Available online at www.sciencedirect.com
ScienceDirect
Journal of Financial Economics 86 (2007) 796–834
JOURNAL OF Financial ECONOMICS
www.elsevier.com/locate/jfec

Comparative advantage, demand for external finance, and financial development ☆

Quy-Toan Do[a], Andrei A. Levchenko[b,*]

[a]The World Bank, 1818 H Street, NW, Washington, DC 20433, USA
[b]International Monetary Fund, 700 19th Street, NW, Washington, DC 20431, USA

Received 9 June 2006; received in revised form 13 November 2006; accepted 20 November 2006
Available online 1 July 2007

Abstract

This paper analyzes the effect of comparative advantage in international trade on a country's level of financial development. Countries with comparative advantage in financially intensive goods experience a higher demand for external finance, and therefore financial development. By contrast, financial development is lower in countries that primarily export goods which do not rely on external finance. We use disaggregated trade data to develop a measure of a country's external finance need of exports, and demonstrate this effect empirically. In order to overcome the simultaneity problem, we develop a novel instrumentation strategy based on the exogenous geographic determinants of trade patterns.

JEL classification: F10; G20; O16; O19

Keywords: Trade patterns; Demand for external finance; Financial development; Gravity model

☆We are grateful to Daron Acemoglu, Thorsten Beck, Simon Johnson, Aart Kraay, Alan Winters, an anonymous referee, and workshop participants at MIT, the World Bank, Brown, CEPR ERWIT (Vienna), the IXth workshop in International Economics and Finance (Santiago) and the IMF Institute for helpful comments. The views expressed in this paper are those of the authors and should not be attributed to the International Monetary Fund, the World Bank, their Executive Boards, or their respective managements.

*Corresponding author.
E-mail address: alevchenko@imf.org (A.A. Levchenko).

doi:10.1016/j.jfineco.2006.11.004

1. Introduction

A quick glance at the levels of financial development across countries reveals large differences. Fig. 1 plots the ratios of private credit to GDP and trade openness to GDP starting in 1970 for developing and advanced countries. The average share of private credit to GDP is more or less three times higher in advanced countries than in developing countries throughout the period. On the other hand, trade volume as a share of GDP grew faster in developing countries, which have now surpassed the advanced ones. What explains persistent financial underdevelopment? In particular, can we say something about the relation between financial development and trade openness?

The literature has often emphasized the idea that the financial system is an endowment. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) provide empirical evidence that a country's legal origin is a strong and arguably exogenous determinant of a country's financial development. When it comes to institutions more broadly, Acemoglu, Johnson, and Robinson (2001) document that the quality of institutions is largely determined by settler mortality rates during the colonial period. Applying these insights to international trade immediately suggests a pattern of comparative advantage: countries endowed with better financial systems will specialize in goods that rely on external finance in production. Indeed, this idea has been formalized theoretically by Kletzer and Bardhan (1987), Baldwin (1989), and Ju and Wei (2005), and has found empirical support in a number of studies (e.g., Beck, 2002, 2003; Becker and Greenberg, 2005; Svaleryd and Vlachos, 2005; Manova, 2005).

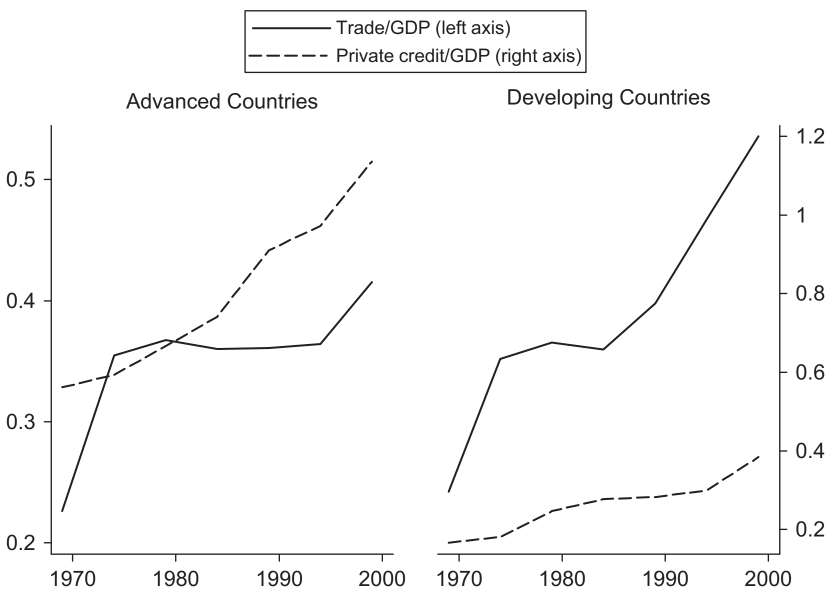

Fig. 1. Average trade volumes (trade/GDP) and financial development (private credit/GDP) are plotted over the period 1970–1999 for advanced and developing countries separately. The units for trade volumes and financial development are given on the left and right axes, respectively. While trade volumes increased steeply in developing countries (solid lines), the dashed lines suggest faster financial development for advanced countries.

The purpose of this paper is to show the reverse link: financial development itself depends on trade patterns. We argue that financial development is endogenous, and that it is determined in part by demand for external finance in each country. Comparative advantage in trade will affect a country's production pattern, and in turn its demand for external finance. Countries specializing in financially dependent goods will have a high demand for external finance and thus a high level of financial intermediation. In contrast, the financial system will be less developed in countries that specialize in goods not requiring external finance. This paper first illustrates this point using a very simple model in which goods differ in their reliance on external finance. Comparative advantage implies that after trade opening, the financially intensive sector expands in one country and disappears in the other. This change in production patterns in turn has implications for equilibrium financial development in the trading countries.

Next, we demonstrate this effect empirically. For a sample of 96 countries over the period 1970 to 1999, we use industry-level export data and information on each industry's reliance on external finance from Rajan and Zingales (1998) to build a measure of the *external finance need of exports*. This measure, constructed following the methodology of Almeida and Wolfenzon (2005), summarizes the demand for external finance that comes from a country's export pattern. We then use a comprehensive data set on financial development first introduced by Beck, Demirgüç-Kunt, and Levine (2000) to show that a country's financial development is strongly and robustly affected by the external finance need of its exports.

Our preferred coefficient estimates imply that moving from the 25th to the 75th percentile in the distribution of external finance need of exports is associated with an increase in financial development of about one standard deviation, or a 33 percentage point rise in private credit to GDP. This effect is economically significant. For example, Greece is roughly in the 25th percentile of the distribution of external finance need of exports: its main export categories are Wearing Apparel and Food Products, which do not rely much on external finance according to our data. Its average private credit as a share of GDP over the period 1970–1999 is 0.35. Moving up to the 75th percentile in the distribution of external finance need of exports would put it roughly at the level of Spain, whose main export categories are Transport Equipment and Machinery. Our estimates imply that this change in external finance need of exports would almost double Greece's private credit as a share of GDP, to 0.68. Indeed, this is only slightly below the corresponding figure for Spain, which is 0.74 over the same period.

This effect is sizeable when compared to the other determinants of financial development identified in the literature. Beck, Demirgüç-Kunt, and Levine (2003) examine the impact of legal institutions and natural endowments on the financial system. They find that in the French legal origin countries, private credit as a share of GDP is 17–27 percentage points lower than in British legal origin countries. These authors also find that a one-standard deviation decrease in the log of settler mortality (see Acemoglu, Johnson, and Robinson, 2001) raises private credit as a share of GDP by 14 to 17 percentage points. These are similar in magnitude to the effect of moving from the 25th to the 75th percentile in the distribution of external finance need of exports. Thus, the role of trade identified in this paper is arguably as prominent in shaping financial development as the traditional explanatory variables such as legal systems and endowments.

A key feature of this paper is the way it addresses the simultaneity problem arising in this exercise. We require an instrument for a country's export pattern. In order to construct such an instrument, this paper expands the geography-based methodology of Frankel and Romer (1999). These authors use the gravity model to predict bilateral trade volumes between each pair of countries based on a set of geographical variables such as bilateral distance, common border, area, and population. Summing up across trading partners then yields, for each country, its "natural openness:" the overall trade to GDP as predicted by its geography. Because we need an instrument for trade patterns rather than total trade volumes, our point of departure is to estimate the Frankel and Romer gravity regressions for each industry. Following their methodology, we then obtain the predicted trade volume as a share of GDP not just in each country, but also in each sector within each country.[1] Doing so allows us to construct each country's predicted external finance need of exports based on its predicted trade shares in each sector. We then use it as an instrument for the actual external finance need of exports.

The model used to illustrate the main idea has two sectors, one of which relies on external finance. The size of the financial system, that is, the amount of borrowing and lending that occurs in the economy, is naturally a function of total output in the financially intensive sector. An additional feature of our theoretical setup is that the quality of the financial system is a function of its size. In the model, as well as conceptually, the quality of the financial system is defined by how successfully entrepreneurs with positive net present value projects can obtain external finance. A larger financial sector improves the entrepreneurs' ability to fulfill their need for external finance. This is because when entrepreneurs start financially intensive projects and engage the country's financial system, they add liquidity. They become potential providers of external finance for fellow entrepreneurs, reducing the likelihood of financial distress. Each entrepreneur who invests in the financially intensive sector hence generates a positive spillover by increasing financial depth.[2] Opening to trade will affect demand for external finance in both trading countries. In particular, the financial system deepens in a country that increases production of the financially dependent good. In the other country the financially dependent sector shrinks, leading to a deterioration in the size and quality of the country's financial system.

The assumptions underlying our model find support in empirical studies that relate the size of financial systems to their quality. Levine and Schmukler (2006) find evidence of a causal link between market size and financial depth. When looking at domestic market liquidity in emerging economies, they find that when some firms decide to raise finance abroad, the remaining domestic firms' trading liquidity is adversely affected. Note also that in most empirical studies of financial development, the positive association between size and quality is implicit. The quality of a financial system—financial development—is often proxied by measures of market size such as ratios of private credit to GDP or stock market capitalization to GDP.

This paper is not the first to explore the effect of trade on financial development. Rajan and Zingales (2003) argue that trade opening, especially when combined with openness to capital flows, weakens the incentives of incumbent firms to block financial development in order to reduce entry and competition. Furthermore, the relative political power of

[1] We adapt this strategy from di Giovanni, Levchenko, and Ranciere (2005).

[2] In modeling the market for external finance and the positive effect of financial system size on its quality, we abstract from the informational and enforcement frictions that are often invoked in this context. One can clearly adopt this approach as well, and think of the quality of the financial system in terms of how well it can overcome these distortions and achieve the efficient level of lending. A positive link between the size of the financial markets and their ability to resolve such frictions has been modeled, for example, by Acemoglu and Zilibotti (1999).

incumbents may decrease with trade as well. Thus, these authors argue that trade has a beneficial impact on financial development. Braun and Raddatz (2005) explore the political channel further. They demonstrate that countries in which trade liberalization reduced the power of groups most interested in blocking financial development saw an improvement in the financial system. When, on the other hand, trade opening strengthened those groups, external finance suffered. This paper can be thought of as complementary to Rajan and Zingales (2003) and Braun and Raddatz (2005). While these two studies are about how trade affects the supply of external finance, this paper focuses instead on the demand side.

It is also important to note that trade may affect financial development through a variety of other channels. Newbery and Stiglitz (1984) argue that trade, by affecting price elasticity, can potentially increase uncertainty and income volatility. Financial development could then be fostered by increased demand for insurance, though Broner and Ventura (2006) show that the outcome is sensitive to assumptions about the nature of asset market frictions.[3] While a Newbery and Stiglitz-type of argument invokes the role of financial markets for insuring risk in consumption, in this paper the financial system plays a role on the production side. Thus, in contrast to the consumption insurance view, the focus of this paper is on the differential impact of trade across countries as a function of the pattern of comparative advantage.

The rest of the paper is organized as follows. Section 2 presents a stylized model of an economy in which the quality of a financial system and its size are jointly determined. We then open the economy to trade and look at the changes in the financial system size and quality as a function of comparative advantage. Section 3 describes our empirical methodology. We construct a measure of external finance need of exports, and present the estimating equation. We then discuss in detail the construction of the instrumental variable that will allow us to identify the causal impact of trade on financial development. Section 4 describes the data used in this paper. Section 5 presents the estimation results, and Section 6 concludes.

2. The model

2.1. The environment

Consider an economy with one factor, L (labor) and two goods: a financially dependent good F and a simple good A. The time horizon consists of the interval $t \in [0, 1]$, and consumption takes place at $t = 1$. Utility is Cobb-Douglas in the two goods:

$$U(c_F, c_A) = c_F^{\alpha} c_A^{1-\alpha}. \tag{1}$$

Let good A be the numeraire, and p_F be the relative price of good F in terms of A. Utility maximization implies the following relation between consumption and the relative price:

$$p_F = \frac{\alpha}{1-\alpha} \frac{c_A}{c_F}. \tag{2}$$

[3] Rodrik (1998) shows that more open countries have larger governments to help them deal with increased uncertainty that is associated with openness. Svaleryd and Vlachos (2002) provide empirical evidence that countries with better developed financial systems are more likely to be open to trade, and argue that this is because a better financial system allows a country to better cope with increased uncertainty. Tangentially, these authors also provide some evidence that the financial system improves after trade opening.

There is a potentially infinite number of entrepreneurs that can produce either A or F. Entrepreneurs make the decision to enter either of the two sectors at $t = 0$. Production in the two sectors then occurs continuously over the interval $t \in [0, 1]$. Good A is produced with a linear technology that requires one unit of L to produce one unit of A. Profit maximization in that sector implies that the price of A is equal to the wage w: $p_A = w = 1$.

Good F relies on external finance. Setting up a production unit of good F requires one unit of L. A project in the F-sector consists of a continuous flow of returns $(R_t)_{t\in[0,1]}$. In each time interval $[t, t + \mathrm{d}t]$, the project experiences a liquidity shock $\tilde{\lambda}_t\,\mathrm{d}t$ of the following form:

$$\tilde{\lambda}_t = \begin{cases} \lambda & w/prob.\ \frac{1}{2} \\ -\lambda & w/prob.\ \frac{1}{2} \end{cases}, \tag{3}$$

where λ is a positive constant. Shocks are i.i.d. across time and firms, and cannot be saved. If in the interval $[t, t + \mathrm{d}t]$ the liquidity shock is positive, or the liquidity need is fulfilled, the project yields a flow of returns $R\,\mathrm{d}t$; otherwise, it returns zero in that instant.[4]

Agents with a liquidity need can borrow to fulfill it. At each time interval $[t, t + \mathrm{d}t]$, there exists a spot credit market in which entrepreneurs with excess liquidity lend to financially distressed agents at the prevailing interest rate r_t. Debt contracted in the time interval $[t, t + \mathrm{d}t]$ is a claim on $t = 1$ returns. Under the assumption of spot credit markets, r_t is determined by the demand and supply of liquidity: if the aggregate liquidity shock is positive, then there is excess supply of finance and interest rates drop to zero. On the other hand, when the aggregate liquidity shock is negative, lenders capture the entire benefit of refinancing the project so that $r_t\lambda\,\mathrm{d}t = p_F R\,\mathrm{d}t$. In the latter case, there are some projects with unfulfilled liquidity needs which yield zero return that instant.

What is the total output in the F-sector? Let η be the share of the labor force L employed in the F-sector. Then the total number of firms in that sector is ηL, and let those firms be indexed by $i \in \{1, \ldots, \eta L\}$.[5] The cumulative output in this sector depends on how many projects are liquidated in each interval $[t, t + \mathrm{d}t]$, and therefore on aggregate liquidity in each instant. Let γ_t be the fraction of projects that are liquidated in the time interval $[t, t + \mathrm{d}t]$. It is given by

$$\gamma_t = \begin{cases} \dfrac{1}{\lambda\eta L}\sum\limits_{i=1}^{\eta L}\tilde{\lambda}_t^i & \text{if } \sum\limits_{i=1}^{\eta L}\tilde{\lambda}_t^i < 0 \\ 0 & \text{otherwise} \end{cases}. \tag{4}$$

The sum of all the shocks across firms in the F-sector, $\sum_{i=1}^{\eta L}\tilde{\lambda}_t^i$, gives the aggregate liquidity in this economy at time t. If it is positive, no projects are liquidated. If it is negative, the fraction of projects that are liquidated depends on the magnitude of the negative aggregate shock. Assuming projects are liquidated at random when aggregate liquidity is negative, the cumulative output realized by each firm in sector F is given by $R[1 - \gamma(\eta L)]$, where $\gamma(\eta L) \equiv \int_0^1 \gamma_t\,\mathrm{d}t$. Profit maximization by entrepreneurs in sector F therefore implies that the price of good F equals unit cost:

$$p_F R[1 - \gamma(\eta L)] = w = 1. \tag{5}$$

[4]If there is an instant at some $t \in [0, 1]$ in which the project returns zero, it is not liquidated completely: the next instant it may produce again.

[5]Here and in the rest of the paper, we ignore integer constraints on ηL for simplicity.

The model captures the positive relation between the financial system's size and its quality. The equilibrium value $\gamma(\eta L)$ is the fraction of time that a firm is unable to fulfill the need for external finance and hence loses output.[6] Thus, one can think of $1-\gamma(\eta L)$ as the quality of the financial system. This quality depends positively on the size of the financially intensive sector η. As the number of entrepreneurs in the F-sector increases, the probability of a negative aggregate shock of a given magnitude is lower, making liquidation a more unlikely event. The following lemma formalizes this property of the financial system's quality.

Lemma 1 (*The quality of the financial system* $\gamma(\eta L)$). *The function* $\gamma(\eta L)$ *is decreasing in* ηL, *with* $\gamma(1)=\frac{1}{2}$ *and* $\lim_{\eta L\to\infty}\gamma(\eta L)=0$.

Proof. See the appendix.

A related feature of this setup is that the volatility of total output in the F-sector at each $t\in[0,1]$ decreases in the number of entrepreneurs accessing external finance. That is, more borrowing and lending in the economy is associated with lower volatility, as long as the F-sector has a positive number of firms. However, it is also often argued that more lending, when it is excessive (a "credit boom"), can sometimes increase volatility by precipitating banking crises.[7] This alternative view is not inconsistent with the model we propose. Our model analyzes the equilibrium level of lending, while credit booms are defined as deviations from trend, or equilibrium, amount of financial intermediation in the economy. Nonetheless, it is ultimately an empirical question whether more lending is associated with higher or lower macroeconomic volatility. While a thorough examination of this issue is beyond the scope of this paper, the correlation between the volatility of real per capita GDP growth over the period 1970–1999 and private credit as a share of GDP is −0.5 in our sample of 96 countries, suggesting that higher levels of lending are generally associated with lower volatility. Note, however, that macroeconomic volatility is not central to this paper. Our main theoretical prediction and empirical result is that trade affects private credit differentially across countries depending on their comparative advantage. These would not change if more lending lead to higher instead of lower volatility.

2.2. Autarky equilibrium

The equilibrium production structure in the closed economy is characterized by a single variable, η, which is the share of the labor force employed in sector F. A value of η pins down the total production of the two goods, and market clearing implies that consumption equals output:

$$c_F = R[1-\gamma(\eta L)]\eta L \tag{6}$$

and

$$c_A = (1-\eta)L. \tag{7}$$

[6]In our setup, the value of $\gamma(\eta L)$ will be appreciably greater than zero only if the number of firms ηL is not too large. Thus, in our model, L should be thought of not as the number of workers, but as the number of large enterprises that the labor force in this economy can potentially staff.

[7]For instance, IMF (2004) documents that 75% of credit booms in emerging markets are associated with banking crises, and 85% with currency crises. For a theoretical and empirical exploration of the link between lending booms and crises, see Ranciere, Tornell, and Westermann (2006).

Eqs. (2), (5)–(7) define the autarky equilibrium. The assumptions made above lead to a simple expression for the allocation of production:

$$\eta^A = \alpha. \tag{8}$$

It is useful to derive the volume of external finance that occurs in this economy. At each instant $t \in [0, 1]$, let k be the number of firms that receive a positive shock, implying that $\eta L - k$ is the number of firms that receive a negative shock. If $k > \eta L - k$, the amount of lending in that instant is $\lambda(\eta L - k)$. If $k < \eta L - k$, the economy is liquidity-constrained, and the amount of lending in that instant is λk. The expected value of lending at each t, and hence the overall volume of lending over the period between $t = 0$ and $t = 1$ is

$$Private\ Credit = \lambda \left[\sum_{1}^{\frac{\eta L}{2}} k \Pr(k) + \sum_{\frac{\eta L}{2}+1}^{\eta L} (\eta L - k) \Pr(k) \right], \tag{9}$$

where k is a binomial random variable with probability $\frac{1}{2}$ and the total number of draws ηL. The expression above simplifies to:

$$Private\ Credit = \frac{1}{2} \lambda \eta L, \tag{10}$$

which shows that in this simple model, the amount of external finance is linear in the size of the externally dependent sector.

2.3. Trade equilibrium

Suppose that there are two countries, the North and the South. They are endowed with L^N and L^S units of labor, respectively, and exhibit a Ricardian productivity difference in the F-sector, $R^N > R^S$. We assume that the parameter values are such that the North is the only country to produce good F in the trade equilibrium. As will become clear below, such an outcome obtains as long as the North is large enough, and/or good F is small enough in the consumption bundle. This means that in order to pin down the trade equilibrium production structure, all one needs to solve for is the share of labor force employed in the F-sector in the North, η^N. Equilibrium is defined by a version of Eq. (2) in which c_F and c_A are now overall world consumption values, Eq. (5) for a given η^N, and the trade versions of the goods market clearing conditions

$$c_F = R^N[1 - \gamma(\eta^N L^N)]\eta^N L^N \tag{11}$$

and

$$c_A = (1 - \eta^N)L^N + L^S. \tag{12}$$

These four equations lead to a simple expression for equilibrium allocation of resources,

$$\eta^N = \alpha \frac{L^N + L^S}{L^N}, \tag{13}$$

as long as $\eta^N \leqslant 1$. It is immediate from (13) that this condition will be satisfied if L^N is large enough, or α is small enough. For example, if the two goods have an equal share of the consumption basket, $\alpha = \frac{1}{2}$, and the two countries have the same factor endowments, $L^N = L^S$, η^N is exactly one.

What is happening to private credit? It is clear that there is no longer any borrowing or lending in the South. Furthermore, as $\eta^S = 0$, the value of $\gamma(\eta^S L^S)$ in the South is at the maximum: the quality of the financial system deteriorates as the marginal entrepreneur does not have any opportunity to insure against shocks through external finance. In the North, comparing (8) and (13) it is immediate that there is more borrowing and lending after trade opening: $\eta^N > \eta^A$. This in turn implies that the quality of the financial system improves as well: $\gamma(\eta^N L^N) < \gamma(\eta^A L^N)$. As more firms enter the F-sector, the frequency with which the external finance needs of firms are unfulfilled decreases.

3. Empirical methodology

The main point of the paper is that to the extent financial development is an outcome of supply and demand for external finance, a country's trade patterns will affect its financial development. Countries whose trade specialization implies that they produce and export financially dependent goods will experience a higher level of financial development than countries producing goods for which it is not important to rely on external finance, all else equal. This is especially true of conventional measures of financial development, such as private credit to GDP, which are equilibrium quantities.

3.1. The estimating equation

In order to demonstrate this empirically, we must first construct a summary measure of the degree of financial dependence associated with a country's export pattern. We start with the standard Rajan and Zingales (1998) classification of industries according to their dependence on external finance. The Rajan and Zingales measure is defined as capital expenditure minus cash flow divided by capital expenditure, and is constructed based on U.S. firm-level data. Intuitively, this measure is intended to capture the share of investment that must be financed with funds external to the firm. This paper uses the version of the variable assembled by Klingebiel, Kroszner, and Laeven (2005), in which industries are classified according to the three-digit ISIC Revision 2 classification. The Rajan and Zingales external dependence measure is reproduced in Table 1.

We combine this industry-level information with data on the structure of a country's exports to develop a measure of a country's external finance need of exports (hereafter, *EFNX*) by following the approach of Almeida and Wolfenzon (2005). In particular, we construct the following variable for each country and period of time:

$$EFNX_{ct} = \sum_{i=1}^{I} \omega_{ict}^{X} ED_i, \tag{14}$$

where c indexes countries, t time periods, i industries, ω_{ict}^{X} is sector i's share in total manufacturing exports from country c in time period t, and ED_i is the Rajan and Zingales measure of dependence on external finance. Summing up across sectors in each country-year implies that this index is measured at country level, but potentially varies over time.

Using this variable, we would like to estimate the following equation in the cross-section of countries:

$$FinDev_c = \alpha + \beta EFNX_c + \boldsymbol{\gamma}\mathbf{Z}_c + \varepsilon_c. \tag{15}$$

Table 1
The Rajan and Zingales measure of external dependence

ISIC code	Industrial sector	External dependence
311	Food products	0.14
313	Beverages	0.08
314	Tobacco	−0.45
321	Textile	0.19
322	Apparel	0.03
323	Leather	−0.14
324	Footwear	−0.08
331	Wood products	0.28
332	Furniture	0.24
341	Paper and products	0.17
342	Printing and publishing	0.2
351	Industrial chemicals	0.25
352	Other chemicals	0.75
353	Petroleum refineries	0.04
354	Petroleum and coal products	0.33
355	Rubber products	0.23
356	Plastic products	1.14
361	Pottery	−0.15
362	Glass	0.53
369	Nonmetal products	0.06
371	Iron and steel	0.09
372	Nonferrous metal	0.01
381	Metal products	0.24
382	Machinery	0.6
383	Electric machinery	0.95
384	Transportation equipment	0.36
385	Professional goods	0.96
390	Other industries	0.47

Source: Klingebiel, Kroszner, and Laeven (2005). External dependence is defined as capital expenditure minus cash flow divided by capital expenditure, and is constructed based on U.S. firm-level data.

The left-hand side variable, $FinDev_c$, is a measure of a country's level of financial development, and $\mathbf{Z}_c$ is a vector of controls. The main hypothesis is that the effect of external finance need of exports, $EFNX$, on financial development is positive ($\beta > 0$). This equation is estimated with two-stage least squares (2SLS), using an instrument constructed as described below.

We also exploit the time variation in the variables to estimate a panel specification that includes both country and time fixed effects:

$$FinDev_{ct} = \alpha + \beta EFNX_{ct} + \gamma \mathbf{Z}_{ct} + \delta_c + \delta_t + \varepsilon_{ct}, \tag{16}$$

where country fixed effects are denoted by δ_c and time fixed effects by δ_t. The advantage of the panel specification is that the use of fixed effects allows us to control for a wide range of omitted variables. However, the instrument does not produce enough variation over time to enable us to use 2SLS in the panel. Thus, the panel specifications are estimated with OLS.

3.2. Instrumentation strategy

It is immediate that there is an important simultaneity problem: a country's trade pattern is surely influenced by its financial development, as documented by Beck (2003), for instance. Thus, in order to estimate the causal relation going from trade to financial development, we must develop an instrument for the main right-hand side variable, namely the external finance need of exports.

In order to do this, this paper expands the geography-based approach of Frankel and Romer (1999). These authors construct predicted trade as a share of GDP by first estimating a gravity regression on bilateral trade volumes between countries using only exogenous geographical explanatory variables such as bilateral distance, land areas, and populations. From the estimated gravity equation, these authors predict bilateral trade between countries based solely on geographical variables. Then, for each country they sum over trade partners to obtain the predicted total trade to GDP, or "natural openness."

The objective of this paper is to find an instrument for export patterns, not aggregate trade openness. Thus, we must extend the Frankel and Romer approach accordingly. Specifically, we apply their methodology to exports at the sector level, following di Giovanni, Levchenko, and Ranciere (2005). For each industry i, we run the Frankel and Romer regression:

$$\begin{aligned} LogX_{icd} = {} & \alpha + \eta_i^1 ldist_{cd} + \eta_i^2 lpop_c + \eta_i^3 larea_c + \eta_i^4 lpop_d + \eta_i^5 larea_d + \eta_i^6 landlocked_{cd} \\ & + \eta_i^7 border_{cd} + \eta_i^8 border_{cd} * ldist_{cd} + \eta_i^9 border_{cd} * pop_c + \eta_i^{10} border_{cd} * area_c \\ & + \eta_i^{11} border_{cd} * pop_d + \eta_i^{12} border_{cd} * area_d \\ & + \eta_i^{13} border_{cd} * landlocked_{cd} + \varepsilon_{cd}, \end{aligned} \tag{17}$$

where $LogX_{icd}$ is the log of exports as a share of GDP in industry i, from country c to country d. The right-hand side consists of the geographical variables. In particular, $ldist_{cd}$ is the log of the distance between the two countries, defined as distance between the major cities in the two countries, $lpop_c$ is the log of the population of country c, $larea_c$ is the log of land area, $landlocked_{cd}$ takes the value of zero, one, or two depending on whether none, one, or both of the trading countries are landlocked, and $border_{cd}$ is the dummy variable for a common border. The right-hand side of the specification is identical to the one Frankel and Romer (1999) use.

Having estimated Eq. (17) for each industry, we then obtain the predicted logarithm of industry i exports to GDP from country c to each of its trading partners indexed by d, $\widehat{LogX}_{icd}$. In order to construct the predicted overall industry i exports as a share of GDP from country c, we take the exponential of the predicted bilateral log of trade, and sum over the trading partner countries $d = 1, \ldots, C$, exactly as in Frankel and Romer (1999):

$$\widehat{X}_{ic} = \sum_{\substack{d=1 \\ d \neq c}}^{C} e^{\widehat{LogX}_{icd}}. \tag{18}$$

That is, predicted total trade as a share of GDP for each industry and country is the sum of the predicted bilateral trade to GDP over all trading partners. Thus, this paper in effect extends and modifies the Frankel and Romer methodology in two respects. First, and most importantly, it constructs the Frankel and Romer predicted trade measures by industry. And second, rather than looking at total trade, it looks solely at exports.

Armed with a working model for predicting exports to GDP in each industry i, it is straightforward to construct the instrument for external financing need of exports, based on predicted export patterns rather than actual ones. In particular, the instrument is, in a manner identical to Eq. (14):

$$\widehat{EFNX}_c = \sum_{i=1}^{I} \widehat{\omega}_{ic}^{X} ED_i. \tag{19}$$

Here, industry i's predicted share of total exports in country c, $\widehat{\omega}_{ic}^{X}$, is constructed from the predicted exports to GDP ratios $\widehat{X}_{ic}$ in a straightforward manner:

$$\widehat{\omega}_{ic}^{X} = \frac{\widehat{X}_{ic}}{\sum_{i=1}^{I} \widehat{X}_{ic}}. \tag{20}$$

Note that even though $\widehat{X}_{ic}$ is exports in industry i normalized by a country's GDP, every sector is normalized by the same GDP, and thus they cancel out when we take the predicted export share.

It is worth discussing at length how such a strategy can work. As mentioned above, we require an instrument for trade patterns, not trade volumes. How can this procedure result in different predictions for $\widehat{X}_{ic}$ across sectors if all of the geographical characteristics on the right-hand side of Eq. (17) do not vary by sector? Note that the procedure estimates an individual gravity equation for each sector. Thus, crucially for the identification strategy, if the vector of estimated gravity coefficients η_i differs across sectors, so will the predicted total exports $\widehat{X}_{ic}$ across sectors i within the same country.

The following simple numerical example illustrates the logic of this strategy. Suppose that there are four countries: the U.S., the E.U., Canada, and Australia, and two sectors, Wearing Apparel and Electrical Machinery. Suppose further that the distance from Australia to either the U.S. or the E.U. is 10,000 miles, but Canada is only 1,000 miles away from both the U.S. and the E.U. (these distances are pretty close to the actual values). Suppose that there are only these country pairs, and that trade between them is given in Table 2. Let the gravity model include only bilateral distance. The trade values have been chosen in such a way that a gravity regression estimated on the entire "sample"

Table 2
An illustration of the instrumentation strategy

Sector	Exporter	Destination	Distance (miles)	Exports (millions 2005 USD)	External dependence
Wearing apparel	Canada	E.U.	1000	2500	0.03
Wearing apparel	Canada	U.S.	1000	4500	0.03
Wearing apparel	Australia	E.U.	10000	850	0.03
Wearing apparel	Australia	U.S.	10000	415	0.03
Electrical machinery	Canada	E.U.	1000	25000	0.95
Electrical machinery	Canada	U.S.	1000	15000	0.95
Electrical machinery	Australia	E.U.	10000	1000	0.95
Electrical machinery	Australia	U.S.	10000	1150	0.95

Notes: This table presents the hypothetical example used to illustrate the intuition behind the identification strategy. The distance and exports values are not actual data; they are chosen in such a way as to produce the distance coefficients of −0.75 for Wearing apparel and −1.25 for Electrical machinery.

yields a coefficient on distance equal to -1, a common finding in the gravity literature. The gravity model estimated separately for each of the two sectors yields the distance coefficient is -0.75 in Wearing Apparel and -1.25 in Electrical Machinery. Using these "estimates" of the distance coefficients, it is straightforward to take the exponent and sum across the trading partners as in Eq. (18), and to calculate the predicted shares of total exports to the rest of the world in each of the two sectors, as in Eq. (20). Now let the external finance dependence of Wearing Apparel be $ED_{APP} = 0.03$, and of Electrical Machinery, $ED_{EM} = 0.95$ (these are the actual values of ED_i for these two industries). Then, the predicted external need of exports of Canada is $\widehat{EFNX}_{CAN} = 0.814$, which is some 30% higher than the predicted value for Australia of $\widehat{EFNX}_{AUS} = 0.622$.

To summarize, the key intuition from this example is that countries located far away from their trading partners will have lower predicted export shares in goods for which the coefficient on distance is higher. This information is combined with variation in external finance dependence of industries to generate predicted $\widehat{EFNX}$. There are several important points to note about this procedure. First, while this simple example focuses on the variation in distance coefficients along with differences in distances between countries, our actual empirical procedure exploits variation in all 13 regression coefficients in Eq. (17), along with the entire battery of exporting and destination country characteristics. Thus, to the extent that coefficients on other regressors also differ across sectors, variation in predicted $\widehat{EFNX}$ will come from the full set of geography variables. Second, while this simple four-country illustrative example may appear somewhat circular—actual exports and distance affect the gravity coefficient, which in turn is used to predict trade—in the real implementation we estimate the gravity model with a sample of more than 150 countries, and thus the trade pattern of any individual country is unlikely to affect the estimated gravity coefficients and therefore its predicted trade. Third, it is crucial for this procedure that the gravity coefficients (hopefully all 13 of them) vary appreciably across sectors. Below, after describing the data, we discuss the actual estimation results for our gravity regressions, and demonstrate that this is indeed the case.

Can we support the notion that the gravity coefficients would be expected to differ across sectors? Most of the research on the gravity model focuses on the effects of trade barriers on trade volumes. Thus, existing empirical research is most informative on whether we should expect significant variation in the coefficients on distance and common border variables, which are meant to proxy for bilateral trade barriers. Anderson and van Wincoop (2003, 2004) show that the estimated coefficients on distance and common border in the gravity model are a function of trade costs and the elasticity of substitution between product varieties within the sector. Thus, the distance coefficient will differ across sectors if trade costs and/or elasticities differ across industries.

What do we know about these? Available direct estimates of freight costs do indeed show large variation across sectors. Hummels (2001) compiles freight cost data, and shows that in 1994 these costs ranged between 1% and 27% across sectors in the U.S. Hummels (2001) further provides evidence that the variation in freight costs is strongly related to value-to-weight ratio. Not surprisingly, it is more expensive to ship goods that are heavy. In addition to the direct shipping costs, goods may differ in the cost of acquiring information about them. Rauch (1999) and Rauch and Trindade (2002) find that the volume of trade reacts differently to informational barriers in differentiated goods sectors compared to homogeneous ones. Thus, empirically it does seem to be the case that trade costs—both simple and informational—vary significantly across industries. When it comes to the estimated elasticity of substitution across sectors, a large number of studies utilizing various approaches reach quantitatively similar conclusions. Anderson and van Wincoop (2004) summarize existing evidence, which produces a range of estimated elasticities from three to ten across industries. In addition to trade costs and elasticities of substitution, Chaney (2006) demonstrates that the degree of firm heterogeneity, which varies across sectors, also has a significant effect on the sector-specific distance coefficient in the gravity regression.

To summarize, there are strong reasons to expect the coefficients in Eq. (17) to vary across sectors. But is this the case in practice? Estimating the gravity model using sector-level data is becoming increasingly common (see Rauch, 1999; Rauch and Trindade, 2002; Hummels, 2001; Evans, 2003, Feenstra, Markusen, and Rose, 2001, Lai and Trefler, 2002; Chaney, 2006). Though studies differ in the level of sectoral disaggregation and specifications, it is indeed typical to find significant variation in the gravity coefficients across sectors. For instance, Hummels (2001) finds that the distance coefficients vary from zero to -1.07 in his sample of sectors, while the coefficients on the common border variable range from positive and significant (as high as 1.22) to negative and significant (as low as -1.23). Chaney (2006) reports that it is common to find sector-specific distance coefficients ranging from -0.5 to -1.5. When we present the results of our own estimation, we will compare them to these studies.

Before moving on to data description and estimation, we discuss another potentially important issue, namely, the treatment of zero trade observations. In our sample, only about two-thirds of the possible exporter-importer pairs record positive exports, in any sector. At the level of individual industry, on average only a third of possible country-pairs have strictly positive exports, in spite of the coarse level of aggregation (28 sectors).[8] How does our estimation procedure deal with zero observations? As a preliminary point, because we develop an instrument for trade patterns rather than trade volumes, we can safely disregard country pairs in which no trade is observed in any sector. Following the large majority of gravity studies, we take logs of trade values, and thus our baseline gravity estimation procedure ignores zeros. Hence, we generate predicted values of trade only when the actual value is positive. One interpretation of our procedure is that it "predicts" zero trade when it observes zero trade. This strategy may contaminate the instrument if the estimated gravity coefficients would instead predict large trade values for some countries and sectors in which actual trade is zero.

We deal with this potential problem in two ways. First, instead of predicting in-sample, we use our estimated gravity model to predict out-of-sample. Thus, for those observations that are zero or missing and not used in the actual estimation, we still predict trade.[9] This completely eliminates the problem of predicting zeros "too well" in the baseline instrument, but may introduce an appreciable amount of noise if there are too many zeros that are ignored in the gravity estimation. In the second exercise, we instead estimate the gravity regression in levels using the Poisson pseudo-maximum likelihood estimator suggested by Santos Silva and Tenreyro (2006). The advantage of this procedure is that it actually includes zero observations in the estimation, and can predict both zero and nonzero trade values

[8]These two calculations make the common assumption that missing trade observations represent zeros (see Helpman, Melitz, and Rubinstein, 2006).

[9]More precisely, for a given exporter-importer pair, we predict bilateral exports out-of-sample for all 28 sectors as long as there are any bilateral exports for that country pair in at least one of the 28 sectors.

in-sample from the same estimated equation. Its disadvantage is that it assumes a particular likelihood function, and is not (yet) a standard way of estimating gravity equations found in the literature. We show that our results are fully robust to using these two alternative instruments. Indeed, it turns out that all three are quite close to each other, an indication that the zeros problem is not an important one for the main instrument.

The next section describes the data sources, and gives a snapshot of the data, focusing on the patterns of the external finance need of exports. Then, the following section documents the stages of constructing the instrument, and presents OLS and 2SLS regression results for a cross-section of countries, as well as fixed-effects panel OLS results.

4. Data description

International trade flows come from the World Trade Database described in Feenstra, Lipsey, Deng, Ma, and Mo (2005). This database contains bilateral trade flows between more than 150 countries, accounting for 98% of world trade, for the period 1962–2000. Trade flows are reported using the four-digit SITC Revision 2 classification. Since the variable of interest, $EFNX_{ct}$, is constructed using information on total exports from each country in each industry, we first aggregate bilateral flows across countries to obtain total exports for each country and manufacturing sector. We then convert the trade flows from SITC to the three-digit ISIC Revision 2 classification. This permits combining trade data with the information on external dependence from Rajan and Zingales.

For the purposes of estimating the gravity equation (17), we retain information on bilateral trade, converting it once again into the three-digit ISIC Rev. 2 classification. We merge bilateral trade data with geography variables taken from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). The CEPII database contains information on bilateral distance between the major cities for each pair of countries, whether two countries share a border, as well as information on land area and whether a country is landlocked.[10] Population data are taken from World Bank's World Development Indicators for the period 1970–1999.

The data on financial development come from the database originally compiled by Beck, Demirgüç-Kunt, and Levine (2000). This paper uses a version that has been checked for accuracy by Loayza and Ranciere (2006). Following the standard in the literature, the preferred indicator of financial development is credit by banks and other financial institutions to the private sector as a share of GDP ("private credit"). The controls in the estimation include overall trade openness (imports plus exports as a share of GDP) and Purchasing Power Parity (PPP) adjusted per capita GDP, both of which come from the Penn World Tables (Heston, Summers, and Aten, 2002). Finally, we use information on countries' legal origin as defined by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), extended to include the socialist legal system.

The final sample includes 96 countries and 30 years, 1970–1999. Appendix Table A1 presents data on the external financing need of exports, *EFNX*, for our sample of countries averaged over the 1970–1999 period. Aside from *EFNX*, the table contains information on the top two export sectors, the top two sectors' share of overall manufacturing exports, overall trade openness, private credit, as well as the sample means of these variables. Not surprisingly, the industrialized countries are at the top of the *EFNX* distribution, with

[10]The data set is available online at http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

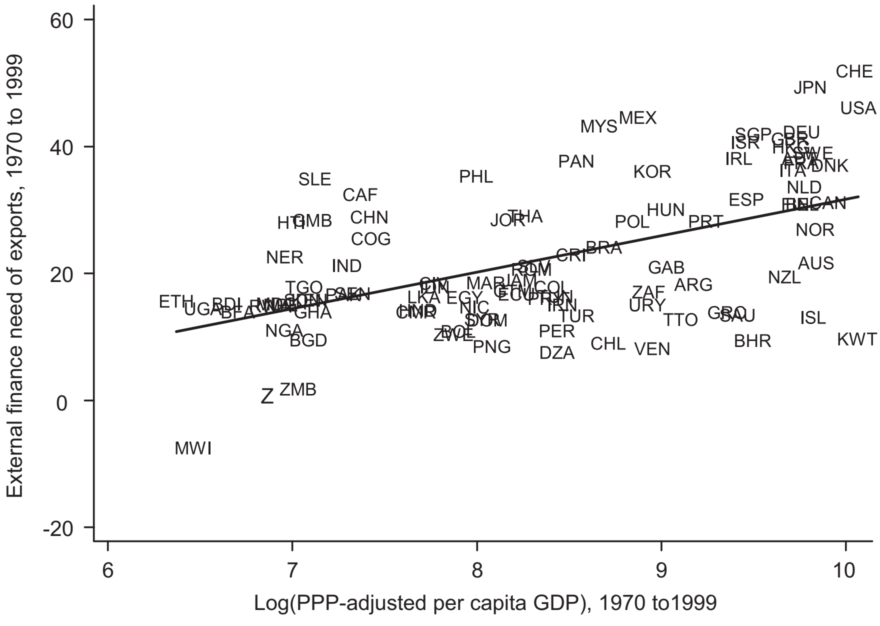

Fig. 2. Scatter plot of the average external finance need of exports (vertical axis) against average log of per capita income (horizontal axis) over the period 1970–1999. For each country, external finance need of exports is the sum over manufacturing industries of external finance dependence of the industry (Rajan and Zingales, 1998), weighted by that industry's share in total manufacturing exports. The scatter plot suggests a positive association between income and our measure of external finance need of exports.

Switzerland, Japan, and the United States as the top three. At the bottom of the distribution are natural resource exporters and some of the poorer countries that tend to specialize in Food Products. Only one country, Malawi, has negative *EFNX* in this period. Its main export industry is Tobacco, which has negative external finance dependence according to the Rajan-Zingales classification.

Fig. 2 plots the external finance need of exports against log of PPP-adjusted per capita income. It is clear that there is a positive association between income and *EFNX*, with a correlation of 0.47. Fig. 3 plots the external finance need of exports against overall trade openness. There is little relation between the two variables, and thus, as expected, *EFNX* measures something distinct from simple trade openness. Finally, Fig. 4 plots financial development against *EFNX*. There is a close positive relation between the two variables, with a correlation coefficient of 0.67, and a Spearman rank correlation of 0.51. The next section turns to a regression analysis of the relation between these two variables after presenting the construction of the instrument.

5. Results

5.1. Sector-level gravity estimation

In order to build the instrument, our procedure estimates Eq. (17) for each industry. The left-hand side variable is averaged over the period 1970–1999, allowing us to increase the

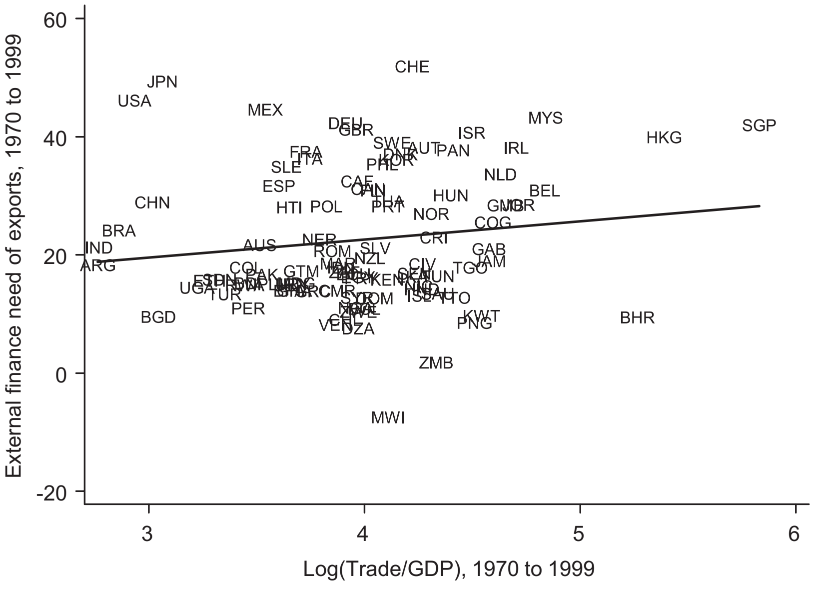

Fig. 3. Scatter plot of the average external finance need of exports (vertical axis) against average log of trade openness (horizontal axis) over the period 1970–1999. For each country, the measure of external finance need of exports is the sum over manufacturing industries of external finance dependence of the industry (Rajan and Zingales, 1998), weighted by that industry's share in total manufacturing exports. The absence of a systematic correlation between the two variables suggests that the external finance need of exports captures a dimension distinct from simple trade openness.

sample size as trade observations are sometimes missing in individual years. The results are reported in Appendix Table A2, which has a column for each individual sector. In the set of the sector-level regressions, the smallest number of observations is 5,011, and the largest is 12,750, with a mean of 8,523. The R^2's range from 0.17 to 0.36, with a mean of 0.29.

Because the right-hand side variables are the same in all regressions, the empirical strategy in this paper would only work if the gravity coefficients differ significantly across sectors. Thus, the first important question is whether or not there is much variation in the estimated coefficients. Fig. 5 presents, for each coefficient, the range of estimates across sectors. Below the plot for each coefficient, we report the minimum, median, and maximum values that the estimates take across all industries. It is apparent that the coefficient estimates differ a great deal between sectors. For instance, the distance coefficient pictured in the first plot ranges from -1.55 to -0.69. This is very close to what is reported in Chaney (2006). Note that several of the coefficients, such as the one on the common border dummy, actually range from positive to negative, a finding similar to Hummels (2001).

These estimates enable us to generate predicted exports as a share of GDP in each sector, as outlined in Section 3. Using this variable, we construct the predicted external finance need of exports. As a preview of the first-stage regressions in our 2SLS estimation, Fig. 6 plots the predicted $\widehat{EFNX}$ against the actual $EFNX$ for the same period, along with a 45-degree line. It is clear that while there is a strong positive relation between the two, it is not at all one-to-one. In particular, the procedure clearly underestimates the external

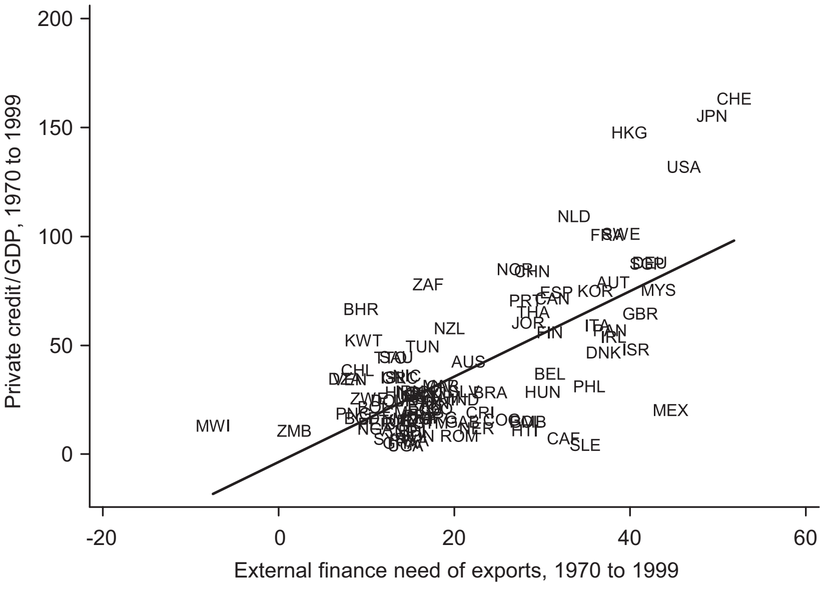

Fig. 4. Scatter plot of financial development measured by the average of the ratio of private credit to GDP (vertical axis) against the average external finance need of exports (horizontal axis) over the period 1970–1999. For each country, the measure of external finance need of exports is the sum over manufacturing industries of external finance dependence of the industry (Rajan and Zingales, 1998), weighted by that industry's share in total manufacturing exports. There is a clear positive association between external finance need of exports and financial development.

finance need of exports for countries in which it is unusually high, and overestimates it for countries in which it is low. This is comforting, as it indicates that this approach is not so mechanical that it reproduces the actual values perfectly. The next subsection describes the results of using this instrument to infer whether trade specialization has an effect on financial development.

5.2. *Financial development results*

5.2.1. *Cross-sectional specifications*

We start with the cross-sectional OLS regression, estimating Eq. (15) on the averages of the left-hand side and all of the controls over the entire time period 1970–1999.[11] The results are presented in Table 3, with robust standard errors in parentheses. Column 1 reports the bivariate regression of financial development on simple trade openness. While trade openness is significant at the 10% level, the relation is not close, with an R^2 of 0.05. When in column 2 we use $EFNX_c$ instead, the R^2 is 0.45, and the variable of interest is significant at the 1% level, with a *t*-statistic of 6.2. Column 3 includes both the trade openness and the external finance need of exports. The coefficient on *EFNX* is virtually unchanged. Columns 4 and 5 attempt to control for other determinants of financial

[11]Note that since we have an unbalanced panel, our procedure results in averaging over different numbers of years for different countries.

development. The first one includes the legal origin dummies from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), and the second per capita income. The latter is meant to capture a country's overall level of development. While in both of these specifications the coefficient on $EFNX_c$ is somewhat smaller, it nonetheless remains

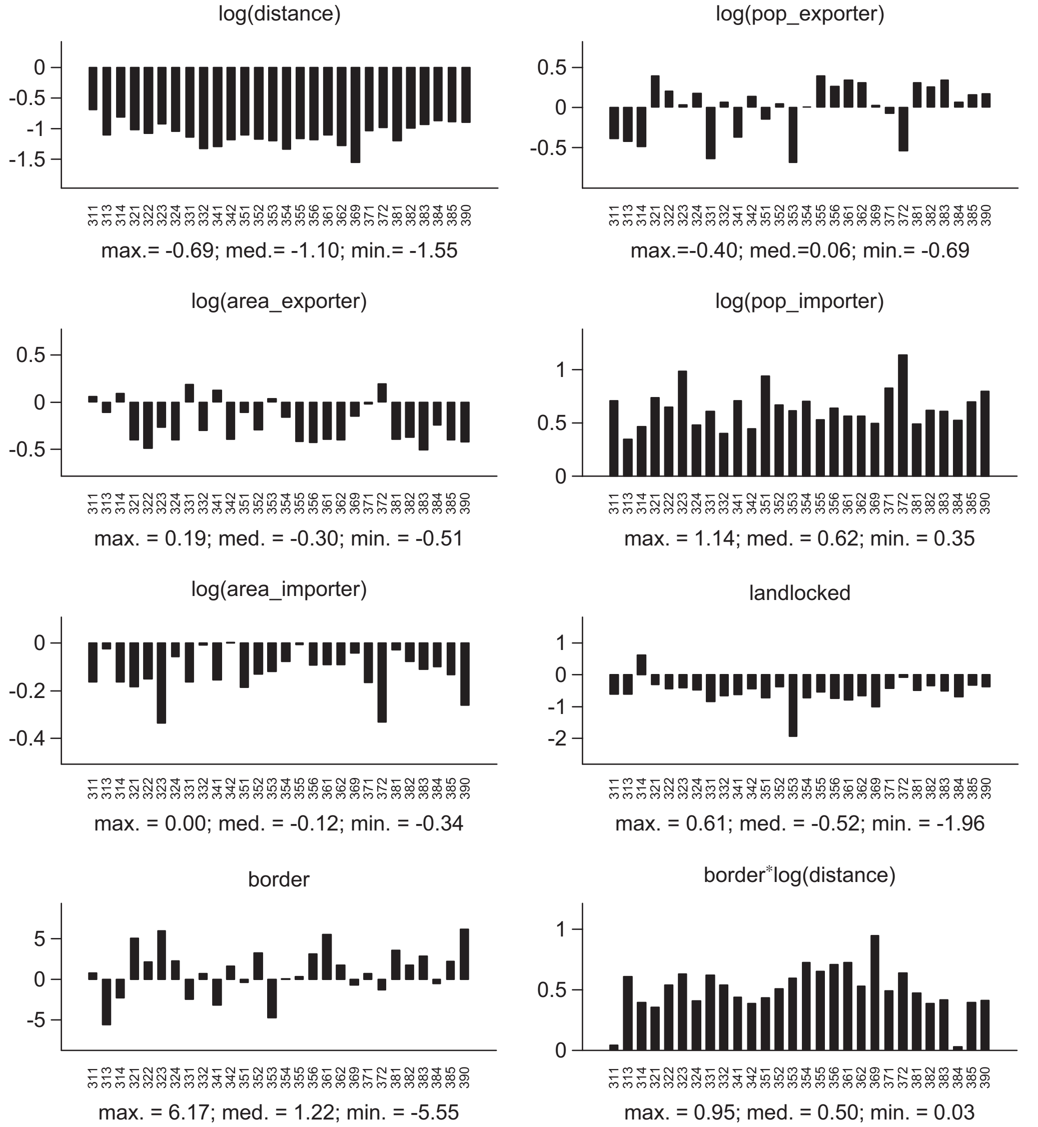

Fig. 5. Bar charts graph values of gravity coefficients for each industry. Each bar represents a three-digit ISIC Rev.2 industry (311–390). Maximum, median and minimum values of the coefficients across all industries are also indicated. Gravity coefficients are estimated by regressing the logarithm of industry-level bilateral export values as a share of GDP, averaged over the period 1970–1999, on the trade partners' geographic and demographic variables. The figure demonstrates a great deal of heterogeneity of gravity coefficients across sectors, permitting the construction of an instrument for trade patterns based on geographical variables.

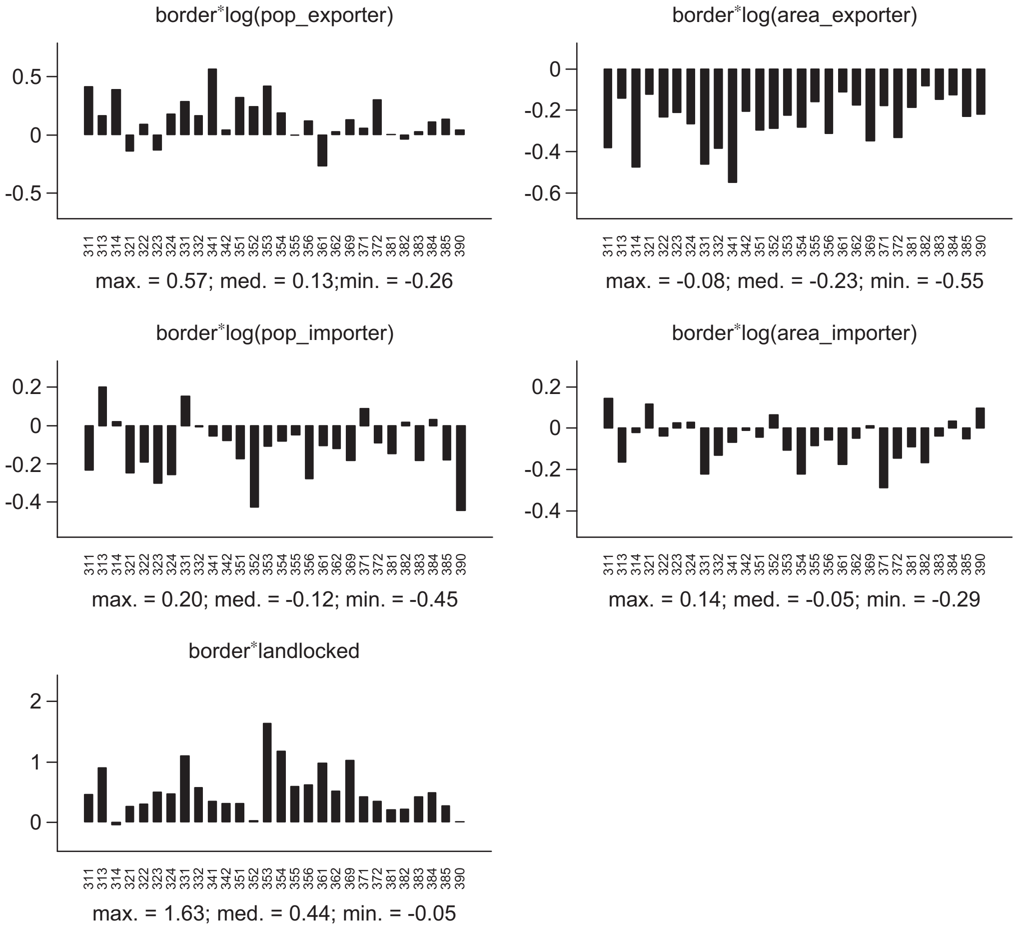

Fig. 5. (*Continued*)

significant at the 1% level. Finally, column 5 includes both the legal origin dummies and per capita income on the right-hand side. The coefficient on the variable of interest is further reduced somewhat, but preserves its significance at the 1% level. Note that with all of the controls included in the estimation, the adjusted R^2 is 0.67, only about one and a half times the R^2 of the bivariate regression with $EFNX_c$ as the only independent variable.

Endogeneity is clearly a first-order issue for these estimates. As shown in several empirical studies, a country's level of financial development influences trade patterns, and thus will affect the external finance need of exports variable. We deal with the simultaneity problem by adopting the instrumental variables approach described in Section 3. Table 4 presents the two-stage least squares (2SLS) estimates that use predicted external finance need of exports $\widehat{EFNX}_c$ as an instrument for actual $EFNX_c$. The top panel contains the full results of the second stage of the regression, while the bottom panel reports the coefficient on $\widehat{EFNX}_c$ from the first stage. Column 1 estimates a bivariate regression with $EFNX_c$ on

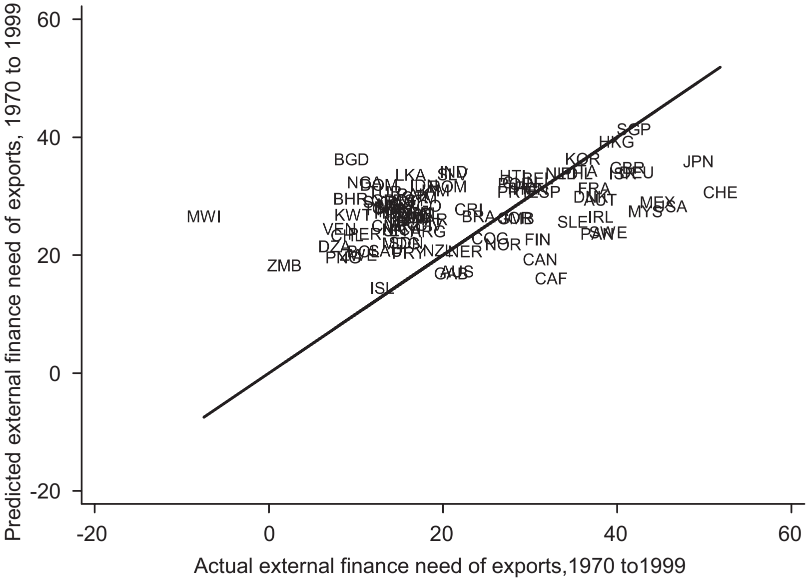

Fig. 6. Scatter plot of the predicted external finance need of exports (vertical axis) against its actual value, averaged over the period 1970–1999. The solid line is the 45° line. For each country, the measure of external finance need of exports is the sum over manufacturing industries of external finance dependence of the industry (Rajan and Zingales, 1998), weighted by that industry's share in total manufacturing exports. The predicted external finance need of exports is the sum over manufacturing industries of external finance dependence of the industry, weighted by its predicted share of total manufacturing exports. The predicted shares are obtained from industry-level gravity estimates. There is a strong positive association between the actual and the predicted values, but the predicted value tends to be lower than the actual for countries with unusually high actual value, and vice versa.

the right-hand side. The 2SLS coefficient is significant at the 1% level. It is about 20% higher in magnitude than the OLS coefficient. Columns 2–5 follow the sequence of Table 3. Adding overall trade openness to the specification leaves the coefficient of interest virtually unchanged. Including the legal origin dummies reduces the coefficient a bit, while controlling for per capita income lowers it further. In the most stringent specification, which includes openness, legal origin indicators, and per capita income, the coefficient of interest is about 20% lower in magnitude than the coefficient in column 1. It is nonetheless significant at the 1% level, with the t-statistic of 2.8.

The bottom panel of the table presents the first-stage results. The coefficient on the predicted external finance need of exports is close to, but slightly below, one. This supports the point illustrated in Fig. 6: while the instrument is positively correlated with the actual *EFNX*, the geography-based procedure will underpredict *EFNX* for countries in which it is unusually high, and overpredict it for countries in which it is unusually low. The coefficient on $\widehat{EFNX}_c$ is always significant at the 1% level. The weak instrument diagnostics are reported at the bottom of the table. The partial R^2 of the instrument ranges from 0.16 in column 1 to 0.12 in column 5, which includes all the controls. The F-statistic associated with the instrument takes values from 18.54 to 11.62. According to Stock and Yogo (2005), when there is only one instrument, it is a strong one when the F-statistic is above 10. Thus, we can safely conclude that 2SLS inference based on this instrument is indeed reliable.

Table 3
OLS cross-sectional regression results, averages, 1970–1999

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: Private credit/GDP						
EFNX		1.959***	1.902***	1.516***	1.237***	0.982***
		(0.314)	(0.335)	(0.327)	(0.298)	(0.263)
Log(Trade/GDP)	14.512*		8.68	8.423	2.618	2.455
	(8.537)		(6.365)	(6.386)	(5.925)	(5.576)
Log(Income)					14.747***	14.298***
					(2.147)	(2.290)
French Legal Origin				−7.23		−8.716**
				(5.668)		(4.345)
German Legal Origin				38.409**		29.042*
				(17.868)		(16.401)
Scandinavian Legal Origin				10.429		−7.28
				(11.072)		(11.630)
Socialist Legal Origin				−13.26		−14.285
				(16.771)		(19.320)
Constant	−17.19	−3.527	−36.857	−25.356	−121.638***	−107.459***
	(34.778)	(6.151)	(22.832)	(24.605)	(24.895)	(25.919)
Observations	96	96	96	96	96	96
R^2	0.05	0.45	0.46	0.55	0.61	0.67

Notes: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The dependent variable, Private credit/GDP, is credit to the private sector by banks and other financial institutions as a share of GDP; EFNX is the external finance need of exports; Log(Trade/GDP) is log of exports and imports as a share of GDP; Log(Income) is the log of PPP-adjusted real per capita income from the Penn World Tables; French, German, Scandinavian, and Socialist Legal Origin dummies are as defined originally by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). All of the variables are average values over 1970–1999. Variable definitions and sources are described in detail in the text.

The results are economically significant but not implausibly large. Using the most conservative coefficient estimates, the OLS results imply that moving from the 25th to the 75th percentile in the external finance need of exports raises the ratio of private credit to GDP by roughly 17 percentage points, equivalent to about 0.48 of the standard deviation of private credit. The most conservative 2SLS estimate implies that the same movement in $EFNX_c$ leads to a predicted change in private credit over GDP of about 33 percentage points, or almost one standard deviation of private credit observed in our sample.

Next, we present a number of robustness checks for these estimates. The first, and potentially most important, set of robustness checks deals with the construction of the instrument, namely the zero-trade observations problem described in Section 3. As discussed above, we address the zeros problem in two ways. First, we use the baseline gravity regressions to predict exports both in- and out-of-sample. The results of using the instrument constructed in this way are presented in column 6 of Table 4. It is clear that this alternative instrument produces the same results: the coefficient of interest is quite similar, and significant at the 1% level. The first-stage results reported in the bottom panel show that this alternative instrument is also a strong one. In the second exercise, we re-estimate the gravity models in levels using the Poisson pseudo-maximum likelihood estimator

Table 4
2SLS cross-sectional regression results, averages, 1970–1999

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Second stage							
Dep. var.: Private credit/GDP							
EFNX	2.420***	2.371***	2.201***	2.177***	1.975***	2.304***	2.059***
	(0.629)	(0.625)	(0.710)	(0.617)	(0.700)	(0.801)	(0.773)
Log(Trade/GDP)		7.242	6.244	2.715	1.754	1.522	1.694
		(5.880)	(5.454)	(5.375)	(4.811)	(4.864)	(4.813)
Log(Income)				9.319***	9.718***	8.199**	9.327***
				(3.523)	(3.354)	(3.765)	(3.599)
French Legal Origin			−6.849		−7.784	−7.475	−7.704
			(5.639)		(4.795)	(5.226)	(5.007)
German Legal Origin			22.832		13.361	8.162	12.024
			(21.050)		(18.135)	(18.892)	(18.654)
Scandinavian Legal Origin			5.127		−7.966	−8.193	−8.024
			(11.646)		(11.113)	(11.573)	(11.210)
Socialist Legal Origin			−17.784		−19.382	−21.071	−19.816
			(15.712)		(17.147)	(16.790)	(16.717)
Constant	−13.945	−41.707*	−31.054	−97.626***	−87.992***	−81.538***	−86.332***
	(14.054)	(23.495)	(23.993)	(25.364)	(25.472)	(27.172)	(25.588)
Panel B: First stage							
Dep. var.: EFNX							
Predicted EFNX	0.881***	0.866***	0.753***	0.769***	0.678***		
	(0.205)	(0.204)	(0.221)	(0.172)	(0.194)		
Predicted EFNX (out of sample)						0.607***	
						(0.181)	
Predicted EFNX (Poisson)							0.702***
							(0.216)
Partial F-test	18.54	18.03	11.62	19.89	12.20	11.29	10.58
Partial R^2	0.16	0.15	0.13	0.16	0.12	0.10	0.11
Observations	96	96	96	96	96	96	96

Notes: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The dependent variable, Private credit/GDP, is credit to the private sector by banks and other financial institutions as a share of GDP; EFNX is the external finance need of exports; Log(Trade/GDP) is the log of exports and imports as a share of GDP; Log(Income) is the log of PPP-adjusted real per capita income from the Penn World Tables; French, German, Scandinavian, and Socialist Legal Origin dummies are as defined originally by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). All of the variables are average values over 1970–1999. Predicted EFNX is the predicted external finance need of exports constructed by first estimating sector-level gravity equations, then predicting in-sample (columns (1)–(5)), or out-of-sample (column (6)), or estimating the gravity equation in levels using the Poisson pseudo-maximum likelihood estimator including the zero trade observations and predicting in-sample (Column (7)), and then generating predicted export shares for each country and sector. Variable definitions and sources are described in detail in the text.

suggested by Santos Silva and Tenreyro (2006). Because this procedure does not require taking logs of the left-hand side variable, the zero trade observations are included in the sample, thus making it possible to predict in-sample whether or not the actual trade value is zero. The results are reported column 7 of Table 4. Once again, the coefficient of interest is virtually unchanged from the baseline result, and still highly significant. The first-stage results are quite similar as well. Based on the similarity of the results across all three instruments, we conclude that the zeros problem is not an important one for the baseline instrument.[12]

We check the robustness of the results further by (i) including additional control variables, (ii) dropping outliers and groups of countries, and (iii) using alternative measures of financial development as the dependent variable. Table 5 presents the first set of checks. All of the columns are estimated using 2SLS and include the most stringent set of controls from the baseline results (per capita GDP, trade openness, and legal origin dummies), but do not report those coefficients to conserve space. Columns 1–5 add a number of variables that are expected to affect private credit. The first column controls for the inflation rate, defined as the average growth rate of CPI over the period, and obtained from the International Financial Statistics. Column 2 includes the number of years a country has been in a banking crisis. The banking crisis dates come from Demirgüç-Kunt and Detragiache (2005). The third column adds the Polity2 index, which is meant to capture the strength of democratic institutions within a country. This index is sourced from the Polity IV database.[13] Column 4 controls for the level of human capital by including the average years of secondary schooling in the population from the Barro and Lee (2000) database. Column 5 controls for the strength of legal institutions as they pertain to lending relationships, by including the legal lights index from the Getting Credit module of the World Bank's Doing Business Indicators (World Bank, 2006).[14] The next column controls for the rule of law index coming from the Governance Matters database of Kaufmann, Kraay, and Mastruzzi (2005). Unlike the Doing Business Indicators, which are de jure, the rule of law index is a de facto one, and thus it captures not only the legal framework, but

[12]We also attempted to implement an alternative instrumentation strategy that uses natural resource endowments as predictors of a country's manufacturing export structure, in the spirit of Almeida and Wolfenzon (2005). As an instrument for a country's production structure, these authors use binary indicators for whether a country produces a range of commodities, namely bananas, coffee, copper, maize, millet, oil, rice, rubber, silver, sugarcane, and wheat. This set of binary indicators was first used by Easterly and Levine (2003). Both Easterly and Levine (2003) and Almeida and Wolfenzon (2005) argue that while the quantity of a commodity produced is endogenous, whether or not a commodity is produced at all in a given country is determined by endowments, and thus is largely exogenous. It is plausible that these endowments affect the manufacturing export structure. For instance, if a country has iron ore deposits, it would be more likely to produce Iron and Steel and Fabricated Metal Products. Because our industries are all manufacturing while the binary variables in these two papers are for the most part agricultural commodities, we used the World Mineral Statistics Yearbooks to code a number of additional mining indicators: iron ore, natural gas, sulfur, bauxite, kaolin, coal, and gold. Using the available mineral indicators as instruments, the second-stage results we obtain are significant, even with the most stringent set of controls. However, with the exception of oil, none of the instruments are robustly significant in the first stage. In addition, the partial F-statistics are extremely low, never topping 1.75. With this many instruments, the F-statistics have to be an order of magnitude higher for us to be confident that the instruments are not weak. Because of this problem, we do not pursue this strategy further in the paper. All of the relevant results are available upon request.

[13]Using instead Polity IV's constraint on the executive variable, meant to capture the checks placed on the power of the executive branch of government, leaves the results unchanged.

[14]Alternatively, we used all of the other sub-indices in the Getting Credit module, such as the credit information index, public credit registry coverage index, and the private credit bureau coverage index. We also controlled for the indices capturing the legal institutions related to contract enforcement, such as the number of procedures, cost (in % of debt), and number of days required to collect on defaulted debt in the amount of 200% of the country's income per capita. All of these indices also come from the Doing Business Indicators database. The results were unchanged.

Table 5
Robustness: 2SLS with additional controls, averages, 1970–1999

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Second stage							
Dep. var.: Private credit/GDP							
EFNX	1.927***	1.997***	1.662**	1.817***	1.584**	1.796**	1.042*
	(0.699)	(0.712)	(0.721)	(0.680)	(0.635)	(0.776)	(0.542)
Inflation	0.054						0.141
	(1.049)						(1.096)
Banking crisis		−113.576					−40.282
		(90.251)					(99.988)
Polity index			−0.625				−1.109***
			(0.411)				(0.367)
Secondary education				2.462			0.775
				(5.220)			(5.310)
Legal rights index					1.632		0.325
					(1.436)		(1.708)
Rule of law						6.15	8.205*
						(5.676)	(4.787)
Constant	−69.701**	−81.849***	−89.836***	−91.054***	−81.053***	−55.09	−15.415
	(27.544)	(26.851)	(22.451)	(34.830)	(23.865)	(36.534)	(38.502)
Other controls	Log(Trade/GDP), Log(Income), Legal Origin dummies						
Panel B: First stage							
Dep. var.: EFNX							
Predicted EFNX	0.689***	0.671***	0.566***	0.702***	0.714***	0.599***	0.745***
	(0.195)	(0.195)	(0.213)	(0.214)	(0.216)	(0.201)	(0.264)
Observations	90	96	94	87	90	96	74

Notes: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The dependent variable, Private credit/GDP, is credit to the private sector by banks and other financial institutions as a share of GDP; EFNX is the external finance need of exports; Log(Trade/GDP) is the log of exports and imports as a share of GDP; Log(Income) is the log of PPP-adjusted real per capita income from the Penn World Tables; French, German, Scandinavian, and Socialist Legal Origin dummies are as defined originally by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). Inflation is the growth rate of CPI; Banking crisis is the number of years a country has been in a banking crisis during the period 1970–1999; Polity index is an indicator of strength of democratic institutions; Secondary education is the average years of secondary schooling in the total population; Legal rights index is the quality of the legal environment as it pertains to lending relationships; Rule of law is an index of rule of law (quality of contract enforcement and security of property rights). All of the variables are average values over 1970–1999. Predicted EFNX is the predicted external finance need of exports constructed by first estimating sector-level gravity equations, and then generating predicted export shares for each country and sector. Variable definitions and sources are described in detail in the text.

also the quality of enforcement.[15] Finally, column 7 includes all of the above regressors together. The coefficient of interestis remarkably robust to the inclusion of all of the additional controls. Even when all of these are used at once, the coefficient is still significant, in spite of the reduction in sample size from 96 to 74 countries.

[15]The results are robust to using other de facto indices from the Governance Matters database, such as corruption and regulatory quality.

Next, we establish that the results are not sensitive to the particular sample used in the baseline estimation. Once again, Table 6 reports the 2SLS estimates with the most stringent set of controls throughout. The first column in Table 6 presents the results of using *EFNX* constructed after dropping the top two and bottom two sectors in the distribution of dependence on external finance. This ensures that the results are not an artifact of outlier sectors, such as Tobacco, having too much of an effect on *EFNX*.[16] The coefficient estimate is slightly larger, and still highly significant. The next three columns drop country groups. In order to check whether the results are driven exclusively by the developed countries, column 2 presents estimates based on non-OECD countries only.[17] The economies sometimes called "Asian tigers" experienced some of the fastest growth of both trade and financial development in the sample period. Column 3 excludes the Asian tigers, to determine whether the results are driven by these particular countries.[18] It is clear that the results are not due to Asian tigers. In fact, the coefficient estimates from this subsample are virtually identical to the full sample coefficients. The next column drops the sub-Saharan African countries, which are often those with the lowest *EFNX*. The results are not sensitive to the exclusion of this region.[19]

Columns 5–7 estimate the model by individual decade: the 1970s, 1980s, and the 1990s. The results are robust across decades, though the coefficient estimates are sometimes smaller in magnitude, and are significant at the 5% level. Note that the sample size across individual decades is sometimes lower than the full sample size by as much as 10%.

Table 7 presents the results of using alternative measures of financial development.[20] Column 1 uses the ratio of liquid liabilities to GDP instead of private credit. Column 2 uses the ratio of stock market value to GDP, while column 3 uses stock market capitalization to GDP. Column 4 presents the results of using the stock market turnover ratio, defined as the value of total shares traded divided by the average real market capitalization, as the dependent variable. Unlike stock market value or capitalization to GDP, which are measures of market size, turnover is a measure of stock market activity. Finally, we would like to use a measure of the quality of the financial system rather than its size. Column 4 reports the outcome of using the net interest margin as the dependent variable. The net interest margin is defined as the accounting value of banks' net interest revenue as a share of interest-bearing assets.[21] The results are robust to all of the alternative measures of financial development.

5.2.2. *Panel specifications*

The cross-sectional results clearly point to an important role of trade in the development of a country's financial system. We would like to go beyond the cross-section, however,

[16]Dropping instead the top and bottom 5% of countries in the distribution of *EFNX* leaves the results unchanged.

[17]OECD countries in our sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. We thus exclude the newer members of the OECD, such as Korea and Mexico.

[18]In our sample, we consider Asian tigers to be Indonesia, Korea, Malaysia, Philippines, and Thailand.

[19]The results are also robust to dropping Latin America and the Caribbean, and the Middle East and North Africa regions.

[20]All of the alternative measures come from the 2005 version of the Beck, Demirgüç-Kunt, and Levine (2000) database.

[21]Unlike all of the other measures, a low value of net interest margin indicates a high quality of the financial system.

Table 6
Robustness: 2SLS, outliers and subsamples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	No outliers (1970–1999)	No OECD (1970–1999)	No East Asian Tigers (1970–1999)	No Sub-Saharan Africa (1970–1999)	Entire sample (1970–1979)	Entire sample (1980–1989)	Entire sample (1990–1999)
Panel A: Second stage							
Dep. var.: Private credit/GDP							
EFNX	2.390**	2.032**	2.155***	1.557***	0.990**	1.211**	2.114**
	(0.952)	(0.912)	(0.762)	(0.512)	(0.471)	(0.575)	(0.965)
Constant	−101.495***	−92.540***	−85.207***	−104.744***	−67.181***	−94.298***	−102.396***
	(26.265)	(28.396)	(26.569)	(30.517)	(17.849)	(23.860)	(38.712)
Other controls	Log(Trade/GDP), Log(Income), Legal Origin dummies						
Panel B: First stage							
Dep. var.: EFNX							
Predicted EFNX	0.690***	0.628***	0.658***	1.012***	0.726***	0.709***	0.615**
	(0.237)	(0.232)	(0.200)	(0.179)	(0.138)	(0.207)	(0.267)
Observations	96	73	91	72	85	87	90

Notes: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The dependent variable, Private credit/GDP, is credit to the private sector by banks and other financial institutions as a share of GDP; EFNX is the external finance need of exports; Log(Trade/GDP) is the log of exports and imports as a share of GDP; Log(Income) is the log of PPP-adjusted real per capita income from the Penn World Tables; French, German, Scandinavian, and Socialist Legal Origin dummies are as defined originally by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). Predicted EFNX is the predicted external finance need of exports constructed by first estimating sector-level gravity equations and then generating predicted export shares for each country and sector. Column (1): EFNX constructed after dropping the two most and two least financially dependent sectors. Columns (2)–(4): regressions among non-OECD countries, excluding Asian Tigers and excluding Sub-Saharan countries, respectively. Columns (5)–(7): values are 10-year averages over the specified periods. All of the variables are average values over 1970–1999 unless stated otherwise. Variable definitions and sources are described in detail in the text.

Table 7
Robustness: 2SLS with other measures of financial development, averages, 1970–1999

	(1)	(2)	(3)	(4)	(5)
Dep.var.:	M2/GDP	Stock market value traded/GDP	Stock market capitalization/GDP	Stock market turnover/GDP	Net interest margin
Panel A: Second stage					
EFNX	2.350***	1.095***	1.408**	2.227***	−0.126*
	(0.884)	(0.408)	(0.660)	(0.581)	(0.072)
Constant	−75.382***	−34.626**	−112.015***	97.603**	16.364***
	(24.616)	(17.621)	(27.168)	(44.739)	(3.980)
Other controls	Log(Trade/GDP), Log(Income), Legal Origin dummies				
Panel B: First stage					
Dep. var.: EFNX					
Predicted EFNX	0.491***	0.886***	0.801***	0.886***	0.729***
	(0.130)	(0.142)	(0.135)	(0.142)	(0.134)
Observations	124	92	100	92	121

Notes: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Dependent variables, Liquid liabilities/GDP (M2/GDP), Stock market value, capitalization, and turnover as a share of GDP, and the Net interest margin, are alternative indicators of financial development; EFNX is the external finance need of exports; Log(Trade/GDP) is the log of exports and imports as a share of GDP; Log(Income) is the log of PPP-adjusted real per capita income from the Penn World Tables; French, German, Scandinavian, and Socialist Legal Origin dummies are as defined originally by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). All of the variables are average values over 1970–1999, although some of the alternative financial development measures start later. Predicted EFNX is the predicted external finance need of exports constructed by first estimating sector-level gravity equations, and then generating predicted export shares for each country and sector. Variable definitions and sources are described in detail in the text.

and exploit the time-series dimension of the data. To this end we estimate the full panel specification given by Eq. (16) on a sample of nonoverlapping five-year averages of all the variables from 1970–1974 to 1995–1999, as well as on ten-year averages for the 1970s, 1980s, and 1990s. In order to identify the effect from the time variation in the variable of interest, all of the specifications include a full set of country and time fixed effects. This allows us to control for unobserved country-specific time-invariant characteristics, as well as changes over time in the global environment, such as the secular increase in trade or capital flows over time. Unfortunately, the instrument is not available in the panel with fixed effects, and thus we estimate these specifications using only OLS.

Table 8 presents the results. Columns 1–3 report estimates using the five-year averages. All of the specifications use the time-varying controls from the cross-sectional regression, namely income per capita and trade openness. The three columns include additional time-varying controls, such as inflation, secondary schooling, and banking crises. (The sources of these variables are described above.) Even with the full set of time and country effects, the coefficients are statistically significant at the 1% level, with t-statistics in the range of 3.4–4.

Table 8
OLS panel regression results with additional controls, 5 and 10 year averages, 1970–1999

	5-year averages			10-year averages		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: Private credit/GDP						
EFNX	0.592***	0.454***	0.451***	0.693***	0.535**	0.532**
	(0.148)	(0.135)	(0.126)	(0.212)	(0.226)	(0.219)
Log(Trade/GDP)	−7.540**	−7.576**	−6.228**	−9.889*	−10.419**	−8.171
	(3.377)	(3.050)	(2.854)	(5.896)	(5.080)	(4.970)
Log(Income)	38.038***	39.768***	36.425***	39.536***	42.240***	37.570***
	(4.485)	(4.656)	(3.836)	(6.095)	(6.122)	(5.242)
Inflation	−0.656**			−0.318		
	(0.267)			(0.647)		
Secondary education		−3.247			−4.598	
		(2.988)			(3.891)	
Banking crisis			1.554			−4.461
			(3.280)			(5.800)
Time fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	457	478	525	238	246	270
Number of countries	90	87	96	90	87	96
R^2	0.90	0.90	0.90	0.92	0.92	0.92

Notes: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The dependent variable, Private credit/GDP, is credit to the private sector by banks and other financial institutions as a share of GDP; EFNX is the external finance need of exports; Log(Trade/GDP) is the log of exports and imports as a share of GDP; Log(Income) is the log of PPP-adjusted real per capita income from the Penn World Tables; Inflation is the growth rate of CPI; Banking crisis is the number of years a country has been in a banking crisis during the 5- or 10-year period; Secondary education is the average years of secondary schooling in the total population; Each specification includes the full set of country and time fixed-effects. All of the variables are 5-year averages for the periods 1970–1974, 1975–1979, ... 1995–1999 (columns (1)–(3)) or 10-year averages for the periods 1970–1979, 1980–1989, 1990–1999 (columns (4)–(6)). Variable definitions and sources are described in detail in the text.

Columns 4–6 present the corresponding results for the panel of ten-year averages. The set of controls is identical to those in the five-year panel specifications. The ten-year panel specification has much fewer degrees of freedom, as there are now at most three observations per country. Nonetheless, the coefficient of interest is still highly significant, with t-statistics between 2.4 and 3.3. Note that the use of fixed effects results in an adjusted-R^2 of 0.9 and above, indeed the R^2 of the regression with no independent variables aside from the fixed effects is 0.84 in both the five-year and the ten-year panels. Thus, while the cross-sectional variation across countries accounts for the overwhelming majority of the variation in financial development, we still detect the within-country effect of the time variation in the external finance need of exports quite clearly in these regressions.

The quantitative effect of the variable of interest as estimated in the panel specifications is economically significant but more modest than the cross-sectional magnitudes. This is not surprising given that the panel specifications exploit only the time variation in the variables of interest within a country, while the bulk of the variation in financial development is across countries. The most conservative OLS coefficient implies that moving from the 25th to the 75th percentile of $EFNX_{ct}$ results in an increase in private credit over GDP of eight percentage points, or about 0.22 of a standard deviation of private credit to GDP observed in the data.

The panel results are fully robust to a similar battery of checks to the one performed on the cross-section: dropping outliers and individual regions, and using alternative measures of financial development as the dependent variable. The results are not reported here in order to avoid unnecessary repetition.

6. Conclusion

It is often argued that institutional quality in general and financial development in particular are shaped largely by exogenous historical events. It is then natural to think of the financial system as an endowment, and therefore differences in financial development as sources of comparative advantage in trade. This paper takes a different view by asking instead whether trade patterns in turn affect countries' financial development. This is an important question. There is a great deal of evidence that financial development is a key determinant of economic growth (see Levine, 2005, for a survey). On the other hand, the debate about the effect of trade on growth is far from settled.[22] This paper demonstrates that trade affects financial development directly, a mechanism for the impact of trade on growth that has not previously been examined.

We first illustrate our main idea by building a model in which financial development—both the financial system's size and quality—is determined by demand for external finance in production. After opening to trade, the country that produces and exports financially dependent goods experiences financial deepening, as demand for external finance inside that country increases. On the other hand, the country that imports financially dependent goods will see its financial system deteriorate, making access to finance more difficult for domestic firms.

We then demonstrate this effect empirically by constructing a measure of a country's external finance need of exports, and relating it to financial development in a large sample of countries. Consistent with the model's predictions, countries that export financially dependent

[22] Recent papers that argue for a positive impact of trade on growth include, but are not limited to, Frankel and Romer (1999) and Alcalá and Ciccone (2004). For the opposing view, see Rodriguez and Rodrik (2000), Rodrik, Subramanian, and Trebbi (2004), and Rigobon and Rodrik (2005).

goods realize higher levels of financial development than countries whose exports are primarily in sectors which do not rely on external finance. To ensure that we are picking up the effect of trade on financial development—as in the theoretical model—and not vice versa, we construct an instrument for countries' trade patterns based on geography. The empirical results thus provide robust support for the theory.

The magnitude of the estimated effect is economically significant. However, these estimates do not imply that trade volumes or trade patterns are the predominant determinant of financial development. Clearly, other variables, such as endowments, legal systems, institutions, or the overall level of development are important as well. Rather, what this paper shows is that the demand for external finance coming from exports differs a great deal across countries, and has an appreciable impact on observed levels of financial development.

Appendix A

Proof of Lemma 1. γ^t is a random variable with the following probability distribution:

$$\gamma^t = \begin{cases} 0 & \text{with probability } \frac{1}{2^{\eta L}} \sum_{k=0}^{Int\left(\frac{\eta L+1}{2}\right)} \binom{\eta L}{k} \\ 1 - \frac{2k}{\eta L} & \text{with probability } \frac{1}{2^{\eta L}} \binom{\eta L}{k} \text{ for } 0 \leqslant k \leqslant Int\left(\frac{\eta L - 1}{2}\right). \end{cases}$$

This implies that

$$\gamma(\eta L) \equiv \mathrm{E}(\gamma^t) = \frac{1}{2^{\eta L}} \begin{pmatrix} \eta L - 1 \\ Int\left(\frac{\eta L - 1}{2}\right) \end{pmatrix}.$$

It is easy to check that $\gamma(1) = 1/2$ and $\lim_{\eta L \to \infty} \gamma(\eta L) = 0$. □

Appendix B

External finance needs and sector level gravity estimation results are given in Tables A1 and A2.

Table A1
External finance needs of exports, financial development, and trade openness, average 1970–1999

Country	EFNX	Largest export sector	Second-largest export sector	Share of two largest sectors	Private credit/ GDP	Trade/ GDP
Switzerland	51.88	Machinery, except electrical	Industrial chemicals	0.37	163.35	68.10
Japan	49.35	Transport equipment	Machinery, except electrical	0.44	155.46	21.37
United States	46.12	Machinery, except electrical	Transport equipment	0.42	131.96	18.79
Mexico	44.60	Machinery, electric	Transport equipment	0.39	20.25	34.45

Table A1 (*continued*)

Country	EFNX	Largest export sector	Second-largest export sector	Share of two largest sectors	Private credit/ GDP	Trade/ GDP
Malaysia	43.22	Machinery, electric	Food products	0.48	75.38	126.54
Germany	42.26	Machinery, except electrical	Transport equipment	0.40	87.98	50.03
Singapore	41.94	Petroleum refineries	Machinery, electric	0.50	87.58	340.44
United Kingdom	41.16	Machinery, except electrical	Transport equipment	0.35	64.59	52.47
Israel	40.66	Other manufactured products	Industrial chemicals	0.36	48.13	89.91
China, P.R.:Hong Kong	39.90	Wearing apparel, except footwear	Machinery, electric	0.46	147.77	218.94
Sweden	38.96	Transport equipment	Machinery, except electrical	0.34	101.10	62.02
Ireland	38.15	Food products	Machinery, except electrical	0.41	53.97	110.18
Austria	38.08	Machinery, except electrical	Iron and steel	0.25	78.88	71.91
Panama	37.72	Transport equipment	Other manufactured products	0.46	56.86	82.55
France	37.40	Transport equipment	Machinery, except electrical	0.33	100.63	41.58
Denmark	36.97	Food products	Machinery, except electrical	0.44	46.65	64.47
Italy	36.28	Machinery, except electrical	Transport equipment	0.30	59.14	42.44
Korea	36.08	Wearing apparel, except footwear	Machinery, electric	0.34	74.85	63.22
Philippines	35.34	Food products	Machinery, electric	0.49	31.27	59.31
Sierra Leone	34.88	Other manufactured products	Industrial chemicals	0.75	4.39	38.00
Netherlands	33.62	Food products	Industrial chemicals	0.31	109.35	102.64
Central African Rep.	32.42	Other manufactured products	Food products	0.79	7.22	52.74
Spain	31.62	Transport equipment	Machinery, except electrical	0.30	74.22	36.67
Canada	31.14	Transport equipment	Paper and products	0.45	71.51	55.47
Belgium	30.89	Transport equipment	Industrial chemicals	0.27	36.86	125.80
Finland	30.87	Paper and products	Machinery, except electrical	0.43	55.96	56.78
Hungary	30.05	Food products	Wearing apparel, except footwear	0.26	28.71	81.54
Thailand	28.98	Food products	Machinery, electric	0.45	65.11	60.98
China, P.R.: Mainland	28.84	Textiles	Wearing apparel, except footwear	0.34	83.92	20.44
Jordan	28.39	Industrial chemicals	Other chemicals	0.40	60.46	111.52
Gambia, The	28.35	Food products	Other manufactured products	0.94	15.04	105.09
Poland	28.18	Food products	Machinery, except electrical	0.24	14.86	45.73

Table A1 (*continued*)

Country	EFNX	Largest export sector	Second-largest export sector	Share of two largest sectors	Private credit/ GDP	Trade/ GDP
Portugal	28.14	Wearing apparel, except footwear	Textiles	0.29	70.50	60.76
Haiti	28.00	Wearing apparel, except footwear	Food products	0.54	10.89	38.49
Norway	26.92	Non-ferrous metals	Industrial chemicals	0.31	84.89	74.51
Congo, Republic of	25.43	Wood products, except furniture	Other manufactured products	0.53	15.82	99.17
Brazil	24.07	Food products	Industrial chemicals	0.46	28.30	17.46
Costa Rica	22.94	Food products	Wearing apparel, except footwear	0.67	19.11	75.22
Niger	22.52	Industrial chemicals	Food products	0.92	11.87	44.29
Australia	21.62	Food products	Industrial chemicals	0.49	42.53	33.57
India	21.24	Textiles	Wearing apparel, except footwear	0.35	25.12	15.94
El Salvador	21.10	Food products	Wearing apparel, except footwear	0.71	28.91	57.31
Gabon	20.90	Petroleum refineries	Industrial chemicals	0.60	14.92	97.26
Romania	20.60	Petroleum refineries	Wearing apparel, except footwear	0.29	8.43	47.06
New Zealand	19.42	Food products	Textiles	0.67	57.84	55.96
Jamaica	18.94	Industrial chemicals	Wearing apparel, except footwear	0.68	26.37	97.66
Morocco	18.48	Wearing apparel, except footwear	Food products	0.46	31.31	48.28
Côte d'Ivoire	18.37	Food products	Wood products, except furniture	0.83	31.11	71.42
Argentina	18.26	Food products	Leather products	0.58	16.89	15.85
Togo	17.84	Food products	Petroleum refineries	0.63	21.06	89.22
Indonesia	17.80	Petroleum refineries	Food products	0.40	23.57	49.03
Colombia	17.79	Food products	Petroleum refineries	0.57	28.54	31.55
Guatemala	17.24	Food products	Wearing apparel, except footwear	0.76	14.57	40.72
South Africa	17.02	Non-ferrous metals	Iron and steel	0.44	77.96	49.77
Senegal	16.77	Food products	Industrial chemicals	0.84	26.43	68.85
Ecuador	16.68	Food products	Petroleum refineries	0.76	20.53	51.94
Pakistan	16.59	Textiles	Food products	0.69	22.88	33.91
Tunisia	16.38	Wearing apparel, except footwear	Industrial chemicals	0.51	49.50	76.75
Sri Lanka	16.25	Wearing apparel, except footwear	Other manufactured products	0.57	16.79	68.18
Egypt	16.17	Textiles	Petroleum refineries	0.52	26.69	52.83
Paraguay	16.06	Food products	Wood products, except furniture	0.70	17.70	53.70
Kenya	15.74	Food products	Petroleum refineries	0.66	27.96	60.63
Sudan	15.74	Food products	Textiles	0.78	8.41	27.88
Ethiopia	15.62	Food products	Leather products	0.85	15.70	26.64
Madagascar	15.20	Food products	Wearing apparel, except footwear	0.73	16.37	39.83

Table A1 (*continued*)

Country	EFNX	Largest export sector	Second-largest export sector	Share of two largest sectors	Private credit/ GDP	Trade/ GDP
Burundi	15.16	Food products	Other manufactured products	0.95	10.78	31.79
Nepal	15.02	Textiles	Food products	0.65	10.20	33.84
Uruguay	14.99	Food products	Textiles	0.53	24.66	39.04
Iran, I.R. of	14.96	Textiles	Petroleum refineries	0.73	28.83	39.29
Rwanda	14.85	Food products	Non-ferrous metals	0.96	6.25	31.35
Nicaragua	14.63	Food products	Wearing apparel, except footwear	0.79	35.99	70.19
Uganda	14.42	Food products	Non-ferrous metals	0.96	4.04	25.14
Honduras	14.12	Food products	Wearing apparel, except footwear	0.69	28.30	71.26
Cameroon	13.92	Food products	Wood products, except furniture	0.64	19.23	48.05
Burkina Faso	13.91	Food products	Leather products	0.66	14.06	38.50
Ghana	13.87	Non-ferrous metals	Food products	0.64	5.20	39.43
Greece	13.79	Wearing apparel, except footwear	Food products	0.34	34.98	43.02
Saudi Arabia	13.39	Petroleum refineries	Industrial chemicals	0.82	44.51	76.68
Turkey	13.32	Wearing apparel, except footwear	Textiles	0.40	15.37	28.51
Iceland	13.00	Food products	Non-ferrous metals	0.77	35.26	70.35
Trinidad and Tobago	12.72	Petroleum refineries	Industrial chemicals	0.77	44.46	82.78
Syrian Arab Republic	12.69	Petroleum refineries	Food products	0.54	7.03	52.72
Dominican Republic	12.63	Food products	Wearing apparel, except footwear	0.62	24.61	57.17
Nigeria	11.01	Petroleum refineries	Food products	0.64	11.66	52.37
Peru	10.96	Non-ferrous metals	Food products	0.71	13.89	31.84
Bolivia	10.87	Non-ferrous metals	Food products	0.71	21.73	54.61
Zimbabwe	10.31	Iron and steel	Food products	0.52	25.54	53.17
Kuwait	9.68	Petroleum refineries	Industrial chemicals	0.85	52.19	93.87
Bangladesh	9.50	Textiles	Wearing apparel, except footwear	0.79	16.49	20.98
Bahrain, Kingdom of	9.40	Petroleum refineries	Non-ferrous metals	0.83	66.58	193.62
Chile	8.98	Non-ferrous metals	Food products	0.73	38.55	49.91
Papua New Guinea	8.49	Non-ferrous metals	Food products	0.93	18.66	90.82
Venezuela, Rep. Bol.	8.12	Petroleum refineries	Industrial chemicals	0.79	34.37	47.79
Algeria	7.52	Petroleum refineries	Beverages	0.82	34.56	53.05
Zambia	1.77	Non-ferrous metals	Tobacco	0.96	10.79	76.20
Malawi	−7.48	Tobacco	Food products	0.76	13.06	60.97
Sample average	22.57				40.67	62.94

Notes: *EFNX* is the external finance need of exports. Largest and Second largest export sectors are the sectors with the highest and second highest share in the total manufacturing exports from each country. Share of the largest two sectors is the total share of the largest two sectors in the total manufacturing exports from each country; Private credit/GDP is the ratio of credit to the private sector by banks and other financial institutions to GDP. Trade/GDP is total exports plus imports as a share of GDP.

Table A2
Sector-level gravity estimation results

Sector (3-digit ISIC Revision 2)[a]	(1) 311	(2) 313	(3) 314	(4) 321	(5) 322	(6) 323	(7) 324	(8) 331	(9) 332	(10) 341
Dep. var.: Log of bilateral exports/GDP										
log(distance)	−0.692***	−1.107***	−0.812***	−1.018***	−1.075***	−0.917***	−1.041***	−1.144***	−1.336***	−1.303***
	(0.029)	(0.037)	(0.050)	(0.028)	(0.037)	(0.037)	(0.040)	(0.037)	(0.037)	(0.034)
log(pop_exporter)	−0.396***	−0.431***	−0.497***	0.394***	0.202***	0.035	0.176***	−0.642***	0.065**	−0.375***
	(0.020)	(0.030)	(0.040)	(0.021)	(0.028)	(0.030)	(0.033)	(0.027)	(0.027)	(0.026)
log(area_exporter)	0.061***	−0.113***	0.095***	−0.405***	−0.496***	−0.262***	−0.403***	0.188***	−0.300***	0.127***
	(0.016)	(0.023)	(0.031)	(0.015)	(0.021)	(0.021)	(0.023)	(0.022)	(0.019)	(0.019)
log(pop_importer)	0.705***	0.346***	0.465***	0.735***	0.649***	0.987***	0.478***	0.608***	0.398***	0.706***
	(0.020)	(0.028)	(0.039)	(0.020)	(0.026)	(0.027)	(0.030)	(0.027)	(0.027)	(0.025)
log(area_importer)	−0.163***	−0.024	−0.164***	−0.183***	−0.150***	−0.337***	−0.059***	−0.164***	−0.007	−0.154***
	(0.015)	(0.021)	(0.028)	(0.015)	(0.020)	(0.022)	(0.022)	(0.020)	(0.021)	(0.020)
landlocked	−0.632***	−0.624***	0.615***	−0.301***	−0.438***	−0.407***	−0.478***	−0.855***	−0.681***	−0.645***
	(0.050)	(0.077)	(0.102)	(0.052)	(0.073)	(0.076)	(0.084)	(0.071)	(0.069)	(0.062)
border	0.81	−5.554***	−2.311	5.124***	2.148	5.979***	2.283	−2.504	0.72	−3.202
	(1.413)	(2.104)	(2.469)	(1.424)	(2.065)	(1.923)	(2.181)	(2.115)	(2.207)	(2.071)
border*log(distance)	0.044	0.611***	0.395	0.358*	0.538**	0.631**	0.409**	0.624**	0.539*	0.439
	(0.205)	(0.214)	(0.244)	(0.185)	(0.227)	(0.256)	(0.235)	(0.289)	(0.276)	(0.286)
border*log(pop_exporter)	0.412***	0.165	0.388**	−0.145	0.09	−0.133	0.178	0.285*	0.166	0.568***
	(0.114)	(0.141)	(0.176)	(0.107)	(0.134)	(0.134)	(0.149)	(0.161)	(0.148)	(0.146)
border*log(area_exporter)	−0.383***	−0.14	−0.472***	−0.122	−0.233*	−0.210*	−0.268*	−0.459***	−0.387***	−0.547***
	(0.120)	(0.124)	(0.160)	(0.101)	(0.128)	(0.117)	(0.153)	(0.165)	(0.144)	(0.141)
border*log(pop_importer)	−0.234**	0.201	0.02	−0.247**	−0.195	−0.301**	−0.256	0.154	−0.008	−0.057
	(0.105)	(0.137)	(0.179)	(0.117)	(0.143)	(0.129)	(0.160)	(0.149)	(0.138)	(0.154)
border*log(area_importer)	0.145	−0.166	−0.025	0.117	−0.039	0.025	0.03	−0.222	−0.133	−0.071
	(0.111)	(0.142)	(0.151)	(0.120)	(0.148)	(0.147)	(0.155)	(0.141)	(0.137)	(0.135)
border*landlocked	0.466***	0.897***	−0.046	0.265	0.306	0.496**	0.466**	1.101***	0.576***	0.348*
	(0.158)	(0.195)	(0.251)	(0.172)	(0.207)	(0.196)	(0.202)	(0.226)	(0.196)	(0.210)
Constant	−4.415***	3.007***	−1.626**	−10.247***	−5.419***	−11.058***	−6.550***	1.143**	−2.528***	−2.605***
	(0.410)	(0.529)	(0.735)	(0.391)	(0.534)	(0.547)	(0.609)	(0.526)	(0.521)	(0.490)
Observations	12750	6966	5011	11212	9346	7294	6609	8162	7026	7804
R^2	0.23	0.28	0.17	0.29	0.24	0.29	0.23	0.28	0.3	0.33

Sector (3-digit ISIC Revision 2)[b]	(11) 342	(12) 351	(13) 352	(14) 353	(15) 354	(16) 355	(17) 356	(18) 361	(19) 362	(20) 369
Dep. var.: Log of bilateral exports/GDP										
log(distance)	−1.190***	−1.111***	−1.177***	−1.201***	−1.343***	−1.169***	−1.183***	−1.100***	−1.286***	−1.552***
	(0.034)	(0.028)	(0.028)	(0.044)	(0.038)	(0.033)	(0.033)	(0.037)	(0.034)	(0.036)
log(pop_exporter)	0.137***	−0.144***	0.045**	−0.690***	0.003	0.395***	0.260***	0.344***	0.312***	0.028
	(0.024)	(0.021)	(0.020)	(0.032)	(0.029)	(0.024)	(0.026)	(0.030)	(0.026)	(0.027)
log(area_exporter)	−0.398***	−0.115***	−0.294***	0.037	−0.156***	−0.418***	−0.431***	−0.400***	−0.403***	−0.150***
	(0.018)	(0.017)	(0.015)	(0.025)	(0.022)	(0.018)	(0.018)	(0.020)	(0.018)	(0.020)
log(pop_importer)	0.444***	0.942***	0.666***	0.614***	0.702***	0.527***	0.636***	0.565***	0.561***	0.493***
	(0.024)	(0.020)	(0.020)	(0.031)	(0.028)	(0.025)	(0.024)	(0.028)	(0.025)	(0.026)
log(area_importer)	0	−0.185***	−0.129***	−0.122***	−0.079***	−0.005	−0.095***	−0.092***	−0.091***	−0.044**
	(0.019)	(0.016)	(0.016)	(0.025)	(0.023)	(0.019)	(0.018)	(0.022)	(0.020)	(0.021)
landlocked	−0.444***	−0.740***	−0.381***	−1.962***	−0.749***	−0.536***	−0.755***	−0.808***	−0.674***	−1.027***
	(0.062)	(0.052)	(0.051)	(0.090)	(0.076)	(0.063)	(0.067)	(0.076)	(0.067)	(0.071)
border	1.634	−0.373	3.307**	−4.699**	0.105	0.327	3.13	5.548**	1.784	−0.698
	(2.116)	(1.698)	(1.639)	(2.082)	(1.997)	(1.910)	(2.214)	(2.206)	(1.955)	(1.898)
border*log(distance)	0.386*	0.434*	0.511**	0.596**	0.729**	0.653***	0.709***	0.725***	0.531**	0.949***
	(0.230)	(0.248)	(0.239)	(0.257)	(0.320)	(0.252)	(0.249)	(0.255)	(0.215)	(0.181)
border*log(pop_exporter)	0.041	0.321***	0.244*	0.417***	0.191	−0.006	0.122	−0.263*	0.026	0.132
	(0.137)	(0.124)	(0.127)	(0.156)	(0.166)	(0.136)	(0.152)	(0.147)	(0.126)	(0.142)
border*log(area_exporter)	−0.204	−0.299**	−0.291**	−0.224	−0.284*	−0.158	−0.314**	−0.112	−0.175	−0.349***
	(0.136)	(0.125)	(0.131)	(0.151)	(0.153)	(0.139)	(0.143)	(0.130)	(0.120)	(0.116)
border*log(pop_importer)	−0.081	−0.176	−0.428***	−0.11	−0.083	−0.05	−0.277*	−0.107	−0.124	−0.184
	(0.159)	(0.119)	(0.122)	(0.151)	(0.151)	(0.136)	(0.150)	(0.153)	(0.135)	(0.126)
border*log(area_importer)	−0.01	−0.047	0.065	−0.107	−0.222	−0.086	−0.059	−0.179	−0.05	0.011
	(0.140)	(0.114)	(0.118)	(0.139)	(0.137)	(0.128)	(0.140)	(0.146)	(0.118)	(0.116)
border*landlocked	0.315	0.307	0.031	1.630***	1.172***	0.589***	0.620***	0.980***	0.518***	1.020***
	(0.201)	(0.194)	(0.181)	(0.229)	(0.226)	(0.194)	(0.207)	(0.206)	(0.188)	(0.189)
Constant	−4.718***	−7.059***	−4.600***	0.072***	−7.930***	−9.310***	−7.342***	−10.228***	−7.007***	−2.151***
	(0.467)	(0.394)	(0.401)	(0.594)	(0.521)	(0.449)	(0.485)	(0.543)	(0.483)	(0.506)
Observations	7560	11052	10349	7189	6132	7475	7749	5889	7296	6953
R^2	0.31	0.36	0.33	0.32	0.35	0.32	0.33	0.29	0.33	0.35

Table A2 (*Continued*)

	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
Sector (3-digit ISIC Revision 2)[c]	371	372	381	382	383	384	385	390
Dep. var.: Log of bilateral exports/GDP								
log(distance)	−1.035***	−0.982***	−1.207***	−0.986***	−0.932***	−0.871***	−0.885***	−0.896***
	(0.034)	(0.035)	(0.028)	(0.028)	(0.031)	(0.032)	(0.030)	(0.032)
log(pop_exporter)	−0.078***	−0.552***	0.312***	0.254***	0.340***	0.064***	0.155***	0.172***
	(0.026)	(0.026)	(0.020)	(0.019)	(0.021)	(0.023)	(0.021)	(0.023)
log(area_exporter)	−0.024	0.194***	−0.396***	−0.376***	−0.507***	−0.241***	−0.404***	−0.429***
	(0.019)	(0.020)	(0.015)	(0.015)	(0.016)	(0.018)	(0.016)	(0.018)
log(pop_importer)	0.827***	1.138***	0.489***	0.617***	0.609***	0.523***	0.698***	0.796***
	(0.024)	(0.025)	(0.020)	(0.019)	(0.021)	(0.023)	(0.022)	(0.023)
log(area_importer)	−0.166***	−0.332***	−0.028*	−0.080***	−0.112***	−0.100***	−0.132***	−0.263***
	(0.019)	(0.020)	(0.016)	(0.015)	(0.017)	(0.018)	(0.017)	(0.018)
landlocked	−0.419***	−0.068	−0.498***	−0.350***	−0.505***	−0.716***	−0.329***	−0.372***
	(0.064)	(0.070)	(0.049)	(0.046)	(0.051)	(0.055)	(0.053)	(0.063)
border	0.741	−1.3	3.629**	1.778	2.876	−0.509	2.216	6.169***
	(1.832)	(2.030)	(1.741)	(1.722)	(2.156)	(1.803)	(2.005)	(1.762)
border*log(distance)	0.491	0.640**	0.476**	0.386*	0.419	0.031	0.395	0.415*
	(0.320)	(0.261)	(0.240)	(0.226)	(0.271)	(0.203)	(0.245)	(0.216)
border*log(pop_exporter)	0.058	0.303**	0.003	−0.042	0.026	0.109	0.135	0.042
	(0.143)	(0.150)	(0.116)	(0.115)	(0.124)	(0.118)	(0.131)	(0.124)
border*log(area_exporter)	−0.178	−0.333**	−0.186	−0.084	−0.146	−0.125	−0.229	−0.217*
	(0.144)	(0.143)	(0.121)	(0.116)	(0.135)	(0.112)	(0.151)	(0.117)
border*log(pop_importer)	0.087	−0.093	−0.148	0.017	−0.185	0.031	−0.183	−0.446***
	(0.123)	(0.136)	(0.109)	(0.115)	(0.148)	(0.119)	(0.142)	(0.121)
border*log(area_importer)	−0.288**	−0.147	−0.092	−0.17	−0.04	0.034	−0.054	0.097
	(0.130)	(0.120)	(0.115)	(0.121)	(0.141)	(0.117)	(0.134)	(0.133)
border*landlocked	0.420**	0.348*	0.209	0.217	0.424**	0.487***	0.271	0.011
	(0.204)	(0.210)	(0.171)	(0.193)	(0.195)	(0.176)	(0.194)	(0.183)
Constant	−8.740***	−7.573***	−6.025***	−7.610***	−7.795***	−5.444***	−8.661***	−8.701***
	(0.468)	(0.500)	(0.404)	(0.384)	(0.430)	(0.438)	(0.421)	(0.467)
Observations	8614	8345	10495	11868	10475	10192	9625	9210
R^2	0.27	0.36	0.3	0.27	0.27	0.2	0.29	0.28

[a,b,c]*Notes*: Robust standard errors are in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. This table presents the estimation results of the gravity model. Each column represents an individual sector. The dependent variable is the log of bilateral exports as a share of exporting country's GDP averaged over the period 1970–1999. Log(distance) is the log of bilateral distance between country pairs. log(pop_exporter) and log(pop_importer) are log populations of the two trading partners; log(area_exporter) and log(area_importer) are log land areas of the two trading partners; landlocked takes values of zero, one, or two depending on whether a none, one, or both trading partners are landlocked; border takes on the value of one if the countries share a common border, zero otherwise. Variable definitions and sources are described in detail in the text.

References

Acemoglu, D., Johnson, S., Robinson, J., 2001. The colonial origins of comparative development. American Economic Review 91, 1369–1401.

Acemoglu, D., Zilibotti, F., 1999. Information accumulation in development. Journal of Economic Growth 4, 5–38.

Alcalá, F., Ciccone, A., 2004. Trade and productivity. Quarterly Journal of Economics 119, 613–646.

Almeida, H., Wolfenzon, D., 2005. The effect of external finance on the equilibrium allocation of capital. Journal of Financial Economics 75, 133–164.

Anderson, J., van Wincoop, E., 2003. Gravity with gravitas: a solution to the border puzzle. American Economic Review 93, 170–192.

Anderson, J., van Wincoop, E., 2004. Trade costs. Journal of Economic Literature 42, 691–751.

Baldwin, R., 1989. Exporting the capital markets: comparative advantage and capital market imperfections. In: Audretsch, D., Sleuwaegen, L., Yamawaki, H. (Eds.), The Convergence of International and Domestic Markets. North-Holland, Amsterdam, pp. 135–152.

Barro, R., Lee, J., 2000. International data on educational attainment: updates and implications. CID Working Paper No. 42.

Beck, T., 2002. Financial development and international trade. Is there a link? Journal of International Economics 57, 107–131.

Beck, T., 2003. Financial dependence and international trade. Review of International Economics 11, 296–316.

Beck, T., Demirgüç-Kunt, A., Levine, R., 2000. A new database on financial development and structure. World Bank Economic Review 14, 597–605.

Beck, T., Demirgüç-Kunt, A., Levine, R., 2003. Law, endowments, and finance. Journal of Financial Economics 70, 137–181.

Becker, B., Greenberg, D., 2005. Financial dependence and international trade. Unpublished Working Paper. University of Illinois at Chicago.

Braun, M., Raddatz, C., 2005. Trade liberalization and the politics of financial development. World Bank Working Paper 3517.

Broner, F., Ventura, J., 2006. Globalization and risk sharing. Unpublished Working Paper. CREI-UPF.

Chaney, T., 2006. Distorted gravity: heterogeneous firms, market structure, and the geography of international trade. Unpublished Working Paper. University of Chicago.

Demirgüç-Kunt, A., Detragiache, E., 2005. Cross-country empirical studies of systemic bank distress: a survey. IMF Working Paper 05/96.

di Giovanni, J., Levchenko, A., Ranciere, R., 2005. Trade and growth at industry level. Unpublished Working Paper, International Monetary Fund.

Easterly, W., Levine, R., 2003. Tropics, germs, and crops: how endowments influence economic development. Journal of Monetary Economics 50, 3–39.

Evans, C., 2003. The economic significance of national border effects. American Economic Review 93, 1291–1312.

Feenstra, R., Lipsey, R., Deng, H., Ma, A., Mo, H., 2005. World trade flows: 1962-2000. NBER Working Paper No. 11040.

Feenstra, R., Markusen, J., Rose, A., 2001. Using the gravity equation to differentiate among alternative theories of trade. Canadian Journal of Economics 34, 430–447.

Frankel, J., Romer, D., 1999. Does trade cause growth? American Economic Review 89, 379–399.

Helpman, E., Melitz, M., Rubinstein, Y., 2006. Trading partners and trading volumes. Unpublished Working Paper, Harvard University.

Heston, A., Summers, R., Aten, B., 2002. Penn World Table Version 6.1. Center for International Comparisons at the University of Pennsylvania (CICUP).

Hummels, D., 2001. Towards a geography of trade costs. Unpublished Working Paper. Purdue University.

International Monetary Fund. 2004. World Economic Outlook. April 2004.

Ju, J., Wei, S., 2005. Endowment versus finance: a wooden barrel theory of international trade. IMF Working Paper No. 05/123.

Kaufmann, D., Kraay, A., Mastruzzi, M., 2005. Governance matters IV: governance indicators for 1996–2004. Unpublished Working Paper, The World Bank.

Kletzer, K., Bardhan, P., 1987. Credit markets and patterns of international trade. Journal of Development Economics 27, 57–70.

Klingebiel, D., Kroszner, R., Laeven, L., 2005. Financial crises, financial dependence, and industry growth. World Bank Working Paper 2855.
Lai, H., Trefler, D., 2002. The gains from trade with monopolistic competition: specification, estimation, and mis-specification. NBER Working Paper No. W9169.
La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1998. Law and finance. Journal of Political Economy 106, 1113–1155.
Levine, R., 2005. Finance and growth: theory and evidence. In: Philippe Aghion, Steven Durlauf (Eds.), Handbook of Economic Growth. Elsevier Science, The Netherlands, pp. 865–934.
Levine, R., Schmukler, S., 2006. Internationalization and stock market liquidity. Review of Finance 10, 153–187.
Loayza, N., Ranciere, R., 2006. Financial development, financial fragility, and growth. Journal of Money, Credit and Banking 38, 1051–1076.
Manova, K., 2005. Credit constraints in trade: financial development and export composition. Unpublished Working Paper, Harvard University.
Newbery, D., Stiglitz, J., 1984. Pareto inferior trade. Review of Economic Studies 51, 1–12.
Rajan, R., Zingales, L., 1998. Financial dependence and growth. American Economic Review 88, 559–586.
Rajan, R., Zingales, L., 2003. The great reversals: the politics of financial development in the 20th Century. Journal of Financial Economics 69, 5–50.
Ranciere, R., Tornell, A., Westermann, F., 2006. Systemic crises and growth. Unpublished Working Paper. UCLA.
Rauch, J., 1999. Networks versus markets in international trade. Journal of International Economics 48, 7–35.
Rauch, J., Trindade, V., 2002. Ethnic chinese networks in international trade. Review of Economics and Statistics 84, 116–130.
Rigobon, R., Rodrik, D., 2005. Rule of law, democracy, openness, and income: estimating the interrelationships. Economics of Transition 13, 533–564.
Rodriguez, F., Rodrik, D., 2000. Trade policy and economic growth: a skeptic's guide to the cross-national evidence. In: Bernanke, B., Rogoff, K. (Eds.), Macroeconomics Annual 2000. MIT Press, Cambridge, pp. 261–324.
Rodrik, D., 1998. Why do more open economies have bigger governments? Journal of Political Economy 106, 997–1032.
Rodrik, D., Subramanian, A., Trebbi, F., 2004. Institutions rule: the primacy of institutions over geography and integration in economic development. Journal of Economic Growth 9, 131–165.
Santos Silva, J., Tenreyro, S., 2006. The log of gravity. Review of Economics and Statistics 88, 641–658.
Stock, J., Yogo, M., 2005. Testing for weak instruments in linear IV regression. In: Stock, J., Andrews, D. (Eds.), Identification and Inference in Econometric Models: a Festschrift in Honor of Thomas Rothenberg. Cambridge University Press, Cambridge (Chapter 5).
Svaleryd, H., Vlachos, J., 2002. Markets for risk and openness to trade: how are they related? Journal of International Economics 57, 369–395.
Svaleryd, H., Vlachos, J., 2005. Financial markets, the pattern of industrial specialization and comparative advantage: evidence from OECD countries. European Economic Review 49, 113–144.
World Bank, 2006. Doing business in 2006: creating jobs. The World Bank and the International Finance Corporation, Washington, DC.