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U.S. Market Concentration and Import Competition

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Abstract

A rapidly growing literature has shown that market concentration among domestic firms has increased in the United States over the last three decades. Using confidential census data for the manufacturing sector, we show that typical measures of concentration, once adjusted for sales by foreign exporters, actually stayed constant between 1992 and 2012. We reconcile these findings by linking part of the increase in domestic concentration to import competition. Although concentration among U.S.-based firms rose, the growth of foreign firms, mostly at the bottom of the sales distribution, counteracted this increase. We find that higher import competition caused a decline in the market shares of the top twenty U.S. firms.

Key words: market concentration, markups, import competition, international trade

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1 Introduction

A salient feature of the U.S. economy is the increasing dominance of large firms. Many studies have documented that market concentration has risen among U.S. firms across all sectors in recent decades (e.g., Gutiérrez and Philippon (2017), Van Reenen (2018), Grullon, Larkin, and Michaely (2019), Covarrubias, Gutiérrez, and Philippon (2019), Autor et al. (2020), and Barkai (2020)). One reason for the close attention to market concentration is that it is often interpreted as a proxy for market power. However, to make that connection, it is necessary to account for all firms that compete in the market. The number of foreign firms competing in the U.S. market has significantly increased as import penetration has more than doubled over the last three decades. Standard international trade models, such as Melitz (2003), predict that trade liberalization increases market concentration among domestic firms due to reallocation from small inefficient firms to large firms, while simultaneously exposing domestic firms to tougher product market competition. In this paper, we provide new evidence for this channel and show that while import penetration contributed to the rise in the dominance of large U.S. firms, it has reduced their sales as a share of the whole U.S. market inclusive of foreign firms' sales. We find that once the sales of foreign exporters are accounted for, market concentration was stable between 1992 and 2012.

Rising market concentration is often associated with an increase in market power, since a firm's market share is a sufficient statistic for markups in a large class of models (e.g. Mrázová and Neary (2017), Amiti, Itskhoki, and Konings (2019)). However, this result rests on an appropriate definition of a market. The standard approach to measuring market concentration computes market shares based on where the sales originate (i.e. in the U.S.), and includes all shipments irrespective of where they are destined, i.e. they also include sales to foreign markets. This contrasts with the theory-consistent measure of a market, which focuses on the destination of the sales. For example, a firm selling a car in the U.S. is unlikely to be competing with a car destined for Japan. Moreover, U.S. firms not only compete with other U.S. firms but also with importers selling to the U.S., which should therefore be included in the concentration measures. This calculation would require knowledge of the universe of all firms' sales to the U.S. market, which is rarely available.

In this paper, we overcome these measurement issues by using confidential data from the U.S. Census Bureau covering the universe of all firm sales in the manufacturing sector in the U.S. for the census years (every 5 years) from 1992 to 2012. We define the market at the 5-digit NAICS industry level, where firms can operate in more than one industry. Importantly, the data include sales of all foreign firms selling in the U.S. market. Having firm-level data for all foreign firms is important because it is not only the share of imports by industry that matters for market concentration but the distribution of these firm sales. For example, an increase of 10 percentage points of imports would have very different implications for market concentration if the increase was due to 100 firms than if it was due to one or two firms. Our study is the first to include all of the foreign firms' sales to measure concentration in the U.S.

Our analysis uncovers a number of new stylized facts. First, once the market shares of foreign firms are taken into account, we find that market concentration did not rise but instead remained flat between 1992 and 2012. This result is consistent with trade theory such as Melitz (2003), which predicts that a trade liberalization reduces domestic firms' sales, leading some firms to exit, while allowing foreign competitors to expand. Under the assumption that firms' productivity is Pareto distributed, these two effects completely offset each other, resulting in no change in market concentration. Furthermore, our results are not driven by just a handful of industries. We find that the inclusion of foreign firms in the market concentration measure attenuates the rise in concentration between 1992 and 2012 in a broad range of industries.

Second, we reconcile the flat trend in overall market concentration with the previously documented rise in domestic concentration by showing that the growth of foreign firms' market shares was mostly at the bottom of the sales distribution. In theory, an increase in imports could be consistent with either rising or falling concentration if the Pareto distribution assumption does not hold or if foreign and domestic firms face different fixed costs. Our comprehensive firm-level data allows us to pinpoint which part of the market share distribution foreign firms enter. We find that the entry of foreign firms with small market shares counteracted the increase in concentration among U.S.-based firms, generating the flat trend in overall concentration.

Our third stylized fact shows that market concentration fell mostly in those industries with high import penetration in 1992, which are also those industries that experienced the fastest growth in import competition over the following 20 years. In contrast, concentration rose in industries with low import penetration. Effectively, domestic and overall concentration differ the most in industries where foreign firms play a significant role. For example, import-competing industries, such as electronics, are the ones that were further liberalized and became less concentrated. By contrast, industries like concrete remain fairly closed to trade and thus do not face the increased competition from foreign firms.

Did tougher import competition affect U.S. market concentration? In order to establish a causal relationship between import competition and concentration, we need exogenous shocks that shift the world supply of goods to the U.S. To this end, we construct time-varying industry instruments for U.S. imports, using a novel methodology developed by Amiti and Weinstein (2018). We then estimate an industry-level regression of the five-year change in market concentration measures on the change in import penetration, using two-stage least squares. First, we compute *domestic* market shares, with total sales of the top 20 U.S. firms as a share of only U.S. firm sales. As predicted by the Melitz (2003) model, we find that higher import penetration increased concentration among domestic firms. Moreover, consistent with the theory, the number of U.S. firms fell with tougher import competition. In contrast, the regression reveals that higher import penetration reduced the market shares of the top 20 U.S. firms as a share of all firms' sales, including foreign exporters to the U.S. Our results show that a one standard deviation increase in import penetration reduced the market shares of the top 20 U.S. firms by 3 percentage points. Aggregating the predicted effects from this regression across industries and years, our results suggest that import competition accounts for half of the overall decline in market concentration of the top 20 U.S. firms. These contrasting results highlight the importance of the definition of a market in understanding the relationship between import competition and concentration. When we only consider the sales of the top U.S. firms relative to the sales of other U.S. firms, we find that larger firms gained market share in industries with tougher import competition, and hence concentration appears to have risen. However, comparing the market share of the top U.S. firms to all sales in the U.S. market, inclusive of foreign firms' sales, we find that the sales share of large U.S. firms actually shrank.

Our paper relates to a growing literature on market concentration. Among the studies that show a rise in concentration among national firms, Autor et al. (2020) is the only one to also use the confidential census data used in our study; however, their work does not use the firm-level trade data but instead makes an adjustment for aggregate imports. A number of recent studies that have used alternative definitions of markets have found that market concentration has declined over the last few decades: Rossi-Hansberg, Sarte, and Trachter (forthcoming) define the market at the local level; Freund and Sidhu (2017) at the global level; and Benkard, Yurukoglu, and Zhang (2021) at a more narrow product level. Defining the relevant market is an open question. Since our data only comprises the manufacturing sector, we define the market at the national level and use the most disaggregated industry level our data allows. We provide robustness at a more aggregated industry level. Focusing only on the exporters, Bonfiglioli, Crinò, and Gancia (forthcoming) also find falling concentration; however, these data only include seaborne trade, which accounts for half of total trade, and exclude domestic sales of U.S. firms. The advantage of our data is that they comprise the entire distribution of domestic and foreign firms selling to the U.S., which is necessary to get an accurate picture of the trend in market concentration.

We also contribute to the literature studying the consequences of rising concentration for markups. Autor et al. (2020) and Baqaee and Farhi (2020) find that domestic concentration has increased due to a reallocation of sales towards larger, more efficient firms that have higher markups. A number of papers have shown that globalization reduces market power. For example, Feenstra and Weinstein (2017) find that Herfindahl indexes in the U.S. fell between 1992 and 2005 once they take account of U.S. imports, and show that their model implies falling markups. De Loecker et al. (2016) find that lower import tariffs in India reduced markups, and Amiti, Itskhoki, and Konings (2014, 2019) provide evidence that large firms reduced their markups in response to lower competitor prices in Belgium. Although markups are generally not observed and their estimation is beyond the scope of this paper, our results have important implications for market power. Our work suggests that once foreign firms are taken into account, domestic firms' market power in the U.S. may have actually declined.

The rest of the paper is organized as follows. Section 2 describes the empirical framework, and Section 3 describes the confidential census data. Section 4 describes the stylized facts, Section 5 presents the results from the regression analysis, and Section 6 concludes.

2 Empirical Framework

A commonly used measure of market concentration is the market share of the top X firms active within an industry, where X is typically 4 or 20. An alternative measure is the Herfindahl-Hirschman Index (HHI), defined as the sum of squares of the whole distribution of market shares within an industry. Earlier studies (e.g., Van Reenen (2018), Grullon, Larkin, and Michaely (2019), Autor et al. (2020)) find increasing market concentration for all of these measures. What is critical in these measures is the definition of the market over which market shares are computed. Let f index firms, and denote by F^{US} the set of firms located in the U.S. (U.S. firms) and by F^* the set of firms located in the rest of the world selling to the U.S. market (foreign exporters). The earlier studies define market shares only for domestic firms, as follows:

$$S_{ift}^{dom} = \frac{shipments_{ift}}{\sum_{f \in F^{US}} shipments_{ift}}, \tag{1}$$

where $shipments_{ift}$ denotes a U.S. firm f's total sales, both domestic sales and exports, in industry i in year t.[1] This equation defines market shares over all firms within industry i located in the U.S. We will refer to measures of market concentration based on this definition of a market share as *domestic* market concentration, as it describes the concentration of sales among domestic firms.

However, if we are interested in concentration as an indicator of market power, we need to construct market concentration based on all sales in the U.S market. Specifically, we need to subtract U.S. firms' exports from total shipments and include foreign firms' imports. Therefore, we define U.S. firms' market shares as

$$S_{ift} = \frac{shipments_{ift} - exports_{ift}}{\sum_{f \in F^{US}} (shipments_{ift} - exports_{ift}) + \sum_{f \in F^*} imports_{ift}}, \tag{2}$$

where the numerator now only includes sales in the domestic market. Critically, the denominator sums the sales of all firms selling to the U.S. market, both by domestic firms and foreign firms, with $imports_{ift}$ denoting the sales of foreign firm f to the U.S. The market shares of foreign firms selling to the U.S. are constructed in the same way, with the numerator measured by their sales to the U.S. market. We show below that market concentration, constructed with market shares in equation (2) summed across both domestic and foreign firms, remained stable between 1992 and 2012.

Standard trade theory generates predictions for how a fall in trade costs affects concentration. For concreteness, we focus on the Melitz (2003) model, and provide more details in Appendix A. With a continuum of firms in monopolistic competition, a fall in variable trade costs has two effects: (i) it increases the productivity cutoff for domestic firms, causing exit of the more inefficient firms and lowering the remaining firms' domestic sales due to increased foreign competition; and (ii) it lowers the productivity cutoff of exporting, allowing additional firms to export and increasing the sales of existing exporters. Consequently, for U.S. firms, the theory predicts a rise in domestic concentration

1. Publicly available U.S. Census data only report concentration measures for U.S. firms, using their total shipments. Note that U.S. firms include establishments of foreign-owned firms that are located in the U.S.

using the market shares in equation (1). By contrast, the theory predicts a fall in U.S. firms' overall market share, i.e., their domestic sales as a share of total sales inclusive of foreign firms, using equation (2) and summing across only the U.S. firms.

The question is what happens to the overall market concentration computed using the market shares in equation (2) and summing across both U.S. and foreign firms. If we assume firms' productivity is Pareto distributed and the fixed cost of entry is the same for domestic and foreign firms, the model predicts that market concentration remains unchanged in response to a fall in trade costs. Intuitively, a reduction in variable trade costs decreases domestic firms' sales in the domestic market (and the least productive firms exit); however, the growth of foreign competitors' sales (and the entry of additional competition) exactly offsets this decline. The two effects exactly cancel out because of the property that a Pareto distribution always remains Pareto with the same shape regardless of where it is cut.

A link between market concentration and market power is provided in Arkolakis et al. (2019), where aggregate markups are variable. In this model, lower trade costs cause the least productive domestic firms that charge near-zero markups to exit, which tends to increase the average markup, but all other domestic firms shrink their markups because of more foreign competition, which lowers the average markup. With a Pareto distributed productivity, the two effects exactly offset each other. The logic is flipped among foreign firms operating in the domestic market. Thus, the markup distribution is also invariant to a decline in trade costs.[2] Once we move away from a Pareto distribution, it is less clear whether the fall in the domestic firms' shares exactly offsets the rise in foreign firms' shares, and therefore the effect of lower trade costs on aggregate market concentration and markups is ambiguous.

Overall, these theories highlight that more concentration among domestic firms is entirely consistent with less market power because of the increased competition from foreign firms. Under the common assumption that productivity is Pareto distributed, trade theory also predicts that a trade liberalization has no effect on market concentration. We next examine these predictions empirically and show that they hold in the data.

3 Data

Our analysis relies on three highly disaggregated datasets from the U.S. Census Bureau. The first dataset is the Census of Manufactures for 1992-2012, which provides, among other things, the total sales for each manufacturing establishment in the U.S. every five years. We merge into this dataset each establishment's time-consistent 6-digit North American Industrial Classification (NAICS) 2007 industry code constructed by Fort and Klimek (2018), and define an industry at the more aggregated 5-digit NAICS level so that we can accommodate the mapping to international trade data. Our unit

2. Relaxing the CES assumption in Arkolakis et al. (2019) generates variable markups. These results also hold in Eaton, Kortum, and Sotelo (2013) and Gaubert and Itskhoki (2021), where the continuum of firm assumption is relaxed, which allows for variable markups via oligopolistic competition.

of analysis will therefore be the 5-digit NAICS-firm level, where each of a firm's major outputs is counted in its corresponding industry. Our analysis covers 169 time-consistent NAICS industries for the manufacturing sector. We define a market at the national level, spanning across all of the U.S. In general, whether one focuses on the U.S. national market or more local markets should depend on how tradeable the sector is.[3] Given our data only comprises the manufacturing sector, defining a market at the national level seems appropriate.

The new data we bring to the analysis of U.S. market concentration is transaction-level import data from the Longitudinal Firm Trade Transactions Database (LFTTD) of the Census Bureau. This dataset contains transaction-level data from U.S. customs forms, covering the universe of U.S. imports since 1992. Critically, these data contain an identifier for the foreign exporter, which enables us to construct the market shares of the foreign sellers in the U.S.[4] Each transaction contains a 10-digit Harmonized Tariff System (HTS10) code for the product traded (comprising around 21,000 product codes), which we map to the 5-digit NAICS industry in which the product is most likely sold using the import concordance by Pierce and Schott (2012) in each year. We adjust these concordances to take account of revisions over time in the NAICS and HTS10 codes and adjust inconsistent mappings from HTS10 to 5-digit NAICS. We show the robustness of our results to more aggregate 4-digit industry definitions in the appendix.

An important feature of the LFTTD is that it contains an indicator for whether a transaction is conducted between related parties, as documented in Bernard, Jensen, and Schott (2009).[5] For each U.S. firm, we use this information to omit related-party imports that fall within an industry in which the firm is active. This approach aims to avoid double counting the imports of final goods obtained from a U.S. firm's plants abroad and sold in the U.S. market, since these will already be counted in the firm's domestic sales. However, we do keep the related-party imports that fall into an industry in which the U.S. firm is not selling. These imports are counted as the foreign firm's sales in that industry.

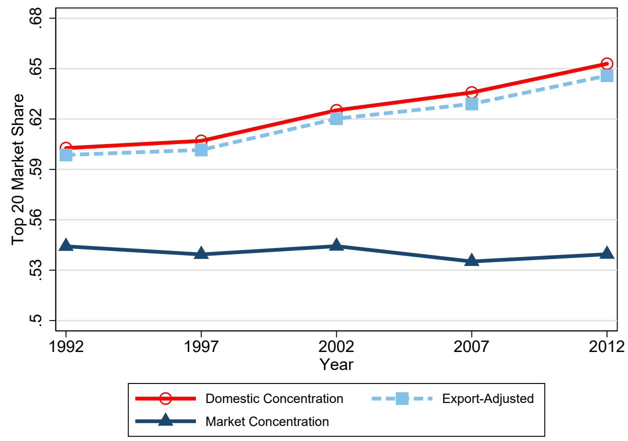
The final dataset we use is firm-level export data, also recorded in the LFTTD. As in the import data, we map the HTS10 code of the product traded to its corresponding NAICS industry code. We construct the domestic sales of U.S. firms in each industry by subtracting the firms' exports from their total sales. We net out both related-party and arm's-length exports, since both are likely to be counted in a firm's total sales. Appendix B provides more information on the construction of our dataset.

3. For example, for services such as hair cuts, a hair salon in New York is not going to be competing with hair salons in California, so a more local market measure would be more appropriate.

4. We clean the foreign exporter identifiers to obtain unique foreign firm names following Kamal and Monarch (2018). These data have been used in other contexts, see, e.g., Heise (2019).

5. Based on Section 402(e) of the Tariff Act of 1930, related-party trade consists of import transactions between parties with "any person directly or indirectly, owning, controlling, or holding power to vote, [at least] 6 percent of the outstanding voting stock or shares of any organization."

Figure 1: Top 20 Concentration over Time



Notes: The figure presents the evolution of top 20 concentration over time. Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line measures concentration of the top 20 firms using market shares defined in equation (1). The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales and sums the market shares over domestic firms. The "Market Concentration" line constructs market shares as in equation (2) for all firms selling in the U.S. irrespective of where the firm is located. The top 20 market share concentration measure is the average across all NAICS 5-digit manufacturing industries.

4 Stylized Facts

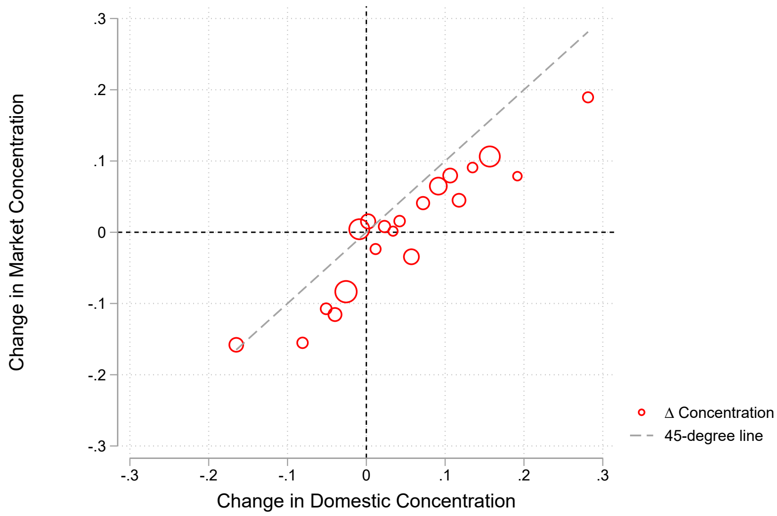
In this section, we present a number of new stylized facts about the evolution of market concentration in the U.S. and how it relates to increased import competition. Since all of the measures of concentration described earlier point to similar trends in domestic market concentration (see, e.g., Autor et al. (2020)), we will use the top 20 market concentration as our baseline and report the robustness of our findings to other measures in Appendix C.

Fact 1. *Market concentration in U.S. manufacturing, adjusted for foreign firms, remained stable between 1992 and 2012.*

We begin by considering how market concentration evolved in the U.S. manufacturing sector. In Figure 1, we plot the top 20 concentration measures, averaged across all 5-digit NAICS industries in manufacturing, from 1992 and 2012. The solid red line depicts the domestic market concentration measure, showing an upward trend in concentration in the last two decades. This upward trend is consistent with a large empirical literature (see, for example, Van Reenen (2018)) that constructs concentration measures using total shipment data for all firms located in the U.S. as in equation (1). It is also consistent with the theory discussion above: a fall in trade costs increases the domestic productivity cutoff, which increases domestic concentration.

However, market concentration, using market shares based on all sales to the U.S. market as in equation (2) and summing across both foreign and domestic sellers, remained flat between 1992 and 2012, depicted by the solid blue line in Figure 1. As discussed, this finding is consistent with a large class of trade models if productivity is Pareto distributed. Interestingly, it turns out that subtracting

Figure 2: Change in Top 20 Market Concentration across Industries, 1992-2012



Notes: The figure shows the change in the top 20 *domestic* concentration measure between 1992 and 2012 (x-axis) against the change in the overall top 20 market concentration measure based on equation 2 constructed using all firms selling to the U.S. market (y-axis). Each bubble is a group of 8 or 9 industries, where industries are grouped by their change in the top-20 domestic market concentration between 1992 and 2012. The size of each bubble is proportional to the total absorption of the industry in 1992, defined as total shipments less exports plus imports.

U.S. firms' exports from their total shipments makes little difference to the trend in concentration, as shown by the dashed blue line, and so it is the inclusion of the foreign firms' sales that is responsible for this new finding.[6]

One can see from equation (2) how including foreign firm sales (and subtracting U.S. firm exports) could move the concentration measure in either direction, since it affects both the numerator and the denominator of firms' market shares. The denominator is likely to have increased over the sample period as imports have grown dramatically over this time. Adding imports to the denominator could in principle be done using publicly available industry level data; however, in practice it requires the micro data to assign establishments to time-consistent NAICS industries. Moreover, the micro data are needed to remove related-party trade and to net out exports for the manufacturing firms in our sample, excluding, for example, exports of wholesalers. For a complete picture it is necessary to also make the appropriate adjustment to the numerator, which requires U.S. firm-level export data to convert U.S. firms' total sales to domestic sales, as well as knowledge of foreign firms' sales in the U.S. to determine the market shares of all firms within each industry.

Is the stable trend in market concentration driven by a few large industries or does foreign competition reduce concentration more broadly? To explore this question, Figure 2 plots the change between 1992 and 2012 in the top 20 domestic concentration measure on the x-axis against the change in the top 20 overall market concentration measure on the y-axis as a bin scatter. We bin the industries

6. Figure 1 plots the simple average across industries. We show in Appendix C that these patterns are robust to aggregating across industries using sales weights and to defining the market concentration measures as top 4 or HHI.

by ranking them by the change in their domestic concentration measure, and then combine them into 20 groups of 8-9 industries each.[7] Each bubble depicts one of these groups, with the size of the bubble proportional to the industry group's total *absorption*, defined as total shipments by U.S. firms minus exports plus total imports. The figure shows that nearly all of the bubbles are below the 45-degree line, indicating that accounting for foreign firms' sales in the U.S. results in a smaller increase in concentration in almost all industry groups than the domestic concentration measures would suggest. However, there is a wide range in the size and direction of changes in concentration, and even with the full measure concentration rose in a number of industries, as shown by the bubbles in the top right quadrant.

The reason the entry of foreign firms did not increase market concentration is because their entry and growth was mostly in the bottom part of the market share distribution, with the loss in domestic shares completely offset by the gain in foreign shares as predicted by models with a Pareto distribution. Combining the foreign firm-level sales data with those of U.S. firms reveals the following novel fact.

Fact 2. *Foreign firms have increased their presence among the top 20 firms, but their share in the top 20 remains low. Foreign firms' largest growth has been in the bottom part of the sales distribution.*

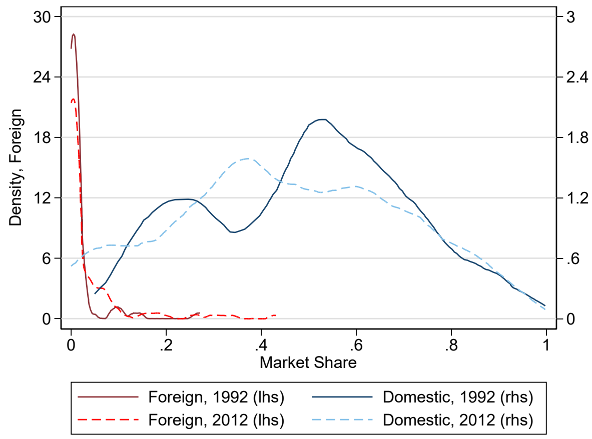
We show how foreign firms affect the overall market share distribution in the U.S. in Figure 3, by slicing the data in two ways.

First, we examine the top part of the market share distribution, and show that foreign firms' share in the top 20 remains low. In Figure 3a, we plot the kernel density of the top 20 market share in each industry accounted for by U.S. firms in blue, and by foreign firms in red. To construct the figure, we first identify the top 20 firms in each industry according to equation (2). We then compute separately the market share of the foreign firms and of the domestic firms that are in the top 20 and compute the density of these market shares across industries. Note that the density on the left axis for foreign firms is 10 times that of the right axis for domestic firms, reflecting that in most industries the market share of foreign firms in the top 20 is close to zero. The foreign densities are conditional on industries in which at least one foreign firm is in the top 20 to avoid a large spike in the density at zero. We find that the number of industries with zero foreign market shares in the top 20 fell from 108 in 1992 to 76 in 2012, but do not show it in the figure in order to zoom in on the positive market share distribution. The figure shows a rightward shift in the foreign firm density between 1992 and 2012 (dashed red line). This shift indicates that foreign firms have increased their presence in the top 20, but in the vast majority of industries the market share of foreign firms in the top 20 remains very low, well below 10 percent. In contrast to the foreign firms, the kernel density of domestic firms in the top 20 has shifted to the left (blue lines), indicating that in the average industry the market share of domestic firms in the top 20 has fallen. However, the market share of U.S. firms in the top 20 in the average industry is still large, falling from around 60 percent to around 50 percent between 1992 and 2012.

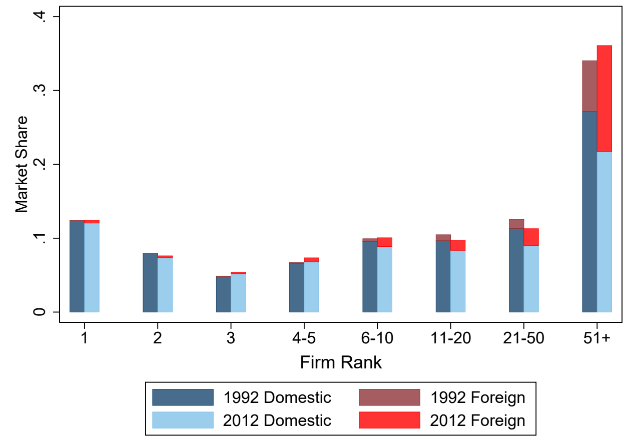
7. Census disclosure rules prevent us from disclosing top 20 market shares for individual industries.

Figure 3: Market Share Heterogeneity

(a) Density of Top 20 Market Shares



(b) Average Share by Rank



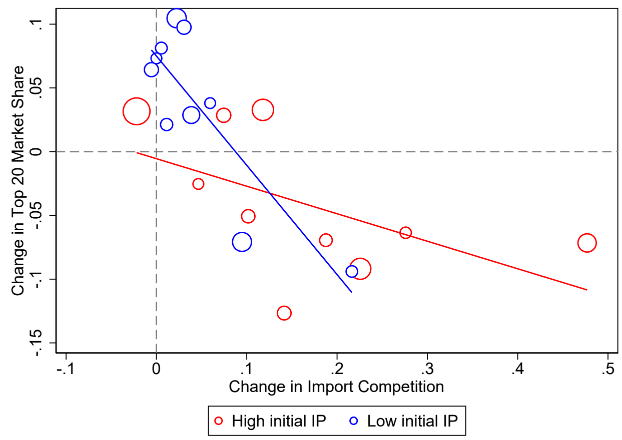
Notes: Panel a plots the kernel densities of the summed market shares of U.S. firms in the top 20 (blue lines) and of foreign firms in the top 20 (red lines) across industries. For foreign firms, we omit from the density industries in which no foreign firms are in the top 20, and hence the density includes only non-zero values. In panel b each set of bars plots the weighted average market share across industries of the firms with the rank noted on the x-axis, where we weight the market shares by each industry's absorption in 1992. The blue bars represent the market share of domestic firms with a given rank and the red bars are the market share of foreign firms with that rank.

Second, we plot the market shares accounted for by firms of a given ranking summed across all industries in Figure 3b. Thus, the height of the first bar shows that the market share of all of the number 1 ranked firms amounts to 12 percent of all manufacturing sales in 1992.[8] We split each bar into the market share accounted for by domestic firms in blue and by foreign firms in red. It turns out that foreign firms with rank 1 account for a market share of virtually zero in the aggregate. This is mostly due to the fact that there are very few industries where foreign firms rank in the top 20. Consequently, nearly all of the market share of firms with rank 1 is accounted for by domestic firms. To see how these patterns evolved over the sample period, we plot the analogous information for 2012 with lighter colors. A clear pattern emerges, showing that the largest growth in foreign sales is in the bottom part of the distribution. Foreign firms with a rank higher than 50 more than doubled their market share from 6.9 percent to 14.4 percent. By contrast, the foreign shares of the top ranked firms remained low on average, below 3 percent for each of the top seven bins.

This analysis helps reconcile the increased domestic concentration shown by the red line in Figure 1 with the flat market concentration across all firms in blue. From Figure 3b, we see that the market share of domestic firms declined in all the bins with ranks above 5, while their market share at the top ranks remained approximately unchanged. As a result, concentration rose among domestic firms themselves, consistent with trade theory which predicts the exit of lower productivity firms. However, the market share gains of foreign firms, mostly in the lower tail of the distribution, have

8. We aggregate the market share of each X ranked firm across industries using each industry's absorption in 1992 as weight. Summing over the bars of firms with rank 1 to 20 gives a weighted average analogue to the solid blue in Figure 1 in 1992 and 2012.

Figure 4: Change in Market Concentration and Import Penetration



Notes: The figure presents a bin scatter plot of the change in the top 20 overall market concentration between 1992 and 2012 on the y-axis against the change in import penetration, defined as the change in imports between 1992 and 2012 divided by initial absorption in each industry. The size of each dot is proportional to industry absorption in 1992. The "High Initial IP" dots are for industries with an above-median level of import penetration in 1992. The "Low Initial IP" dots are for industries with a below-median level of import penetration in 1992. We sort industries within each of these two groups into 10 deciles based on their change in import competition between 1992 and 2012, and take a weighted average of the change in import penetration and the change in the top 20 market share across the industries in each decile.

offset the rise in domestic concentration. As Figure 3b shows, the market shares of the top 20 firms barely changed between 1992 and 2012, consistent with the flat market concentration trend in the earlier figure.

Fact 3. *Market concentration fell the most in industries with high import penetration.*

To examine the relationship between market concentration and import competition, we first need a measure for import competition, which we proxy with import penetration for each industry i in year t, as follows:

$$IP_{it} = \frac{Imports_{it}}{Absorption_{it}}. \tag{3}$$

We compute absorption as total sales less exports plus imports, as in the denominator of equation (2). Based on our import measure, which excludes some related-party trade, aggregate import penetration has increased by nearly 9 percentage points over our sample period, from 10.7 percent to 19.2 percent.

Figure 4 plots an industry's change in import penetration between 1992 and 2012 against the change in concentration over the same period. We distinguish industries with a below-median level of import competition in 1992 (blue dots) from those with above-median import competition (red dots), and sort industries within each of these two groups into 10 deciles based on their change in import competition between 1992 and 2012. We take a weighted average of the change in import penetration and the change in the top 20 market share across the industries in each decile, using the absorption of each industry in 1992 as weight. The figure shows that the behavior of concentration is strikingly different for the industries with low import competition in 1992 compared to those with high initial import competition. Most industries with above-median import penetration in 1992 experienced further increases in foreign competition in subsequent years and almost no change or even a decline in concentration. Examples include audio and video equipment manufacturing, semi-conductor and electronic components, and curtain and linen mills.[9] In contrast, the industries with low initial import penetration continued to have a low share of foreign firms, and showed the largest growth in market concentration, for example, concrete industries. The figure illustrates that the industries with the largest increase in import competition showed the slowest growth in market concentration.

5 Market Concentration and Import Competition

In this section, we turn to analyzing how import competition affected domestic market concentration and overall market concentration of the top 20 U.S. firms. Since changes in imports are partially due to changes in U.S. demand, we need exogenous shocks that shift the world supply of goods to the U.S. to isolate the causal effect of import competition on U.S. firms. To this end, we construct time-varying instruments for U.S. imports using a methodology developed in Amiti and Weinstein (2018). This approach is related to the methodology developed by Autor, Dorn, and Hanson (2013), with adjustments to further address the possibility that rest-of-the-world supply shocks are correlated with the demand shocks in the U.S. Our instrument has the desirable property that it strips out any U.S.-specific factors.

To provide intuition for this methodology, we start with a standard fixed effects regression model, with

$$\triangle M_{ijkt} = \alpha_{ikt} + \beta_{ijt} + \epsilon_{ijkt}, \tag{4}$$

where $\triangle M_{ijkt}$ is the percentage change in imports from country j to country k in a 5-digit NAICS industry i over the five-year period up to time t. The dependent variable is regressed on importer country-industry-time fixed effects, α_{ikt}, and exporter country-industry-time fixed effects, β_{ijt}. The coefficients on these fixed effects isolate the change in imports due to conditions in the importer country and the exporter country, respectively, holding fixed the other component.

These coefficients could, in principle, be recovered using fixed effects estimation. However, the dependent variable is in percentage changes and is therefore not defined for any new importer-exporter country-industry trading relationship, which leads to biased estimates in cases where the share of new trading relationships is high. We overcome this problem by using the Amiti and Weinstein (2018) approach, which enables us to include these new trading relationships in the estimation of the coefficients in equation (4).[10]

We estimate α_{ikt} and β_{ijt} with bilateral HS 6-digit import data from UN COMTRADE, collapsed

9. These examples are based on publicly available census data for 1997 to 2012.

10. Amiti and Weinstein (2018) show that this methodology is equivalent to a weighted least squares estimation with lagged values as weights when there are no new trade relationships. The sum of the predicted values aggregates exactly to the country-level imports. See Appendix D for more details.

to the bilateral 5-digit time-consistent NAICS level, for the countries making up the top 50 U.S. trading partners, which cover more than 90 percent of U.S. trade.[11] Importantly, we also include the U.S. as an exporter j and an importer k in the estimation. By including the U.S. trade flows, we can strip out any U.S. specific effects that might be correlated with the exporter and importer shocks in other countries, and hence obtain export supply shocks that are cleaned of U.S. demand effects.

To construct export supply shocks at the industry level, we aggregate across all countries j within each NAICS industry i:

$$Instrument \triangle IP_{it} = \sum_{j \neq US} w_{ij,t-5} \hat{\beta}_{ijt} \tag{5}$$

where the weights are the five-year lagged total imports of industry i from country j as a share of total absorption of that industry i, and $\hat{\beta}_{ijt}$ are the estimated coefficients from equation (4), relative to their industry-year median. This variable will serve as an instrument for import competition, which we proxy with the percentage change in import penetration:

$$\triangle IP_{it} = \frac{Imports_{it} - Imports_{i,t-5}}{Absorption_{i,t-5}}.$$

We estimate the effect of import competition on market concentration using two-stage least squares:

$$\triangle C_{it}^{20} = \gamma \triangle IP_{it} + \delta_t + \epsilon_{it}, \tag{6}$$

where ΔC_{it}^{20} is the five-year change in top 20 U.S. firm concentration in industry i in year t. All regressions include time fixed effects and are weighted by five-year lagged industry shipments or absorption.

First, we consider the effect of import competition on the domestic top 20 market concentration measure, $\triangle C_{it}^{dom20}$, with the market shares from equation (1). Given the upward sloping red line in Figure 1, and the predictions of trade theory, we would expect tougher competition to increase domestic market concentration. However, using OLS estimation in column 1 of Table 1, we find a negative, albeit insignificant, coefficient.[12] This result may be due to the endogeneity of import penetration, as changes in U.S. demand could affect the demand for imports and the demand for domestically produced goods simultaneously. Once we instrument for import competition in column 2, we find a positive and significant coefficient of import penetration on domestic concentration, as hypothesized, equal to 0.25. This result implies that a one standard deviation increase in import penetration causes a 2 percentage point increase in domestic market concentration. To get a sense of the aggregate effect on manufacturing, we calculate the implied change in import penetration using the first stage coefficient times the import penetration shock, $Instrument \triangle IP_{it}$, and then multiply

11. https://comtrade.un.org/db/default.aspx. We include the periods 1997-2002, 2002-2007, and 2007-2012; and omit the earlier period 1992-1997 because few countries had adopted the Harmonized System of reporting in 1992.

12. We show results for unweighted regressions and results with weighted regressions using 1992 weights in Appendix C.

Table 1: Regressions

	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
Dependent variable	ΔC_{it}^{dom20}	ΔC_{it}^{dom20}	ΔC_{it}^{20}	ΔC_{it}^{20}	ΔNfirms$_{it}$	ΔNfirms$_{it}$
Trade adjusted	no	no	yes	yes		
ΔIP_{it}	-0.041	0.247**	-0.263***	-0.321***	0.254*	-2.243***
	(0.031)	(0.110)	(0.029)	(0.089)	(0.150)	(0.567)
First stage		ΔIP_{it}		ΔIP_{it}		ΔIP_{it}
instrument$_{\Delta IP_{it}}$		0.347***		0.375***		0.375***
		(0.048)		(0.048)		(0.048)
Predicted effects		0.004		-0.008		
Actual		0.030		-0.015		
Weighted	shipments$_{i,t-5}$		absorption$_{i,t-5}$		absorption$_{i,t-5}$	
N	500	500	500	500	500	500

Notes: Decimals have been rounded to four significant digits per Census Bureau disclosure guidelines. Number of observations has been rounded to hundreds. Mean of ΔIP_{it} is 0.052; standard deviation is 0.098. The predicted effects are calculated by first predicting the change in import penetration as the first-stage coefficient times the instrument, and then multiplying this by the second-stage coefficient and aggregating across all industries using five-year lagged absorption weights for the market concentration measure and five-year lagged U.S. shipment weights for the domestic concentration measure. Year fixed effects are included.

this effect by the second stage coefficient in column 2. Summing across all industries and time periods, using five-year lagged shipment weights as in the regression, we find that the predicted effect is equal to 0.004, which accounts for about one-eighth of the actual rise in domestic concentration between 1997 and 2012.[13]

We next consider the effect of import competition on the market shares of the top 20 U.S. firms using the overall market share measure from equation (2). According to trade theory, increased competition lowers the domestic sales of U.S. firms. We would therefore expect import competition to lower the domestic sales as a share of absorption of the top ranked U.S. firms. To test this, in columns 3 and 4, we replace the dependent variable with the concentration measure using the top 20 U.S. firms, calculated using equation (2).[14] Consistent with theory, we find negative and significant coefficients on import competition in column 3 using OLS and in column 4 using IV. The IV estimate is of larger magnitude than the estimate under OLS, equal to -0.32. Our estimate implies that a one standard deviation increase in import penetration results in a 3 percentage point fall in the market share of the top 20 U.S firms. Using the estimates from the first stage and second stage coefficients in column 4, and aggregating across industries and time, we predict a decline of 0.8 percentage point

13. The predicted effect is calculated as equal to 0.347x$Instrument\triangle IP_{it}$x0.247, summed across all industries and all time periods using five-year lagged shipment weights. We construct the actual rise in concentration using the same weights. This should be viewed as a back-of-the-envelope calculation as with regressions of this type we cannot say how import competition affected the constant.

14. Note that this market concentration measure focuses on the top 20 U.S. firms in each industry. It may differ in some industries from the market concentration measure used to construct the solid blue line in Figure 1 since that measure uses the market share of the top 20 firms irrespective of whether they are domestic or foreign.

in the market concentration of the top 20 U.S. firms due to import competition between 1997 and 2012. Import competition therefore accounts for half of the 1.5 percentage points decline in the actual weighted average concentration of the top 20 U.S. firms over this period.

How can we reconcile the positive coefficient in column 2 with the negative one in column 4? The key to understanding these results is to consider how to define the market in which a firm competes. If we ignore the sales of foreign firms in the U.S. market, we find that large firms are taking a larger share of U.S. firms' total sales in industries with more import competition. It is likely that the large firms are less hurt by foreign competition than small firms if, for example, they adjust their markups.[15] However, once we consider the total sales in the U.S. market, inclusive of imports, we find that the share of the top 20 U.S. firms actually fell, as foreign firms gained some of their market share. Specifically, as shown in Figure 1, the market share of the top 20 firms inclusive of foreign firms was basically flat over this time period. We further see in the IV estimation in column 6, where we replace the dependent variable with the ratio of the number of domestic firms in t and in $t - 5$, that the number of U.S. firms in industries with increased import competition also falls.[16] This finding is also consistent with trade theory where the domestic exit cutoff rises with lower trade costs.

6 Conclusion

A large literature has shown an increase in the concentration among domestic firms in the U.S. over the last three decades. This trend has raised concerns of increasing market power. However, according to standard international trade models, rising import competition would lead to the reallocation of market share from small inefficient firms to large firms, and hence rising domestic concentration would coincide with tougher product market competition. Using confidential Census data of all firms selling in the U.S. market, we provide new evidence in support of these trade theory predictions. We show that once foreign firms' sales in the U.S. are taken into account, market concentration did not rise but instead remained flat between 1992 and 2012. We reconcile the flat trend in market concentration with the previously documented rise in *domestic* concentration by showing that the growth of foreign firms' market shares was mostly at the bottom of the sales distribution, counteracting the increase in concentration among U.S.-based firms. Consistent with the theory, we show that import competition caused an increase in domestic market concentration among U.S. firms as well as exit. In contrast, import competition caused the largest U.S. firms to lose sales as a share of total sales in the U.S. market, inclusive of both foreign and domestic firms.

Our findings have important implications for market power. Standard models (such as Atkeson and Burstein (2008)) link markups directly to market shares. Interpreting our findings through the

15. In many models, large firms reduce markups in response to increased competition; see, for example, Atkeson and Burstein (2008) and Arkolakis et al. (2019). See De Loecker et al. (2016) for empirical support showing that import competition reduces markups.

16. This result is consistent with Gutiérrez and Philippon (2017), who find in the Compustat data that the number of firms in the U.S. fell in response to Chinese import penetration.

lens of these models suggests that markups of domestic firms have fallen and those of foreign firms have risen, offsetting each other resulting in stable aggregate markups.

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Appendix

A Melitz model

We briefly outline how import competition affects market concentration in the standard Melitz (2003) model. The details are exactly as in Melitz (2003).

A continuum of firms indexed by productivity φ produces differentiated consumption goods. The firms can export to a symmetric set of n foreign countries, subject to a fixed cost of exporting $f_x > 0$ and a standard iceberg trade cost $\tau > 1$. Each firm's revenues are

$$r(\varphi) = r_d(\varphi) + \mathbb{I}_x n r_x(\varphi), \tag{A.1}$$

where $r_d(\varphi)$ are revenues from the domestic market, $r_x(\varphi)$ are revenues from exporting to a foreign country, and $\mathbb{I}_x$ is an indicator that is equal to one if firm φ is an exporter. Firms face a marginal cost of production of φ^{-1} and sell to a representative household with CES demand with elasticity σ. Revenues are therefore given by

$$r_d(\varphi) = \left(\frac{\sigma - 1}{\sigma}\varphi P\right)^{\sigma-1} R$$

and

$$r_x(\varphi) = \left(\frac{\sigma - 1}{\sigma}\frac{\varphi P}{\tau}\right)^{\sigma-1} R.$$

where R are aggregate revenues and P is the aggregate price level. Thus, more productive firms obtain larger revenues and have a higher market share. Each firm has to pay a fixed overhead cost f to stay in the market. Since profits are increasing in productivity, the presence of this fixed cost implies that there is a cutoff productivity level φ^* such that profits are zero. Firms with $\varphi < \varphi^*$ exit the market and are replaced by new entrants. Similar to the domestic cutoff, there exists an export productivity cutoff level φ_x^* such that only firms with $\varphi \geq \varphi_x^*$ become exporters. If $\tau^{\sigma-1} f_x > f$, then $\varphi_x^* > \varphi^*$, and some domestic firms do not export.

We show that a trade liberalization increases domestic market concentration defined by equation (1), i.e., domestic sales plus exports. We define domestic market concentration as

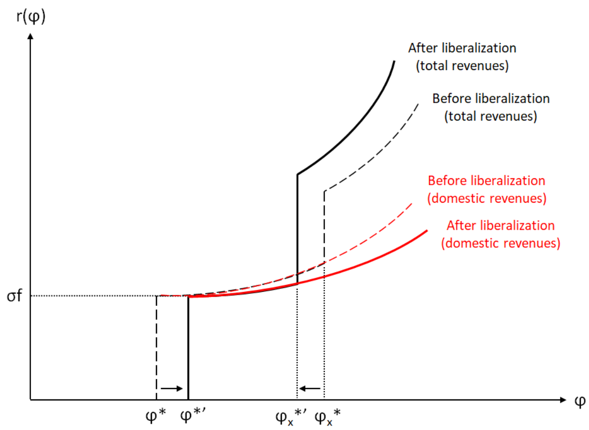
$$C_{\bar{\varphi}} = \frac{\int_{\bar{\varphi}}^{\infty} r(\varphi)\mu(\varphi)d\varphi}{R},$$

where $\mu(\varphi)$ is the mass of firms with productivity φ and $\int_{\bar{\varphi}}^{\infty} \mu(\varphi)d\varphi = X$. Here, X is some exogenously chosen constant. This measure is a model analogue to the market share of the top X firms.

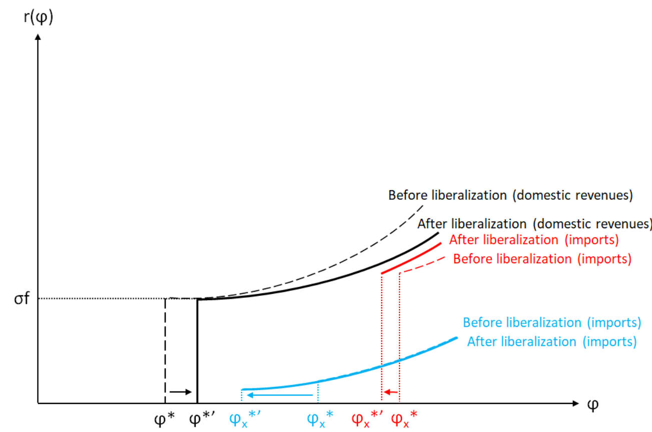
Consider a reduction in the iceberg trade cost τ. The black lines in Figure A.1a plot the effect of this liberalization on firms' total revenues, $r(\varphi)$, as a function of firms' productivity level φ. As shown in Melitz (2003), the reduction in τ causes expected profits to rise, leading additional competitors to enter the market and bidding up wages, which shifts the domestic productivity cutoff φ^* to the right to $(\varphi^*)'$. As a result, firms with productivity between φ^* and $(\varphi^*)'$ exit the market. At the same time, the lower trade costs enable some firms that did not export before to become exporters,

Figure A.1: Effect of a Trade Liberalization on Revenues

(a) Domestic Concentration



(b) Market Concentration



Notes:

shifting the export cutoff φ_x^* to the left to $(\varphi_x^*)'$. Revenues from the domestic market, $r_d(\varphi)$, decline, as illustrated by the downward shift of the revenue curve to the left of the exporting cutoff. However, exporters more than compensate for this decline by an increase in export revenues, causing their overall revenues $r(\varphi)$ to increase and shifting the portion of the revenue curve to the right of the exporting cutoff upward. Overall, the more productive exporting firms increase their revenues while smaller non-exporters exit or lose revenues. Thus, $C_{\bar{\varphi}}$ must increase, and the Melitz model predicts that a trade liberalization increases domestic market concentration. The results are similar if the trade liberalization is associated with a fall in the fixed cost f_x, except that existing exporters' revenues do not increase. Nevertheless, domestic concentration still rises since some smaller firms exit the market.

The red lines in Figure A.1a plot firms' domestic revenues, $r_d(\varphi)$. All domestic firms lose revenues at home due to the additional competition resulting from the liberalization, shifting the domestic revenue curve downward. Foreign firms enter the market and increase their revenues, due to a leftward shift in their exporting cutoff. Since a trade liberalization must expand the total market size (since the aggregate price level P must decline), domestic firms' share of the overall market falls. The Melitz model thus predicts that all domestic firms, including the top X firms, lose market share when we define it according to equation (2).

Next, we consider overall concentration from equation (2) summing across both foreign and domestic firms. The behavior of domestic firms' revenues is still given by the red lines in Figure A.1a, replicated in black in Figure A.1b. For the effect of foreign exporters' revenues, we consider two scenarios, and show that the effect of a trade liberalization on market concentration depends on whether foreign firms enter at the top or at the bottom of the domestic sales distribution. First, consider the scenario in which the fixed cost of exporting f_x is large, but the iceberg trade cost τ is relatively close to one. In this case, only the most productive foreign firms are profitable enough to export. However, these exporters generate revenues that are similar to those of the largest domestic firms. This case is illustrated by the red dashed line in Figure A.1b. Consider the effect of a reduction in τ. As before, the exporting cutoff shifts to the left, allowing more foreign firms into the domestic market. Additionally, the revenues of the existing exporters increase, as illustrated by the steepening of the thick red line. Since large foreign exporters gain market share while small domestic non-exporters exit (to the left of $(\varphi^*)'$), market share is reallocated from small to large sellers. Therefore, market concentration rises.

Second, consider an alternative scenario in which the fixed cost of exporting f_x is small, but the iceberg trade cost τ is relatively large. In this case, relatively many foreign firms export to the domestic market, but their revenues are small compared to domestic firms' revenues. This scenario is illustrated by the blue line in Figure A.1b. Consider the effect of a decline in f_x. This reduction shifts the exporting cutoff to the left, allowing more foreign firms to enter and extending out the blue line to the left. The entering firms have smaller revenues than the lowest productivity domestic firms due to the large iceberg trade costs. The revenues of existing exporters are unchanged, and hence the revenue curve does not shift. Since domestic firms' revenues fall, there is a reallocation of market share from larger domestic sellers towards smaller foreign sellers. Therefore, market concentration falls.

If firms' productivity is Pareto distributed and the fixed cost of entry is the same for domestic and foreign firms, then the loss of domestic firms' market share and the gains by foreign firms exactly cancel each other out, and market concentration is unchanged.

B Data Construction

We combine two datasets of the U.S. Census Bureau.

Census of Manufactures This dataset contains the universe of U.S. manufacturing establishments from the Census Bureau. We obtain from this dataset the total sales (also referred to as shipments) for each manufacturing establishment in the U.S. every five years over the period 1992-2012. We merge into this dataset each establishment's time-consistent 6-digit North American Industrial Classification (NAICS) 2007 industry code constructed by Fort and Klimek (2018).

To address measurement errors in reporting, we clean the data by dropping establishments whose industry code splits over time into more than 100 possible NAICS codes and establishments with missing NAICS codes. We also drop inactive establishments with zero employees.

To facilitate the merge with the trade data, we aggregate across establishments to the 5-digit NAICS-firm level. Thus, a firm with establishments active in multiple industries would be recorded in each of these industries with the corresponding sales. We take account of revisions over time in the NAICS codes, resulting in a time-consistent industry aggregation of 169 NAICS industries at the 5-digit level for the manufacturing sector. We drop outlier firms whose increase in the sales/employees ratio between year $t-5$ and year t is above the 99.5th percentile and whose sales/employee ratio in year t is above the 99.5th percentile of that industry-year.

Longitudinal Firm Trade Transactions Database (LFTTD) The LFTTD dataset provides transaction-level data for the universe of all U.S. imports. Critically, it contains an identifier for the foreign exporter in addition to the identifier for the U.S. importer for each transaction. Since the foreign firm identifier differs across establishments of the same foreign firm and we are interested in the foreign *firm-level* exports to the U.S., we follow the methodology by Kamal and Monarch (2018) and replace the exporter ID with a shortened identifier that contains only the country ISO code and the name portion of the ID.[17] Transactions with a missing foreign firm identifier account for 1.1 percent of total imports and 0.2 percent of total sales (imports plus domestic sales) in the U.S. We keep imports with missing identifiers for the denominator of the market shares. We drop all transactions with a negative value and imports flagged as warehouse entries.

The LFTTD also contains an indicator for whether a transaction is conducted between related parties. Based on Section 402(e) of the Tariff Act of 1930, a related-party trade is an import transaction between parties with "any person directly or indirectly, owning, controlling, or holding power to vote, [at least] 6 percent of the outstanding voting stock or shares of any organization." To correct for missing or incorrect related-party flags, we classify an importer-exporter pair as related if it had a related-party flag for any transaction in the given year. We drop related-party imports when the industry code of the imports falls within the same NAICS code as the U.S. firm's shipments, since these products are unlikely to have any additional value added, and keep related-party imports that are not within the firm's output industry. This step removes about 34 percent of U.S. imports.

Each import transaction also contains a 10-digit Harmonized Tariff System (HTS10) code for the product traded, which we map to NAICS codes using the import concordance by Pierce and Schott (2012). We adjust this concordance to take account of revisions over time in the HTS10 and inconsistent mappings from HTS10 to NAICS. We finally aggregate across transactions to the foreign exporter-year-5-digit NAICS level.

In addition to U.S. imports, the LFTTD also provides transaction-level data on U.S. firms' exports. We clean the export data by keeping only domestic exports, and map the HTS10 product codes to time-consistent NAICS codes analogously to the import data. We then construct the domestic sales of U.S. firms in each industry by subtracting exports from total shipments. We net out both related-party and arms'-length exports from total shipments, since both are likely to be counted in a firm's total shipments. We drop all export transactions that we cannot map to a manufacturing firm in the Census of Manufactures.

17. The overall foreign exporter ID is a combination of the exporter's country, its name, and the street address. Kamal and Monarch (2018) find that the number of shortened identifiers is consistent with the total number of exporting firms to the U.S. from other countries' trade statistics.

C Additional Results

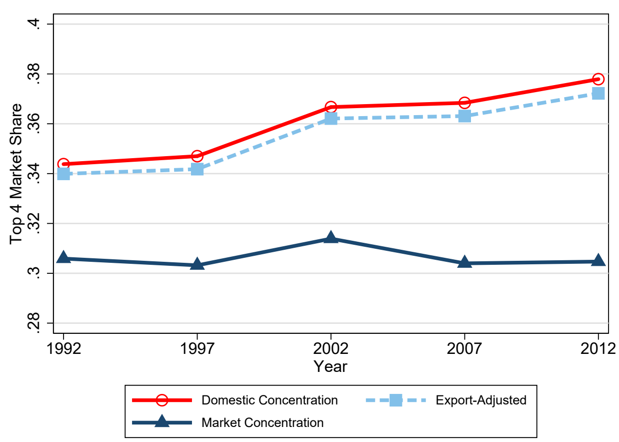
C.1 Alternative Measures of Market Concentration

We show that market concentration remained virtually unchanged between 1992 and 2012 using alternative measures of concentration and using different weighting approaches.

Figure C.1 shows the evolution of the top four concentration measures and Figure C.2 shows the HHI. As in the main text, each figure shows the evolution of the domestic concentration measures using the total sales of all firms located in the U.S. (red solid line), an "export-adjusted" measure that subtracts U.S. firms' exports (blue dashed line), and the full market concentration measure that also includes the sales of foreign firms (blue solid line). While the domestic and export-adjusted measures increase over time, the overall market concentration measure is flat or decreasing.

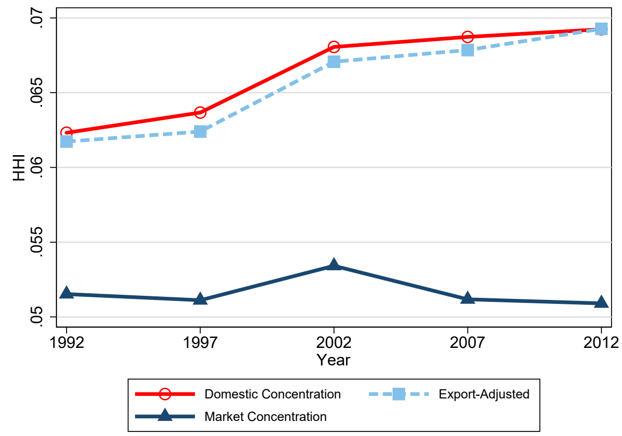
Figures C.3 to C.5 present similar measures, where we aggregate across industries using sales weights. For the "Domestic Concentration" measure we weight each industry by its U.S. firms' total shipments in 1992; for the "Export-Adjusted" measure we use shipments minus exports in 1992; and for the "Market Concentration" measure we use total absorption in 1992, i.e., shipments minus exports plus imports. We find results similar to those obtained before.

Figure C.1: Top 4 Market Concentration



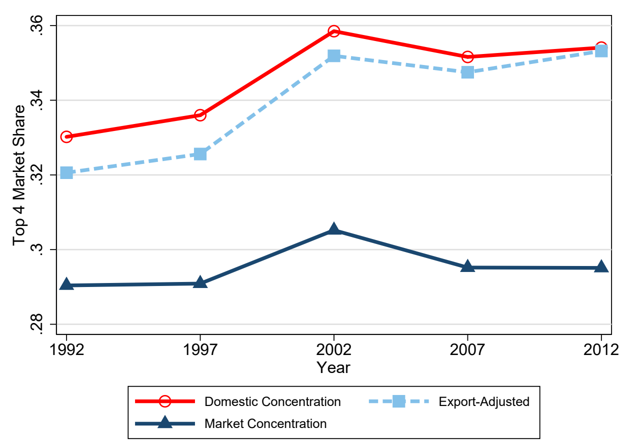
Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line is a conventional market concentration measure of the top four firms using only total sales data of firms located in the U.S. The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales. The "Market Concentration" line uses all firms' sales in the U.S. irrespective of where the firm is located. The top four market share concentration measure is the average across all NAICS 5-digit manufacturing industries.

Figure C.2: Herfindahl-Hirschman Index (HHI)



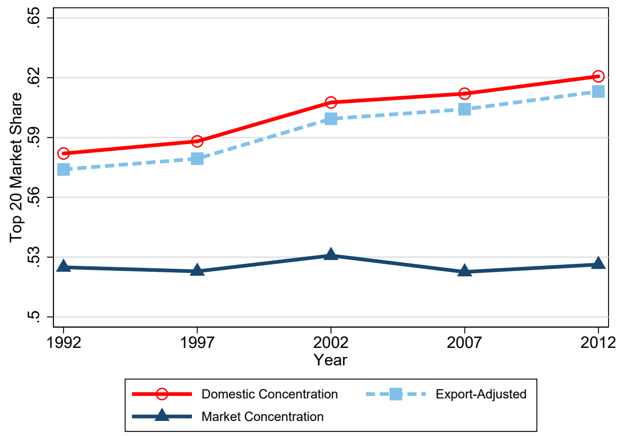
Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line is a conventional HHI measure using total sales data of firms located in the U.S. The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales. The "Market Concentration" line uses all firms' sales in the U.S. irrespective of where the firm is located. The HHI measure is the average across all NAICS 5-digit manufacturing industries.

Figure C.3: Top 4 Market Concentration (Weighted)



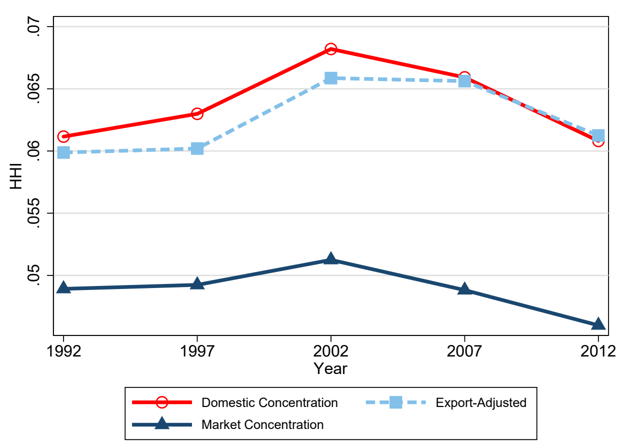
Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line is a conventional market concentration measure of the top four firms using only total sales data of firms located in the U.S. The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales. The "Market Concentration" line uses all firms' sales in the U.S. irrespective of where the firm is located. The top four market share concentration measure is the weighted average across all NAICS 5-digit manufacturing industries. For the "Domestic Concentration" measure we weight each industry by its U.S. firms' total shipments in 1992; for the "Export-Adjusted" measure we use shipments minus exports in 1992; and for the "Market Concentration" measure we use total absorption in 1992, i.e., shipments minus exports plus imports.

Figure C.4: Top 20 Market Concentration (Weighted)



Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line is a conventional market concentration measure of the top 20 firms using only total sales data of firms located in the U.S. The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales. The "Market Concentration" line uses all firms' sales in the U.S. irrespective of where the firm is located. The top 20 market share concentration measure is the weighted average across all NAICS 5-digit manufacturing industries, using each industry's sales in 1992 as weight. For the "Domestic Concentration" measure we weight each industry by its U.S. firms' total shipments in 1992; for the "Export-Adjusted" measure we use shipments minus exports in 1992; and for the "Market Concentration" measure we use total absorption in 1992, i.e., shipments minus exports plus imports.

Figure C.5: Herfindahl-Hirschman Index (HHI) (Weighted)

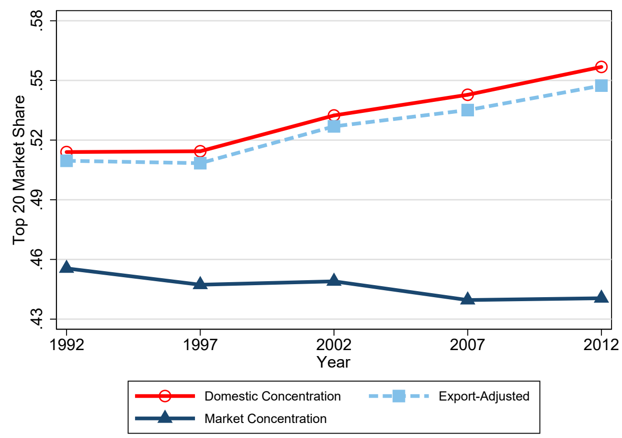


Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line is a conventional HHI measure using total sales data of firms located in the U.S. The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales. The "Market Concentration" line uses all firms' sales in the U.S. irrespective of where the firm is located. The HHI measure is the weighted average across all NAICS 5-digit manufacturing industries. For the "Domestic Concentration" measure we weight each industry by its U.S. firms' total shipments in 1992; for the "Export-Adjusted" measure we use shipments minus exports in 1992; and for the "Market Concentration" measure we use total absorption in 1992, i.e., shipments minus exports plus imports.

C.2 Aggregation at the 4-Digit NAICS Level

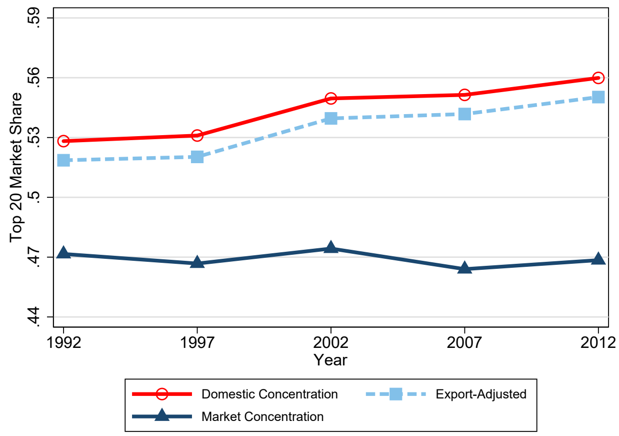
We present the top 20 concentration measure computed at the 4-digit NAICS level. Figure C.6 presents an unweighted average across industries and Figure C.7 presents a weighted average. The results are similar to those for the 5-digit aggregation.

Figure C.6: Top 20 Market Share, NAICS 4-Digit Aggregation



Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The "Domestic Concentration" line is a conventional market concentration measure using only total sales data of firms located in the U.S. The "Export-Adjusted" line subtracts U.S. firms' exports from their total sales. The "Market Concentration" line uses all firms' sales in the U.S. irrespective of where the firm is located. The top 20 market share concentration measure is the average across all NAICS 4-digit manufacturing industries.

Figure C.7: Top 20 Market Share, NAICS 4-Digit Aggregation (Weighted)



Notes: Data are for census years: 1992, 1997, 2002, 2007, and 2012. The “Domestic Concentration” line is a conventional market concentration measure using only total sales data of firms located in the U.S. The “Export-Adjusted” line subtracts U.S. firms’ exports from their total sales. The “Market Concentration” line uses all firms’ sales in the U.S. irrespective of where the firm is located. The top 20 market share concentration measure is the average across all NAICS 4-digit manufacturing industries - solid lines are simple averages and dashed lines are sales weighted averages. The top 20 market share concentration measure is the weighted average across all NAICS 4-digit manufacturing industries, using each industry’s sales in 1992 as weight. For the “Domestic Concentration” measure we weight each industry by its U.S. firms’ total shipments in 1992; for the “Export-Adjusted” measure we use shipments minus exports in 1992; and for the “Market Concentration” measure we use total absorption in 1992, i.e., shipments minus exports plus imports.

C.3 Alternative Regression Weightings

We present the regression results for unweighted regressions and for weighted regressions with 1992 sales weights. Table C.1 presents the unweighted regression results. Table C.2 presents the results using 1992 weights. The results are broadly similar to those in the main text.

Table C.1: Unweighted Regression Results

	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
Dependent variable	ΔC_{it}^{dom20}	ΔC_{it}^{dom20}	ΔC_{it}^{20}	ΔC_{it}^{20}	ΔNfirms$_{it}$	ΔNfirms$_{it}$
Trade adjusted	no	no	yes	yes		
ΔIP_{it}	-0.007	0.122*	-0.184***	-0.339***	0.106*	-0.959***
	(0.023)	(0.072)	(0.026)	(0.081)	(0.098)	(0.325)
First stage		ΔIP_{it}		ΔIP_{it}		ΔIP_{it}
instrument$_{\Delta IP_{it}}$		0.446***		0.446***		0.446***
		(0.056)		(0.056)		(0.056)
Predicted effects		0.003		-0.009		
Actual		0.046		-0.016		
N	500	500	500	500	500	500

Notes: Decimals have been rounded to four significant digits per Census Bureau disclosure guidelines. Number of observations has been rounded to hundreds. Mean of ΔIP_{it} is 0.052; standard deviation is 0.098. The predicted effects are calculated by first predicting the change in import penetration as the first-stage coefficient times the instrument, and then multiplying this by the second-stage coefficient and taking a simple average across all industries. Year fixed effects are included.

Table C.2: Regression Results with 1992 Sales Weights

	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
Dependent variable	ΔC_{it}^{dom20}	ΔC_{it}^{dom20}	ΔC_{it}^{20}	ΔC_{it}^{20}	ΔNfirms$_{it}$	ΔNfirms$_{it}$
Trade adjusted	no	no	yes	yes		
ΔIP_{it}	-0.025	0.209**	-0.238***	-0.289***	0.219	-2.298***
	(0.027)	(0.089)	(0.028)	(0.083)	(0.140)	(0.539)
First stage		ΔIP_{it}		ΔIP_{it}		ΔIP_{it}
instrument$_{\Delta IP_{it}}$		0.383***		0.390***		0.390***
		(0.050)		(0.049)		(0.049)
Predicted effects		0.005		-0.008		
Actual		0.033		-0.016		
Weighted	shipments$_{i,1992}$		absorption$_{i,1992}$		absorption$_{i,1992}$	
N	500	500	500	500	500	500

Notes: Decimals have been rounded to four significant digits per Census Bureau disclosure guidelines. Number of observations has been rounded to hundreds. Mean of ΔIP_{it} is 0.052; standard deviation is 0.098. The predicted effects are calculated by first predicting the change in import penetration as the first-stage coefficient times the instrument, and then multiplying this by the second-stage coefficient and aggregating across all industries using 1992 absorption weights for the market concentration measure and 1992 U.S. shipment weights for the domestic concentration measure. Year fixed effects are included.

D Derivation of Trade Shocks

We provide some more details on the construction of the trade shocks that we use to construct the instrument in our regressions. Start with a standard fixed effects regression model:

$$\triangle M_{ijkt} = \alpha_{ikt} + \beta_{ijt} + \epsilon_{ijkt}, \tag{D.1}$$

where the dependent variable is the change in imports from country j to k at time t in industry i. The right-hand side variables are source country-industry-time fixed effects and destination country-industry-time fixed effects. In order to identify these coefficients, there must be a connected set of source country and destination country trade, and the error term must satisfy $E[\epsilon_{ijkt}] = 0$.

A major shortcoming in using standard fixed effects regressions to estimate the coefficients is that the dependent variable is undefined for new trading relationships, i.e., country-industry pairs that trade in t but not in $t-5$. So the gap between the predicted aggregate imports and actual imports is going to depend on how important new trading relationships are in explaining the variation in aggregate trade. Our methodology overcomes this problem by incorporating new trade relationships, estimating supply and demand shocks that exactly match aggregate imports. In fact, the methodology collapses to weighted least squares estimation, with lagged trade weights, and the dependent variable defined as the percentage change in trade, if there are no new trade relationships (see Amiti and Weinstein (2018) Appendix A for proof).

The percentage change in a country j's total exports of industry i, D_{ijt}, can be obtained by summing equation (D.1) cross all destination countries k; and the percentage change in a country k's total imports of industry i, D_{ikt}, can be obtained by summing equation (D.1) across all source countries to give us the following moment conditions:

$$D_{ijt} \equiv \frac{\sum\limits_k M_{ijkt} - \sum\limits_k M_{ijk,t-5}}{\sum\limits_k M_{ijk,t-5}} = \beta_{ijt} + \sum_k \phi_{ijk,t-5}\alpha_{ikt}, \text{with } \phi_{ijk,t-5} \equiv \frac{M_{ijk,t-5}}{\sum_k M_{ijk,t-5}};$$

and

$$D_{ikt} \equiv \frac{\sum\limits_j M_{ijkt} - \sum\limits_j M_{ijk,t-5}}{\sum\limits_j M^i_{jk,t-5}} = \alpha_{ikt} + \sum_j \theta_{ijk,t-5}\beta_{ijt}, \text{with } \theta_{ijk,t-5} \equiv \frac{M_{ijk,t-5}}{\sum_j M_{ijk,t-5}}.$$

These are $I + J$ equations in $I + J$ unknowns, which will produce unique α_{ikt} and β_{ijt} up to a numeraire. These adding-up constraints ensure that exporting equals importing, and the predicted values will exactly match aggregate exporting at the exporting country level, importing country level, and time level. Note that the denominator in the first equation is country $j's$ total exports of industry i, since it is summed across imports from all the countries that imported that product at time $t-5$; so new relationships that form between these countries will still be included provided there was an export to at least one country in industry i.