The real effects of finance: evidence from exports

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Abstract. In this paper, we investigate the link between financial development and exports. Exporting firms face significant up-front costs in intangible investments such as product design, marketing, distribution etc. In an economy where outside financing for such investments is difficult to secure, exports may suffer. Using bilateral trade data, we find that having a better financial system increases exports. The marginal impact of financial development on exports is higher in those industries and country pairs where up-front investments are large, due to either product characteristics or economic distance between exporter and importer.

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There is a large empirical literature establishing the link between finance and growth (e.g. King and Levine (1994)) and another distinct literature linking trade and growth (E.G. Frankel and Romer (1999). In this paper, we propose that these two literatures are closely related. We find that one channel through which financial development may promote growth is by facilitating trade.

Recent research (Rajan and Zingales (1998), Demirgüç-Kunt and Maksimovic (1998)) suggests that a well developed financial system makes it easier for firms to secure external finance for investment. We extend this idea in another direction and propose that firms exporting to foreign markets may also benefit from higher levels of financial development since exporting involves fixed up-front costs[1] which are more difficult to finance than other investments. Such investments include distribution, marketing, and adapting products to foreign markets to satisfy importers' regulations, tastes and business practices. In the trade literature, some of these investments are sometimes referred to as search costs (e.g. Rauch 1999). If these investments cannot be financed externally when the financial sector is less developed, there can be first-order effects on trade, income and welfare. For example, if exports are limited by financial underdevelopment, gains from trade will in turn be limited.

We estimate bilateral trade equations and find that for a given industry and country-pair (exporter and importer), higher levels of financial development are associated with increased exports. Accounting standards, stock market capitalization over GDP, ratio of credit to the private sector over GDP, and new issues of equity and bonds over GDP are all used as proxies for financial development and are all positively related to the level of exports. We then test the hypothesis that financial development should matter more the greater the estimated up-front costs. We use two geographical measures of exporter-importer distance to proxy for the size of up-front costs: the log of distance (between major cities) and whether the countries have a common border. We also use a cultural distance measure, a dummy for whether countries have a shared language. Finally, we use a measure of the heterogeneity of products as a source of industry variation in the up-front investments, i.e. the more commoditized a product, the lower the costs in adapting the product for export. All of these proxies yield the same result: financial development matters more when up-front investment needs are higher.

This paper makes two contributions to the literature. First, the paper identifies exports as an area where there will likely be underinvestment if there are poor financial institutions. The

[1] Throughout the paper, we use the terms export investment and sunk costs interchangeably.

policy implications of this result are clear; development of better financial institutions may be a more effective way of promoting exports than other trade-promoting policies (such as subsidies, reduced tariffs etc). Alternatively, improving the financial system may be complementary with other trade-promoting policies.

Our paper also makes a methodological contribution to the existing literature on the importance of financial institutions for growth. Because we study bilateral trade, we can include country fixed effects, thus addressing several problems with cross-country regressions, especially the omitted variable problem. Recent work has circumvented the omitted variable problem that plagues cross-country regressions by focusing on within country, between industry variation (e.g. Rajan and Zingales (1998), Claessens and Laeven (2003), Carlin and Mayer (2003), Fisman and Love (2003), Braun (2003)).[2]

The cross-industry method has proven very successful, and the authors cited above have extended the empirical understanding of the links between finance and growth. For instance, Rajan and Zingales (1998) find that industries which are more in need of outside financing grow more quickly when the financial sector is more developed. By comparing industry rather than aggregate growth rates, they can include country fixed effects.

This approach has certain drawbacks however. It requires a way to rank industries either in terms of their dependence on external finance, in terms of their dependence on bank finance, in terms of the tangibility of their assets, etc. The ranking is then used to identify industries that will benefit the most from financial development. All the papers make the assumption that industries in the United States (or Germany and Japan for Carlin and Mayer's bank and skilled labor dependence) are representative of industries worldwide in their dependence on external finance (or an alternative measure). While there are probably world-wide characteristics to industries, there are also country-specific characteristics. The reasons for slower industry growth in a less developed country may be several (e.g. factor supplies, enforcement of contracts, infrastructure, or anything affecting comparative advantage). The method is vulnerable to the criticism that financial development proxies for one or more of these aspects of the local environment rather than represent the true cause of slow growth. Our methodology allows us to run tests without

[2] Carlin and Mayer show that the growth rate of industries that are dependent on bank financing (as opposed to outside finance in general or equity finance) or skilled labor are sensitive to financial development. Braun finds that industries which make large investments in intangible assets grow relatively faster in a well developed financial system.

assumptions about industry characteristics. Geographic and linguistic differences across different country-pairs result in different up-front export costs and different demands for external finance. We can therefore test whether there are benefits to finance using within industry, within country variation.

Our method has drawbacks as well. In particular, we require proxies for the up-front investment need of exporting firms. Some of the fixed cost proxies relate directly to trade: distance, for example, proxies for up-front investment needs, but is also related to transport costs. We attempt to address these potential problems in the robustness section.

Finally, we also use industry variation, a measure of the amount of differentiation of industry output. When we use this measure, we have to address the issue of comparative advantage. We explore the question of whether our results might be driven by finance proxying for some source of comparative advantage, and through a number of tests demonstrate that this is unlikely. Specifically, we find that exports are increasing in the importing country's level of financial development and that the interaction of fixed cost proxies and importers' level of financial development is also positive. If financial development were proxying for comparative advantage, exports should be decreasing in the financial development of the importer.

The rest of the paper is organized as follows: section 1 provides some background on sunk costs and trade, section 2 introduces our theory and tests, section 3 describes our data and section 4 the empirical results from the basic specifications. Section 5 addresses comparative advantage issues and section 6 other robustness tests. Section 7 concludes.

1. Background: Fixed costs of trade

Our argument that financial development plays an important role in facilitating exports hinges on the assumption that exporting firms face large fixed costs. The existence of fixed costs for a potential exporter has long been recognized in the literature on international trade, even if the potential importance of financial development for financing them has not been emphasized. Fixed costs are key elements in theoretical work by Baldwin (1988), Baldwin and Krugman (1989) and Dixit (1989), who suggest that the sluggish response of import penetration to exchange rates may be due to such fixed costs. More recently, Melitz (2002) addresses the effect of fixed costs on firm composition in exporting industries. Hausmann and Rodrik (2002) point to the inefficiencies that may arise if private incentives to invest in export development are lower than the social benefits. There is also some empirical evidence of the fixed costs of exporting at the micro level. Roberts and

Tybout (1997) infer that sunk costs play an important role in a firm's exports since they find that a firm's current exporting status is largely determined by its previous export experience. Prior exporting experience increases the probability of exports by up to 60%.

Detailed information about the fixed costs faced by exporting firms in developing countries has also been gathered by the World Bank. The World Bank Standards and Trade Database is a survey of 690 exporting firms in developing countries across a wide range of industries that investigates the costs imposed on exporting firms by different impediments to trade. These costs include R&D expenditures, marketing costs, distance to markets, translation costs, and other fixed exporting costs. The survey also inquires about product standards, government standards and other technical barriers to trade faced by exporting firms.

2. Theory and methodology

2.1. The gravity equation

We use the gravity equation for international trade as our empirical starting point (see e.g. Linneman (1966)). This equation captures an empirically robust relationship linking trade volumes to the product of exporter GDP and importer GDP. It often includes one or several measures of distance. For several recent examples, see Frankel (1997).

A typical empirical specification of the gravity equation states that total trade between two countries *i* and *j* will be

$$\ln T_{ij} = \alpha + \beta_1 y_i + \beta_2 y_j + \beta_2 \ln D_{ij} + e_{ij}$$

where T_{ij} is trade, y_i is the log of country i's income, and D_{ij} is the distance between the two countries. If there is no particular prediction about balanced vs. unbalanced trade flows, the symmetric equation applies to total trade. Other geographic variables, such as country size, common borders and country population are sometimes included (see e.g. Frankel and Romer (1999) regarding geographical determinants of trade). Our regressions separate trade flows by their direction, i.e. we use the regression for bilateral exports rather than total bilateral trade. We also include a variable measuring financial development in the exporting country. Because some country pairs have zero bilateral trade, we use the log of one plus exports, and use tobit regressions for censored data. Our basic specification for the exports from country *i* to country *j* is thus

$$y_{ij} = \alpha + \beta_1 y_i + \beta_2 y_j + \beta_2 \ln D_{ij} + \gamma F_i + e_{ij}$$

$\log[1+E_{ij}] = y_{ij}$ *if* $y_{ij} > 0$, *otherwise* $\log[1+E_{ij}] = 0$

where F_i is a measure of financial development.

2.2. Fixed costs to export, and the need for outside finance

We depart from the standard gravity equation in two ways. First, we estimate regressions industry-by-industry. More importantly, we introduce financial development as an explanatory variable. This approach is appropriate if financial development is a key determinant of whether a firm which needs outside finance can get it and if exports require special investments, separate from those made for domestic production. As mentioned above, such investments include the costs of identifying promising markets, developing foreign distribution channels, and adjusting products, marketing and production to foreign standards and regulations.

There are several reasons why these sunk costs are difficult to finance. The investments are made long before any export revenue is collected and provide limited collateral compared to e.g. machine or real estate investments. To the extent that foreign investments are tangible, they may still be harder to seize than domestic assets. Revenues from abroad may be difficult to verify for outsiders, and be more difficult to extract from the firm. Therefore, export revenues may be more difficult to pledge to outsiders than domestic revenues. Finally, export revenues may be volatile and difficult to predict, for both firm insiders and outsiders. The bottom line is that it may therefore be very difficult to secure outside financing for export investment. A sophisticated financial system makes it easier to finance these intangible investments since lenders have access to more information, contracts are enforced more reliably, and financial intermediaries are more capable of assessing potential risks and rewards.

Including financial development in trade regressions

If sunk costs are important, the availability of external finance will play a key role in the export performance of a country. The most straightforward test of this prediction is to include a measure of financial development in the gravity equation, using exports as the dependent variable. If financial development is important in practice for export performance, we expect to see a positive coefficient on finance. We report the results for those regressions in section 5.

Variation in sunk costs

There are two important problems with using financial development in the gravity equation. First, we cannot possibly control for all country-wide variables that might bias our

results. Secondly, reverse causality might drive the relationship. We address this by using interaction variables. We use variation both across country-pairs (i.e. how distant and dissimilar are the two countries) and across industries (i.e. how standardized are the products) to identify exporter-importer-industry triplets where the sunk costs are expected to be large and then test the hypothesis that financial development has a greater marginal effect on exports for those triplets with higher sunk costs. Proxies that correlate positively with sunk costs should have a negative effect on exports. Since well developed finance should ameliorate the problem of financing sunk costs, the interaction of cost and financial development should have a positive sign. For proxies which are negatively related to fixed costs, coefficients on the interaction variable should have positive signs. When we use interaction terms, we include fixed effects for exporter, importer and industry. This eliminates most sources of omitted variable bias.

We use many different proxies for up-front investment. First, the physical distance between exporter and importer is a proxy for overall difference between the economies, regulatory environment, culture etc. The breadth of this proxy has both advantages and disadvantages. We may pick up something different from our sunk cost hypothesis. For instance, distance is a proxy for transport costs, and it is conceivable (although not obvious) that countries with better financial development export products which have lower transport costs. They might then export farther away which would generate our predicted positive interaction. We also use a common border proxy to measure whether two countries are similar, but this variable may also be related to transport costs.

We also use proxies of sunk costs which are unlikely to be related to transport costs. One non-geographical proxy for sunk costs is a dummy for whether the official language for exporter and importer are the same. A common language facilitates communication, eliminates translation costs, and may imply that fewer adjustments to domestic output will be necessary in order to export it (e.g. software).

Finally, we use a proxy based on Rauch's (1999) measure of whether industry output has standardized prices or consists of differentiated products. Rauch assigns each SITC industry to one of three categories, differentiated products (e.g. footwear), goods with reference prices[3] (e.g.

[3] Rauch (1999) describes why this category of goods are more transparent than differentiated goods: "prices can be quoted for these products without mentioning the name of the manufacturer, and these 'reference prices' are found to be sufficiently useful by industry actors to be worth listing in trade

Polymerization and Copolymerization Products, SITC 583) and exchange-traded goods (e.g. Lead). For the first category, he argues that the "uninformativeness of prices prevents 'globally scanning' traders from substituting for organized exchanges in matching international buyers and sellers". In industries with output of many different varieties and no established prices, it will be more difficult to identify and develop export opportunities. Hence, we predict that the costs of identifying and developing profitable trade opportunities are higher.

Tobit regressions

The gravity equation is usually formulated using levels of exports (i.e. logs). We expect up-front investments to be particularly important when there is very limited trade, and would like to use the observations where trade is zero (i.e. country pairs with no trade). We therefore use tobit specifications, where the dependent variable is the log of one plus exports. This variable is essentially identical to the log of exports where exports are positive, and takes the value zero where exports are zero. We treat this variable as a censored dependent variable (with left hand censoring at zero). As a practical matter, most of the power in our regressions come from those observations where trade is positive, and using tobit (on all observations) instead of OLS (on the positive observations) reduces the R-squared somewhat, leaves the significance of coefficients unchanged, and never changes the results for our financial variables.

3. Data

Bilateral data

Data on international trade in merchandize is available at the industry level under the SITC-classification system.[4] We use bilateral trade data from the Statistics Canada World Trade Database, which provides data on annual bilateral trade flows from 1970-1997 at the 4 digit SITC level using the U.S. Bureau of Economic Analysis industry classification system. There are more than 170 countries, but we only have financial variables for at most a hundred countries, and for many regressions we have fewer exporters than importers. The analysis in this paper uses either total bilateral exports (across all industries) or trade for each of 34 BEA industries (listed in Table

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publications. For example, a price per pound of Polyoxyethylene Sorbitan Monostearate is quoted weekly in Chemical Marketing Reporter on the basis of surveys of suppliers."

[4] We do not study trade in services.

A1), or the disaggregated data for 4-digit level SITC industries. We use the most aggregated data we can for all specifications. We use 1995 as our base year, but 1985 results are reported in the robustness section.

We include several controls commonly used in estimation of gravity equations. For each country-pair, we use a dummy variable equal to one if they share a land border and a dummy equal to one if they share an official language. These data are from Jon Haveman's website.[5] We also use distance in miles, as measured between largest cities, reported in Fitzpatrick and Modlin (1986). These three variables are also used as proxies for up-front investment need.

Exporter data

For each exporting country in our sample, we need to measure financial development, and controls such as GDP, area and population. We use GDP and population numbers from the Summers-Heston data set. We get measures of size (in million acres) from *The Universal Almanac 1997*. As a human capital measure, we use the log of average years of schooling (see Barro and Lee (1996) and Barro and Lee (1993)).

There is no consensus on how to measure financial development across countries. As our primary variable, we use accounting standards, a measure of the quality of accounting in a country. The Center for International Financial Analysis and Research (CIFAR) created an index for different countries by rating the annual reports of at least three firms in every country on the inclusion or omission of 90 items. Comprehensive data on the measure dates to 1990, and is discussed in Rajan and Zingales (1998). The advantage of this measure is that it proxies for the amount of external financing available, rather than the amount actually given.

An alternative to accounting standards is some measure of the stock of actual financing. We use the ratio of stock market capitalization to GDP, and the ratio of credit to the private sector to GDP, both reported by Beck, Demirgüç-Kunt and Levine (2001).[6] More countries report data for these measures than for accounting standards, but they are more likely to be subject to reverse causality problems.

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[5]http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html

[6] These authors use raw data from the IMF's International Financial Statistics and country-specific sources.

Finally, we use a measure of the flow of financing. We add equity issues over GDP and private long-term bond issues over GDP to get total new security issues over GDP. Since it measures a flow of financing, this measure does not capture any beneficial role of existing claimholders (e.g. monitoring). Also, the measure does not cover the flow of bank finance, a major source of outside funds in most countries. However, the measure avoids the problem of how to value financing stocks, which is an issue for private credit and a big issue for market capitalization.

Of the measures, we prefer accounting standards, and only report specifications with the alternative measures for initial gravity regression to establish robustness. Exporting country measures of financial development are reported in Table 1 with exporting volumes.

Industry data

While country-pair differences are a good source of variation in investment needs, we use industry variation as an alternative source of variation. One promising source of industry variation is the degree to which the output of that industry is commoditized. Rauch (1999) creates a measure where he categorizes industries (at the level of four-digit SITC codes) based on whether the industries' output is exchange-traded, reference-priced, or differentiated. We use a modified version of this measure in this paper. Of Rauch's three categories, industries with differentiated products are likely to have significant up-front costs for firms that wish to export. Hence we define a dummy variable equal to one if a product is differentiated and zero otherwise. We aggregate Rauch's measure to match the 34 BEA industry groups by taking weighted averages within each industry, where the weights are the total amount of world trade in each four-digit SITC code. This measure, which is bounded between zero and one, we refer to as differentiation. If it is close to zero, almost all industry output has standardized prices, almost none if differentiated.

Table 2 reports summary statistics for our proxies of up-front investment costs for the whole sample. The sample actually used in the regressions varies somewhat depending on data availability for individual variables.

For each industry where it was possible, we adapt the measure of financial dependence developed by Rajan and Zingales (1998), for use in one of our robustness tests. They calculated the fraction of investment that was financed externally during the 1980's in the US for firms in different industries. We translated the measure from ISIC-industries to BEA-industries.

4. Results

Financial development and export volumes

We now estimate the gravity equation of industry-level exports with measures of financial development. Column one of Table 3 shows the basic "bare bones" specification of the gravity equation, including only exporter GDP, importer GDP, distance and accounting standards. The coefficients are as expected for GDP (positive) and distance (negative) and finance enters positively and highly significantly. Other variables that are important in estimating bilateral trade equations are added in column 2. Countries that share a common border or a common language trade more, while controlling for GDP, larger countries trade less. Population enters with a negative coefficient in most specifications, similar to the results for aggregate trade in Frankel and Romer (1999). Differentiation has a negative effect on export volumes consistent with the results reported by Rauch (1999). The coefficient on accounting standards is virtually unchanged by including all these controls. The magnitude of the coefficient is economically important. An increase in accounting standards of one standard deviation predicts an increase in the log of export volume by 0.36 (which corresponds to a 43% increase in exports).[7]

Columns three to five report the same regression with alternative measures of financial development: private credit over GDP, stock market capitalization over GDP and new issues of private bonds and equity over GDP. All the coefficients on the proxies of financial development are positive and statistically significant at the 1% level, although the magnitudes vary somewhat.[8] The sample sizes differ depending on data availability for each measure of financial development.

Fixed effect regressions using proxies for investment need

The regressions in Table 3 suggest that finance may play an important role in promoting exports, but do not control for all possible country-specific variables that may be correlated with financial development (and might be the actual determinants of exports). Following Rajan and

[7] This is the average effect. The effect is larger if exports are positive to begin with. With zero initial exports, the effect will sometimes be none, but in some cases will push exports to positive levels.

[8] The implied increase in export volume for a one standard deviation increase in financial development is 34% for private credit, 74% for market capitalization, and 17% for new issues. In further regressions, we focus on accounting standards, since it is a priori more attractive and the results are similar across the various measures.

Zingales (1998), we circumvent this problem by exploring the interaction of financial development and potential need for external finance. Specifically, we test the hypothesis that financial development has a larger impact on exports when sunk costs are higher. All exporter and importer country specific measures are dropped in these specifications since they are absorbed by the country fixed effects. [9]

For each proxy, we expect the interaction with finance to enter in the following way: if the proxy is associated with higher dependence on external finance because of large sunk costs (distance, product differentiation) we predict a positive sign (high costs imply more need for finance). For the proxies that predict low sunk costs (common border, common language), we predict a negative sign.

Table 4, column one reports the results using distance as the proxy for up front costs. Our hypothesis predicts that the interaction coefficient should be positive, i.e. finance should be more important for trade when the two countries are farther apart (when up-front costs are higher). We find that the interaction coefficient is positive and significant at the 1% level. To judge the magnitude, the coefficient can be compared to the average coefficient on accounting standards (Table 3, column two). An increase in log Distance by one standard deviation (0.762) increases the importance of finance by 79% of the average coefficient.

Common border and common language are used as the proxies for up-front costs in Table 4 column 2 and 3 respectively. The interaction effect should be negative for both common border and common language since the impact of finance on exports is predicted to be lower when up-front costs are lower. The interaction coefficient is significantly negative in both cases. Taking the average coefficient on accounting standards (0.0034) as a starting point, the implied coefficient on accounting standards when the dummies are equal to one (i.e. 0.0034 + interaction coefficient) is negative. This implies a strong effect of both interactions.[10] Our interpretation is that when trading

[9] The regressions in column one to three of Table 4 include importer and exporter fixed effects, and the dependent variable is total bilateral exports. In column four, we use the differentiation measure of Rauch (1999). The dependent variable is the log of bilateral exports for each BEA industry. This allows dummy variables for each exporter-importer pair (meaning distance, and dummies for common border and language cannot be included) as well as for each industry.

[10] Another way of estimating the effect of a common border or a common language is to run the regression without fixed effects (as in Table 3) separately for country pairs with borders and for those

partners are close, the sunk costs are so low that financial development is effectively no longer a constraint on exports.

Finally, Table 4, column four presents the results for the measure of product differentiation. Note that the number of observation is much larger here, since the dependent variable is industry level exports. We use random effects Tobit instead of fixed effects Tobit due to the large number of country pairs. We expect a positive coefficient for the interaction of accounting standards and differentiation, since more differentiated products would seem a priori more complicated to export, hence requiring larger sunk costs, meaning a larger role for finance. As predicted, the coefficient is positive and also highly significant. An increase of the differentiation measure from zero (the minimum) to one (the maximum) increases the effect of finance by 0.076, which is approximately twice the magnitude of the average coefficient on accounting standards (0.0034). Exports of differentiated product categories are more sensitive to financial development than homogenous exports, consistent with the sunk cost prediction. The result is also consistent with accounting standards constituting (or proxying for) a comparative advantage in high-differentiation industries. This issue is addressed in the following section.

5. Comparative advantage

International trade theory has traditionally focused on comparative advantage as a determinant of the patterns of trade across countries. The standard explanation of why a country exports more in a certain industry is that it has a comparative advantage in that industry, not because financial development helps to finance sunk costs in exports. It is natural then to ask whether our results can be explained by a more traditional comparative advantage story.

Perhaps the most natural hypothesis would be that financial development proxies for a source of comparative advantage, but it is also possible that finance itself is a source of comparative advantage. Most of our empirical results could then be explained simply by saying that countries with high levels of financial development have a comparative advantage in the industries represented in the sample data. Since our trade data covers most traded goods, the comparative advantage explanation would require countries with high levels of financial development to have a comparative advantage in all goods, which is nearly impossible. The

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without. We tried this with the common border dummy (not reported) and found no effect of accounting standards for neighbors (t = -0.4) while the coefficient for non-neighbors is similar to that in Table 3 (t = 12.2).

comparative disadvantage of financially developed countries would have to be in services, which seems unlikely indeed.

The nature of the bilateral trade data also allows us to rule out this comparative advantage story more directly. If financial development is proxying for comparative advantage, so that exports are increasing in exporter's financial development, then they should be decreasing in the financial development of the importer.

Table 5, column one reports the OLS regression of exports on regular exporter and importer controls (the coefficient are not reported for these variables), distance, common border and common language, as well as exporter's and importer's accounting standards. For both exporting and importing countries, higher financial development exerts a positive effect on exports. Column two reports a fixed effects regression with the interaction of distance with both importer and exporter finance. Although the coefficients on exporter's accounting standards are larger, the coefficients on both importer's and exporter's accounting standards are highly significant in both the direct regressions and the regressions with the interaction term.[11] This suggests that importer's financial development can help exports, and that comparative advantage is unlikely to explain the positive effect of finance across the board.

While financial development may not be a proxy for comparative advantage on average in the sample, it may proxy for comparative advantage in certain industries. We investigate two alternative hypotheses: finance may provide a comparative advantage in those industries with highly differentiated output (directly affecting our results using differentiation as cost proxy) or in industries with high dependence on external finance. We address these possibilities in order.

If our industry measure of differentiation is correlated with dependence on this source of comparative advantage, then the positive interaction between differentiation and external finance reported in Table 4 column 4 may be spurious. Countries with high levels of financial development will export more in those industries that have higher levels of differentiation because of their comparative advantage. Analogous to our tests on the direct effect of finance, though, we can test this alternative explanation by comparing the impact of both exporter and importer finance on exports. We interact importer's accounting standards with differentiation and include it with the exporter's finance interaction in a fixed effects regression. The results are reported in table 5,

[11] We also interacted both importer's and exporter's finance with the border and language dummies and found that both importer's and exporter's finance enter positively (results not reported).

column three. Both the interactions are positive and significant, suggesting as before that importing country's finance increases exports more in differentiated industries than in industries with homogenous products. This finding is consistent with the sunk cost hypothesis (if some sunk costs can be financed in the recipient country), and it is inconsistent with a comparative advantage explanation for our findings. Note however, that this does not rule out comparative advantage effects together with an overall positive effect on exports.

Rajan and Zingales (1998) find that industries which have a high dependence on external finance grow faster in the presence of high financial development. They also find that industries that have a low dependence on external finance actually experience negative growth in countries with high levels of financial development. This finding concerning output may also carry over to exports, namely exports may also be lower in industries that have low levels of financial development. If this were true, it would suggest that finance might be a source of comparative advantage in those industries that are highly dependent on external finance. [12] Our sunk cost theory would predict the opposite, that higher levels of financial development would result in higher levels of exports everywhere, both in industries with low and high dependence on external finance.

To determine whether either prediction is validated in the data, we used the measure of financial dependence from Rajan and Zingales (1998). The measure captures the share of investment that was financed externally for an industry during the 1980s, in the US. We first matched the measure, which is reported by 3 digit ISIC code, into our BEA industry classification. Next, the sample was divided into two groups based on external dependence, high and low (the cut-off was 0.245, the median industry value). Export regressions are run separately for the two groups of industries. The results are presented in Table 5, columns four and five. While finance is *more important* for high financial dependence industries, it is *also positive* for low external dependence industries. Financial development may thus give a certain comparative advantage in industries with high dependence on external finance, but *all* industries tend to export more if finance is more developed.

In this paper we emphasize that financial development may have first order effects on the level of trade. Financial development as a source of comparative advantage represents an

[12] Svaleryd and Vlachos (2002) explore this and indeed confirm that exports in externally dependent industries (as defined by Rajan and Zingales) are more sensitive to financial development.

alternative theory for how finance may impact trade, but predicts an influence on the composition of trade rather than on the overall amount of trade. All the tests in this section support the sunk cost theory, in that finance increases exports across the board, and more where sunk costs are higher. Our findings give mixed support for the comparative advantage theory. The effect of finance seems to be stronger in those industries where a comparative advantage of finance is most likely. On the other hand, in none of our tests does importer's finance reduce exports, contradicting the comparative advantage story.

It may be that finance provides a meaningful comparative advantage in some activities, but the sunk costs theory seems to be quantitatively more important. Put simply, financial development may give a comparative advantage in certain industries, but the level effect that we identify is so strong that it swamps the comparative advantage effect; even in the industries least dependent on external finance, exports increase with higher financial development. This is important for policy purposes. It means that improvements in financial development are likely to increase exports in general, and not just in those industries which generally depend on finance. In particular, the findings suggest that any country can benefit from financial development (through higher exports), whatever the pattern of comparative advantage.

6. Other robustness tests

While theories of comparative advantage probably can be ruled out as explanations for our findings concerning the effect of finance on trade, there a few other issues which could also explain some of our results, while not necessarily rejecting the sunk costs theory. We address one of these below and rerun some specifications for earlier data (1985).

Industry variation in human capital

It is possible that the availability of the required skills, rather than of external financing, is the key limitation of equilibrium amounts of export investments. Several components of export investments, e.g. product design and translations, are intensive in some form of human capital. The supply of human capital may therefore affect the cost and feasibility of the investments needed to export. Human capital is correlated with accounting standards (and other measures of financial development), suggesting that finance may proxy for supply of inputs. This explanation of our findings does not contradict the importance of sunk costs, but rejects that finance is a

limiting factor. To test this conjecture, we interact a sunk cost variable with human capital and run a horse race between this interaction and our cost proxy-finance interaction.

The results, using distance as proxy for sunk costs, are presented in Table 6, column one. High human capital does predict exports further away, but the coefficient on accounting standards is positive and highly significant.

Does the relationship hold for earlier years?

As a general robustness check, data from a different year can be used. Table 7 reports results for 1985 using all four sunk cost proxies. The results are very similar to the 1995 results (see Table 4). All sunk cost proxies work as predicted when interacted with finance, mostly with smaller coefficients and slightly lower significance than in the 1995 exports regressions. All the interactions have the same sign as in the 1995 regressions and all are significant at the 1% level.

7. Conclusions

The main idea of this paper is very simple. We propose that exports require significant up-front investments that are hard to finance, and that the higher the up-front costs, the more important it becomes to have a well-developed financial system to finance them. Consistent with this hypothesis, we find that higher levels of financial development increase exports. For a whole set of proxies for up-front costs – distance, common border and language, and degree of differentiation of industry output – we find that finance matters more when up-front costs are high. We have thus identified trade as a specific channel through which financial development affects economic performance. The effect we identify is substantial and economically important.

Previous research has acknowledged the potential impact of financial development on international specialization and patterns of trade. We have sought to emphasize that financial development may do more than just influence the pattern of trade – it may have first order effects on the level of trade. This distinction has important policy implications, since our results suggest finance may be critical in avoiding underinvestment in exports on average.

A further contribution of the paper is to provide additional evidence that there are real effects of financial development, with a methodology impervious to some of the criticisms leveled against previous research on finance and growth, bolstering the overall case for financial development as a factor in economic development.

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Table 1. Summary statistics for selected variables

Summary statistics of key variables for all exporting countries. Accounting standards are the fraction of 90 elements reported in annual reports in each country; Stock market capitalization is the total value of all outstanding shares of all listed firms, divided by GDP; Private credit refers to all credit given by banks and other financial institutions to private sector borrowers; Exporting volume is in current USD, by industry; Export frequency measures the fraction of industry-importer pairs for which the given (exporting) country exports.

Country	Accounting standards 1990	Stock market capitalization over GDP 1995	Private credit over GDP 1995	Bilateral exporting volume by BEA industry 1995
Argentina	45	0.13	0.18	3,644
Australia	75	0.66	0.71	8,405
Austria	54	0.13	0.93	9,955
Bahamas, The	n/a	n/a	0.64	105
Bangladesh	n/a	0.04	0.23	556
Barbados	n/a	0.29	0.47	41
Belgium	n/a	0.35	0.64	28,670
Bolivia	n/a	0.01	0.45	196
Brazil	n/a	0.24	0.32	8,148
Burkina Faso	n/a	n/a	0.07	18
Burundi	n/a	n/a	0.15	38
Cameroon	n/a	n/a	0.08	249
Canada	74	0.61	0.79	33,801
Chile	52	1.11	0.62	2,793
Colombia	50	0.20	0.35	1,801
Congo, Dem. Rep.	n/a	n/a	0.00	272
Congo, Rep.	n/a	n/a	0.09	206
Costa Rica	n/a	n/a	0.13	498
Cote d'Ivoire	n/a	0.06	0.19	603
Cyprus	n/a	0.22	1.16	215
Denmark	62	0.32	0.30	8,163
Dominican Republic	n/a	n/a	0.23	658
Ecuador	n/a	0.14	0.28	786
Egypt, Arab Rep.	24	0.10	0.32	609
El Salvador	n/a	n/a	0.31	177
Fiji	n/a	0.02	0.41	95
Finland	77	0.33	0.64	7,018
France	69	0.31	0.84	49,388
Gabon	n/a	n/a	0.06	0
Gambia, The	n/a	n/a	n/a	29
Germany	62	0.21	1.02	88,250

Country	Accounting standards	Stock market cap	Private credit	Exporting volume
Ghana	n/a	0.27	0.05	235
Greece	55	0.14	0.30	1,886
Guatemala	n/a	n/a	0.16	354
Guyana	n/a	n/a	n/a	84
Haiti	n/a	n/a	0.12	31
Honduras	n/a	0.04	0.23	135
Hong Kong, China	69	2.06	1.48	28,578
Iceland	n/a	0.08	0.45	312
India	57	0.38	0.23	5,214
Indonesia	n/a	0.28	0.48	7,779
Iran, Islamic Rep.	n/a	0.05	0.23	2,717
Ireland	n/a	0.26	0.70	7,608
Israel	n/a	0.37	0.64	3,309
Italy	62	0.17	0.52	40,194
Jamaica	n/a	0.37	0.24	243
Japan	65	0.72	2.07	73,055
Jordan	n/a	0.69	0.69	307
Kenya	n/a	0.27	0.29	239
Korea, Rep.	62	0.41	1.21	20,612
Kuwait	n/a	0.47	n/a	2,294
Liberia	n/a	n/a	n/a	155
Madagascar	n/a	n/a	0.11	59
Malawi	n/a	n/a	0.09	71
Malaysia	76	2.45	1.13	12,160
Malta	n/a	n/a	0.91	321
Mauritius	n/a	0.36	0.44	254
Mexico	60	0.39	0.34	13,888
Morocco	n/a	0.15	0.43	839
Myanmar	n/a	n/a	0.05	217
Nepal	n/a	0.05	0.19	47
Netherlands	64	0.81	1.60	30,973
New Zealand	70	0.49	0.85	2,257
Niger	n/a	n/a	0.07	30
Nigeria	n/a	0.05	0.07	2,076
Norway	74	0.27	0.83	7,283
Pakistan	n/a	0.18	0.22	1,335
Panama	n/a	0.09	0.69	184
Papua New Guinea	n/a	n/a	n/a	457
Paraguay	n/a	0.01	0.25	161

Country	Accounting standards	Stock market cap	Private credit	Exporting volume
Peru	38	0.16	0.12	948
Philippines	65	0.76	0.38	2,866
Portugal	36	n/a	0.57	4,049
Rwanda	n/a	n/a	n/a	8
Saudi Arabia	n/a	0.31	0.63	8,380
Senegal	n/a	n/a	0.16	87
Seychelles	n/a	n/a	0.09	8
Sierra Leone	n/a	n/a	0.02	30
Singapore	78	1.66	1.02	19,337
South Africa	70	2.02	1.33	4,501
Spain	64	0.31	0.71	15,569
Sri Lanka	n/a	0.18	0.23	393
Sudan	n/a	n/a	0.02	73
Suriname	n/a	n/a	n/a	80
Sweden	83	0.67	1.20	13,492
Switzerland	n/a	1.16	2.17	14,394
Syrian Arab Republic	n/a	n/a	0.10	683
Taiwan, China	65	0.85	1.55	20,177
Tanzania	n/a	n/a	n/a	102
Thailand	64	0.82	1.25	9,349
Togo	n/a	n/a	0.18	40
Trinidad and Tobago	n/a	0.17	0.42	432
Tunisia	n/a	0.18	0.65	952
Turkey	51	0.13	0.12	3,800
United Kingdom	78	1.19	1.12	43,575
United States	71	0.82	1.59	103,068
Uruguay	31	0.01	0.23	374
Venezuela	40	0.06	0.09	3,318
Zambia	n/a	n/a	0.06	156
Zimbabwe	n/a	0.26	0.27	306

Table 2. Summary statistics, proxies of up-front investment need

Summary statistics of key variables. Export volume is log of one plus 1995 bilateral export volume. Differentiation is the average measure of product differentiation in an industry, based on Rauch (1999). See the text for detailed variable definitions. All statistics are calculated over the range of data most relevant: Export Frequency is for the whole sample; Accounting standards is across exporting countries; Distance, Common Border and Common Language are across all exporter-importer country pairs; the Differentiation measure is across the 34 BEA industries (based on Rauch's (1999) conservative measure, see the text for details on aggregation).

	Min	10^{th} percentile	Median	Mean	90^{th} percentile	Max	Std dev
Log of Export volume	0	0	4.25	4.91	12.1	18.9	5.07
Accounting standards	24	39	64	60.9	76.5	83	14.2
Distance	1.39	7.74	8.95	8.78	9.57	9.89	0.76
Common Border	0	0	0	0.014	0	1	0.119
Common Language	0	0	0	0.077	0	1	0.267
Differentiation	0	0.04	0.97	0.70	1	1	0.38

Table 3. Gravity equations with finance

Tobit regression of log of [1995 export volume plus one] on independent variables. Exports are bilateral exports. Variables include area and population for exporter and importer, in logs; log of exporter and importer GDP; the log of distance in miles (between largest cities); dummies for common land border between exporter and importer and for common major language; various financial measures: accounting standards, private credit over GDP, market capitalization over GPD, new issues of equity and bonds over GDP. All regressions have robust standard errors, reported under the coefficients. One star (*) denotes significant coefficient at the 5% level, two stars at the 1% level.

Dependent variable	(1) Log of Exports	(2) Log of Exports	(3) Log of Exports	(4) Log of Exports	(5) Log of Exports
Type	Tobit	Tobit	Tobit	Tobit	Tobit
Exporter GDP	**2.97****	**3.31****	**4.50****	**4.11****	**3.43****
	0.069	0.085	0.079	0.064	0.101
Exporter area		**-0.25****	**-0.27****	**-0.17****	**-0.39****
		0.022	0.027	0.026	0.040
Exporter population		**-0.13****	**0.033**	**-0.060**	**0.21***
		0.040	0.042	0.038	0.090
Importer GDP	**2.66****	**2.83****	**3.59****	**3.28****	**2.99****
	0.037	0.049	0.053	0.052	0.065
Importer area		**-0.14****	**-0.22****	**-0.17****	**-0.12****
		0.023	0.025	0.025	0.030
Importer population		**-0.05**	**-0.12****	**-0.09***	**-0.12***
		0.036	0.040	0.039	0.049
Distance	**-1.17****	**-0.91****	**-1.49****	**-1.44****	**-1.20****
	0.046	0.049	0.053	0.053	0.069
Common border		**0.55***	**-0.41**	**-0.14**	**0.28**
		0.25	0.28	0.28	0.33
Common language		**1.34****	**1.86****	**1.66***	**1.48****
		0.11	0.11	0.11	0.15
Accounting standards	**0.053****	**0.034****			
	0.0029	0.0031			
Private credit			**0.678****		
			0.121		
Market capitalization				**1.20****	
				0.082	
New issues					**5.16****
					1.44
N	4,640	3,800	8,455	6,270	2,660
R^2	0.201	0.228	0.226	0.224	0.230

Table 4. Exports and finance: fixed effects

Tobit regression of log of one plus 1995 bilateral export volume on independent variables. In regressions (1) to (3) observations are log of total bilateral exports, aggregated across industries. These regressions include fixed effects for exporting country and importing country. In column (4), observations are industry-level exports (exports are aggregated to 34 BEA industries). This regression includes dummies for exporter-importer pair and industry. Explanatory variables include the log of distance in miles (between largest cities); dummies for common land border between exporter and importer and for common major language. All regressions include an interaction of financial development (accounting standards) and a proxy for sunk costs. The proxy is listed at the top of each regression. All regressions have robust standard errors, reported under the coefficients. One star (*) denotes significant coefficient at the 5% level, two stars at the 1% level.

Dependent variable	(1) Log of exports	(2) Log of exports	(3) Log of exports	(4) Log of exports
Type	Tobit: FE	Tobit: FE	Tobit: FE	Tobit: RE
Cost proxy	log Distance	Common Border	Common Language	Differentiation
Distance	**-3.39****	**-1.23****	**-1.15****	**-**
	0.21	0.053	0.053	
Common border	**-0.015**	**4.77****	**0.19**	**-**
	0.23	0.98	0.23	
Common language	**1.10****	**1.26****	**5.50****	**-**
	0.12	0.12	0.55	
Accounting standards	**0.035****	**-0.080****	**-0.069****	**0.076****
X COST PROXY	0.0033	0.017	0.0087	0.0014
N	4,920	4,920	4,920	228,288
R^2	0.270	0.266	0.268	-
Fixed effects	Exporter, Importer	Exporter, Importer	Exporter, Importer	Exporter-Importer pair, Industry

Table 5. Robustness checks: comparative advantage

Tobit regression of log of one plus 1995 bilateral export volume on independent variables. In column one and two, the dependent variable is total bilateral exports. The regression in column one includes exporter and importer controls which are not reported (log of GDP, log of area and log of population). The regression reported in column two includes fixed effects for exporting country, importing country and industry. In column three the dependent variable is total bilateral exports for those industries that have low external dependence (as reported by Rajan and Zingales (1998)) (BEA 1-9, 11, 13-15, 17-19, 32). In column four the dependent variable is total bilateral exports in industries with high external dependence (10, 12, 16, 20-31, 33, 34, others). All regressions have robust standard errors, reported under the coefficients. One star (*) denotes significant coefficient at the 5% level, two stars at the 1% level.

Dependent variable	(1) Log of exports	(2) Log of exports	(3) Log of exports	(4) Log of exports	(5) Log of exports
Type	Tobit	Tobit: FE	Tobit: FE	Tobit	Tobit
Cost proxy	-	Log Distance	Differ-entiation	-	-
Sub sample	-	-	-	Low external dependence	High external dependence
GDP, area, population	-	-	-	[not reported]	[not reported]
Distance	**-0.83****	**-2.33****	-	**-1.06****	**-1.06****
	0.041	0.22		0.054	0.052
Common border	**0.56****	**0.27**	-	**0.52***	**0.69****
	0.20	0.17		0.27	0.26
Common language	**0.68****	**0.78****	-	**1.47****	**1.61****
	0.12	0.11		0.12	0.12
Accounting standards	**0.049****			**0.015****	**0.068****
	0.0028			0.0034	0.0033
Importer's acc. standards	**0.018****				
	0.0028				
Accounting standards		**0.017****	**0.043****		
X COST PROXY		0.0027	0.0019		
Importer's acc. standards		**0.0057***	**0.0046****		
X COST PROXY		0.0027	0.0017		
N	1,560	1,560	41,899	3,800	3,800
R²	0.267	0.358	0.465	0.207	0.250
Fixed effects	-	Exporter, Importer, Industry	Exporter-Importer pair, Industry	-	-

Table 6. Robustness checks II

Tobit regression of log of one plus 1995 bilateral export volume on independent variables. The regressions include fixed effects for exporting country, importing country and industry. Explanatory variables are the log of distance in miles (between largest cities); dummies for common land border between exporter and importer and for common major language. All regressions include an interaction of accounting standards with log of distance. Column two includes an interaction of human capital (the log of average total years of schooling in exporting country) and distance. All regressions have robust standard errors, reported under the coefficients. One star (*) denotes significant coefficient at the 5% level, two stars at the 1% level.

Dependent variable	(1) Log of exports
Type	Tobit: FE
Distance	**-3.78****
	0.20
Common border	**-0.29**
	0.22
Common language	**1.16****
	0.12
Accounting standards x Distance	**0.013****
	0.0038
Human capital x Distance	**0.22****
	0.022
Total exports (log) x Distance	
N	4,797
R^2	0.28
Fixed effects	Exporter, Importer, Industry

Table 7. Robustness checks III: earlier year

Tobit regression of log of one plus 1985 bilateral export volume on independent variables. In regressions (1) to (3) observations are log of total bilateral exports, aggregated across industries. These regressions include fixed effects for exporting country and importing country. In column (4), observations are industry-level exports (exports are aggregated to 34 BEA industries). This regression includes dummies for exporter-importer pair and industry. Explanatory variables are the log of distance in miles (between largest cities); dummies for common land border between exporter and importer and for common major language. All regressions include an interaction of financial development (accounting standards) and a proxy for export sunk costs. The proxy is listed at the top of each regression. All regressions have robust standard errors, reported under the coefficients. One star (*) denotes significant coefficient at the 5% level, two stars at the 1% level.

Dependent variable	(1) Log of exports	(2) Log of exports	(3) Log of exports	(4) Log of exports
Type	Tobit: FE	Tobit: FE	Tobit: FE	Tobit: RE
Year	1985	1985	1985	1985
COST PROXY	Distance	Common Border	Common Language	Differentiation
Distance	**-4.33****	**-1.48****	**-1.37****	**-**
	0.28	0.073	0.075	
Common border	**-0.41**	**6.62****	**-0.13**	**-**
	0.32	1.27	0.33	
Common language	**1.75****	**1.97****	**6.97****	**-**
	0.16	0.16	0.72	
Accounting standards	**0.047****	**-0.12****	**-0.081****	**0.035****
x COST PROXY	0.0043	0.021	0.011	0.012
N	4,305	4,305	4,305	219,240
R^2	0.233	0.230	0.231	-
Fixed effects	Exporter, Importer, Industry	Exporter, Importer, Industry	Exporter, Importer, Industry	Exporter-Importer pair, Industry

Table A1. Industry list

These are the 34 industries according to the BEA classification, used for all regressions. Differentiation is a measure of how differentiated or homogenous an industry's output is, based on Rauch (1999). See the text for details.

Industry (BEA classification)		
BEA	**Industry name**	**Differentiation**
1	Grain, Mill and Bakery Products	**n/a**
2	Beverages	**0.14**
3	Tobacco Products	**0**
4	Other Food and Kindred Products	**0.04**
5	Apparel and Other Textile Products	**0.83**
6	Leather and Leather Products	**1.0**
7	Pulp, Paper, and Board Mills	**0.01**
8	Other Paper and Allied Products	**0.55**
9	Printing and Publishing	**1.0**
10	Drugs	**0.94**
11	Soaps, Cleaners, and Toilet Goods	**1.0**
12	Agricultural Chemicals	**0**
13	Industrial Chemicals and Synthetics	**0.12**
14	Other Chemicals	**0.70**
15	Rubber Products	**1.0**
16	Miscellaneous Plastic Products	**1.0**
17	Primary Metal Industries, Ferrous	**0.27**
18	Primary Metal Industries,Nonferrous	**0.20**
19	Fabricated Metal Products	**1.0**
20	Farm and Garden Machinery	**1.0**
21	Construction, Mining, etc	**1.0**
22	Computer and Office Equipment	**1.0**
23	Other Nonelectric Machinery	**1.0**
24	Household Appliances	**1.0**
25	Household Audio and Video, etc.	**1.0**
26	Electronic Components	**n/a**
27	Other Electrical Machinery	**1.0**
28	Motor Vehicles and Equipment	**1.0**
29	Other Transportation Equipment	**1.0**
30	Lumber, Wood, Furniture, etc.	**0.74**
31	Glass Products	**n/a**
32	Stone, Clay, Concrete, Gypsum, etc.	**0.89**
33	Instruments and Apparatus	**1.0**
34	Other Manufacturing	**0.63**