The Great Recession and a Missing Generation of Exporters*

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Abstract

The collapse of international trade during the Great Recession has garnered significant attention. This paper studies firm entry and exit in foreign markets and their role in the post recession recovery of U.S. exports using confidential microdata from the U.S. Census Bureau. We find that incumbent exporters account for the vast majority of the decline in foreign sales during the Great Recession and induced a missing generation of exporters, with large increases in firm exits and a substantial decline in entries in foreign markets. During the recovery following the Great Recession, new exporters tended to have larger foreign sales, however, which compensated for the decline in the number of exporting firms. Thus, while entry and exit drove substantial changes in the variety of U.S. goods that were sold abroad, overall they were less important for the trajectory of aggregate exports during the recovery.

JEL: F10, F40, E32, E44, J2
Keywords: entry, exit, business cycles, exports, firm dynamics, recession, financial crisis

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I. Introduction

International trade in a given year is typically dominated by relatively large and old firms. At some point in the past, however, these firms were young, small, and new to international markets. The Great Recession caused a large decline in U.S. exports along with a decline in entry into foreign markets. As shown by Levchenko et al. (2010a), the collapse was unprecedented in the magnitude of the decline in exports and imports relative to gross domestic product (GDP). While the initial rebound following the Great Recession was rapid, by 2014 foreign sales were still below their historical post-recession average. In this study, we explore the extent to which a missing generation of exporters created by the Great Recession led to lower U.S. export growth during the recovery.

We begin our analysis by documenting a large spike in firm exits and a concurrent decline in entries into foreign markets during this period. If one assumes that each firm produces a distinct kind of product, this missing generation of exporters suggests that the Great Recession had substantial effects on the variety of goods exported by the United States. We then turn to a more rigorous approach to look at the effect of the Great Recession on foreign market participation. Estimating a dynamic linear probability model, we find that during the crisis incumbent exporters were substantially less likely to sell abroad. Measured effects are robust across a variety of different specifications and measures of the recession. These effects were driven by both foreign and domestic shocks.

Having shown that the Great Recession affected foreign market participation, we consider what effect this had on aggregate outcomes over time. To do so, we rely on an export growth decomposition in order to look at the scarring effects of the changes in foreign market participation on the trajectory of aggregate exports over 2008 to 2014. We conduct a set of counterfactual experiments to look at how export dynamics would have evolved if different aspects of foreign sales had followed their historical trends. The main conclusion from these estimations is that changes in the intensive margin of exports from incumbent

exporters are the main driver of the decline in foreign sales during the financial crisis. At the same time, the intensive margin outperformed relative to its historical relationship with real GDP growth. Although there was a decline in the number of firms exporting during these years, this was compensated for by the relatively larger volume of foreign sales from new entrants into markets abroad.

Our findings have a number of implications. Firstly, access to a wider variety of goods has been recognized as one of the primary gains from international trade at least since the work of Hicks (1969): "The extension of trade does not primarily imply more goods... the variety of goods is (also) increased, with all the widening of life that that entails. There can be little doubt that the main advantage that will accrue to those with whom merchants are trading is a gain of precisely this kind." Given the decline in the number of varieties of goods sold abroad, it is thus reasonable to conclude that the Great Recession had substantial effects on welfare internationally. This conclusion is particularly important given that a very large share of U.S. exports come from firms with patented technologies (Lin and Lincoln, 2017) and that developing countries are often dependent on imports of intermediate capital goods from industrialized markets that embody the latest technologies (Eaton and Kortum, 2001).

It is clear that these variety effects were not the primary drivers of changes in the aggregate volume of exports during this period, however. This finding is broadly consistent with the prior literature in that, on a year to year basis, large firms are primarily responsible for changes in trade volumes (e.g., Bernard et al. 2009). Behrens et al. (2013) in particular consider the collapse in Belgian trade during the Great Recession and show that it was driven by adjustments in the quantity of exports by large firms. These results complement those of Bernard et al. (2009) on the effects of the 1997 Asian Financial Crisis on U.S. producers. Our results build on both of these papers by estimating the importance of the size of entering and exiting firms in determining changes in aggregate export volumes.

At the same time, our findings contrast with the literature that considers the effects of the Great Recession on employment. In particular, Siemer (2019) finds a 30 percent

reduction in firm birth rates during these years and an ensuing fall in employment attributable to young firms. Gourio et al. (2016) and Clementi et al. (2014) show that declines in firm births have a persistent effect on employment and productivity. Our results thus suggest that trade and employment followed fundamentally distinct trajectories over this period and point to the importance of different mechanisms in determining these outcomes during financial crises.

The next section discusses our data sources and presents a number of new stylized facts about U.S. exports during the Great Recession. This is followed by a set of estimations that look at how these events affected participation in foreign markets. We then consider the aggregate implications of these extensive margin adjustments over time through a decomposition analysis and a set of counterfactuals. We close with a discussion of potential avenues for further research.

II. Data and Stylized Facts

Data

Our confidential microdata come from the U.S. Census Bureau and include all export shipments recorded by U.S. Customs and Border Protection. These transactions and the firm identification numbers associated with them are compiled into the Longitudinal Firm Trade Transactions Database (LFTTD). To obtain additional information on firm characteristics, we draw on the Longitudinal Business Database (LBD). This is sourced from Internal Revenue Service records and contains information on the employment, payroll, industry, and geographic location of every tax paying business establishment in the United States. We first aggregate these measures to the firm level and then merge them with the LFTTD. Bernard et al. (2009) were the first to conduct this merge and recent efforts to improve this mapping have been developed by Barresse et al. (2016). Jarmin and Miranda (2002) provide an extensive description of the construction of the LBD along with an insightful characterization of the data.

We use this matched longitudinal information on firm exports from 1993 to 2014. The data set allows us to follow firms over time and to perform analyses using a firm's industry, location, and age. Due to the comprehensiveness of our data, and unlike much of the previous literature, we are able to consider sectors outside of manufacturing and can include firms with as few as one employee in our estimations. This makes it possible to provide a much more comprehensive picture of the evolution of exports, particularly with respect to the extensive margin of trade.

In terms of our aggregate measures, total exports, GDP, and the export price index are all sourced from the Bureau of Economic Analysis' national income and product accounts. County and state level house price data are obtained from Bogin et al. (2019). We define U.S. business cycles using the National Bureau of Economic Research (NBER) Business Cycle reference dates and thus treat 2001, 2008, and 2009 as recession years.

Stylized Facts

Aggregate Stylized Facts

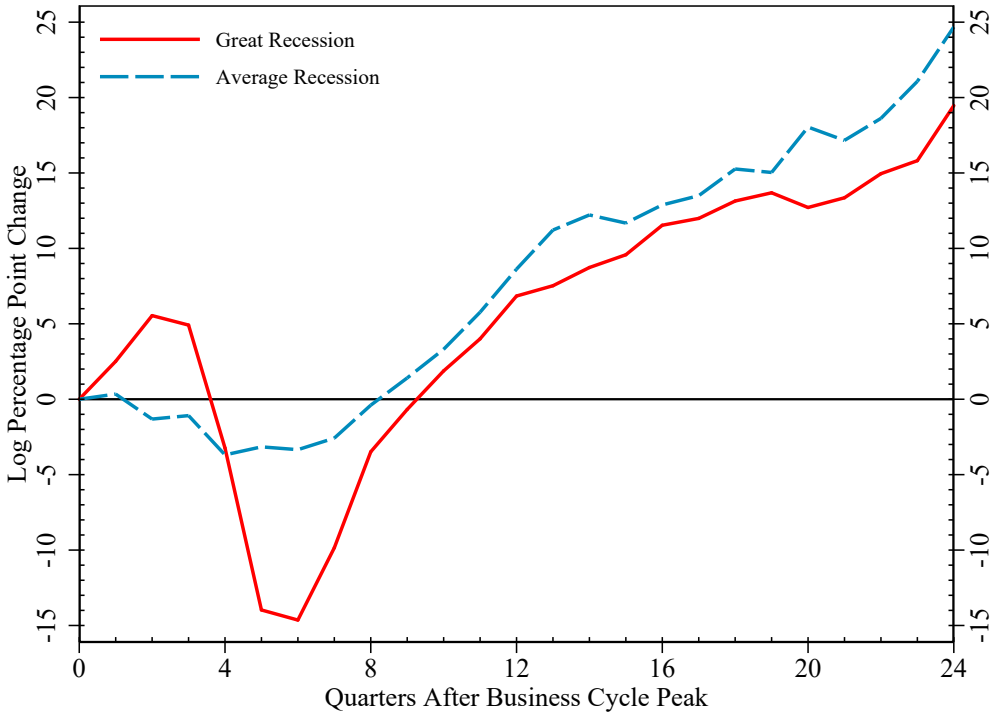
Figure 1 begins our analysis by comparing the log growth of exports after the Great Recession with the typical trajectory following the recessions that began between 1948 and 2001.[1] It shows that the decline in exports after the Great Recession was much larger than what typically occurs during a recession. Foreign sales also did not recover by as much; 24 quarters after the most recent business cycle peak, the level of real goods exports is only 20 percent above its pre-recession level relative to the comparable figure for prior recessions, which is 25 percent.

Micro-level Stylized Facts

Bernard and Jensen (1999) and a long literature following this study have documented that large firms dominate the level of exports in a given year. Gopinath and Neiman (2014)

[1]The exact dates used to construct these figures are discussed in the appendix. Other important studies of the collapse include Amiti and Weinstein (2011), Baldwin (2011), Groot et al. (2011), Lane and Milesi-Ferretti (2011), Yi (2011), Gopinath and Neiman (2014), and Bricongne et al. (2012).

Figure 1: Exports After the Great Recession

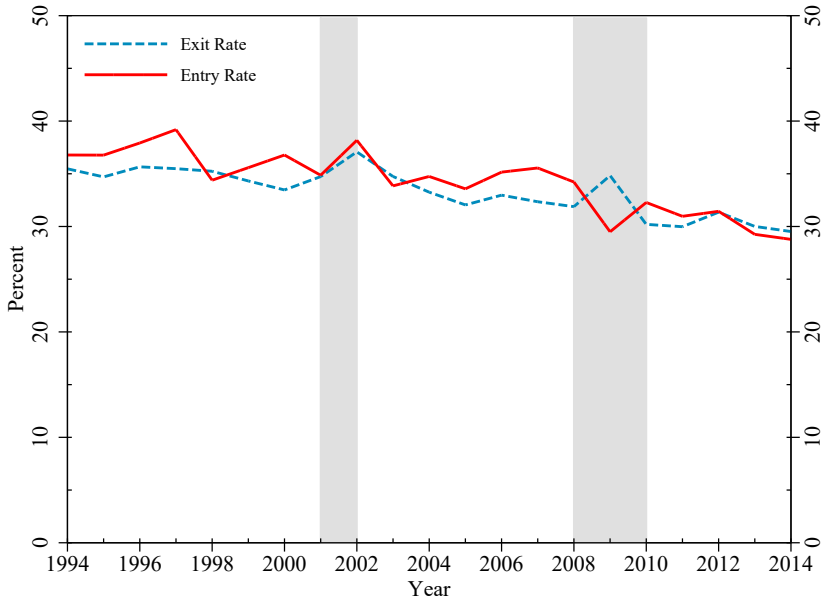


Notes: The figure shows the typical trajectory of the log of real goods exports 24 quarters after the most recent business cycle peak that preceded the 11 recessions between 1948 and 2001, as well as the same measure for the period after the Great Recession.

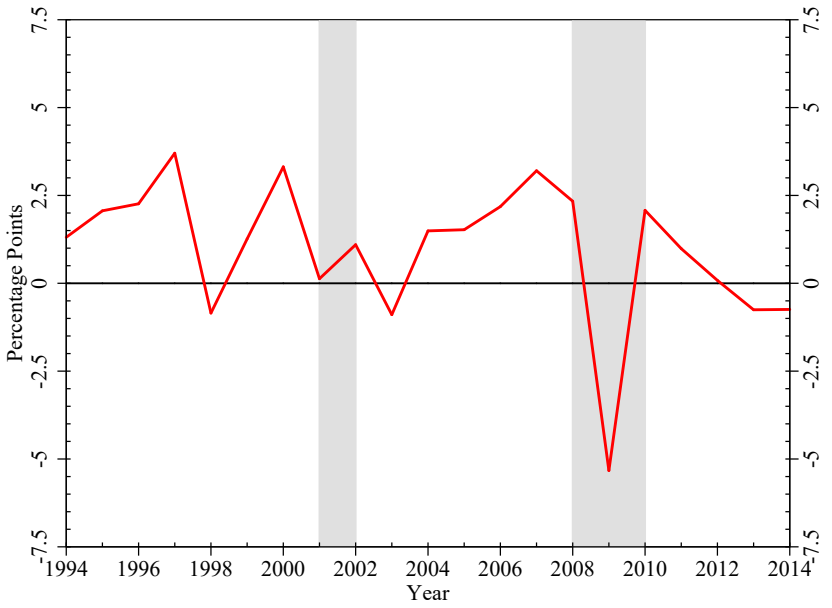
similarly show that almost all of the annual growth in total exports is due to changes in the foreign sales of incumbent exporters. Over long time horizons, however, producers that are new to international markets make up the majority of total exports. For example, Lincoln and McCallum (2018) document that amongst manufacturing plants, 29 percent of exports in 2002 came from producers who had exported for less than five years, whereas 46 percent came from those who had exported for more than 15 years. This points to a potentially important role for any factors that might result in a missing generation of exporters.

Figure 2a plots firm foreign market entry and exit rates over the years in our sample. The entry rate is defined as the number of firms exporting in year t that do not do so in $t-1$ divided by the total number firms that export in year t. The exit rate is similarly defined as the number of firms that export in year $t-1$ but do not do so in t relative to the number of firms exporting in year $t-1$. While the entry and exit rates are usually between 30 and 35 percent, the entry rate drops sharply and the exit rate spikes at the onset of the

Figure 2: Foreign Market Entry and Exit Rates



(a) Entry and Exit Rates



(b) Difference in Entry and Exit Rates

Notes: Panel A shows foreign market entry and exit rates in percentage terms from 1994 to 2014. The entry rate is defined as the number of firms exporting in year t that do not do so in year $t-1$, divided by the total number firms that export in year t. The exit rate is similarly defined as the number of firms that export in year $t-1$ but do not do so in year t, relative to the number of firms exporting in year $t-1$. Panel B shows the difference between these entry and exit rates in percentage points. The shaded bars indicate recession years as defined by the National Bureau of Economic Research.

Great Recession. Figure 2b plots the difference between the entry and exit rates and shows that, even though the net difference is typically small and positive, during this period the difference declined by more than 5 percentage points.

III. Regression Evidence

We now turn to understanding the effect that the last two recessions had on the number of firms that export by focusing on each firm's individual decision to sell abroad. We begin by considering a set of estimations that use aggregate measures of economic activity. Building on the influential work of Mian and Sufi (2011), we then consider the effects of firm level proxies of the business cycle. These results in particular draw upon measures of foreign export demand and local conditions in the domestic market. Our findings demonstrate quantitatively that the Great Recession had substantial effects on the extensive margin of firm trade. We then perform a series of estimations that explore the sectoral heterogeneity in these effects.

The Great Recession and Export Participation

Starting with the work of Dixit (1989) and Baldwin and Krugman (1989), a longstanding theoretical literature has investigated the effects that the upfront costs of entering foreign markets have on the dynamics of aggregate exports. This work shows that these costs lead to a data generating process for current firm export status that includes a lag of prior export status. The intuition for this result is that the upfront costs of entering foreign markets create an option value for firms to continue to sell abroad, which in turn induces state dependence in export status. We thus begin with evidence from estimating a dynamic linear probability model. This specification is similar to those in Roberts and Tybout (1997), Bernard and Jensen (2004), Lincoln and McCallum (2018), Lee and Lincoln (2019), and McCallum (2019).

In equation (1) we introduce a stylized form of the specifications we estimate:

$$y_{it} = \alpha y_{it-1} + \beta r_t \times y_{it-1} + X'_{it}\gamma + r_t \times X'_{it}\delta + \phi_i + \phi_{st} + \varepsilon_{it}, \tag{1}$$

in which $y_{it} = \{0, 1\}$ indicates if firm i exports in year t, r_t is a measure related to the U.S. business cycle in year t, ϕ_{st} and ϕ_i are industry-year and firm fixed effects, and ε_{it} is the error term. We define a firm's industry using one digit SIC or NAICS classifications. Among the firm specific variables in X_{it}, we include the log of the average real wage, x_{1it}, the log of the number of employees, x_{2it}, and a young firm indicator variable that takes the value one if the firm is less than five years old and zero otherwise, x_{3it}. The industry-year fixed effects control for changes in variable trade costs, such as tariffs. Kee et al. (2013) in particular analyze trade tariffs and antidumping duties and conclude that the Great Recession was neither a substantial cause nor a consequence of greater protectionism.

Our dynamic linear probability model estimation approach has several advantages. First, it relies on relatively weak assumptions compared to other econometric approaches to estimating this type of data generating process. Second, its simple structure allows for a computationally straightforward consideration of all of the roughly 9.5 million firm-year observations in our main sample from 1993 until 2014. Third, it allows us to exploit the panel structure of the data to control for unobserved heterogeneity at the firm level and allows these individual effects to be correlated with the other independent variables.

As with any econometric technique, however, this approach also has potential drawbacks. Among these are ‘‘Nickell Bias,’’ so named because removing fixed effects by first differencing was shown by Nickell (1981) to give persistence estimates, α, that are biased downward when the true coefficient is positive in dynamic panel data models. We use the within group transformation with time dummies so that the explicit functional form of that bias is given in Hahn and Moon (2006). Additionally, our estimates may also suffer from the problem of initial conditions bias discussed in Heckman (1981).

With $T = 22$ yearly observations, the number of time periods in our panel data set significantly attenuates concerns about both Nickell and initial conditions biases. This is because, for fixed N, the asymptotic Nickell Bias of our estimator is of order $O\left(T^{-1}\right)$ so that as $T \to \infty$ the bias eventually disappears (Hahn and Moon, 2006). Using Monte Carlo experiments, Arellano (2003) in particular argues that if the number of periods is 20 or more, then the downward bias caused by the within group estimator is small. While other solutions for both of these problems are possible, such as Arellano and Bond (1991) and Blundell and Bond (1998), these rely on substantially stronger identifying assumptions. Likewise, Heckman (1981) shows that initial conditions bias disappears as $T \to \infty$.

Aggregate Measures of the Business Cycle

We consider two alternative aggregate measures of the U.S. business cycle. The first uses recession years defined by the NBER as indicators. For $r_t = \{0, 1\}$, we have $r_{2001} = 1$, $r_{2008} = 1$, and $r_{2009} = 1$, while all other years have $r_t = 0$. The second measure uses the log growth of annual real U.S. GDP. These partial equilibrium specifications essentially treat the aggregate business cycle measures as exogenous to the decisions of the firm. This approach is well justified by prior work. Groot et al. (2011) and Eaton et al. (2016), for example, show that the declines in export volumes during this period can be attributed to a shift away from spending on tradable goods.

Table 1 presents our first set of results. Here, we multiply each coefficient estimate and the associated standard error by 100 for presentation purposes. The interpretation of each of the coefficients is that a change equal to one in the covariate is associated with a percentage point (ppt.) change in the probability of exporting equal to the value of the coefficient estimate. For example, the coefficient on ‘‘Exported last year’’ is the marginal ppt. increase in the probability of selling abroad this year if the firm did so last year. Similarly, the coefficient on ‘‘Log employment’’ is the marginal ppt. increase in the probability of exporting this year if a firm’s employment increased by 100 log percent. The coefficient on the interaction terms, ‘‘Recession $\times$ Log employment,’’ for example, captures the effect

Table 1: Export Participation and Recessions

	Dependent Variable: $y_{it} = \{0, 1\}$			
	(1)	(2)	(3)	(4)
Exported last year (y_{it-1})	16.98***	16.99***	16.06***	16.07***
	(0.06)	(0.06)	(0.05)	(0.05)
Exported two years ago (y_{it-2})			5.07***	5.07***
			(0.05)	(0.05)
Recession × Exported	−0.95***	−0.99***	−0.46***	−0.50***
last year ($r_t \times y_{it-1}$)	(0.07)	(0.08)	(0.10)	(0.10)
Recession × Exported			−0.92***	−0.95***
two years ago ($r_t \times y_{it-2}$)			(0.10)	(0.10)
Log employment (x_{1it})	7.16***	7.16***	6.96***	6.95***
	(0.03)	(0.03)	(0.03)	(0.03)
Log average wages (x_{2it})	4.26***	4.24***	4.17***	4.14***
	(0.04)	(0.04)	(0.04)	(0.04)
Young (x_{3it})	-0.68***	-0.71***	-0.50***	-0.54***
	(0.05)	(0.05)	(0.05)	(0.05)
Recession × Log		0.01		0.02
employment ($r_t \times x_{1it}$)		(0.02)		(0.02)
Recession × Log		0.18***		0.20***
average wages ($r_t \times x_{2it}$)		(0.04)		(0.05)
Recession × Young ($r_t \times x_{3it}$)		0.21**		0.24**
		(0.10)		(0.11)
Industry × Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	9.47	9.47	9.47	9.47

Notes: The table presents the results from estimating variants of the following equation from the main text:

$$y_{it} = \alpha y_{it-1} + \beta r_t \times y_{cit-1} + X'_{it}\gamma + r_t \times X'_{it}\delta + \phi_i + \phi_{st} + \varepsilon_{it}. \quad (1)$$

$y_{it} = \{0, 1\}$ indicates if firm i exports in year t, r_t is an indicator function for a U.S. recession in year t, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls, and ε_{it} is the error term. x_{3it} is a young firm indicator variable for whether the firm is less than 5 years old. Throughout, we multiply each coefficient estimate and the associated standard error by 100 for presentation purposes. This scaling implies that the probability of exporting changes by coefficient percentage points when an indicator variable equals one and when a log-continuous variable increases by 100 log percent. R^2 values range between 21 and 25 percent. Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

during a recession of increasing a firm's employment by 100 log percent. Importantly, the total effect of a recession and higher employment would need to consider the linear and interacted terms together. Regressions including export status lagged by three years give similar results. The same is true of estimations that lag the control variables by one year.

This is consistent with the prior literature.

Based on Figure 2, we expect the probability of exit to rise during downturns. These results are borne out, as the coefficient on the interaction term between the recession indicator and prior exporting status is negative for both the first and second lags. Focusing on columns (1) and (2), we can see that recessions reduced the probability of exporting by about 1 ppt. for firms that exported last year. In columns (3) and (4), the effect of recessions on firms that exported last year is somewhat lower. The effect on the interaction with exporting two years ago, however, is substantial. More broadly, we find that larger firms and those with a more skilled workforce, as measured by employment and average wages, are more likely to export. This is consistent with the broader empirical and theoretical trade literature. Young firms are also less likely to sell abroad overall. However, they are more likely to engage in exporting during recessions than older firms. This is an understudied issue and suggests that young firms may turn more towards foreign markets during downturns.

We consider a similar set of estimations in which we use separate indicators for the two recessions in our sample in appendix Table A1. While both downturns had a negative impact on export participation, the effect of the Great Recession was about twice as large. Interestingly, here and in following estimations larger firms and those with a more skilled workforce fared better during the Great Recession. As these firms are more likely to export in the first place, it is natural that they would have a stronger attachment to foreign markets during downturns. Consistent with Table 1, young firms were also more likely to export both during the 2001 recession and during the Great Recession.

Table 2 replaces the recession year indicators in these estimations with U.S. real GDP growth. The interpretation of the coefficients on these variables is that 100 log percent growth is associated with a ppt. change in the probability of exporting equal to the coefficient for firms that exported in the previous year. As such, column (1) implies that a recession with negative one log percent growth lowers the probability of exporting by 0.41 ppt. for firms that sold abroad last year. Note that the main coefficients of interest using

Table 2: Export Participation and Real GDP Growth

	Dependent Variable: $y_{it} = \{0, 1\}$			
	(1)	(2)	(3)	(4)
Exported last year (y_{it-1})	15.85***	15.82***	15.26***	15.23***
	(0.07)	(0.07)	(0.07)	(0.07)
Exported two years ago (y_{it-2})			4.29***	4.27***
			(0.06)	(0.06)
$\Delta \log RGDP \times$ Exported	41.27***	42.38***	30.83***	31.85***
last year ($r_t \times y_{it-1}$)	(1.68)	(1.76)	(2.03)	(2.06)
$\Delta \log RGDP \times$ Exported			27.22***	28.03***
two years ago ($r_t \times y_{it-2}$)			(1.98)	(2.00)
Log employment (x_{1it})	7.17***	7.20***	6.96***	7.00***
	(0.03)	(0.04)	(0.03)	(0.03)
Log average wages (x_{2it})	4.27***	4.27***	4.18***	4.19***
	(0.04)	(0.04)	(0.04)	(0.04)
Young (x_{3it})	-0.68***	-0.55***	-0.50***	-0.35***
	(0.05)	(0.08)	(0.05)	(0.08)
$\Delta \log RGDP \times$ Log		−1.63***		−1.99***
employment ($r_t \times x_{1it}$)		(0.50)		(0.49)
$\Delta \log RGDP \times$ Log		−0.25		−0.74
average wages ($r_t \times x_{2it}$)		(1.07)		(1.06)
$\Delta \log RGDP \times$ Young ($r_t \times x_{3it}$)		−4.94**		−5.36**
		(2.38)		(2.39)
Industry × Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	9.47	9.47	9.47	9.47

Notes: The table presents the results from estimating variants of equation (1) such as:

$$y_{it} = \alpha y_{it-1} + \beta \Delta \log RGDP_t \times y_{it-1} + X'_{it}\gamma + \Delta \log RGDP_t \times X'_{it}\delta + \phi_i + \phi_{st} + \varepsilon_{it}.$$

$y_{it} = \{0, 1\}$ indicates if firm i exports in year t, $\Delta \log RGDP_t$ is U.S. real GDP growth in year t, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls, and ε_{it} is the error term. x_{3it} is a young firm indicator variable for whether the firm is less than 5 years old. The scaling of the results is generally done as in Table 1. For the variables that include real GDP growth, however, we scale the results so that 100 log percent growth changes the probability of exporting by coefficient ppt. R^2 values range between 21 and 25 percent. Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

growth intuitively have the opposite sign of those on the interactions included in Table 2.

Our estimates in column (4) suggest that in 2009, firms that exported in the prior two years were 0.88 ppt. less likely to export because U.S. real GDP shrank by 0.3 log percent in 2008 and shrank by an additional 2.8 log percent in 2009. The size and significance of the

coefficients included in Table 2 are broadly consistent with those in the previous estimations. With regards to young firms, we again find that these businesses are more likely to export than older firms during times of low real GDP growth.

In the same vein as work by Blum et al. (2013), we also estimated the specification in column (4) of Table 2 separately for perennial and occasional exporters. We define occasional exporters as those having sold abroad at least once during our sample period but also having five years or less of observed exporting experience. As this definition would imply, perennial exporters exhibit higher export status persistence compared to occasional exporters. Real GDP growth, however, affects the probability that these two types of firms continue exporting in much the same way as it did in our estimations for all firms.

Foreign and Domestic Channels

In this section, we consider measures of foreign and local conditions to understand the channels through which the Great Recession affected export participation. In particular, we use the log difference in industry level exports and U.S. county level house prices to proxy for firm specific foreign and local U.S. conditions. Our foreign exports measure accounts for the export demand shock that a firm might face. On the domestic side, many recent studies have documented the effect of changes in local house prices and economic activity during and after the Great Recession (Mian and Sufi, 2011; Adelino et al., 2015; Schmalz et al., 2017). Following this work, we use the change in county level house price indexes from Bogin et al. (2019) as a measure of changes in local conditions. This measure will capture local demand shocks as well as the effect of local credit supply shocks.

Specifically, our measures of foreign and local shocks are given by

$$d_{it} = \sum_{s} \frac{E_{ist-1}}{E_{it-1}} \Delta \ln \left(D_{st} \right), \qquad p_{it} = \sum_{c} \frac{E_{ict-1}}{E_{it-1}} \Delta \ln \left(P_{ct} \right). \tag{2}$$

We define the firm level export demand shock,d_{it}, as the geometric average of the change in industry level real exports. We use the share of total employment, $\frac{E_{ist-1}}{E_{it-1}}$, for firm i in

industry s in year $t-1$ to apportion the log difference in U.S. industry level real exports, $\Delta \ln(D_{st}) = \ln(D_{st}) - \ln(D_{st-1})$, to each firm. Similarly, we define the firm level house price shock, p_{it}, as the geometric average of the change in county level house prices. We use the share of employees, $\frac{E_{ict-1}}{E_{it-1}}$, for firm i located in county c in year $t-1$ to apportion the log difference in county level house price changes, $\Delta \ln(P_{ct})$, to each firm. The units for each of these measures are log percent changes.

The underlying assumption behind using geometric averages in equation (2) is that foreign demand shocks to a particular industry will affect each firm in proportion to its employment in that particular industry. Likewise, county level shocks are assumed to affect a firm according to the share of its employees who work at establishments in that geographic area. Since the LBD records employment at the industry and county level for establishments within each firm, employment shares can vary over time within the same firm as different establishments grow or shrink. We lag the shares by one year so that they do not change in response to current developments. On average across years and firms, our foreign demand measure grew by about 5 percent annually while the local house price measure grew by roughly 3 percent each year.

Using these measures of domestic and foreign shocks, we estimate three specifications. A stylized version encompassing all three is

$$\begin{aligned} y_{it} &= \alpha y_{it-1} + \beta d_{it} + \gamma p_{it} + \delta d_{it} \times y_{t-1} + \zeta p_{it} \times y_{t-1} \\ &+ X'_{it}\eta + d_{it} \times X'_{it}\lambda + p_{it} \times X'_{it}\theta + \phi_i + \phi_{st} + \varepsilon_{it}. \end{aligned} \tag{3}$$

The definitions of the other covariates here are the same as in equation (1). The three specifications will, in turn, include only foreign shocks, only local shocks, and then both types of shocks together. Considering them simultaneously will allow us to compare the roles of foreign and local conditions.

Table 3 presents the results. Column (1) shows that a negative 100 log percent foreign

Table 3: Export Participation, Foreign Demand, and Local House Prices

	Dependent Variable: $y_{it} = \{0, 1\}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Exported last year (y_{it-1})	16.83***	16.83***	16.83***	16.80***	16.81***	16.78***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
Foreign demand (d_{it})	0.36***		0.36***	0.15		0.23
	(0.05)		(0.05)	(0.19)		(0.19)
Local house prices (p_{it})		0.34	0.33		-6.31***	-6.22***
		(0.24)	(0.24)		(0.82)	(0.82)
Foreign demand × Exported last year ($d_{it} \times y_{it-1}$)				0.58***		0.56***
				(0.13)		(0.13)
Local house prices × Exported last year ($p_{it} \times y_{it-1}$)					0.91**	0.81**
					(0.38)	(0.38)
Log employment (x_{1it})	7.16***	7.16***	7.16***	7.16***	7.17***	7.17***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Log average wages (x_{2it})	4.26***	4.27***	4.26***	4.26***	4.21***	4.21***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Young (x_{3it})	-0.69***	-0.69***	-0.69***	-0.68***	-0.64***	-0.63***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Foreign demand × Log employment ($d_{it} \times x_{1it}$)				-0.04*		-0.04*
				(0.03)		(0.03)
Foreign demand × Log average wages ($d_{it} \times x_{2it}$)				0.07		0.04
				(0.06)		(0.06)
Foreign demand × Young ($d_{it} \times x_{3it}$)				-0.13		-0.11
				(0.14)		(0.14)
Local house prices × Log employment ($p_{it} \times x_{1it}$)					-0.21*	-0.20*
					(0.11)	(0.11)
Local house prices × Log average wages ($p_{it} \times x_{2it}$)					2.03***	2.00***
					(0.23)	(0.23)
Local house prices × Young ($p_{it} \times x_{3it}$)					-1.14*	-1.12*
					(0.58)	(0.59)
Industry × Year FE (ϕ_{st})	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes	Yes	Yes
Obs. (millions)	9.47	9.47	9.47	9.47	9.47	9.47

Notes: The table presents the results from estimating variants of the following equation from the main text:

$$\begin{aligned} y_{it} &= \alpha y_{it-1} + \beta d_{it} + \gamma p_{it} + \delta d_{it} \times y_{t-1} + \zeta p_{it} \times y_{t-1} \\ &+ X'_{it}\eta + d_{it} \times X'_{it}\lambda + p_{it} \times X'_{it}\theta + \phi_i + \phi_{st} + \varepsilon_{it}. \quad (3) \end{aligned}$$

$y_{it} = \{0, 1\}$ indicates if firm i exports in year t, d_{it} is a measure of foreign demand shocks, p_{it} is a measure of local house price shocks, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls, and ε_{it} is the error term. x_{3it} is young firm indicator variable for whether the firm is less than 5 years old. The scaling of the results is done as in Table 1. R^2 values are roughly 22 percent across each of the estimations. Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

demand shock reduces the probability that a firm exports by about 1/3 ppt., which is approximately the same size effect as that of a local house price shock in column (2). Column (3) includes both shocks together, finding that the coefficients on each of these factors remain essentially the same when considered simultaneously. Although the coefficient on local house prices is insignificant, in each of these approaches the point estimates suggest that the magnitude of foreign and local effects were broadly similar.

Column (4) takes the specification in column (1) and additionally interacts the covariates with the foreign demand shock. It shows that the overall effect of changes in foreign demand works through its interaction with last year's export status. Intuitively, in response to a decline in foreign demand, firms that exported last period become less likely to export this period. Coefficients on the linear terms are little changed and the interacted foreign demand effects are small and mostly insignificant. Column (5) instead adds interaction terms to the house price shocks specification. As in column (4), we find significant effects for the interaction of house prices with previous export status and the magnitude of this coefficient is much larger than the foreign demand effects. Finally, column (6) includes all of the covariates and interaction terms simultaneously and leads to similar conclusions.

Sectoral Patterns

While much of the literature on international trade has focused on manufacturing, our results in Tables 1 and 2 include firms in all industries that ever sell abroad. This section exploits the comprehensiveness of our data to examine the effects across three broadly defined sectors: (i) manufacturing, (ii) services, and (iii) wholesale and retail. These industries account for the overwhelming majority, but not all, of U.S. exports.[2]

Table 4 presents the results. We find that there is substantial heterogeneity across sectors with regards to firms' exporting behavior. First, export status in the previous two years has stronger effects for the manufacturing sector than for the wholesale/retail and

[2]Trade in the services sector in particular has gained substantial attention in recent years. See, for example, Jensen (2011), Lincoln (2012), and Blinder and Krueger (2013).

Table 4: Export Participation and GDP Growth by Sector

	Dependent Variable: $y_{it} = \{0, 1\}$			
	(1)	(2)	(3)	(4)
	All Firms	Manufacturing	Services	Wholesale/Retail
Exported last year (y_{it-1})	15.23***	20.03***	12.20***	15.07***
	(0.07)	(0.16)	(0.14)	(0.11)
Exported two years ago (y_{it-2})	4.27***	6.09***	2.94***	4.20***
	(0.06)	(0.15)	(0.13)	(0.10)
$\Delta \log RGDP \times$ Exported	31.85***	28.48***	19.98***	28.32***
last year ($r_t \times y_{it-1}$)	(2.06)	(4.64)	(4.38)	(3.24)
$\Delta \log RGDP \times$ Exported	28.03***	30.54***	12.59***	30.91***
two years ago ($r_t \times y_{it-2}$)	(2.00)	(4.56)	(4.16)	(3.18)
Log employment (x_{1it})	7.00***	8.43***	5.81***	7.92***
	(0.03)	(0.07)	(0.07)	(0.06)
Log average wages (x_{2it})	4.19***	5.60***	2.75***	5.36***
	(0.04)	(0.11)	(0.08)	(0.07)
Young (x_{3it})	-0.35***	-0.74***	-0.58***	0.13
	(0.08)	(0.19)	(0.17)	(0.13)
$\Delta \log RGDP \times$ Log	-1.99***	-0.54	1.04	-4.91***
employment ($r_t \times x_{1it}$)	(0.49)	(1.06)	(0.92)	(0.91)
$\Delta \log RGDP \times$ Log	-0.74	3.94	2.65	-10.22***
average wages ($r_t \times x_{2it}$)	(1.06)	(2.93)	(1.85)	(1.81)
$\Delta \log RGDP \times$ Young ($r_t \times x_{3it}$)	-5.36**	1.96	-0.22	-11.05***
	(2.39)	(5.31)	(4.85)	(3.77)
Industry $\times$ Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	9.47	2.14	2.20	3.64

Notes: The table presents the results from estimating variants of the following equation:

$$y_{it} = \alpha y_{it-1} + \beta \Delta \log RGDP_t \times y_{cit-1} + X'_{it}\gamma + \Delta \log RGDP_t \times X'_{it}\delta + \phi_i + \phi_{st} + \varepsilon_{it}.$$

$y_{it} = \{0, 1\}$ indicates if firm i exports in year t, $\Delta \log RGDP_t$ is U.S. real GDP growth in year t, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls and ε_{it} is the error term. x_{3it} is a young firm indicator variable for whether the firm is less than 5 years old. The scaling of the results is done as in Table 2. Column (1) shows the estimates for all firms together while columns (2)-(4) provide the results for the manufacturing, services, and wholesale/retail sectors, respectively. Across columns (1)-(4), R^2 values are roughly 25, 38, 12, and 21 percent. Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

services sectors. At the same time, firms in manufacturing and wholesale/retail that sold abroad in previous years appear to be more responsive to changes in real GDP growth than firms in the services sector. While not determinative, this suggests that a secular shift in the economy towards services could reduce the responsiveness of aggregate exports to recessions

through a composition effect. Second, when real GDP growth is high, firms in the wholesale/retail sector are less likely to export when they are large or pay high wages. They are substantially more likely to sell abroad during recessions, however. Firms in other sectors do not show nearly the same type of differential response for any of these interaction effects. This suggests that the response of large, high wage, and young firms to recessions for the whole sample in these estimations is primarily driven by the firms in the wholesale/retail sector.

In Table 5 we consider different types of sectoral heterogeneity. We estimate specifications that make three primary distinctions based on what kinds of goods firms produce and the nature of their production processes: (i) durable vs. nondurable goods, (ii) intermediate vs. final goods, and (iii) externally financially dependent vs. not externally financially dependent. Analysis of the effects of these forms of firm heterogeneity has played a substantial role in the prior literature on the Great Recession. Levchenko et al. (2010b) in particular show that a large portion of the decline in goods trade during the Great Recession can be explained by the decline in durables. They further argue that restrictions in trade credit did not play a large role in the trade collapse. di Giovanni and Levchenko (2010) relatedly show that vertical linkages were an important factor for comovement during this period. A large literature more broadly considers the role of financial constraints during the Great Recession, such as Duygan-Bump et al. (2015) and Siemer (2019). Given the nature of these distinctions as well as the importance of manufacturing to aggregate trade, here we limit our analysis to firms in this sector.[3]

Column (1) of Table 5 presents the estimates for all manufacturing firms together using the specifications considered in column (2) of Table 2. Columns (2)-(4) show estimations

[3]We rely on the sectoral credit constraint measures that were developed by Rajan and Zingales (1998) and Cetorelli and Strahan (2006). Our analysis follows the latter study to construct our estimates of external financial dependence. To do so, we compute the sum of a firm's total capital expenditures over all years and then subtract cash flow from operations for all Compustat firms older than 10 years old from 1980-1997. The sectoral measure is then defined as the median external financial dependence value of all firms in a given 2 digit SIC sector. To construct the indicator variable for final goods, we classify firms based on the median level of the upstream variable reported in di Giovanni and Levchenko (2010).

Table 5: Export Participation and GDP Growth: Durable Goods, Final Goods, and High External Finance Dependence Sectors

	Dependent Variable: $y_{it} = \{0,1\}$			
	(1) Manufacturing	(2) Durables	(3) Final Goods	(4) High EFD
Exported last year (y_{it-1})	20.03***	19.27***	20.85***	19.87***
	(0.16)	(0.29)	(0.46)	(0.17)
Exported two years ago (y_{it-2})	6.09***	4.81***	5.73***	6.08***
	(0.15)	(0.27)	(0.43)	(0.16)
$\Delta \log RGDP \times$ Exported	28.48***	6.51	39.21***	25.88***
last year ($r_t \times y_{it-1}$)	(4.64)	(8.63)	(13.63)	(5.01)
$\Delta \log RGDP \times$ Exported	30.54***	32.81***	10.42	30.13***
two years ago ($r_t \times y_{it-2}$)	(4.56)	(8.48)	(13.41)	(4.93)
Exported last year		1.04***	-0.92*	1.06**
$\times$ Indicator		(0.35)	(0.49)	(0.45)
Exported two years ago		1.77***	0.41	0.04
$\times$ Indicator		(0.32)	(0.46)	(0.41)
$\Delta \log RGDP \times$ Exported		30.87***	-12.24	17.75
last year $\times$ Indicator		(10.23)	(14.48)	(13.29)
$\Delta \log RGDP \times$ Exported		-3.51	22.77	2.73
two years ago $\times$ Indicator		(10.06)	(14.24)	(13.00)
Log employment (x_{1it})	8.43***	8.33***	8.92***	8.45***
	(0.07)	(0.14)	(0.20)	(0.08)
Log employment		0.15	-0.56**	-0.07
$\times$ Indicator		(0.20)	(0.28)	(0.25)
Log average wages (x_{2it})	5.60***	5.18***	5.95***	5.51***
	(0.11)	(0.18)	(0.27)	(0.12)
Log average wages		0.58***	-0.39	0.54**
$\times$ Indicator		(0.20)	(0.28)	(0.25)
Young (x_{3it})	-0.74***	-0.25	-0.59	-1.09***
	(0.19)	(0.38)	(0.55)	(0.21)
Young $\times$ Indicator		-0.66	-0.17	1.69***
		(0.43)	(0.58)	(0.43)
$\Delta \log RGDP \times$ Firm Covariates	Yes	Yes	Yes	Yes
$\Delta \log RGDP \times$ Firm Covariates $\times$ Indicator	Yes	Yes	Yes	Yes
Industry $\times$ Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	2.135	2.135	2.135	2.135

Notes: The table presents the results from estimating variants of the following equation:

$$y_{it} = \alpha y_{it-1} + \beta \Delta \log RGDP_t \times y_{cit-1} + X'_{it}\gamma + \Delta \log RGDP_t \times X'_{it}\delta + \phi_i + \phi_{st} + \varepsilon_{it}.$$

$y_{it} = \{0,1\}$ indicates if firm i exports in year t, $\Delta \log RGDP_t$ is U.S. real GDP growth in year t, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls, and ε_{it} is the error term. "Indicator" denotes a variable that takes a value of one for the respective measure in each column and zero otherwise. The scaling of the results is done as in Table 2. The R^2 values are roughly 25 percent in column (1) and 38 percent in columns (2)-(4). Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

that interact an indicator variable for the measure corresponding to the heading with other covariates. Thus, in column (2) the indicator variable takes the value of 1 for durable goods sectors, in column (3) it takes the value of 1 for final goods sectors, and in column (4) it takes the value of 1 for sectors that are dependent on external finance (EFD sectors). These indicators are constant across time for each firm so their direct effect on export status is captured by the firm fixed effects. The main coefficients of interest in these specifications are those on the triple interaction terms between real GDP growth, lagged export status, and the sectoral indicators. For parsimony, we report only the main results for these estimations; appendix Table A2 presents the full results.

Consistent with the findings in Levchenko et al. (2010b), durable goods firms show the most significant difference relative to other firms. Relative to others, producers in this sector are more likely to export if they have sold abroad in the past two years. These firms are also more responsive to real GDP growth if they exported last year. The final goods sector essentially behaves like manufacturing as a whole. Finally, firms in sectors with high dependence on external financing behave similarly to other manufacturing firms, with the exception of young firms. These new businesses are more likely to export than other manufacturing firms.

Table 6 extends the analysis in Table 5 by exploring sectoral heterogeneity in the response of firms to foreign versus local shocks. Here, we similarly restrict the sample to manufacturing producers and consider the same types of distinctions between firms.

In column (2), durable goods manufacturers are more affected by foreign demand than others while the differential effect of local conditions is not statistically significant. Column (3) shows that neither foreign nor local shocks have a statistically significant effect on export participation for final goods firms relative to other producers. Lastly, in column (4) we find that firms that are dependent on external finance are less sensitive to foreign shocks but much more sensitive to local house price shocks. Our estimates imply that, holding all else equal, the probability that exports from firms that are dependent on external finance would

Table 6: Export Participation, Foreign Demand and Local House Prices by Sector

	Dependent Variable: $y_{it} = \{0, 1\}$			
	(1) Manufacturing	(2) Durables	(3) Final Goods	(4) High EFD
Exported last year (y_{it-1})	22.30***	20.58***	23.23***	22.05***
	(0.12)	(0.22)	(0.34)	(0.13)
Exported last year (y_{it-1}) × Indicator		2.38***	-1.06***	1.69***
		(0.26)	(0.36)	(0.33)
Foreign demand (d_{it})	0.31	-0.30	0.29	0.46**
	(0.21)	(0.31)	(0.39)	(0.22)
Foreign demand (d_{it}) × Indicator		1.08***	0.03	-0.83*
		(0.39)	(0.44)	(0.49)
Local house prices (p_{it})	0.98*	0.66	1.70	0.20
	(0.55)	(0.86)	(1.14)	(0.58)
Local house prices (p_{it}) × Indicator		0.42	-0.85	4.82***
		(0.93)	(1.18)	(1.04)
Log employment (x_{1it})	8.73***	8.56***	9.18***	8.73***
	(0.07)	(0.13)	(0.19)	(0.08)
Log employment (x_{2it}) × Indicator		0.24	-0.52**	-0.02
		(0.16)	(0.21)	(0.19)
Log average wages (x_{2it})	5.82***	5.50***	6.16***	5.75***
	(0.09)	(0.16)	(0.25)	(0.09)
Log average wages (x_{2it}) × Indicator		0.45**	-0.38	0.42*
		(0.19)	(0.26)	(0.24)
Young (x_{3it})	-1.08***	-0.53**	-1.08***	-1.17***
	(0.11)	(0.21)	(0.31)	(0.12)
Young (x_{3it}) × Indicator		-0.75***	-0.00	0.51*
		(0.25)	(0.32)	(0.27)
Industry × Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	2.135	2.135	2.135	2.135

Notes: The table presents the results from estimating variants of the following equation from the main text:

$$\begin{aligned} y_{it} &= \alpha y_{it-1} + \beta d_{it} + \gamma p_{it} + \delta d_{it} \times y_{t-1} + \zeta p_{it} \times y_{t-1} \\ &+ X'_{it}\eta + d_{it} \times X'_{it}\lambda + p_{it} \times X'_{it}\theta + \phi_i + \phi_{st} + \varepsilon_{it}. \quad (3) \end{aligned}$$

$y_{it} = \{0, 1\}$ denotes if firm i exports in year t, d_{it} is a measure of foreign demand shocks, p_{it} is a measure of local house price shocks, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls, and ε_{it} is the error term. x_{3it} is a young firm indicator variable for whether the firm is less than 5 years old. d_{it} and p_{it} are given in equation (2). "Indicator" denotes a variable that takes a value of one for the respective measure in each column and zero otherwise. The scaling of the results is done as in Table 1. The R^2 values are roughly 25 percent in column (1) and 34 percent in columns (2)-(4). Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

fall by about 5 percentage points more than other firms if house prices declined by 1 percent. Fluctuations in the value of real estate as collateral could be a potential explanation for these estimates that would be supported by theory.

IV. Aggregate Implications and Counterfactuals

The previous section showed that the Great Recession substantially impacted firms' individual export participation decisions. However, our results are not dispositive about whether firms' participation choices had quantitatively important implications for aggregate export growth over time. It could be, for example, that while there are fewer firms exporting, this does not affect total foreign sales substantially. This mapping from micro to macro effects explicate how much the extensive margin affected the trajectory of aggregate exports after the Great Recession ended.

In this section, we consider a different estimation approach from the previous section that allows us to consider how aggregate foreign sales would have evolved after the Great Recession if different margins of exports had followed their historical trajectory. We first present an exact decomposition of export growth, which includes the role of changes in behavior by incumbent exporters as well as the contribution from firms entering and exiting foreign markets. This approach allows us to connect aggregate growth in foreign sales with the outcomes of individual firms during and after the Great Recession. We then study the implications of several partial equilibrium counterfactuals to better understand the importance of different margins of exporting on the recovery of aggregate foreign sales after the Great Recession.

An Exact Export Growth Decomposition

Our decomposition of total real export growth is based on the work of di Giovanni et al. (2014). Log growth of total exports over h years g_t^h can be decomposed into five margins as:

$$
\begin{aligned}
g_t^h \equiv & \underbrace{\ln\left(\frac{\bar{X}_t\left(I_{t\cap t-h}\right)}{\bar{X}_{t-h}\left(I_{t\cap t-h}\right)}\right)}_{i_t^h=\text{ intensive margin}} \\
+ & \underbrace{\underbrace{\ln\left(\frac{N_t\left(I_t\right)}{N_t\left(I_{t\cap t-h}\right)}\right)}_{ee_t^h=\text{ entry extensive}} + \underbrace{\ln\left(\frac{\bar{X}_t\left(I_t\right)}{\bar{X}_t\left(I_{t\cap t-h}\right)}\right)}_{ei_t^h=\text{ entry intensive}}}_{e_t^h=\text{ entry margin}} - \underbrace{\underbrace{\ln\left(\frac{N_{t-h}\left(I_{t-h}\right)}{N_{t-h}\left(I_{t\cap t-h}\right)}\right)}_{xe_t^h=\text{ exit extensive}} - \underbrace{\ln\left(\frac{\bar{X}_{t-h}\left(I_{t-h}\right)}{\bar{X}_{t-h}\left(I_{t\cap t-h}\right)}\right)}_{xi_t^h=\text{ exit intensive}}}_{x_t^h=\text{ exit margin}} \\
& \underbrace{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}_{n_t^h=\text{ net extensive margin}}
\end{aligned}
\tag{4}
$$

I_t is the set of firms that export in year t, $N_t\left(I_t\right)$ is the number of exporting firms in year t, and $\bar{X}_t\left(I_t\right)$ is average foreign sales per firm in year t. $I_{t\cap t-h}$ is the set of firms that sell abroad in both years t and $t-h$. Likewise, $N_t\left(I_{t\cap t-h}\right)$ is the number of firms that export in both years t and $t-h$ and $\bar{X}_t\left(I_{t\cap t-h}\right)$ denotes the average foreign sales per incumbent exporting firm in year t. The decomposition uses the fact that exports for any subset of firms can be written as the product of the number of firms selling abroad and the average foreign sales of each firm in the relevant subset. For example, total exports in year t by incumbents with h years of exporting history can be written as $\sum_{i\in I_{t\cap t-h}} X_{it} = N_t\left(I_{t\cap t-h}\right)\bar{X}_t\left(I_{t\cap t-h}\right)$. A detailed derivation and an additional discussion of this decomposition are included in appendix B.

The term i_t^h in equation (4) is the intensive margin contribution in year t to total log growth over the past h years by firms that exported in both years t and $t-h$. By definition, the number of these incumbent exporters in year t is the same as the number in year $t-h$ so that $N_t\left(I_{t\cap t-h}\right) = N_{t-h}\left(I_{t\cap t-h}\right)$. As such, the intensive margin is unaffected by changes in the number of firms and is summarized by changes in the average exports of incumbents. The remaining four margins of equation (4) together compose the net extensive margin n_t^h. As the name implies, this includes the entry margin e_t^h minus the exit margin x_t^h. We define e_t^h as the contribution to total export growth of firms that sold abroad in year t but did not do so in year $t-h$. Similarly, we define x_t^h as the contribution to export growth of firms

that sold abroad in year $t-h$ but did not do so in year t. We further decompose the entry and exit margins into the contribution of the number of exporting firms and average exports per entering and exiting firm. The entry margin is made up of the entry extensive margin ee_t^h, which captures the number of entrants relative to the number of incumbents, and the entry intensive margin ei_t^h, which captures the effect of the average size of those entrants.

For the purposes of giving intuition for the discussion of our results, note that the entry extensive margin can also be written as

$$\ln\left(\frac{N_t\left(I_t\right)}{N_t\left(I_{t\cap t-h}\right)}\right)=\ln\left(1+\frac{N_t\left(I_{t\setminus t-h}\right)}{N_t\left(I_{t\cap t-h}\right)}\right). \tag{5}$$

The measure of the entry rate given by the ratio in the right-hand side of equation (5) is the number of firms that exported in year t but did not do so in year $t-h$ divided by the total number of firms that exported in both periods. We use set notation to denote the firms that are new entrants which are formally given by the set $I_{t\setminus t-h}=\{i:i\in I_t, i\notin I_{t-h}\}$.

Like the entry margin, the exit margin is made up of the exit extensive margin xe_t^h, which captures the number of exiting firms relative to the number of incumbents, and the exit intensive margin xi_t^h, which captures the average size of exiting firms. We similarly can write the contribution to total export growth from the number of exiting firms as

$$\ln\left(\frac{N_{t-h}\left(I_{t-h}\right)}{N_t\left(I_{t\cap t-h}\right)}\right)=\ln\left(1+\frac{N_{t-h}\left(I_{t-h\setminus t}\right)}{N_t\left(I_{t\cap t-h}\right)}\right). \tag{6}$$

The ratio on the right-hand side of equation (6) provides a measure of the exit rate, which is the number of firms that export in year $t-h$ but not in year t divided by the number of firms that export in both periods. Similarly, we define the set in the numerator as $I_{t-h\setminus t}=\{i:i\notin I_t, i\in I_{t-h}\}$.

The entry and exit extensive margins as written in (5) and (6) give a sense how the regressions based on equation (1) in the prior section are connected to this decomposition. When $h=1$, the fraction of firms that enter $\frac{N_t\left(I_{t\setminus t-1}\right)}{N_t\left(I_{t\cap t-1}\right)}$ is akin to the model's predicted

probability of entry, $P\left[y_{it}=1 \mid y_{it-1}=0, X_{it}\right]$. The fraction of firms that exit $\frac{N_{t-1}\left(I_{t-1\setminus t}\right)}{N_t(I_{t\cap t-1})}$ is similarly linked to the probability of exit, $P\left[y_{it}=0 \mid y_{it-1}=1, X_{it}\right]$.

Table 7: Annualized Real Export Log Growth Decomposition, 1993-2006 vs. 2008-2014

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$
	Panel A: 1993-2006 Average					
Total growth	6.08	5.67	5.34	5.10	4.78	4.67
Intensive margin	6.82	6.54	6.24	5.96	5.66	5.60
Net extensive	-0.74	-0.87	-0.90	-0.86	-0.88	-0.93
Entry margin	2.91	2.71	2.63	2.58	2.54	2.49
- extensive	44.64	29.48	23.64	20.41	18.29	16.79
- intensive	-41.73	-26.77	-21.01	-17.83	-15.75	-14.30
Exit margin	-3.65	-3.58	-3.53	-3.44	-3.42	-3.42
- extensive	-42.41	-27.26	-21.50	-18.34	-16.28	-14.75
- intensive	38.76	23.68	17.97	14.90	12.86	11.33
	Panel B: 2008-2014					
Total growth	-15.65	-1.06	1.47	2.21	2.24	2.35
Intensive margin	-15.11	-0.41	2.09	3.05	2.89	3.00
Net extensive	-0.53	-0.65	-0.62	-0.84	-0.64	-0.65
Entry margin	2.17	2.18	2.25	2.12	2.10	1.90
- extensive	34.96	23.11	18.14	15.76	13.65	12.26
- intensive	-32.79	-20.93	-15.89	-13.65	-11.55	-10.36
Exit margin	-2.70	-2.83	-2.88	-2.96	-2.74	-2.55
- extensive	-42.42	-25.53	-19.28	-16.58	-12.10	-13.16
- intensive	40.12	22.70	16.40	13.63	11.78	10.61

Notes: The table presents the results from decomposing changes in aggregate real exports over the period 1993-2006 as well as over 2008-2014. The findings for the different margins are calculated using equation (4). Each column corresponds to a different value of h, the time horizon over which the changes are estimated. For ease of comparison, we annualize the log growth rates and contributions from each margin by dividing each figure by h.

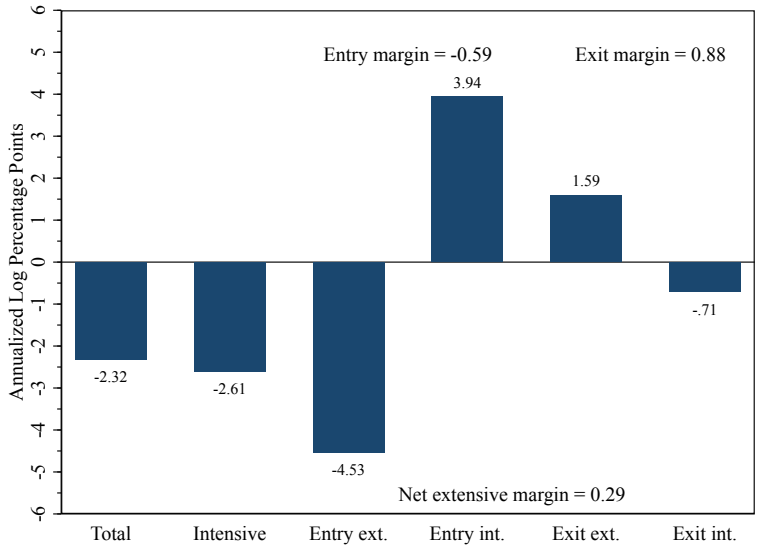
Panel A of Table 7 presents annualized estimates of each of the five terms in equation (4) for all U.S. firms that exported at least once between 1993 and 2006 for horizons between one year and six years. This gives us a historical baseline that we can use to compare to the evolution of exports during and after the Great Recession. Panel B shows the same decomposition starting in 2008. All measures of exports are adjusted using the goods exports

deflator from the national income and product accounts (NIPA) with 2000 as the base year and are reported as annualized rates so that they can be compared across different horizons. As shown in column $h = 1$ in Panel A of Table 7, one year log growth averaged 6.1 log percent per year between 1993 and 2006. The intensive margin on average contributes 6.8 log percentage points (lppt.), while the net extensive margin contributes negative 0.7 lppt. That is, on average, export growth between two consecutive years during this period was entirely driven by incumbents. Firms entering and exiting foreign markets on net contribute negatively to total export growth.

This small negative net contribution contains significant gross churn in the entry and exit margins, which on average contribute 2.9 and negative 3.7 lppt., respectively. A closer examination of the extensive margin reveals that, relative to incumbents, a large number of new firms begin to export each period. However, these entrants tend to be relatively small. The number of new exporters contributes 44.7 lppt. via the entry extensive margin. Since new exporters sell less abroad than incumbents, bringing down the average, they also reduce total log growth by 41.7 lppt. via the entry intensive margin. Finally, the number of exits subtracts about 42.4 lppt. via the exit extensive margin. As exiting firms are smaller than the average incumbent, their exit from foreign markets raises average exports, contributing 38.7 lppt. to total growth.

With the importance of gross churn and the magnitude of each contribution for one year in mind, we document the evolution of each of these margins in the six years after the Great Recession. Panel B of Table 7 shows the same decompositions as Panel A but starts in 2008. We select 2008 as the starting point because 2009 is the first year with a decline in total foreign sales. A comparison of column $h = 6$ in Panel A with the corresponding column in Panel B reveals that average export growth in pre-crisis years was 4.7 lppt., whereas it was only 2.4 lppt. over 2008-2014. This fact is at the heart of the motivation for our analysis; exports grew more slowly after the Great Recession relative to how they performed in the recent past (Figure 1).

Figure 3: Six Year Contribution Differences,
2008-2014 Minus the 1993-2006 Average



Notes: The figure shows the differences in contributions across the margins of exports between the 2008-2014 and the 1993-2006 periods at the $h = 6$ horizon. These figures correspond to the values in Panel A of Table 7, column $h = 6$, minus the values in Panel B of Table 7, column $h = 6$.

The decomposition provided in Table 7, column $h = 6$ allows us to consider each margin in an attempt to understand reasons underlying slower overall export growth since 2008. The intensive margin contribution was smaller by about 2.6 lppt. relative to the 1993-2006 average (3 lppt. versus 5.6 lppt.) but other margins' contributions also differ. The net extensive margin historically contributed -0.9 lppt. but contributed -0.6 lppt. since 2008, the entry margin contribution fell from 2.5 lppt. to 1.9 lppt. and the exit margin rose from -3.4 lppt. to about -2.6 lppt. Figure 3 graphically illustrates the differences between the 2008-2014 and 1993-2006 periods at the $h = 6$ horizon. Here, we simply subtract the estimate in Panel B from the corresponding estimate in Panel A. The entry extensive margin shows the largest change and pulled export growth down by 4.53 lppt. more than it did on average between 1993-2006. This large drag was offset somewhat by an increase in the size of the average new exporter, which added 3.94 lppt., leaving the total entry margin effect at -0.59 lppt. Even accounting for the larger size of new exporters, the missing generation of exporters captured by the entry margin accounts for a sizable portion of slower export

growth seen during the recovery. A similar pattern holds for the exit extensive and exit intensive margins so that the exit margin's total effect is to add 0.88 lppt. to total export growth more than the average contribution. Taking both entry and exit margins together shows that the net extensive margin added 0.29 lppt. more to aggregate real export growth after the Great Recession than during 1993-2006. In contrast, slower intensive margin growth contributed 2.61 lppt. less per year since 2008 than what averages over 1993-2006 would imply. As a result, slower export growth since the Great Recession is largely explained by slower growth in the intensive margin for existing exporters.

Export Growth Decomposition by Sector

In results reported in the appendix D, we extend the preceding analysis to firms in different sectors. In estimations akin to those in Table 7, we break down the sample across manufacturing, services, and wholesale/retail. Considering manufacturing firms first, it is clear that this sector drives the results for the economy as a whole. The findings here are very similar to the overall figures. The biggest discrepancies occur with respect to the entry and exit margins. Compared to the economy as a whole, there are relatively few new exporters contributing to export growth on the entry extensive margin. However, new exporters in manufacturing tend to be bigger on the entry intensive margin. This finding holds for both the 1993-2006 and 2008-2014 periods. A similar picture also emerges with respect to the effects of exits; while there are fewer exits in manufacturing than in the economy as a whole, they tend to be somewhat bigger. Since the financial crisis, the net extensive margin also contributed positively to export growth, in contrast to the results for all firms.

When considering exports in services, we see significant differences relative to the manufacturing sector and the overall economy. Whereas one year log growth averaged 6.1 log percent per year between 1993 and 2006 for the economy as a whole, it averaged 45.83 log percent for this sector over the same time period. Even at the six year horizon during this period, exports as a whole grew 6.1 log percent annually, whereas in services they grew

almost 23 log percent annually. When we consider exports since the financial crisis, however, the picture changes dramatically. While both total exports and services exports fall by about 15 log percent initially, their subsequent recovery was very different. The six year annual average export growth rate starting in 2008 averaged 2.35 log percent for the economy overall, whereas it averaged negative 11 log percent for the services sector.

With regards to the intensive and extensive margins, the services sector also shows significant differences from the economy as a whole. The biggest difference has to do with the fact that the importance of intensive and net extensive margins are reversed in services. During the 1993-2006 period, the net extensive margin contributed 40 log percent to one year export growth whereas the intensive margin contributes about 6 log percent. In contrast, during 2008-2014 the net extensive contribution to one year export growth is -42 percent, whereas it is 27 percent for the intensive margin. A similar pattern is found at the $h = 6$ horizon. Exporting firms in services struggled during the recovery, as a much larger fraction of firms in this industry decided to exit following the crisis.

Finally, we find that exports by the wholesale and retail sectors boomed in both the 1993-2006 and 2008-2014 periods. Remarkably, overall export growth in this sector accelerated in the post 2008 period compared to the 1993-2006 period. In the six years following 2008, exports increased on average at 34 log percent per year. This compares to an average growth rate of roughly 19 percent over the same time horizon during the 1993-2006 period and a growth rate of 2.35 percent for overall exports. Both the intensive and the net extensive margins contributed to these post-2008 increases. Relative to the pre-recession years, however, the net extensive margin was much more important after 2008.

Partial Equilibrium Counterfactuals

In this section, we consider two sets of counterfactuals. First, we consider a hypothetical economy in which at least one of the margins in our decomposition in equation (4) did not follow the path that it took during the Great Recession but instead behaved according to its

typical historical trajectory. These estimations illustrate the extent to which the recovery from the Great Recession differed from those of the past. Second, we examine a similar set of counterfactuals in which we allow for comovement between the extensive and intensive margins of exports. For this purpose, we first establish the historical relationship between each margin and real GDP growth. We then perform a set of estimations in which we consider how exports would have evolved after the Great Recession if one of the margins had behaved as it had in the past relative to GDP growth.

Great Recession vs. Historical Averages

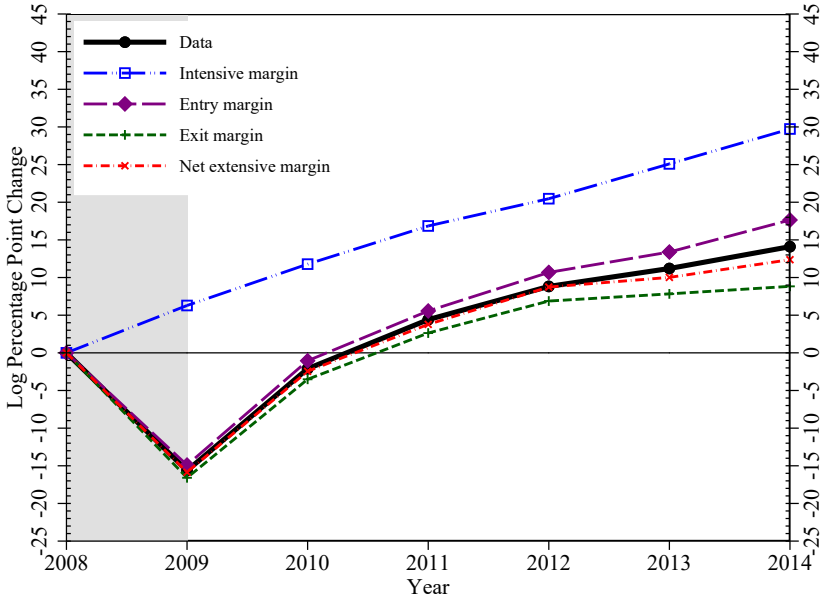
We begin by considering four simple exercises. In each, we estimate how exports would have evolved after the Great Recession if a given margin of exports had followed its historical trajectory, while other margins behaved as they did in the 2008-2014 data. The first counterfactual examines the importance of the intensive margin. In this exercise we keep the export growth rate of incumbents, i_t^h in equation (4), at its 1993-2006 average. In the second, we examine the importance of firm entry and keep the margins ee_t^h and ei_t^h constant at their 1993-2006 average. In the third, we similarly study the relevance of the exit margin and impose that xe_t^h and xi_t^h remain at their prior levels. In the last, we examine the role of the extensive margin and fix n_t^h at its historical average. All other margins in each of these estimations are allowed to follow the same trajectory as they actually did in the data.

Interpreting the results from these estimations requires comparing the counterfactual evolution of overall exports with what actually occurred. Before we go into the details, it is useful to briefly discuss how to interpret our findings. If the evolution of exports in the counterfactual is pictured to be above that which is found in the data, this means that foreign sales would have grown faster had the margin of interest remained at its historical average. Said differently, if the trajectory of exports is shown to be above the actual one in the figures, the margin of interest performed worse since 2008 than it did historically.

Figure 4 shows the findings from each of these four counterfactuals. The first, labeled "Intensive Margin," shows that the decline in exports during the recession is driven by

incumbent exporters. If the intensive margin i_t^h would have performed at its historical average, exports would have continued to grow steadily. In 2014 they would have been 29 lppt. above their 2008 level relative to the realized differential of 14 lppt., a difference of 15 lppt.; exports at the intensive margin grew much slower since 2008 than they did historically.

Figure 4: Counterfactual Real Export Growth



Notes: The figure shows the growth of aggregate exports since 2008 in the data relative to four counterfactuals based on equation (4). The intensive margin counterfactual plots the evolution of exports if i_t^h remained at its 1993 to 2006 average. The entry margin counterfactual instead holds ee_t^h and ei_t^h remained at their historical averages. The exit margin holds xe_t^h and xi_t^h at their historical averages. The counterfactual for the entry and exit rates together holds both ee_t^h and xe_t^h at their historical averages. The shaded bar indicates the recession period as defined by the National Bureau of Economic Research.

The extensive margin counterfactuals show much smaller effects. The second counterfactual, labeled "Entry Margin," shows that if the entry margin component of exports e_t^h followed its historical trajectory, foreign sales would have been 17 lppt. above their 2008 level at the end of 2014, only 3 lppt above the level in the data. Firm entry during and after the crisis contributed less to export growth than it had historically. The third counterfactual, labeled "Exit Margin," shows that the effect of the exit component of export growth x_t^h is also rather small during the recession, resulting in a 2014 level of exports only 9 lppt above the 2008 level.

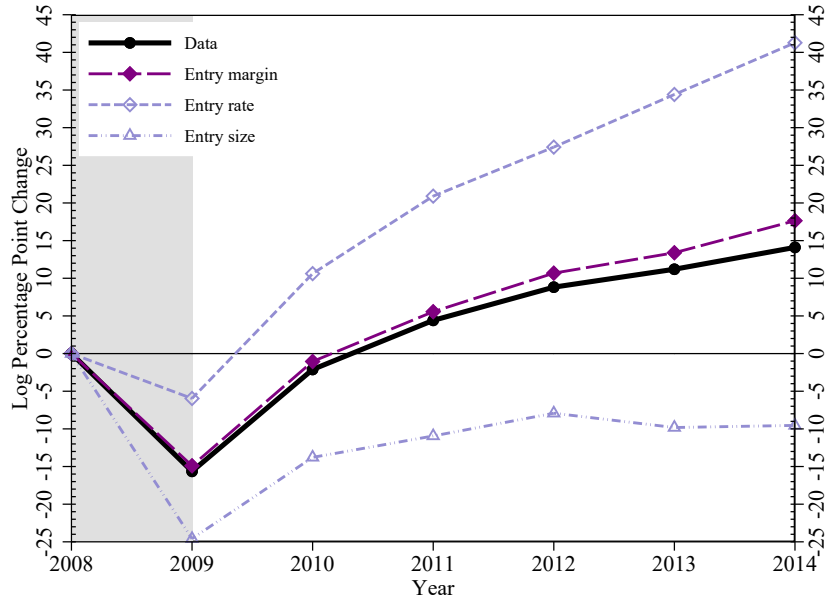
The fourth counterfactual, labeled "Net extensive margin", shows the evolution of

exports if the net extensive margin, n_t^h, which captures both the entry and exit margins, would have followed its historical trajectory. In these estimations, aggregate exports would have evolved similarly as in the data, since the implied deviations of each margin from the data roughly offset each other. As our subsequent estimations will make clear, this minimal deviation of the net results does not imply that the extensive margin is not important. It only implies that impacts of changes in the components of the net extensive margin happen to roughly cancel each other out.

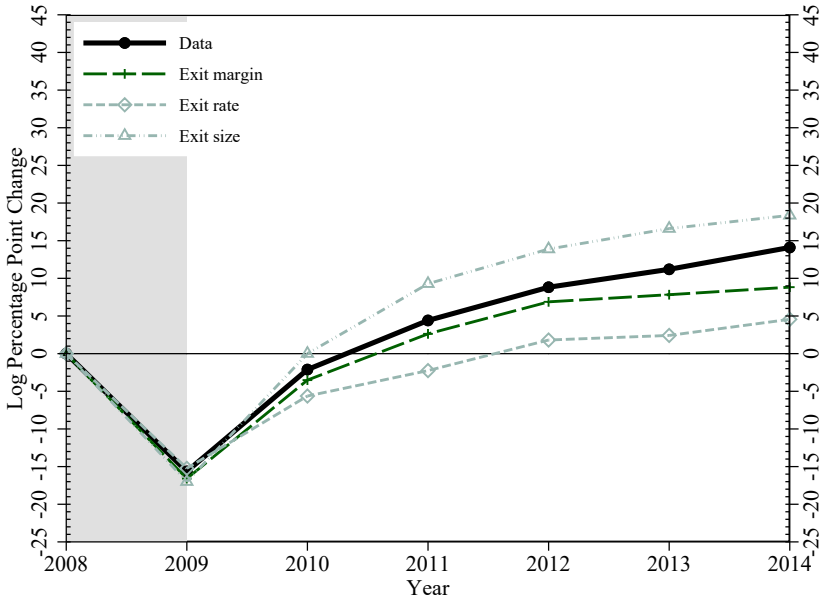
In Figure 5 we explore the effects of changes in the extensive margin after the Great Recession in further depth. Figure 5a considers three counterfactuals with respect to the entry margin. We begin by exploring the implications of holding changes in the relative number of exporting firms—the entry extensive margin, ee_t^h, in equation (4)—at their historical average (labeled ‘‘entry rate’’). In the second set of estimations, we hold the contribution of the average foreign sales of entrants —the entry intensive margin, ei_t^h, in equation (4)—at its historical average (labeled ‘‘entry size”). In the first exercise, exports in 2014 would have been more than 40 lppt. above their 2008 level, more than twice the increase recorded in the data. This fact, however, is largely offset by a relative increase in the size of new entrants into foreign markets, as seen in the second exercise. If the average exports of entrants had stayed at their 1993-2006 average, then the level of total foreign sales in 2014 would have been almost 10 lppt. points below its 2008 level. Thus, while there were fewer new exporters after 2008, those that did enter tended to export more on average than in the past. We keep both entry margins, ee_t^h and ei_t^h, at their historical levels in the third exercise and show that exports follow a trajectory similar what actually happened.

Figure 5b shows the three corresponding counterfactuals for the exit margin. In the first two, we fix the exit extensive (labeled ‘‘exit rate”) and exit intensive (labeled ‘‘exit size”) margins, xe_t^h and xi_t^h in equation(4), at their historical averages. Again, we see two largely offsetting movements, albeit with a somewhat smaller absolute magnitude as Figure 5a. As a consequence, in the third counterfactual in which we keep both xe_t^h and xi_t^h at their

Figure 5: Entry and Exit Counterfactuals: Number versus Size



(a) Entry: Components



(b) Exit: Components

Notes: The figure shows the actual growth of aggregate exports since 2008 in the data relative to three counterfactuals based on equation (4) in each panel. Panel A plots the evolution of exports if the entry extensive margin ee_t^h (labeled "entry rate") and the entry intensive margin ei_t^h margin remained (labeled "entry size") at their historical averages. Panel B plots the evolution of exports if the exit extensive margin xe_t^h (labeled "exit rate") and the exit intensive margin xi_t^h (labeled "exit size") remained at their historical averages. The shaded bar indicates the recession period as defined by the National Bureau of Economic Research.

historical contributions, the trajectory is similar to the one observed in the data. The appendix gives additional details of the counterfactuals shown in the figures above.

A Different Approach: Allowing for Comovement

The previous counterfactuals explored how foreign sales would have evolved if various export margins had followed their historical averages, instead of the paths that they actually took. One limitation of this approach is that it does not allow the evolutions of different margins to be correlated. To overcome this, we account for one main source of comovement between the various components of exports by allowing each one to comove with GDP growth. For each margin $m_t^h \in \left\{i_t^h, ee_t^h, ei_t^h, xe_t^h, xi_t^h, e_t^h, x_t^h\right\}$ defined in equation (4) and for every time horizon $h = 1, ..., 6$, we estimate the following regression using the sample over 1993-2006:

$$m_t^h = \alpha^h + \beta^h \Delta \log RGDP_t^h + \varepsilon_t^h, \quad t = 1993, \ldots, 2006. \tag{7}$$

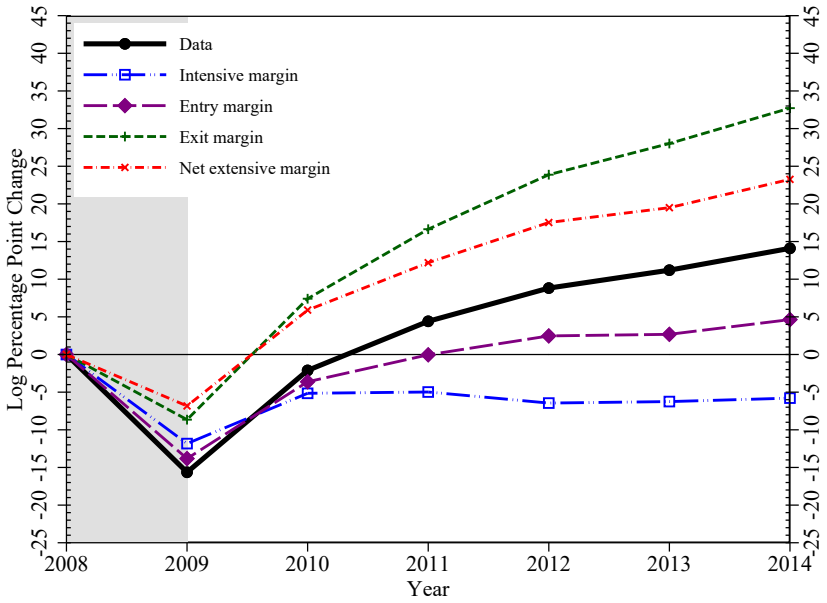
Using the estimates for $\hat{\alpha}^h$ and $\hat{\beta}^h$ for each $h = 1, ..., 6$, we then construct how each margin would have evolved during the 2008-2014 period had it maintained its historical relationship with GDP growth as

$$\hat{m}_t^h = \hat{\alpha}^h + \hat{\beta}^h \Delta \log RGDP_t^h, \quad t = 2008, \ldots, 2014. \tag{8}$$

Conceptually, the counterfactuals based on averages in the prior section undertake a similar exercise but simply estimate equation (7) with only the constant included in the regression.

Figure 6 reports the results where the margin(s) under consideration follow equation (8) while the others evolve as they actually did in the data. Replacing the intensive margin with the relevant estimate from equation (8) shows that exports in 2014 would have been about 5 lppt. below the pre-recession level and 20 lppt. below the actual level. This implies that the intensive margin contributed more to foreign sales than would have been expected from its relationship with GDP growth. The same conclusion holds for the entry margin. Had this

Figure 6: Counterfactuals Allowing for Comovement



Notes: The figure shows the growth of aggregate exports since 2008 in the data relative to four counterfactuals that are based on equation (7). The intensive margin exercise plots the evolution of exports if i_t^h comoved with real GDP as it has, on average, between 1993 to 2006. The entry margin one instead imposes that ee_t^h and ei_t^h had comoved with real GDP as they did historically. The exit margin counterfactual imposes that xe_t^h and xi_t^h had comoved with real GDP as they did historically. The last one for the entry and exit rates together imposes that both ee_t^h and xe_t^h had comoved with real GDP as they did historically. The shaded bar indicates the recession period as defined by the National Bureau of Economic Research.

margin performed relative to GDP as it did historically, exports would have been 10 lppt. below the actual amount in 2014 and only 5 lppt. above the pre-recession level.

In contrast, had the exit margin evolved according to its typical relationship with GDP growth, exports would have been nearly 20 lppt. higher than in the data. This implies that the exit margin took away much more from export growth than would have been expected based on the path of GDP growth following the Great Recession. The entry and exit margins together underperformed and would have been expected to result in roughly 10 lppt. more exports, driven mostly by the exit margin rather than the entry margin.

Compared to the results in Figure 4, the counterfactuals shown in Figure 6 have somewhat different implications. First, while exports along the intensive margin grew slower than they did historically, the intensive margin outperformed in comparison to its historical relationship with GDP growth. As a result, one would have expected lower total export growth had the intensive margin evolved following its past trajectory. Second, the net

extensive margin overall behaved as it did in the past in that deviations from historical growth by the entry and exit margins roughly offset each other. However, in terms of its contribution to changes in exports, the net extensive margin fared worse than the historical relationship to GDP growth would have suggested. In appendix E, we present tables that numerically show the counterfactual evolution of each margin that was used to construct these figures. We further include results that consider the same types of estimations across the manufacturing, services, and wholesale and retail sectors.

V. Conclusion

In this study we have considered the effect of the Great Recession on the extensive and intensive margins of U.S. firm level exports. We find evidence of substantial exits and a decline in entries into foreign markets during these years. Decomposing the log growth in aggregate exports, we show that the drop in entries and spike in exits were offset by the fact that new entrants into foreign markets tended to be bigger than they were historically. Thus, while a missing generation of exporters had effects on the variety of goods sold by the United States internationally, the effect of these trends on aggregate export volumes was small.

Despite the sizable literature on the trade collapse during the Great Recession, many unanswered questions remain. To the best of our knowledge, this is the first study to consider the scarring effects of the crisis on firm exports. Quantifying the welfare effects of this decline in the number of varieties along with the rise in foreign market entrant size in a general equilibrium framework would particularly further our understanding of these events. Because international trade flows have still not returned to trend growth, such analyses would be valuable for central bank economists, elected officials, and academics alike.

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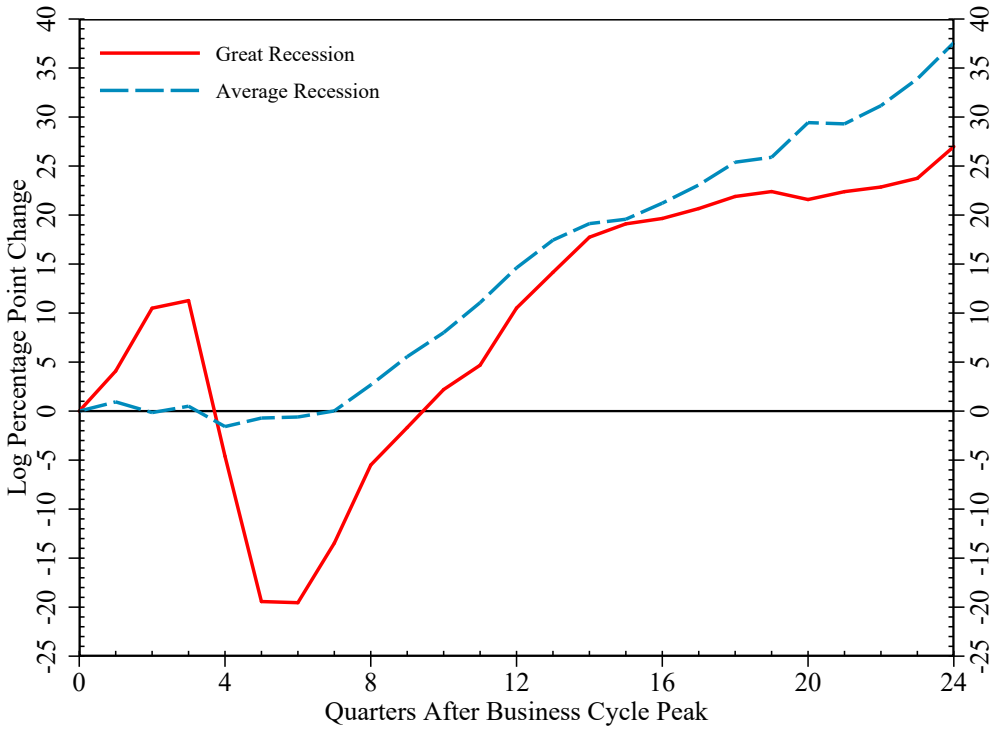
The Great Recession and a Missing Generation of Exporters

Appendix

William F. Lincoln Andrew H. McCallum Michael Siemer

A. Aggregate Exports

Figure A.1: Nominal Export Growth After the Great Recession



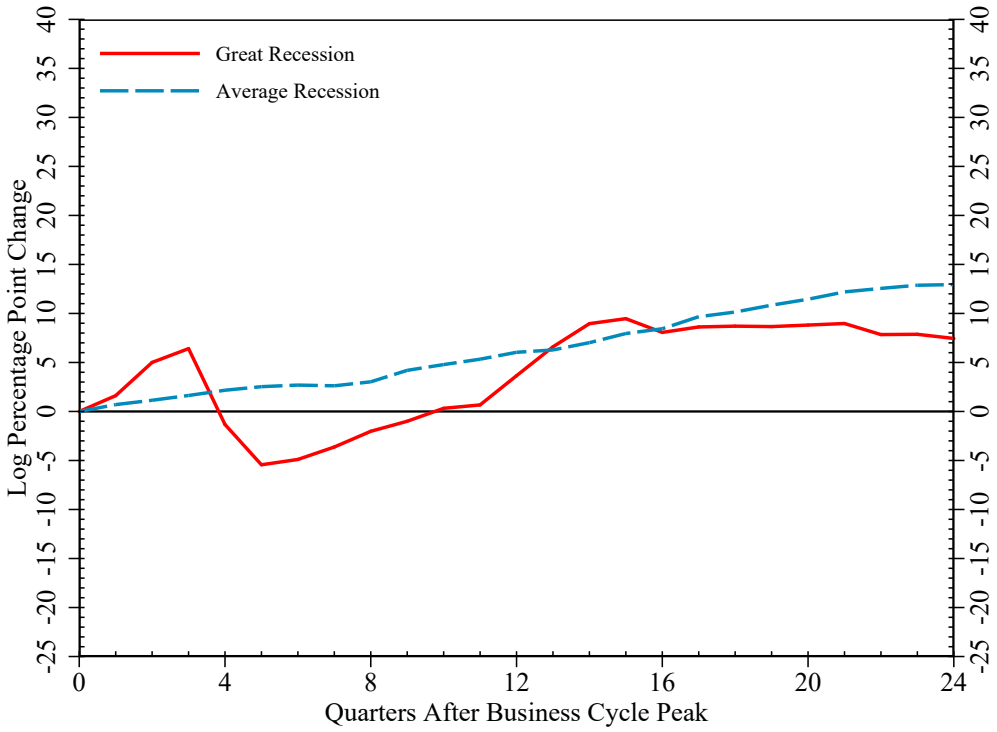
Notes: The figure shows the typical trajectory of log nominal goods exports 24 quarters after the most recent business cycle peak that preceded the 11 recessions between 1948 and 2001 and the same measure after the Great Recession. After 6 years, the growth of nominal exports following the Great Recession was about 10 log percentage points lower than what it was after the average recession.

Figure A.1 shows the evolution of nominal aggregate exports during the Great Recession in comparison with the average trajectory during recessions over 1948-2001. Overall, this is similar to the results for real goods exports in Figure 1 of the main text. Historically, these periods had only a minor impact, with exports staying roughly flat over the first 8 quarters after the start of the downturn. The Great Recession, however, showed an initial increase in

foreign sales over the first several quarters followed by a dramatic decline, falling to 20 percent below the initial level after 6 quarters. With regards to the recovery, exports initially rebounded faster after the Great Recession than they did in the past. Despite this, however, the recovery fails to catch up with the historical average by 2014.

Figure A.2 shows the evolution for goods exports prices during the Great Recession relative to the typical trajectory for recessions during 1948-2001. The periods used to construct this as well as Figure 1 of the main text are 2007q4-2014q4, 2001q1-2007q1, 1990q3-1996q3, 1981q3-1987q3, 1980q1-1986q1, 1973q4-1979q4, 1969q4-1975q4, 1960q2-1966q2, 1957q3-1963q3, 1953q3-1959q3, 1948q4-1954q4, where the year is indicated and followed by the relevant quarter. Unlike the past, the Great Recession initially brought along a temporary decline in export prices in the second year. They subsequently catch up with the historical average before flattening out roughly 3 years after the peak.

Figure A.2: Goods Exports Price Growth After the Great Recession



Notes: The figure shows the typical trajectory of log goods exports prices 24 quarters after the most recent business cycle peak that preceded the 11 recessions between 1948 and 2001 and the same measure after the Great Recession. Prices for exported goods initially declined by 5 percent before rising almost 10 percent. 24 quarters after the peak before the Great Recession, however, goods exports prices had increased only by about 7.5 percent, which was roughly 5.5 percentage points less than after the average recession.

B. Log Export Growth Decomposition

Three Term Decomposition

In this section, we present an exact decomposition of total export growth inspired by di Giovanni et al. (2014). We begin by considering a three term decomposition that is then extended into one with five terms. The log difference growth rate of total exports over h years g_t^h can first be written as

$$\begin{aligned} g_t^h &\equiv \ln\left(X_t\right) - \ln\left(X_{t-h}\right) \\ &= \ln\left(\frac{\sum_{i\in I_{t\cap t-h}} X_{it}}{\sum_{i\in I_{t\cap t-h}} X_{it-h}}\right) + \ln\left(\frac{\sum_{i\in I_t} X_{it}}{\sum_{i\in I_{t\cap t-h}} X_{it}}\right) - \ln\left(\frac{\sum_{i\in I_{t-h}} X_{it-h}}{\sum_{i\in I_{t\cap t-h}} X_{it-h}}\right) \\ &= \underbrace{\ln\left(\frac{\sum_{i\in I_{t\cap t-h}} X_{it}}{\sum_{i\in I_{t\cap t-h}} X_{it-h}}\right)}_{i_t^h=\text{intensive margin}} + \underbrace{\underbrace{\ln\left(1+\frac{\sum_{i\in I_{t\setminus t-h}} X_{it}}{\sum_{i\in I_{t\cap t-h}} X_{it}}\right)}_{e_t^h=\text{entry margin}} - \underbrace{\ln\left(1+\frac{\sum_{i\in I_{t-h\setminus t}} X_{it-h}}{\sum_{i\in I_{t\cap t-h}} X_{it-h}}\right)}_{x_t^h=\text{exit margin}}}_{n_t^h=\text{net extensive margin}} \end{aligned} \tag{9}$$

in which I_t is the set of firms that export in year t. $N_t\left(I_t\right)$ is the number of exporting firms in year t, and $\bar{X}_t\left(I_t\right)$ denotes average foreign sales per firm in year t. $I_{t\cap t-h}$ is the set of firms that export in both years t and $t-h$. We define $N_t(I_t)$ as the number of exporting firms in year t and $\bar{X}_t(I_t)$ as the average foreign sales per firm in year t. Likewise, $N_t\left(I_{t\cap t-h}\right)$ is the number of firms that export in both years t and $t-h$ and $\bar{X}_t\left(I_{t\cap t-h}\right)$ denotes average foreign sales per incumbent exporting firm in year t. The contribution to total growth over h years from the intensive margin i_t^h in year t is defined as the log growth by firms that sold abroad in both years t and $t-h$. We define the entry margin e_t^h as the contribution to the growth of foreign sales by firms that exported in period t but did not do so in period $t-h$. Similarly, we define the exit margin x_t^h as the contribution to export growth of firms that sold abroad in year $t-h$ but did not do so in year t. Prior work, including Gopinath and Neiman (2014) and Kamal and Krizan (2012), has considered related decompositions.

We can further decompose total export growth by using the fact that foreign sales for any subset of producers can be written as the product of the number of exporters and the average foreign sales per firm in the relevant subset. For example, total exports can be written as $\sum_{i\in I_t} X_{it} = N_t\left(I_t\right)\bar{X}_t\left(I_t\right)$ and exports by incumbents can be written as $\sum_{i\in I_{t\cap t-h}} X_{it} = N_t\left(I_{t\cap t-h}\right)\bar{X}_t\left(I_{t\cap t-h}\right)$. Starting with equation (9), we can decompose these

terms further as follows:

$$\begin{aligned}
\underbrace{g_t^h}_{\text{total growth}} &= \ln\left(\frac{\sum_{i\in I_{t\cap t-h}} X_{it}}{\sum_{i\in I_{t\cap t-h}} X_{it-h}}\right) + \ln\left(\frac{\sum_{i\in I_t} X_{it}}{\sum_{i\in I_{t\cap t-h}} X_{it}}\right) - \ln\left(\frac{\sum_{i\in I_{t-h}} X_{it-h}}{\sum_{i\in I_{t\cap t-h}} X_{it-h}}\right) \\
&= \underbrace{\ln\left(\frac{\bar{X}_t\left(I_{t\cap t-h}\right)}{\bar{X}_{t-h}\left(I_{t\cap t-h}\right)}\right)}_{i_t^h=\text{intensive margin}} + \underbrace{\ln\left(\frac{N_t\left(I_t\right)}{N_t\left(I_{t\cap t-h}\right)}\right)}_{ee_t^h=\text{entry extensive margin}} \\
&+ \underbrace{\ln\left(\frac{\bar{X}_t\left(I_t\right)}{\bar{X}_t\left(I_{t\cap t-h}\right)}\right)}_{ei_t^h=\text{entry intensive}} - \underbrace{\ln\left(\frac{N_{t-h}\left(I_{t-h}\right)}{N_{t-h}\left(I_{t\cap t-h}\right)}\right)}_{xe_t^h=\text{exit extensive}} - \underbrace{\ln\left(\frac{\bar{X}_{t-h}\left(I_{t-h}\right)}{\bar{X}_{t-h}\left(I_{t\cap t-h}\right)}\right)}_{xi_t^h=\text{exit intensive}}
\end{aligned} \tag{10}$$

Writing the expression using symbols for each margin gives

$$\underbrace{g_t^h}_{\text{total growth}} = \underbrace{i_t^h}_{\text{intensive}} + \underbrace{ee_t^h}_{\text{entry extensive}} + \underbrace{ei_t^h}_{\text{entry intensive}} - \underbrace{xe_t^h}_{\text{exit extensive}} - \underbrace{xi_t^h}_{\text{exit intensive}} \tag{11}$$

This five term decomposition includes the definition for average exports of firms in year t as $\bar{X}_t\left(I_t\right)$, the average in year $t-h$ as $\bar{X}_{t-h}\left(I_{t-h}\right)$, and the average for firms in year t that sell abroad in both years as $\bar{X}_t\left(I_{t\cap t-h}\right)$. Similarly, $\bar{X}_{t-h}\left(I_{t\cap t-h}\right)$ denotes the average foreign sales in year $t-h$ of firms that export in both year t and in year $t-h$. $N_t\left(I_t\right)$ and $N_{t-h}\left(I_{t-h}\right)$ are the number of firms that export in years t and $t-h$ respectively. By definition, the number of firms in year t that exported in both years is the same as the number that export in $t-h$ so $N_t\left(I_{t\cap t-h}\right) = N_{t-h}\left(I_{t\cap t-h}\right)$. As such, the only way the intensive margin contributes to the total is through growth in average exports of firms that sell abroad in both years t and $t-h$.

C. Additional Export Participation Regressions

Table 1 in the main text shows the effect of recessions on export participation. Table A1 extends this analysis and allows for differential impacts across the two downturns in our sample in 2001 and 2007-2008. The key conclusion is that while both recessions had effects, the Great Recession had a larger one. This is consistent with the results in Table 2 that showed that export participation is positively associated with GDP growth. Since the Great Recession was more severe than the 2001 recession, this leads to a larger effect. Table A2 shows the unabridged version of Table 5 of the main text with the full set of results.

Table A1: Export Participation and Different Recessions

	Dependent Variable: $y_{it} = \{0, 1\}$			
	(1)	(2)	(3)	(4)
Exported last year (y_{it-1})	16.98***	16.99***	16.06***	16.07***
	(0.06)	(0.06)	(0.05)	(0.05)
Exported two years ago (y_{it-2})			5.07***	5.07***
			(0.05)	(0.05)
2001 recession × Exported	-0.53***	-0.51***	-0.01	-0.01
last year ($r_{2001,t} \times y_{it-1}$)	(0.12)	(0.13)	(0.17)	(0.17)
2001 recession × Exported			−0.91***	−0.89***
two years ago ($r_{2001,t} \times y_{it-2}$)			(0.16)	(0.16)
Great Recession × Exported	−1.15***	−1.23***	−0.67***	−0.74***
last year ($r_{GR,t} \times y_{it-1}$)	(0.09)	(0.09)	(0.11)	(0.12)
Great Recession × Exported			−0.94***	−0.99***
two years ago ($r_{GR,t} \times y_{it-2}$)			(0.11)	(0.11)
Log employment (x_{1it})	7.16***	7.16***	6.96***	6.95***
	(0.03)	(0.03)	(0.03)	(0.03)
Log average wages (x_{2it})	4.27***	4.24***	4.17***	4.14***
	(0.04)	(0.04)	(0.04)	(0.04)
Young (x_{3it})	-0.68***	-0.71***	-0.50***	-0.54***
	(0.05)	(0.05)	(0.05)	(0.05)
2001 recession × Log		−0.17***		−0.15***
employment ($r_{2001,t} \times x_{1it}$)		(0.03)		(0.03)
2001 recession × Log		0.36***		0.38***
average wages ($r_{2001,t} \times x_{2it}$)		(0.07)		(0.07)
2001 recession × Young ($r_{2001,t} \times x_{3it}$)		0.15		0.17
		(0.15)		(0.15)
Great Recession × Log		0.10***		0.11***
employment ($r_{GR,t} \times x_{1it}$)		(0.02)		(0.03)
Great Recession × Log		0.07		0.10*
average wages ($r_{GR,t} \times x_{2it}$)		(0.06)		(0.06)
Great Recession × Young ($r_{GR,t} \times x_{3it}$)		0.26*		0.29**
		(0.14)		(0.14)
Industry × Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	9.47	9.47	9.47	9.47

Notes: The table presents the results from estimating variants of the following equation:

$$y_{it} = \alpha y_{it-1} + \beta_1 r_{2001,t} \times y_{cit-1} + X'_{it}\gamma + r_{2001,t} \times X'_{it}\delta_1 + \beta_2 r_{GR,t} \times y_{cit-1} r_{GR,t} \times X'_{it}\delta_2 + \phi_i + \phi_{st} + \varepsilon_{it}.$$

$y_{it} = \{0, 1\}$ indicates if firm i exports in year t, $r_{2001,t}$ is an indicator for the 2001 U.S. recession, $r_{GR,t}$ is an indicator for the Great Recession, ϕ_i and ϕ_{st} are firm and industry-year fixed effects, X_{it} is a set of controls, and ε_{it} is the error term. Throughout, we multiply each coefficient estimate and the associated standard error by 100 for presentation purposes. Scaling of the results is done as in Table 1 of the main text. R^2 values are roughly 22 percent in columns (1)-(2) and roughly 25 percent in columns (3)-(4). Standard errors are in parentheses and are clustered by firm, with significance levels of 1%, 5%, and 10% denoted by ***, **, and *, respectively.

Table A2: Export Participation and GDP Growth: Durable Goods, Final Goods and High External Finance Dependence Sectors

	Dependent Variable: $y_{it} = \{0, 1\}$			
	(1) Manufacturing	(2) Durable	(3) Final Goods	(4) High EFD
Exported last year (y_{it-1})	20.03***	19.27***	20.85***	19.87***
	(0.16)	(0.29)	(0.46)	(0.17)
Exported two years ago (y_{it-2})	6.09***	4.81***	5.73***	6.08***
	(0.15)	(0.27)	(0.43)	(0.16)
$\Delta \log RGDP \times$ Exported last year ($r_t \times y_{it-1}$)	28.48***	6.51	39.21***	25.88***
	(4.64)	(8.63)	(13.63)	(5.01)
$\Delta \log RGDP \times$ Exported two years ago ($r_t \times y_{it-2}$)	30.54***	32.81***	10.42	30.13***
	(4.56)	(8.48)	(13.41)	(4.93)
Exported last year $\times$ Indicator		1.04***	-0.92*	1.06**
		(0.35)	(0.49)	(0.45)
Exported two years ago $\times$ Indicator		1.77***	0.41	0.04
		(0.32)	(0.46)	(0.41)
$\Delta \log RGDP \times$ Exported last year $\times$ Indicator		30.87***	-12.24	17.75
		(10.23)	(14.48)	(13.29)
$\Delta \log RGDP \times$ Exported two years ago $\times$ Indicator		-3.51	22.77	2.73
		(10.06)	(14.24)	(13.00)
Log employment (x_{1it})	8.43***	8.33***	8.92***	8.45***
	(0.07)	(0.14)	(0.20)	(0.08)
Log employment $\times$ Indicator		0.15	-0.56**	-0.07
		(0.20)	(0.28)	(0.25)
Log average wages (x_{2it})	5.60***	5.18***	5.95***	5.51***
	(0.11)	(0.18)	(0.27)	(0.12)
Log average wages $\times$ Indicator		0.58***	-0.39	0.54**
		(0.20)	(0.28)	(0.25)
Young (x_{3it})	-0.74***	-0.25	-0.59	-1.09***
	(0.19)	(0.38)	(0.55)	(0.21)
Young $\times$ Indicator		-0.66	-0.17	1.69***
		(0.43)	(0.58)	(0.43)
$\Delta \log RGDP \times$ Log employment ($r_t \times x_{1it}$)	-0.54	-1.04	-0.02	-1.01
	(1.06)	(2.11)	(2.92)	(1.20)
$\Delta \log RGDP \times$ Log average wages ($r_t \times x_{2it}$)	3.94	8.40**	4.21	4.68
	(2.93)	(3.51)	(4.32)	(2.99)
$\Delta \log RGDP \times$ Young ($r_t \times x_{3it}$)	1.96	-2.50	-5.45	10.62*
	(5.31)	(10.78)	(15.83)	(5.99)
$\Delta \log RGDP \times$ Log employment $\times$ Indicator		0.47	-0.58	2.12
		(2.43)	(3.12)	(2.51)
$\Delta \log RGDP \times$ Log average wages $\times$ Indicator		-5.85**	-0.38	-4.23
		(2.46)	(3.49)	(2.96)
$\Delta \log RGDP \times$ Young $\times$ Indicator		6.10	8.32	-40.53***
		(12.32)	(16.75)	(12.79)
Industry $\times$ Year FE (ϕ_{st})	Yes	Yes	Yes	Yes
Firm FE (ϕ_i)	Yes	Yes	Yes	Yes
Obs. (millions)	2.135	2.135	2.135	2.135

Notes: See the notes to Table A1 and Table 5 of the main text.

Table A3: Summary Statistics

	(1)	(2)
	Mean	St. Dev.
Export status ($100 \times y_{it}$)	34.83	47.64
Exported last year (y_{it-1})	0.3453	0.4755
Exported two years ago (y_{it-2})	0.3338	0.4716
Recession $\times$ Exported last year ($r_t \times y_{it-1}$)	0.0537	0.2254
2001 recession $\times$ Exported last year ($r_{2001,t} \times y_{it-1}$)	0.0163	0.1266
Great Recession $\times$ Exported last year ($r_{GR,t} \times y_{it-1}$)	0.0374	0.1898
Recession $\times$ Exported two years ago ($r_t \times y_{it-2}$)	0.0509	0.2197
2001 recession $\times$ Exported two years ago ($r_{2001,t} \times y_{it-2}$)	0.0152	0.1225
Great Recession $\times$ Exported two years ago ($r_{GR,t} \times y_{it-2}$)	0.0356	0.1854
Log employment (x_{1it})	2.469	1.622
Log average wages (x_{2it})	3.334	0.7553
Young (x_{3it})	0.1696	0.3753
Recession $\times$ Log employment ($r_t \times x_{1it}$)	0.3658	1.075
2001 recession $\times$ Log employment ($r_{2001,t} \times x_{1it}$)	0.1247	0.6558
Great Recession $\times$ Log employment ($r_{GR,t} \times x_{1it}$)	0.2411	0.886
Recession $\times$ Log average wages ($r_t \times x_{2it}$)	0.4988	1.222
2001 recession $\times$ Log average wages ($r_{2001,t} \times x_{2it}$)	0.1644	0.7413
Great Recession $\times$ Log average wages ($r_{GR,t} \times x_{2it}$)	0.3345	1.027
Recession $\times$ Young ($r_t \times x_{3it}$)	0.0242	0.1535
2001 recession $\times$ Young ($r_{2001,t} \times x_{3it}$)	0.0096	0.0977
Great Recession $\times$ Young ($r_{GR,t} \times x_{3it}$)	0.0145	0.1196
Foreign demand (d_{it})	0.0487	0.2488
Local house prices (p_{it})	0.0293	0.0747
Foreign demand $\times$ Exported last year ($d_{it} \times y_{it-1}$)	0.0156	0.1208
Local house price $\times$ Exported last year ($p_{it} \times y_{it-1}$)	0.0095	0.0474
Foreign demand $\times$ Log employment ($d_{it} \times x_{1it}$)	0.1205	0.7649
Foreign demand $\times$ Log average wages ($d_{it} \times x_{2it}$)	0.1651	0.8225
Foreign demand $\times$ Young ($d_{it} \times x_{3it}$)	0.0088	0.1051
Local house price $\times$ Log employment ($p_{it} \times x_{1it}$)	0.0737	0.2113
Local house price $\times$ Log average wages ($p_{it} \times x_{2it}$)	0.0992	0.2599
Local house price $\times$ Young ($p_{it} \times x_{3it}$)	0.0059	0.0333

Notes: The table presents the mean and standard deviation of the dependent and independent variables used throughout the paper reported in the same units as included in each regression specification.

D. Sectoral Decompositions

Tables A4, A5, and A6 present the decomposition estimations from Table 7 of the main text for the manufacturing, services, and wholesale/retail sectors respectively. All exports were deflated using the goods exports deflator from the national income and product accounts with 2000 as the base year. There are noticeable differences across these three sets of results. Manufacturing is by far the most influential sector in terms of aggregate exports. As a consequence, manufacturing behavior is on average quite similar to the behavior of overall aggregate exports shown in Table 7. At the same time, both services and wholesale/retail exports have been increasing in relative importance over the past couple of decades. In Tables A5 and A6 we see that they grew at significantly faster rates than overall exports did during the 1993-2006 period. The one year log growth of services foreign sales averaged about 46 percent, whereas for wholesale/retail it averaged about 18 percent. This compares to a figure of roughly 6 percent for manufacturing and aggregate exports overall.

During the Great Recession, exports in manufacturing, in services, and in the overall economy declined by about 15 percent in the first year of the recession. In wholesale/retail, however, exports actually increased by about 71 percent. Six years after the beginning of the Great Recession, total exports and manufacturing exports on average grew about 2.5 percent per year, whereas in services they fell by about 10 percent per year and in wholesale/retail they rose by about 34 percent per year. With regards to the intensive and extensive margins, the picture is similar: manufacturing exports behave like the aggregate figures, while in services and wholesale/retail exports have higher growth rates along both margins. In particular, the wholesale/retail sector stands out as having the largest contribution from the net extensive margin.

Table A4: Real Export Log Growth Decomposition: Manufacturing Sector

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$
	Panel A: 1993-2006 Average					
Total growth	5.76	5.34	5.04	4.64	4.35	4.24
Intensive margin	6.21	5.94	5.70	5.26	4.99	4.90
Net extensive	-0.45	-0.60	-0.66	-0.62	-0.64	-0.66
Entry margin	1.83	1.81	1.81	1.81	1.82	1.82
- extensive	25.35	17.57	14.58	12.79	11.63	10.82
- intensive	-23.55	-15.76	-12.77	-10.98	-9.81	-9.00
Exit margin	-2.28	-2.41	-2.47	-2.43	-2.46	-2.48
- extensive	-24.47	-16.59	-13.58	-11.91	-10.81	-10.00
- intensive	22.19	14.18	11.11	9.48	8.35	7.52
	Panel B: 2008-2014					
Total growth	-15.19	0.08	1.44	2.30	2.15	2.50
Intensive margin	-16.57	-0.73	1.41	2.47	2.25	2.47
Net extensive	1.38	0.81	0.03	-0.17	-0.10	0.03
Entry margin	2.68	2.61	2.06	1.84	1.84	1.82
- extensive	20.15	14.26	11.40	9.84	8.79	8.18
- intensive	-17.47	-11.65	-9.34	-8.00	-6.95	-6.36
Exit margin	-1.30	-1.80	-2.03	-2.01	-1.94	-1.79
- extensive	-24.07	-15.16	-11.77	-10.36	-9.29	-8.44
- intensive	22.77	13.36	9.74	8.35	7.35	6.65

Notes: The table presents the results from decomposing changes in aggregate real exports over the period 1993-2006 as well as 2008-2014. The different margins are calculated using equation (4) of the main text. Each column corresponds to a different value of h, the time horizon over which the changes are estimated. For ease of comparison, we annualized the contributions of the separate margins by dividing each by h.

Table A5: Real Export Log Growth Decomposition: Services Sector

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$
	Panel A: 1993-2006 Average					
Total growth	45.83	43.78	30.51	26.10	26.88	22.95
Intensive margin	5.83	11.95	10.71	19.01	18.07	12.08
Net extensive	40.00	31.83	19.80	7.09	8.81	10.87
Entry margin	73.68	64.90	53.80	48.33	54.29	46.20
- extensive	73.13	49.49	41.64	39.21	36.92	30.12
- intensive	0.55	15.41	12.16	9.12	17.37	16.08
Exit margin	-33.68	-33.07	-34.00	-41.24	-45.48	-35.33
- extensive	-66.73	-43.18	-35.28	-32.88	-30.27	-24.24
- intensive	33.05	10.11	1.28	-8.36	-15.21	-11.09
	Panel B: 2008-2014					
Total growth	-15.17	-14.58	0.11	-1.78	-7.38	-10.98
Intensive margin	26.54	23.49	12.99	19.18	6.01	5.46
Net extensive	-41.71	-38.07	-12.88	-20.96	-13.39	-16.44
Entry margin	80.27	47.67	45.29	25.02	24.53	14.98
- extensive	55.21	27.60	25.13	24.30	22.63	16.55
- intensive	25.06	20.07	20.16	0.72	1.90	-1.57
Exit margin	-121.98	-85.74	-58.17	-45.98	-37.92	-31.42
- extensive	-71.91	-35.96	-29.70	-25.61	-27.2	-22.68
- intensive	-50.07	-49.78	-28.47	-20.37	-10.70	-8.74

Notes: The table presents the results from decomposing changes in aggregate real exports over the period 1993-2006 as well as 2008-2014. The different margins are calculated using equation (4) of the main text. Each column corresponds to a different value of h, the time horizon over which the changes are estimated. For ease of comparison, we annualized the log growth rates and contributions by dividing each term by h.

Table A6: Real Export Log Growth Decomposition: Wholesale and Retail Sectors

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$
	Panel A: 1993-2006 Average					
Total growth	17.77	18.36	18.45	20.58	18.77	18.93
Intensive margin	9.41	10.27	10.96	11.84	10.05	11.83
Net extensive	8.36	8.09	7.49	8.74	8.72	7.10
Entry margin	15.96	16.79	17.55	19.21	17.67	15.85
- extensive	40.07	26.48	22.18	19.88	17.29	15.78
- intensive	-24.11	-9.69	-4.63	-0.67	0.38	0.07
Exit margin	-7.60	-8.70	-10.06	-10.47	-8.95	-8.75
- extensive	-35.99	-23.56	-19.06	-16.76	-14.26	-12.51
- intensive	28.39	14.86	9.00	6.29	5.31	3.76
	Panel B: 2008-2014					
Total growth	71.72	38.16	30.80	26.53	23.86	34.23
Intensive margin	28.60	2.42	2.42	10.85	13.13	14.36
Net extensive	43.12	35.74	28.38	15.68	10.73	19.87
Entry margin	44.92	43.25	30.84	25.16	18.42	26.92
- extensive	42.42	27.12	23.10	16.75	15.28	13.37
- intensive	2.50	16.13	7.74	8.41	3.14	13.55
Exit margin	-1.80	-7.51	-2.46	-9.48	-7.69	-7.05
- extensive	-38.64	-22.23	-15.50	-14.31	-12.86	-11.55
- intensive	36.84	14.72	13.04	4.83	5.17	4.50

Notes: The table presents the results from decomposing changes in aggregate real exports over the period 1993-2006 as well as 2008-2014. The different margins are calculated using equation (4) of the main text. Each column corresponds to a different value of h, the time horizon over which the changes are estimated. For ease of comparison, we annualized the contributions of the separate margins by dividing each by h.

E. Partial Equilibrium Counterfactuals

This section provides additional details for the counterfactuals discussed in the main text.

Great Recession vs. Historical Averages

Table A7 shows the detailed results of the counterfactuals for the one year horizon in 2009 and the six year horizon in 2014. This numerically summarizes the results from the estimations over the short and long terms. While the Great Recession induced a missing generation of exporters, the effect of this was muted because although there was a smaller number of entrants, they tended to be bigger than they were historically.

Allowing for Comovement with GDP

This section includes tables with the numerical results that were used to construct the counterfactuals that allowed various margins of exports to comove with GDP in the main text. They show the counterfactual evolution of each margin had it followed its historical relationship with real GDP growth. This is constructed using equations (7) and (8) of the main text. All exports were deflated using the goods exports deflator from the national income and product accounts with 2000 as the base year.

Table A8 presents the results for exports across all sectors. If export growth had behaved as it did historically, then it should have been about -12 percent in 2008. Instead, it was -16 percent in the data. While the decline in exports was less deep relative to GDP than what the past would have suggested, the recovery was significantly faster. In the six years following 2008, export growth would have averaged -3 log percent had exports behaved relative to real GDP as they did in the past. In reality, export growth in these years averaged 2.35 log percent and both the intensive and the net extensive margin outperformed the historical relationship. The intensive margin did better than the past by almost 5 percent. The net extensive margin, on the other hand, was only 0.75 percentage points larger than in the past.

In Table A9 we break down the results in Table A6 across the manufacturing, services, and wholesale/retail sectors. The results imply that each of these industries performed worse than what the historical relationship to GDP growth would have suggested. In the manufacturing and wholesale/retail sectors, this relatively worse performance in export growth is driven by the intensive margin. In contrast, in the services sector the net extensive margin is the main factor that detracts from growth. This is particularly true with respect to the exit margin.

Table A7: Data versus Counterfactuals

	Data	Intensive Margin	Entry Margin			Exit Margin		
			Total	Number	Size	Total	Number	Size
	Panel A: Immediate Effect, $h = 1$							
Total growth	-0.16	0.06	-0.15	-0.06	-0.25	-0.17	-0.15	-0.17
Intensive margin	-0.15	0.07	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
Entry extensive	0.35	0.35	0.45	0.45	0.35	0.35	0.35	0.35
Entry intensive	-0.33	-0.33	-0.42	-0.33	-0.42	-0.33	-0.33	-0.33
Exit extensive	0.43	0.43	0.43	0.43	0.43	0.42	0.42	0.43
Exit intensive	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.39
	Panel B: Longer-Term Effect, $h = 6$							
Total growth	0.14	0.30	0.18	0.41	-0.10	0.09	0.05	0.18
Intensive margin	0.18	0.34	0.18	-0.15	-0.15	-0.15	-0.15	-0.15
Entry extensive	0.74	0.74	1.01	1.01	0.74	0.74	0.74	0.74
Entry intensive	-0.62	-0.62	-0.86	-0.62	-0.86	-0.62	-0.62	-0.62
Exit extensive	0.79	0.79	0.79	0.79	0.79	0.89	0.89	0.789
Exit intensive	-0.64	-0.64	-0.64	-0.64	-0.64	-0.68	-0.64	-0.68

Notes: The table presents the decomposition of the growth in exports and seven different counterfactuals for the period 2008-2014 for the immediate effect (one year) in Panel A and the longer term effect (six years) in Panel B. The first column shows the decomposition using the raw data. Columns (2) through (8) hold different margins at their historical levels.

Table A8: Real Export Log Growth Decomposition: Allowing for Comovement with GDP

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$
Total growth	-11.60	-4.86	-4.40	-4.22	-4.17	-3.29
Intensive margin	-11.3	-3.85	-3.11	-3.09	-3.03	-1.9
Net extensive	-0.30	-1.01	-1.29	-1.13	-1.14	-1.39
Entry margin	3.99	2.85	2.31	2.11	1.97	1.94
- extensive	42.46	29.08	22.42	18.04	15.6	14.3
- intensive	-38.47	-26.23	-20.11	-15.93	-13.63	-12.36
Exit margin	-4.29	-3.86	-3.6	-3.24	-3.11	-3.33
- extensive	-43.91	-28.65	-22.15	-18.33	-15.99	-14.5
- intensive	39.62	24.79	18.55	15.09	12.88	11.17

Notes: The table presents the results for the counterfactual growth rates based on the regression specification in equation (7) of the main text. Each column corresponds to a different value of h, the time horizon over which the changes are estimated. For ease of comparison, we annualized the contributions of the separate margins by dividing each by h.

Table A9: Real Export Log Growth Decomposition Across Sectors: Allowing for Comovement with GDP

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$
	Panel A: Manufacturing					
Total growth	-9.35	-5.00	-5.07	-4.72	-4.49	-3.52
Intensive margin	-9.33	-4.38	-4.35	-4.1	-3.8	-2.54
Net extensive	-0.02	-0.62	-0.72	-0.62	-0.69	-0.98
Entry margin	2.44	2.13	1.9	1.76	1.63	1.37
- extensive	18.46	13.93	11.52	10.03	8.85	8.2
- intensive	-16.02	-11.8	-9.62	-8.27	-7.22	-6.83
Exit margin	-2.46	-2.75	-2.62	-2.38	-2.32	-2.35
- extensive	-26.15	-17.86	-14.34	-12.22	-10.97	-10.2
- intensive	23.69	15.11	11.72	9.84	8.65	7.85
	Panel B: Services					
Total growth	27.23	-0.35	-35.66	-33.04	-4.81	19.91
Intensive margin	8.13	35.65	-13.39	-26.11	-29.2	-44.21
Net extensive	19.10	-36.00	-22.27	-6.93	24.39	64.12
Entry margin	-45.15	3.53	17.27	10.9	21.19	63.09
- extensive	39.88	31.54	13.43	4.09	-13.02	5.81
- intensive	-85.03	-28.01	3.84	6.81	34.21	57.28
Exit margin	64.25	-39.53	-39.54	-17.83	3.2	1.03
- extensive	-70.65	-51.4	-25.16	-12.76	3.54	-13
- intensive	134.9	11.87	-14.38	-5.07	-0.34	14.03
	Panel C: Wholesale and Retail Trade					
Total growth	78.72	49.41	58.68	59.92	52.34	41.64
Intensive margin	43.57	28.72	21.31	19.06	16.8	15.78
Net extensive	35.15	20.69	37.37	40.86	35.54	25.86
Entry margin	25.24	26.24	39.92	45.31	41.52	35.14
- extensive	27.04	16.15	12.79	11.4	10.43	7.91
- intensive	-1.8	10.09	27.13	33.91	31.09	27.23
Exit margin	9.91	-5.55	-2.55	-4.45	-5.98	-9.28
- extensive	-24.42	-10.95	-7.92	-7.49	-7.57	-8.59
- intensive	34.33	5.4	5.37	3.04	1.59	-0.69

Notes: The table presents the results for the counterfactual growth rates based on the regression specification in equation (7) of the main text. Each column corresponds to a different value of h, the time horizon over which the changes are estimated. For ease of comparison, we annualized the contributions of the separate margins by dividing each term by h.