Finance, Comparative Advantage, and Resource Allocation*

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Abstract

Can financial institutions and markets enhance the discipline imposed by competitive product markets and thus improve resource allocation in the real economy? We address this question in the context of international trade, using disaggregated product-level data from 71 countries exporting to the USA. We show that exported products exit the US market sooner if they stand far away from the exporting country's comparative advantage. This pattern is stronger when the exporting country has a well-developed banking system, but it is unaffected by the depth of stock markets. These results are in accordance with theories stressing the disciplining role of debt.

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1 Introduction

The importance of product market competition as the ultimate disciplining force motivating firms and their managers to use efficiently the available resources has been acknowledged since Adam Smith (1776) and Sir John Hicks (1935). However, as pointed out by Michael Jensen in his 1993 AFA presidential address, while the discipline imposed by product markets is inevitable in the long run, the effects often take too long to materialize (Jensen 1993, p. 850). Competitive pressures on product markets thus seem to be a necessary but not a sufficient condition for achieving optimal resource allocation in the economy. Could well-functioning financial institutions and markets enhance the discipline provided by product markets and help avoid waste of scarce resources? The intuitive answer seems to be yes. According to Levine (2005), creditors and shareholders can often improve the resource allocation by inducing managers to maximize firm value. The immediate threats of bankruptcy by creditors (Grossman and Hart 1982) or takeover through the stock markets (Scharfstein 1988, Stein 1988) seem to be particularly strong devices enabling financial agents to enhance the ultimate but slow-acting disciplining impact of product markets on firms' behavior.[1]

However, available data pose a challenge when it comes to distinguishing empirically between the disciplining effects of product and financial markets. On the one hand, various country-specific institutional factors such as the quality of legal enforcement or government regulations affect both the level of competition in product markets and the quality of financial institutions and markets. This, in turn, affects estimations relying on data variation at the cross-country level. On the other hand, the use of more disaggregated data from a particular country raises the issue of comparability and external validity as product data classifications used in measuring domestic production levels are generally country-specific. In addition, it is not only the overall level of competition at the country level that matters (e.g., product markets in the USA and Russia are arguably not equally competitive), competition also varies substantially across industries within a country. A firm producing heavy machinery for oil drilling industry faces very different competitive pressures than a firm specializing in producing T-shirts for children. Controlling for such

[1] Besides complementing the discipline imposed by the product markets, financial markets and institutions can improve resource allocation also by monitoring the firms and providing valuable information about them to other agents, thereby decreasing information asymmetries in the economy. This task can be executed both by banks (Allen 1990, Bhattacharya and Pfleiderer 1985, Boyd and Prescott 1986, Diamond 1984, Ramakrishnan and Thakor 1984) and by stock markets (Grossman and Stiglitz 1980, Holmstrom and Tirole 1993, Merton 1987).

heterogeneity is important. In this paper, we rely on the framework of international trade to address some of these issues.

Our objective is to disentangle the additional disciplining effect imposed by well-developed financial institutions and markets from that of the product markets. Our identification strategy consists of a difference-in-difference approach using data on more than 4,500 different products exported to the United States (USA) by 71 countries at different stages of financial, institutional and economic development. These highly disaggregated and internationally comparable trade data allows for a cleaner empirical distinction between the disciplining forces of product markets in the US destination market and the disciplining impact of financial markets and institutions captured by the varying levels of banking and stock markets development across countries exporting to the USA.

Our measure of the strength of competitive pressures faced by a given product in the US destination market is motivated by the Heckscher-Ohlin theory of comparative advantage in international trade. It captures the extent of discrepancy between each product's revealed factor intensity and each country's factor endowment (Cadot et al. 2011). Intuitively, if the exporters want to be successful in a competitive destination market, they need to focus on selling products that extensively use factors of production (e.g., physical or human capital) that are abundant and therefore cheap in the exporting country. Products not fulfilling this condition will require more scarce and therefore expensive production factors and consequently face much stronger headwinds in the product markets, especially if their destination market is the highly competitive US market.[2] Empirically, we thus investigate whether products exported to the USA that rely mostly on scarce and expensive production factors from the exporting country face worse survival odds in the US market. At the same time, we examine whether strong banks and deep stock markets in the country of origin further contribute to the termination of inefficient export flows and thus enhance the disciplining impact of US product markets. Here we rely on various measures capturing the strengths of banking sector, stock and bond markets in the countries trying to place their products in the US market.[3]

Our empirical results confirm that the larger the distance between the exported product's revealed factor intensity and the exporting country's factor endowment, the sooner

[2] According to the alternative Ricardian theory of comparative advantage in international trade, countries should export the products in which they possess relative advantage in total factor productivity. Section 2 motivates in more detail our choice of the Heckscher-Ohlin theoretical framework.

[3] Section 3 explains in more detail our data, including the concept of revealed factor intensity at the product level and various measures of the strength of financial institutions and markets at the country level.

the product exits the US market. Highly competitive product markets in the USA thus force out exporters who fail to optimally use resources available in their country. Crucially, the products whose factor intensity puts them at a comparative disadvantage exit the US market even faster if the exporting country has a well-developed banking system. These results suggest that strong banks in the country of origin can prevent a suboptimal use of resources by enforcing an efficient export composition before a competitive destination market does so. Interestingly, we do not find the same disciplining effect in the case of deep and liquid stock markets in the exporting countries. When it comes to pushing country's exports towards products congruent with its comparative advantage, our results therefore imply a particular role for banks rather than for a well-developed domestic financial system in general. These findings are robust to a battery of sensitivity checks, including alternative ways of measuring distance to comparative advantage and the use of various proxies for the strength of banks, stock and bond markets. We thus see the main contribution of our paper in providing new evidence about the unique importance of banks in enhancing the disciplining impact of product markets and improving resource allocation in the real economy.[4] That makes our work related to several distinct strands of literature.

Finance literature has traditionally focused on misallocation of physical capital and its consequences for economic growth (e.g., Lang et al. 1996, Wurgler 2000). In this paper, using trade data and the concept of revealed factor intensity allows us to compare products' overall factor intensities with countries' overall factor endowments and thus examine the disciplining role of finance and product markets in the wider context of resource allocation (physical capital, human capital, natural resources).[5] Our findings on the disciplining role of banks but not stock markets is of particular interest. This result is in accordance with various theories that stress the disciplining role of debt (e.g., Grossman and Hart 1982, Jensen 1986, Harris and Raviv 1990, Stulz 1990, Hart and Moore 1995, Aghion et al. 1999). In Section 7, we discuss the applicability of these theories in the context of international trade. One could also see this result in the light of an idea introduced by Allen (1993), building upon the conceptual framework of Diamond (1984). Allen (1993) argues that banks will have advantage over stock markets in monitoring firms when there is a broad consensus on what the firms should do and the main issue

[4] Bernard et al. (2006, 2007) investigate the resource reallocation alongside the lines of comparative advantage following trade liberalization. However, they do not examine the role of financial factors in their work.

[5] Most of our estimations focus on the physical and human capital. Table 9 confirms that our results extend to natural resources as well.

is to ensure that these actions are indeed taken by the firms' management. Arguably, this is exactly the situation when it comes to the question whether firms should focus on exporting products that correspond to the comparative advantage of the country of origin, in particular if their destination market is the highly competitive US market.

The paper also contributes to the literature on the effects of financial factors on trade (Beck 2002, 2003; Ju and Wei 2005, Greenaway et al. 2007, Muûls 2008, Manova 2008ab, Manova et al. 2009, Berman and Héricourt 2010).[6] This recently growing line of research shows that financial development improves export performance. Finance especially bolsters exports of firms that come from financially vulnerable industries or face credit constraints. These are important results, but their implications for overall allocative efficiency are not straightforward. What if financially constrained firms specialized in products whose factor intensities match poorly with the country's factor endowment? Well-developed financial institutions and markets could in this case reinforce inefficient exporting patterns with adverse allocative consequences. In comparison, our paper provides evidence suggesting that banks do specifically promote exports on the "right side" of the comparative advantage.

Furthermore, our paper brings a new perspective to the existing work on the survival of trade relationships. Besedes and Prusa (2006a) were the first to apply the analytical tools of survival analysis in the context of international trade and discovered that most exports to the US are surprisingly short-lived.[7] Regarding finance as a potential driving force behind the long-term survival of trade flows, Jaud et al. (2009) introduce the difference-in-difference estimation approach into the trade survival framework and show that industries dependent on external finance benefit relatively more from being located in financially developed countries. Jaud et al. (2015) also document the importance of finance for the long-term survival of cost-intensive exports, combining a unique firm-product database with a new measure of export-related financial needs at the product

[6] A related strand of papers has examined the effect of financial crisis on trade performance (e.g., Bricongne et al. 2010, Amiti and Weinstein 2011, Levchenko et al. 2011, Chor and Manova 2012).

[7] The patterns of export survival seem to vary systematically across products and countries. Homogeneous goods are more likely to exit the US market compared to differentiated goods (Besedes and Prusa 2006b) and the export survival is on average shorter for developing countries than for developed ones (Besedes and Prusa 2011). Numerous papers have confirmed the early findings of Besedes and Prusa (2006a, 2006b) at the product level (Nitsch 2009, Brenton et al. 2010, Obashi 2010, Fugazza and Molina 2011, Carrere and Strauss-Kahn 2012, Wei-Chih 2012, World Bank 2012, Besedes 2013) and using firm-level data (Carballo and Volpe Martincus 2008, Görg et al. 2012, Cadot et al. 2013).

level.[8] While all of the above results can be explained by introducing uncertainty and various shocks into the seminal framework of Melitz (2003), the angle of this paper is quite different. Here, the exit of a product from the US market is not the negative outcome of a random adverse shock. It is rather the structural consequence of the decline in factor misallocation enforced by a highly competitive destination market and a well-developed banking sector in the exporting country.

Finally, the paper is to some extent also related to the macroeconomic and development literature that has looked at resource misallocation within countries (Banerjee and Duflo 2005, Restuccia and Rogerson 2008, Hsieh and Klenow 2009).[9] Due to lack of internationally comparable production data at a highly disaggregated level, existing empirical studies using domestic production measures of factor misallocation have often compared only a few countries and mostly abstracted from potential cross-country aspects of resource misallocation.[10] The framework of international trade allows us to examine resource misallocation using disaggregated product-level data that are both internationally comparable and available for a broad sample of countries.

The rest of this paper is structured as follows. The next section provides background for our methodological approach designed to explore the disciplining forces of the US product market and financial markets and institutions in the exporting countries. Section 3 and 4 describe the data and our empirical strategy, respectively. Section 5 reports our main results and Section 6 offers a series of robustness checks. Section 7 suggests a possible explanation for the disciplining effect of banks and the lack of it in the case of stock markets, based on the insights from existing theories on disciplining role of debt applied in the context of international trade. Section 8 concludes.

2 Disciplining Role of Product Markets and Finance in the Context of International Trade

Economists since Smith (1776) and Hicks (1935) have argued that competition in product markets is an important source of discipline, ensuring that firms and individuals make the

[8] Besedes et al. (2014) use the empirical framework of the survival analysis to compute a measure of project risk, which they then use as an explanatory variable in their main OLS regression examining the role of credit constraints for the export growth.

[9] This line of research usually focuses on the significant heterogeneity of marginal products or rates of return to production factors within countries. See also Bernard et al. (2010) and the references therein for a more microeconomic perspective on resource allocation.

[10] For instance, the seminal paper by Hsieh and Klenow (2009) uses microdata on manufacturing establishments to measure potential factor misallocation in China and India versus the United States.

best possible use of the resources at their disposal.[11,12] The available empirical evidence in both economics (Nickell 1996) and finance (Giroud and Mueller 2010, 2011) backs this claim. The problem is that competitive pressures in the product markets often represent a rather slow-acting disciplining force (Jensen 1993). This naturally leads to the question whether financial institutions and markets could play an additional disciplining role, given their importance for the optimal allocation of scarce resources in the wider economy.[13] We address this question in the context of international trade, using highly disaggregated and internationally harmonized trade data at the product level. To convey a better idea about both the breadth and the level of disaggregation in our data, Table 1 provides some examples of different product categories among shirts and washing machines.

According to the theory of international trade, exporters should specialize in products that correspond to the comparative advantage of the exporting country. Sometimes, firms may start exporting products that do not fulfill this condition, due to agency problems (managers pursuing their own agendas), information asymmetries (lack of knowledge about foreign markets), export subsidies, and other market failures or government interference. Nevertheless, competition in the foreign product markets should in the long run force out inefficient exporters. We investigate whether financial markets and institutions in the exporting country enhance this ultimate but slow-acting product market discipline by looking at the product-level exports from many countries into one destination market - the United States. The focus on a single destination country filters out potential confounding influences that could arise from the destination-markets heterogeneity. Furthermore, we consider the US destination market to be the best laboratory for examining the competitive impact of product markets. Product markets in the rich developed countries are generally the ones with the most demanding customers and the toughest competitors. Among these countries, the US market is certainly the largest. The United States is also the strongest political and military power in the world and therefore uniquely well-placed to withstand political pressures from other countries trying to place their products on international markets. For example, Berger et al. (2013) show that successful CIA interventions in foreign countries (installing a new leader or upholding an

[11] As cited by, e.g., Giroud and Mueller (2010, p. 312).

[12] Other early contributions include the introduction of the concept of X-inefficiency by Leibenstein (1966), the AEA presidential address by Machlup (1967) and an early theoretical model by Winter (1971). The notion of importance of product market competition for avoiding misallocation of available resources was later formalized by Hart (1983), Schmidt (1997) or Raith (2003).

[13] Levine (2005) provides a review about the important role financial actors like banks or financial markets play in the real economy. Aghion et al. (1999) formally model the incentive effects of product market competition and financial market discipline in the context of innovation and growth.

Table 1: Examples from the Harmonized System (HS) Product Classification

Chapter HS 2-digit code	Heading HS 4-digit code	Sub-heading HS 6-digit code	Description
61			Articles of apparel & clothing accessories-knitted or crocheted
	61.06		Women's or girls' blouses & shirts, knit or crocheted
		6106.10	Women's or girls' blouses, shirts, of cotton, knitted or crocheted
		6106.20	Women's blouses, shirts, of man-made fibres, knitted or crocheted
		6106.90	Women's or girls, blouses, shirts, of other textile materials
84			Nuclear reactors, boilers, machinery & mechanical appliances, computers
	84.50		Washing machines, household or laundry-type
		8450.11	Fully-automatic washing machines, dry linen capacity not exceeding 10 kg
		8450.12	Machines, with built-in centrifugal drier, capacity not exceeding 10 kg
		8450.19	Other washing machines, each of a dry linen capacity not exceeding 10 kg
		8450.20	Washing machines, each of a dry linen capacity exceeding 10kg
		8450.90	Parts of household or laundry-type washing machines

Note: Harmonized System (HS) of tariff nomenclature is an internationally standardized system of names and numbers to classify traded products.

existing one) lead to dramatic export increases from the US to these countries. The CIA interventions have no impact on trade flows going in the opposite direction, i.e. on the exports from the affected countries to the US destination market.

In terms of outcomes, we focus on products' long-run export survival rather than their year-to-year entry or exit rates, and we rely on formal duration (survival) analysis for most of our estimations. Long-lasting competitive pressures will arguably have a significant impact on the long-term survival of products on the US market. By contrast, product entry may only capture firms' short-run export success. In addition, the export dynamics at the extensive margin could be driven by the short-run effects of government interventions in exporting countries (Cadot et al. 2011). Consistent with the stated objective of promotion agencies, Volpe and Carballo (2008) show that export promotion does indeed work mostly via the extensive margin.[14] However, most countries do not

[14] Görg et al. (2008) provide some evidence that general government subsidies like R&D grants promote also the intensive margin of exports.

have sufficient resources to subsidize exports of non-competitive products indefinitely. The forces of competition in the foreign markets (the US market in our case) will prevail eventually, making products' long-term export survival the most appropriate measure of export success in the context of our paper.[15]

When it comes to identifying products not congruent with the comparative advantage of the countries that export them, we rely on a measure called "distance to comparative advantage" that captures the extent of discrepancy between each product's revealed factor intensity and each country's factor endowment (Cadot et al. 2011). For a given country-product pair, a large distance to comparative advantage identifies products which would represent inefficient exports as they use up scarce rather than abundant resources in a given economy. The theoretical foundations for measuring distance between exported product's factor intensity and exporting country's factor endowment are based on the Heckscher-Ohlin theory of international trade. According to a long-standing idea within this theoretical framework, international trade in multiple commodities can be explained by a "product chain of comparative advantage" that ranks the products in order of their factor intensities. In a two-country model without factor price equalization, the relative factor endowments determine which end of this product chain comprises exports of a given country (Jones 1956-57, Bhagwati 1972). Deardorff (1979) extends the idea to a more realistic world of multiple products and multiple countries. In this higher-dimension case, the product chain of comparative advantage effectively breaks into several segments, one for each country. In particular, countries are arranged along the product chain in accordance with their relative factor endowments, with each country exporting the products within its own segment and importing all the others. Each country thus specializes in exporting products whose relative factor intensity broadly corresponds to the relative factor endowment of this country.[16]

Our approach should be seen as complementary to the influential strand of recent literature examining the alternative Ricardian theory that stresses technology rather than factor endowments as a possible source of comparative advantage in international trade

[15] In one of the robustness checks, we also run a linear probability model of exiting the US destination market as an alternative to the formal survival framework.

[16] Like in the two-country case, this reasoning is valid only if factor price equalization does not hold and the world is thus divided into multiple diversification cones. In Heckscher-Ohlin framework with more products than production factors, equalization of factor prices would namely lead to indeterminacy of both production and trade (see also Dornbusch et al. 1980). More recent papers on diversification cones include Schott (2003, 2004) and Xiang 2007.

(Eaton and Kortum 2002, Costinot 2009, Costinot et al. 2012).[17] It would go beyond the scope of our paper to make a substantial contribution to the ongoing theoretical debate regarding the Ricardian and Heckscher-Ohlin sources of comparative advantage. Clearly, both workhorse models of international trade are important in our understanding of international trade flows. Our focus on factor endowments as the main source of comparative advantage is a pragmatic decision motivated by data availability at a highly disaggregated level in a broad cross-country setting.[18] Any empirical work looking at a particular source of comparative advantage might of course be subject to omitted variable biases. Morrow (2010) makes an important contribution in this regard, showing that omitting Ricardian forces do not bias tests of the Heckscher-Ohlin model, at least in his data. At the same time, Morrow (2010) finds some evidence that ignoring Heckscher-Ohlin forces can lead to biased tests of the Ricardian model.[19]

3 Data

Our unit of analysis is an export spell defined as the length (in years) that a country c exports a particular good k defined at the HS-6 digit level to the USA without interruption. Let $z(ck)$ denote an export spell of product k exported from country c to the USA. Furthermore, let t_z be the spell initiation year, i.e., the first year in which the export spell is active. As the initiation year is spell-specific, indexing observations by initiation year eliminates the need to index them by spell. Note that there can be multiple

[17] Eaton and Kortum (2002) develop and quantify a modern Ricardian model of international trade with many countries, extending the seminal two-country model of Dornbusch et al. (1977). In principle, their framework can be combined with the factor endowment theory of comparative advantage by including other immobile factors of production than labour (Eaton and Kortum 2002, p. 1744). Costinot (2009) indeed develops a multifactor generalization of the Eaton-Kortum framework. However, the part of model in Costinot (2009) that focuses on factor endowment as the main source of comparative advantage is not quite identical with the Heckscher-Ohlin approach – e.g., it provides predictions on the cross-sectional variation of aggregate output rather than the factor content of trade. Costinot et al. (2012) further extend the modern Ricardian framework and quantitatively explore comparative advantage in a sample of 21 countries and 13 industries. Their framework could also be reconciled with factor endowment as the source of comparative advantage. However, the authors seem to prefer the Ricardian interpretation and also provide some evidence supporting it (Costinot et al. 2012, p. 597ff).

[18] Costinot et al. (2012) provide a modern interpretation of the revealed comparative advantage in the context of the Ricardian theory, testing it in a sample of 21 rich and middle-income countries and 13 broadly defined industries.

[19] To be fair, Morrow (2010) himself calls the evidence about potential bias in empirical work focusing on Ricardian comparative advantage "weak and mixed". Costinot et al. (2012) show evidence for the orthogonality of Ricardian and Heckscher-Ohlin motives in their data, although this is not the main focus of their paper.

spells for a given country-product pair.[20] The unit of observation is thus an (exporting country)*product*(initiation year) triplet. All time-varying explanatory variables are measured at the time t_z.

3.1 Distance to Comparative Advantage

Our empirical strategy exploits a novel measure developed by Cadot et al. (2011) that allows us to identify products that do not correspond to the comparative advantage of the exporting country. The measure of distance to comparative advantage (DCA) is computed at the 6-digit level of the HS classification and compares in a given year the revealed factor intensity of a given product with the factor endowment of a given country. Specifically, the formula for the Euclidean distance of product k from the comparative advantage of country c, in the initiation year t_z of export spell z, writes:

$$DCA_{ck,t_z} = \sqrt{std(\kappa_{c,t_z} - \hat{\kappa}_{k,t_z})^2 + std(h_{c,t_z} - \hat{h}_{k,t_z})^2} \quad (1)$$

where κ_{c,t_z} and h_{c,t_z} are the endowments in physical and human capital of country c, and $\hat{\kappa}_{k,t_z}$ and $\hat{h}_{k,t_z}$ are the corresponding revealed factor intensities of product k, all in log terms and measured in the initiation year t_z of the export spell z. In one of the robustness tests, we will extend the two-factor framework of distance to comparative advantage and consider also the role of natural resources by adding arable land per worker as a third production factor. Since κ and h are measured in different units, we use normalized differences between product factor intensities and country factor endowments with mean 0 and standard deviation 1 ("std" in the formula above stands for "standardized"). This ensures that physical and human capital are given equal weights in the overall distance formula.[21]

The data on national factor endowments are from Cadot et al. (2009). In a given year, the stock of physical capital per worker in a given country (κ) is constructed according to the perpetual inventory method. Human capital per worker (h) is calculated from the average years of schooling in a given country using attainment data. The product revealed factor intensities are from Cadot et al. (2009). They are calculated as weighted

[20] For instance, if a country exports a given product to the USA during ten years starting in 1992, we take this as one spell with a length of 10 years and initiation year 1992. If a country exports a given product to the USA in two (or more) distinct non-overlapping spells, for example, during 1995-1998 and then again during 2000-2005, we treat these as two independent spells of 4 and 6 years with initiation years of 1995 and 2000, respectively.

[21] Note that we differ in this respect from the original measure in Cadot et al. (2011).

averages of the factor endowments of the countries exporting a given product, following the methodology introduced by Hausmann et al. (2007). Specifically, the revealed physical capital intensity of product k in year t_z is calculated as:

$$\hat{\kappa}_{k,t_z} = \sum\nolimits_c \omega_{ck,t_z} \kappa_{c,t_z} \tag{2}$$

where κ_{c,t_z} is country c's endowment in physical capital at time t_z, and the weights are given by $\omega_{ck,t_z} = \frac{X_{ck,t_z}/X_{c,t_z}}{\sum_c X_{ck,t_z}/X_{c,t_z}}$, with X denoting export values. These weights correspond to the revealed comparative advantage of country c in product k. The numerator in the formula for ω_{ck,t_z} measures the importance of product k in the overall exports of country c. The denominator aggregates the export shares of product k across all countries. Weighting countries' factor endowments by the revealed comparative advantage rather than by the simple export shares allows us to account for distortions due to differences in countries' size (Hausmann et al. 2007 and Cadot et al. 2009 provide numerical examples).[22] Similarly, the revealed human capital intensity of product k is calculated as:

$$\hat{h}_{k,t_z} = \sum\nolimits_c \omega_{ck,t_z} h_{c,t_z} \tag{3}$$

where h_{c,t_z} is endowment in human capital of country c at time t_z.

3.2 Financial Variables

We use several variables measuring the strength of financial markets and institutions in the exporting country. As our main proxy for the strength of the banking sector, we use the ratio of the bank credit to private sector over the country's GDP (BC_{c,t_z}). The ratio of the stock market capitalization over the GDP (StM_{c,t_z}) captures the depth of stock markets in the exporting country. Both variables are the standard proxies for the strength of banks and stock markets in a given country (for a more detailed discussion and further references see, e.g., Strieborny and Kukenova, forthcoming).

We also use various alternative measures to test the robustness of our results. In the case of banks, these measures include bank assets (BA_{c,t_z}), total credit (TC_{c,t_z}), non-bank credit (NBC_{c,t_z}), and credit to government (GC_{c,t_z}). Bank assets are claims on domestic real non-financial sector by deposit money banks as a share of GDP, total credit is the

[22] The formulation of ω_{ck,t_z} used by Hausmann et al. (2007) and Cadot et al. (2009) slightly differs from the original index of revealed comparative advantage by Balassa (1965). This modified formulation ensures that the weights add up to one: $\sum_c \omega_{ck,t_z} = \sum_c \frac{X_{ck,t_z}/X_{c,t_z}}{\sum_c X_{ck,t_z}/X_{c,t_z}} = \frac{\sum_c X_{ck,t_z}/X_{c,t_z}}{\sum_c X_{ck,t_z}/X_{c,t_z}} = 1$

ratio of private credit by deposit money banks and other financial institutions over GDP, non-bank credit is the credit extended by other financial institutions than banks as a share of GDP (i.e., the difference between values for total credit and bank credit), credit to government is the credit extended to the general government sector, including central, state and local governments and social security funds. In the case of stock markets, the alternative measures are stock market value traded ($StMVT_{c,t_z}$) and stock market turnover ($StMT_{c,t_z}$). Stock market value traded is the value of stock market transactions relative to GDP and stock market turnover is the ratio of the value of total shares traded to market capitalization.

In one of the robustness tests, we also examine the impact of bond markets in the exporting country. We use three proxies for the strength and development of bond markets. Domestic private bonds (DPB_{c,t_z}) is the ratio of outstanding domestic private debt securities over GDP while the proxy called international private bonds (IPB_{c,t_z}) represents the ratio of outstanding international private debt securities over GDP. The third proxy, non-financial international bonds ($NFIB_{c,t_z}$), captures the ratio of international corporate bonds issued by non-financial firms to GDP.

The data are from the Global Financial Development Database that builds on the earlier work by Beck et al. (2000) and has been substantially extended by Cihak et al. (2012). The database contains various indicators of financial development across countries and over time and is regularly updated (the latest online available version is from the year 2015). The exception is the financial variable non-financial international bonds ($NFIB_{c,t_z}$) that comes from the statistics compiled by the Bank for International Settlements (BIS). All financial variables measured at the exporting country level enter the regressions both directly (BC_{c,t_z}, StM_{c,t_z}, etc.) and interacted with our product-country measure of distance to comparative advantage ($BC_{c,t_z} * DCA_{ck,t_z}$, $StM_{c,t_z} * DCA_{ck,t_z}$, etc.).

3.3 Other Variables

Product-level trade variables: The export survival rate in the US market and all trade-related control variables at the product level (initial export, total export, number of suppliers, multiple spell dummy) are computed using the BACI dataset developed by the CEPII and described in Gaulier and Zignago (2009).[23] The dataset provides harmonized

[23] BACI is the French acronym for "Base pour l'Analyse du Commerce International": Database for International Trade Analysis. See http://www.cepii.fr/anglaisgraph/bdd/baci.htm.

bilateral trade flows for more than 5,000 HS 6-digit products and 143 countries, over the 1988-2005 period. We focus on the manufacturing exports to the USA from the 1995-2005 period due to the high number of missing values before 1994.[24] Export flows are reported annually in values (thousands of US dollars) and quantities.[25] Trade data at the HS 6-digit level is particularly fitting for survival analysis. It allows us to account for export failures at a detailed product level which would otherwise be undetected when using more aggregated industry data.

Macroeconomic variables: Real exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. The source is the World Development Indicators of the World Bank. The annual data for the GDP per capita measured in log terms ($GDPpc_{c,t_z}$) are taken from the World Development Indicator Report 2006 and are reported in constant 2000 US dollars. Both macroeconomic variables measured at the exporting country level enter the regressions directly (RER_{c,t_z}, $GDPpc_{c,t_z}$) as well as interacted with our measure of distance to comparative advantage ($RER_{c,t_z} * DCA_{ck,t_z}$, $GDPpc_{c,t_z} * DCA_{ck,t_z}$).

Industry-level variables: Let j denote an industry. External finance dependence at the level of ISIC 4-digit sectors comes from Raddatz (2006) and is based on financial data about US firms from Compustat. In particular, the dependence on external finance of industry j (ExF_j) is defined as capital expenditures minus cash flow from operations, divided by capital expenditures, for the median firm in that industry. Human capital intensity ($HumInt_j$) and physical capital intensity ($CapInt_j$) for ISIC 3-digit sectors come from Braun (2003) and have already been used in trade literature (Manova 2008a, 2008b).[26,27] All industry characteristics (ExF_j, $CapInt_j$, $HumInt_j$) are computed solely from the US data and thus do not vary across exporting countries. The US market is large, diversified, well-functioning, and comparatively frictionless. Industry characteristics based on the US data can thus be interpreted as exogenous technological character-

[24] We are using BACI in HS classification from 1992 that covers the period 1994-2005. As the survival analysis relies on the length of export spells, we cannot use the data from the initial year. This leaves us with the data for 1995-2005.

[25] We do not need export values for measuring the export survival rate but we do use them for constructing some trade-related control variables and the dependent variable in one of the robustness tests.

[26] Dependence on external finance as well as strata effects in the econometric analysis are defined at the finer 4-digit level of the ISIC classification. In the text, we therefore generally refer to j as denoting ISIC 4-digit industry.

[27] Romalis (2004) uses US SIC classification instead.

istics that are not driven by various market imperfections prevalent in many countries. This idea comes back to the seminal paper of Rajan and Zingales (1998).[28]

Table 2 shows descriptive statistics for the main variables used in our analysis. When controlling for all variables of interest, our final database consists of 191,078 export spells of 4,562 HS 6-digit products from 71 exporting countries to the USA over the period 1995-2005. Online Appendix A gives the list of countries in our sample.

Table 3 provides some preliminary evidence on the relationship between export survival, finance, and comparative advantage. Products that are closer to the comparative advantage of the exporting countries seem to face better survival odds in the US destination market. The average length of export spells with initial value of distance to comparative advantage DCA_{ck,t_z} below the 25th percentile is 5.06 years while the average length for export spells with initial value of DCA_{ck,t_z} above the 75th percentile is 4.00 years. The corresponding median values are 3 and 2 years, respectively. A strong domestic banking sector in the exporting country (initial value of BC_{c,t_z} above the 75th percentile versus below the 25th percentile) also seems to improve products' survival chances on the US market (average spell lengths of 5.60 years versus 3.56 years and median spell lengths of 4 versus 2 years). Well-developed stock markets seem to play quantitatively a somewhat lesser role (5.13 years versus 4.10 years in case of average spell lengths and 3 versus 2 years in case of median spell lengths). However, these prima-facie differences cannot be interpreted directly as they do not control for export spells heterogeneity and are thus vulnerable to many confounding influences. We now turn to a systematic exploration of the disciplining effect of product markets and finance on countries' export composition, controlling for observed and unobserved heterogeneity among export spells.

4 Empirical Strategy

We are interested in the long-term survival of the export spells and rely on the widely used continuous time proportional hazard model proposed by Cox (1972), henceforth Cox model (see Online Appendix B for further technical details and Kiefer (1988) for a detailed description of duration analysis). Our dependent variable is the hazard rate (hazard function) $h_{ck}(t)$ - the probability that a given product k exported by country c exits the US market at time t, conditional on its survival until that time (i.e., conditional

[28] Our product-level variables are at the HS 6-digit level and there is no direct concordance between the industry-level ISIC 4-digit Revision 2 classification and the product-level HS classification. In order to match the data, we therefore first apply the concordance between ISIC Revision 2 and ISIC Revision 3 classification and then the concordance between the latter and the HS 6-digit classification.

Table 2: Summary Statistics: Data

Variable	Obs.	Mean	Std. Dev.	Min	Max
Distance to comparative advantage, (DCA_{ck,t_z})	191078	1.18	0.79	0	6.64
Banks, (BC_{c,t_z})	191078	0.61	0.46	0.03	2.18
Stock markets, (StM_{c,t_z})	175481	0.50	0.46	0.01	3.03
GDP per capita, $(GDPpc_{c,t_z})$	191078	9.16	0.94	6.29	10.47
Dependence on external finance, (ExF_j)	191078	0.25	0.29	-0.55	1.26
Banks x dist. to comp. adv., $(BC_{c,t_z} * DCA_{ck,t_z})$	191078	0.69	0.75	0	12.09
Stock markets x dist. to comp. advantage, $(StM_{c,t_z} * DCA_{ck,t_z})$	175481	0.54	0.70	0	14.71
GDPpc x dist. to comp. advantage, $(GDPpc_{c,t_z} * DCA_{ck,t_z})$	191078	10.65	6.73	0.01	69.00
Banks x dep. on ext. finance, $(BC_{c,t_z} * ExF_j)$	191078	0.15	0.25	-1.19	2.74
Stock markets x dep. on ext. finance, $(StM_{c,t_z} * ExF_j)$	175481	0.12	0.22	-1.65	3.82
Bank assets, (BA_{c,t_z})	191078	0.70	0.47	0.04	2.48
Total credit, (TC_{c,t_z})	191078	0.63	0.44	0.03	2.28
Non-bank credit, (NBC_{c,t_z})	191078	0.02	0.19	-1.19	0.83
Credit to government, (GC_{c,t_z})	54329	51.91	24.66	6.90	143.80
Stock market value traded, $(StMVT_{c,t_z})$	173368	0.27	0.34	0.00	2.00
Stock market turnover, $(StMT_{c,t_z})$	172200	0.56	0.60	0.00	5.12
Domestic private bonds to GDP, (DPB_{c,t_z})	127,260	0.23	0.22	0.00	1.42
International private bonds to GDP, (IPB_{c,t_z})	158,291	0.09	0.09	0.00	0.92
Non financial international bonds to GDP, $(NFIB_{c,t_z})$	168,113	0.02	0.03	0.00	0.16
Real exchange rate, (RER_{c,t_z})	129642	-2.23	0.02	-2.31	-2.10
Average export growth	191078	0.02	0.44	-7.25	5.23
Physical capital, (κ_{c,t_z})	191078	10.50	1.17	6.35	12.09
Human capital, (h_{c,t_z})	191078	7.24	2.56	0.69	11.89
Physical capital intensity, $(CapInt_j)$	191078	0.06	0.02	0.02	0.20
Human capital intensity, $(HumInt_j)$	191078	0.95	0.24	0.50	1.66
Physical capital x phys. cap. intensity, $(\kappa_{c,t_z} * CapInt_j)$	191078	0.67	0.27	0.12	2.36
Human capital x hum. cap. intensity, $(h_{c,t_z} * HumInt_j)$	191078	6.90	3.10	0.34	19.67
Initial export, $(initial\_export_{ck,t_z})$	191078	10.12	2.64	0.00	23.72
Total export, $(total\_export_{ck,t_z})$	191078	13.00	2.83	0.00	24.07
Number of suppliers, $(NSuppliers_{k,t_z})$	191078	37.07	19.09	1.00	136
Multiple spell, $(multiple_spell_{ck})$	191078	0.58	0.49	0.00	1.00
Alternative measures of distance to comparative advantage					
Absolute distance	191078	1.60	1.12	0.00	9.20
Euclidean distance, incl. land per worker	191078	1.54	0.80	0.02	7.26
Absolute distance, incl. land per worker	191078	2.39	1.28	0.03	12.18
Euclidean distance, excl. origin country	190490	1.21	0.77	0.01	7.85
Absolute distance, excl. origin country	190490	1.59	1.04	0.01	11.10
Euclidean distance, excl. USA as destination country	191078	1.22	0.77	0.00	7.86
Absolute distance, excl. USA as destination country	191078	1.59	1.04	0.00	11.12

Note: Let j denote an industry (ISIC 3-digit or 4-digit), k denote product (HS 6-digit). The time dimension in our dataset is reduced to the initiation year. All time-varying variables take value in time t_z. The variables $GDPpc_{c,t_z}$, $initial\_export_{ck,t_z}$, $total\_export_{ck,t_z}$ are taken in log terms.

on the fact that country c exported the given product k to US continuously for t years, counted from the initiation year t_z of the export spell z). The hazard function varies from zero (meaning no risk at all) to infinity (meaning the certainty of failure at time t). In the Cox model, the hazard function is defined as a product of two multiplicative terms. The first term is a baseline (underlying) hazard function h_0 that is function of time alone. The second multiplicative term is an exponential function containing a set of independent variables that shift the baseline hazard function. An important advantage of

Table 3: Summary Statistics: Export Spells

	# Spells	Mean spell length	Median spell length
Full sample	1191078	4.79	3
DCA_{ck,t_z} < 25th percentile	47769	5.06	3
DCA_{ck,t_z} > 75th percentile	47769	4.00	2
BC_{c,t_z}< 25th percentile	47733	3.56	2
BC_{c,t_z}>75th percentile	47735	5.60	4
StM_{c,t_z}< 25th percentile	43766	4.10	2
StM_{c,t_z}>75th percentile	43729	5.13	3

Note: The time dimension in our dataset is reduced to the initiation year t_z of export spell z. All time-varying variables are measured in the year t_z. DCA_{ck,t_z} is distance to comparative advantage measured as the Euclidean distance of the revealed factor intensity of product k to the factor endowment of country c. BC_{c,t_z} is the proxy for banking development in country c measured as bank credit over GDP. StM_{c,t_z} is the proxy for stock markets development in country c measured as stock market capitalization over GDP.

the semiparametric Cox model is the fact that the shape of the baseline hazard function is left unspecified so that no distributional assumptions are required. Such assumptions could possibly lead to misspecifications and biased estimates.

4.1 The Role of Banks

We start by examining the allocative and selective role of banks. We ask whether these external debtholders enhance the disciplining effect of product markets by pushing the composition of manufacturing exports towards goods congruent with the comparative advantage of the exporting country. Specifically, we regress the hazard rate $h_{ck}(t)$ of a country-product export spell to the US on the following independent variables: the Euclidean distance between the revealed factor intensity of product k and the factor endowment of exporting country c at the initiation of the export spell at time t_z (distance to comparative advantage - DCA_{ck,t_z}), an interaction term between the ratio of the bank credit over GDP in exporting country c and our measure of distance to comparative advantage at time t_z ($BC_{c,t_z} * DCA_{ck,t_z}$), the bank credit over GDP in exporting country c (BC_{c,t_z}), a vector of control variables ($\mathbf{x}$), as well as a full set of exporting-country fixed effects (δ_c) and initiation-year fixed effects (δ_{t_z}). Note that the time dimension in our dataset is reduced to the initiation years and time-varying variables are thus measured at the time t_z. The unit of analysis is an observation at the (exporting country)*product*(initiation year) level. Our estimation equation focusing on the disciplining impact of banks and product markets thus writes:

$$h_{ck}(t) = h_{0,j}(t) \exp[\beta_1 DCA_{ck,t_z} + \beta_2 BC_{c,t_z} * DCA_{ck,t_z} + \gamma BC_{c,t_z} + \mathbf{x}_{ck,t_z}\phi + \delta_c + \delta_{t_z} + \varepsilon_{ck,t_z}] \quad (4)$$

where ε_{ck,t_z} is an error term. Equation 4 is estimated using partial maximum likelihood and standard errors are clustered at the (exporting country)*(initiation year) level ($c{*}t_z$).

Our two main variables of interest are the proxy for distance of the exported product to the comparative advantage of the exporting country (DCA_{ck,t_z}) and the interaction term of this proxy with the strength of the banking sector in the exporting country ($BC_{c,t_z} * DCA_{ck,t_z}$). The relationship between the covariates and the hazard rate is log-linear, allowing parameters to be interpreted as semi-elasticities. The parameter β_1 captures the disciplining effect of the competitive US market. A positive coefficient would indicate that products not congruent with the comparative advantage of the exporting country face a higher hazard rate in the US market. The parameter β_2 captures the additional role of banks in reinforcing this pattern. A positive coefficient β_2 would suggest that a strong banking system pushes the export composition towards the comparative advantage of a given country even before the competition in the US market sets in.[29]

In some regressions, we also use other banking variables that measure various dimensions of the banking system in the country of origin - bank assets, total credit, non-bank credit, and credit to government. Similarly to our main banking proxy, these measures also enter the regressions both directly (BA_{c,t_z}, TC_{c,t_z}, NBC_{c,t_z}, GC_{c,t_z}) and interacted with the distance of the exported product to the comparative advantage of the exporting country ($BA_{c,t_z} * DCA_{ck,t_z}$, $TC_{c,t_z} * DCA_{ck,t_z}$, $NBC_{c,t_z} * DCA_{ck,t_z}$, $GC_{c,t_z} * DCA_{ck,t_z}$).

We control for heterogeneity across manufacturing sectors by fitting a stratified Cox model at the industry level j. This allows the shape of the baseline hazard function, $h_{0,j}(t)$, to vary across 118 ISIC 4-digit industries and adds more flexibility to the model. We also address the omitted variable bias by the use of fixed effects. In the Cox model, the inclusion of fixed effects results in a shift of the baseline hazard function. The exporting-country fixed effects (δ_c) control for a wide array of observable and unobservable characteristics of exporting countries that might affect the chances of their products to survive

[29] Ai and Norton (2003) discuss the issues associated with estimating a non-linear model with interaction terms. As a robustness check, we define a time-varying dummy variable marking countries with high level of banking development. We set λ_{t_z} at the 75th percentile of the cross-sectional distribution of countries' level of banking development. We split our measure of distance to comparative advantage in two, one for countries in the bottom 75th percentile ($B_{75} * DCA_{ck,t_z}$) and one for countries in the top 25th percentile ($T_{25} * DCA_{ck,t_z}$) regarding the level of banking development. We then re-run our estimations, replacing the interaction term between the level of banking sector development and the measure of distance to comparative advantage ($BC_{c,t_z} * DCA_{ck,t_z}$) with these two new distance measures ($B_{75} * DCA_{ck,t_z}, T_{25} * DCA_{ck,t_z}$). Results confirm the additional effect of banking development. The coefficients are increasing in magnitude from the bottom 75th percentile to the top 25th percentile and are statistically significantly different from each other. Results are available upon request.

in the US market. These factors include physical and cultural proximity to the USA, common border, common language, etc. The initiation-year fixed effects (δ_{t_z}) control for the possibility that the initial conditions in the first year of export spell (t_z) might influence the products' chances for subsequent survival in the US market.

The vector $\mathbf{x}$ includes the GDP per capita of the exporting country c taken in log terms ($GDPpc_{c,t_z}$), country c's endowments in physical and human capital ($\kappa_{c,t_z}, h_{c,t_z}$) and their interactions with the corresponding capital intensities at the industry level ($\kappa_{c,t_z} * CapInt_j, h_{c,t_z} * HumInt_j$), as well as several product-related control variables. We include the log value of export of product k from country c to the US market in the initial year of the trade relationship t_z ($initial\_export_{ck,t_z}$). This reflects the level of confidence importers in the US have in the reliability of their trading partners. Additionally, we include the total log export value of product k from country c to all countries in the initial year of the trade relationship ($total\_export_{ck,t_z}$). This variable captures the experience the exporting country has in supplying the world market with product k. We further control for the varying degree of competition in the US product markets by incorporating the number of countries exporting a given product k to the USA in year t_z ($NSuppliers_{k,t_z}$). We also account for trade relationships that experience multiple spells within the same (exporting country)*product pair by including a dummy variable ($multiple\_spell_{ck}$) marking all spells within such "on-and-off" trade relationships.[30] In some specifications, the vector $\mathbf{x}$ also includes GDP per capita of the exporting country c interacted with the distance to comparative advantage ($GDP_{c,t_z} * DCA_{ck,t_z}$), real exchange rate ($RER_{c,t_z}$), and real exchange rate interacted with the distance to comparative advantage ($RER_{c,t_z} * DCA_{ck,t_z}$).

Finally, we re-estimate Equation 4, stratifying by product k, allowing the baseline function to vary across individual products rather than just across industries. The estimating equation then becomes:

$$h_{ck}(t) = h_{0,k}(t) \exp[\beta_1 DCA_{ck,t_z} + \beta_2 BC_{c,t_z} * DCA_{ck,t_z} + \gamma BC_{c,t_z} + \mathbf{x}_{ck,t_z}\phi + \delta_c + \delta_{t_z} + \varepsilon_{ck,t_z}] \quad (5)$$

This specification allows for a different baseline hazard function, $h_{0,k}(t)$, for every of the 4,562 analyzed products from the HS 6-digit classification. In terms of controlling for product heterogeneity, the specification is thus even more stringent than would be a one

[30] We also use alternative methods for handling multiple spells that will be shown later in the analysis.

including product fixed effects. Fixed effects merely shift the baseline hazard function while stratification allows different products to have different underlying hazard functions (see Online Appendix C for a more technical treatment of this issue). In one of our robustness tests, we allow the underlying hazard rate to differ even for the same product k if the export spell started in different year t_z.

4.2 The Role of Stock Markets

As the next step in our analysis, we examine whether well-developed stock markets also enhance the disciplining effect of product markets in the context of international trade. We re-estimate Equation 4, replacing the variable measuring the strength of the banking sector (BC_{c,t_z}) with the ratio of the stock market capitalization over the GDP in the exporting country c measured in the initiation year of the export spell t_z (StM_{c,t_z}). This variable captures the depth and liquidity of stock markets in the exporting country. The estimating equation focusing on the role of stock markets in enhancing the product market discipline thus writes:

$$h_{ck}(t) = h_{0,j}(t) \exp[\beta_1 DCA_{ck,t_z} + \beta_2 StM_{c,t_z} * DCA_{ck,t_z} \\ + \gamma StM_{c,t_z} + \mathbf{x}_{ck,t_z}\phi + \delta_c + \delta_{t_z} + \varepsilon_{ck,t_z}] \quad (6)$$

where ε_{ck,t_z} is the error term. As previously, Equation 6 is estimated using partial maximum likelihood and standard errors are clustered at the (exporting country)*(initiation year) level ($c * t_z$). We also include exporting-country and initiation-year fixed effects (δ_c, δ_{t_z}) and stratify the estimation by 118 ISIC 4-digit industry categories j. The parameter β_1 captures the disciplining effect of the competitive US market and the parameter β_2 captures the additional effect of well-developed stock markets in the exporting country.

In some regressions, we use stock market value traded and stock market turnover as alternative measures of the depth and liquidity of stock markets in the exporting country. Like with other financial variables, these measures enter the regressions both directly ($StMVT_{c,t_z}$, $StMT_{c,t_z}$) and interacted with the distance of the exported product to the comparative advantage of the exporting country ($StMVT_{c,t_z} * DCA_{ck,t_z}$, $StMT_{c,t_z} * DCA_{ck,t_z}$). The non-financial control variables are identical to the ones in Equation 4.

Similarly to the regressions focusing on the banking sector, also in the case of stock markets we re-estimate Equation 6, stratifying at the product level k and thus allowing the baseline hazard function h_0 to vary across the 4,562 products according to the HS

6-digit classification:

$$h_{ck}(t) = h_{0,k}(t)\exp[\beta_1 DCA_{ck,t_z} + \beta_2 StM_{c,t_z} * DCA_{ck,t_z} + \gamma StM_{c,t_z} + \mathbf{x}_{ck,t_z}\phi + \delta_c + \delta_{t_z} + \varepsilon_{ck,t_z}] \quad (7)$$

4.3 Estimation Issues

The previous subsections described our general empirical strategy, including our handling of the omitted variables bias. We discussed the use of control variables, employment of the full sets of exporting-country and initiation-year fixed effects, and stratification of the estimated equation at the industry and product level. However, estimating the effect of financial institutions and markets on export survival raises some further identification issues, like endogeneity or unobserved heterogeneity.

First, financial development may be endogenous to export performance (Do and Levchenko 2007). Greenaway et al. (2007) find no evidence that firms with a better ex-ante financial health are more likely to enter foreign markets. They do, however, find strong evidence that firms' financial health improves once they start exporting. This result poses serious challenge for studies examining whether better developed financial institutions and markets promote exports of financially vulnerable firms. Berman and Héricourt (2010) address this issue when examining the selection role of finance with respect to exporting. They look at firm's productivity rather than just its financial health and show that productivity is an important determinant of export decision only after some threshold of financial development is reached. However, subsidies or political connections could still affect both productivity and export performance at the firm level. By contrast, the lack of product's congruence with the comparative advantage of the exporting country (distance to comparative advantage - DCA_{ck,t_z}) is a technological characteristic. It measures the extent to which the product's manufacturing process uses up production factors that do not correspond to the endowment of a given economy. Presumably, neither the various political factors affecting export performance nor the export performance itself will alter the capital or labor intensity of individual products. Our regressors measuring the strength of banks and the depth of stock markets in exporting countries could also be subject to the endogeneity bias if credit and/or stock markets in the economy expand in anticipation of future export booms. However, this bias is less of an issue in our survival framework where the dependent variable is the hazard rate of highly disaggregated trade relationships and not the annual volume of export. Additionally, we measure all explanatory variables, including our bank and stock market proxies, in the initiation years of these individual trade relationships (t_z).

Second, there are some issues associated with using the Cox model in the context of export survival.[31] The Cox model is based on the assumption that the explanatory variables influencing survival have a proportionate impact on the baseline hazard function. A change in covariates would thus shift the hazard function by the same factor in any period. Brenton et al. (2010) provide evidence that this restrictive assumption typically does not hold in export-duration samples. The violation of the proportional hazards assumption may be due to unobserved heterogeneity that causes the estimated parameters to depend on the duration time. Alternatively, it may be that the effect of the explanatory variables is intrinsically non-proportional. Our Cox model is stratified to account for unobserved time-invariant heterogeneity at the industry or product level. This implies that the baseline hazard rate varies across industries and products. However, covariate effects are still assumed to be constant across industry or product strata.[32] In order to account for unobserved heterogeneity and for the possibility of intrinsically non-proportional effects of explanatory variables, we will follow Araujo et al. (2014) and estimate a variant of our main specification using a linear probability model with fixed effects in one of the robustness checks. In that model, the dependent variables are spell survivals of different lengths - one, five, and eight years.

Finally, because all our financial variables (bank credit BC_{c,t_z}, stock market capitalization StM_{c,t_z}, etc.) vary at the country-time level, where time t_z stands for the year when the export spell has been initiated, we report in all tables robust standard errors clustered at the country*(initiation year) level. This procedure avoids biasing the standard errors downwards for our financial development variables whose value is constant across product-level observations within the country-time clusters (Moulton 1986, 1990; Cameron and Trivedi 2005). As robustness checks, we will also cluster standard errors at the country level (Bertrand et al. 2004) and use the two-way clustering for standard errors, following the procedure described in Cameron et al. (2006).

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31 See Hess and Persson (2012) for a full discussion of the drawbacks of Cox regressions in the context of trade data and alternative estimators.

32 Stratification in the continuous Cox model is equivalent to modeling frailty with a gamma distribution in a discrete-time duration model (Hosmer et al. 2008).

5 Empirical Results

5.1 The Role of Banks

In Table 4, we investigate the interplay between disciplinary pressures from product markets and banks towards exporting patterns congruent with the idea of comparative advantage. Table 4 reports estimates using Equation 4 in columns (1) to (3) and Equation 5 in columns (4) to (6). The dependent variable is the probability of exiting the US market (hazard rate, in the terminology of survival analysis) for product k exported from country c. All regressions control for fixed effects at the level of exporting countries and initiation years of the export spells.

Columns (1) to (3) of Table 4 allow for different baseline hazard rate across industries by defining industry as the strata variable (Equation 4). The first column focuses on the disciplining impact of product markets. The positive and significant coefficient for the distance to comparative advantage (DCA_{ck,t_z}) confirms the importance of competitive product markets in enforcing the optimal allocation of resources. Products with factor intensity far away from the endowment of the exporting country face a significantly higher probability of failure in the US destination market. In terms of control variables, higher initial values of exports both to the US and to all destinations ($initial\_export_{ck,t_z}, total\_export_{ck,t_z}$) decrease the hazard rate. Intuitively, products survive longer on the US market when the importers are willing to accept a higher initial shipment and when the exporting country has experience with exporting a given product to other markets as well. The coefficient for the multiple spell dummy ($multiplespell_{ck}$) is positive and significant, suggesting a higher risk of failure for products that repeatedly exit and re-enter the US market. The last product-related variable is the number of suppliers ($NSuppliers_{k,t_z}$), which has a negative impact on the hazard rate. This result is rather counter-intuitive as a higher number of countries exporting a given product should increase the competition in the destination market. A possible explanation could be the positive network effect among exporters (Koenig 2009, Cassey and Schmeiser 2010, Cadot et al. 2013). The effect of the GDP per capita of the exporting country ($GDPpc_{c,t_z}$) has no significant effect in this specification.

The second column in Table 4 examines whether domestic banks provide an additional check on inefficient exporting. The regressors now also include the ratio of bank credit over the GDP in the exporting country (banks - BC_{c,t_z}) and an interaction term between this variable and the distance of exported product to the exporting country's

Table 4: Banks and Comparative Advantage

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)	(6)
distance to comparative advantage	0.126^a	0.102^a	0.076^a	0.145^a	0.109^a	0.080^a
	(0.007)	(0.013)	(0.012)	(0.008)	(0.014)	(0.013)
banks x distance to comparative advantage		0.041^b	0.043^b		0.068^a	0.064^a
		(0.016)	(0.017)		(0.018)	(0.019)
banks		-0.035	-0.039		-0.081^b	-0.082^c
		(0.036)	(0.040)		(0.039)	(0.043)
GDPpc	0.141	0.235^b	0.287^b	0.207^b	0.312^a	0.332^a
	(0.099)	(0.103)	(0.115)	(0.096)	(0.100)	(0.112)
physical capital			-0.053			0.035
			(0.111)			(0.107)
human capital			0.085			0.105
			(0.065)			(0.066)
physical capital x phys. cap. intensity			1.031^a			1.011^a
			(0.165)			(0.167)
human capital x hum. cap. intensity			-0.091^a			-0.098^a
			(0.009)			(0.010)
initial export	-0.084^a	-0.084^a	-0.085^a	-0.091^a	-0.091^a	-0.093^a
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
total export	-0.104^a	-0.105^a	-0.104^a	-0.121^a	-0.121^a	-0.120^a
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
number of suppliers	-0.020^a	-0.020^a	-0.020^a	0.007^a	0.006^a	0.005^a
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
multiple spell	1.024^a	1.013^a	1.045^a	1.026^a	1.014^a	1.033^a
	(0.090)	(0.091)	(0.094)	(0.083)	(0.084)	(0.084)
Exporting country FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
ISIC4 industry strata	yes	yes	yes			
HS6 product strata				yes	yes	yes
Observations	220,041	211,643	191,078	220,041	211,643	191,078

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects. Estimations also allow for different baseline hazard rate across industries (columns 1 to 3) and across products (columns 4 to 6) by defining industry j and product k as strata variables. Our first variable of interest is the Euclidean distance of the revealed factor intensity of product k to the factor endowment of exporting country c (distance to comparative advantage - DCA_{ck,t_z}). Our second variable of interest is the interaction between the distance measure and banking development in country c proxied by bank credit over GDP (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$). The control variables include the direct effect of bank credit over GDP (banks - BC_{c,t_z}) as well as GDP per capita of country c ($GDPpc_{c,t_z}$), countries' endowments of physical capital (κ_{c,t_z}) and human capital (h_{c,t_z}), corresponding physical and human capital intensities at the industry level ($CapInt_j, HumInt_j$), initial export value to the USA ($initial\_export_{ck,t_z}$), total export value to the world market ($total\_export_{ck,t_z}$), number of countries exporting product k to the USA ($NSuppliers_{k,t_z}$), and a dummy variable taking value one if the spell is a higher order spell ($multiplespell_{ck}$). All time-varying explanatory variables are measured in the initial year of the export spell t_z. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

comparative advantage (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$). A well-developed banking sector should in general help the exporters survive on foreign markets. Domestic banks (BC_{c,t_z}) indeed lower the hazard rate, but this direct effect is not statistically significant. By contrast, the interaction term between banks and distance to comparative advantage ($BC_{c,t_z} * DCA_{ck,t_z}$) has a positive and statistically significant effect on the hazard rate. The coefficient for the distance to comparative advantage measure (DCA_{ck,t_z}) also remains highly significant. Joint interpretation of positive estimates for both coefficients (DCA_{ck,t_z}, $BC_{c,t_z} * DCA_{ck,t_z}$) suggests that banks push exporters to abandon products that are already facing an uphill battle on the US destination market due to the suboptimal use of the domestic factor endowments. With regard to our control variables, the GDP per capita of the exporting country ($GDPpc_{c,t_z}$) has a positive and significant effect on the hazard rate. While this result might appear counter-intuitive at first sight, two features of our estimation strategy provide an explanation. First, we control for exporting-country fixed effects in all regressions. The effect of $GDPpc_{c,t_z}$ is thus identified solely from variations within countries over time. These variations emerge both from growth trend and from business cycle fluctuations. Second, we measure all time-varying regressors in the first year of an export spell (t_z). Economically, the positive estimated coefficient for $GDPpc_{c,t_z}$ would then imply that exports initiated at the peak of a business cycle in the country of origin face higher risk of failure. Possible reasons for this effect include over-confidence of exporters during a boom or difficulties to maintain the costly presence in the US destination market once the business climate at home deteriorates.

In the third column of Table 4, we add interaction terms between the exporting countries' factor endowments and the corresponding factor intensities at the sectoral level (physical capital x physical capital intensity - $\kappa_{c,t_z} * CapInt_j$, human capital x human capital intensity - $h_{c,t_z} * HumInt_j$). These interacted variables control for the possibility that products from industries extensively using physical or human capital survive longer in the US destination market if the exporting country is abundant in such a capital. When adding these interaction terms, we also control for the direct effect of exporting countries' endowments in physical capital (κ_{c,t_z}) and human capital (h_{c,t_z})[33] while the direct effect of the corresponding factor intensities ($CapInt_j$, $HumInt_j$) is captured by

[33] Countries' factor endowments are time-varying variables measured in the initial year of a trade relationship. Direct impact of the physical and human capital (κ_{c,t_z},h_{c,t_z}) is therefore *not* absorbed by the exporting country fixed effects. The same logic also applies to other time-varying characteristics of the exporting countries like the bank credit over GDP (BC_{c,t_z}) or the GDP per capita ($GDPpc_{c,t_z}$).

the industry strata effects.[34] Our main interaction term capturing the disciplining effects of banks (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) maintains a positive and statistically significant coefficient. Similarly, the direct effect of distance to comparative advantage (DCA_{ck,t_z}) still translates into a higher hazard rate of exports, confirming the disciplining impact of the competitive US market. The interaction term between human capital and human capital intensity ($h_{c,t_z} * HumInt_j$) has the expected negative sign while the direct effects of endowments in physical and human capital (κ_{c,t_z}, h_{c,t_z}) are insignificant. The interaction between physical capital and physical capital intensity ($\kappa_{c,t_z} * CapInt_j$) has a positive sign, suggesting that products of capital-intensive industries coming from capital-abundant countries face a higher risk of exit from the US destination market. This rather counter-intuitive result is similar to Manova (2008a), who finds a negative effect of this interaction term on export volume.

In columns (4) to (6) of Table 4, we explore the disciplining effects of the US destination market and banking system in the country of origin within a more stringent econometric specification. We replicate the specifications in columns (1) to (3) but apply the stratification according to HS 6-digit products (Equation 5) rather than ISIC 4-digit industries. Concerning our main focus on the interplay between disciplining forces of product markets and banks, the results confirm in qualitative terms those obtained in columns (1) to (3). Both distance to the comparative advantage and the interaction of this variable with the strength of banking system in the country of origin retain a positive and significant effect on products' probability of exit from the US market. Furthermore, both the point estimate and the significance level of our main interaction term (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) increase after stratification at the product rather than just industry level. Accounting for unobserved heterogeneity at the product level also yields two changes regarding our control variables. First, the number of suppliers ($NSuppliers_{k,t_z}$) - measuring the number of countries exporting the given product to the US and thus capturing the strength of import competition on the US product markets - now has the expected positive sign, increasing the products' hazard rate. Second, the expected negative direct effect of banks (BC_{c,t_z}) on the hazard rate is now statistically significant in the fifth and sixth column where it is included.

[34] To be precise, this capturing is not complete due to application of concordances in order to match data measured in different classifications as described in the data section. We do not report the coefficients for direct effect of factor intensities as these do not have a meaningful economic interpretation and are a mere artefact of the circumstance that official concordances sometimes match an ISIC 3-digit industry according to Revision 2 to more than one ISIC 4-digit industry according to Revision 3.

Column (6) of Table 4 represents our preferred specification. Unless stated otherwise, later estimations take this specification as the reference point. Overall, the results from Table 4 suggest a statistically significant disciplining effect of both product markets and banks when it comes to terminating exports to the US that do not optimally use the available factors of production in the countries of origin. Before moving to further robustness checks, let us consider the economic significance of our results.

One way to get a sense of the economic magnitude regarding the disciplining forces of product markets and banks is as follows. First, let us take Turkey as an example of a country exporting into the USA and consider the effect of distance to comparative advantage alone from column (4) of Table 4. Given the available factor endowment of Turkey, one would intuitively expect that the comparative advantage for Turkish exporters could lie in the area of clothing and footwear. And indeed, one product from the bottom 25th percentile of the distance to comparative advantage (DCA_{ck,t_z}) in case of Turkey is "Footwear with leather" ($DCA_{ck,t_z} = 0.71$). By contrast, a product called "Equipment for automatically developing photographic films" ($DCA_{ck,t_z} = 1.90$) is in the top 25th percentile of the distance to comparative advantage and thus far away from the comparative advantage of Turkey. The estimated coefficient for DCA_{ck,t_z} in column (4) of Table 4 is 0.145. Between two products exported from Turkey to the USA, a product far away from the comparative advantage of Turkey like "Equipment for automatically developing photographic films" thus faces approximately a 17 per cent higher hazard rate on the US destination market than a product that is well aligned with with Turkish comparative advantage like "Footwear with leather". This is computed as follows: $0.145 * (1.90 - 0.71) \simeq 0.173$. Second, let us consider the effect of banking sector from column (6) of Table 4 and assume that Turkey would reach the average level of banking development among the OECD countries, i.e. the value of the variable BC_{c,t_z} would increase from 0.16 to 0.84. Equation 5 and estimated coefficients from column (6) of Table 4 then imply that that the hazard rate for any given product exported from Turkey to the USA would change by $\beta_2 \Delta BC_{c,t_z} * DCA_{ck,t_z} + \gamma \Delta BC_{c,t_z} = \Delta BC_{c,t_z} * [\beta_2 DCA_{ck,t_z} + \gamma] = (0.84 - 0.16) * [0.064 * DCA_{ck,t_z} - 0.082]$. In case of a product far away from the comparative advantage of Turkey like "Equipment for automatically developing photographic films" ($DCA_{ck,t_z} = 1.90$), the hazard rate of exports would then increase by approximately 2.7 per cent: $(0.84 - 0.16) * [0.064 * 1.90 - 0.082] = 0.027$. In case of a product well aligned with with Turkish comparative advantage like "Footwear with leather"($DCA_{ck,t_z} = 0.71$), the hazard rate would actually decrease by approximately 2.5 per cent: $(0.84 - 0.16) * [0.064 * 0.71 - 0.082] = -0.025$. The example thus shows how a better developed banking sector could significantly push the exporting sector of a country towards products that make the optimal use of available resources.

In Table 5, we further examine the disciplining role banks have on exports not corresponding to the notion of comparative advantage. In columns (1) to (2), we look at alternative proxies of the strength of the banking sector in the exporting country. In columns (3) to (6), the focus is on the disciplining role traditional banks have on real non-financial sector versus the impact of various other financial institutions on real economy.

Column (1) of Table 5 reports the results of our preferred specification from column (6) in Table 4, replacing the credit by banks to private real sector (BC_{c,t_z}) with the overall bank assets (BA_{c,t_z}) - both normalized by GDP of a given country. The main interaction term in the first column of Table 5 is thus bank assets x distance to comparative advantage ($BA_{c,t_z} * DCA_{ck,t_z}$). In column (2), we replace the bank credit (BC_{c,t_z}) with the total credit by both banks and other financial institutions (TC_{c,t_z}) - again, normalized by GDP. The main interaction terms thus becomes total credit x distance to comparative advantage ($TC_{c,t_z} * DCA_{ck,t_z}$). Compared to Table 4, column (1) of Table 5 looks at a broader measure of the claims bank have on the non-financial real sector of the economy rather than at extended credit alone while column (2) looks at credit extended by a broader set of financial institutions rather than by the deposit-taking money banks alone. Our main results from Table 4 are robust to using these broader measures of the importance of financial institutions for the real economy.

Comparing column (2) from Table 5 to column (6) from Table 4, it seems that the results for a broader set of financial institutions is somewhat weaker than when looking at traditional banks alone. In particular, the main interaction term in column (2) of Table 5 (total credit x distance to comparative advantage - $TC_{c,t_z} * DCA_{ck,t_z}$) has a lower level of significance, suggesting a possibly lower disciplining effect of other financial institutions on exporting activities of the real sector. This could be explained by the presence of state banks and other governmental financial institutions in many countries in our sample. These institution do not rely on deposit taking but receive a bulk of their funding directly from government. Arguably, such institutions face lower pressure to invest their funds efficiently and are thus less suitable as a disciplining device towards their own borrowers. We examine this hypothesis more directly in column (3) of Table 5, where our main financial proxy is the difference between total credit by all banks and financial institutions and the credit extended by deposit-taking money banks, capturing

Table 5: Alternative Measures of Banks and Comparative Advantage

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)
distance to comparative advantage	0.078^a	0.083^a	0.120^a	0.081^a	0.086^a	0.047^c	0.001
	(0.014)	(0.014)	(0.008)	(0.014)	(0.020)	(0.025)	(0.022)
banks x distance to comparative advantage				0.064^a		0.055^a	0.053^b
				(0.019)		(0.021)	(0.021)
bank assets x distance to comp. advantage	0.051^a						
	(0.019)						
total credit x distance to comp. advantage		0.047^b					
		(0.020)					
non-bank credit x dist. to comp. advantage			-0.053	-0.005			
			(0.062)	(0.057)			
credit to government x dist. to comp. adv.					-0.001^b	-0.001^a	
					(0.000)	(0.000)	
banks				-0.046		-0.211^b	-0.147
				(0.043)		(0.096)	(0.093)
bank assets	-0.113^c						
	(0.061)						
total credit		0.022					
		(0.042)					
non-bank credit			0.147^c	0.104			
			(0.088)	(0.086)			
credit to government					-0.001	-0.002	
					(0.002)	(0.002)	
Full set of controls	yes	yes	yes	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes
HS6 product strata	yes	yes	yes	yes	yes	yes	yes
Observations	196,627	197,450	191,078	191,078	54,329	54,329	54,329

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects and allow for different baseline hazard rate across products by defining product k as strata variable. Bank assets are claims on domestic real non-financial sector by deposit money banks as a share of GDP, total credit is the ratio of private credit by deposit money banks and other financial institutions over GDP, non-bank credit is the credit extended by other financial institutions than banks as a share of GDP (i.e., the difference between values for banks and total credit), credit to government is the credit extended to the general government sector, including central, state and local governments and social security funds. Other variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

the credit extended by other financial institutions (non-bank credit - NBC_{c,t_z}). The non-significant interaction term between non-bank credit and distance to comparative advantage ($NBC_{c,t_z} * DCA_{ck,t_z}$) confirms that when it comes to inefficient exporting, other financial institutions lack the disciplining impact of deposit-taking banks. This picture is further reinforced in column (4) where the two proxies capturing the strength of banks and the strength of other financial institutions jointly enter the regression. While the interaction term between banks and distance to comparative advantage has the expected sign and a high level of statistical significance, the interaction of non-bank credit and distance to comparative advantage remains insignificant.

In columns (5) and (6) of Table 5, we distinguish between credit extended to private non-financial sector and credit extended to government. If our results are driven by the specific disciplining role of banks towards firms rather than by some general pattern of exporting during credit booms, credit to government (GC_{c,t_z}) should not have the same impact on terminating inefficient exports. And indeed, high levels of credit extended to government of the exporting country has actually a worsening impact on resource allocation, by disproportionately lowering the hazard rate of exports not corresponding to comparative advantage of exporting country. In particular, the interaction term between credit to government and distance to comparative advantage ($GC_{c,t_z} * DCA_{ck,t_z}$) is negative and significant in column (5) of Table 5. This result for credit to government remains the same in column (6) where we allow our main interaction of banks and distance to comparative advantage to enter the regression. In contrast, the main interaction term itself is significant and of expected sign in column (6).

The last column of Table 5 performs an additional robustness test due to the significantly lower number of observations in columns (5) and (6). Data on government credit are available only for a smaller subset of countries, so that the results in column (6) could be partially driven by multicollinearity between the bank credit to private non-financial sector and the credit to government in the small sample. In column (7) of Table 5, we thus re-run the estimation on the smaller sample from previous two columns but allow only the interaction of banks and distance to comparative advantage to enter the regression. Even without the presence of government credit in the estimation, the disciplining impact of banks on export does survive, as can be seen from the positive and significant impact of the main interaction term (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) on the hazard rate of exports into USA.

Overall, results in Table 5 provide further evidence that a strong banking sector in the exporting country can enhance the disciplining impact of the US destination market when it comes to products not corresponding to the comparative advantage of the country exporting to the USA. While it does not seem to matter whether the importance of banking sector in the economy is measured by credit extended to private non-financial sector or by the overall bank assets, other financial institutions do not seem to exert the same disciplining effect as banks. And the credit extended to government has, if anything, a negative impact on the resource allocation. These results are in line with conventional wisdom both about disciplining effect of external creditors like banks on firms and about potential misallocative effects related to financial flows where either the lender or borrower has access to taxpayers' money. We plan to look deeper into this issue in our future work.

Banks and Bond Markets

In our paper, we sometimes use the terms banks and external debtholders interchangeably. Our focus on banks is motivated by the clear dominance of bank lending in debt financing around the world (see, e.g., Shleifer and Vishny 1997). Banks are also the principal suppliers of financing for the exporting activities of firms (see, e.g., Amiti and Weinstein 2011). When it comes to the disciplining role of external debt, existing literature often does not distinguish between private creditors (e.g., banks extending credit to firms) and public creditors (e.g., holders of publicly tradable corporate bonds). However, Denis and Mihov (2003) extend the arguments by Stulz (1990) and Berger et al. (1997) about the role of managerial discretion in choosing the debt/equity ratio to the case of public versus private debt and argue that private lenders like banks are better equipped to push firms' management towards optimal level of investment than public debtholders are. This is due to their concentrated holdings of external debt and superior access to information. Lin et al. (2013) make a similar argument regarding the monitoring abilities of banks versus the holders of public debt.[35]

For completeness, Table 13 in the Appendix reports additional regressions that include three proxies for the strength of bond markets in countries exporting to the USA: domestic private bonds (columns 2-3), international private bonds (columns 5-6) and international bonds issued by non-financial firms only (columns 8-9) - all normalized by the GDP of the exporting country. Given the dominance of bank lending in most countries, the number of observations is lower for all three bond markets proxies compared to our main bank proxy. For better comparison, columns (1), (4), and (7) of Table 13 therefore report results in these reduced samples for the specification from column (6) of Table 4 that focuses on our main banking channel. Columns (2), (5), and (8) report the regression results with the interactions of our three bond markets proxies with distance to comparative advantage measure. Finally, columns (3), (6), and (9) allow for the possibility that both strong banks and well-developed bond markets in exporting countries increase the hazard rate in the

[35] Recent papers that examine bank loans versus public bonds from different perspectives than disciplining role of debt include Gomes and Phillips (2012), Colla et al. (2013), and Morellec et al. (2015).

US destination market disproportionately for those products that do not correspond to the comparative advantage of the exporting country.

In Table 13, the bank interaction term is always positive and significant when included, confirming the importance of the banking sector in the exporting country when it comes to enhancing the disciplining impact of the US destination market on products far away from the comparative advantage of the exporting country. When it comes to the bond markets, only the interaction term of the first bond proxy with distance to comparative advantage enters significantly the regressions in columns (2) and (3). This results may be explained by the fact that both this proxy and the proxy entering columns (5) and (6) of Table 13 include bonds issued by financial firms like banks themselves. These bonds can arguably contribute to financing bank operations that support exporting activities of firms and do not necessarily show up in data on bank loans (e.g., letters of credit, export insurance). In future research, we plan to look further into disentangling these channels. Importantly for the purposes of this paper, the interaction term of distance to comparative advantage with the one bond proxy that does capture solely the bonds issued by non-financial firms is not significant in columns (8) and (9) of Table 13. Overall, these results suggest that private debtholders like banks are indeed more effective than bondholders when it comes to disciplining firms' export behavior.

5.2 The Role of Stock Markets

In Table 6, we repeat the estimations from Table 4, but in the main interaction term we replace the ratio of private credit over GDP with the ratio of stockmarket capitalization over GDP. Specifications in columns (1) to (3) allow for a different baseline hazard rate across 118 ISIC 4-digit industries (Equation 6) while the regressions reported in columns (4) to (6) allow the baseline hazard rate to vary across all 4,562 HS 6-digit products (Equation 7). A positive coefficient for the resulting variable (stock markets x distance to comparative advantage - $StM_{c,t_z} * DCA_{ck,t_z}$) would suggest that shareholders are also able to exert a disciplining influence on exports that do not correspond to the exporting country's comparative advantage. The results in Table 6 do not support this hypothesis. The interaction term between stock market capitalization and distance to comparative advantage is never significant and once even enters the regression with the wrong sign.

These results are not likely to stem from a measurement problem. Similarly to the banking development, we rely on a standard and widely used empirical proxy for the stock markets development. Moreover, the traditional channel of financial institutions

Table 6: Stock Markets and Comparative Advantage

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)	(6)
distance to comparative advantage	0.126^a	0.131^a	0.098^a	0.145^a	0.147^a	0.108^a
	(0.007)	(0.011)	(0.010)	(0.008)	(0.012)	(0.011)
stock markets x distance to comp. advantage		-0.000	0.004		0.005	0.006
		(0.012)	(0.012)		(0.014)	(0.013)
stock markets		0.031	0.025		0.026	0.024
		(0.026)	(0.028)		(0.028)	(0.030)
GDPpc	0.141	0.111	0.210	0.207^b	0.193^c	0.271^b
	(0.099)	(0.115)	(0.132)	(0.096)	(0.112)	(0.132)
physical capital			-0.110			-0.051
			(0.121)			(0.119)
human capital			0.057			0.076
			(0.065)			(0.066)
physical capital x phys. cap. intensity			0.847^a			0.851^a
			(0.196)			(0.195)
human capital x hum. cap. intensity			-0.110^a			-0.118^a
			(0.010)			(0.011)
initial export	-0.084^a	-0.085^a	-0.087^a	-0.091^a	-0.093^a	-0.096^a
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
total export	-0.104^a	-0.105^a	-0.103^a	-0.121^a	-0.126^a	-0.124^a
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
number of suppliers	-0.020^a	-0.021^a	-0.021^a	0.007^a	0.008^a	0.006^a
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
multiple spell	1.024^a	1.076^a	1.116^a	1.026^a	1.076^a	1.101^a
	(0.090)	(0.099)	(0.104)	(0.083)	(0.091)	(0.092)
Exporting country FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
ISIC4 industry strata	yes	yes	yes			
HS6 product strata				yes	yes	yes
Observations	220,041	203,649	182,592	220,041	203,649	182,592

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects. Estimations also allow for different baseline hazard rate across industries (columns 1 to 3) and across products (columns 4 to 6) by defining industry j and product k as strata variables. Stock markets development of country c is represented by the ratio of stock market capitalization over GDP (stock markets - StM_{c,t_z}). Other variables are defined in Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

and markets promoting exports via easing the liquidity constraints does work in the case of stock markets (see Table 14 in the Appendix). The coefficient for the interaction term of stock markets and dependence on external finance ($StM_{c,t_z} * ExF_j$) is negative and significant in all columns of Table 14. As predicted by theory and previous empirical work (e.g., Jaud et al. 2009), deep stock markets do improve countries' export performance (decrease the hazard rate of export spells) especially for those industries that heavily depend on external finance. The comparison between Table 4 and Table 6 therefore does not imply that stock markets are not important for export performance in general. It is only the case of the disciplining channel examined in this paper where banks play a pivotal role. Section 7 proposes a theoretical explanation consistent with these results.

Table 7 further explores whether stock markets in exporting countries play a role in enhancing the disciplining effects of the US product market. Columns (1) and (2) report the results of estimations analogous to column (6) of Table 6 with alternative measures of the strength of stock markets in the exporting country. These measures are the value of stock market transactions relative to GDP - stock market value traded ($StMVT_{c,t_z}$) and the ratio of the value of total shares traded to market capitalization - stock market turnover ($StMT_{c,t_z}$). Both alternative measures are supposed to capture not only size but also liquidity of the stock markets in a given country (for a more detailed discussion of various stock market measures see, e.g., Strieborny and Kukenova, forthcoming). Like with all other financial proxies, the two alternative measures capturing the depth of stock markets in a given country exporting to the USA enter the regression both directly and interacted with the country-product measure of distance to comparative advantage. In column (1) of Table 7, the interaction of stock market value traded and distance to comparative advantage is insignificant, confirming the results using stock market capitalization in Table 6 - deep stock markets do not seem to complement the disciplining effect of the US product market that is captured by the positive and significant direct impact of distance to comparative advantage. In column (2), the interaction of stock market turnover and distance to comparative advantage is marginally significant but with the wrong sign.

Columns (3) to (5) of Table 7 report the results of direct horse-races between the effect of banks (measured by our main bank proxy BC_{c,t_z}) and the effect of stock markets (measured by our three alternative stock market proxies - StM_{c,t_z}, $StMVT_{c,t_z}$, $StMT_{c,t_z}$). In the third column of Table 7, we run an econometric horse-race between our main bank and stock market proxies and include the levels of banking and stock market development (banks - BC_{c,t_z}, stock markets - StM_{c,t_z}) and their interaction with distance to comparative advantage ($BC_{c,t_z} * DCA_{ck,t_z}$, $StM_{c,t_z} * DCA_{ck,t_z}$) simultaneously into our specification. The coefficients for distance to comparative advantage (DCA_{ck,t_z}) and its interaction with banks ($BC_{c,t_z} * DCA_{ck,t_z}$) are both positive and highly significant. In contrast, the interaction term between stock markets and distance to comparative advantage ($StM_{c,t_z} * DCA_{ck,t_z}$) is non-significant in this specification, further confirming the results from Table 6. In columns (4) and (5) of Table 7, the econometric horse-race is between our main bank proxy and the alternative stock market measures from the first two

Table 7: Alternative Measure of Stock Markets and Comparative Advantage

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)
distance to comparative advantage	0.117^a	0.124^a	0.086^a	0.089^a	0.094^a
	(0.010)	(0.010)	(0.015)	(0.015)	(0.016)
banks x dist. to comp. advantage			0.064^a	0.071^a	0.054^a
			(0.023)	(0.022)	(0.020)
stock markets x dist. to comp. advantage			-0.017		
			(0.015)		
stock market value traded x dist. to comp. advantage	-0.017			-0.047^a	
	(0.014)			(0.017)	
stock market turnover x dist. to comp. advantage		-0.018^c			-0.015
		(0.009)			(0.009)
banks			-0.060	-0.071	-0.050
			(0.044)	(0.044)	(0.042)
stock markets			0.053^c		
			(0.030)		
stock market value traded	0.101^a			0.132^a	
	(0.028)			(0.030)	
stock market turnover		0.037^c			0.020
		(0.021)			(0.021)
Full set of controls	yes	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 product strata	yes	yes	yes	yes	yes
Observations	180479	179311	175,481	173368	172200

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects and allow for different baseline hazard rate across products by defining product k as strata variable. Stock markets is the ratio of stock market capitalization over GDP, stock market value traded is the value of stock market transactions relative to GDP and stock market turnover is the ratio of the value of total shares traded to market capitalization. Other variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

columns of Table 7. The previously insignificant interaction term of stock market value traded from column (1) becomes significant but with wrong sign in column (4) while the previously significant interaction of stock market turnover from column (2) gets insignificant when controlling for the bank channel in column (5). In contrast, the coefficients for distance to comparative advantage and its interaction term with banks have once again the right sign and are highly significant in both column (4) and (5) of Table 7.

Overall, the results in Table 6 and Table 7 suggest that stock markets do not exercise the same disciplining impact on the exports as banks and therefore do not complement the positive allocative impact of the competitive US markets in this regard. The occasional significance of the wrong sign for the interactions of distance to comparative advantage with some stock markets proxies in some specifications is somewhat puzzling and warrants further research. We will provide some preliminary evidence for a possible explanation in the next subsection where we look at alternative channels that could be correlated with the disciplining impact of product markets in the destination country and banks and stock markets in the country of origin.

5.3 Alternative Channels

One concern in estimations reported in the previous two subsections is that our bank and stock market interaction terms may be picking up effects of other alternative channels that could be correlated with our mechanism. In Table 8, we therefore re-estimate our baseline specification that entails the bank interaction term (column 6 in Table 4), while adding the interaction term of our main stock market variable with distance to comparative advantage as well as additional controls capturing possible alternative channels.

In the first column of Table 8, we control for an alternative channel from finance to export survival. The seminal paper of Rajan and Zingales (1998) emphasizes the beneficial impact of a well-developed financial system for financially constrained industries that are highly dependent on external financing. Jaud et al. (2009) confirm the relevance of this mechanism in the context of export survival. They show that a strong financial sector facilitates export survival disproportionately for those sectors that do not generate enough cash-flow to cover their investment needs and therefore have to rely on external finance. In the first column, we therefore augment the specification by adding interaction of countries' bank credit with industries' dependence on external finance ($BC_{c,t_z} * ExF_j$). The significant disciplining effects of the US destination market and banking sector in the country of origin are not affected by this additional variable. The stock markets in the country of origin lack a significant disciplining effect on products not congruent with the comparative advantage also in this specification, confirming the results from Subsection 5.2. The estimated coefficient for the control itself (banks x dependence on external finance - $BC_{c,t_z} * ExF_j$) is negative and significant, confirming the findings of Jaud et al. (2009). The direct effect of banks (BC_{c,t_z}) on export survival remains insignificant while the direct effect of industry's dependence on external finance (ExF_j) is captured by the strata effects.

Another bias might arise due to the high correlation between countries' financial and overall economic development. Rather than the disciplining effects of banks, our main interaction term (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) may simply capture the effect of some unobservable features of rich countries that help them

Table 8: Banks, Stock Markets, and Comparative Advantage: Alternative Channels

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)	(6)
					External finance dependence	
					Low	High
distance to comparative advantage	0.090[a]	0.163[c]	2.630[a]	2.650[a]	0.046[a]	0.100[a]
	(0.014)	(0.090)	(0.812)	(0.858)	(0.016)	(0.024)
banks x dist. to comp. advantage	0.051[b]	0.070[a]	0.042[c]	0.045[c]	0.024	0.080[b]
	(0.022)	(0.025)	(0.024)	(0.026)	(0.021)	(0.034)
stock markets x dist. to comp. advantage	-0.016	-0.016	-0.037[b]	-0.033[b]	0.006	-0.037
	(0.015)	(0.015)	(0.015)	(0.015)	(0.019)	(0.026)
banks x dep. on ext. finance	-0.222[a]			-0.245[a]		
	(0.037)			(0.040)		
GDPpc x dist. to comp. advantage		-0.009		-0.037[a]		
		(0.011)		(0.012)		
real exchange rate x dist. to comp. advantage			1.126[a]	0.983[b]		
			(0.362)	(0.395)		
banks	0.008	-0.067	-0.075	-0.021	0.021	-0.080
	(0.043)	(0.047)	(0.047)	(0.051)	(0.055)	(0.067)
stock markets	0.052[c]	0.052[c]	0.085[a]	0.081[a]	-0.008	0.072[b]
	(0.030)	(0.030)	(0.029)	(0.029)	(0.039)	(0.036)
GDPpc	0.358[a]	0.362[a]	0.174	0.213	0.448[a]	0.361[a]
	(0.132)	(0.133)	(0.166)	(0.167)	(0.165)	(0.133)
real exchange rate			-0.693	-0.557		
			(0.862)	(0.875)		
Full set of controls	yes	yes	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
HS6 product strata	yes	yes	yes	yes	yes	yes
Observations	175,481	175,481	121,157	121,157	48,158	50,504

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects and allow for different baseline hazard rate across products by defining product k as strata variable. Estimations reported in columns (1) to (4) are run on the whole sample. Columns (5) and (6) report results for subsamples of products from the bottom and the top quartile of ISIC 4-digit industries dependent on external finance. Additional control variables include: the interaction between the bank credit over GDP in country c and the dependence of industry j on external finance ($BC_{c,t_z} * ExF_j$), the interaction between GDP per capita of country c and the distance to comparative advantage ($GDPpc_{c,t_z} * DCA_{ck,t_z}$), and the real exchange rate (RER_{c,t_z}) and its interaction with the distance to comparative advantage ($RER_{c,t_z} * DCA_{ck,t_z}$). Other variables are defined in Table 4 and Table 6. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

avoid using resources inefficiently for unpromising exports. In the second column of Table 8, in addition to exporting country's GDP ($GDPpc_{c,t_z}$), we therefore also include its interaction with the distance to comparative advantage ($GDPpc_{c,t_z} * DCA_{ck,t_z}$) to account for any direct and indirect effect of country's economic development on export performance. Despite the high correlation between financial and economic development, the coefficients for the distance to comparative advantage (DCA_{ck,t_z}) and its interaction with banks ($BC_{c,t_z} * DCA_{ck,t_z}$) remain positive and significant.[36] Both the interaction of stock markets and distance to comparative advantage ($StM_{c,t_z} * DCA_{ck,t_z}$) and the interaction of the GDP per capita with the distance to comparative advantage ($GDPpc_{c,t_z} * DCA_{ck,t_z}$) are insignificant. It seems to be the disciplining impact of a well-developed banking system rather than some general feature of rich countries that prevents resource misallocation in form of attempted exports not corresponding to the exporting country's factor endowment.

In the third column of Table 8, we control for the level of real exchange rate of countries exporting their products to the USA. As countries develop both economically and financially, their currencies often appreciate due to the well-known Harrod-Balassa-Samuelson effect. The episodes of rapid financial development are also sometimes associated with inflows of foreign capital that can lead to currency appreciations. These developments could introduce bias with unclear sign into our regressions if changes in the currency levels affect exports of products that use up mostly abundant factors of production in a given country (i.e., products with low values of our distance to comparative advantage measure) differently from exports of products that use up a lot of scarce production factors (i.e., products with high values of the distance to comparative advantage). The results in the third column of Table 8 document the robustness of our main results to this alternative channel. Coefficients for both distance to comparative advantage and its interaction with banks remain significant with the expected positive sign. In contrast, the stock market interaction now becomes significant with the wrong sign. The result from Table 7 where the other two stock market proxies were also sometimes significant with the wrong sign could thus be explained by some interplay between stock market development and real appreciations, for example during economic booms driven by inflows of foreign capital. We leave this issue for further research.

In the fourth column of Table 8, we simultaneously control for all three alternative economic channels examined in columns (1) to (3). In particular, we include as control variables the interaction term between countries' banking sector development and industries' dependence on external finance ($BC_{c,t_z} * ExF_j$), the interaction term between countries' economic development and the distance to comparative advantage ($GDPpc_{c,t_z} * DCA_{ck,t_z}$), and the real exchange rate (RER_{c,t_z}) and its interaction with distance to comparative advantage ($RER_{c,t_z} * DCA_{ck,t_z}$). Our main results are robust also in this extended spec-

[36] The strength of banking sector (BC_{c,t_z}) and the GDP per capita ($GDPpc_{c,t_z}$) are correlated at 61% in our sample.

ification. Both distance to comparative advantage (DCA_{ck,t_z}) and its interaction term with banking development in the exporting country (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) remain positive and significant.

Finally, in column (5) and (6) of Table 8, we look closer at the interplay between the channel examined in this paper and the traditional role banks and stock markets play in alleviating financial constraints. The role of financial constraints is particularly important in the case of a costly and investment-intensive activity like exporting (see, e.g., Beck 2002, 2003; Jaud et al. 2009, 2015). We have already documented the importance of banks (first column of Table 8) and stock markets (Table 14) in disproportionately decreasing hazard rate for financially constrained industries that are dependent on external finance. On the other hand, the disciplining channel examined in this paper seems to operate only through strong banks and not through deep stock markets. Now we examine whether the strength of this disciplining effect varies according to the severity of financial constraints firms face. Column (5) of Table 8 reports the results for the subset of exported products from industries that are in the bottom quartile of dependence on external finance. Column (6) of Table 8 reports results for the highly financially constrained industries from the top quartile of dependence on external finance. One could expect that external debtholders like banks in the exporting countries are better able to enhance the disciplining effect of the US destination market in industries where firms require a high level of external financing in the first place. And indeed, while the interaction term of banks and comparative advantage has expected sign and is highly significant in column (6), it is insignificant in column (5). The direct effect of distance to comparative advantage is positive and significant in both column (5) and (6). The higher magnitude of the coefficient in column (6) suggests that the disciplining effect of the US destination market might also be higher for the products from financially constrained industries. Again, deep stock markets in exporting countries do not seem to enhance the disciplining effect of the US destination market as the coefficient of the stock market interaction is insignificant for both financially constrained and unconstrained industries.

6 Robustness Tests

In this section, we perform a series of additional regressions to confirm the robustness of our main results. As stock markets do not exert a significant disciplining effect on exports already in the previous specifications (as seen in Table 6, Table 7, Table 8, and Table 14), we focus on the robustness of the bank channel. The point of departure is column (6) of

Table 4.

6.1 Alternative Sample and Measures of Distance to Comparative Advantage

Table 9 examines the robustness of our main results to both sample composition and alternative definitions of the variable capturing the distance to comparative advantage (DCA_{ck,t_z}).

In the first column of Table 9, we drop all observations from small island countries as they often specialize in exports of only a few products.[37] The reported results are similar to those in the sixth column of Table 4. Products far away from the comparative advantage of the exporting country still face higher hazard rate on the competitive US market as documented by a positive and significant coefficient for distance to comparative advantage DCA_{ck,t_z}. This pattern is stronger if the exporting country has a well-developed banking system (positive and significant coefficient for the main interaction term between banks and distance to comparative advantage $BC_{c,t_z} * DCA_{ck,t_z}$). Our results are thus not driven by small countries in the sample.

Table 9: Robustness Checks I: Banks and Comparative Advantage

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No small islands		Incl. land		No exp. country in DCA		No USA in DCA	
		Abs.	Eucl.	Abs.	Eucl.	Abs.	Eucl.	Abs.
distance to comparative advantage	0.082^a	0.053^a	0.067^a	0.038^a	0.059^a	0.040^a	0.060^a	0.041^a
	(0.014)	(0.009)	(0.014)	(0.008)	(0.011)	(0.008)	(0.011)	(0.008)
banks x dist. to comp. advantage	0.061^a	0.046^a	0.080^a	0.054^a	0.045^a	0.034^a	0.046^a	0.034^a
	(0.019)	(0.013)	(0.019)	(0.012)	(0.014)	(0.010)	(0.014)	(0.010)
banks	-0.081^c	-0.080^c	-0.134^a	-0.141^a	-0.056	-0.055	-0.058	-0.056
	(0.043)	(0.042)	(0.048)	(0.049)	(0.040)	(0.039)	(0.040)	(0.039)
Full set of controls	yes	yes	yes	yes	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
HS-6 product strata	yes	yes	yes	yes	yes	yes	yes	yes
Observations	181,612	191,078	191,078	191,078	190,490	190,490	191,078	191,078

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects and allow for different baseline hazard rate across products by defining product k as strata variable. Variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

[37] The excluded microstate islands are The Dominican Republic, Haiti, Jamaica, Mauritius and Trinidad and Tobago.

The remaining columns of Table 9 examine the robustness of our results to alternative ways of computing the distance to comparative advantage (DCA_{ck,t_z}). In the second column, we replace the Euclidean distance with the absolute distance. The new formula for distance of product k from comparative advantage of exporting country c (Equation 1) now writes:

$$DCA_{ck,t_z} = |std(\kappa_{c,t_z} - \hat{\kappa}_{k,t_z})| + |std(h_{c,t_z} - \hat{h}_{k,t_z})| \tag{8}$$

Results remain qualitatively the same. In the third and fourth column of Table 9, we add arable land per worker as a third production factor when computing the distance to comparative advantage. We use the Euclidean distance in column (3) and absolute distance in column (4). Adding the third production factor does not qualitatively change our results for either the direct effect of distance to comparative advantage (DCA_{ck,t_z}) or the main interaction term between banks and distance to comparative advantage ($BC_{c,t_z} * DCA_{ck,t_z}$).

In columns (5) to (8), we address the potential bias that could emerge due to the fact that for all trade flows from any given exporting country to the USA, the factor endowments of both country of origin and the destination country enter the computation of our distance to comparative advantage measure. In columns (5) and (6), we drop the data from the country of origin c when computing the distance to comparative advantage (DCA_{ck,t_z}). In columns (7) and (8), we recompute DCA_{ck,t_z} without data from the US destination market. Columns (5) and (7) report the results for recomputed Euclidean distance, while columns (6) and (8) report the results for recomputed absolute distance. As one can see from columns (5) to (8) of Table 9, our main results are robust to exclusion of data from the country of origin and from the US destination market in computing the distance to comparative advantage (DCA_{ck,t_z}).

6.2 Fixed Effects, Stratification, and Clustering

Table 10 examines the robustness of our results to changing the set of fixed effects, stratifying the Cox model at an even finer level, as well as changing the clustering level for our standard errors. Our main results remain qualitatively the same, independently on fixed effects, stratification, and clustering applied.

In the first column of Table 10, we re-estimate the specification from the sixth column of Table 4 but replace the separate exporting country and initiation year fixed

Table 10: Robustness Checks II: Banks and Comparative Advantage

Dep. Var: hazard rate	(1)	(2)	(3)	(4)
distance to comparative advantage	0.088^a	0.084^a	0.080^a	0.080^a
	(0.014)	(0.015)	(0.018)	(0.018)
banks x distance to comparative advantage	0.047^b	0.095^a	0.064^a	0.064^a
	(0.020)	(0.019)	(0.024)	(0.024)
banks		-0.107^b	-0.082	-0.082
		(0.050)	(0.054)	(0.054)
Full set of controls	yes	yes	yes	yes
Exporting country FE		yes	yes	yes
Year FE		yes	yes	yes
(Exporting country)-year FE	yes			
HS6 product strata	yes		yes	yes
(HS6 product)-year strata		yes		
Observations	191,078	191,078	191,078	191,078

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972). Variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Fixed effects and strata variable used vary across specifications. In columns (1) and (2), standard errors are clustered at country*time ($c * t_z$) level (in parentheses). In column (3), we cluster standards errors at the level of exporting country c. In column (4), we follow Cameron et al. (2006) and apply a two-way clustering procedure, first according to country and second according to time. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

effects with the combined (exporting country)*(initiation year) effects. These fixed effects capture any time-varying characteristics of the exporting countries that could affect the export performance of products. They therefore absorb also the direct impact of bank development that explicitly entered the previous estimations. The (exporting country)*(initiation year) fixed effects also absorb the impact of three variables from our set of controls: GDP per capita, physical and human capital. The significant impact of both the distance to comparative advantage (DCA_{ck,t_z}) and its interaction with the banking sector (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) on the hazard rate of exports to the US market survives this additional stringency of included fixed effects.

In the second column of Table 10, we strengthen our control for omitted variables bias by stratifying the Cox model according to product*(initiation year) indicator variable (η_{k,t_z}). The baseline hazard function h_{k,t_z} can now differ even within the same product category k if the export spells start in different initiation years t_z. This controls for the possibility that initial conditions in the US destination market vary across both products and time. The product's chances for subsequent survival could then differ depending on the year in which the export spell started. A typical example of such different initial conditions is the degree of competition on the US market, proxied by number of suppliers (i.e., exporting countries) of a given product in the US market at the beginning of a given export spell ($NSuppliers_{k,t_z}$), which is included in our set of control variables. The product*(initiation year) strata effects now capture the effect of this variable as well as of all other product-specific initial conditions on the US market. The estimation results for distance to comparative advantage (DCA_{ck,t_z}) and its interaction with banks ($BC_{c,t_z} * DCA_{ck,t_z}$) remain qualitatively the same.

In the last two columns of Table 10, we test the robustness of our results to alternative ways of clustering the standard errors. In the third column, we replicate the specification from the sixth column of Table 4 with standards errors clustered at the country level, addressing the econometric issues raised by Bertrand et al. (2004). In the fourth column of Table 10, we report results when standard errors are clustered two-way, both in exporting country and initiation year dimension.[38] Neither of the alternative clustering procedures affects our main results.

6.3 Trade Duration Data

In Table 11, we take into account several characteristics of the duration data. One feature of the survival data is censoring. Export spells observed in the first year of the sample may have already been active for years so that the spell is left censored. Similarly, spells observed in the final year of the sample may continue to exist, in which case the spell is right censored. While the problem of right censoring is directly accounted for in the Cox model,[39] procedures available to address left censoring are more complicated and less frequently used (e.g., Moffitt and Rendall 1995). Following usual practice, we ignored left censoring in our main specifications. In the first column of Table 11, we re-estimate the specification from the sixth column of Table 4 while dropping all left-censored observations. Our results remain qualitatively the same, despite the substantially lower number of observations compared to previous tables.

Another feature of the duration data is the existence of multiple spells within some (exporting country)*product pairs. A country may start exporting a product to the USA, then exit the US market, later re-enter with the same product and possibly exit

[38] We estimate two-way clustered standard errors following the procedure by Cameron et al. (2006). The idea is based on three variance matrices: the first one is computed using clustering according to country, the second one is based on clustering according to time, and the third one uses clustering alongside country-time dimension. The final variance matrix is the sum of the first and the second matrix, minus the third one.

[39] Stata includes a dummy variable taking value one if the spell is still existing in the last year of the sample.

Table 11: Robustness Checks III: Banks and Comparative Advantage

Dep. Var: hazard rate	(1) No left censored spells	(2) First spells only	(3) Single spells only	(4) Efron method
distance to comparative advantage	0.062^a	0.075^a	0.056^b	0.108^a
	(0.010)	(0.015)	(0.025)	(0.015)
banks x distance to comparative advantage	0.028^b	0.076^a	0.155^a	0.063^a
	(0.012)	(0.022)	(0.037)	(0.021)
banks	-0.036	-0.034	-0.502^a	-0.056
	(0.027)	(0.058)	(0.127)	(0.048)
Full set of controls	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
HS6 product strata	yes	yes	yes	yes
Observations	113,263	134,947	81,022	191,078

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects and allow for different baseline hazard rate across products by defining product k as strata variable. Variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

again.[40] In the previous specifications, we have treated these multiple spells as different and independent spells and used a dummy $multiple\_spell_{ck}$ in our set of control variables. In the second and third column of Table 11, we provide two additional robustness tests to control for potentially different hazard rate of exports that repeatedly exit and re-enter the US market. In column (2), we restrict our sample to the first spells only, thus including trade relationships with one single spell as well as the first spells of multiple-spell trade relationships. In column (3), we further restrict the sample to single-spell trade relationships only. While both treatments reduce our sample significantly compared to previous tables, the impact of both distance to comparative advantage (DCA_{ck,t_z}) and its interaction with the strength of the banking sector (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) remains significant.

The Cox proportional hazard model assumes that the hazard function is continuous and therefore no two spells terminate at exactly the same time. In practice, such tied-spells termination events do occur in large export survival datasets like ours. In our baseline specifications, we followed the existing literature and applied the Breslow method

[40] In our sample, about 57 per cent of trade relationships experience multiple spells at the HS 6-digit level and about half of those experience two spells. Less than 15 per cent of all trade relationships have more than three spells.

(Breslow, 1974) to address this issue. As a further robustness check, we report in the fourth column of Table 11 the results relying on the alternative Efron method.[41] Our results remain qualitatively the same, suggesting that the Breslow method is efficient in handling tied survival observations.

6.4 Cox Proportional Hazard Model

In the first three columns of Table 12, we examine the robustness of our results to relaxing the assumption of hazard proportionality made under the Cox model. The Cox model is based on the assumption that all explanatory variables have a proportionate effect on the hazard rate irrespective of the duration time of the spell. One way to address the possibly non-proportional effect of explanatory variables, while properly controlling for country, product and initiation year effects, is to estimate a linear probability model for the various lengths l of export spells. We follow Araujo et al. (2014) and re-estimate specification in the sixth column of Table 4, replacing the hazard rate with the probability of survival S_{ck,t_z} as dependent variable. S_{ck,t_z} is a dummy variable that equals one if country c, which started to export the product k to the US market in the year t_z, is still serving the US after l years. We run a linear probability model for each spell length l. This econometric framework imposes less restrictions on the time profile of survival than a hazard function as the effects of explanatory variables are allowed to vary across survival periods.

In columns (1) to (3) of Table 12, we report results for survival length l= 1, 5, and 8 years. The vector of control variables is the same as in our baseline specification (the sixth column of Table 4). We include fixed effects for HS 6-digit products, exporting countries, and initiation years of export spells. Since our dependent variable is the probability of survival, the coefficients for all explanatory variables reported in Table 12 have opposite signs compared to previous tables where the dependent variable was the hazard rate. In Table 12, the *negative* coefficients for distance to comparative advantage and its interaction with banks would confirm that products not aligned with comparative advantage of the exporting country face lower probability of survival in the US destination market and that a strong banking sector in the exporting country reinforces this pattern.

For all spell durations considered, the coefficient for distance to comparative advantage (DCA_{ck,t_z}) has indeed the expected negative sign and is statistically significant. The coefficient for the interaction term between distance to comparative advantage and the

[41] In Stata, the Breslow method is the default option. The Efron method (Efron, 1988) requires substantially more computing time.

Table 12: Robustness Checks IV: Banks and Comparative Advantage

	(1)	(2)	(3)	(4)
Dep. Var:	Prob. of survival k years upon entry			Average
	l=1	l=5	l=8	export growth
distance to comparative advantage	-0.033[a]	-0.017[a]	-0.012[b]	-0.022[a]
	(0.006)	(0.006)	(0.006)	(0.003)
banks x distance to comparative advantage	0.005	-0.017[c]	-0.016[b]	-0.013[a]
	(0.008)	(0.009)	(0.008)	(0.004)
banks	-0.038[b]	0.059[a]	0.087[a]	0.055[a]
	(0.017)	(0.022)	(0.022)	(0.010)
Full set of controls	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
HS6 product FE	yes	yes	yes	yes
R-squared	0.288	0.552	0.630	0.139
Observations	191,078	191,078	191,078	191,078

Note: The dependent variable in the first three columns is a dummy variable equal to one if country c still exports product k to the US destination market l years upon export entry in year t_z. The dependent variable in column (4) is the average yearly growth rate of export value over the duration of a given export spell. All regressions control for country, time, and product fixed effects. Variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

level of banking sector development (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) is negative and significant except for the spell duration $l = 1$. This is not surprising as we expect banks to matter more for the longer term survival of export relationships rather than for their short-term turnover. These last results thus provide further support for our decision to use formal survival analysis, with its long-term focus, as our main econometric framework.

As a final robustness test, we briefly look beyond the concept of export survival and examine whether the patterns identified in this paper extend to the average export growth. In column (4) of Table 12, we replace the dependent variable by the average yearly growth rate of export value over the duration of export spell while keeping our preferred set of explanatory variables from the sixth column of Table 4. Like in the previous three columns of Table 12, all explanatory variables in our final specification have opposite expected signs compared to previous tables due to the different dependent variable. The results are qualitatively the same. The coefficients for both the distance to comparative advantage (DCA_{ck,t_z}) and its interaction term with our main bank proxy (banks x distance to comparative advantage - $BC_{c,t_z} * DCA_{ck,t_z}$) are negative and significant. Products far away from the comparative advantage of exporting country thus experience slower export growth[42] after entering the US destination market and this pattern is more pronounced if the exports originate in country with a well-developed banking sector.

7 Discussion: Disciplining Role of Debt and International Trade

Our results suggest that there is something special about external debtholders like banks that enables them to push the composition of manufacturing exports toward goods that are congruent with the comparative advantage of the exporting country. In this section, we discuss some insights from agency theories of the firm to suggest a possible explanation for the fact that banks seem to be more effective than stock markets in enhancing the disciplining effect of the US destination market. Although some of the papers discussed below focus on the disciplining effects coming from the holders of corporate bonds, their arguments go through for all debtholders.[43]

Agency theories view managers as rational agents maximizing their own utility instead of following the best interest of the firm's owners (principals). In particular, managers derive utility from various non-pecuniary aspects of running "their" firm that do not increase the firm's value. The lower the share of a manager in the profits of the firm, the higher level of non-pecuniary benefits she will aim for (Jensen and Meckling 1976). This can lead managers to satisfy their "empire-building" ambitions by expanding the firm beyond the optimal size as well as to spend firm's resources on various pet projects and personal perks like corporate planes or luxuriant offices (Harris and Raviv 1991, Shleifer and Vishny 1997).

Various papers suggested external debt as a possible disciplining force in this regard. In the case of a manager-entrepreneur who has a significant ownership stake in the firm and needs to raise external funds to pursue her investment project, a higher debt-equity ratio aligns her incentives better with other shareholders' interest (Stiglitz 1974, Jensen and Meckling 1976).[44] In firms where managers have none or only a negligible ownership stake, the marginal utility of managers from maximizing the value of the firm vis-a-vis their marginal utility from pursuing non-pecuniary benefits will not be substantially affected by the amount of debt taken by the firm. In this case, the disciplining role

[42] Like in the previous estimations, we control for the initial level of exports at the beginning of the export spell.

[43] Subsection 5.1 motivates our focus on bank lending and Table 13 in the Appendix provides additional results for bond markets.

[44] Jensen and Meckling (1976) focus on the case of modern corporations. Stiglitz (1974) develops his theory in the context of agriculture and considers his model more applicable to the case of a closely held firm rather than of a corporation with disperse ownership (Stiglitz 1974, p. 252f).

of debt comes from the desire to avoid bankruptcy (Grossman and Hart 1982, Zwiebel 1996). Put simply, the threat of a possible failure to satisfy debt service payments pushes managers towards the efficient use of available resources. Managers would namely lose the control of "their" firm and all the pecuniary and non-pecuniary benefits associated with this control if unpaid external debt triggers a bankruptcy procedure. Not only does unpaid debt give creditors the option to liquidate the firm but debt has also important informational role to play. Both the ability of firms to make the regular payments to creditors and the informal negotiations or formal bankruptcy in case of firm's failure to do so provide useful information to the outside creditors (Harris and Raviv 1990).

A prominent example of agency approach particularly relevant for an investment-intensive activity like exporting is the "free cash flow" theory introduced by Jensen (1986). Here the main problem is the overinvestment. Managerial perks and benefits namely often increase with the level of investment undertaken by firm or a given organizational unit. This gives managers an incentive to invest even in projects that have a negative net present value if the firm has cash flow exceeding funding needs of all available projects with a positive net present value. Jensen (1986) stresses the disciplining role of outside debt in counteracting these internal pressures to divert "free cash flow" into unprofitable investments. Unlike dividends, regular debt payments are not subject to managerial discretion and therefore automatically reduce the "free cash" available to managers.[45]

Admittedly, a debt contract can be interpreted just as a form of dividend payout requirement. However, creditors can rely on courts and legal enforcement in case of a failed debt payment, while it is much more difficult for shareholders to extract dividend payments from entrenched management (Harris and Raviv 1990, p. 325). Compared to shareholders, the rights of creditors are in general much more clearly defined and therefore better enforceable even by mediocre and poorly motivated courts (see, e.g., Shleifer and Vishny 1997). This is especially important in countries with insufficient judicial quality where the disciplining influence exercised by financial institutions and markets might be particularly needed.

Exporting activities are in our view especially prone to the agency problems described above and could therefore benefit from the disciplining role of external debtholders like

[45] Stulz (1990) and Hart and Moore (1995) build upon the work of Jensen (1986) and develop formal models of the disciplining role of external debt. Aghion et al. (1999) incorporate Jensen's insight into a dynamic model of innovation and growth. Lang et al. (1996) and Wurgler (2000) focus on the detrimental impact of physical capital misallocation on economic growth and provide empirical evidence along the lines of Jensen's theory.

banks. Not only do exporting firms pay higher wages and offer better working conditions than domestic firms (e.g., Bernard and Jensen 1995, Verhoogen 2008, Frias et al. 2009, Brambilla et al. 2010), the export status of a firm also involves monetary and non-monetary managerial rewards that can persist even after a switch to another employer. Mion and Opromolla (2011) find a 15% wage premium for managers who have previously worked for an exporting firm. Interestingly, they do not find such a premium for previous export experience in the case of non-managerial employees. Other export-driven managerial perquisites can range from travelling abroad and spending time in luxury hotels to gaining a better access to domestic politicians who are eager to create national export champions. All these perks and benefits provide strong incentives for managers to push even for exports that they know are not sustainable in the long run.

Export subsidies might further skew the incentives towards inefficient exporting. These subsidies represent additional funds at managers' disposal that can worsen the agency problem of "free cash flow". For example, management can spend government's funds for broad export promotion like establishing distribution networks or various marketing and public relations activities. Once the firm has set up this general export infrastructure, managers can use it to promote also products that match poorly with the factor endowment of the country. In a different context, Blanchard et al. (1994) already showed that additional funds coming from won or settled lawsuits often lead to inefficient investment in accordance with agency models from the finance literature. In the case of export promotion, the problem might be even more severe. Here the subsidies are earmarked for exporting activities and cannot be used otherwise even if alternative domestic projects would promise a higher investment return.

Naturally, this section offers just one possible explanation for the the unique role of banks from exporting countries in enhancing the discipline imposed by the US product markets. A detailed analysis about possible mechanisms behind this result is an interesting venue for further research, which we intend to explore ourselves and invite others to do as well.

8 Conclusion

This paper provides evidence for the allocative and disciplining role of finance. Banks do not promote exports in a sweeping non-discriminate way. They rather push exporters towards the optimal use of countries' factor endowments, in compliance with the idea of comparative advantage. A well-developed banking system can thus enforce efficient export composition before a competitive foreign market does so. In this way, finance prevents inefficient export patterns with positive consequences for national and international allocation of available resources.

Our results entail some interesting policy implications. According to the conventional wisdom, export promotion serves as a remedy for prevailing financial frictions. In the absence of government interventions, the argument goes, capital market imperfections might prevent firms from exploiting potentially good export opportunities. If the aim is to improve the short-run export performance of credit-constrained firms, then governmental export promotion might indeed be a near-perfect substitute for bank lending. It is less clear whether government can replace the disciplining role that banks play in pushing the country's export composition toward its comparative advantage. If financially vulnerable firms disproportionately use inappropriate factors of production, export promotion could even reinforce inefficient export patterns and further worsen the resource misallocation. Governments eager to promote exports might rather consider facilitating the development of a strong banking system that could then provide the right incentives for the manufacturing sector to focus on exports that are sustainable in the long-run.

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Appendix

Table 13: Banks and Bond Markets

Dep. Var: hazard rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
distance comparative advantage	0.068^a	0.077^a	0.054^a	0.080^a	0.109^a	0.081^a	0.081^a	0.116^a	0.084^a
	(0.018)	(0.013)	(0.017)	(0.016)	(0.011)	(0.016)	(0.015)	(0.010)	(0.015)
banks x dist. comp. adv.	0.047^b		0.037^c	0.055^a		0.054^b	0.054^a		0.056^a
	(0.020)		(0.021)	(0.020)		(0.023)	(0.019)		(0.020)
banks	-0.052		-0.041	-0.068^c		-0.038	-0.060		-0.075^c
	(0.040)		(0.039)	(0.041)		(0.049)	(0.041)		(0.043)
dom. private bonds x dist. comp. adv.		0.107^a	0.092^b						
		(0.036)	(0.041)						
domestic private bonds to GDP		-0.075	-0.058						
		(0.109)	(0.113)						
inter. private bonds x dist. comp. adv.					0.075	-0.005			
					(0.052)	(0.066)			
international private bonds to GDP					0.261^c	0.372^a			
					(0.140)	(0.139)			
nonfin. inter. bonds x dist. comp. adv.								-0.005	-0.176
								(0.201)	(0.209)
nonfinancial international bonds to GDP								-0.695	-0.518
								(0.518)	(0.530)
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporting country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HS6 product strata	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127,260	127,260	127,260	158,291	158,291	158,291	168,113	168,113	168,113

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects. Estimations also allow for different baseline hazard rate across HS6 products by defining product k as strata variable. Additional control variables include the interaction between three proxies of the strength of bond markets in the exporting country and the distance to comparative advantage. These three proxies are domestic private bonds (including bonds issued by banks) over GDP, international private bonds (including bonds issued by banks) over GDP and nonfinancial international bonds (bonds issued by non-financial firms only) over GDP. Other variables are defined in Table 4. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 14: Stock Markets and Comparative Advantage: Alternative Channels

Dep. Var: hazard rate	(1)	(2)	(3)	(4)
distance to comparative advantage	0.102[a]	-0.022	0.113[a]	0.035
	(0.010)	(0.071)	(0.011)	(0.081)
stock markets x distance to comparative advantage	-0.006	-0.014	-0.008	-0.012
	(0.011)	(0.012)	(0.013)	(0.013)
stock markets x dependence on external finance	-0.172[a]	-0.176[a]	-0.209[a]	-0.212[a]
	(0.028)	(0.028)	(0.031)	(0.031)
GDPpc x distance to comparative advantage		0.014[c]		0.009
		(0.008)		(0.009)
stock markets	0.076[a]	0.087[a]	0.088[a]	0.093[a]
	(0.029)	(0.030)	(0.032)	(0.032)
GDPpc	0.210	0.195	0.271[b]	0.262[b]
	(0.132)	(0.133)	(0.133)	(0.133)
Full set of controls	yes	yes	yes	yes
Exporting country FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
ISIC4 industry strata	yes	yes		
HS6 product strata			yes	yes
Observations	182,592	182,592	182,592	182,592

Note: The dependent variable is the hazard rate on the US destination market for an export spell of product k from country c that started at time t_z. All regressions are estimated using the Cox Proportional Hazard model (Cox 1972) and control for country and time fixed effects. Estimations also allow for different baseline hazard rate across industries (columns 1 to 2) and across products (columns 3 to 4) by defining industry j and product k as strata variables. Additional control variables include the interaction between the development of stock markets in country c and the dependence of industry j on external finance (stock markets x dependence on external finance - $StM_{c,t_z} * ExF_j$), the interaction between the GDP per capita of country c and the distance to comparative advantage ($GDPpc_{c,t_z} * DCA_{ck,t_z}$). Other variables are defined in Table 4 and Table 6. Full set of controls corresponds to column (6) of Table 4. We report coefficients and not hazard ratios. Robust standard errors clustered at country*time ($c * t_z$) level are in parentheses. a, b, and c denote statistical significance at the 1%, 5%, and 10% level, respectively.

Online Appendix for the paper "Finance, Comparative Advantage, and Resource Allocation" by Melise Jaud, Madina Kukenova, and Martin Strieborny

Appendix A: Full Sample of Countries Exporting to the USA

Argentina; Australia; Austria; Bangladesh; Benin; Bolivia; Brazil; Cameroon; Canada; Chile; China; Colombia; Congo; Costa Rica; Denmark; Dominican Republic; Ecuador; Egypt; El Salvador; Finland; France; Gambia; Germany; Ghana; Greece; Guatemala; Haiti; Honduras; India; Indonesia; Ireland; Italy; Jamaica; Japan; Jordan; Kenya; Korea; Malawi; Malaysia; Mali; Mauritius; Mexico; Mozambique; Nepal; Netherlands; New Zealand; Nicaragua; Niger; Norway; Pakistan; Panama; Paraguay; Peru; Philippines; Portugal; Rwanda; Senegal; Spain; Sri Lanka; Sweden; Switzerland; Thailand; Togo; Trinidad and Tobago; Tunisia; Turkey; United Kingdom; Uruguay; Venezuela; Zambia; Zimbabwe.

Appendix B: The Cox Proportional Hazard Model

Ordinary Least Squares (OLS) estimation is not suitable for duration data as the survival times are restricted to be positive and thus have a skewed distribution. Survival analysis allows an examination of the relationship between the distribution of survival times and some covariates of interest. The survival function gives the probability that a trade relationship will survive past time t. Conversely, the hazard rate function, $h(t)$, assesses the instantaneous risk of demise at time t, conditional on survival till that time. Formally, let $T \geq 0$ denote the survival time (length) of a trade relationship, with covariates X. The hazard rate, $h(t)$, is thus given by:

$$h(t|X) = \lim_{\Delta t \to 0} \frac{Pr[(t \leq T < t + \Delta t)|T \geq t, X]}{\Delta t}$$

Alternatively, in discrete time:

$$h(t|X) = Pr(T = t|T \geq t, X), t = 1, 2, ...$$

We estimate the hazard rate for our trade relationships data using a Cox Proportional Hazard (PH) model (Cox 1972). The Cox model is broadly applicable and represents the most widely used method for survival analysis. The hazard function for a given product k exported from country c with covariates $X = \{x_1, x_2, ...x_j, ..x_n\}$,

$$h(t|X) = h_0(t) \exp(X.\beta)$$

is defined as the product of a baseline hazard function $h_0(t)$, common to all observations, and a parametrized function $\exp(X.\beta)$ with a vector of parameters β. The form of the baseline hazard function characterizes how the hazard changes as a function of time. The covariates X affect the hazard rate independently of time. The model offers some convenient features. It makes no assumptions about the form of the underlying baseline function. Additionally, the relationship between the covariates and the hazard rate is log-linear, allowing for a straightforward interpretation of the parameters. Increasing x_j by 1, all other covariates held constant, affects the hazard function by a factor of $\exp(\beta_j)$ at all points in time. Thus, it shifts all points of the baseline hazard function by the same factor. Parameter estimates in the Cox model are obtained by maximizing the partial likelihood as opposed to the likelihood for an entirely specified parametric hazard model (Cox 1972). The resulting estimates are less efficient than maximum-likelihood estimates. However, the model makes no arbitrary, and possibly incorrect, assumptions about the form of the baseline hazard function.

Appendix C: Strata versus Fixed Effects

In a non-stratified Cox Proportional Hazard (PH) Model, all export spells would share a common underlying hazard rate $h_0(t)$. In a stratified Cox PH Model, the baseline hazard rate is allowed to vary across different groups (strata). Let us define strata at the product level, allowing export spells of different products k to have different underlying hazard rate $h_{0,k}(t)$. The overall hazard rate of product k would then write:

$$h(t|X) = h_{0,k}(t) \exp(X.\beta).$$

Let us now use product fixed effects instead. This means keeping underlying hazard rate uniform across products but including among regressors a set of dummy variables that are equal to 1 if the observation belongs to product k and zero otherwise. The overall hazard rate of product k would then write:

$$h(t|X) = h_0(t) \exp(X.\beta + \alpha_k D_k),$$

with α_k being the estimated coefficient for the dummy variable D_k and dummy variable D_k itself being equal to one for any export spell related to product k.

This expression can be rewritten as:

$$h(t|X) = h_0(t) \exp(X.\beta) \exp(\alpha_k D_k) = \overline{h_{0,k}(t)} \exp(X.\beta),$$

with $\overline{h_{0,k}(t)} \equiv h_0(t) \exp(\alpha_k D_k)$.

Using fixed effects can be thus interpreted as a particular case of stratification, which assumes that baseline hazard rates differ across products merely by the factor of proportionality.