.2 Literature

3.2.1 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.[2] 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

[2] A comprehensive overview of the resource curse literature is given in Chapter 2.

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). The finding is confirmed in Chapter 2. 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.[3] 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 reforms 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.

[3] See Chapter 2.

Whereas the aforementioned studies provide reasonable but rather vague suggestions, Chapter 2 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.

3.2.2 Further Literature

The present chapter 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.[4] 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

[4]Details are available on request.

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.[5]

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 in Naudé, Bosker and Matthee 2010 and Hesse 2008).[6] 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

[5]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.

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

private investment, thus also affecting economic growth.[7]

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.

3.3 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

[7] 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.

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 productivity 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 3.4.3). As in Chapter 2, 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 2004a). 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.

3.4 Empirical Strategy and Data

The theory in Section 3.3 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 essay 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 work. The literature review in Section 3.2 nonetheless indicates the plausibility of the channel from both a theoretical and an empirical perspective.

3.4.1 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:

$$FD_c = \alpha + \beta \ EXPCON_c + \boldsymbol{\gamma} X_c + \epsilon_c, \tag{3.1}$$

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, see also Chapter 2). Details on the data are given in Section 3.4.3. 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:

$$FD_{ct} = \alpha + \beta \, EXPCON_{ct} + \boldsymbol{\gamma} X_{ct} + \delta_c + \delta_t + \epsilon_{ct}, \tag{3.2}$$

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).

3.4.2 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 essay.

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.[8] 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.[9]

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 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

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

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

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.[10] The regression equation comes from Chapter 2, where resource endowment is also taken into account. It is estimated for each industry i:

$$\begin{aligned} LogEXP_{icd} = \alpha &+ \eta_i^1 ldist_{cd} + \eta_i^2 lpop_c + \eta_i^3 larea_c + \eta_i^4 lpop_d + \eta_i^5 larea_d \\ &+ \eta_i^6 landlocked_{cd} + \eta_i^7 border_{cd} + \eta_i^8 border_{cd} * ldist_{cd} \\ &+ \eta_i^9 border_{cd} * pop_c + \eta_i^{10} border_{cd} * area_c + \eta_i^{11} border_{cd} * pop_d \\ &+ \eta_i^{12} border_{cd} * area_d + \eta_i^{13} border_{cd} * landlocked_{cd} \\ &+ \eta_i^{14} subsoilintotalwealth_c + \eta_i^{15} subsoilintotalwealth_d + \epsilon_{cd}. \end{aligned} \tag{3.3}$$

$LogEXP_{icd}$ is the log of exports from country c to d relative to GDP in sector i.[11] 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 3.4.3). The obtained sector coefficients are then used to predict the log of exports to GDP in sector i from country c to d, $\widehat{LogEXP}_{icd}$.[12] The exponential of $\widehat{LogEXP}_{icd}$ is taken and summed over all trade partners ($d = 1, ..., D$):

$$\widehat{EXP}_{ic} = \sum_{d=1}^{D} e^{\widehat{LogEXP}_{icd}}, \qquad \text{where} \qquad d \neq c. \tag{3.4}$$

[10] 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.

[11] "Log" refers to the natural logarithm in this chapter.

[12] Hats indicate predicted values.

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

$$\widehat{\omega}_{ic} = \frac{\widehat{EXP_{ic}}}{\sum_{i=1}^{I} \widehat{EXP_{ic}}}. \tag{3.5}$$

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 as well as Chapter 2).

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 access to the sea. Following Bond and Malik (2009), a simple landlocked dummy variable serves as possible instrument for export concentration.[13] 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).

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

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 3.2). 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 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.[14] 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

[14]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.

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.[15]

All instruments described above are used in regression equation (3.1) 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 dynamic panel data techniques, in particular the generalized method of moments (GMM) approach of Arellano and Bond (1991). The corresponding regression equation is:

$$FD_{ct} = \alpha_1 FD_{c,t-1} + \alpha_2 FD_{c,t-2} + \beta EXPCON_{ct} + \boldsymbol{\gamma} X_{ct} + \epsilon_{ct}. \tag{3.6}$$

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

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

above equation into:

$$\Delta FD_{ct} = \alpha_1 \Delta FD_{c,t-1} + \alpha_2 \Delta FD_{c,t-2} + \beta \Delta EXPCON_{ct} + \boldsymbol{\gamma} \Delta X_{ct} + \Delta \epsilon_{ct}. \quad (3.7)$$

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 (3.7).[16] The difference GMM estimator is generally recommended in a situation where the number of time periods is smaller than the number of countries.

3.4.3 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 3.6.

3.4.3.1 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, 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). As in Chapter 2, 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 3.3. 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,

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

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).

3.4.3.2 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 comparability with Chapter 2. In addition, 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):

$$HHI_{(ct)} = \sum_{i=1}^{I} \omega_{i(ct)}^{2}. \tag{3.8}$$

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 UNC-

TAD. It is calculated as:

$$Modified \;\; HHI = \frac{\sqrt{\sum_{i=1}^{I} {\omega_i}^2} - \sqrt{\frac{1}{I}}}{1 - \sqrt{\frac{1}{I}}}, \tag{3.9}$$

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:

$$CR(4) = \sum_{i=1}^{4} \omega_i. \tag{3.10}$$

The index captures less information than the previous ones because it does not consider the remaining sectors. In the essay, 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:

$$Theil = \frac{1}{I} \sum_{i=1}^{I} \left[\frac{x_i}{\mu} \;\; \log \frac{x_i}{\mu} \right] \;, \qquad \text{where} \quad \mu = \frac{1}{I} \sum_{i=1}^{I} x_i. \tag{3.11}$$

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:

$$Gini = \frac{2 \sum_{i=1}^{I} i \; x_i}{I \sum_{i=1}^{I} x_i} \; - \; \frac{I+1}{I} \; . \tag{3.12}$$

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

3.4.3.3 Instruments for Export Concentration

The same trade data as in Section 3.4.3.2 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).[17] 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.

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).[18] 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).

[17] The essay benefits from previous work in Chapter 2.

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

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 3.2). 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 (3.11) and (3.12). 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 3.7.

3.4.3.4 Further Variables

As in Chapter 2, 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 total wealth includes all natural assets (e.g., forests) as well as produced capital and intangible capital.

3.4.3.5 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 3.18.

3.5 Results

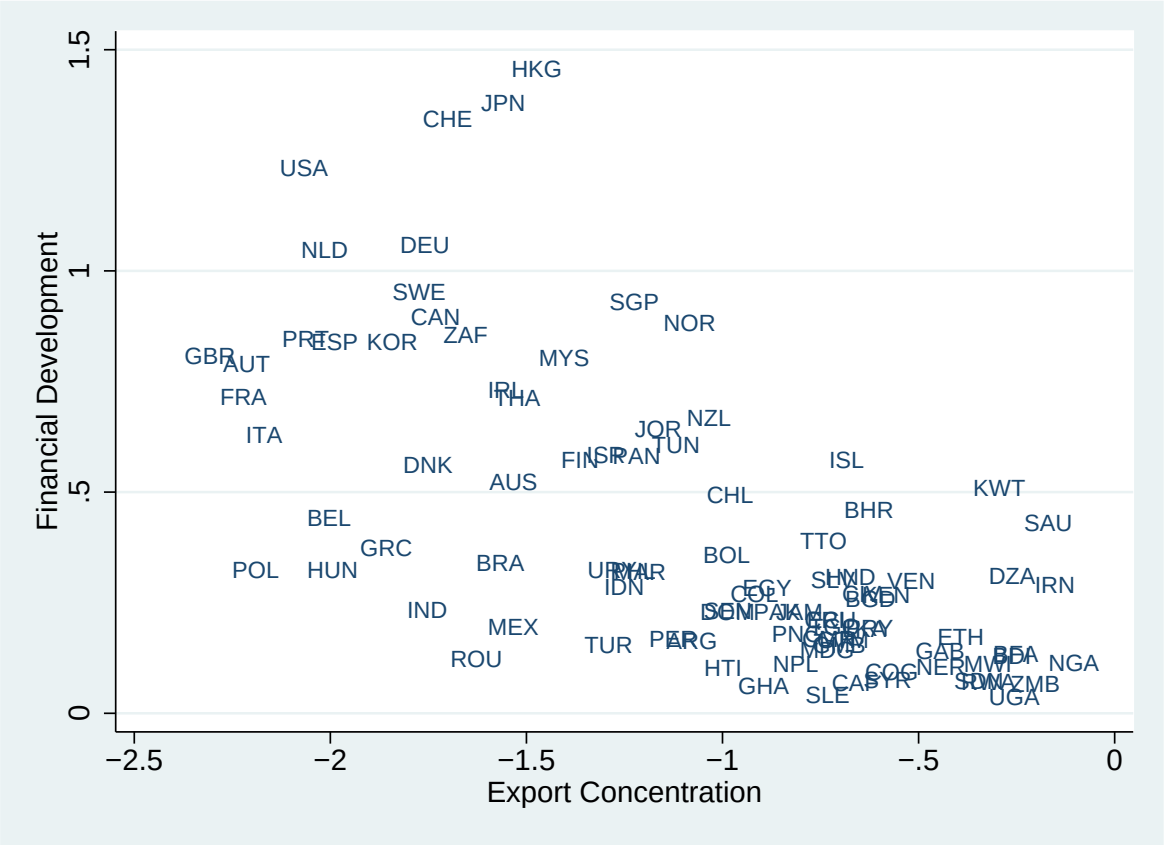

Figure 3.1: Financial Development (private credit to GDP) and Export Concentration (log of the modified Herfindahl-Hirschman index, where low values indicate low concentration).

The empirical results of the essay 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.

3.5.1 Cross-sectional Analysis

3.5.1.1 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 3.1 shows the estimation results obtained from equation (3.1). 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 3.1). 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 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 3.8). 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 3.9 depicts the results of estimations with alternative measures of financial develop-

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 3.1

ment. 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 (3.1) 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 essay.

3.5.1.2 Geography-based Instrumentation Strategy

In the following, the results of the instrumentation strategy with 2SLS are presented. As indicated in Section 3.4.2, 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 (3.3) is estimated for each ISIC sector separately. The Appendix Tables 3.10 to 3.13 demonstrate the coefficients on the geographical right-hand side variables by sector.[19] 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 (see Chapter 2 for a comprehensive discussion). As outlined in Section 3.4.2, the regressors refer to geographic 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 3.2 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

[19] These results fully correspond to Chapter 2.

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 3.2

$\widehat{EXPCON}$ 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 3.2 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.[20] 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 another outlier, Australia, is removed from the sample instead of Japan, as demonstrated in Appendix Table 3.14 (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 3.2. Overall, the

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

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 3.14 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 3.5.2.1).

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 3.4.2, 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 3.3. The vector of control variables is similar to Column 3 in the previous Table 3.2, 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 essay. Generally, the outcome for the coefficients on the controls (Columns 1 to 6) is similar to that from Table 3.2 (mainly not depicted in Table 3.3).

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 appropriate 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

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 3.3

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 coefficients 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 in-

strumental variables seem to support the hypothesis of a negative impact of export concentration on (bank-based) finance.

3.5.2 Panel Analysis

3.5.2.1 Fixed-effects Estimation

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 3.4

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 3.4, both country and time fixed effects enter the regression equation (3.2). 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.[21]

Table 3.4 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

[21] 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.

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 3.3 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 3.15 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 3.4, 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 3.16, 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 3.4, 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 essay since the theory from Section 3.3 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 chapter.

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 3.17 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.

3.5.2.2 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 also considers the time-series dimension, is the Arellano-Bond (1991) difference GMM estimator.[22]

The results are presented in Table 3.5. 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 auto-

[22]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).

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 3.5

correlation 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).[23] 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 3.5.2.1, 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.[24]

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

3.6 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 (see also Chapter 2). 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

[23] 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.

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

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 essay. 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 3.5, 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. Accordingly, Chapter 2 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 (see Tables 2.2 and 2.3).

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.[25] Prior neoclassical advice to fully exploit comparative advantage and allow high aggregate

[25]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).

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

3.7 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 3.4.3.

Table 3.6

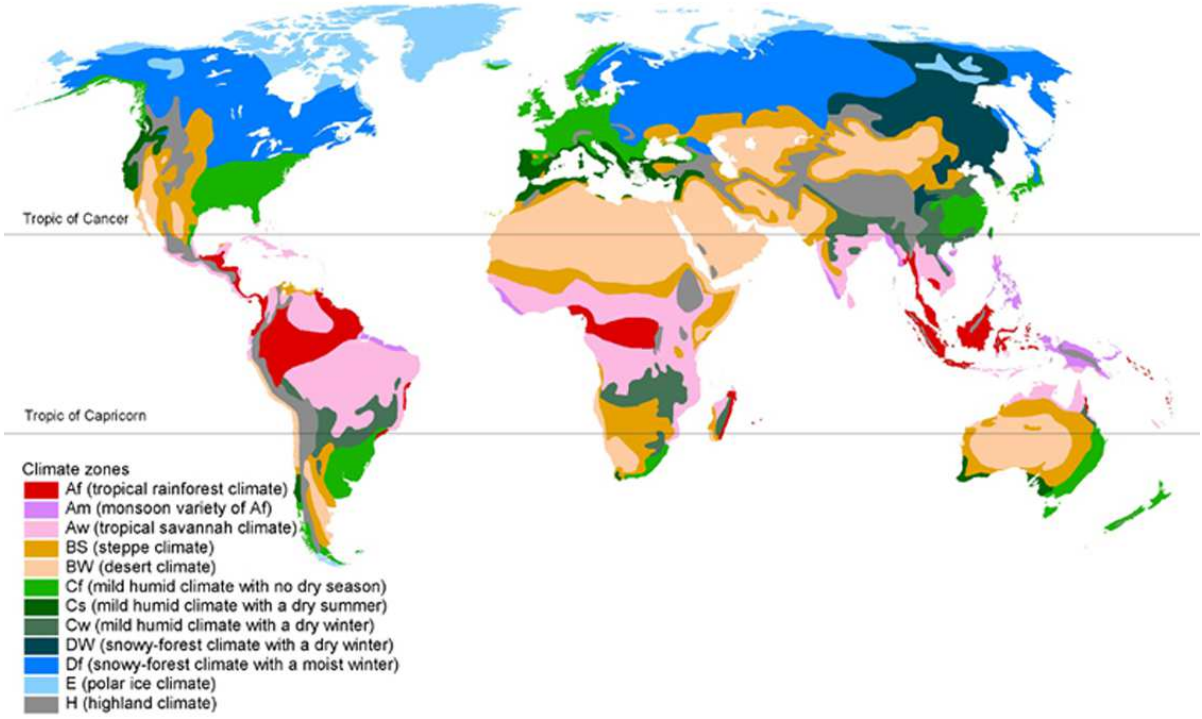

Figure 3.2: The Koeppen-Geiger Temperate Zones (Cf + Cs + Df + DW). Based on Gallup, Sachs and Mellinger (1999). Map sourced from *www.cid.harvard.edu/ciddata/geog/GISfiles/kgzones lrg.jpg* (30. August 2013).

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 3.7

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 3.8

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 3.9

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. Equivalent to Chapter **2**.

Table 3.10

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 3.11

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 3.12

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 3.13

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 3.14

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 3.15

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 3.16

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 3.17

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 3.18

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List of Symbols

General indices used in the thesis. For variables, items and abbreviations, see the corresponding essay.

t	Time index
c	Country index
d	Index of trading partners
D	Total number of trading partners d
i	Sector/ industry index
I	Total number of sectors i

Kurzzusammenfassung

Die Analyse der wirtschaftlichen Entwicklung im internationalen Vergleich zeigt, dass rohstoffreiche Länder in den letzten Jahrzehnten häufig ein geringeres durchschnittliches Wirtschaftswachstum aufwiesen als Staaten, die kaum über eigene natürliche Ressourcen verfügen. Diese Beobachtung gibt Anlass zu vermuten, dass sich Rohstoffe – insbesondere Öl, Gas und Bergbauprodukte – nicht nur als Segen, sondern auch als Fluch für ein Land erweisen können.

Für dieses Phänomen des „Ressourcenfluchs“ gibt es eine Reihe verschiedener Erklärungen. Ein Ansatz, der in der Vergangenheit große Popularität erlangt hat, beschreibt die so genannte „Holländische Krankheit“ (Dutch disease). Es wird angenommen, dass ein Rohstoffboom zu einem steigenden realen Wechselkurs führt und damit zu einer Schwächung der Wettbewerbsfähigkeit der verarbeitenden Industrie. Andere Theorien bringen den Rohstoffreichtum eines Landes in Zusammenhang mit einer höheren Wahrscheinlichkeit bewaffneter Konflikte wie zum Beispiel in Westafrika. Ein weiterer Erklärungsansatz ist der so genannte institutionelle Kanal bzw. Wirkungsmechanismus (institutional channel). Rohstoffausbeutung steigert möglicherweise Korruption und das Bestreben der politischen Führung, Einfluss auf die Verteilung von Rohstoffgewinnen zu nehmen (rent-seeking). In der Regel wirkt sich eine solche Verhaltensweise negativ auf das Wirtschaftswachstum aus. Andererseits können Länder, die bereits über gute staatliche Institutionen verfügen, häufig in vollem Umfang von ihrem natürlichen Reichtum profitieren. Jüngere Forschungsarbeiten verweisen zunehmend auf Probleme, die mit der hohen ökonomischen Konzentration und der damit einhergehenden Volatilität verbunden sind. Empirische Befunde deuten demzufolge darauf hin, dass der negative Einfluss von Rohstoffreichtum vor allem in Ländern beobachtet werden

kann, in denen die heimische Wirtschaft von der Rohstoffgewinnung dominiert wird wie etwa in Nigeria oder Russland. In diesen Volkswirtschaften machen natürliche Ressourcen oft mehr als zwei Drittel der Gesamtexporte aus. Im Gegensatz dazu können Länder, die über viele fossile Rohstoffe verfügen, aber zugleich gut diversifiziert sind, die schädlichen Auswirkungen des „Ressourcenfluchs“ vermeiden. Beispiele sind unter anderem die Vereinigten Staaten, Australien oder einige skandinavische Länder.

Darüber hinaus kann argumentiert werden, dass es einen finanzwirtschaftlichen Wirkungsmechanismus des Ressourcenfluchs gibt (financial channel). Empirische Ergebnisse zeigen, dass Rohstoffreichtum, vor allem Rohstoffdominanz, in einer Volkswirtschaft häufig mit einem schwach entwickelten Finanzsystem einhergeht. Ein gutes Finanzsystem ist jedoch ein bestimmender Faktor für Wirtschaftswachstum. Der negative Einfluss von Rohstoffen auf die Entwicklung des Finanzsystems belastet daher mittelbar auch die Gesamtwirtschaft. Dieser negative Zusammenhang zwischen Ressourcen und Finanzen kann unterschiedlich erklärt werden. Einige Studien identifizieren zum Beispiel eine vorherrschende Rolle des Staates bei Investitionen und einen schwachen privaten Sektor als Grundproblem des verhältnismäßig schwachen Finanzsystems. Andere Theorien gehen davon aus, dass großer Rohstoffreichtum die Fähigkeit und den Willen eines Landes zu tiefgreifenden Finanzreformen mindert. Das könnte an der oft relativ kleinen verarbeitenden Industrie liegen, die Reformen üblicherweise eher positiv gegenüber steht, oder an der geringen Glaubwürdigkeit einer korrupten Regierung. Korruption und Rent-Seeking stehen zudem im Verdacht, das generelle Vertrauensniveau in einer Gesellschaft zu beeinträchtigen. Gerade in der Finanzwirtschaft spielt Vertrauen jedoch eine wichtige Rolle.

Die oben genannten Theorien zum finanzwirtschaftlichen Wirkungsmechanismus sind plausibel, sie beschränken sich jedoch auf eher vage Vermutungen. Die vorliegende Dissertation schlägt zwei weitere Erklärungsansätze vor und untersucht diese empirisch. Der erste Ansatz gründet auf der Annahme, dass die Größe des Finanzsystems und damit, vereinfacht gesagt, auch seine Qualität von der Nachfrage der Unternehmen nach externer Finanzierung beeinflusst werden. Wenn man – wie in der Literatur üblich – annimmt, dass Rohstofffirmen in geringem Maße externe Finanzierung benötigen,

wäre in einer rohstoffdominierten Volkswirtschaft eine geringe Kreditnachfrage und folglich ein kleineres und weniger gut entwickeltes Finanzsystem zu beobachten. Diese Theorie wird im ersten und zweiten Aufsatz der Arbeit behandelt. Der dritte Aufsatz schließlich zieht die hohe Exportkonzentration vieler rohstoffreicher Länder, d. h. eine wenig diversifizierte Exportstruktur, als Erklärung heran. Exportkonzentration könnte in Verbindung mit wirtschaftlicher Volatilität und den dadurch bedingten hohen Realzinsen eine Schwächung des Finanzsystems bewirken. Die Dissertation leistet damit einen Beitrag zur Fachliteratur über den Ressourcenfluch sowie zur Literatur über die Einflussfaktoren des Finanzsystems.

Im Folgenden werden die drei Aufsätze der Dissertation vorgestellt.

Kapitel 1: Sind Rohstoffsektoren weniger abhängig von externer Finanzierung als die verarbeitende Industrie?

Wie oben erwähnt bezieht sich der erste Ansatz zur Erklärung des finanzwirtschaftlichen Kanals auf die Abhängigkeit der Unternehmen von externer Finanzierung. Der vorliegende Aufsatz stellt verschiedene Maße für finanzielle Abhängigkeit vor und berechnet die entsprechenden Kennzahlen, die im nächsten Kapitel benötigt werden. Er ist also eine wesentliche Grundlage für die folgende empirische Analyse. Eigene Berechnungen sind notwendig, weil sich die Finanzliteratur bisher auf Unternehmen der verarbeitenden Industrie beschränkt hat. Diese Studie umfasst zusätzlich die Rohstoffsektoren Öl- und Gasförderung, Kohlebergbau, Erzbergbau sowie sonstigen Bergbau.

Die Idee, dass sich Wirtschaftssektoren in ihrer Abhängigkeit von externer Finanzierung unterscheiden, basiert auf einem Fachartikel von Rajan und Zingales (1998). Die Autoren führen diesen systematischen Unterschied auf dauerhafte technologische Faktoren zurück, unter anderem auf typische Projektgrößen, Amortisationsdauer von Investitionen oder den Bedarf an regelmäßigen Investitionsmaßnahmen. Einige Sektoren sind also in geringerem Maße abhängig vom Finanzsystem als andere. Finanziell unabhängige Firmen benötigen weniger externe Kredite, da sie für ihre Investitionen auf interne Finanzströme zugreifen können.

Der technologisch bedingte Bedarf der Unternehmen an externer Finanzierung kann mit Hilfe verschiedener Methoden erfasst werden. Meine Arbeit verwendet das Maß von Rajan und Zingales (1998), welches die Investitionsaufwendungen und den operativen Cash Flow miteinander in Beziehung setzt, sowie ähnliche Maße, die die Zusammensetzung des Cash Flows variieren. Als Kennzahlen eignen sich zudem die relativen Ausgaben für Forschung und Entwicklung, das Verhältnis der Lagerbestände zum Umsatz sowie der Anteil der kurzfristigen Verschuldung an den Erträgen.

Wissenschaftliche Studien nehmen häufig an, dass Rohstofffirmen, vor allem Öl- und Gasförderer, weniger externe Finanzierung benötigen als andere Branchen. Im Gegensatz zu dieser verbreiteten Annahme zeigt der vorliegende Aufsatz ein differenzierteres Bild. Er verdeutlicht, dass die relative finanzielle Abhängigkeit vom jeweils eingesetzten Maß abhängt. Maße, die das Verhältnis von Investitionen zum operativen Cash Flow berechnen, weisen auf eine hohe finanzielle Abhängigkeit von Rohstoffunternehmen hin. Maße, die den kurzfristigen Finanzierungsbedarf erfassen wie die Vorräte zum Umsatz, zeigen, dass die Ressourcensektoren eher durch geringe finanzielle Abhängigkeit charakterisiert sind. Dieses Ergebnis verändert sich kaum im Zeitablauf und kann zudem in unterschiedlichen Ländern beobachtet werden.

Kapitel 2: Natürliche Ressourcen, Nachfrage nach Externer Finanzierung und die Entwicklung des Finanzsystems

Der zweite Aufsatz bestätigt zunächst die These, dass Rohstoffausbeutung und Finanzsystem negativ korreliert sind. Außerdem stellt er eine mögliche Erklärung für diese Beobachtung vor. Diese bezieht sich auf das Konzept der unterschiedlichen Abhängigkeit der Sektoren vom Finanzsystem, das im vorhergehenden Kapitel erläutert wird. In einer Volkswirtschaft, in der finanziell unabhängige Sektoren dominieren, wäre die aggregierte Kreditnachfrage relativ gering und damit auch die Notwendigkeit ein starkes Finanzsystem zu entwickeln, das die Kredite zur Verfügung stellt. Diese Überlegung fußt auf der Annahme, dass das Finanzsystem wenigstens zum Teil von der Kreditnachfrage der Unternehmen beeinflusst wird. Falls Rohstoffsektoren weniger abhängig von externer Finanzierung wären, hätten von Rohstoffen dominierte Länder folglich

ein weniger gut entwickeltes Finanzsystem. Kapitel 1 zeigt, dass Rohstoffsektoren vor allem von kurzfristiger Finanzierung unabhängig sind.

Der beschriebene Mechanismus wird in einem formalen Modell von Do und Levchenko (2007) erfasst, das die Entwicklung des Finanzsystems und die finanzielle Abhängigkeit der Sektoren unter der Annahme internationalen Handels in Beziehung setzt.

Ich folge im Wesentlichen der empirischen Herangehensweise dieser Autoren und passe sie für die Anwendung auf den Ressourcenfluch entsprechend an. Die aggregierte (kurzfristige) Kreditnachfrage einer Volkswirtschaft wird dabei mit Hilfe des Kreditbedarfs der Exporte (external finance need of exports) dargestellt. Hierbei werden die Kennzahlen für die finanzielle Abhängigkeit der Sektoren mit dem jeweiligen Anteil am Gesamtexport multipliziert. Diese Variable erfasst also die Kreditnachfrage, welche sich aufgrund der Exportstruktur eines Landes ergibt. Sie dient in den Regressionen als wichtigste unabhängige Variable. Die abhängige Variable ist ein Maß für die Entwicklung des Finanzsystems, zum Beispiel das Verhältnis von Krediten an den privaten Sektor zum Bruttoinlandsprodukt (BIP). Sowohl der Kleinste-Quadrate-Schätzer (OLS) in einem Querschnitt (cross-section) von ungefähr 100 Ländern als auch Panel-Schätzverfahren kommen zum Einsatz (1970-2007). Als Kontrollvariablen werden weitere Einflussfaktoren des Finanzsystems wie das reale BIP pro Kopf, der Anteil des Handels am BIP sowie das Rechtssystem (legal origin) verwendet.

Allerdings deuten Studien darauf hin, dass Größe und Qualität des Finanzsystems umgekehrt auch die Exportstruktur eines Landes beeinflussen können, die in der gewählten Variable „External Finance Need of Exports“ enthalten ist. Um diesem Endogenitätsproblem zu begegnen, wird ein Instrument für die aggregierte Kreditnachfrage konstruiert. Die tatsächlichen Handelsströme werden mit Hilfe von Gravitätsgleichungen geschätzt, die ausschließlich auf geographischen Handelsdeterminanten wie zum Beispiel Entfernung zu Handelspartnern oder Landesgröße basieren. Das auf diese Weise konstruierte Instrument wird in einer 2SLS-Regression verwendet (two-stage least squares).

Auf den ersten Blick scheinen die Ergebnisse nicht eindeutig zu sein. Die Querschnittsanalyse mit OLS und 2SLS deutet auf eine Bestätigung der Hypothese hin, während

die Panel-Spezifikation die Theorie widerlegt. Der Grund für diese Diskrepanz könnte in der Verzerrung der Querschnittsergebnisse durch das Auslassen relevanter Einflussgrößen liegen (omitted variables). Als ein möglicher relevanter Regressor kann die Exportkonzentration eines Landes identifiziert werden. Wird diese Variable in die Regressionen einbezogen, muss die These, dass die geringe (kurzfristige) Kreditnachfrage von Rohstoffunternehmen den negativen Zusammenhang zwischen Ressourcen und Finanzsystem erklären könnte, verworfen werden.

Kapitel 3: Natürliche Ressourcen, Exportkonzentration und die Entwicklung des Finanzsystems

Der dritte Aufsatz der Dissertation führt die Rolle der Exportkonzentration näher aus. Die Ergebnisse des vorherigen Aufsatzes deuten darauf hin, dass eine geringe Diversifikation für die Erklärung des finanzwirtschaftlichen Kanals des Ressourcenfluchs wesentlich bedeutender sein könnte als die finanzielle Abhängigkeit der Rohstoffsektoren. Das vorliegende Kapitel untersucht nun eingehend, ob sich wirtschaftliche Konzentration, insbesondere Exportkonzentration, negativ auf das Finanzsystem auswirkt.

Der Zusammenhang zwischen Konzentration und Finanzen stützt sich auf ein Modell von Hausmann und Rigobon (2003). In diesem Modell ziehen sich rohstoffreiche Länder aus der Aktivität in der verarbeitenden Industrie zurück. Die damit einhergehende Spezialisierung auf wenige Sektoren (Ressourcen und nicht handelbare Güter) verringert zugleich ihre Fähigkeit, plötzlichen Nachfrageschwankungen zu begegnen, indem sie die Allokation der Produktionsfaktoren anpassen. Dadurch werden die relativen Preise von handelbaren und nicht handelbaren Gütern beeinflusst, was mit einer höheren Volatilität des realen Wechselkurses einhergeht. D. h., eine konzentrierte bzw. spezialisierte Volkswirtschaft wird zusätzlich zur ohnehin herrschenden Volatilität der Terms of Trade durch Wechselkursvolatilität beeinträchtigt. Unter der Annahme von Finanzfriktionen führt Volatilität zu höheren Realzinsen, weil Kreditgeber eine Risikoprämie fordern. Ich argumentiere im vorliegenden Aufsatz, dass die höheren Realzinsen zu einer Verringerung der Investitionen führen, die nachgefragte Kreditmenge senken und damit das Finanzsystem schwächen.

Der Einfluss der Exportkonzentration auf das Finanzsystem wird im Essay empirisch untersucht. Laut Theorie wird dabei ein negativer Koeffizient der erklärenden Variable Exportkonzentration erwartet. Das bevorzugte Maß für Konzentration ist der Herfindahl-Hirschman-Index. Das Verhältnis der privaten Kredite zum BIP dient als abhängige Variable. Schätzmethoden, Kontrollvariablen und Instrumente lehnen sich an Kapitel 2 an. Zusätzlich zur auf Gravitätsgleichungen basierenden Instrumentenvariable nutzt der Aufsatz Maße für die geographische Abgelegenheit eines Landes, dessen Meereszugang sowie geologische und klimatische Bedingungen als Instrument für Exportkonzentration. Es wird vermutet, dass diese Variablen einen Einfluss auf die Handelskosten und damit auf die Exportstruktur haben. Außerdem kommen dynamische Panel-Methoden zum Einsatz, um die Ergebnisse zu überprüfen. Die Sensitivitätsanalyse umfasst die Variation von Konzentrations- und Finanzmaßen, von Kontrollvariablen sowie die Verwendung unterschiedlicher Stichproben.

Die empirische Analyse deutet auf eine Bestätigung der Hypothese hin, dass sich eine hohe Exportkonzentration negativ auf das private Kreditvolumen auswirkt. Allerdings kann eine signifikante Korrelation der beiden Größen nur beobachtet werden, wenn arme Länder aus der Stichprobe ausgeschlossen werden. Eine vorsichtige Interpretation könnte sein, dass das vorgeschlagene Zusammenspiel von Spezialisierung, Volatilität und Realzinsen in schwach entwickelten Volkswirtschaften nur eine untergeordnete Rolle spielt. Ferner zeigen die Ergebnisse, dass der beschriebene Mechanismus eher bei schlichter Kreditfinanzierung Anwendung findet. Der Aktienmarkt, also die Finanzierung über Eigenkapital, scheint nicht von Exportkonzentration geschwächt zu werden. Dieses Ergebnis könnte die relativ hohe Risikoaversion von Banken mit ihrem klassischen Kreditgeschäft im Gegensatz zu weniger risikoscheuen Eigenkapitalgebern widerspiegeln.

Der Effekt der Exportkonzentration auf die private Kreditvergabe ist ökonomisch signifikant. Wenn man eine Veränderung der Exportkonzentration vom 25. zum 75. Perzentil ihrer Verteilung zu Grunde legt, verändert sich das Kreditvolumen bei Verwendung einer vorsichtigen Schätzung um etwa eine Standardabweichung. Das ist vergleichbar mit anderen Einflussfaktoren des Finanzsystems wie zum Beispiel der Qualität der

Institutionen.

Zusammengefasst lässt sich feststellen, dass eine hohe Exportkonzentration als mögliche Erklärung für den finanzwirtschaftlichen Kanal des Ressourcenfluchs in Betracht kommt. Folglich spricht sich die vorliegende Arbeit für eine Politik aus, die die wirtschaftliche Diversifizierung rohstoffreicher Länder fördert. Diese Empfehlung entspricht den Ergebnissen früherer Studien zum Thema Ressourcenreichtum.

Vorveröffentlichungen

Aus den Artikeln der Dissertation sind bisher folgende Veröffentlichungen hervorgegangen:

Kapitel 1

„Do Natural Resource Sectors Rely Less on External Finance than Manufacturing Sectors?“, Berlin: Discussion Paper, School of Business & Economics: Economics, Nr. 2012/17.

„Do Natural Resource Sectors Rely Less on External Finance than Manufacturing Sectors?“, Berlin: SFB 649 Discussion Paper, Nr. 2012/50. (Gleiche Version)

Kapitel 2

„The Natural Resource Curse Revisited: Is There a Financial Channel?“, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Economic Development and Technological Change, Nr. D10-V3.

Alle Fachartikel wurden ohne die Hilfe von Ko-Autoren verfasst.