Capital Controls and International Trade: An Industry Financial Vulnerability Perspective*

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Abstract

Capital control policies have consequences on economic growth and international trade. In recent decades, some countries have liberalized their capital accounts, while others have used capital control policies in response to financial crises. Using data on 99 countries from 1995-2014, we find evidence that the effect of capital controls on trade vary across industries that have differing levels of external financing and asset tangibility. For exporter countries that tighten capital controls, industries that rely more heavily on external financing experience a larger decline in exports, while industries that possess more tangible assets experience a smaller decline in exports. For importer countries, tighter capital controls imply a decrease in trade, and this effect is uniform across all industries. The pattern with respect to external financing persists after accounting for availability of domestic credit and the differences in industry shares, and are predominantly found in countries with low levels of financial development. On the other hand, the varying effect related to asset tangibility is mostly absorbed by domestic credit market.

JEL Classification: F14, F38, F68.

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1 Introduction

Capital control policy has been a highly debated topic in macroeconomics. Despite a rich and long-lasting debate on the relationship between capital controls, or capital account liberalization, and overall growth, the results have been inconclusive. For example, Henry (2007) and Quinn and Toyoda (2008) point to a positive relationship between capital account liberalization and growth, while Rodrik (1998) and Kose et al. (2009) fail to find the same. The disagreement in the literature encourages further studies of the impacts of capital controls on specific components of economic growth. This paper contributes to the empirical discussion of capital controls and growth by addressing the relationship between capital control policies and the patterns of international trade.

Capital control policies affect international trade through multiple channels. First, they could be used to maintain a fixed, and sometimes undervalued exchange rate, which spurs export growth. According to the trilemma in international economics, if an economy wishes to retain monetary autonomy, it faces a trade-off between a stable exchange rate and free capital movement. A stable exchange rate is conducive to trade growth as it eliminates the uncertainty on exchange rate fluctuations (Fleming, 1962; Mundell, 1963). For instance, Jeanne (2012) argues that Chinese capital control policies prevented domestic investors from borrowing aboard when its central bank accumulated massive foreign reserves. This contributed to high domestic savings rate and real undervaluation of the currency, a driver for the Chinese export hikes in the 2000s. In this case, capital control policies affect trade growth directly through altering the relative prices of goods across countries. Second, capital control policies also affect trade through their impact on the cost and supply of domestic capital. Surveying both microeconomic and macroeconomic evidence, Forbes (2007) argues that capital controls reduce the supply of capital, raise the cost of firm financing, and increase financing constraints, especially for firms that do not have access to international capital markets or preferential lending. These effects of capital flow restrictions are heterogeneous across firms. Chor and Manova (2012) and Manova (2013) further propose detailed mechanisms through which credit constraints affect exports during the global financial crisis and through a country's financial development respectively. Looking specifically at trade credit, Auboin and Engemann (2014) and Eck, Engemann and Schnitzer (2015) document the stimulating effect of credit availability on international trade. Manova (2008) bridges the literature of capital account openness and credit constraints, and show that financial liberalization promotes trade through a credit availability channel. She argues that financial liberalialrezation promotes trade disproportionately in sectors intensive in external finance or with softer assets.

To the best of our knowledge, the literature that examine the direct links between capital control policy and trade is limited. Using limited cross-sectional data for 40 countries, Tamirisa (1998) suggests that an increase in the usage of exchange restrictions implies a decline in bilateral

trade levels. Wei and Zhang (2007) argue that results in Tamirisa (1998) are not reliable due to an incorrectly specified statistical model, and show that capital controls, specifically controls on foreign exchange transactions and trade payments, have significant adverse effects on international trade.

This paper builds on the results of Wei and Zhang (2007) and Manova (2008). We utilize a new *de jure* capital control measure from Fernandez et al. (2016) that aggregates capital control restrictions across 10 asset categories, and examine the relationships between trade and capital control policies of both the exporting and importing countries using a panel of 99 countries across 20 years from 1995 to 2014. We follow the approach suggested in a seminal paper by Rajan and Zingales (1998) to explore the heterogeneity of capital control policies across countries, and examine the differential impact of capital controls on trade across 27 industries with varying levels of financial vulnerabilities. We adopt two different measures of financial vulnerabilities, namely external finance dependence from Rajan and Zingales (1998) and asset tangibility from Braun (2003). This methodology has two major advantages. First, it mitigates the endogeneity problem as it is unlikely that a country's capital control policy is motivated by the patterns of bilateral trade at the industry level. Second, it allows us to explore specific mechanisms through which capital control policy impacts international trade.[1]

The main contribution of this paper is the examination of the effects of capital controls of both the exporting and importing economies on bilateral trade flows across the various industries. To the best of our knowledge, the current literature only focuses on the dynamics of exporters, but ignores those of the importers. Additionally, we incorporate the availability of domestic credit into our econometric model, which allows us to complement previous literature on credit constraint and international trade, and identify the direct effects of capital controls on trade against indirect effects mediated by the domestic capital supply in the economy.

We first establish that higher levels of capital control in either the exporting or the importing countries imply lower average levels of bilateral trade across industries. Then, exploiting the heterogeneity in industry financial vulnerability, we find that the industries that require higher levels of external financing are more exposed to the negative effects on trade of exporter capital controls, while those industries that have higher levels of asset tangibility and access to collateral are better shielded from such effects. On the other hand, our results suggest that higher levels of capital control by an importing country imply lower levels of trade, but this effect tends to be homogeneous across all industries.

Our results are robust to using alternative measures of key variables. In light of recent findings by Choi (2019), we explore alternative assumptions on measures of industry financial vulnerability

[1]This methodology is widely applied in other studies which explore heterogeneity across industries, including Manova (2013), Friedrich, Schnabel and Zettelmeyer (2013), and Eichengreen, Gullapalli and Panizza (2011).

to those in Rajan and Zingales (1998). We update the industry measures using data in 1995-2014, to account for technology development relative to the period of late 80s and early 90s, adopted in Rajan and Zingales (1998). We also create country-variant industry measures, relaxing the assumption of representing the world with US industries. Finally, following Manova (2013), we find that exporter countries with more developed financial systems lessens the negative effects on industries that require more external capital upon increasing levels of capital controls.

The paper is structured as follows. Section 2 provides a motivation for our empirical strategy. Section 3 presents our baseline estimation strategy. Section 4 describes the construction of the sample. Section 5 presents our main results and findings, along with robustness checks. Section 6 discusses the role of financial development in the relationship between capital controls and trade. Section 7 concludes.

2 Capital Control and International Trade Transactions

Firms are financed, either internally or externally, for their operations, productions and international trade transactions. The Bank of International Settlements (BIS) provides a recent snapshot of the structure of international trade financing: roughly 40 percent of global trade transactions are financed by bank-intermediated trade finance and the remainder by inter-firm trade credit. Regardless of means of finance, an international trade transaction entails a capital flow from the importing to the exporting economy, and a flow of goods or services in the opposite direction.

Capital controls create frictions for international trade both directly and indirectly by affecting exchange rates, adding to the cost of financing, and the cost of trade. Firms borrow externally when internal cash flow is not sufficient to maintain production and daily operations. Capital control policies can limit a firm's direct access to international lenders. Restriction on foreign investors also lower the overall supply of credit in the domestic market, thereby increase the cost of capital and exert a negative effect on firm activity (Forbes, 2007; Wei and Zhang, 2007). Additionally, a transaction of international trade usually takes at least weeks, if not months, to close. The extended length of transactions exacerbates the effect of rising cost of capital on international trade. If financial guarantee is absent from banks, capital control policies further discourage trade transactions by amplifying the uncertainty of capital availability. In its enforcement, a government further imposes additional administrative cost, such as intensified border inspections and increased documentation requirements, further increasing the cost of trade (Wei and Zhang, 2007).

The effect of capital control on international trade is also heterogeneous across industries. Manova (2013) provided plausible explanations on why and how exporters use external finance. Firms incur fixed cost for R&D, product development, marketing and advertising, and investment in equipment. For exporting firms, additional fixed costs are incurred due to the involvement

in foreign markets, including making further market-specific investments, customizing products for individual markets, complying to international regulatory standards, and constructing foreign distributional networks. They also incur upfront variable costs in intermediate input purchases, advanced salary payments, and land or equipment rentals. The difference among industries' reliance on external finance, especially foreign capital finance, and their ability in securing a credible collateral to access funding allows capital flow restrictions to impact trade heterogeneously across industries.

We hypothesize that capital control policy influences the pattern of international trade as follows. In the exporting country, higher levels of capital controls, particularly those on inflows, reduce the amount and raise the cost of capital an exporting firm is able to borrow, especially from foreign sources. In the destination country, higher levels of capital controls, especially on outflows, restrict an importing firm's ability to transfer capital out of the country, whether it is used for transaction cost or to fund the exporter. In this regard, capital control policy can be viewed as a source of comparative advantage, where a country that imposes tighter capital controls have comparative advantages in industries that depend less on external finance or cross-border capital finance. Capital control policy hence influences the patterns of international trade.

3 Empirical Strategy

Tamirisa (1998) and Wei and Zhang (2007) suggest capital controls have adverse effects on international trade. Our simple approach, highlighted in Section A.2, replicates the empirical strategy from the earlier literature using our larger paneled sample. The coefficients suggest that capital controls negatively affect international trade for the average industry.

Our baseline empirical approach posits that due to technological nature of the industries, different industries have varying degrees of dependence on external finance (efd), as opposed to internal finance, typically referring to the cash flow generated from firm operations. Industries also have varying degrees of asset tangibility (at), which further accounts for investor behavior in an environment of poor financial contractibility. Specifically, efd describes the extent to which the medium firm of an industry relies on capital external to the firm and at describes the proportion of hard assets in total book-value assets for the medium firm of an industry, an approximation for the strength of collateral and assurance for financiers.

To explore further the dynamics between capital control and trade, we hypothesize that for both the exporting and importing countries, (1) industries that rely more on external financing are more exposed to the negative effects of capital controls, and (2) industries with higher asset tangibility are less exposed to these effects. In other words, the effects of capital controls are stronger on industries that have higher levels of financial vulnerability.

This hypothesis can be tested by estimating a differences-in-differences style regression in which the effect of capital control on trade varies with the level of financial vulnerability, for both exporters and importers. Formally, the estimation equation underlying the baseline specification is:

$$\begin{aligned} log(Trade_{i,j,n,t}) = \beta X_{i,n,t} + \gamma M_{j,n,t} + \xi Z_{i,j} + \theta_1 KC_{j,t} + \boldsymbol{\theta_{2i} KC_{i,t} \times efd_n} + \boldsymbol{\theta_{2j} KC_{j,t} \times efd_n} \\ + \boldsymbol{\theta_{3i} KC_{i,t} \times at_n} + \boldsymbol{\theta_{3j} KC_{j,t} \times at_n} + \delta_{it} + \delta_{jn} + \epsilon_{i,j,n,t} \end{aligned} \tag{1}$$

where the dependent variable $log(Trade_{i,j,n,t})$ is the natural log of the value of trade flow from exporting country i to importing country j denotes the importing country in industry n at time t. For our primary measurement of capital controls, $KC_{i,t}$ is the level of capital inflow controls of the exporter country over time, and $KC_{j,t}$ is the level of capital outflow controls of the importing country over time. $X_{i,n,t}$ and $M_{j,n,t}$ are vectors of country and industry controls for exporters i and importer j respectively at time t.[2] $Z_{i,j}$ is a vector of gravity model variables between the trading partners.[3] The use of exporter $\times$ time (δ_{it}) and importer $\times$ industry (δ_{jn}) fixed effects help mitigate endogeneity problems. Following standard trade literature, we cluster the standard errors in all our specifications on country pair. Our preferred specification uses exports data to exclude insurance and transaction costs in the trade value. These costs are potentially endogenous to the usage of capital control, and are usually included in the imports data.

The main coefficients of interest are θ_{2i}, θ_{2j}, θ_{3i} and θ_{3j}. θ_{2i} and θ_{2j} capture the differential impacts of capital controls of the exporting and the importing countries on bilateral trade across industries with varying external finance dependence, respectively. If the negative effects of capital controls are exacerbated in industries with higher external finance dependence, θ_{2i} and θ_{2j} will be negative. Similarly, θ_{3i} and θ_{3j} captures the differential impacts of capital controls on trade based on varying degree of asset tangibility across industries for the exporters and importers respectively. If the negative effects of capital controls are mitigated in industries with higher assurance for investors, θ_{3i} and θ_{3j} will be positive.

Manova (2013) show that domestic financial frictions impede export differently based on industry financial vulnerability. In order to isolate the direct effect of capital control policy on international trade, we further control for the domestic credit interaction variables. Formally, we

[2] $X_{i,n,t}$ (exporter controls): Capital-Labor Ratio $\times$ Physical Capital Intensity and Human Capital Index $\times$ Human Capital Intensity. $M_{j,n,t}$ (importer controls): Capital-Labor Ratio, Human Capital Index, Real GDP, Real Effective Exchange Rate, Tariffs, Capital-Labor Ratio $\times$ Physical Capital Intensity, and Human Capital Index $\times$ Human Capital Intensity, and GATT/WTO Affiliation.

[3] $Z_{i,j}$ (Gravity variables): Distance, Common Language, Former Colony, Common Currency, and Common Religion.

extend Equation 1:

$$\begin{aligned} log(Trade_{i,j,n,t}) = \beta X_{i,n,t} + \gamma M_{j,n,t} + \xi Z_{i,j} + \theta_1 KC_{j,t} + \boldsymbol{\theta_{2i} KC_{i,t} \times efd_n} + \boldsymbol{\theta_{2j} KC_{j,t} \times efd_n} \\ + \boldsymbol{\theta_{3i} KC_{i,t} \times at_n} + \boldsymbol{\theta_{3j} KC_{j,t} \times at_n} + \phi_1 DomCredit_{i,t} \times efd_n + \phi_2 DomCredit_{i,t} \times at_n \\ + \delta_{it} + \delta_{jn} + \epsilon_{i,j,n,t} \end{aligned} \tag{2}$$

θ_{2i}, θ_{2j} θ_{3i} and θ_{3j} remain the main coefficients of interest. The interpretation is however slightly different. In this specification, θ_{2i}, θ_{2j} θ_{3i} and θ_{3j} capture only the direct impact of capital controls on trade depending on financial vulnerability of the industry for both the exporting and importing countries. The indirect effect, whereby capital control affects trade through affecting domestic credit availability, are captured by the interaction of financial vulnerability and domestic credit availability.

A limitation to this empirical strategy lies in the difficulty of identification of industry in the importing country. While it is safe to assume that exporting firms specialize in the industry identified by the trade flow, the importing firms do not have to be in the same industry. In other words, the consumers are not necessarily in the same industry as the producer. Hence, we recognize that our explanation for effects on the importer side are limited.

4 Capital Controls, Industry, Trade, and Country Data

Our data consist of four main parts: measures of capital controls, measures of industry financial vulnerability, international trade statistics, and additional control variables. In this section, we highlight the the construction and limitations of our final sample.

Capital Controls

It is difficult to precisely measure the intensity of capital control policies. Past studies have used *de jure*, *de facto*, or hybrid indicators to measure the intensity of capital control policy. Quinn et al. (2011) argue that *de jure* indicators are subject to error since the actual implementation of the policy might be different from what the policy intended. Additionally, the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), on which most *de jure* indicies are based, never methodologically defined the "switch point" of binary transition between restriction to no restriction in its categorical tables. On the other hand, *de facto* measures are highly subjected to endogeneity problems, where the outcomes are likely a consequence of more than one policy. Following the majority of studies in the literature, we adopt *de jure* measurement of capital control intensity as our preferred measurement. We utilized a comprehensive dataset on *de jure* capital

controls, compiled by Fernandez et al. (2016) based on the text descriptions of capital controls in AREAER. Comparing to a construction based on the categorical tables, text-based *de jure* indicator has the advantage of covering a wider range of asset categories, and distinguishing between inflow and outflow transactions. The dataset reports annual restrictions on inflow and outflow for 10 asset categories across 99 countries from 1995-2015.[4] The direction of flow is determined by the residency of the buyer or seller of a transaction, and whether the transaction denotes a purchase or a sale. Each transaction category is characterized binarily, with a 1 representing presence of restriction and a 0 representing absence of restriction.[5] This binary measure is assigned based on the authors' interpretations of the detailed narrative descriptions for each country in yearly AREAER reports.

The richness of this dataset enables a detailed analysis of the effects of capital restrictions at different levels. First, capital control intensity can be measured at the asset category level by taking the average across the binary measures for four transaction types. Similarly, a measure can be constructed for a subset of asset categories. Next, capital control intensity can be measured at the inflow and outflow level by taking the average across 10 asset categories for inflow or outflow. Lastly, the overall capital control index is constructed by taking a simple average of the inflow and outflow capital control indices. Fernandez et al. (2016) also groups countries into three categories based on capital control strictness: wall (high level of capital controls), gate (some capital controls), and open (little to no capital controls). Countries are also considered based on income levels (low, low-middle, upper-middle, and high) as classified by the World Bank. Figure 1 visualizes the average levels of capital control over time by capital control strictness group. The levels of capital controls remain fairly stable over the past 20 years for each group.

In our robustness test, we also consider four additional capital control measures: KC, $KCTrade$, *de facto* capital controls, and the Chinn-Ito index. KC represents the overall level of capital control based on Fernandez et al. (2016), with no differentiation based on inflow or outflow restrictions. $KCTrade$ uses only the four main categories of assets that pertain to trade from Fernandez et al. (2016), namely commercial credits, financial credit, guarantees, and direct investment. *De facto* capital controls are calculated as the ratio of foreign assets and liabilities to GDP, following the approach outlined in Lane and Milesi-Ferretti (2003). The Chinn-Ito index from Chinn and Ito (2008) is a widely used *de jure* measurement of financial openness.[6]

[4] **10 asset categories:** Money market instruments, bonds, equity, collective investment securities, financial credit, derivatives, commercial credit, guarantees, real estate, and direct investment.

[5] There are four transaction categories for most asset categories, each assigned a binary variable based on AREAER. Inflow refers to assets purchased locally by non-residents or sold abroad by residents. Outflow refers to assets purchased abroad by residents or sold locally by non-residents.

[6] Chinn and Ito (2008) use data based on categorical tables in IMF's AREAER to construct their financial openness index, $KAOPEN$. The index aims at measuring the extent of the overall openness in cross-border transactions related to capital controls policies and regulations.

Industry Financial Vulnerability

We obtain measures on industry financial vulnerability from Rajan and Zingales (1998) and Manova (2008), and Braun (2003). Table A1 presents the data for 27 industries at the three-digit level of International Standard Industrial Classification (ISIC) Revision 2, along with factor intensities for the industries from standard sources.

External finance dependence, defined by Rajan and Zingales (1998), is calculated as the ratio of capital expenditures less cash flow from operations to capital expenditures for the median firm in each industry. It measures an industry's reliance to external capital. Asset tangibility, defined by Braun (2003), is calculated as the share of net property, plant and equipment in total book-value assets for the median firm. It measures an industry's typical strength of collateral, a crucial precondition to access external financing. Both measures are based on data on US-headquartered firms and are averaged over the period of 1986-1995. These two measures are of particular interest to us as exporting firms tend to incur significant upfront costs that are typically financed by external capital, which is backed by collateral in the form of tangible assets.

Manova (2013) argue that external finance dependence may not capture all expenditures for international trade, but it is an appropriate proxy. The empirical data used to construct the variables are mainly based on large US exporters, further suggesting that external finance is more connected to international trade than domestic activities. While both external finance dependence and asset tangibility measures are constructed using US company data, Rajan and Zingales (1998) and Braun (2003) argue that their respective measures capture a large technological component innate to the manufacturing process in a sector and are good proxies for ranking industries across all countries in their respective financial vulnerabilities. The US' highly developed financial system implies that these measures tend to reflect a firm's optimal choice over external financing and asset structure.[7]

International Trade

We obtain annual exports and imports trade data from the UN Comtrade Database for each country at the six-digit Harmonized System (HS) product level, from 1995 to 2014. Using appropriate industry concordances from World Integrated Trade Solution (WITS), we aggregate the trade flows to the three-digit ISIC level. While exports and imports data reflect the same trade transaction between two countries, the trade values differ due to trade costs as well as measurement errors. We use export data in our preferred specification and import data in robustness check. The trade values are normalized to 2010 US dollars, using Personal Consumption Expenditures index from

[7]The industrial measures are treated as time-invariant over the period of interest to smooth the fluctuations over time and reduce the effects of outliers.

Federal Reserve Economic Data (FRED).

Country Variables

We also include essential control variables that have profound effects on countries' bilateral trades. We control for a country's economic size with its real GDP level taken from World Development Indicators (WDI) database from the World Bank. To capture the effects of trade barriers, we include yearly tariff data from WDI, a simple average of tariff rates across all manufactured products. We obtain data on domestic credit from two sources: private credit over GDP from the World Bank for our full sample of countries, and domestic credit to non-financial sector from the BIS for a smaller sample of 43 countries. To control for the effect of exchange rate fluctuation, we use real effective exchange rate (REER) data from Darvas (2012). For our gravity model specification, we include standard gravity model variables from CEPII. For financial development, we use financial development data from Svirydzenka (2016), which constructs and classifies financial development indices for 180 countries from 1980 to present. We use Penn World Table 9.0 to include information on a country's capital stock, physical capital, human capital, engaged population and employment to control for a country's factor endowments (Feenstra et al., 2015). To account for a country's production capabilities and comparative advantage in global trade, we construct our country capital-labor ratio[8] using the Penn World Table from 1995 to 2014 (Feenstra et al., 2015).

4.1 Summary Statistics

For our empirical analysis, we primarily look at 2,112,778 annual export trade entries that span 27 industries and 99 exporting and importing countries, from 1995 to 2014. We use export entries for two reasons: (1) export entries exclude any additional cost of shipment, insurance, and other trade costs, and we want to eliminate the noisy and potentially endogenous factors of trade or transaction costs, and (2) because of reporting standards, exports data is more consistent in terms of identifying the source country and the amount it is exporting. We utilize the 2,352,595 import trade entries as an added robustness check. Table 1 presents the summary statistics of the variables in our dataset, where each unit of observation is at the exporter-importer-industry-time level.

5 Baseline Results

Table 2 reports the baseline results from equation 1 and 2. Column 1 and 2 examine the dynamics from exporter and importer capital control policies respectively. Column 3 reports the results of equation 1. The main coefficients of interest are those on the interaction terms involving exporter

[8]We define the capital-labor ratio as the capital stock divided by engaged person. Capital stock reflects the prices for structures and equipment within the countries and engaged person is defined as employees or self-employed.

capital control policies (KC), which correspond to θ_{2i} and θ_{3i} in equation 1 and 2. The two coefficients capture the differential impact of exporter capital inflow control policies on industries of varying financial vulnerabilities. We find strong evidence that a more external-financing dependent industry is more negatively impacted by the imposition of capital inflow control in an exporting country. The estimated coefficient is negative and significant at 1% level consistently. We also find evidence that an exporting economy's capital control policy has a varying effect depending on an industry's ability to access funding and assure investors, proxy-measured by asset tangibility. The estimated coefficient is positive and significant at 1% level in columns 1 and 3. The result confirms the idea that the effect of exporter capital inflow control in general is exacerbated on industries with higher reliance on external finance, but mitigated on industries with higher asset tangibility.

However, capital control policies affect both domestic and foreign credit environment. Manova (2013) argued that domestic credit condition affects trade heterogeneously depending on the financial vulnerability of the industry. Columns 4 and 5 attempt to isolate the effect stemming from changes in foreign credit environment, induced by capital control policy, on international trade, by further controlling for the domestic credit market dynamics explained in Manova (2013). Two measures are used to proxy domestic credit condition. Column 4 utilizes domestic credit to non-financial sector, a more direct measure of credit directed to potential exporting firms provided by BIS, while column 5 adopts a more conventional metric of domestic credit to private sector as a share of GDP, used in many existing literature including Manova (2013).

The differential impact of export capital inflow control on industries with varying external finance dependence remains strong. The estimated coefficient remains significant and negative, with an expected drop in magnitude due to the removal of domestic credit market dynamics. The direct impact of capital inflow control, however, no longer varies across industries of different asset tangibility, as the coefficients become insignificant. This implies that asset tangibility tends to be more important for domestic financial markets, which is picked up by the statistically significant coefficients on domestic credit market dynamics (Braun, 2003). It is consistent with the idea that less stringent credit conditions promote growth of industries with higher reliance on external finance and is more advantageous towards industries with weaker collateral (Eichengreen, Gullapalli and Panizza, 2011; Manova, 2013).

We calculate differentials in trade volumes in order to gauge the economic significance of the statistically significant coefficients, following the methodology from Rajan and Zingales (1998) and Friedrich, Schnabel and Zettelmeyer (2013). Consider two industries at the 25th and 75th percentiles in terms of external finance dependence, and two countries at the 25th and 75th percentiles in terms of exporter capital control intensity. We compare the differentials in export volume of the two industries across two countries. Column 5 reports our preferred baseline results. The estimated coefficient of -0.46 implies that the difference in export volume between the two industries is 12%

more negative or less positive in a country with high capital control intensity compared to a country with lower capital control intensity.[9]

The next set of coefficients of interest are those on the interaction terms with importer KC (corresponding to θ_{1j} and θ_{2j} in equation 1 and 2). The point estimates for the interaction effects on the importer side are insignificant for all but one specification, suggesting industries of varying degrees of financial vulnerabilities are impacted similarly by an importer's capital outflow restrictions. The lack of findings is potentially caused by the fact that the industry of a trade flow tends to characterize the exporting firm correctly, but often does not match the industry of an importing firm.[10]

5.1 Robustness Checks

We conduct a series of robustness checks for our baseline results. First, we check against choices of KC measures. Second, we check the robustness to alternative constructions of external finance dependence and asset tangibility. Finally, we conduct robustness checks for other considerations, including using different data and samples, checking for simultaneity biases, and the inclusion of industry shares in the regressions.

5.1.1 Alternative Measures of Capital Control

We first examine if our results remain robust to the choice of capital control measures, as seen in Table 3. In addition to capital inflow and outflow controls exerted by the exporting and importing countries respectively in the baseline result, we adopted four other capital control measures. First, we use KC, an aggregated measure of capital control intensity that includes restrictions on inflows and outflows from Fernandez et al. (2016). As reported in column 2, the interactive effects of exporter capital controls and external finance dependence remains negative and significant, and the order of magnitude is similar to that from our baseline result. We create another capital control measure, $KCTrade$, from Fernandez et al. (2016), including only the asset categories that are potentially related to international trade. As reported in column 3, when using capital control measures that pertain to international trade, the differential effect of capital control depending on external finance dependence is more prominent. We also use the widely-cited Chinn-Ito index, a *de jure* measure of overall financial openness based on AREAER categorical tables Chinn and Ito (2008). Contrary to the scoring system in Fernandez et al. (2016), a higher score implies a more open capital account in Chinn-Ito index. Hence, we expect an opposite sign on the coefficients to our baseline result. A positive and statistically significant point estimate in column 4 hence

[9] We arrive at this value by doing the following back of the envelope calculation: $-0.46 * (KC_{p75} * efd_{p75} - KC_{p25} * efd_{p25})$. So, $-0.46 * (0.67 * 0.40 - 0.05 * 0.06) = -0.12$

[10] Further analyses utilizing input-output matrices might be useful to address this issue.

also supports our baseline result. A *de facto* measure, defined as the ratio of the sum of foreign assets and liabilities to GDP and constructed following Lane and Milesi-Ferretti (2003), is used in column 5. The amount of capital involved in lending to or borrowing from the international community relative to its economic size can be viewed as a proxy for the openness of a country's capital account. A higher ratio implies a more open capital account. A positive and statistically significant point estimate in column 5 confirms our baseline result. Overall, using alternative capital control measures does not alter our main results, as seen with the consistent signs of our interaction coefficients. The statistically significant estimates in table 3 confirm that capital control does have varying effect dependent on the external financial dependence of the industry.

5.1.2 Alternative Measures of Industry Financial Vulnerability

We explore two further variations of our measures of financial vulnerability. Our baseline result adopts the financial vulnerability data directly from Rajan and Zingales (1998) and Braun (2003), which are based in the 80s and early 90s. Considering that industry characteristics evolve over time, we first reconstruct the financial vulnerability measures using firm-level data in the concurrent period of our analysis (1995-2014). An important assumption in Rajan and Zingales (1998) is that external financial dependence is an inherent technological nature of an industry which persists across all countries. The use of US-headquartered firms for the construction of industry characteristics further embeds the assumption that the US' financial market is the closest to a complete market with little financial frictions. On the other hand, Choi (2019) argues that external finance dependence is country-variant due to differences in institutional policies and market situations. To further examine the effect of this proposition, we construct country-varying measures of external financial dependence and asset tangibility.[11] When reconstructing these measures, we also consider two different periods: pre-global financial crisis (1995-2007) and post-global financial crisis (2008-2014).

Table 4 presents the results using the new efd and at measures computed using North American Compustat for US firms and Global Compustat for firms in other countries.

Column 1 replicates the baseline results from Table 2. Column 2 presents the results using the updated efd and at constructed based on US firms from the period 1995-2014. Column 3 and 4 reports the results of updated efd and at in pre- and post-crisis periods. Despite a drop in magnitude, the point estimates on the interaction terms of capital controls and external financing dependence remain negative and statistically significant. Our baseline result remains robust to different measures of external financing dependence. The point estimates on interaction terms of capital controls and asset tangibility does vary in both signs and statistical significance. Overall, results in columns 1 through 4 confirm that our baseline results are robust, with the construction of

[11] Detailed methodology and summary statistics of the reconstruction are documented in Section A.3.

industry characteristics closely following the assumptions suggested in Rajan and Zingales (1998).

Column 5 presents the results using the country-variant efd and at measures, as suggested by Choi (2019). The interaction between capital controls and external financing remains negative, but is smaller in magnitude and loses statistical significance. On the other hand, the interaction between capital controls and asset tangibility is positive and statistically significant. Accounting for institutional differences between different countries, industries that have more tangible assets incur a smaller decline in exports upon increasing the level of capital controls on inflows. The results are in line with Choi (2019) that efd is subject to more variation across countries while at is a better measure of industry characteristics. Nonetheless, these country-varying measures are likely subject to endogeneity problems as capital control policies affect financial market situations that dictate the firms' realized external financing levels.[12] Therefore, our preferred measure for industry financial vulnerability remain those based on US data.

5.1.3 Other Considerations

In Table 5, we consider additional robustness checks to address other potential problems. In Column 1, we consider replacing export data with import data in the regression. Although import data include shipment and insurance cost, which could be endogenous to capital control policy of a country and add more noise to the results, it is usually considered to be more accurate than exports data because a country has more incentive to collect accurate import data as they are related to tariff revenue. The point estimates in column 1 suggest qualitatively similar results to our baseline results in Table 2.

Next, we check to see if the effects of capital controls on trade are dominated by large exporting countries. It is possible for certain influential countries to impact international trade beyond the sheer sizes of their economies, due to their imbalanced positions in the global supply chain, or the importance of their currencies. In Column 2, we exclude five such countries to ensure that our results are not drive solely by changes in these countries.[13] We find that the interaction effect of exporter capital controls and efd retain the same sign as in our baseline specification, and is slightly larger in magnitude.

Column 3 considers the scenario where capital controls have a delayed effect on trade. Using one-year lagged capital control variables, we find similar results to our baseline specification. Column 4 and 5 add country-industry weights, extracted from United Nations Industrial Development Organization (UNIDO), to account for the fact that countries have varying levels of output in

[12] Additionally, the limited country coverage in Global Compustat reduces the sample size significantly. A limited firm coverage in available countries with less developed financial system also potentially creates bias in the country-variant industrial measures.

[13] We remove the United States, France, Germany, Japan, and China from our sample. These countries are representatives of powerful countries in terms of trade from North America, the EU, and East Asia.

different industries.[14] Column 4 considers the country-industry weight for the start of our period of interest. However, UNIDO lacks data for many emerging economies in the those years. In order to include more emerging economies in the sample, including important players such as China, we consider country-industry weights in the median years of the period of interest in column 5. We find that controlling for industry size, our qualitative results remain unchanged from our baseline results. The magnitudes of the coefficients of importer capital controls and the interaction of exporter capital controls and efd are even larger.

Overall, the point estimates in Table 5 confirm our baseline results that capital control policy has varying effect depending on the external financial dependence of an industry. Analogous to our baseline results, the point estimates for the interaction term for external financial dependence remain significantly negative at 1% level across all specifications. We also note that the magnitude of the point estimates is larger in 4 out of 5 cases.

6 Financial Development

In this section, we examine the effect of financial development on the interaction of industry financial vulnerability and capital control policies to see whether our results are similar between countries with low vs high levels of financial development.

With regards to financial development and trade, using cross-sectional and panel approaches, Beck (2003) and Manova (2013) show respectively that financially developed countries have a comparative advantage in industries more intensive in external financing. An important reason is that better accounting standards, disclosure rules, and financial institutions will reduce the cost gap between internal and external funds, and hence enhance growth especially for firms in more external-financing dependent industries (Rajan and Zingales, 1998). At a more general level, Eichengreen, Gullapalli and Panizza (2011) find evidence that financial openness has positive effects on the growth of financially depending industries. With regards to financial development and capital control policy, Schmukler and Vesperoni (2006) and Forbes (2007) use firm-level data to show that firms in exporting countries with more developed domestic financial markets and more robust financial institutions are less affected by capital control policies, since countries with more developed financial markets are more capable of efficiently allocating capital across firms.

We use five measures of financial development for our empirical analysis. Svirydzenka (2016) provides a comprehensive financial development index which includes aspects from both financial market and financial institutions.[15] In addition, we include two other conventional measures fre-

[14] Country-industry data are converted from ISICver3 to ISICver2. Some industrial data are missing at a more detailed 4-digit level, which is adjusted by splitting the corresponding 3 digit level data evenly.

[15] It evaluates two parts of the financial system separately: the financial market, defined as the stock and bond markets; and the financial institutions, including the availability of banks, insurance companies, pension funds and

quently used in literature: private-sector credit to GDP and stock market capitalization to GDP from Beck et al. (2000). Table 6 presents the summary statistics of the five financial development variables we use.

We modify Equation 2 to examine the relationship between financial develop and capital control policy dynamics explored in previous section. We determine low and high financial development by the country's financial development index relative to a median cutoff in 1995 for all 99 countries in our sample. A binary variable $HighFD$ denotes whether the country has relatively high financial development in our sample. This will allow us to assign time-consistent groupings of high and low financial development. Formally, we estimate

$$\begin{aligned} log(Trade_{i,j,n,t}) = {} & \beta X_{i,n,t} + \gamma M_{j,n,t} + \xi Z_{i,j} + \theta_1 KC_{j,t} + \boldsymbol{\theta_{2i} KC_{i,t} \times efd_n} + \boldsymbol{\theta_{2j} KC_{j,t} \times efd_n} \\ & + \boldsymbol{\theta_{3i} KC_{i,t} \times at_n} + \boldsymbol{\theta_{3j} KC_{j,t} \times at_n} + \phi_1 DomCredit_{i,t} \times efd_n + \phi_2 DomCredit_{i,t} \times at_n \\ & + \boldsymbol{HighFD_i} \times (\boldsymbol{\psi_{2i} KC_{i,t} \times efd_n} + \boldsymbol{\psi_{3i} KC_{i,t} \times at_n}) \\ & + \boldsymbol{HighFD_j} \times (\psi_1 KC_{j,t} + \boldsymbol{\psi_{2j} KC_{j,t} \times efd_n} + \boldsymbol{\psi_{3j} KC_{j,t} \times at_n}) \\ & + HighFD_i \times (\tau_1 DomCredit_{i,t} \times efd_n + \tau_2 DomCredit_{i,t} \times at_n) + \delta_{it} + \delta_{jn} + \epsilon_{i,j,n,t} \end{aligned} \tag{3}$$

Capital control measures and industry vulnerability measures remain unchanged from our specification in Equation 2. We also maintain the same fixed effect specifications and standard error clustering. In this estimation, θ_{2i}, θ_{2j}, θ_{3i} and θ_{3j} now measure the industry-varying effect of capital control in exporter and importer countries with low levels of financial development, and $\theta_{2i} + \psi_{2i}$, $\theta_{3i} + \psi_{3i}$, $\theta_{2j} + \psi_{2j}$, and $\theta_{3j} + \psi_{3j}$ now measure the industry-varying effect of capital control in exporter and importer countries with high levels of financial development, respectively.

Table 7 presents the regression results of Equation 3. We only reported the results on the exporter side, where most of the dynamics are observed. The second line shows that in less financially developed exporting countries, capital inflow restrictions affect industries with higher external financing reliance more adversely. Four out of five point estimates are negative and statistically significant. The differential impact observed is much smaller for countries with higher levels of financial development. The sum of the two point estimates, $\theta_{2i} + \psi_{2i}$, takes on values close to zero for four of the five measures. The point estimates suggest that the differential impact of capital controls on trade is more prominent in less financially developed countries. In line with Calvo et al. (1996), countries that are less financially developed benefit greatly from foreign capital in terms of investment and economic growth. It is possible that this implies that restrictions on these capital

mutual funds. Hence, the index incorporates key metrics from both sides, including but not limited to the size and liquidity of financial markets, the ability of individuals and firms to access financial services, and the ability of institutions to provide low-cost financial service with sustainable revenue etc.

flows in less financially developed countries reduces the availability of foreign investments in high external finance dependent industries. The results are consistent with findings from Schmukler and Vesperoni (2006) and Forbes (2007) that robust domestic financial market and financial institutions shield firms from the effect of capital control policy, and are in line with the argument presented in Rajan and Zingales (1998). The third and fifth line report the interaction terms between capital control and asset tangibility in less and more financially developed countries. The point estimates vary in their significance and magnitudes across the five different financial development measures, without a clear pattern.

The point estimates of the interaction of capital controls of the importing countries and external finance or asset tangibility ($\theta_{2j}, \psi_{2j}, \theta_{3j}, \psi_{3j}$) remain insignificant, and are not reported in the table. We do not observe clear distinctions in capital control dynamics with respect to the importing country's level of financial development. The point estimates of the interaction of domestic credit availability and capital control, for both financially more and less developed countries, are consistent with our estimates in previous tables.

7 Conclusion

This paper provides an empirical attempt to explain how capital controls can affect international trade, and how these effects vary across industries with varying levels of external finance and asset tangibility. Utilizing a comprehensive panel data, we find that capital controls influence trade patterns via the differences in external financing across different industries, controlling for the availability of domestic credit in the exporting country. A tightening of a country's capital controls is associated with a reduction in its exports, and industries with higher levels of external financing are associated with larger reductions. Importer capital control implies a decrease in trade regardless of different external finance dependence across industries. Our results remain robust across different specifications, including using different measures of capital controls and various changes to other variables. Additionally, consistent with existing literature, the effect of capital control varies among countries with varying degrees of financial development. We find that higher levels of financial development has a dampening effect on the heterogeneous impacts of capital controls on trade across the various industries.

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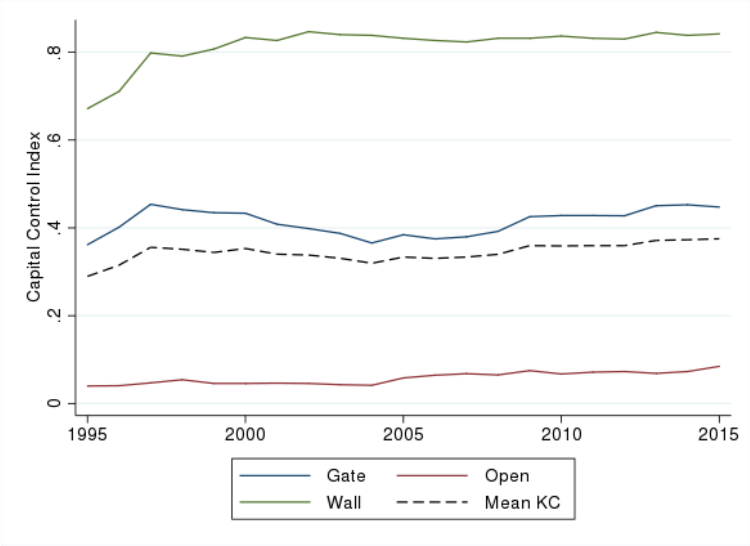
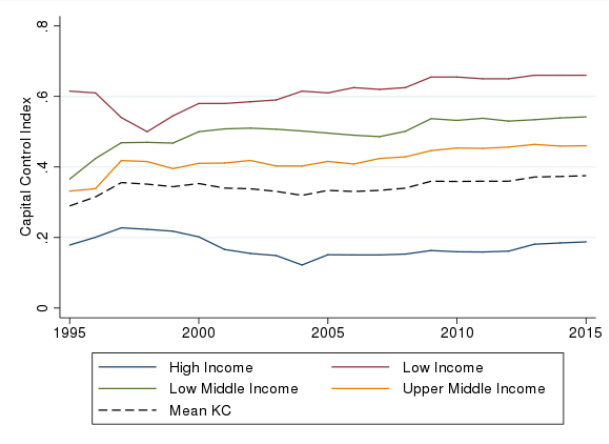
Figures and Tables

Figure 1: Capital Control Index by Capital Control Strictness Over Time

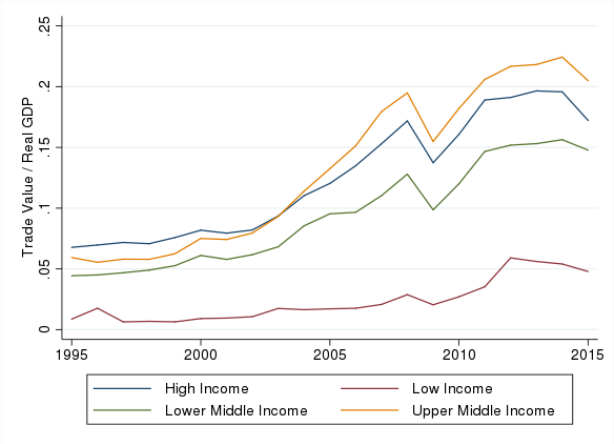


Note: This graph shows the capital control strictness, classified by Fernandez et al. (2016), of the reporter (exporter) countries over time.

Figure 2: Capital Controls Index and Trade over time by Income Group



(a) Capital Controls by Income Group



(b) Trade by Income Group

Note: Panel (a) presents the average level of capital controls by income group from 1995-2015. Panel (b) presents the average of Exports/GDP for each income group from 1995-2015. Level of capital controls and income groups are defined according to Fernandez et al. (2016).

Table 1: Summary Statistics of Variables (1995-2014)

	mean	sd	min	p25	p50	p75	max	count
A. Trade								
Trade Value ($, Millions) - Export data	57.11	680.06	0.00	0.04	0.51	6.19	165537.33	2500473
Trade Value ($, Millions) - Import data	52.85	643.33	0.00	0.02	0.36	4.97	134434.70	2717653
B. Capital Controls								
KC	0.34	0.32	0.00	0.05	0.20	0.65	1.00	1966
KC inflows	0.32	0.30	0.00	0.10	0.20	0.55	1.00	1966
KC outflows	0.37	0.37	0.00	0.00	0.20	0.75	1.00	1966
KC Trade inflows	0.29	0.34	0.00	0.00	0.12	0.62	1.00	1966
KC Trade outflows	0.35	0.41	0.00	0.00	0.00	0.75	1.00	1966
Chinn-Ito	0.63	0.36	0.00	0.17	0.70	1.00	1.00	1934
De-facto KC (%)	3.61	7.18	0.12	1.01	1.52	2.80	77.02	1462
C. Industry Level								
external finance dependence (Rajan-Zingales)	0.25	0.33	-0.45	0.06	0.22	0.40	1.14	27
asset tangibility (Rajan-Zingales)	0.30	0.14	0.07	0.20	0.30	0.38	0.67	27
human capital intensity	1.02	0.27	0.50	0.80	1.01	1.21	1.66	27
physical capital intensity	0.07	0.04	0.02	0.05	0.07	0.09	0.20	27
Exporter Ind. Share (95-97, adj)	0.03	0.04	0.00	0.01	0.02	0.04	0.46	1404
Exporter Ind. Share (05-07, adj)	0.03	0.05	0.00	0.00	0.02	0.04	0.55	2025
D. Country Level								
Real GDP ($, millions)	564927.16	1610960.19	2072.63	25241.17	129626.00	375349.00	16177500.00	1961
REER	97.56	18.83	27.81	89.79	98.72	103.58	269.26	1946
Human Capital Index	2.56	0.64	1.05	2.09	2.59	3.07	3.73	1906
(Log) K/L	11.97	1.17	6.87	11.46	12.20	12.71	14.68	1966
Tariff (%)	7.07	6.60	0.00	2.23	4.76	10.42	86.48	1675
Domestic Credit/GDP (WDI)	0.59	0.50	0.00	0.21	0.41	0.88	3.12	1838
Nonfin. Credit/GDP (BIS)	1.57	0.88	0.24	0.82	1.43	2.21	4.75	746

Note: This table presents the summary statistics for all variables used in all specifications.

Table 2: Capital Controls Levels Regressions

	Baseline			w/ Domestic Credit	
	(1)	(2)	(3)	(4)	(5)
	Ex. Side	Im. Side	Full Reg	BIS Banks	Full Sample
Importer KC outflows		-0.082*	-0.079*	-0.114**	-0.091*
		(0.04)	(0.04)	(0.05)	(0.05)
Exporter KC inflows × external finance dependence	-1.225***		-1.225***	-0.530***	-0.459***
	(0.06)		(0.06)	(0.06)	(0.06)
Exporter KC inflows × asset tangibility	1.064***		1.064***	-0.169	-0.112
	(0.16)		(0.16)	(0.17)	(0.15)
Importer KC outflows × external finance dependence		0.008	0.011	-0.124***	-0.004
		(0.05)	(0.05)	(0.05)	(0.05)
Importer KC outflows × asset tangibility		0.049	0.034	0.154	0.010
		(0.12)	(0.12)	(0.14)	(0.14)
Exporter Dom. Credit × external finance dependence				0.390***	0.013***
				(0.02)	(0.00)
Exporter Dom. Credit × asset tangibility				-0.953***	-0.026***
				(0.06)	(0.00)
Observations	2112778	2112778	2112778	1354840	1957117
R^2	0.619	0.618	0.619	0.673	0.620
Ex. × Time, Im. × Industry	Y	Y	Y	Y	Y

Note: This table presents the results of our baseline regression, seen in Equation 1. Columns 1 and 2 present the results by exporter and importer sides separately. Column 3 presents the results when we include both the exporter and importer sides of the story together in the same regression. Columns 4 and 5 includes the interaction between exporter domestic credit (divided by GDP) and efd/at. Column 4 only includes countries that are a part of the BIS Locational Banking Statistics and Column 5 uses the domestic credit/GDP metric from the World Bank WDI statistics.

Table 3: Capital Controls Levels Regressions: Robust KC Measures

	(1) Baseline	(2) KC	(3) KC Trade	(4) Chinn-Ito	(5) De Facto
Importer KC	-0.091*	-0.056	-0.109**	-0.011	-0.006***
	(0.05)	(0.06)	(0.04)	(0.05)	(0.00)
Exporter KC × external finance dependence	-0.459***	-0.426***	-0.634***	0.730***	0.016***
	(0.06)	(0.05)	(0.05)	(0.05)	(0.00)
Exporter KC × asset tangibility	-0.112	0.065	0.077	-1.161***	-0.072***
	(0.15)	(0.15)	(0.14)	(0.14)	(0.01)
Importer KC × external finance dependence	-0.004	0.002	0.025	-0.071	-0.001
	(0.05)	(0.06)	(0.05)	(0.05)	(0.00)
Importer KC × asset tangibility	0.010	-0.246	-0.126	0.723***	0.014***
	(0.14)	(0.17)	(0.12)	(0.14)	(0.01)
Exporter Dom. Credit × external finance dependence	1.288***	1.287***	1.240***	1.189***	1.214***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Exporter Dom. Credit × asset tangibility	-2.558***	-2.530***	-2.533***	-2.322***	-1.831***
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Observations	1957117	1957117	1957117	1937855	1491137
R^2	0.620	0.620	0.620	0.620	0.636
Ex. × Time, Im. × Industry	Y	Y	Y	Y	Y

Note: In Fernandez et al. (2016), 0 refers to no capital control and 1 refers to consistent full capital control. The measure is reversed for Chinn-Ito and De Facto, where 0 refers to consistent control and 1 refers to open capital account.

Table 4: Capital Controls Levels Regressions with Different Financial Vulnerability Assumptions

	(1) RZ (1998) (1980-1990)	(2) US Comp (1995-2014)	(3) US Comp (1995-2007)	(4) US Comp (2008-2014)	(5) Ex. Vary (1995-2014)
Importer KC outflows	-0.091*	-0.052	-0.056	-0.057	-0.317***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.12)
Exporter KC inflows × external finance dependence	-0.459***	-0.088***	-0.083***	-0.124***	-0.051
	(0.06)	(0.02)	(0.03)	(0.02)	(0.04)
Exporter KC inflows × asset tangibility	-0.112	0.450**	0.272	0.653***	1.833***
	(0.15)	(0.18)	(0.19)	(0.20)	(0.26)
Importer KC outflows × external finance dependence	-0.004	-0.019	-0.057*	0.049***	-0.003
	(0.05)	(0.02)	(0.03)	(0.02)	(0.03)
Importer KC outflows × asset tangibility	0.010	-0.139	-0.154	-0.065	0.581
	(0.14)	(0.17)	(0.17)	(0.18)	(0.35)
Exporter Dom. Credit × external finance dependence	1.288***	0.278***	0.442***	-0.016	-0.133***
	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)
Exporter Dom. Credit × asset tangibility	-2.558***	-4.070***	-4.130***	-4.906***	-0.295*
	(0.10)	(0.11)	(0.12)	(0.13)	(0.18)
Observations	1957117	1825267	1825267	1562449	284294
R^2	0.620	0.619	0.619	0.625	0.758
Ex. × Time, Im. × Industry	Y	Y	Y	Y	Y

Note: This table presents the regression results using different variants of efd and at. Column 1 presents the results using the Rajan and Zingales (1998) efd and at measures. Column 2-4 uses our calculated efd and at from the North American Compustat data across years 1995-2014, 1995-2007, and 2008-2014 respectively. Column 5 uses our calculated efd and at from the Global Compustat data by headquarter location (loc), across years 1995-2014.

Table 5: Capital Controls Levels Regressions Robustness

	Import Data	No Large	t-1 lags	Ind. Share	
	(1)	(2)	(3)	(4)	(5)
				95-97 (adj)	05-07 (adj)
Importer KC outflows	0.052	-0.084	-0.112**	-0.128**	-0.114**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Exporter KC inflows × external finance dependence	-0.117**	-0.634***	-0.491***	-0.611***	-0.627***
	(0.05)	(0.07)	(0.06)	(0.08)	(0.05)
Exporter KC inflows × asset tangibility	-0.539***	0.108	-0.176	-0.126	-0.559***
	(0.16)	(0.17)	(0.16)	(0.23)	(0.15)
Importer KC outflows × external finance dependence	-0.032	-0.023	-0.003	-0.053	-0.032
	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)
Importer KC outflows × asset tangibility	0.056	-0.037	0.057	-0.010	0.053
	(0.13)	(0.15)	(0.14)	(0.14)	(0.14)
Exporter Dom. Credit × external finance dependence	1.330***	1.198***	1.197***	0.655***	0.731***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)
Exporter Dom. Credit × asset tangibility	-2.739***	-2.768***	-2.570***	-1.027***	-1.572***
	(0.10)	(0.12)	(0.10)	(0.10)	(0.09)
Observations	2199941	1615891	1796800	1307854	1715318
R^2	0.639	0.568	0.613	0.676	0.655
Ex. × Time, Im. × Industry	Y	Y	Y	Y	Y

Note: This table presents the robustness checks laid out in Section 5.1. Column 1 presents the results of our baseline regression using Imports Data. Column 2 presents the results of our baseline regression when we remove five large countries from the sample (both as importers and exporters): United States, China, Germany, France, and Japan. Column 3 presents the results of our baseline regression using lagged variables $(t-1)$ values on the right hand side. Columns 4-5 presents the results when we include industry share variables as a right-hand side variable (Friedrich et al., 2013).

Table 6: Summary Statistics of Financial Development Variables

	mean	sd	min	p25	p50	p75	max	count
FD: Financial development index	0.39	0.23	0.04	0.19	0.34	0.57	1.00	1980
FM: Financial markets	0.32	0.26	0.00	0.06	0.28	0.51	1.00	1980
FI: Financial institutions	0.46	0.23	0.06	0.27	0.41	0.67	1.00	1980
Priv. Credit by Banks & Fin. Inst. to GDP (%)	58.08	48.10	0.85	20.86	42.56	87.18	262.46	1938
Stock Market Cap to GDP (%)	54.73	87.57	0.03	14.76	32.59	68.72	1086.34	1580

Note: This table presents the summary statistics of financial development variables. Financial development (FD), financial market (FM), and financial institution (FI) index from Svirydzenka (2016) is computed at the country-year level, and is scaled between 0-1. Private credit by banks and financial institutions to GDP and stock market capitalization to GDP ratios from Beck et al. (2000) are computed at the country-year level.

Table 7: Capital Controls Levels Regressions with Financial Development

	(1) Fin Dev	(2) Fin Mkt	(3) Fin Inst	(4) Priv Cred	(5) St Mkt Cap
Importer KC outflows	-0.316***	-0.309***	-0.281***	-0.118	-0.039
	(0.09)	(0.09)	(0.08)	(0.09)	(0.07)
Exporter KC inflows × external finance dependence	-0.379***	-0.638***	-0.109	-0.644***	-0.565***
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)
Exporter KC inflows × asset tangibility	0.040	-0.223	-1.068***	-0.198	-0.605***
	(0.26)	(0.25)	(0.23)	(0.26)	(0.23)
Exporter High Fin Dev=1 × Exporter KC inflows × external finance dependence	0.349***	0.781***	-0.391***	0.445***	0.240***
	(0.09)	(0.08)	(0.10)	(0.09)	(0.08)
Exporter High Fin Dev=1 × Exporter KC inflows × asset tangibility	-0.558*	-0.403	1.597***	-0.020	0.764***
	(0.30)	(0.28)	(0.30)	(0.29)	(0.28)
Observations	1957117	1957117	1957117	1957117	1957117
R^2	0.621	0.622	0.620	0.621	0.620
Ex. × Time, Im. × Industry	Y	Y	Y	Y	Y

Note: This table presents the results of the impact of capital controls on trade by industry, for exporters and importers of low vs. high financial development based on measures constructed by Svirydzenka (2016). Column 1 presents the results using the metric of overall financial development. Columns 2 and 3 present the results using components of financial development: development of financial markets and financial institutions. Columns 4 and 5 measure financial development using private credit to GDP ratio and stock market capitalization respectively from Beck et al. (2000). The interactions of financial vulnerability and domestic credit are included, but are not reported. The importer variables are included and not statistically significant, so they are not reported.

A Appendix

A.1 Industry Characteristics

Table A1: Industry Characteristics from Manova (2008)

isic3d	industry	efd	at	pci	hci	nri
311	food products	0.137	0.378	0.062	0.812	0
313	beverages	0.077	0.279	0.062	1.135	0
314	tobacco	-0.451	0.221	0.018	1.354	0
321	textiles	0.401	0.373	0.073	0.688	0
322	wearing apparel, except footwear	0.029	0.132	0.019	0.502	0
323	leather products	-0.140	0.091	0.032	0.687	0
331	wood products, except furniture	0.284	0.380	0.065	0.741	1
332	furniture, except metal	0.236	0.263	0.039	0.698	0
341	paper and products	0.176	0.558	0.132	1.139	1
342	printing and publishing	0.204	0.301	0.052	0.934	0
352	other chemicals	0.219	0.197	0.060	1.209	0
353	petroleum refineries	0.042	0.671	0.196	1.656	1
354	misc. petroleum and coal products	0.334	0.304	0.074	1.153	1
355	rubber products	0.227	0.379	0.066	0.985	0
356	plastic products	1.140	0.345	0.088	0.827	0
361	pottery, china, earthenware	-0.146	0.075	0.055	0.804	0
362	glass and products	0.529	0.331	0.090	1.012	0
369	other non-metallic products	0.062	0.420	0.068	0.952	1
371	iron and steel	0.087	0.458	0.102	1.251	1
372	non-ferrous metals	0.006	0.383	0.101	1.098	1
381	fabricated metal products	0.237	0.281	0.056	0.914	0
382	machinery, except electrical	0.445	0.183	0.058	1.119	0
383	machinery, electric	0.768	0.213	0.077	1.064	0
384	transport equipment	0.307	0.255	0.071	1.322	0
385	prof and scient. equipment	0.961	0.151	0.053	1.234	0
390	other manufactured products	0.470	0.188	0.039	0.755	0
3511	industrial chemicals	0.205	0.412	0.124	1.408	0

Note: This table presents industry characteristics from Manova (2008). efd and at are external finance and asset tangibility respectively. pci, hci, and nri are the intensity indices of physical capital, human capital, and natural resources.

A.2 Overall Effect of Capital Control Policy

This section empirically examines the overall effect of capital control policies, imposed by both exporter and importer, on international trade. Our specification follows from specifications in previous literature, including but not limited to Beck, Manova etc. Specifically, the specification is shown in equation:

$$log(Trade_{i,j,n,t}) = \beta X_{i,n,t} + \gamma M_{j,n,t} + \xi Z_{i,j} + \theta_1 KC_{i,t} + \theta_2 KC_{j,t} + \delta_i + \delta_j + \delta_n + \delta_t + \epsilon_{i,j,n,t} \quad \text{(A1)}$$

where $X_{i,n,t}$ and $M_{j,n,t}$ are the vectors of country and industry controls for exporter country i and importer country j respectively, in industry i at time t, $Z_{i,j}$ is a vector of gravity model variables between exporter country i and importer country j, and δ's are exporter-importer pair, time and industry fixed effects.[1] Country and industry fixed effects control for time-invariant country and industry characteristics, and time fixed effect controls for macro-environment at the time trade transaction occurs. $KC_{i,t}$ and $KC_{j,t}$ measure the level of capital control of exporting and importing countries in the trade transaction. We include exporter and importer country (δ_i and δ_j respectively), industry (δ_n), and time (δ_t) fixed effects and cluster our standard errors by country pair and industry.

We examine the overall effect of capital control policy using 4 different measurements of capital restrictions. Column 1 and Column 2 use our main measurement of capital control, from Fernandez et al. (2016), whose details are carefully elaborated in Section 4. Column 3 measures capital account openness with Chinn-Ito index, a de jure measurement frequently featured in relative literatures.[2] Column 4 measures capital account restriction with a de facto index, the sum of foreign asset and liability relative to GDP, proposed by the pioneering work of Lane and Milesi-Ferretti (2003).

Overall, results in table shows that higher level of capital control correlates with lower level of international trade, considering all countries in the sample. Column 1 suggests a mixed result that higher overall level of capital control by exporter leads to higher trade, but higher level of capital control by importer reduces trade. However, if we were to carefully examine the two capital control restrictions most pertinent to international trade, namely inflow restrictions by exporters and outflow restrictions by importers, higher levels of capital control by both exporters and importers discourage international trade, as suggested by results in column 2. Column 3 echoes similar results to column 2, where more open capital account openness correlates with higher levels of international trade. Column 4 suggests that increases in *de facto* capital control measures for

[1] $X_{i,n,t}$ (exporter controls) & $M_{j,n,t}$ (importer controls): Capital-Labor Ratio, Human Capital Index, Real GDP, Real Effective Exchange Rate, Tariffs, and GATT/WTO Affiliation. $Z_{i,j}$ (Gravity variables): Distance, Common Language, Former Colony, Common Currency, and Common Religion.

[2] Chinn-Ito index, (Chinn and Ito, 2008), measures capital account openness in an normalized fashion, with values ranging from 0 to 1, with 0 being the least open and 1 being the most open in capital account.

the exporters and importers are correlated with lower levels of trade, but these point estimates are either tiny or insignificant. Overall, the results reflect that in a simple cross-country setting higher levels of capital control correlate with lower level of trade transaction. The capital control measures from column 2 are our measures of choice in the results section.

Table A2: Capital Controls Sign

	(1)	(2)	(3)	(4)
	KC	KC in/out	Chinn-Ito	De-facto KC
Exporter KC	0.089	-0.126*	0.210***	-0.010***
	(0.06)	(0.06)	(0.06)	(0.00)
Importer KC	-0.129***	-0.101***	0.206***	-0.002
	(0.04)	(0.03)	(0.04)	(0.00)
Exporter Log Real GDP	0.656***	0.654***	0.648***	0.565***
	(0.10)	(0.10)	(0.10)	(0.10)
Importer Log Real GDP	0.921***	0.919***	0.930***	0.992***
	(0.07)	(0.07)	(0.07)	(0.09)
Exporter REER	0.003***	0.003***	0.002***	0.005***
	(0.00)	(0.00)	(0.00)	(0.00)
Importer REER	0.004***	0.004***	0.003***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)
Exporter Log real K/L - pop.	0.129***	0.124***	0.119***	0.175***
	(0.03)	(0.03)	(0.03)	(0.03)
Importer Log real K/L - pop.	-0.053***	-0.051***	-0.054***	0.010
	(0.02)	(0.02)	(0.02)	(0.02)
Observations	2112778	2112778	2089407	1580624
R^2	0.585	0.586	0.586	0.603
Ex., Im., Time, Industry	Y	Y	Y	Y

A.3 Recalculate external finance dependence and asset tangibility

This section covers how we recompute external finance dependence and asset tangibility using fields from both the North American Compustat and Global Compustat data.

The construction of efd and at follow from Rajan and Zingales (1998), where we first sum the fields Capital Expenditures (capx), Cashflow from Operations, Net Property Plant & Equipment (ppent), and Total Assets (at) from 1995-2014 by firm. Cashflow from Operations is defined as the sum of funds from operations, decreases in inventories (invch), decreases in accounts receivable (recch), and increases in accounts payable (apalch in NA Compustat or apch in Global Compustat).[3]

We then compute the ratios:

$$efd = \frac{\text{Capital Expenditures} - \text{Cashflow from Operations}}{\text{Capital Expenditures}} \tag{A2}$$

$$at = \frac{\text{Net Property, Plant \& Equipment}}{\text{Total Assets}} \tag{A3}$$

Similar to the literature, within ISIC 3-digit industry and country headquarters, we use the median efd and at measures to avoid excessively weighting large firms within an industry.

We also compute the efd and at over 1995-2014 using the North American Compustat to check the time-invariance assumptions made by Rajan and Zingales (1998). We also compute the efd and at for pre- and post-global financial crisis periods (1995-2007 and 2008-2014). We compute the efd and at over 1995-2014 using the Global Compustat to compute time-invariant measures by exporting country, defined by headquarter locations (loc). We exclude industries that contain less than 15 firms in the Global Compustat Data and 15 firms in the North American Compustat. Furthermore, we winsorize the exporter country efd at the 1st and 99th percentile. Table A3 presents the summary statistics of the new efd and at measures. Due to data constraints, we only compute exporter efd and at measures for 36 of the 99 exporter countries.

Table A3: Summary Statistics of Robust Industry Variables

	mean	sd	min	p25	p50	p75	max	count
NA external finance dependence (1995-2014)	-0.25	1.10	-4.37	-0.41	-0.32	-0.03	2.40	25
NA asset tangibility (1995-2014)	0.29	0.12	0.10	0.17	0.27	0.37	0.58	25
NA external finance dependence (1995-2007)	-0.28	0.76	-3.33	-0.34	-0.28	-0.08	0.76	25
NA external finance dependence (2008-2014)	-0.51	0.94	-2.88	-0.74	-0.60	-0.29	2.01	21
NA asset tangibility (1995-2007)	0.29	0.12	0.12	0.19	0.29	0.38	0.57	25
NA asset tangibility (2008-2014)	0.26	0.12	0.09	0.16	0.26	0.35	0.56	21
Exporter external finance dependence	0.17	1.15	-2.37	-0.25	0.07	0.41	10.12	198
Exporter asset tangibility	0.32	0.12	0.03	0.24	0.32	0.39	0.72	198

[3]For more detailed accounts of calculating funds from operations, see Appendix in Choi (2019).

Capital Control Policy, Industry, and Trade: Evidence from the Past 20 Years

Online Appendix

Kevin Lai Tao Wang David Xu

Table 1: Correlation Matrix: Capital Controls

	KC	KC inflows	KC outflows	KC Trade	Chinn-Ito	de facto KC
KC	1					
KC Inflows	0.95	1				
KC Outflows	0.97	0.84	1			
KC Trade	0.93	0.88	0.9	1		
Chinn-Ito	-0.8	-0.75	-0.78	-0.78	1	
de facto KC	-0.23	-0.19	-0.23	-0.23	0.27	1

Note: This table presents the correlations between capital controls measures: KC, KC inflows, KC outflows, KC Trade, KC Chinn-Ito, de facto KC.

Table 2: Correlation Matrix: Financial Development

	FD: Financial Development index	FM: Financial Markets index	FI: Financial Institutions index	Priv Credit by Banks to GDP	Stock Mkt Cap to GDP
FD: Financial development index	1				
FM: Financial markets	0.95	1			
FI: Financial institutions	0.93	0.77	1		
Priv Credit by Banks to GDP	0.82	0.71	0.83	1	
Stock Mkt Cap to GDP	0.45	0.46	0.39	0.47	1

Note: This table presents the correlations between financial development measures: FD: Financial development index, FM: Financial markets index, FI: Financial institutions index, Priv Credit by Banks to GDP, and Stock Mkt Cap to GDP.

Table 3: Correlation Matrix: Industry Financial Vulnerability

	efd (RZ)	NA efd (1995-2014)	NA efd (1995-2007)	NA efd (2008-2014)	Exporter efd (1995-2014)	at (RZ)	NA at (1995-2014)	NA at (1995-2007)	NA at (2008-2014)	Exporter at (1995-2014)	hci	pci
efd (RZ)	1											
NA efd (1995-2014)	0.63	1										
NA efd (1995-2007)	0.64	0.96	1									
NA efd (2008-2014)	0.44	0.84	0.77	1								
Exporter efd (1995-2014)	0.22	0.33	0.31	0.32	1							
at (RZ)	-0.34	-0.37	-0.38	-0.12	-0.11	1						
NA at (1995-2014)	-0.38	-0.35	-0.36	-0.05	-0.12	0.89	1					
NA at (1995-2007)	-0.38	-0.34	-0.36	-0.05	-0.12	0.9	1	1				
NA at (2008-2014)	-0.44	-0.45	-0.48	-0.04	-0.13	0.91	0.99	0.99	1			
Exporter at (1995-2014)	-0.32	-0.43	-0.44	-0.12	-0.23	0.71	0.75	0.75	0.75	1		
hci	0.15	0.22	0.23	0.35	0.13	0.09	0.04	0.07	0.03	-0.07	1	
pci	0.04	-0.03	0	0.13	0	0.75	0.66	0.66	0.62	0.46	0.54	1

Note: This table presents the correlations between industry financial vulnerability measures, described in Section 4 and Appendix Section A.3.

Table 4: Capital Controls Levels Regressions: Robust KC Asset Measures

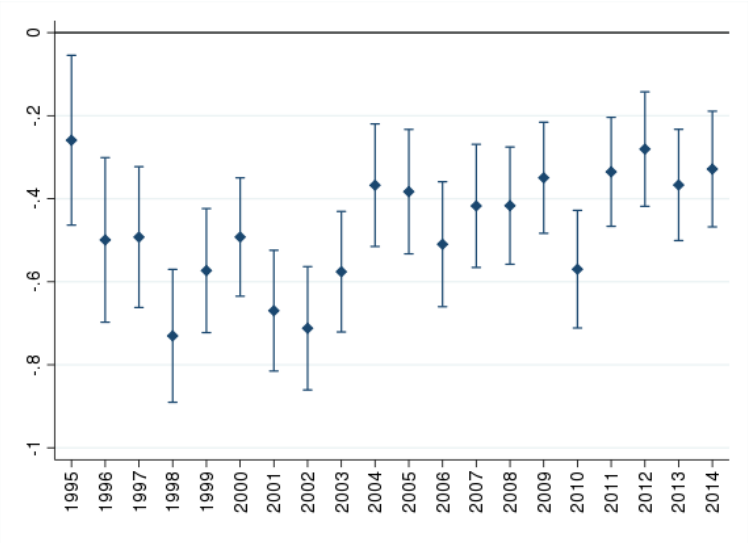
	(1) eq	(2) bo	(3) mm	(4) ci	(5) de	(6) cc	(7) fc	(8) gs	(9) di
Importer KC	-0.018	-0.087***	-0.047	0.028	-0.034	-0.025	-0.042*	-0.079***	-0.072**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)
Exporter KC × external finance dependence	-0.331***	-0.511***	-0.355***	-0.448***	-0.208***	-0.433***	-0.435***	-0.223***	-0.154***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)
Exporter KC × asset tangibility	0.404***	0.697***	0.036	-0.203	-0.192*	-0.235**	0.385***	-0.631***	0.546***
	(0.12)	(0.12)	(0.12)	(0.13)	(0.11)	(0.11)	(0.10)	(0.11)	(0.09)
Importer KC × external finance dependence	-0.014	0.077**	0.017	-0.059*	-0.014	-0.033	0.011	0.010	0.053*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Importer KC × asset tangibility	-0.083	0.325***	0.085	-0.008	0.058	-0.227***	0.095	-0.118	-0.045
	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	(0.07)	(0.09)	(0.09)
Exporter Dom. Credit × external finance dependence	1.308***	1.279***	1.295***	1.291***	1.330***	1.273***	1.263***	1.329***	1.348***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Exporter Dom. Credit × asset tangibility	-2.478***	-2.450***	-2.535***	-2.570***	-2.573***	-2.590***	-2.471***	-2.649***	-2.451***
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.09)
Observations	1957117	1957117	1957117	1957117	1957117	1957117	1957117	1957117	1957117
R^2	0.620	0.620	0.620	0.620	0.620	0.620	0.620	0.620	0.620
Ex. × Time, Im. × Industry	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 5: Capital Controls Levels Regressions - Exports Side

	Baseline		w/ Domestic Credit	
	(1)	(2)	(3)	(4)
Exporter KC inflows	0.188		0.213	
	(0.32)		(0.30)	
Exporter KC inflows × external finance dependence	-1.254***	-1.239***	-0.521*	-0.500
	(0.38)	(0.38)	(0.31)	(0.31)
Exporter KC inflows × asset tangibility	0.446	0.384	-0.747	-0.828
	(0.96)	(0.96)	(0.76)	(0.75)
Exporter Domestic Credit			0.243	
			(0.18)	
Exporter Domestic Credit × external finance dependence			1.267***	1.269***
			(0.19)	(0.19)
Exporter Domestic Credit × asset tangibility			-2.019***	-2.024***
			(0.53)	(0.53)
Observations	2645131	2645131	2436650	2436650
R^2	0.302	0.310	0.306	0.314
Ex., Time FE	Y	N	Y	N
Ex. × Time FE	N	Y	N	Y

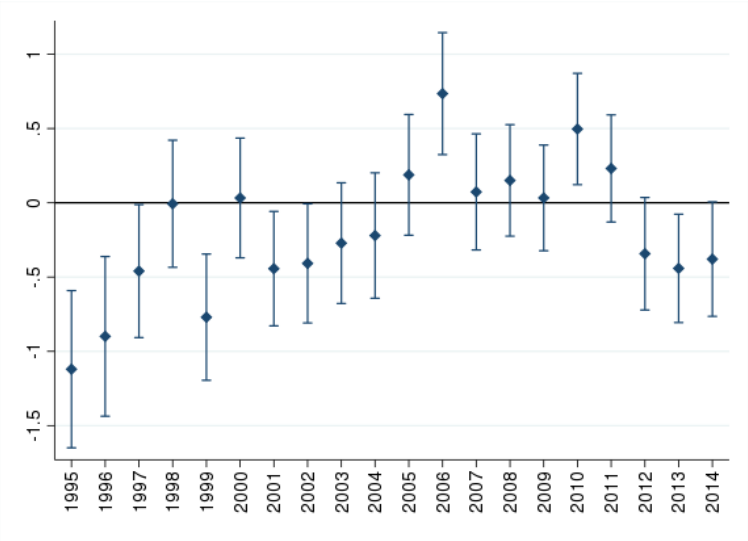
1 Robustness of Coefficients Across Time

Figure 1: $ExporterKC \times efd$ across time



Note: This plot shows the cross-sectional coefficients of $ExporterKC \times efd$ of our baseline result for each year.

Figure 2: $ExporterKC \times at$ across time



Note: This plot shows the cross-sectional coefficients of $ExporterKC \times at$ of our baseline result for each year.