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# Welfare Effects of Financial Access on Trade: Evidence from Community Reinvestment Act (CRA)

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# Welfare Effects of Financial Access on Trade: Evidence from Community Reinvestment Act (CRA) Business Loans

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**Abstract**

Credit access plays a pivotal role in enabling firms to participate in global markets and support broader economic growth. While large firms benefit from steady revenue streams and easier financing options, small and medium-sized enterprises (SMEs) frequently encounter substantial challenges in securing credit. This paper analyzes U.S. metropolitan area–level data to assess how local expansions in credit supply, particularly via Community Reinvestment Act (CRA) loans, influence export performance. Using the geographic dispersion of bank headquarters as an instrumental variable, we estimate that a 10% increase in credit availability results in a 4.5% increase in export volumes. Extending the analysis to a heterogeneous firm framework with credit frictions, we show that a 10% reduction in trade costs produces welfare gains from trade that are 18.75% larger when firms are unconstrained by credit.

**Keywords:** Credit access, Exports, SMEs, Community Reinvestment Act, Financial constraints, Trade, Welfare

# 1 Introduction

Growing attention has been given to the role of credit availability in enabling international trade, prompting a central question: To what extent does loan access shape firms' capacity to participate in global markets and enhance economic welfare?

This paper examines the relationship between regional export volume and credit access for small businesses. Using CRA small business loan data, we find a positive relationship between credit access—measured as the number of CRA loans per trade sector firm—and the total value of merchandise exports. To address endogeneity concerns, we construct a geography-based instrumental variable that estimates expected bank branch density based on distance and population ratios between regions and bank headquarters. This isolates credit supply from demand. Our results show that a 10% increase in credit access leads to a 4.5% rise in export volume.

The focus on small and medium-sized enterprises (SMEs) is motivated by their unique financial constraints relative to large firms. Large firms generally enjoy steady internal cash flows that allow them to operate at lower costs and maintain cash reserves (Brealey et al., 2011). Furthermore, their diversified customer bases shield them from market risks, reinforcing their financial stability (Bodnar & Wong, 2003). In addition, their substantial credit history and status as lower-risk borrowers grant them easier access to external financing (Modigliani & Miller, 1958). In contrast, SMEs often face significant financial constraints. Unlike large firms, SMEs cannot typically self-fund operations and rely heavily on external financing, where their limited resources and credit history frequently pose barriers to accessing capital (Fazzari et al., 1987).

To evaluate the broader implications of this increase, we develop a trade model with credit constraints. The model is calibrated using the empirical finding and parameters such as elasticity of substitution, Pareto shape parameter, fixed cost ratio, share of credit constrained exporters, share of exporters from the literature. Credit expansion enables firms to scale up output, which increases labor demand and wages—amplifying the welfare gains from trade. Welfare is measured by real consumption, which rises as both income and access to goods improve. We find that eliminating credit constraints raises welfare gains from trade by 19%. Our findings underscore the critical role of SMEs in driving economic growth and development.

Small and medium-sized enterprises (SMEs)[1] are vital to economic growth and employment, making up 99.9% of all U.S. businesses, 97.5% of exporters, 64% of job creation, and 45% of total private sector employment in 2019 (Punjwani, 2024). Despite this, only about 4% of SMEs engaged in exporting. Their smaller scale, limited collateral, shorter credit histories, and higher perceived risk relative to larger firms often restrict access to external finance (World Trade Organization, 2016). These challenges are magnified in global trade, where substantial upfront financing is needed for compliance, logistics, and working capital. According to a 2010 survey conducted by the U.S. International Trade Commission(USITC), financing was cited as a key barrier by 22.4% of manufacturing SMEs, compared to just 9.6% of large manufacturing firms—a gap that highlights the disproportionate burden on smaller exporters. The survey included responses from over 3,000 firms across the U.S. manufacturing and services sectors, and report details how SMEs rated various export impediments. Among manufacturing SMEs, lack of access to finance was ranked as the most frequently reported barrier to exporting. These survey results are shown in Figure 1, which illustrates the percentage of firms identifying each type of trade barrier . This financing gap is critical, especially in periods such as the post–Great Recession recovery, when exports accounted for nearly 40% of U.S. GDP growth (Suominen & Lee, 2015). Credit constraints not only slow the growth of small and medium-sized enterprises (SMEs) but also hinder their ability to enter export markets, limiting opportunities for diversification and international expansion. Large firms, by contrast, benefit from steady internal cash flows, diversified customer bases, and well-established credit histories, enabling easier and cheaper access to finance (Bodnar & Wong, 2003; Brealey et al., 2011; Modigliani & Miller, 1958). SMEs' heavier reliance on external credit markets therefore makes them particularly sensitive to changes in local loan supply.

Small and medium-sized enterprises (SMEs) are widely acknowledged as key drivers

[1]SMEs are defined as businesses with fewer than 500 employees ("Frequently Asked Questions About Small Business", n.d.)

of economic growth, innovation, and employment. Representing the overwhelming majority of firms worldwide, they play a central role in regional development and economic diversification. Empirical evidence indicates that 90.1% of micro, small, and medium enterprises (MSMEs) have a positive impact on economic growth (Juminawati et al., 2021), while numerous studies emphasize their contribution to job creation (Beck et al., 2005; Decker et al., 2014; Haltiwanger et al., 2013; Kongolo, 2010). This economic significance has prompted policymakers to prioritize policies that foster SME activity and promote start-up formation (Ayyagari et al., 2007). Beyond their domestic impact, SMEs engaged in international trade tend to experience faster growth and greater innovation, with exporting linked to productivity gains and competitiveness (Golovko & Valentini, 2011).

Building on this broader role of SMEs, a substantial body of empirical research has examined how financial constraints influence firms' ability to participate in global markets. These studies consistently find that firms with limited access to credit are less likely to export, tend to export a narrower range of products, and achieve lower export revenues (Bellone et al., 2010; Berman & Héricourt, 2010; Manova et al., 2015; Muûls, 2015; Paravisini et al., 2015). The effects are particularly severe for SMEs, which often face higher borrowing costs and lack the collateral necessary to secure financing. Our study contributes to this strand by shifting the focus from firm-specific financial indicators to measures of local credit availability. Specifically, we estimate the elasticity of exports with respect to CRA-related credit access at the regional level, finding an elasticity of 0.45—consistent with the range of estimates for firm-level financial constraints reported by Dai et al. (2021).

A third strand of literature employs structural trade models to analyze how financial constraints shape firms' international behavior. Building on Melitz (2003), researchers have developed models that incorporate credit frictions into firms' export decisions (Caggese & Cuñat, 2013; Leibovici, 2021). These models simulate how constrained firms allocate limited capital between domestic and foreign markets, generating predictions about export entry, intensity, and survival. We contribute to this tradition by using a simplified version of Chaney (2016)'s model to examine how local credit access affects trade flows in a small open economy framework, holding foreign demand and prices constant.

Bringing these strands together, this study examines the role of Community Reinvestment Act (CRA) business loans in supporting SME internationalization. While previous research has explored the CRA's impact on firm formation (Bostic & Canner, 1998) and employment growth (Ding et al., 2018; Rupasingha & Wang, 2017), its influence on export outcomes remains unstudied. By testing whether CRA credit availability correlates with stronger SME export performance, we offer new insights into how localized financial policies affect broader trade dynamics and regional economic development.

The rest of the paper is organized as follows: Section 2 gives the institutional background, Section 3 presents the data and Section 4 our empirical methodology, its robustness, and heterogeneity. In Section 5, we develop a simple small open economy model with credit-constrained firms that illustrates the economic forces behind the empirical findings and performs counterfactual analysis. Section 6 concludes our study.

# 2 Institutional Background

The U.S. federal government has a longstanding history of supporting small and medium-sized enterprises (SMEs) involved in international trade through agencies such as the Export-Import Bank (Ex-Im Bank) and the Small Business Administration (SBA). These agencies offer financial tools like loan guarantees and export credit insurance aimed at reducing the financing barriers SMEs face when entering global markets. However, despite these efforts, SMEs continue to report significant challenges in accessing capital.

The SBA, for instance, imposes strict eligibility criteria, complex paperwork requirements, and long approval timelines. Its most widely used loan program—the 7(a) loan—reaches only about 1% of U.S. small businesses (Suominen & Lee, 2015). Many potential borrowers are further constrained by the need for collateral, which smaller firms often lack. Meanwhile, although the Ex-Im Bank provides export-specific financing, its scope has been periodically restricted by political factors. After its charter lapsed in 2015, the Bank's lending capacity was sharply reduced for several years, preventing it from fully serving SME clients. Even when operational, the Bank's programs can be difficult for SMEs to access due to high domestic content requirements and long application processes (Suominen & Lee, 2015).

According to the Federal Reserve's 2020 Small Business Credit Survey, 20% of SME applicants were denied loans in 2019, and 30% of firms reported not having enough financing available to meet business needs ("Report on Employer Firms Based on the 2020 Small Business Credit Survey — fedsmallbusiness.org", 2020). This underscores a persistent funding gap, particularly for firms seeking capital to support early-stage export activities.

The Community Reinvestment Act (CRA), enacted in 1977, was designed to motivate banks to reinvest in their local communities, with a particular focus on low- and moderate-income areas. Under this mandate, banks issue Community Reinvestment Act (CRA) loans, which are a subset of loans to individuals and small businesses that qualify under CRA guidelines—for example, loans located in low- and moderate-income census tracts or loans that support community development. While not explicitly designed to finance exporting costs, CRA obligations often include small business lending in underserved areas, which can overlap with the financing needs of SMEs preparing to enter foreign markets. CRA loans are typically extended to commercially viable firms that may not qualify for traditional credit due to limited collateral or credit history.

The reach of CRA lending expanded after the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. This led to industry consolidation and a broader geographic distribution of bank branches. Figure 2 illustrates this trend, showing a marked increase in interstate branches relative to intrastate branches since the mid-1990s. This shift has implications for SME lending, as a wider branch network improves banks' ability to gather "soft information" about local firms, which is crucial for assessing SME creditworthiness (Petersen & Rajan, 1994).

As CRA regulations scaled with bank consolidation, related lending and investment volumes grew significantly. In 2007 alone, CRA-qualified loans and investments totaled \$4.6 trillion (Calomiris & Haber, 2014). Although many SMEs do seek smaller loans—particularly to cover early export costs such as market entry analysis or regulatory compliance (Suominen & Lee, 2015)—export-related financing needs are not necessarily limited to low amounts. Loan size can vary considerably depending on a firm's industry, scale of operations, and target markets. For instance, firms in capital-intensive sectors or those entering distant or heavily regulated markets may require larger financing packages to support production, logistics, or compliance. As such, while CRA-backed small business loans may help address part of the funding gap, they are not a one-size-fits-all solution for SMEs pursuing international expansion.

## 2.1 Credit Access Construction

We measure access to credit using the following proxy:

$$\text{Credit Access}_{mt} = \frac{\text{Number of loans}_{mt}}{\text{Number of firms in Tradable Sectors}_{mt}} \tag{1}$$

where $m$ and $t$ denote MSA and year, respectively. The numerator reflects the count of CRA loans issued within each MSA-year, while the denominator approximates the relevant pool of potential borrowers by focusing on firms in sectors more likely to be engaged in global markets. A higher value of this ratio indicates broader access to external finance and, conversely, a lower value reflects tighter local credit conditions.

# 3 Data

**Community Reinvestment Act** The Community Reinvestment Act (CRA), enacted in 1977, aims to encourage financial institutions to help meet the credit needs of underserved communities. This study utilizes small business loan origination data collected under the CRA and maintained by the Federal Financial Institutions Examination Council (FFIEC), covering a 14-year period from 2005 to 2018. Banks are required to report both the number and total dollar value of CRA-related loans they originate or hold. The CRA dataset provides geographic identifiers — such as census tract, county, and Metropolitan Statistical Area (MSA) — for the businesses receiving these loans. Importantly, the data are aggregated at the census tract level rather than reported for each individual loan. Although CRA data do not cover all small business lending, Greenstone et al. (2020) estimate that it represents about 86% of loans under $1 million.

The CRA aggregate data categorize loans into three size groups: (a) $100K or less, (b) $100K to $250K, and (c) $250K to $1 million. In this study, we define medium-sized loans by combining the two categories of $100K–$250K and $250K–$1 million.

Microloans, typically regarded as loans under $100K, are aimed primarily at supporting daily operations rather than export endeavors. These microloans are mainly directed towards household consumption and small-scale businesses, rather than export-oriented initiatives (Morduch & Haley, 2002). (Banerjee et al., 2015) demonstrate that microfinance predominantly fulfills operational and immediate needs. Conversely, (Ayyagari et al., 2007) indicate that medium-sized loans are essential for businesses aspiring to broaden their operations and penetrate international markets. This study centers on medium-sized loans and their impact on export growth.

**Number of Firms** The denominator in our credit access measure, the number of manufacturing firms per MSA, is constructed using the County Business Patterns (CBP) dataset. The CBP offers annual county-level statistics on establishments by industry, employment, and payroll. We aggregate the count of manufacturing firms to the MSA level using the county-to-MSA crosswalk file provided by the U.S. Department of Housing and Urban Development (HUD).

**Export Data** The trade data come from the U.S. Department of Commerce's International Trade Administration (ITA), which reports total merchandise exports at the MSA level for the years 2005–2018 reported in nominal US dollars, the time frame of our study.

**Population and Per-capita Income** To ensure the robustness of our analysis, we include control variables such as population size and per capita personal income. These variables are critical for accounting for regional economic differences. We collect county-level population and income data from the Bureau of Economic Analysis (BEA). Since our analysis is at the Metropolitan Statistical Area (MSA) level, we aggregate these county-level figures using the county-to-MSA crosswalk file from the U.S. Department of Housing and Urban Development (HUD).

**Demographic and Industry shares** Numerous studies emphasize the importance of demographic and industry shares in shaping local economies. For instance, (Carree & Thurik, 1999) highlights the significance of industry composition in determining regional economic growth and development. The construction of industry share and demographic share data is achieved using the Integrated Public Use Microdata Series (IPUMS) American Community Survey (ACS) (Ruggles et al., 2025). By aggregating this information, we can identify the representation of various industries within an MSA and discern demographic trends that may influence business performance and export potential. In our study, we employ base year data from IPUMS ACS to establish a consistent reference point for our analysis. Using predetermined demographic characteristics, as in (Autor et al., 2015), allows us to minimize endogeneity concerns and ensures that our comparisons over time are not confounded by cyclical economic fluctuations or reverse causality.

We include demographic and industry shares to capture variation in local economic capacity, workforce skills, and market access. Educational attainment enhances productivity and innovation (Becker, 2009), while foreign-born populations and racial diversity contribute to entrepreneurial activity, international networks, and creative problem-solving (Marchal & Nedoncelle, 2017; Parrotta et al., 2016), all of which shape a region's export potential.

Table 1 presents the summary statistics for our key variables. Our final dataset has 5414 MSA-year observations covering 387 MSAs over the period 2005 to 2018.

# 4 Empirical Results

## 4.1 OLS

The empirical model is specified as follows:

$$\log(\text{Exports}_{mt}) = \beta\,(\text{Credit Access}_{mt}) + X_{mt}\gamma + Z_m\delta + \alpha_t + u_{mt} \tag{2}$$

In equation 2, $\log(\text{Exports}_{mt})$ is the export volume for MSA $m$ in year $t$. The term Credit $\text{Access}_{mt}$ indicates the proportion of firms taking out loans. $X_{mt}$ comprises population and per capita income. $Z_m$ refers to the base year industry and demographic composition. Here, $\alpha_t$ and $u_{mt}$ are time fixed effects and idiosyncratic errors respectively. Our coefficient of interest, $\beta$, represents the elasticity of regional exports with respect to the availability of loans. We anticipate a positive coefficient of interest, indicating that improved access to credit promotes export growth. As a robustness test, we substitute the credit access ratio with the total dollar value of CRA loans per firm to assess the impact of loan size on exports.

Table 2 presents the results of the baseline OLS regression. In column (2), with control variables, the estimated value of the coefficient $\beta$ is 0.183 and statistically significant, while the control variables population and per capita income are both significant, showing strong positive relationships with exports.

In column (4), the inclusion of the average loan amount per firm yields a statistically significant coefficient of 0.218, reinforcing the robustness of the relationship between credit availability and export volumes. Importantly, both population and per capita income remain positive and significant in our regressions, underscoring their continued role in explaining regional variation in exports. A larger population may provide a more substantial customer base, supporting firm growth and international competitiveness (Amiti & Konings, 2007). Per capita income, which reflects the average economic output and development level of a region, is also positively associated with export activity. This suggests that wealthier regions may offer better financial infrastructure, investment conditions, and demand for higher-value products, enabling firms to scale and access global markets more effectively (Leonidou, 2004; Xu, 2016). While previous research has highlighted the nuanced relationship between income and exports — where rising income might shift firm focus toward domestic luxury markets (Caserta & Murphy, 2009; Pinho & Martins, 2010) — our findings suggest that, on balance, higher income enhances export potential.

## 4.2 IV

An important concern with the OLS specification is the potential endogeneity in the link between CRA loan availability and export performance. Specifically, the number of loans granted to firms may be influenced by unobserved factors or reverse causality. For instance, firms that are already successful exporters may be more likely to receive loans, as lenders perceive them as lower-risk borrowers with strong repayment prospects. This reverse causation can lead to an upward bias in the OLS estimates, overstating the effect of loans on exports. This concern is echoed in the trade-finance literature; for example, (Chor & Manova, 2012) emphasize that banks prioritize lending to firms with established export histories during periods of credit tightening, further reinforcing this selection effect.

Conversely, unobserved factors such as local economic strength can confound the relationship in the opposite direction. A stronger regional economy might lead to higher exports due to greater demand and productive capacity, while simultaneously reducing the need for external financing. This could generate a downward bias in the estimated effect of CRA loans on exports.

As a result, the net direction of the bias in the OLS coefficients is ambiguous, highlighting the importance of adopting an identification strategy to isolate the causal effect of CRA loans on export outcomes. To tackle this issue, we employ an instrumental variable (IV) that is correlated with the number of loans but has no direct effect on exports. This approach enables us to identify the causal impact of financial access on export performance.

#### 4.2.1 Construction of Instrumental Variable

We construct an instrumental variable that isolates the variation in loan supply, which is unaffected by the export outcomes. Specifically, we use the geographic distribution of bank branches predicted by the locations of bank headquarters as an instrument for loan supply. By predicting bank branch locations based on the distance from headquarters and population ratio, which affect banks' strategic decisions to expand but do not directly influence exports, the gravity model helps us disentangle the availability of financial resources (loan supply) from the firm's export-driven demand for loans. The gravity model is adapted to predict the number of branches a bank establishes in different counties, based on geographic distance from the bank headquarters county and the relative population sizes between counties. To handle the count nature of the data, we employ the Poisson Pseudo-Maximum Likelihood (PPML) estimator. One significant advantage of PPML is its ability to handle zero outcomes, which are prevalent in our dataset, without biasing the results (Brei & von Peter, 2018). To estimate the distribution of bank branches across county pairs, we use the gravity model by focusing on both intrastate and interstate banks. For banks operating within a single state (intrastate banks), we limit our analysis to county pairs within that state. For banks that operate across state lines (interstate banks), we consider all possible county pairs across state boundaries. This allows us to capture the full scope of bank branching decisions.

The construction of the instrument follows the gravity model of investment, which posits that the cost of expanding into a new market increases with geographic distance. This model has been used in trade to predict that firms are more likely to invest in closer markets due to lower costs of monitoring and information asymmetries (Anderson & Van Wincoop, 2003). Applied to banking, we hypothesize that banks are more likely to open branches in counties that are geographically closer to their headquarters because of reduced operational costs. Moreover, counties with larger populations are expected to attract more bank branches, given their greater market potential (Levine et al., 2021);(Goetz et al., 2016);(Rice & Strahan, 2010).

For the exclusion restriction, our instrument draws on two plausibly exogenous sources of variation: the geographic distance between a branch and its headquarters, and the population ratio of the branch county to the headquarters county. We omit banks whose headquarters were established after the study period began, ensuring that the measured distance between headquarters and branch locations is fixed over time and thus exogenous. The population ratio, distinct from total population (which is included as a control in the second stage), captures the relative customer base influencing bank branching decisions rather than economic activity directly. Moreover, the correlation between exports and the population ratio is low and statistically insignificant (with correlation of 0.05), supporting the exclusion of this variable from the export equation.

The number of bank branches in a given county pair is estimated using the following regression equation:

$$\text{Bank Branches}_{bjt} = \alpha + \beta \log(\text{Distance}_{i(b)j}) + \gamma \log\left(\frac{\text{Population}_j}{\text{Population}_{i(b)}}\right) + \varepsilon_{bjt} \quad (3)$$

where Bank $\text{Branches}_{bjt}$ represents the number of branches that bank $b$ operates in county $j$ during time $t$. The variable $\log(\text{Distance}_{i(b)j})$ is the natural logarithm of the geographic distance between county $j$ and the county of bank $b$'s headquarter, $i(b)$. The variable $\log\left(\frac{\text{Population}_j}{\text{Population}_{i(b)}}\right)$ is the logarithmic transformation of the population ratio between the branch county and the bank's headquarter county.

We estimate several specifications that control for year-fixed effects to account for all year-specific influences and county-pair fixed effects to control for time-invariant characteristics between county pairs. Additionally, we consider a specification that includes bank-year fixed effects, accounting for time-varying characteristics specific to each bank.

Table 3 reports the results from the regression analysis, showing that geographic distance is negatively associated with the number of branches a bank holds. Specifically, column (1) shows the estimated distance elasticity is -0.949, significant at the 1% level. This suggests that banks are more likely to expand into geographically closer counties. Furthermore, the coefficient for the log population ratio is positive and significant across all columns, indicating that banks tend to target counties with larger populations relative to their home county.

With the instrument, we implement the instrumental variable (IV) regression through a two-stage approach. Using the estimated coefficients from Equation (3), we generate the expected number of branches at the county level.

Next, we aggregate the predicted branch counts to the MSA level using the county-to-MSA crosswalk provided by the U.S. Department of Housing and Urban Development (HUD). We then compute the expected bank branch density by dividing the aggregated number of predicted branches by the total population of the MSA:

$$\text{Expected Branch Density}_{mt} = \frac{\sum_{c \in m} \widehat{\text{Branches}}_{ct}}{\text{Population}_{mt}}. \tag{4}$$

This variable serves as our instrument for financial access. It captures variation in the geographic and demographic determinants of bank branch presence, while remaining plausibly exogenous to unobserved shocks to local exports. This approach aligns with the logic in Célerier and Matray (2019), who use branch network expansion to study financial inclusion.

#### 4.2.2 IV results

Table 4 presents our 2SLS results on exports and loan availability. We begin by presenting results from a reduced-form specification, where we directly regress the predicted bank branch density from equation (2) on export volume in Column 1. The findings reveal a strong positive relationship between predicted branch density and export volume. In column 2, we show the first-stage results, regressing predicted branch density on the number of loans to firms. The first stage is robust, with an F-statistic well above the Stock–Yogo critical value of 16.38 for a 10% maximal IV bias. The estimated coefficient indicates that a 10% rise in predicted branch density corresponds to a 5.58% increase in the number of loans to firms. Column 3 reports the second-stage results, where we assess the effect of the number of loans on exports. The results suggest that a 10% increase in loans to firms is linked to a statistically significant 4.5% increase in exports. This underscores the role of credit availability in boosting export performance, demonstrating that improved access to financing can meaningfully enhance firms' capacity to participate in international trade.

Columns 4–6 in Table 4 present our 2SLS results for the amount of loans to firms. The reduced-form coefficient is similar to the number of loans to firms. The first-stage coefficient is slightly weaker. Finally, the 2SLS coefficient (column 6) is statistically significant, with a 10% increase in the loan amount to firms increasing exports by 5.17%.

## 4.3 Heterogeneity

The impact of financial access on exports is unlikely to be uniform across all regions. Understanding this heterogeneity is essential for designing policies that target credit where it delivers the largest trade gains. If the elasticity of exports with respect to credit is higher in certain areas, reallocating loan supply toward these regions—without increasing total credit—could enhance aggregate export performance. Our analysis focuses on two dimensions motivated by trade theory and empirical evidence: (i) geographic location (coastal vs. inland MSAs) and (ii) industry-level external financial dependence (EFD). The first captures variation in variable trade costs tied to location, while the second relates to sector-specific financing needs. The results show that spatial targeting of credit yields clearer trade gains than sectoral reallocation.

### 4.3.1 Coastal and Inland MSAs

Geography shapes the marginal benefit of credit through its effect on trade costs. Coastal MSAs enjoy proximity to ports and dense trade infrastructure, which reduces variable costs of serving foreign markets (Noponen et al., 1997). Lower variable costs mean that a given expansion in credit can more easily push firms over the profitability threshold for exporting. Inland MSAs, by contrast, face higher variable costs due to distance from ports and weaker logistics networks, meaning that part of the credit expansion is absorbed in covering these additional costs (Ducruet & Guerrero, 2022).

We classify MSAs as coastal if located within 50 km of the shoreline. Results in Table 5 show that a 1% increase in the number of loans per firm raises exports by 0.464% in coastal MSAs, substantially larger than the effect in inland areas. This suggests that reallocating credit toward coastal regions could yield disproportionate trade gains. Interestingly, the effect of average loan size (0.027) is smaller, indicating that broadening access (extensive margin) is more potent than deepening loans to existing borrowers in these high-potential areas.

### 4.3.2 External Financial Dependence

To examine the heterogeneous effects of financial development on exports at the MSA level, this section incorporates the External Financial Dependence (EFD) measure as developed by (Rajan & Zingales, 1996) and adapted for MSA-level analysis. The concept of EFD posits that industries with higher dependency on external finance grow disproportionately more in financially developed regions than in underdeveloped ones. This model has since been extended to various spatial and sectoral contexts, illustrating the importance of accessible external capital in supporting firm growth, productivity, and market expansion. Financial development, as argued by (Beck, 2003) and others, significantly influences the export performance of firms by enhancing credit availability and facilitating investments in productivity-improving activities.

The EFD measure is constructed based on the proportion of external financing required by firms within different industries, as outlined by (Rajan & Zingales, 1996). We obtain a set of firms from Compustat from 1988 to 2000 and calculate industry-level EFD measures. The EFD measure for a specific MSA, $EFD_{MSA}$, is calculated as:

$$EFD_{MSA} = \frac{EFD_i}{\sum_{i=1}^{N} EFD_i} \tag{4}$$

where $EFD_i$ is the EFD measure for industry $i$ within the MSA, and $N$ is the total number of industries present in the MSA. Finally, we assign an MSA as High EFD when the EFD measure is above the median value in the sample.

In contrast to the geographic heterogeneity, Table 6 shows that the interaction of financial access and high-EFD status is statistically insignificant and close to zero. This suggests that sectoral financing needs, as measured by EFD, do not strongly mediate the credit–export relationship at the MSA level. From a policy perspective, this indicates that geographic targeting of credit—particularly toward coastal regions with lower variable trade costs—may be more effective for boosting exports than reallocating credit across industries based on EFD profiles.

## 4.4 Robustness Checks

The results of our robustness exercises, our results remain consistent with the baseline specification. Excluding influential observations identified by Cook's distance does not materially alter the estimated effect of CRA loans on exports, indicating that the findings are not driven by outliers. Similarly, replacing the contemporaneous CRA loan measure with a 3-year rolling average yields coefficients that are nearly identical in magnitude and significance to the baseline.

### 4.4.1 Outlier Removal

We perform additional robustness checks by investigating the impact of outliers through Cook's distance. Following (Stevens, 1984), we adopt the conventional threshold of $\frac{4}{n}$, where $n$ denotes the number of observations, to identify influential data points. Observations with a Cook's distance exceeding the threshold were classified as influential and subsequently excluded to evaluate their effect on the model's outcomes . Following the re-estimation of the model without these outliers, the results remained stable, suggesting that the findings are robust and not unduly influenced by any single data point.

### 4.4.2 Rolling Average

Past CRA loans might be more responsible for present export growth, hence we follow an approach similar to (Popov & Roosenboom, 2013) and use a 3-year average CRA loans to firms at the MSA level in the main specification. (Rupasingha & Wang, 2017) considers a 5-year rolling average and finds similar results. Our results with the 3-year rolling average are remarkably similar to the main results in our baseline model.

# 5 Model

To motivate the theory, we briefly summarize our empirical result: a 10% increase in credit access leads to a 4.5% rise in export volume. By isolating credit supply from demand, this shows that financial constraints play a key role in shaping trade outcomes. Standard models may miss this effect, and our framework fills that gap by capturing how limited credit access can dampen the gains from trade. We propose a model that integrates the welfare gains from trade in a Melitz-style open economy model (Melitz, 2003) with exporting under credit constraints as described by (Chaney, 2016). This integration is important given that access to financing can significantly affect the export volume. Firms with limited access to credit may be unable to finance the fixed costs associated with exporting, thus influencing the overall welfare gains from trade differently than what would be under no credit constraint setting. The formal derivation of the model is provided in the appendix A.

## 5.1 Setup

Firms differ in productivity and face fixed and variable costs to serve domestic and foreign markets. Exporting requires payment of an upfront fixed cost, which must be financed either through internal cash flow or external credit. We assume that a fraction $\theta \in [0, 1]$ of firms is credit-constrained and can only export if their domestic profits suffice to fund the fixed export cost. Unconstrained firms face no such liquidity barrier.

As a result, firms face two separate productivity thresholds for exporting: one for unconstrained firms and a higher one for constrained firms. Credit constraints thus raise the extensive margin cutoff and reduce the mass of exporters relative to a frictionless benchmark.

In each of the domestic and foreign markets, the representative consumer has a CES preference over the differentiated goods. The foreign supplies and demands are fixed. Firms operate under monopolistic competition and choose whether to enter the market, weighing expected profit against the entry cost. After entry, each firm realizes its productivity and credit constraint, and decides whether to sell in each of the domestic and foreign markets.

This model allows us to evaluate how changes in trade costs and financial access affect export participation and, ultimately, real consumption.

**Equilibrium conditions:** In equilibrium, firms maximize profit, consumers maximize utility, goods and labor markets clear, and trade is balanced:

- *Profit cutoffs:* Domestic/export productivity thresholds determined by profitability; higher for credit-constrained exporters.
- *Labor market clearing:* Total labor demand from entry, domestic production, and exporting equals the exogenous labor supply.
- *Goods market clearing:* The CES price index aggregates domestic and imported varieties.
- *Balanced trade:* Export revenues equal domestic expenditure.
- *Free entry:* Expected profits net of entry costs are driven to zero.

## 5.2 Welfare and Trade Revenue

This section explores how credit constraints influence the welfare gains from trade and the distribution of export activity across firms. In our model, international trade increases welfare by enabling firms to access foreign markets, raise output, and pass efficiency gains on to consumers through lower real prices. However, when access to credit is limited, some productive firms are unable to pay the fixed costs required to export, limiting their ability to respond to trade liberalization.

We examine how key productivity thresholds shift under trade shocks in economies with financial frictions. Firms with access to credit face lower export entry thresholds and are more likely to benefit from trade. In contrast, credit-constrained firms face higher barriers and participate less. This reduces the extensive margin of trade and weakens the link between foreign demand shocks and domestic welfare improvements.

The model also allows us to characterize how aggregate export revenue and welfare respond to changes in credit conditions. By decomposing the share of exporting firms into constrained and unconstrained groups, we show that a higher incidence of credit constraints leads to smaller trade-induced welfare gains. A central component of our calibration is the share of firms that take out loans, which serves as an observable proxy for financial access and maps directly into model predictions about trade responsiveness.

We use this framework to interpret our empirical findings that regions with more accessible credit exhibit stronger export responses. Calibrating the model to match observed export elasticities and firm-level loan participation, we find that removing credit constraints would raise welfare gains from trade by approximately 18.75%.

## 5.3 Calibration

To quantify the welfare implications of credit access in trade, we calibrate the model using standard parameter values from the literature on heterogeneous firms and international trade. We assume firms differ in productivity following a Pareto distribution, as is common in trade models, and use benchmark values for substitution elasticity, fixed trade costs, and firm distribution parameters given in Table 9.

The calibration holds structural parameters constant and focuses on matching empirical moments that capture how credit-related frictions shape export behavior. A key moment is the observed sensitivity of exports to credit availability, estimated in our empirical analysis from Table 4. This elasticity reflects how changes in firm-level borrowing capacity influence aggregate trade volumes, particularly through the extensive margin—how many firms choose to export.

We also incorporate the observed share of firms that participate in export markets and those that take loans, using these values to recover internally consistent model parameters. This includes identifying the share of exporters who are financially constrained and the extent to which credit access influences export participation.

Based on this strategy, the model estimates that removing credit-related barriers increases overall welfare improvements from trade policy reforms by approximately 18.75%.

Conversely, a 10% increase in iceberg trading costs—covering higher customs duties—such as higher tariffs, transportation expenses, or non-tariff barriers—reduces welfare by approximately 1.93% in our model. This result illustrates the well-documented adverse effects of rising trade barriers on market access and efficiency, consistent with theoretical predictions from (Melitz & Redding, 2015). Our estimate aligns with prior findings from (Melitz, 2003) and (Krugman et al., 1980), who report welfare gains of roughly 2.2% for a comparable reduction in trade costs, and is slightly below the 2% gain implied by the Armington framework (Armington, 1969).

Similarly, a 10% increase in import prices—often driven by supply chain disruptions or protectionist policies—reduces welfare by 2.5%, as shown by (Das, 2004). This outcome reflects the combined effect of diminished consumer purchasing power and increased input costs for firms relying on imported goods, both of which erode aggregate welfare.

By contrast, a 10% rise in foreign demand leads to a 0.64% increase in welfare, consistent with classical trade models such as (Krugman et al., 1980), which emphasize how stronger foreign demand improves terms of trade, encourages export growth, and raises both consumer and producer surplus in the domestic economy.

## 5.4 Counterfactual Analysis

This section investigates the welfare implications of eliminating credit constraints within our model framework.

*Scenario: Share of credit constrained firms* $\theta = 0$

We first study the effects of a scenario where there are no credit-constrained firms in the economy. For instance, a 10% increase in trade costs leads to a substantial welfare loss of 2.3%, as compared to the baseline scenario with $\theta = 0.25$ The welfare loss is accentuated when credit constraints are removed because it leads directly to fewer firms engaging in international trade, reducing the welfare generated from trade activities.

In the Figure 3, we also show that a 10% increase in foreign demand results in a modest welfare gain of 0.76% which is higher than the gains observed under the baseline setting. When no credit constraints, more firms can participate in the increased foreign demand, resulting in greater output, trade, and overall welfare. Market inefficiencies that arise for credit-constrained firms that could potentially export and contribute to welfare expansion and misallocation of resources are reduced when there is credit access for all firms.

Furthermore, a 10% rise in import prices precipitates a significant welfare loss of 3.03%. The loss in welfare when there are no credit-constrained firms is larger than the loss in the baseline model. The exit of the less productive credit-constrained firms in the baseline case means there is a selection effect, where only more productive firms remain, which can partly offset the welfare loss by ensuring that the remaining firms are more efficient. With unrestricted access to finance, all firms participate in trade and have access to financing, which encourages them to increase their workforce in response to compete in the global market. Nevertheless, this heightens their vulnerability to risk, as the elevated costs may not be easily transferred to consumers, thus diminishing profitability. Although the augmented labor commitment initially enhances production capacity, it becomes unsustainable if demand declines or if costs remain elevated, leading to a greater welfare loss (Vannoorenberghe, 2014). This scenario culminates in a significant welfare loss, as the entire economy endures greater uncertainty and diminished economic activity compared to a situation with some credit-constrained firms ($\theta > 0$). In such a case, less productive firms exit the market, thereby mitigating the wider economic impact.

## 5.5 Sensitivity Analysis

Our empirical study estimates the elasticity of exports to credit access at 0.449, as reported in Table 4. To explore the implications of this elasticity, we vary it over a broader range, from 0.1 to 0.8, extending slightly beyond the range considered in (Dai et al., 2021). This variation shows shifts in the calibrated parameters—namely, the shares of unconstrained and constrained exporters. Specifically, the share of unconstrained exporters rises modestly from 24% to 28%, while the share of constrained exporters drops sharply from 14% to 1.7%. Although the share of unconstrained exporters shows limited variation, the steep decline in the share of constrained exporters with higher elasticity suggests that greater responsiveness of exports to credit access enables more firms to overcome financial barriers.

This finding aligns with theoretical expectations and prior literature. A higher elasticity reflects an enhanced capacity of firms to utilize credit for expanding trade operations, reducing the prevalence of constrained exporters. For instance, (Manova, 2013) highlights the critical role of financial frictions in determining trade outcomes, suggesting that improved access to credit disproportionately benefits financially constrained firms. Similarly, (Chaney, 2016) argues that financial constraints significantly hinder firms' participation in export markets, and addressing these barriers can unlock substantial trade potential.

As the share of exporters in the economy increases from 18% to 40% — a range consistent with predictions from the census data (18%) and estimates from administrative records (Boehm et al., 2023) — we observe shifts in the estimated shares of unconstrained and constrained exporters. Specifically, the share of unconstrained exporters grows steeply from 12% to 27%, reflecting a substantial expansion in the proportion of firms that can participate in international trade without facing credit or operational constraints. This growth indicates that as more firms enter export markets, a larger share of them manage to do so with sufficient financial and logistical capacity to operate unconstrained.

Conversely, the share of constrained exporters shows a more modest increase, rising from 2.7% to 6%. This limited variation suggests that while the absolute number of constrained firms increases alongside the overall growth in the exporter base, their relative share remains comparatively stable. This reflects structural barriers that prevent certain firms from overcoming financial frictions, even as market participation broadens. For instance, smaller or less resource-endowed firms might still struggle to access credit or scale up operations, leading to their continued categorization as constrained exporters.

# 6 Conclusion

This research highlights the importance of finance access to support exports despite the resource limitations faced by small and medium-sized enterprises (SMEs). Drawing on data regarding CRA loans and their influence on local export performance, we demonstrate that improved access to finance can meaningfully shape local trade outcomes. The findings reveal an explicit positive correlation between credit availability and export volumes and show how financing such as CRA loans helps SMEs to absorb initial costs and negotiate foreign markets.

The results further reveal pronounced geographic differences, with coastal MSAs exhibiting a stronger connection between credit access and export performance compared to inland areas. This divergence reveals that financial accessibility is vital for every region, although the economic effects of credit are amplified for areas with natural logistical advantages for trade.

Moreover, this work adds to a more general discussion on trade policy by showing that credit constraints do not only constrain an exporter's capacity but also reduce the welfare of a region to positive shocks from the global market. Financial inclusion policies such as CRA-backed loans act as a cushion, so more companies can participate in international trade and thus improve economic well-being. Other research could build on these findings by examining the longer-term consequences of financial access for firm expansion and regional economic resilience, thereby offering a deeper understanding of how credit availability influences trade performance.

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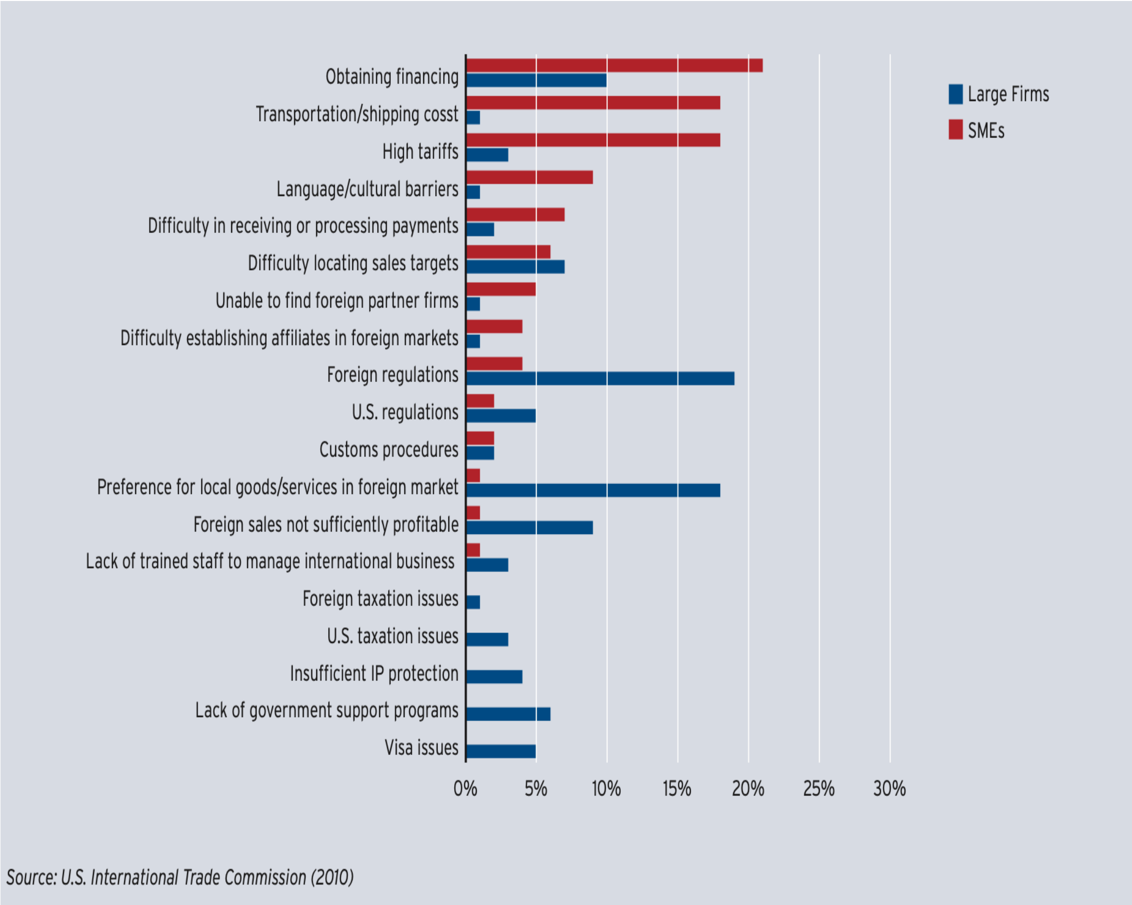
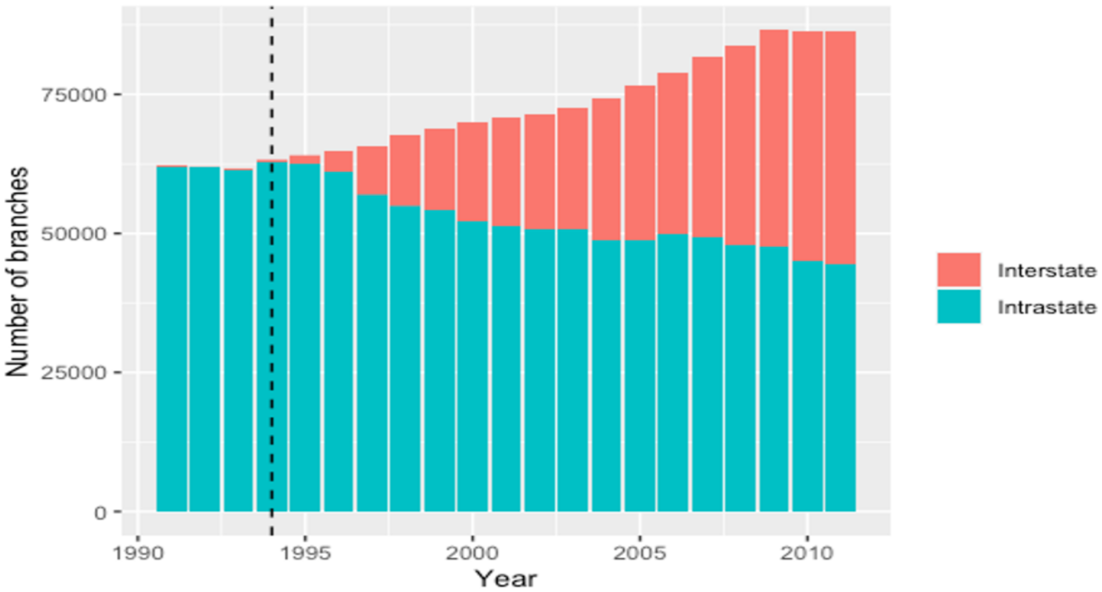
# FIGURES

Figure 1: US Manufacturing SMEs Impediments to Engaging in Global Trade



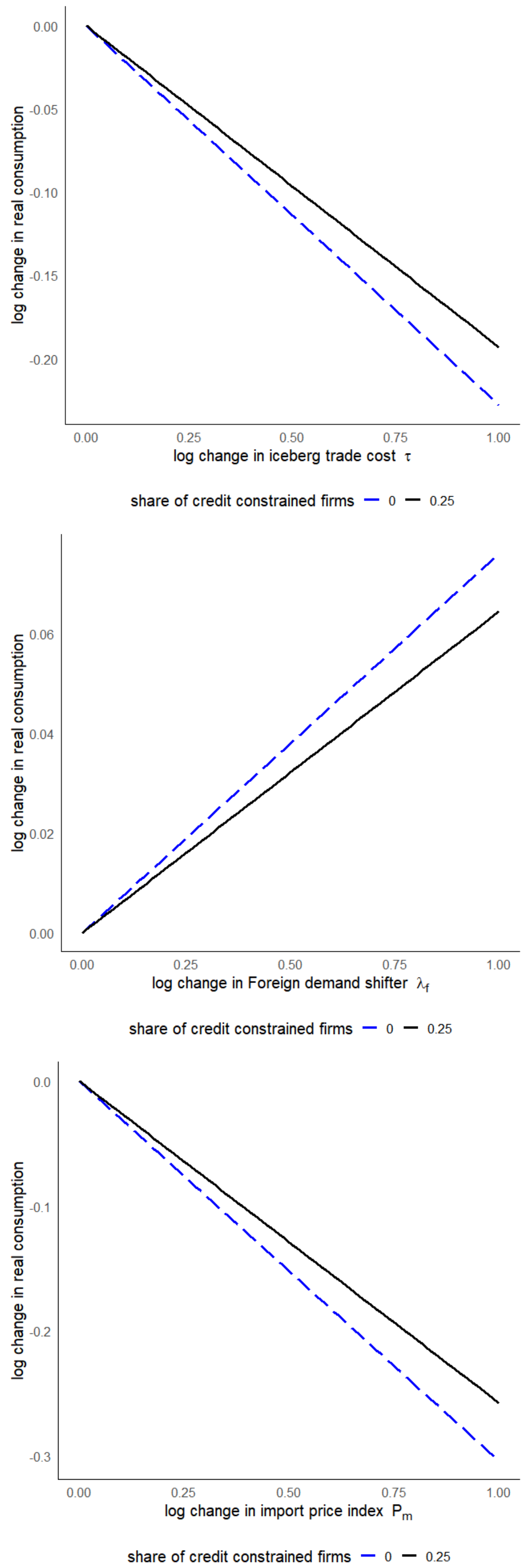

*Notes:* This figure shows the min impediments faced by SMEs and Large Firms when engaging in global trade. The figure has been borrowed from Suominen and Lee, 2015

Figure 2: Number of branches operated by FDIC-insured commercial banks



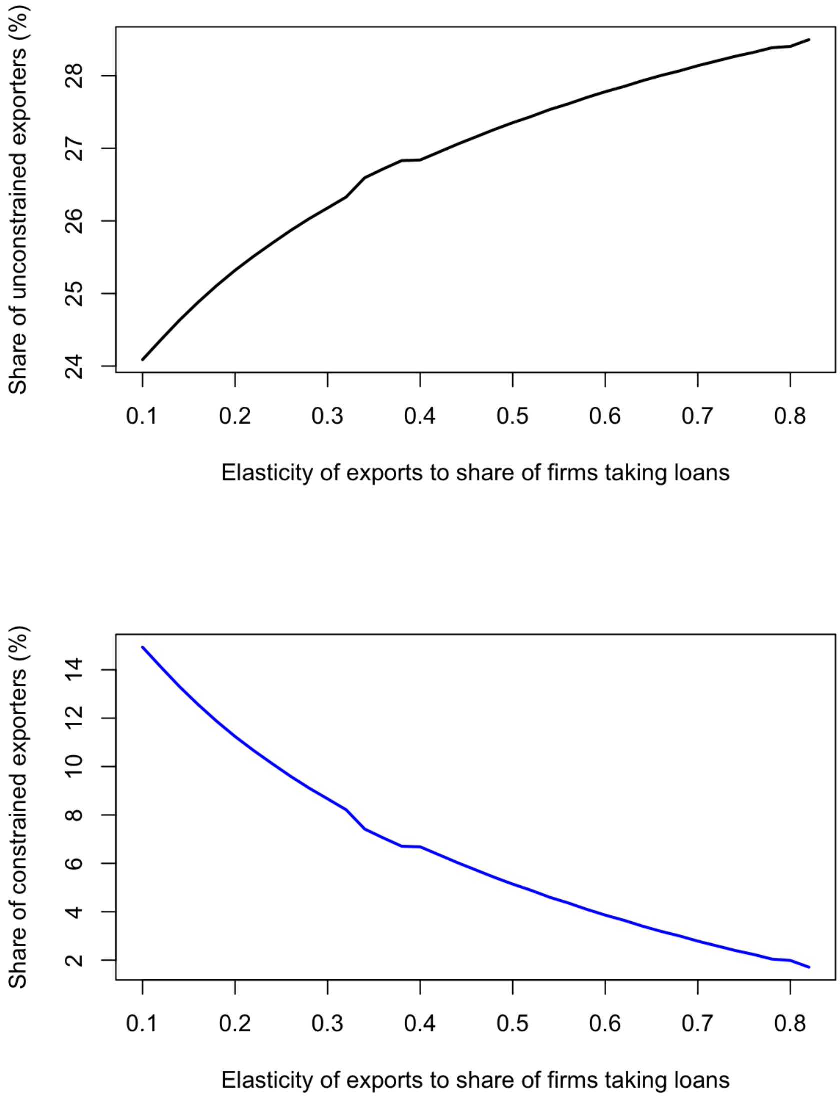

*Notes:* This figure shows the number of interstate and intrastate branches operating in the United States over the years 1990-2010. Data are from the FDIC.

Figure 3: Welfare Implications from trade liberalization



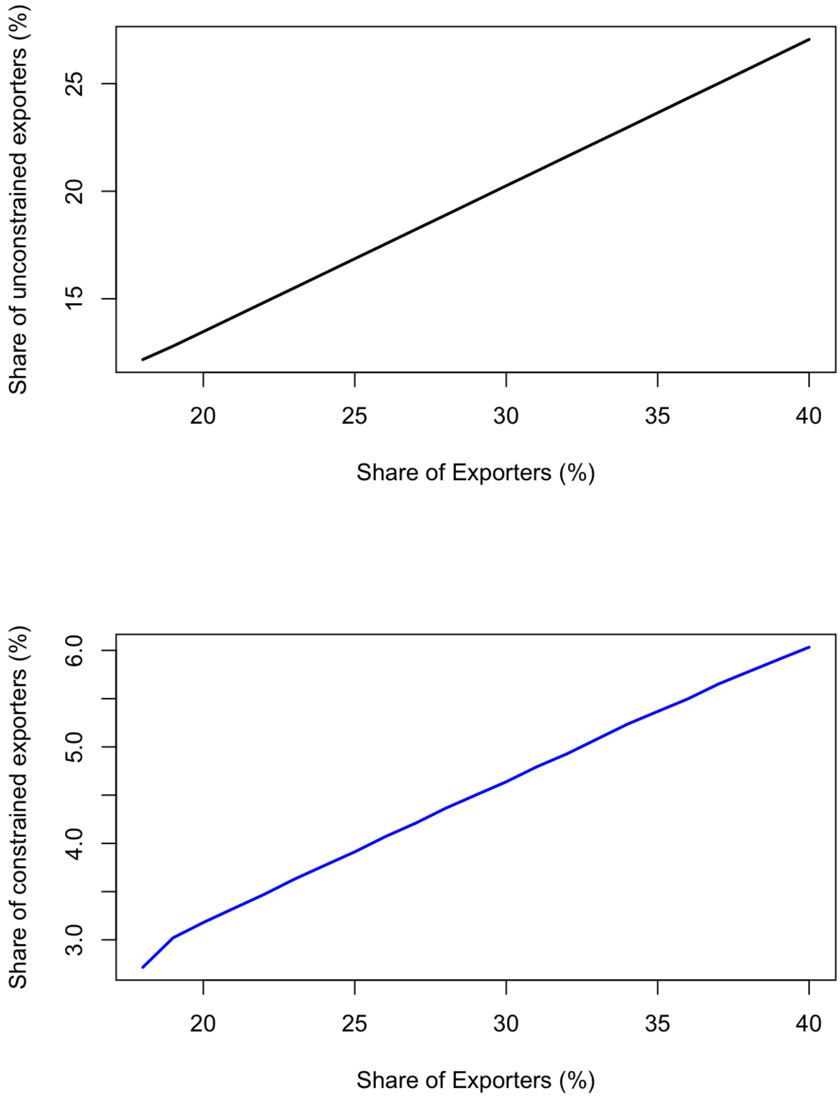

*Notes:*This figure gives us the log change in welfare due to log change in (a) foreign demand, (b) import price index, and (c) iceberg trade cost

Figure 4: Sensitivity of calibrated parameters to elasticity of exports to credit access




*Notes:*This figure gives us the sensitivity of calibrated parameters to changes in elasticity of exports to credit access.

Figure 5: Sensitivity of calibrated parameters to share of exporters




*Notes:*This figure gives us the sensitivity of calibrated parameters to changes in share of exporters.

# TABLES

Table 1: Descriptive Statistics

| **Variable** | **Observations** | **Mean** | **Std. Dev.** |
|---|---|---|---|
| log(Exports) | 5,122 | 6.519 | 1.700 |
| log(Number of loans/firms) | 5,414 | -0.969 | 0.445 |
| log(Amount of loans/firms) | 5,414 | 4.888 | 0.441 |
| log(Per capita Income) | 5,414 | 16.291 | 1.169 |
| log(Population) | 5,414 | 12.645 | 1.074 |
| Expected branch density | 5,414 | 0.228 | 0.140 |
| *Industry shares* | | | |
| Agriculture share | 5,414 | 0.023 | 0.020 |
| Manufacturing share | 5,414 | 0.100 | 0.048 |
| Mining share | 5,414 | 0.004 | 0.009 |
| Construction share | 5,414 | 0.061 | 0.014 |
| Wholesale trade | 5,414 | 0.024 | 0.008 |
| Utilities share | 5,414 | 0.047 | 0.012 |
| Retail trade share | 5,414 | 0.148 | 0.016 |
| Finance and Real estate share | 5,414 | 0.042 | 0.015 |
| Business share | 5,414 | 0.041 | 0.011 |
| Personal share | 5,414 | 0.026 | 0.010 |
| Entertainment share | 5,414 | 0.013 | 0.009 |
| Professional share | 5,414 | 0.206 | 0.038 |
| Public Administration share | 5,414 | 0.038 | 0.019 |
| Military share | 5,414 | 0.006 | 0.011 |
| *Demographic shares* | | | |
| Highschool share | 5,414 | 0.402 | 0.057 |
| College share | 5,414 | 0.166 | 0.049 |
| Foreign share | 5,414 | 0.082 | 0.068 |
| Female share | 5,414 | 0.510 | 0.010 |
| Black share | 5,414 | 0.098 | 0.105 |
| White share | 5,414 | 0.811 | 0.119 |
| Hispanic share | 5,414 | 0.077 | 0.132 |

*Notes:* This table reports the summary statistics for all dependent and independent variables at the MSA-level. The number of MSAs covered is 387 over the time period 2005-2018.

Table 2: Access to Loans and Exports: OLS Regression

| | log(Exports) | | | |
|---|---|---|---|---|
| Dependent Variable | (1) | (2) | (3) | (4) |
| log(Number of Loans/Firms) | 0.769*** | 0.183*** | | |
| | (0.047) | (0.032) | | |
| log(Amount of Loans/Firms) | | | 1.022** | 0.218*** |
| | | | (0.047) | (0.032) |
| log(Population) | | 0.497*** | | 0.516*** |
| | | (0.102) | | (0.101) |
| log(Per capita income) | | 0.638*** | | 0.613*** |
| | | (0.099) | | (0.098) |
| Observations | 5122 | 5122 | 5122 | 5122 |
| R-squared | 0.000 | 0.786 | 0.001 | 0.786 |
| Year Fixed Effects | No | Yes | No | Yes |
| Industry Share Controls | No | Yes | No | Yes |
| Demographic Share Controls | No | Yes | No | Yes |

*Notes:* This table analyzes the relationship between credit access and exports, both in logarithmic form. Controls for industry share include the NAICS 2-digit industry share within each MSA. Demographic controls account for variations in racial composition, education levels, and the foreign-born population. We also include year-fixed effects. Robust standard errors are reported in parentheses.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 3: Gravity Regression for Bank Branch Distribution

| | Bank branches | | | |
|---|---|---|---|---|
| Dependent Variable | (1) | (2) | (3) | (4) |
| log(Distance) | -0.949*** | -1.109*** | -0.093*** | -1.121*** |
| | (0.004) | (0.006) | (0.029) | (0.006) |
| log(Population ratio) | 0.473*** | 0.309*** | 0.736*** | 0.517*** |
| | (0.003) | (0.037) | (0.058) | (0.120) |
| Year FE | No | Yes | Yes | No |
| Branch county FE | No | Yes | No | Yes |
| Bank FE | No | Yes | Yes | No |
| Bank-Year FE | No | No | No | Yes |
| County-Pair FE | No | No | Yes | No |
| Estimation model | PPML | PPML | PPML | PPML |
| Observations | 14403650 | 14352290 | 529658 | 14218588 |

*Notes:* This table presents Poisson Pseudo-Maximum Likelihood (PPML) regression results for the number of bank branches held by bank b headquartered in county i in branches located in another county j in year t using population ratio and distance between bank headquarter and branch location as independent variables. Standard errors are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4: Access to Loans and Exports: 2SLS Results

| | RF | FS | IV | RF | FS | IV |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dependent Variable | log(Exports) | log(Number of Loans/firms) | log(Exports) | log(Exports) | log(Amount of Loans/firms) | log(Exports) |
| Expected Branch Density | 0.261** | 0.558*** | | 0.261** | 0.479*** | |
| | (0.131) | (0.059) | | (0.136) | (0.058) | |
| log(Number of Loans/Firms) | | | 0.449* | | | |
| | | | (0.247) | | | |
| log(Amount of Loans/Firms) | | | | | | 0.517** |
| | | | | | | (0.286) |
| log(Population) | 0.486*** | -0.226*** | 0.505*** | 0.486*** | -0.112*** | 0.551*** |
| | (0.109) | (0.046) | (0.110) | (0.109) | (0.045) | (0.108) |
| log(Per capita income) | 0.666*** | 0.107*** | 0.615*** | 0.666*** | 0.201*** | 0.559*** |
| | (0.106) | (0.045) | (0.111) | (0.106) | (0.043) | (0.113) |
| First stage F-Statistic | | | 114.711 | | | 88.565 |
| Observations | 5122 | 5414 | 5122 | 5122 | 5414 | 5122 |
| R-squared | 0.78609 | 0.36708 | 0.77884 | 0.78609 | 0.37004 | 0.77840 |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Share Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Demographic Share Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes:* This table examines the effect of credit access on exports using (number of loans/ firms) as a proxy for credit access (columns 1 to 3) and (amount of loans/firms) in columns 4 to 6. Columns 1 and 4 report the reduced form (RF), regressing log(exports) on expected branch density. The first stage (FS) results of the Instrumental Variables (IV) regressions are reported in columns 2 and 5. The IV coefficients are reported in columns 3 and 6. Control variables are described in Table 2. Bootstrapped standard errors are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 5: Access to Loans and Exports: Coastal vs. Inland MSAs

| | **log(Exports)** | |
|---|---|---|
| | **(1)** | **(2)** |
| log(Number of loans/firms) | 0.366** | |
| | (0.181) | |
| log(Amount of loans/firms) | | 0.575*** |
| | | (0.189) |
| log(Number of loans/firms) * Coastal | 0.464*** | |
| | (0.097) | |
| log(Amount of loans/firms) * Coastal | | 0.027*** |
| | | (0.006) |
| log(Population) | 0.769*** | 0.822*** |
| | (0.120) | (0.133) |
| log(Per capita Income) | 0.347*** | 0.284** |
| | (0.120) | (0.136) |
| Observations | 5,122 | 5,122 |
| R-squared | 0.779 | 0.773 |
| Year Fixed Effects | Yes | Yes |
| Industry Share Controls | Yes | Yes |
| Demographic Share Controls | Yes | Yes |

*Notes:* This table investigates the impact of credit access on exports, with a primary focus on the interaction of credit access with coastal and inland MSAs. The IV coefficients are reported in columns 1 and 2. Control variables are described in Table 2. Bootstrapped standard errors are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 6: Access to Loans and Exports: External Financial Dependency

| | log(Exports) | |
|---|---|---|
| | (1) | (2) |
| log(Number of loans/firms) | 0.449* | |
| | (0.200) | |
| log(Amount of loans/firms) | | 0.521 |
| | | (0.242) |
| log(Number of loans/firms) * High EFD | 0.001 | |
| | (0.034) | |
| log(Amount of loans/firms) * High EFD | | -0.001 |
| | | (0.007) |
| log(Population) | 0.504*** | 0.553*** |
| | (0.097) | (0.101) |
| log(Per capita Income) | 0.615*** | 0.558*** |
| | (0.095) | (0.103) |
| Observations | 5,122 | 5,122 |
| R-squared | 0.779 | 0.778 |
| Year Fixed Effects | Yes | Yes |
| Industry Share Controls | Yes | Yes |
| Demographic Share Controls | Yes | Yes |

*Notes:* This table investigates the impact of credit access on exports, with a primary focus on the interaction of credit access with MSA-level external financial dependence. The IV coefficients are reported in columns 1 and 2. Control variables are described in Table 2. Bootstrapped standard errors are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 7: Access to Loans and Exports: Outlier Removal

| | log(Exports) | |
|---|---|---|
| | (1) | (2) |
| log(Number of loans/firms) | 0.649** | |
| | (0.250) | |
| log(Amount of loans/firms) | | 0.741** |
| | | (0.298) |
| log(Population) | 0.366*** | 0.434*** |
| | (0.121) | (0.131) |
| log(Per capita Income) | 0.741*** | 0.662*** |
| | (0.126) | (0.142) |
| Observations | 4904 | 4907 |
| R-squared | 0.700 | 0.769 |
| Year Fixed Effects | Yes | Yes |
| Industry Share Controls | Yes | Yes |
| Demographic Share Controls | Yes | Yes |

*Notes:* This table investigates the impact of credit access on exports after removing outliers using the Cook's distance. The IV coefficients are reported in columns 1 and 2. Control variables are described in Table 2. Bootstrapped standard errors are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 8: Access to Loans and Exports: 3-year Rolling Average

| | log(Exports) | |
|---|---|---|
| | (1) | (2) |
| log( Number of loans/firms) | 0.337* | |
| | (0.216) | |
| log(Amount of loans/firms) | | 0.377* |
| | | (0.215) |
| log(Population) | 0.552*** | 0.591*** |
| | (0.128) | (0.121) |
| log(Per capita Income) | 0.573*** | 0.529*** |
| | (0.129) | (0.125) |
| Observations | 4829 | 4829 |
| R-squared | 0.779 | 0.779 |
| Year Fixed Effects | Yes | Yes |
| Industry Share Controls | Yes | Yes |
| Demographic Share Controls | Yes | Yes |

*Notes:* This table investigates the impact of credit access on exports using 3-year rolling average of the number and amount of loans to firms as described by Popov and Roosenboom, 2013. The IV coefficients are reported in columns 1 and 2. Control variables are described in Table 2. Bootstrapped standard errors are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 9: Calibration and Parameters

| Parameter | Value | Description | Target/Source |
|---|---|---|---|
| *Panel A: Externally calibrated parameters* | | | |
| $\sigma$ | 4 | elasticity of substitution | (Bernard et al., 2003) |
| $\alpha$ | 5.171 | Pareto shape parameter | (Balistreri et al., 2011) |
| $C_d/C_f$ | 0.545 | Fixed cost ratio | (Melitz & Redding, 2015) |
| $\theta$ | 0.25 | Probability of credit access | Source: Chamber of Commerce |
| Share of exporters | 0.4 | Share of exporters in US | (Boehm et al., 2023) |
| Elasticity | 0.445 | Elasticity of exports to share of firms taking loans | Table 4 |
| *Panel B: Internally calibrated parameters* | | | |
| $s_1$ | 27.1% | Share of unconstrained exporters | Profit cutoff and free entry condition |
| $s_2$ | 6.04% | Share of constrained exporters | Profit cutoff and free entry condition |

*Notes:* Panel (A) shows the parameters borrowed from literature or externally calibrated. Panel (B) shows the internally calibrated parameters.

# A Model Overview

Consider a small open economy where each producer can sell its variety to the domestic market ($j = d$) or a foreign market ($j = f$). The model is characterized by the following equations and parameters.

## A.1 Price Index

The aggregate price index includes domestic and imported varieties:

$$P^{1-\sigma} = \int_{x \in X} p(x)^{1-\sigma} dx + P_m^{1-\sigma} \tag{1}$$

where $X$ is the set of varieties produced by domestic firms and $P_m > 0$ is the given (exogeneous) import price index.

## A.2 Demand

Demand in market $j \in \{d, f\}$ is:

$$q_j(p) = \lambda_j p^{-\sigma} \tag{2}$$

where $\lambda_d = EP^{\sigma-1}$ is the domestic demand shifter (endogenous), and $\lambda_f > 0$ is a given foreign demand shifter.

## A.3 Potential Profit

The potential profit of a firm with productivity $x$ selling in market $j$ is:

$$\pi_j(x) = \frac{\tilde{\lambda}_j}{\sigma} \left( \frac{\sigma}{\sigma - 1} \frac{w}{x} \right)^{1-\sigma} - wC_j \tag{3}$$

where $\tilde{\lambda}_j$ is the effective demand shifter in market $j$:

$$\tilde{\lambda}_d = \lambda_d \quad \text{(domestic market)}$$

$$\tilde{\lambda}_f = \lambda_f \tau^{1-\sigma} \quad \text{(foreign market)}$$

Here, $\tau > 1$ represents iceberg trade costs.

### A.4 Labor Employed

Let $l_j(x)$ denote the labor employed by a firm with productivity $x$ for sales in market $j$, given by:

$$l_j(x) = C_j + \left(\frac{\sigma}{\sigma - 1} w\right)^{-\sigma} \tilde{\lambda}_j x^{\sigma-1} \tag{4}$$

for $x \geq \bar{x}_j$.

## B Credit Constraints

We extend the model to allow for credit constraints. Each firm needs to fund its export overhead cost $wC_f$ either through internal cash flow or through a loan. The credit access indicator $A \in \{0, 1\}$ is drawn upon entry, where $Pr[A = 0] = \theta \in [0, 1]$. If a firm's $A$ is 1, it has access to credit; if $A$ is 0, it must fund the export overhead with internal cash flow from domestic profits.

The share of exporting firms is given by:

$$\text{Share of exporters} = (1 - \theta) S(\bar{x}_f) + \theta S(\bar{x}_{cc}) \tag{1}$$

.

The conditions for credit-constrained and unconstrained firms entering the global market are:

$$\pi_d(x) \geq wC_f \tag{5}$$

.

$$\pi_d(f) \geq 0 \tag{6}$$

.

# C Equilibrium

## C.1 Profit cut-off conditions:

$$\bar{x}_j = \left(\frac{\sigma}{\sigma-1}w\right)\left(\frac{\sigma w C_j}{\tilde{\lambda}_j}\right)^{\frac{1}{\sigma-1}}$$

Credit-constrained export cutoff:

$$\bar{x}_{cc} = \left(\frac{\sigma}{\sigma-1}w\right)\left(\frac{\sigma w (C_d + C_f)}{\tilde{\lambda}_d}\right)^{\frac{1}{\sigma-1}}$$

## C.2 Labor Market Clearing

The labor market clearing condition is given by:

$$L = M\Bigg[f_E + C_d S(\bar{x}_d)\left(1 + (\sigma-1)H(\bar{x}_d)\right) \tag{2}$$

$$+(1-\theta)C_f S(\bar{x}_f)\left(1 + (\sigma-1)H(\bar{x}_f)\right) \tag{3}$$

$$+\theta C_f S(\bar{x}_{cc})\left(1 + (\sigma-1)H(\bar{x}_{cc})\right)\Bigg] \tag{7}$$

where:

$S(\bar{x}) := \Pr[x \geq \bar{x}]$ is the share of firms (entrants) whose productivity is at least $\bar{x}$,

$H(\bar{x}) := E\left[\left(\frac{x}{\bar{x}}\right)^{\sigma-1} \middle| x \geq \bar{x}\right]$ is the conditional average-to-minimum ratio of productivity among thos

## C.3 Goods Market Clearing

The goods market clearing condition is:

$$P^{1-\sigma} = M\left(\frac{\sigma}{\sigma-1}w\bar{x}_d\right)^{1-\sigma} H(\bar{x}_d)S(\bar{x}_d) + P_m^{1-\sigma} \tag{8}$$

## C.4 Balanced Trade

The balance of trade condition is given by:

$$E = wL \tag{9}$$

## C.5 Free Entry Condition

The free entry condition simplifies to:

$$f_E = C_d S(\bar{x}_d)\left(H(\bar{x}_d)-1\right) + (1-\theta)C_f S(\bar{x}_f)\left(H(\bar{x}_f)-1\right) + \theta C_f S(\bar{x}_{cc})\left(H(\bar{x}_{cc})-1\right) \tag{10}$$

# D Pareto Distribution

Assume firm productivity $x$ follows a Pareto distribution with shape $\alpha > \sigma - 1$ and scale $x_m > 0$. Then:

$$S(\bar{x}) = \left(\frac{x_m}{\bar{x}}\right)^{\alpha},$$
$$H(\bar{x}) = \frac{\alpha}{\alpha-(\sigma-1)}.$$

Under Pareto, the average-to-minimum ratio is invariant to the choice of the minimum. The equations for free entry and labor market clearing imply:

$$M = \frac{\sigma-1}{\alpha\sigma}\frac{L}{f_E}. \tag{4}$$

The price index condition under Pareto can be expressed as:

$$\left(\frac{P_m}{P}\right)^{1-\sigma} = \frac{\sigma - 1}{\alpha - (\sigma - 1)} \frac{C_f}{f_E} \left((1-\theta) S(\bar{x}_f) + \theta S(\bar{x}_{cc})\right) \tag{11}$$

# E Gains from Trade

The change in consumer utility is expressed as:

$$d\log(U) = d\log(Q) = d\log(E) - d\log(P). \tag{5}$$

The domestic cutoff conditions yield:

$$d\log(\bar{x}_d) = d\log(w) - d\log(P). \tag{6}$$

The export cutoff condition gives two thresholds: for credit-constrained and unconstrained firms:

For unconstrained firms:

$$d\log(\bar{x}_f) = \tilde{\sigma} d\log(w) - \frac{1}{\sigma - 1} d\log(\tilde{\lambda}_f). \tag{7}$$

For constrained firms:

$$d\log(\bar{x}_{cc}) = d\log(w) - d\log(P). \tag{8}$$

The free entry condition implies that the cutoffs move in opposite directions in response to trade shocks:

$$d\log(\bar{x}_d) = -s_1(1-\theta)\, d\log(\bar{x}_f) - s_2 \theta\, d\log(\bar{x}_{cc})$$

where

$$s_1 := \frac{C_f\, S(\bar{x}_f)}{C_d\, S(\bar{x}_d)}$$

and

$$s_2 := \frac{C_f\, S(\bar{x}_{cc})}{C_d\, S(\bar{x}_d)}$$

is the initial share of exporters, $\frac{S(\bar{x}_f)}{S(\bar{x}_d)}$ and $\frac{S(\bar{x}_{cc})}{S(\bar{x}_d)}$, multiplied by the relative export overhead cost $\frac{C_f}{C_d}$.

The price index condition simplifies to:

$$(\sigma-1)d\log(P)-(\sigma-1)d\log(P_m)=-\frac{\alpha(1-\theta)d\log(\bar{x}_f)}{(1-\theta)+\theta*k_1}-\frac{\alpha\theta k_1 d\log(\bar{x}_{cc})}{(1-\theta)+\theta*k_1}$$

where

$$k_1:=\frac{S(\bar{x}_{cc})}{S(\bar{x}_f)}$$

We are solving for the unknowns $d\log(\bar{x}_d)$, $d\log(\bar{x}_f)$, $d\log(\bar{x}_{cc})$, $d\log(P)$, and $d\log(w)$. The system of linear equations is given by:

$$\begin{bmatrix} 1 & 0 & 0 & 1 & -1 \\ 0 & 1 & 0 & 0 & -\tilde{\sigma} \\ 0 & 0 & 1 & 1 & -1 \\ 1 & s_1(1-\theta) & s_2\theta & 0 & 0 \\ 0 & \frac{\alpha(1-\theta)}{(1-\theta)+\theta*k_1} & \frac{\alpha\theta k_1}{(1-\theta)+\theta*k_1} & \sigma-1 & 0 \end{bmatrix}\begin{bmatrix} d\log(\bar{x}_d) \\ d\log(\bar{x}_f) \\ d\log(\bar{x}_{cc}) \\ d\log(P) \\ d\log(w) \end{bmatrix}=\begin{bmatrix} 0 \\ -\frac{1}{\sigma-1}d\log(\tilde{\lambda}_f) \\ 0 \\ 0 \\ (\sigma-1)d\log(P_m) \end{bmatrix}$$

$$d\log(\bar{x}_d)=-\frac{(1-\theta)s_1(d\log P_m\sigma-d\log\lambda_f)}{-(\theta k_1 s_1+1)\left(-\frac{\alpha(1-\theta)\sigma}{(\sigma-1)(-\theta+\theta k_1+1)}-\sigma+1\right)-\frac{(1-\theta)\sigma s_1\left(\frac{\alpha\theta k_1}{-\theta+\theta k_1+1}-\sigma+1\right)}{\sigma-1}}$$

Now,we solve for the comparative statics of the equilibrium by computing the following elasticities with respect to the credit constraint parameter $\theta$ using the expressions for $d\log(\bar{x}_d)$, $d\log(\bar{x}_f)$, $d\log(\bar{x}_{cc})$, $d\log(P)$, and $d\log(w)$ derived above.

$$d\log(\bar{x}_d)=d\log(w)-d\log(P) \tag{a}$$

$$d\log(\bar{x}_f)=\tilde{\sigma}d\log(w) \tag{b}$$

$$d\log(\bar{x}_d) = -s_1(1-\theta)d\log(\bar{x}_f) - s_2\theta d\log(\bar{x}_{cc}) + d\log(\theta)\frac{(s_2\theta - \theta s_1)}{\alpha} \tag{c}$$

$$(\sigma-1)d\log(P) = -\frac{\alpha(1-\theta)d\log(\bar{x}_f)}{(1-\theta)+\theta k_1} - \frac{\alpha\theta k_1 d\log(\bar{x}_{cc})}{(1-\theta)+\theta k_1} + \frac{(\theta k_1 - \theta)d\log(\theta)}{(1-\theta)+\theta k_1} \tag{d}$$

$$d\log(\bar{x}_{cc}) = d\log(w) - d\log(P) \tag{e}$$

# F Trade Volume

Let $R_j$ denote the aggregate value of sales to market $j \in \{d, f\}$, defined as:

$$R_j := ME\left[r_j(x) \cdot 1_{\{x \geq \bar{x}_j\}}\right],$$

where $r_j(x) := q(p_j(x)) \cdot p_j(x)$ is the revenue of a firm with productivity $x$ in market $j$.

Under the model's equilibrium, aggregate sales to market $j$ simplify to:

$$R_j = \sigma M w C_j H(\bar{x}_j) S(\bar{x}_j),$$

## Elasticity of Export Volume with Respect to Credit Constraints

Let $R_f$ denote aggregate export sales.Further, under if the productivity x is distributed Pareto,

$$\frac{d\log(R_f)}{d\log(\theta)} = \frac{(\theta k_1 - \theta)}{(1-\theta)+\theta k_1} + \frac{d\log(w)}{d\log(\theta)} - \frac{d\log(\bar{x}_f)}{d\log(\theta)}\frac{\alpha(1-\theta)}{(1-\theta)+\theta k_1} - \frac{d\log(\bar{x}_{cc})}{d\log(\theta)}\frac{k_1\theta\alpha}{(1-\theta)+\theta k_1} \tag{A}$$

## Elasticity of Loan-Taking Share

Let $T$ denote the share of firms that take out loans to finance exports. We define:

The share of firms taking out loans:

$$T = \frac{(1-\theta)S(\bar{x}_f) - \theta S(\bar{x}_{cc})}{S(\bar{x}_d)}$$

Taking dlog:

$$\begin{aligned}\frac{d\log(T)}{d\log(\theta)} = &-\frac{\theta}{1-\theta-\theta k_1} - \frac{k_1\theta}{1-\theta-\theta k_1} \\ &-\alpha\frac{(1-\theta)}{1-\theta-\theta k_1}\cdot\frac{d\log(\bar{x}_f)}{d\log(\theta)} \\ &+\alpha\frac{d\log(\bar{x}_d)}{d\log(\theta)} + \frac{\alpha\theta k_1}{1-\theta-\theta k_1}\cdot\frac{d\log(\bar{x}_{cc})}{d\log(\theta)}\end{aligned} \tag{B}$$

This expression captures how the share of loan-reliant exporters changes as access to credit tightens or eases.

## Mapping to Empirical Elasticity

To relate the model to empirical evidence, we construct the elasticity of export volume with respect to credit access by dividing equation (A) by equation (B):

$$\text{Model-implied Elasticity} = \frac{d\log(R_f)}{d\log(\theta)} \Big/ \frac{d\log(T)}{d\log(\theta)}$$

This gives the percentage change in exports for a 1% change in the share of loan-dependent firms, holding other factors constant.

## Parameter Substitutions

To simplify and calibrate the elasticity expression, we apply the following substitutions:

- We assume $s_2 = k_1 s_1$ based on the definition of cutoff ratios and export costs.
- We express $s_1$ as a function of observables:

$$s_1 = \frac{\text{Share}_{\text{exporter}}\cdot(C_f/C_d)}{\theta k_1 + (1-\theta)} \tag{C}$$

where:

  - $\text{Share}_{\text{exporter}} = (1-\theta)S(\bar{x}_f) + \theta S(\bar{x}_{cc})$
  - $C_f/C_d$ is the ratio of fixed export to domestic entry costs

- $k_1 = \frac{S(\bar{x}_{cc})}{S(\bar{x}_f)}$ reflects the relative share of constrained to unconstrained exporters.

This completes the derivation of the model-implied elasticity of trade volume with respect to credit frictions.