Firm-level export and import survival over the business cycle*

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January 3, 2024

Abstract

This paper examines how business cycle conditions affect the dynamics of exporting and importing firms, using micro-level data on trade spells initiated by French firms over the period 1998-2015. First, we find evidence of firm reallocation during recessions. Entry rates fall while exit rates increase. Both entrants and exiters exhibit higher productivity, suggesting tougher selection into export and import participation. Second, business cycle conditions at times of entry have persistent effects on exporters and importers: cohorts 'born' in recessions have a systematically lower exit rate at any age. They also exhibit persistently different characteristics from firms that enter in better times. In the case of exports, cohorts born at recessions and booms display a similar age-dependence path. In other words, firms entering export markets in a recession enjoy a one-off premium to their spell duration prospects. Third, conclusions are largely unaffected when we use a joint model of export and import duration. Our estimates reveal a positive correlation in the unobservable factors explaining both decisions. To put it simply, exporters-importers tend to have either short-short or long-long spells. Overall, our results suggest that business cycle conditions affect trade participation in the short- and long-run, with recessions having both 'cleansing' and 'scarring' effects.

Keywords: firm export and import survival; business cycle; inflow heterogeneity

JEL Codes: F14, C41, E32

*We thank Suzanne Bellue, Pierre Boyer, Paul-Emmanuel Chouc, Javier Ferri, Francis Kramarz, Olivier Loisel, Jean-Baptiste Michau, Francesco Pappadà, Giovanni Ricco and Benoit Schmutz for valuable comments. All errors remain ours. This work was supported by a grant overseen by the French National Research Agency (ANR) as part of the Investissements d'Avenir Programme (LabEx ECODEC; ANR-11-LABX-0047). S. Esteve-Pérez and S. Gil-Pareja thankfully acknowledge that this research was conducted as part of the Project PID2021-122133NB-I00 financed by MCIN/AEI/10.13039/501100011033/FEDER, EU and CIPROM/2022/50 (Prometeo).

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1 Introduction

How do business cycles affect the dynamics of exporting and importing firms? There is widespread evidence that year-to-year aggregate export growth is driven by the intensive margin, i.e., changes in trade volumes among *continuing* exporters, rather than the extensive margin, i.e., entry and exit.[1] This applies particularly to international trade during the Great Recession, as the 2008-09 trade collapse mainly occurred at the intensive margin.[2] A less well-researched question is whether recessions affect trade through the extensive margin over a longer time horizon. Indeed, even though new exporters typically start small and face high initial hazard rates, export survival is a key driver of long-run export dynamics and of the large long-run response of trade volumes to the business cycle.[3] Yet little is known about the role of post-entry trade dynamics in the propagation of economic shocks over time.

How business cycles affect firm dynamics matters to understand the effects of recessions on resource allocation. In the context of domestic firms, a literature has emphasized a 'cleansing' effect of recessions, which forces firms with obsolete techniques and out-of-date products out and free resources for more productive uses.[4] As entry and exit selection get tougher, recessions thus raise average productivity among both entrants and exiters through pure composition effects. At the same time, recessions also have long-lasting *scarring effects* on firm size, with firms born in recessions failing to catch up with those born in booms.[5]

In this paper, we examine the effects of the business cycle conditions at entry on export and import dynamics over time. Our main focus is on how business cycles affect the hazard of exiting export/import markets. Our analysis accounts for spell-specific age-dependence, current business cycle conditions and unobserved heterogeneity or more precisely inflow heterogeneity, which refers to the variation over the business cycle in the composition of the new export/import spells with respect to their survival chances. To do so, we exploit exhaustive French export and import transaction records over the 1998-2015 period, which we call our *Full Sample*. These data are also matched with reported firm-level characteristics extracted from corporate tax returns (FICUS/FARE dataset) for a subset of trading firms, which we call our *Restricted Sample*. The combination of these data sources allows us to examine exporting

[1] See, for instance, Bernard et al. (2009), for the US; Amador and Opromolla (2013), for Portugal; Álvarez and Fuentes (2011), for Chile; De Lucio et al. (2011), for Spain; Bricongne et al. (2012), and Behrens et al. (2013), for France; Wagner (2014), for Germany; and Cebeci and Fernandes (2015), for Turkey.

[2] World trade in manufactures fell by about 30% between the first quarter of 2008 and the second quarter of 2009 (World Trade Organization, 2009), which was disproportionately higher than the drop in aggregate output. That fall has been attributed to both a shortage of trade finance (Amiti and Weinstein (2011); Bricongne et al. (2012); Chor and Manova (2012); Paravisini et al. (2015)) and a disproportionate fall in demand for imports, especially durable goods (Levchenko et al. (2010); Eaton et al. (2016); Bems et al. (2010); Abiad et al. (2014)). However, a general consensus is that intensive margin changes have been prominent.

[3] See, among others, Besedeš and Prusa (2011), Eaton et al. (2007), Albornoz et al. (2012), Bellas and Vicard (2014), and the survey by Alessandria et al. (2021). This echoes findings on employment dynamics by Haltiwanger et al. (2013) and Decker et al. (2014), who show the long-lasting contribution of young firms to net job creation.

[4] See Caballero and Hammour (1994), Campbell (1998), Gomis and Khatiwada (2017), among others. Gomis and Khatiwada (2017) do not find evidence of a cleansing effect in terms of productivity, but they do find that firms born in recessions have persistently higher employment and capital.

[5] See Moreira (2016), Sedláček and Sterk (2017), Vardishvili (2023), among others.

and importing spells at the firm level or at the firm-country level.

First, we find that recessions reallocate firms in and out of exporting and importing. Gross exit rates increase and gross entry rates decrease during downturns, leading to a fall in foreign market participation. Probit entry regressions confirm that entrants in economic downturns are more productive. Firms entering during downturns are systematically different from firms entering during booms: the former are initially smaller but more productive than the latter, and we observe persistent differences over these firms' export/import lifetimes, providing evidence in support of both 'cleansing effects' and 'scarring effects' of recessions.

Second, we estimate survival models to assess whether and how the hazard of exiting export/import activity differs across cohorts that face different business cycle conditions *at 'birth'*,[6] accounting for spell-specific age-dependence, current business cycle conditions and unobserved heterogeneity. We examine both whether spells initiated under recessions face a one-off difference in hazard rates and if they also have different patterns of duration dependence. In our context, a challenge is to identify the separate contributions to the average survival probability of the baseline hazard, unobserved heterogeneity, the business cycle indicators and other covariates including spell age. Following Cameron and Trivedi (2005), we deal with these issues through the estimation of several specifications of a flexible semi-parametric discrete time proportional hazards model (i.e., a Mixed Proportional Hazards Model equivalent to a piece-wise constant exponential hazards model and the Cox proportional hazards model) that includes a discrete mixture distribution with finite support to summarize unobserved exporter- and importer-level heterogeneity (Heckman and Singer (1984)). The export and import hazards are estimated by maximum likelihood.[7] We employ several binary and continuous business cycle measures for robustness.

We find that while the overall hazard of leaving export/import markets is higher during downturns, exporters/importers 'born' under bad macroeconomic conditions face a lower hazard of ending their export/import spells. This suggests that firms that start exporting and/or importing during downturns are intrinsically fitter to survive than those beginning spells during upturns. Furthermore, our results confirm the existence of genuine negative age-dependence in hazard rates (which may be due to learning or success-breads-success effects), accounting for 61% (41%) of the observed aggregate negative export (import) duration dependence in the *Restricted sample* for the survival analysis at the firm level. Besides, the pattern of negative duration dependence does not differ between firms that start exporting at bad and good times, suggesting the existence of a one-off drop in the hazard of leaving foreign participation for firms that start exporting during recessions. However, the pattern differs between firms that start importing at bad and good times.

Third, we estimate a joint model of export and import duration. This model allows for arbitrary correlation in unobservable factors affecting each decision, capturing interdependence

[6] Birth and entry refer to the start of exporting/importing spells throughout the paper. We use both words interchangeably.

[7] The identification of the parameters of interest (i.e., duration dependence, business cycle, and inflow heterogeneity effects) is improved due to both the presence in the data of multiple spells per firm (for example, in the *Full sample*, about 22.7% of firms in the data experience more than one firm-level non-left-censored export spell -repeated spells, and 86.3% of these repeated spells are complete), and the use of business cycle and inflow heterogeneity indicators.

between both activities. While we find a positive correlation between both decisions, our conclusions on the persistent effects of business cycle conditions are unaffected. In other words, the joint pattern of firm's export and import duration tends to be either long-long or short-short.

After reviewing the related literature in the next sub-section, the rest of the paper is organized as follows. Section 2 describes the data and presents some evidence on firm export/import dynamics and the business cycle. Section 3 briefly outlines the empirical methodology on duration models and presents the main results. Section 4 discusses our results and relates them to existing research on firm trade dynamics, and on firm dynamics and business cycles. Section 5 concludes.

Background and Related Literature

Our paper is related to two streams of literature. First, it is related to work on export dynamics. Much of the theoretical literature on export dynamics treats export participation as an investment choice under uncertainty: Dixit (1989) and Dixit (1991); Roberts and Tybout (1997); Melitz (2003); Das et al. (2007); Ruhl and Willis (2017). A 'canonical model' is offered by Alessandria et al. (2021). In that framework, heterogeneous firms start trade relationships by incurring sunk costs under some uncertainty about their future profitability. Export dynamics are driven by innovations to idiosyncratic productivity and inaction (i.e., no entry, no exit) can be optimal in a certain range of the state variable. However, the relationship between the extensive margin of trade and macroeconomic conditions has received less attention. Some authors have developed theories focused on the relationship between the number of exporters/importers and the business cycle, e.g., Alessandria and Choi (2007) and Alessandria and Choi (2019), but to the best of our knowledge, no previous studies have examined exporters' and/or importers' survival and business cycle conditions at 'birth' over their export/import lifetime.[8] On the empirical side, several studies have found 'age dependence' in the hazard out of exporting or importing.[9] While our paper shows that these findings also apply to our dataset, our contribution is to examine the independent effect of macroeconomic conditions at 'birth'.

Second, our paper is related to a literature on firm dynamics and macroeconomic conditions at birth: Caballero and Hammour (1994); Campbell (1998); Haltiwanger et al. (2013); Lee and Mukoyama (2015) and Lee and Mukoyama (2018); Moreira (2016); Sedláček and Sterk (2017); Vardishvili (2023). Empirically, these studies find robust evidence of persistent effects of entry conditions. Part of that literature focuses on the *cleansing effect* of recessions, i.e. the

[8] Some studies have examined export survival under financial constraints, e.g. Berman and Héricourt (2010); Besedeš et al. (2014). They conclude that credit constraints are an important barrier to start exporting, with a decreasing or even no effect as the duration in export markets increases. However, although these studies consider market dynamics, they do not account for re-entry possibility in a dynamic framework with more than two (either consecutive or distant) periods. In such dynamic setting, entry barriers become exit barriers so an option value of staying in arises.

[9] See, for instance, Bernard and Jensen (2004), Bernard et al. (2012), Volpe Martincus and Carballo (2008), Eaton et al. (2008), Lawless (2009), Iacovone and Javorcik (2010), Amador and Opromolla (2013), Esteve-Pérez et al. (2013), Esteve-Pérez (2021), Albornoz et al. (2016), and Araujo et al. (2016).

elimination of firms with outdated techniques and products. The underlying mechanism, which involves selection based on productivity, dates back to Schumpeter (1939) and was formally examined by Caballero and Hammour (1994). Empirical studies finding pro-cyclical firm/plant entry and counter-cyclical exit support this view e.g., Campbell (1998); Lee and Mukoyama (2015); Gomis and Khatiwada (2017); Tian (2018). Besides, a number of studies point out that recessions at birth have persistent *scarring effects* on firm size, e.g., Haltiwanger et al. (2013); Lee and Mukoyama (2015) and Lee and Mukoyama (2018); Moreira (2016); Sedláček and Sterk (2017); Vardishvili (2023)). In newborn cohorts, firms start smaller because of either low demand or heightened financial frictions, and demand accumulation processes or capital adjustment costs create persistence in firm size. Ouyang (2009) builds a model with demand fluctuations and learning about idiosyncratic productivity, which encompasses both *cleansing* and *scarring* effects. Our contribution with respect to that literature is to provide evidence in an international trade context, with the advantage that trade data allow us to look more closely at cycles in partner countries.

2 Empirical evidence on firm export/import dynamics and business cycle

In this section, we present the dataset used in this paper, define some key variables for the analysis, and provide some evidence on the relationship between firm export/import dynamics and the business cycle.

2.1 Data and variables

2.1.1 Data sources

To carry out our analysis we use two datasets that span the period from 1997 to 2016.[10] First, the *Full Sample* consists of annual firm-level export and import data from French Customs. This dataset includes detailed information on all transactions (in euros) by firm, HS6 product, destination country and year.[11] Our paper focuses on the study of export/import spells. A firm export (import) spell is defined as a set of years in which a firm exports (imports) consecutively. As most of our analyses are conditional on the initial characteristics of export/import spells, we exclude export/import spells for which data on main destination/origin country

[10] Year 1997 is used to identify left-censored export/import spells and year 2016 is used to identify whether export/import spells are right-censored or failed by the end of 2015.

[11] See Bergounhon et al. (2019) for a detailed presentation of this dataset. Following these authors, we keep valid firm identification numbers and valid destination countries. Moreover, we drop both special product codes and countries that account for a tiny share of all French exports (imports) over the sample period. We further drop "sporadic export and import relationships", which comprise firm-level export relationships with a value of sales abroad below 1500 euros in a particular year. As this threshold may create artificial exits, we treat spells with observations with a single year below the threshold as continuous spells. To handle revisions of the HS classifications, we concord product categories using data from Van Beveren et al. (2012), who use a version of the J. R. Pierce and P. K. Schott (2012) algorithm.

characteristics are missing in the first year of the spell.[12] The resulting *Full sample* contains both left-censored (i.e., ongoing firm-level export/import spells in 1997) and non left-censored export/import spells. Regarding non left-censored export spells, the *Full sample* consists of 403,833 export spells (about 89.3% of them complete) that correspond to 307,504 firms leading to 994,199 (spell-year) observations between 1998 and 2015. Regarding non left-censored import spells, the *Full sample* consists of 365,865 import spells (about 86.0% of them complete) that correspond to 296,823 firms leading to 1,052,992 (spell-year) observations between 1998 and 2015.

The second dataset (*Restricted sample*, hereafter) results from matching the *Full sample* with balance sheet data from corporate tax returns (FICUS/FARE dataset) and data on firm ownership (LIFI dataset). The FICUS/FARE dataset includes sales, value-added, employment, capital stock, cost of materials, primary industry, foreign ownership, etc. for all French firms taxed under 2 main corporate tax regimes. We further exclude those firm-level export/import spells of micro firms which are not included in FICUS before 2008 or in the distribution sector (NACE industry categories 50-52) in the first year of the spell. Regarding non left-censored export spells of which the first year observation can be matched with balance sheet data, the *Restricted sample* consists of 202,210 export spells (about 85.7% of them complete) that correspond to 157,027 firms leading to 485,652 (spell-year) observations between 1998 and 2015. Regarding non left-censored import spells, the *Restricted sample* consists of 190,311 import spells (about 82.3% of them complete) that correspond to 156,485 firms leading to 498,661 (spell-year) observations between 1998 and 2015. In some subsections, we rely on subsamples of the *Restricted sample*, as will be explained in detail below. Appendix A gives summary statistics of some firm-level covariates of the *Restricted sample*.

These two datasets provide exhaustive annual information on foreign trade participation over a long period (1997-2016). The long time span makes them particularly suitable for the analysis of the relationship between the business cycle and export/import survival. First, we can observe entry and exit from foreign markets before, during and after a recession. Second, the time period includes a large number of *new* export/import spells, including repeated spells (see Section 3).

In the survival analysis of Section 3, we also examine firm-country level export/import survival using a spell definition similar to the aforementioned firm-level export/import spells. A firm-country export (import) spell is defined as a set of consecutive years during which a firm exports to (imports from) a specific country. This approach allows us to investigate firm survival in a specific foreign country while controlling for its characteristics directly.

Finally, in the survival analysis, we also include additional control variables on country characteristics. We use standard gravity variables from the CEPII Gravity dataset used in Head et al. (2010). Measures of country risk come from the OECD. Details on variable definitions and sources are provided in Appendix A.

[12] For a given firm-year, the main destination (origin) country is the one with the highest export (import) value.

2.1.2 Definition of variables

We now turn to the definitions of entry and exit from export/import and business cycle indicators.

Throughout our analysis, a firm begins exporting (importing) in year t, when it had zero export (importing) value in $t-1$, but a positive value in year t. Second, a firm exits from exporting (importing) in year t, when it has a positive export (import) value in year t, but has zero export (import) value in $t+1$.[13] Third, we use two binary variables as our *main* business cycle indicators. The two variables capture business cycle conditions in the *current* year and in the *first* year of a firm export spell (i.e., at entry).[14] To capture conditions at entry we define the indicator *birth*2008_10, which equals 1 if firm export/import spells were initiated in year 2008, 2009 or 2010, and zero otherwise. Thus, *birth*2008_10 captures those export/import spells that were born during the economic downturn. Second, current macroeconomic conditions are captured by *current*2008_10, which equals 1 if the current year is 2008, 2009 or 2010. Hence, *current*2008_10 aims to capture the effect of the recessionary periods on all ongoing spells between 2008 and 2010. Therefore, we refer to these years as *birth/current* bad times.[15]

For the sake of robustness, we will consider alternative business cycle indicators in the export/import survival analysis of Section 3. In the main text we will report results with a second set of binary indicators, which are equal to 1 if detrended GDP is negative in the entry year and the current year respectively. Importantly, this second indicator allows us to distinguish between business cycle conditions in France and in the main destination or origin country. In further robustness checks we will report results with 9 additional indicators: 5 binary and 4 continuous measures of business cycles. The binary indicators include a dummy for the financial crisis and its aftermath covering the 2008-2015 period, a dummy that takes value 1 in years 2001 and 2008-2010, a dummy that equals 1 if the difference between a country's GDP growth and world GDP growth is smaller than the mean of this difference across sample years, and two dummies that take value 1 if the output gap is negative (as measured by either the IMF or the OECD). The continuous variables include the underlying GDP growth rate difference, the two measures of the output gap as well as a measure of (log) aggregate Total Factor Productivity. Results with all business cycle indicators are reported in Appendix D, while more precise definitions of the indicators are provided in Appendix A.

[13] For the survival analysis at the firm-country level in Section 3, the definition of entry/exit is similar to that at the firm level, except it is applied to a specific country.

[14] Notice that we cannot capture birth/current business cycle conditions with simple year dummies in the survival analysis of Section 3. This is because we want to analyze how macroeconomic conditions and spell age both affect export/import spell duration. In the presence of cohort dummies, spell age dummies and year dummies would be collinear. To build our business cycle indicator we choose to group adjacent years instead, in the spirit of Heckman and Robb (1985).

[15] Our definition relies on World Bank, NBER and CEPR official recession dates. For instance, Kose et al. (2020) date the trough in global activity in 2009, corresponding to a fall in annual real per capita global gross domestic product. The latter two institutions locate the trough in the second quarter of 2009, with the peak in late 2007 and recovery in early 2011. Our choice is consistent with that of Ayres and Raveendranathan (2023) and Vardishvili (2023). Note that France did not experience a recession in 2012 and early 2013, even though the Euro Area as a whole did.

2.2 Evidence: export/import entry and exit over the business cycle

In this subsection, we present some evidence on exporters' and importers' performance over business cycle from different perspectives.

2.2.1 Trade is cyclical & extensive margin is important in the long-run

We now provide evidence on the correlation between trade and the business cycle relying on the *Full sample*. Figure 1 plots France total export and import values and GDP between 1997 and 2016. At first glance, there exists a clear co-movement between trade values and business cycle (GDP). The Great Recession prompted by the financial crisis of 2008 is associated with the Great Trade Collapse. Hence, this figure suggests that trade flows are highly cyclical.

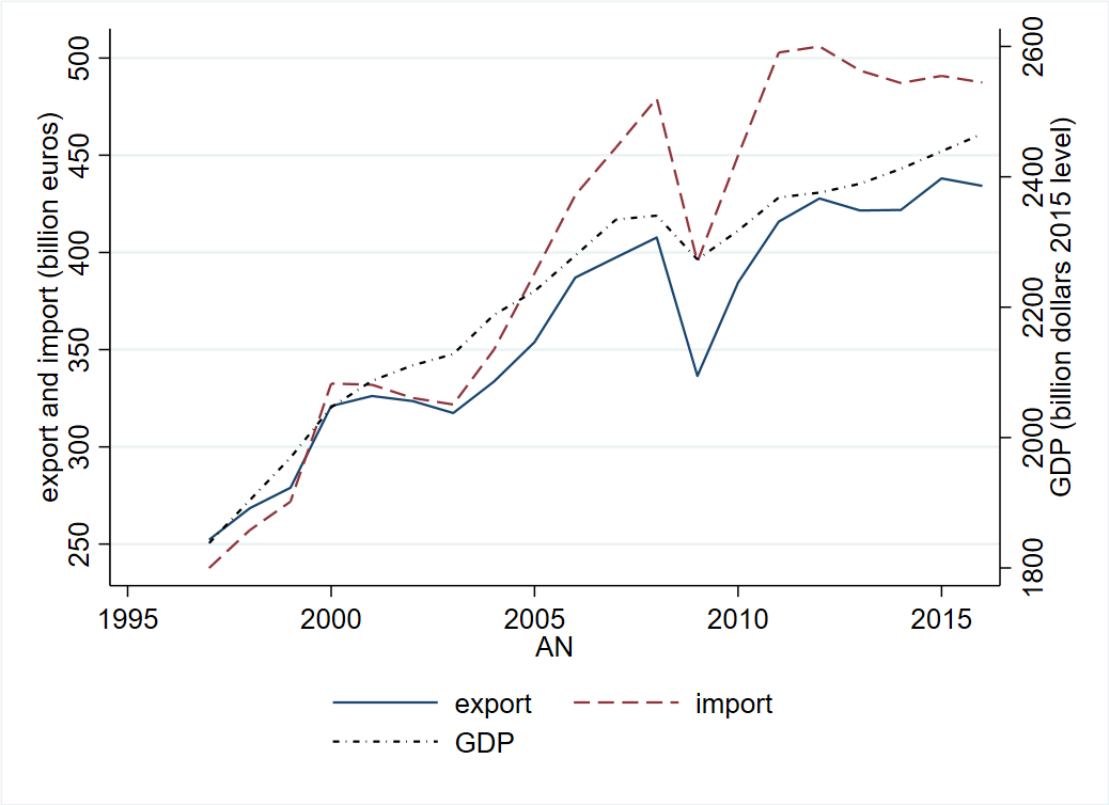
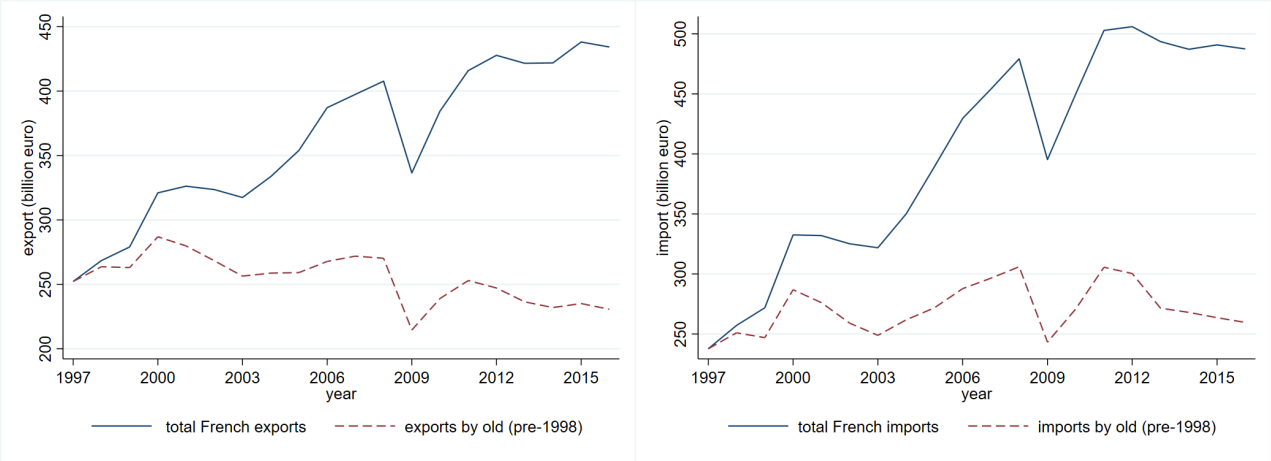


Fig. 1: France total exports and imports, and GDP (1997-2016)

The two panels of Figure 2b plot France's total annual exports (left panel) and imports (right panel), as well as annual exports and imports by firms that were active traders before 1998, whom we dub 'old' exporters and importers. The vertical distance between both curves represents the contribution of new exporters and importers. Over 20 years, that contribution amounts to roughly half of both types of trade flows. These two figures illustrate the relevance of the extensive margin (i.e., entry, growth and survival of new exporters/importers) to explain the dynamics of aggregate trade flows.



(a) exports (b) imports

Fig. 2: French total exports/imports and exports/imports by old (pre-1998) exporters (1997-2016)

2.2.2 Entry/exit rates and the business cycle

Table 1 provides evidence on the relationship between entry and exit rates and the business cycle in the *Full sample*. In this Section as well as in the survival analysis of Section 3, we define an entrant in year t as a firm whose exports or imports are positive in t and zero in $t-1$. An exiter in year t is a firm whose exports or imports are positive in t and zero in $t+1$. To compute entry/exit rates, we treat firms that both enter and exit in year t (i.e. one-year spells) as 0.5 entrant and 0.5 exiter. Furthermore, we define the Entry (Exit) rate at bad (good) times as the ratio between the mass of entrants (exiters) and the mass of all exporters/importers at bad (good) times. For instance, the export entry rate at bad times equals to the mass of entrants between 2008 and 2010 divided by the mass of exporters during this period.

Table 1 reveals that entry rates are lower and exit rates are higher during bad times (i.e., years 2008, 2009, and 2010). Net entry is negative during the recession and close to zero in other periods. Overall, we conclude that entry rates are pro-cyclical, exit rates are counter-cyclical and net entry rates are pro-cyclical. These observations suggest that recessions affect the selection of both incumbents and potential entrants out of exporting and importing.

	Exports		Imports	
	Good (%)	Bad (%)	Good (%)	Bad (%)
Entry rate	18.6	17.4	16.2	15.2
Exit rate	18.6	19.7	16.0	19.2
Net entry	-0.076	-2.366	0.216	-4.030

Note: The sample coverage is between 1998 and 2015. Bad if year 2008, 2009 or 2010. Entrant in year t means export (import) in t and not in $t-1$. Exiter in year t means export (import) in t and not in $t+1$. For a firm that belongs to both entrant and exiter in a given year, it is considered as 0.5 entrant and 0.5 exiter.

Tab. 1: Entry and exit rates

2.2.3 Differences in firm-level characteristics of entrants, exiters and continuers over the business cycle

To gain insights into how firms are selected in and out of foreign markets, we now explore differences in firm-level characteristics of entrants, continuers and exiters between good and bad times. To do so, we focus on the *Restricted sample* which documents firm-level characteristics on exporters and importers.

Table 2 presents median values of some firm-level characteristics: number of full-time workers (labor), total factor productivity (TFP), and total sales. These characteristics are reported for entrants, continuers and exiters among exporters (Panel A) and importers (Panel B) across good and bad times. The last column of each panel indicates statistically significant differences between good and bad times.[16] The sample coverage is from 1998 to 2015 and left-censored spells are included. It is important to bear in mind that exiters and continuers include some left-censored export/import spells (i.e., firms that were already exporting/importing in 1997). These probably include a disproportionate share of experienced exporters/importers that might bias upwards some median values. By construction, left-censored spells that we observe from 1997 onwards can only be classified as continuers or exiters.

Table 2 indicates that, both for exporters and importers, entrants and exiters have a lower median labor force during bad times than in good times. The median labor force of continuers is similar across bad and good times. However, the share of observations with labor force greater than the median is lower during bad times and the difference test is significant at 5% and 1% levels for exporters and importers, respectively. Regarding TFP, all the types of exporters and importers have a significantly greater median performance at bad times (vs good times), yet the absolute difference is smaller for importers. This may suggest that the selection becomes tougher for both entry and exit during recessionary periods. More productive firms

[16] We follow our previous definitions of entrants (a firm with exports/imports in t but not in $t-1$) and exiters (a firm with exports/imports in t but not in $t+1$) and business cycle (i.e., bad years include 2008, 2009, and 2010). Those exporters (importers) that are not classified as entrants or as exiters are considered as continuers. For entrants, continuers and exiters in year t, we use their characteristics in t. We perform the default median test by group in STATA. When values for an observation are equal to the sample median, they are added to the group below the median.

are selected in and some relatively productive incumbents are selected out of foreign markets. In order to stay in their export/import markets during bad times, firms need to have a higher TFP. These findings are compatible with the *cleansing* effect hypothesis of Caballero and Hammour (1994). With regard to total sales, entrants have difficulty in achieving high total sales during bad times as the market condition is worse. Meanwhile, some relatively large exporters are selected out during recessionary periods and only large incumbents succeed in surviving in foreign markets. For importers, there is no difference for continuers and median total sales of exiters are significantly smaller during bad times.

		Panel A. Exporters			**Panel B. Importers**		
		Good	Bad	Diff	Good	Bad	Diff
labor	entrants	5	4	***	5	3	***
	continuers	18	18	**	18	17.75	***
	exiters	5	4	***	5	4	***
TFP	entrants	431.4	520.1	***	412.3	427.5	***
	continuers	959.5	1074.3	***	1053.8	1163.7	***
	exiters	414.0	515.8	***	393.2	464.4	***
total sales	entrants	742 085	722 535	**	681 314	512 525	***
	continuers	3 191 085	3 367 658	***	3 491 160	3 493 380	
	exiters	713 000	776 455	***	667 000	649 610	**

Note: *Restricted sample* dataset over the period 1998-2015 (including left-censored spells). Bad if year 2008, 2009 or 2010. Entrant in year t means export (import) in t and not in $t-1$. Exiter in year t means export (import) in t and not in $t+1$. Continuer in year t is the one that exports (imports) in t and does belong to neither entrant nor exiter group. Units are number of employees for labor, and euros for total sales. TFP is calculated using the Levinsohn-Petrin method. Diff gives statistical significance of a test of equality of medians for good and bad groups. When values for an observation are equal to the sample median, they are added to the group below the median. * p<0.10, ** p<.05, *** p<.01

Tab. 2: Exporters and importers firm-level characteristics (median values)

To sum up, we find that during recessionary periods new exporters and importers are smaller, but more productive. Firms quitting exporting and importing tend to be smaller in terms of employment, but have higher productivity.

2.2.4 Entry to export/import probability over the business cycle

We now examine how the effect of business cycle conditions on entry depends on firm characteristics. This will shed light on possible changes in the composition of entrants over the business cycle.

To do so, we use a subset of our *Restricted sample*. We exclude all left-censored spells to focus on entrants and non-entrants. Entrants are defined as previously: firms that trade in year t but not in year $t-1$. Non-entrants are firms that don't trade in both years t and $t-1$.[17]

[17] For non entrants in t, we drop those which belong to micro firms or are in distribution sectors in $t-1$.

Since we use firm characteristics at $t-1$ to predict entry in t, firms must exist the year before they begin exporting (importing) to be in the sample.

We estimate several specifications of the following probit model:

$$Pr(entry_{i,t} = 1|X_{i,t}) = \Phi(\beta_0 + \beta_1 birth2008\_10_t + \beta_2 birth2008\_10_t * X_{i,t-1} + fe_{nace}) \quad (1)$$

where $entry_{i,t}$ can represent either export or import entry and $X_{i,t-1}$ can represent 3 different firm characteristics measured at entry. $birth2008\_10$ equals to 1 if the export/import spell started in year 2008, 2009 or 2010.

Panels A and B of Table 3 report estimates of (1) for exports and imports respectively. We consider 3 firm characteristics: total factor productivity (TFP), employment (L) and total sales ($catotal$). Results are reported without NACE sector fixed effects in columns 1, 3, and 5 and with sector fixed effects in columns 2, 4, and 6. Note that our specification is similar to Equation (6) in Moreira (2016) which includes the business cycle indicator and its interaction with each firm-level performance variable to examine the role of these performance indicators on the selection mechanism during bad times.[18] A positive estimate of the interaction term suggests that an increase in that characteristic is positively associated with a higher probability of starting to export/import. For instance, a positive estimate for TFP suggests that the average productivity of entrants at bad times is higher (compared to that of non-entrants), suggesting that the average quality of entry cohorts is counter-cyclical.

Results in Table 3 show that bad macroeconomic conditions at birth reduce the probability of starting an export/import relationship. Moreover, the coefficients on interaction terms suggest that to start exporting or importing, firms' TFP, labor size and total sales become more crucial at bad times. Therefore, the selection mechanism to enter is associated with these firm-level characteristics.

The results in this subsection are still robust to the use of our *Restricted sample* without that selection.

[18] Moreira (2016) regresses the demeaned log change in the number of entrants (i.e., *newborn* firms) in market segment in a given year on the change of business cycle indicator and the interaction between the change of business cycle indicator and market characteristics.

Panel A: export entry probability

	(1)	(2)	(3)	(4)	(5)	(6)
birth2008_10	-1.832	-1.753	-0.275	-0.243	-2.968	-2.669
	(0.014)***	(0.016)***	(0.004)***	(0.004)***	(0.018)***	(0.019)***
birth2008_10*lnTFP	0.334	0.320				
	(0.002)***	(0.003)***				
birth2008_10*lnL			0.214	0.200		
			(0.002)***	(0.002)***		
birth2008_10*lncatotal					0.241	0.216
					(0.001)***	(0.001)***
nace		yes		yes		yes
N	14538981	14538981	15910467	15910467	32710594	32710594
ll	-755550.22	-702375.096	-789599.462	-729708.113	-1055181.861	-969290.194

Panel B: import entry probability

	(1)	(2)	(3)	(4)	(5)	(6)
birth2008_10	-1.571	-1.528	-0.227	-0.206	-2.574	-2.326
	(0.015)***	(0.016)***	(0.004)***	(0.005)***	(0.019)***	(0.020)***
birth2008_10*lnTFP	0.294	0.287				
	(0.003)***	(0.003)***				
birth2008_10*lnL			0.198	0.187		
			(0.002)***	(0.002)***		
birth2008_10*lncatotal					0.213	0.192
					(0.001)***	(0.002)***
nace		yes		yes		yes
N	14495221	14495221	15865605	15865605	32659403	32659403
ll	-665629.29	-632858.824	-697497.441	-660557.069	-940615.138	-882926.349

Note: Probit estimation of export/import entry probability (Eq. (1)). The sample coverage is between 1998 and 2015. $birth2008\_10 = 1$ if entry year is 2008, 2009 or 2010. For exporters (importers), entry in year t means a firm exports (imports) in t and not in $t-1$ and no entry in t means not export (import) in $t-1$ and t. See Appendix A for the definition of TFP, L, and nace. *lncatotal* is the logarithm of firms' total sales. fe_{nace} in Eq. (1) is nace sector fixed effect and we use firm's sector in $t-1$. We use a subset of our *Restricted sample*, which consists of two-year observations for entrants and non-entrants. For consistency, we drop those non entrants in t that are micro firms or in distribution sectors in $t-1$. The number of observations varies across different specifications as many firms have 0 labor force and their lnTFP and lnL are missing. The unit of total sales is euro. Standard errors are clustered at the firm level. * p<0.10, ** p<.05, *** p<.01

Tab. 3: Export and import entry probability

2.2.5 Persistent effects of conditions at birth

In this subsection, we look at whether export/import values, TFP, and employment of firms varies with business cycle conditions at birth over their export/import spell's lifetime. More specifically, we examine whether there are *persistent* differences in firm characteristics between exporters (importers) that start to export (import) at different stages of the business cycle.

Following Moreira (2016), we estimate by way of OLS the following age-period-cohort equation, that expresses the characteristics of exporter/importer i as a log-linear function of cohort (c), age (a) and year (t) effects:

$$ln(X_{it}) = \beta_{b0} birth2008\_10_{c(i)} + \sum_{s=1}^{8+} \beta_s \mathbb{1}_{a_{c(i)t}=s} + fe_{nace} + fe_t \tag{2}$$

We bin age 8 or more into age 8.[19] We add NACE industry dummies as additional controls.

This specification uses $birth2008\_10$ as a proxy to identify cohort effects (Heckman and Singer (1984)). Under the standard exogeneity restrictions, β_{b0} provides an approximation to the average effect over the entire spell's lifetime of economic conditions at birth on firm performance, controlling both for business cycle conditions over the entire lifetime and for spell age.

Results in Table 4 show persistent effects of conditions at entry on firm characteristics. The coefficient of the business cycle indicator at birth is negative and statistically significant for TFP and employment in the case of exports and imports, and for export value in the case of exports. Firms that start exporting/importing in recessions thus have, on average, persistently lower TFP and employment. Export values remain lower and import values remain higher than among firms starting in good times.

Results on TFP contrast with those of Table 2, which showed that export/import entrants in recessions are more productive than entrants in booms. Estimates of (2) capture not only the effect of economic conditions at entry, but also the cumulative effect of economic conditions faced by each cohort over its lifetime. For example, the 2008 cohort faced bad conditions in its first three years, while the 2003 cohort faced no bad times until the age of 5. These cumulative conditions are not captured by year dummies or by common age effects.

To sum up, we find evidence of persistent effects of entry conditions that are compatible with both cumulative effects of recessions and scarring effects at work.

[19] Since $birth2008\_10 = 1$ if export (import) spells start in 2008, 2009 or 2010, one caveat is that the maximum age of cohort 2008, cohort 2009 and cohort 2010 are 8, 7, and 6, respectively.

	Export		
	Export value (lnv_ex)	Total factor productivity (lnTFP)	Labor (lnL)
*birth*2008_10	-0.070	-0.043	-0.147
	(0.018)***	(0.011)***	(0.014)***
age dummy	yes	yes	yes
nace	yes	yes	yes
year	yes	yes	yes
N	485651	389081	398115
ll	-1031489	-615787	-718128
r2	0.964	0.968	0.732
	Import		
	Import value (lnv_im)	Total factor productivity (lnTFP)	Labor (lnL)
*birth*2008_10	0.101	-0.064	-0.219
	(0.017)***	(0.011)***	(0.014)***
age dummy	yes	yes	yes
nace	yes	yes	yes
year	yes	yes	yes
N	498661	393489	403403
ll	-1068037	-630502	-726790
r2	0.966	0.967	0.743

Note: The estimation method is OLS without constant. We use *Restricted sample* over the period 1998-2015. Left-censored spells are excluded. *birth*2008_10 = 1 if export/import spells started in year 2008, 2009 or 2010. See Appendix A for the definition of TFP, L and nace. *lnv_ex*/*lnv_im* is the logarithm of firms' export/import value. The number of observations varies across different specifications as many firms have 0 labor force and their lnTFP and lnL are missing. The unit of export/import value is euro. Standard errors are clustered at the firm level. * p<0.10, ** p<.05, *** p<.01

Tab. 4: Persistent effects of business cycle conditions at entry to export/import

2.3 Remarks on trade dynamics and business cycle

To sum up, we have uncovered the following results:

1. (Export/Import) entry rates are pro-cyclical and exit rates are counter-cyclical.

Moreover, the number of exporters and importers tends to fall during recessions, with (relatively) less variation during upturns.

2. Recessions change the composition of exporters and importers.

New, continuing and quitting exporters/importers tend to be smaller in size (employment), but more productive during bad times than during good times. This suggests tougher selection both at entry and at exit.

3. The entry selection mechanism gets tougher during bad times.

We find a higher entry productivity threshold at bad times. This result is consistent with the view that new entrants during bad times must overcome the overall/general negative macroeconomic conditions.

4. Persistent effects of macro conditions at birth.

The results indicate that there are persistent differences (over export/import spells' lifetimes) in firm-level characteristics between exporters (importers) starting to export (import) at different stages of the business cycle.

Taken together, our results are consistent with the *cleansing* effect hypothesis, with tougher selection of entrants and exiters on productivity cutoffs during recessions. We also find evidence consistent with the existence of *scarring* effects of conditions at export/import entry, with initial and persistent negative effects of recession at entry on size. Overall, results emphasize the importance of accounting for inflow heterogeneity to better understand trade dynamics over the business cycle. This will be an important consideration in the next section, where we will explore how business cycle conditions at entry affect the duration of exporters' and importers' spells.

3 The hazard rate of exiting export/import markets

In this section we examine the relationship between the business cycle and the hazard of leaving export/import markets, accounting for age-of-spell effects (i.e., duration dependence) and individual (observed and unobserved) heterogeneity. More specifically, we investigate whether and how the macro conditions at birth of spells (i.e., when firms start exporting and/or importing) is associated with their post-entry survival performance controlling for current business cycle conditions.

3.1 Empirical methodology

This subsection presents the empirical methods and includes a brief discussion of some identification issues. We use survival models that examine the association between risk factors and time-to-an event since the onset of the spell (i.e., duration until the end of a new firm-level export/import spell). Survival models have some interesting features that make them suitable for our analysis. First, they account for whether and when an event takes place, so it allows controlling for both the evolution of hazard rate with spell age (i.e., duration dependence) and business cycle conditions. Secondly, these methods appropriately deal with right-censored observations, which arise when export/import spells are incomplete (i.e., spells that are ongoing at the end of the sample period). These methods use the information on the time of survival up to the censoring point but do not make any inference about the subsequent survival time of the spell. Thirdly, the long-time span of our dataset allows for examining a large number of new spells over time with a long follow-up period, which permits us to overcome some drawbacks of previous studies on trade and firm survival that examine a few cohorts over short

follow-up periods after entry.[20]

We choose to estimate a flexible semi-parametric discrete time frailty survival model to uncover long-run effects of different stages of different business cycle conditions, accounting for entry, exit and re-entry of export/import spells. The use of a frailty model is justified by firm heterogeneity. For instance, hazard rates may fall with age either because of genuine age-dependence in export and import spells,[21] or because of sorting, that is a selection mechanism that leads to an over-representation of "fitter-to-survive" spells as a given cohort ages. We saw in the previous Section that entrants in recessions and booms have different observable characteristics. Unobserved firm characteristics, e.g. managerial capabilities, will also affect the observed duration dependence in the sample if firms sort into export/import status based on them. Therefore, a frailty model capturing such unobserved heterogeneity will help us disentangle between genuine age dependence and sorting.

To estimate our survival model we use both the *Full sample* and the *Restricted sample* described in Section 2.1. The unit of observation is an export/import flow by a firm i in year t. From the annual data, we define a new firm-level export/import spell relying on the number of periods t (years) of consecutive exporting/importing activity (i.e., transactions) by a firm since it started or re-started to export/import (i.e., "fresh" export/import spell). A firm's export/import spell starts in year t (i.e., birth year t) if the firm did not export/import in year $t-1$ but it does export/import in year t. Therefore, the information in 1997 is only used to identify new export/import spells in 1998. A spell ends in year t when the firm was engaged in exporting/importing in year t but not in year $t+1$. Hence, information in year 2016 is only used to determine whether ongoing spells in year 2015 end in that year or are right-censored (i.e., they continue beyond 2015). The duration of a firm's export/import spell is defined as the number of consecutive years in which a firm is exporting (since it started). We also carry out the analysis on firm-country export and import spells, which have been built following the procedure explained above but relying on firm-(destination/source) country level information.

In the survival analysis, we exclude left-censored spells (i.e., export/import spells that were running at the start of the sample period - initiated on or before 1997) given that we do not know their exact entry-date.[22] That is, we do not know whether the first observed year of the spell (start of sample period) is in fact the first year of the relationship or the trade relationship had begun in some prior year. If we overlook that, duration estimates would be biased. Therefore, we focus on 'fresh' spells (i.e., those spells born from 1998 onwards). Yet, we will add a dummy variable to control for those trade relationships that existed in 1997.

[20] In such studies, the robustness of their results critically depends on the representativeness of the few cohorts considered. In this line, Audretsch (1991) points out that the determinants of entrants' survival crucially depend on the length of the follow-up period. Besides, Wagner (1994) underlines the need to investigate several entrant cohorts given that the year of birth of a particular cohort may be an important factor that shapes its survival fates.

[21] This dependence may be due to the existence of persistent productivity shocks, learning, trust dynamics or other success-breeds-success mechanisms. See among others Roberts and Tybout (1997); Clerides et al. (1998); Rauch and Watson (2003); Das et al. (2007); Albornoz et al. (2012).

[22] Notice that the sample that includes export/import relationships in 1997 is left-truncated because we only observe those firm-level export/import spells born before 1997 that have survived long enough to be ongoing in 1997, therefore excluding high-risk export/import spells initiated before 1997.

Therefore, the *Full sample* consists of all firm-level/firm country-level export (import) spells initiated over the period 1998-2015 (i.e., population of "fresh spells"). The maximum length of a spell is eighteen years.[23] The *Restricted sample* further includes firm-level controls such as TFP, leverage ratio, labor force, etc. In this sample, we also exclude firm-level export/import spells of micro firms or in distribution sectors in the first year of the spell.

Non-parametric Kaplan-Meier estimates of the export/import survivor functions[24] confirm the commonly found pattern of aggregate negative duration/age dependence. That is, the hazard rate is very high immediately after entry, and it drops off quickly with the duration of the flow.

To analyze the relationship between business cycle conditions (both current and at entry) and the hazard of exiting export/import markets, we estimate the following semi-parametric discrete-time proportional hazards model specification (*cloglog* model) with a non-parametric characterization of the frailty distribution.

$$h_{zkt} = 1 - exp\left(-exp\left(m_z + \beta_{b0} bad_0 + \beta_b bad_t + \sum_{a=1}^{8+} \beta_a \mathbb{1}_{age\,k=a} + \beta_c controls_{i0}\right)\right) \quad (3)$$

where the dependent variable is the hazard rate, which is the probability of leaving export or import markets at a given duration/age conditional upon survival up to that age. t is current year and k is spell age. The model is semi-parametric in the sense that we impose no particular functional form to the age-of-spell effects on the hazard. The relationship between age-of-spell and hazard is fitted from the data rather than specified *a priori*. To retrieve explicit estimates of the baseline hazard that capture age-of-spell effect on the hazard we include a set of dummy variables. Thus, we estimate discrete time models that are equivalent to the continuous time Cox's proportional hazards model (and the piece-wise exponential model with a similar set of age dummies).

Furthermore, we follow a non-parametric approach to characterizing the frailty distribution. More specifically, the model includes a discrete mixture distribution with finite support to summarize unobserved exporter/importer level heterogeneity. The distribution is characterized by two mass points m_z, where $z = 1, 2$ refers to mass points that characterized the two unobserved types.[25] We assume that there exist 2 unobserved types. With probability $p1$, a spell belongs to type 1 with mass point value equal to $m1$. With probability $1 - p1$, a spell belongs to type 2 with mass point value equal to $m2$. $m1$ is normalized to 0. The unobserved heterogeneity (or frailty) parameter is assumed to be constant over time (across spells of the same firm) and independent of observed characteristics. It controls for both omitted variable bias (i.e., unobserved individual heterogeneity not fully accounted for after includ-

[23] While the data source is comprehensive, our sample ends in 2015 for all export and import relationships, regardless of their starting time, which involves that the maximum potential age that individual spells can reach is different across cohorts. Whereas a spell initiated in 1998 can reach a maximum of 18 years of life, those initiated since 2008 can reach, at most, 8 years of service.

[24] Not reported for brevity, but available from the authors upon request.

[25] We follow a non-parametric frailty distribution (Heckman and Singer (1984)). The model is estimated using Stephen Jenkins' *hshaz* program (Stephen P. Jenkins (2004)).

ing the full set of explanatory variables) and measurement errors in observed survival times and regressors (Jenkins, 2005). The estimation of Equation (3) allows us both to mitigate the bias associated with overlooking unobserved heterogeneity and to disentangle the relative importance of genuine duration dependence and sorting in driving the observed (aggregate) duration dependence.[26]

Business cycle indicators As stated earlier, we cannot simultaneously include annual cohort dummies and year effects to account for macro conditions at birth and current economic conditions in a survival model. As discussed by Imbens and Angrist (1994), the identification of duration and calendar effects is problematic. Following Kalwij (2010), we use either binary indicators or continuous variables to account for business cycle effects and for conditions at birth effects to identify these time effects.[27]

In Tables 5 and 6 we present estimations results that rely on two binary indicators of both current and at-birth macroeconomic conditions. First, the dummy variable bad_0 takes value 1 when the export/import spell was initiated in 2008, 2009, or 2010 (labelled *birth bad* in the tables). bad_t (labelled *current bad* in the tables) is constructed in a similar way for the current year. Second, we use a measure of origin and destination country business cycle conditions. More precisely, we create four dummy variables based on these countries' detrended GDP using Hodrick-Prescott filter following the Ravn-Uhlig rule. Thus, *birth bad fr* (*birth bad des*) takes value one if France's (the destination country's) detrended GDP is negative at entry. Besides, *current bad fr* (*current bad des*) takes value one if France's (destination country's) detrended GDP is negative in the current year.[28]

Other control variables In all our estimations we control for age-of-spell effects as well as for a large set of control variables denoted by $controls_{i0}$, which includes spell-specific (time-invariant) initial conditions other than business cycle and i represents an individual spell index.[29] Using the *Full sample*, $controls_{i0}$ includes trade-related (initial size of the spell, product comparative advantage, whether the firm is a two-way trader, firm previous export/import experience, multi-product, multi-country exporter/importer) and main destination/sourcing country specific characteristics (OECD country risk; gravity controls) for export/import spells. Using the *Restricted sample*, we further control for additional firm-level characteristics (namely, a firm's TFP, leverage ratio, age, labor force, wage per labor force, foreign-owned, foreign affiliate, sector, region).[30]

[26] For the survival analysis at the firm-country level, the country dimension is incorporated into Equation (3).

[27] Heckman and Robb (1985) also discuss potential solutions to the age-period-cohort effect identification problem in earnings equations. They argue that one possibility is to group a sequence of adjacent years (e.g., recessive period) to proxy "cohort" effects and/or year effects.

[28] As robustness checks, we further estimate several specifications of equation (3) using: a common dummy of bad macro conditions for origin and destination; several dummies distinguishing between origin and destination, including output gap measures of the OECD and IMF; and also continuous measures of current and at-birth macro conditions for origin and destination countries. Appendix D provides the main results using these alternative measures of business cycle conditions.

[29] The use of time-invariant covariates measured at the onset of the spells helps to mitigate the potential simultaneity problem between a firm's export/import status and the explanatory variables that may arise in survival analysis (Van den Berg (2001)).

[30] See Tables 1b and 1c in Appendix A for detailed variable definitions in firm-level and firm-country level analysis, respectively. Note that the firm's leverage ratio is defined within its birth cohort and splits firms into

In all the specifications, our results point to the existence of unobserved heterogeneity, given that we reject the null hypothesis that mass point 2 is equal to zero (i.e., equal to mass point 1 that is normalized to 0). All tables report the estimated hazard ratios ($exp(\beta)$). The reported coefficients indicate the effect on the hazard for a shift from 0 to 1 for a dummy variable or a one-unit increase in a continuous variable. Thus, a hazard ratio smaller (greater) than 1 indicates a reduction (increase) in the hazard and a longer (shorter) duration. A hazard ratio of 1 indicates that the corresponding covariate has no effect on the baseline hazard. The percentage change in the hazard produced by a change in a covariate by one unit (or from 0 to 1 for dummy variables) is obtained as $(exp(\beta) - 1) \times 100$. We discuss our main results in turn.

3.2 Export duration: entry conditions and business cycle

Table 5 presents the results of our export survival analysis. Columns (1)-(4) report results of the estimation of equation (3), where the dependent variable is the hazard rate out of exporting for a firm. As explained earlier, the main variables of interest are *current bad* and *birth bad* which capture business cycle conditions in the current year and at entry, respectively. Columns 1 and 2 report results with the Great Recession indicator while Columns 3 and 4 make use of the detrended GDP indicator, both for the origin country (France) and the destination country. In each case we report estimation results on the Full Sample (Columns 1 and 3) and on the Restricted Sample (Columns 2 and 4) with firm-level controls. The latter are our preferred estimates due to larger set of control variables. Finally, note that Table 5 only reports the coefficient of business cycle indicators, but a corresponding Table with the full set of estimates is reported in Appendix C for the firm-level survival analysis.

	Firm level				Firm country level			
	2008_10		Binary: detrended GDP <0		2008_10		Binary: detrended GDP <0	
	(1) Full	(2) Restricted	(3) Full	(4) Restricted	(5) Full	(6) Restricted	(7) Full	(8) Restricted
current bad fr	1.204	1.214	1.023	1.025	1.220	1.187	1.028	1.019
	(0.009)***	(0.014)***	(0.006)***	(0.009)***	(0.003)***	(0.004)***	(0.002)***	(0.003)***
current bad des			1.022	1.019			1.010	1.014
			(0.006)***	(0.009)**			(0.002)***	(0.003)***
birth bad fr	0.892	0.904	0.974	0.961	0.893	0.933	0.978	0.981
	(0.008)***	(0.012)***	(0.006)***	(0.010)***	(0.003)***	(0.004)***	(0.002)***	(0.003)***
birth bad des			0.956	0.962			0.949	0.943
			(0.006)***	(0.010)***			(0.002)***	(0.003)***
N	994199	382450	910757	351184	5834330	3490268	5514500	3325987

Note: The sample coverage is between 1998 and 2015. In cols. (1), (2), (5), and (6) *birth_bad* = 1 if export spells started in year 2008, 2009 or 2010; and *current_bad* = 1 if current year is 2008, 2009 or 2010. In cols. (3), (4), (7) and (8) *current bad fr*, *current bad des*, *birth bad fr*, *birth bad des* take value 1 when the current or at-birth detrended GDP is negative for France or the destination country. Left-censored spells are excluded. See Appendix A for the definition of all the covariates and Appendix C for the full set of estimates from the firm-level survival analysis. * p<0.10, ** p<.05, *** p<.01

Tab. 5: Hazard of exiting export markets

three groups according to the distribution of this ratio. Our results are robust to the use of over-the-sample firm's leverage ratio variable (not reported for brevity, but available upon request from the authors).

First, we find that the probability of leaving export markets is significantly higher during downturns, controlling for spell age effects, observed firm characteristics and unobserved heterogeneity. Results in column (2) indicate that the overall hazard rate during recessions is about 21.4% higher than the overall risk during upturns. Second, firms that begin to export during bad times endure better survival prospects, *ceteris paribus*, than that faced by new exporters at good times. Exporters that enter during recessions display a 9.6% lower hazard of leaving export markets, controlling for spell age effects, observed firm characteristics and unobserved heterogeneity. Results using the negative detrended GDP indicator are qualitatively similar, with both origin and (main) destination country cycles affecting the hazard rate in the same way.

We further analyze the role of destination country cycles by extending the analysis to firm-country export spells. The definition of entry and exit in firm-country spells still follows the description in Section 3.1, but adapted to exports by a firm in a country irrespective of exports elsewhere. By extending the analysis to firm-country spells, we can now test the hypothesis that business cycle conditions in *each* destination country have both contemporaneous and persistent effects on survival in that market. We can also control more accurately for observed destination country characteristics. The results, displayed in Columns (5)-(8) of Table 5, are very similar to those found in the firm-level survival analysis.

Overall, our two main results are robust to the use of both samples, both business cycle indicators at both firm- or firm-country level. We have performed additional robustness checks using alternative business cycle indicators and/or year dummies instead of *current_bad* to control for current macroeconomic conditions. Results with alternative business cycle indicators are reported in Appendix D. These results are remarkably consistent with those in Table 5, keeping in mind that downturns correspond to higher values of some indicators (e.g. Great Recession dummy) and lower values of others (e.g. GDP growth differential). We conclude that our results on business cycle conditions in the current year and at entry hold in the vast majority of macroeconomic indicators, making it likely that both aggregate demand and supply shocks affect firm export dynamics.

We now comment additional results corresponding to estimates reported in Appendix C. First, as in much of the literature on export dynamics, we find that hazard rates out of exporting fall with age. As discussed in the previous subsection, this may either reflect genuine age-dependence or different sorting of 'fitter' firms/spells along the business cycle, with different implications. In our preferred specification (i.e., using binary indicators *current bad* and *birth bad* and the *Restricted sample* which includes the full set of covariates) we find that 61% of the observed negative duration dependence at the firm-level is related to "true" age-dependence and 39% due to unobserved heterogeneity).[31] A related question is whether business cycle conditions at entry shape the pattern of genuine duration dependence. We test this hypothesis by interacting the inflow-heterogeneity dummy with the age-of-spell dummies. Our findings (available upon request) suggest that there are no significant differences in how this mechanism operates across cohorts of exporters born under different macroeconomic conditions. We conclude that cohorts of exporters born at bad times enjoy one-off 'premium' (fall in the hazard) but face the same pattern of genuine negative age-dependence.

[31] See also Appendix E for evidence of negative duration dependence at the firm level using the *Full sample*.

Finally, estimates of the coefficients on our rich set of covariates also provide some insights of independent interest for the analysis of export survival. The initial size of the spell, as well as the number of products and destination markets are negatively related with the hazard rate of leaving export markets. Experience in international markets, acquired either through simultaneous involvement in import activities, or by having exported previously also are positively related with survival. Several features of destination markets also matter for survival. Export spells initiated with neighboring countries are expected to be shorter. In particular, starting to export to high-risk countries is positively related with the risk of ending an export spell. Exporting a product for which France holds comparative advantage is positively associated with survival.

3.3 Import duration: entry conditions and business cycle

We now turn to the hazard of exiting import relationships. We use the same methodology as with exports. We estimate a version of (3), applying this time to firm-level and firm-country-level import spells. Results are presented in Table 6, which has the same structure as Table 5.

	Firm level				Firm country level			
	2008_10		Binary: detrended GDP <0		2008_10		Binary: detrended GDP <0	
	(1) Full	(2) Restricted	(3) Full	(4) Restricted	(5) Full	(6) Restricted	(7) Full	(8) Restricted
current bad fr	1.241	1.278	0.995	1.013	1.249	1.251	1.023	1.021
	(0.008)***	(0.015)***	(0.006)	(0.010)	(0.004)***	(0.006)***	(0.003)***	(0.004)***
current bad des			1.015	1.017			0.998	1.004
			(0.006)**	(0.010)*			(0.003)	(0.004)
birth bad fr	0.990	0.959	0.946	0.943	0.944	0.960	0.975	0.998
			(0.007)***	(0.012)***			(0.003)***	(0.005)
birth bad des	(0.009)	(0.014)***	0.967	0.958	(0.004)***	(0.005)***	0.951	0.950
			(0.007)***	(0.012)***			(0.003)***	(0.004)***
N	1052992	380683	958019	346245	4530367	2310914	4117952	2112046

Note: The sample coverage is between 1998 and 2015. In cols. (1), (2), (5), and (6) *birth_bad* = 1 if import spells started in year 2008, 2009 or 2010; and *current_bad* = 1 if current year is 2008, 2009 or 2010. In cols. (3), (4), (7) and (8) *current bad fr*, *current bad des*, *birth bad fr*, *birth bad des* take value 1 when the current or at-birth detrended GDP is negative for France or the destination country. Left-censored spells are excluded. See Appendix A for the definition of all the covariates and Appendix C for the full set of estimates from the firm-level survival analysis. * p<0.10, ** p<.05, *** p<.01

Tab. 6: Hazard of exiting import markets

As with exports, we find that current downturns increase the hazard of ending import relationships, whether at the firm- or firm-country level. Column (2) indicates that importers faced a 27.8% higher probability of exiting during the Great Recession. We also find that downturns at entry are associated with lower hazard rates in the majority of the specifications, though not all. Starting to import during the Great Recession is associated with a 4.1% lower probability of exit from importing. Results are qualitatively similar when using the negative detrended GDP indicator. In that case we find that cohort effects are roughly similar when either the origin country or the destination country (France) faces a downturn. Results on firm-country spells reveal a broadly similar pattern.

As before, we have checked the robustness of the results reported in Table 6 in several ways. Results with alternative business cycle indicators are reported in Appendix D. The findings of Table 6 are very robust. The effect of business cycles in the current period and at entry are qualitatively similar across macroeconomic indicators, although magnitudes may vary (partly because these macroeconomic indicators do not have the same country coverage). Given the variety of macroeconomic indicators, we again conclude that both aggregate demand and supply shocks are likely to affect firm import dynamics.

Finally, we find that, unobserved heterogeneity accounts for roughly 59% of the observed aggregated negative duration dependence at the firm level using the *Restricted sample*.[32] We further check whether inflow heterogeneity shapes the pattern of duration dependence (results available upon request). After controlling for frailty, there exists negative age-dependence for cohorts born at good times. Yet, in contrast to our previous results for exports, we find no clear pattern for the effect of macro conditions at birth on the pattern of negative duration dependence over the spell's lifetime.

3.4 Credit constraints and cohort effects

Both exporting and importing are credit-intensive activities. In all the estimations reported so far, we have accounted for the effect of credit contraints on survival by controlling for measures of firm leverage (debt/assets) at entry. The full regression tables in Appendix C show that a higher leverage is associated with higher exit, as expected.

A related question is whether business cycle conditions at birth capture episodes of credit tightening (as recessions often coincide with financial crises) rather than macroeconomic conditions per se. To investigate this possibility, we augment our analysis by interacting our leverage measure with the dummy for recession at entry. Recall that we measure whether a firm belongs to the first, second or third tercile of the distribution of the leverage ratio within its birth cohort, and treat the first tercile as our reference category. If cohort effects are driven by reactions to financial crises, we should observe a positive coefficient for the interaction between the recession at birth dummy and second tercile dummy, and logically an even higher one in the case of the third tercile.

[32] See also Appendix E for evidence of negative duration dependence at the firm level using the *Full sample*.

	Export				Import			
	Firm level		Firm country level		Firm level		Firm country level	
	baseline	interaction	baseline	interaction	baseline	interaction	baseline	interaction
*current*2008_10	1.214	1.215	1.187	1.187	1.278	1.279	1.251	1.251
	(0.014)***	(0.014)***	(0.004)***	(0.004)***	(0.015)***	(0.015)***	(0.006)***	(0.006)***
*birth*2008_10	0.904	0.907	0.933	0.928	0.959	0.940	0.960	0.947
	(0.012)***	(0.017)***	(0.004)***	(0.005)***	(0.014)***	(0.020)***	(0.005)***	(0.007)***
leverage2	1.064	1.062	1.064	1.061	1.050	1.030	1.034	1.029
	(0.010)***	(0.011)***	(0.003)***	(0.003)***	(0.011)***	(0.012)***	(0.004)***	(0.004)***
leverage3	1.206	1.213	1.199	1.200	1.230	1.222	1.187	1.182
	(0.012)***	(0.013)***	(0.004)***	(0.004)***	(0.014)***	(0.015)***	(0.005)***	(0.006)***
*birth*2008_10*lev2		1.015		1.017		1.067		1.020
		(0.023)		(0.007)**		(0.027)**		(0.009)**
*birth*2008_10*lev3		0.970		0.994		0.996		1.019
		(0.023)		(0.008)		(0.026)		(0.010)**
N	382450	382450	3490268	3490268	380683	380683	2310914	2310914

Note: The sample coverage is between 1998 and 2015. Terciles of the leverage ratio distribution are computed in each cohort birth year. The first tercile of each leverage ratio distribution is used as a reference category. See Appendix A for the definition of all the covariates. * p<0.10, ** p<.05, *** p<.01

Tab. 7: Credit constraints

Results are reported in Table 7, where 'baseline' results correspond to our main specification and are shown again for ease of comparison.

In the case of exports, we find that cohort effects are not significantly different between high and low leverage firms when export spells are defined at the firm level, and only mildly different when spells are defined at the firm-country level. In the latter case, we only find a significant difference between the first and the second tercile, but not with the third. Coefficients for the recession at birth dummy (now applying to the first tercile) are virtually unchanged. We conclude that cohort effects in export survival are not driven by extra credit constraints during financial crises.

In the case of imports, we also found earlier that highly-leveraged firms are more likely to exit. The effect of starting to import in a recession appears to depend on leverage. The effect of a recession at entry on exit remains negative and highly significant for the least leveraged firms (reference category). The impact of conditions at entry on highly-leveraged firms is milder, albeit still negative or not significantly different from zero. In addition, coefficients are similar between the second and third terciles of the leverage distribution. We conclude that the tightening of credit constraints may play a marginal role in explaining the persistent effects of recessions on import exit, but do not affect our general conclusion.

3.5 Bivariate duration

Two-way traders are common among firms engaged in international trade, as shown for example by Kasahara and Lapham (2013) and Bernard et al. (2018). Yet, all the analysis in Section 3 so far has implicitly assumed that export and import transitions were independent. In this subsection, we estimate a bivariate duration model to analyze the dependence of exit

from exporting and importing on spell age and other explanatory variables. More specifically, we account for unobserved firm-specific factors (constant across both spells and the transitions considered -i.e., exporting and importing) that affect the hazard of an event for all spells and transitions (e.g., managerial capabilities of firms not captured by the included explanatory variables). In this setting, we allow for correlation between time-invariant factors that influence each transition.

3.5.1 A multilevel two-state logit model

At any time t, a firm i may be in one of the two states indexed by s (s = exporting, importing), and S_{tji} denotes the state occupied by firm i during interval t of episode j (i.e., firms may show more than one export and/or import spell). We estimate the probability that a firm exits from exporting or importing during period/age k, given that it has been either exporting or importing for k-1 previous periods. Since we have yearly information, we treat duration as a discrete variable and estimate a bivariate discrete-time duration model. Let us define y_{kji} as a binary variable indicating whether any transition (i.e., an exit from the spell of exporting or importing) has occurred during interval k. The discrete-time hazard function for state s, that is, the probability of a transition from state s during interval k, given that no transition has occurred before the start of k, is defined as follows:

$$h_{skji} = Pr(y_{kji} = 1 | y_{k-1,ji} = 0, S_{tji} = s), \qquad s = exporting(EXP), importing(IMP) \quad (4)$$

We estimate the following multilevel two-state logit model:

$$log\left(\frac{h_{skji}}{1 - h_{skji}}\right) = \alpha_s D_{skji} + \beta_s X_{stji} + u_{si} \quad (5)$$

where D_{skji} is a vector of dummy variables that capture the age effects of a specific spell in state s by firm i. In particular, we report models in which D_{skji} includes eight dummy variables to control for age-of-spell effects as in the previous section.[33] X_{stji} is the vector of explanatory variables that affects the transition from state s.

Finally, u_{si} allows for unobserved heterogeneity between firms in their probability of exiting from state s. There may exist unobserved firm-specific factors (constant across both episodes and states) that affect the hazard of an event for all episodes and states (e.g., firm managerial skills not captured by the included explanatory variables). We assume that $u_{si} = (u_{EXPi}, u_{IMPi})$ follows a bivariate normal distribution, which allows for correlation between time-invariant factors that influence each transition. In other words, we allow for $cov(u_{EXPj}, u_{IMPj}) \neq 0$, given that the firms move in and out of different states over time. If this correlation is positive, firms will have a tendency of either long export and import spells, or short export and import spells. If the correlation is negative, we should expect firms to bunch into groups with short export spells but long import spells, and long export spells but short import spells.

[33] As Jenkins (2005) points out, the cloglog and logistic hazard models with the same duration dependence specification and covariates lead to similar estimates as long as the hazard rate is relatively *small*.

3.5.2 Results

As reported in Table 8, the two unobserved firm-specific factors are positively correlated. This suggests that firms fall into two groups: experiencing both long episodes of exporting and importing, and firms more prone to experience short spells of both exporting and importing (i.e, high churning). Our findings are confirmed when we carry out the estimation for firm- and firm-country level export and import spells, using the *Full* and *Restricted* samples. In the firm-country level analysis, we account for unobserved firm-country specific factors (constant across both spells and the transitions considered), and allow for correlation between time-invariant factors that influence each transition. [34]

	firm level				firm country level			
	Full		Restricted		Full		Restricted	
	export	import	export	import	export	import	export	import
*current*2008_10	1.272	1.363	1.290	1.398	1.298	1.354	1.231	1.300
	(0.011)***	(0.011)***	(0.017)***	(0.019)***	(0.004)***	(0.005)***	(0.005)***	(0.006)***
*birth*2008_10	0.861	0.988	0.881	0.958	0.873	0.940	0.904	0.940
	(0.009)***	(0.010)	(0.014)***	(0.016)***	(0.004)***	(0.004)***	(0.004)***	(0.005)***
cov(ex,im)	2.165		1.835		1.665		1.351	
	(0.024)***		(0.029)***		(0.009)***		(0.005)***	
N	2047191		763133		10364697		5801182	

Note: The sample coverage is between 1998 and 2015. *birth*2008_10 = 1 if firm-/firm-country level export/import spells started in year 2008, 2009 or 2010. *current*2008_10 = 1 if the current year is 2008, 2009 or 2010. Firm-level (firm-country level) results are obtained using firm-level (firm-country-level) random effects except for the firm-country-level restricted sample. We use firm-level random effects for the firm-country-level restricted sample as there is an issue of lack of memory. Left-censored spells are excluded. See Appendix A for the definition of all the covariates. * p<0.10, ** p<.05, *** p<.01

Tab. 8: Hazard of exiting export and import markets - joint estimation

The results in Table 8 are fully consistent with those reported in Tables 5 and 6. First, during recessionary periods, the overall hazard of leaving export and import markets is significantly higher than during expansionary periods. More specifically, for the firm-level analysis, we find that the higher risk is about 27.2-29.0% and 36.3-39.8% for exports and imports, respectively. Second, conditions at birth matter and have long-lasting effects. Firms that start exporting at bad times face a 11.9-13.9% lower hazard of leaving export markets, while those firms that start importing during recessionary periods also seem to endure a lower hazard (between 1.2-4.2% lower, yet not statistically significant when we use our *Full sample*). The results obtained from the firm-country level analysis fully confirm these findings.

3.6 Summary of results

To sum up, this section has uncovered the following results:

[34] For computational reasons, we cannot use firm-country random effects in the bivariate estimation for firm-country spells when using the restricted sample.

1. The exporters' (importers') hazard rate of exiting foreign markets is higher at bad times [overall business cycle effects].

2. The (Export/Import) new spells born during recessions face a lower hazard of exiting export/import markets than those initiated during good times over their lifetime [cohort effect].

That is, exporters/importers born during bad times survive longer than those born during good times. Thus, conditions at entry have long-lasting (positive) effects on expected duration.

Therefore, new exporters that are born during downturn have an intrinsically lower hazard of exiting export markets, despite the (overall) higher hazard rate during bad times. The evidence on new importers is less compelling.

3. The hazard rate is high at entry and drops off quickly with the spell's age for cohorts born at good and bad times [aggregate negative duration dependence].

4. Approximately 61% (41%) of aggregate negative age dependence in exports (imports) is related to "true" age dependence, and 39% (59%) is related to sorting.

For export spells, there are no significant differences in the pattern of "true" negative age dependence (the hazard of quitting exporting falls with ongoing experience) between cohorts born at good times and cohorts born at bad times. Hence, we find a one-off fall in the hazard of leaving exporting for spells initiated at bad times, with no additional effect on the slope of the hazard over a spell's lifetime. For import spells, there are some differences in the pattern of "true" negative age dependence between cohorts born at good times and cohorts born at bad times, so no clear pattern stands out.

5. The bivariate duration model allows us to identify 2 groups of firms according to the expected duration of their export and import spells: either long-long or short-short.

The results of the estimations of a bivariate duration model are broadly consistent with our results from the separate analysis of the hazard of exporting and importing. During recessionary periods, the overall macroeconomic conditions raise the overall risk of failure, although new export/import spells initiated during these difficult times are intrinsically "fitter-to-survive" compared to those born at expansionary periods. Yet, the positive and statistically significant covariance suggests a positive firm-level association in the duration of export and import episodes. Hence, firms can be split into two types, such that firms' export and import duration tend to be either long-long or short-short.

This result adds to the previously found complementarity in export and import participation (Kasahara and Lapham (2013); Bernard et al. (2018)). Our results point towards strong positive complementary effects in export/import duration.

4 Discussion of results

In this paper we found that recessions reallocate firms in and out of exporting and importing, with long-lasting effects on starters. Confronting our results to existing models of firm trade dynamics and firm dynamics and business cycles, several interesting insights stand out.

First, we find evidence in support of both 'cleansing effect' and 'scarring effect' hypotheses. In terms of export and import participation, entry rates are pro-cyclical and exit rates are counter-cyclical. Together with higher productivity cutoffs for entrants and exiters, this suggests stronger selection during recessions (cleansing effect). Our survival analysis further confirms that cohorts of new exporters/importers born during recessions endure better survival prospects at any age. These results are in the spirit of the Caballero and Hammour (1994) vintage capital model, where the replacement of older firms by younger and more productive units intensifies at times of lower demand, to an extent that depends on creation costs. This feature is also shared by all trade dynamics models with idiosyncratic productivity and entry costs if demand fluctuations are introduced (see Alessandria et al. (2021) for a survey).

At the same time, in line with the 'scarring effect' hypothesis, we find that entrants during recessions had persistently lower labor size.[35] This finding can be rationalized by models such as Moreira (2016), which features demand fluctuations and a demand accumulation disadvantage for entrants.[36] In her model, both selection at entry and demand accumulation are at work. Business cycle conditions at birth affect the size of initial investments and their ability to adjust their size following an initial investment (e.g., building a customer base). In the same spirit, Sedláček and Sterk (2017) develop a general equilibrium model where macroeconomic conditions at birth have long-lasting effects on macroeconomic aggregate fluctuations, through the differences in the composition of cohorts born at different stages of the business cycle. In their model new entrants choose whether to serve niche or mass markets from the outset, and the composition of mass and niche firms evolves endogenously along the business cycle. Ouyang (2009) offers a model where both cleansing and scarring effects are at work. As in Caballero and Hammour (1994), recessions have cleansing effects on older unproductive firms. However, uncertainty about idiosyncratic productivity stunts the growth of young firms that would have been productive.[37] Finally, we note that scarring effects may originate from the combination of severe credit constraints, which affect entrants and young incumbents disproportionately, and capital adjustment costs (as in Ayres and Raveendranathan (2023), for example).

Second, our results on age dependence and cohort effects in exit can be discussed in relation with the existence of sunk entry costs in both trade (e.g. Melitz (2003); Das et al. (2007); Alessandria and Choi (2019)) and macro models of firm dynamics (e.g. Bilbiie et al. (2012); Lee and Mukoyama (2018); Vardishvili (2023)). Our findings can relate to three types of

[35] The results still hold if we use total sales as a measure of size.

[36] Recently, some have introduced models of export dynamics that feature investment in market access and costly foreign demand accumulation (e.g., Ruhl and Willis (2017); Piveteau (2021); Fitzgerald et al. (2023)). These models may explain that new exporters are common but relatively small upon entry, and that endure a low probability of success. Over time, they increase their importance as continuing exporters gradually grow.

[37] His model does not formally address how firm size endogenously varies along the business cycle, but it would be a straightforward extension.

predictions related to sunk costs. Firstly, negative age dependence in exit hazard does not sit well with the existence of sunk entry costs in the first place. However, as was pointed out by Ruhl and Willis (2017), negative age dependence can be reconciled with these models in the presence of demand accumulation (Ruhl and Willis (2017); Piveteau (2021); Fitzgerald et al. (2023)) or learning (e.g. Albornoz et al. (2012); Albornoz et al. (2023)). In that sense, our result that negative age dependence holds irrespective of business cycle conditions and composition effects provides further support to these models. Secondly, sunk entry costs affect the timing of entry by creating an option value of deferring entry. This prediction reinforces the cleansing effect prediction, in that only the most productive young firms would enter immediately during a recession. For example in Vardishvili (2023) recessions reduce profits for incumbent and entrant firms alike, but create an option to wait for entrants. This is totally consistent with evidence of an overall higher exit hazard, higher survival of entrants 'born' in recessions, and higher entry cutoffs during recessions. Thirdly, our finding that exit rates increase during recessions appears to be at odds with sunk cost models, and particularly those where these costs increase during recessions. Notice that models in which credit constraints raise the barriers to entry in foreign markets (e.g. Impullitti et al. (2013); Manova (2013); Manova et al. (2015); and Chaney (2016)) would have the same prediction.[38]

5 Conclusions

In this paper, we examined the relationship between the business cycle and the firms' export/import survival, accounting for duration dependence, individual heterogeneity and inflow heterogeneity.

We found three main results. First, recessions reallocate firms in and out of exporting and importing. Entry rates are lower, exit rates are higher and the composition of trading firms changes: entrants and exiters are both smaller but more productive. Second, recessions have important and long-lasting effects for aggregate trade. The estimation of frailty duration models shows that entry during a recession implies lower exit rates at any age (i.e., longer expected duration) in recession cohorts all else equal. In the case of exports, we find the same genuine age dependence path irrespective of conditions at entry: the better survival prospects of cohorts born at bad times results from a one-off drop in the hazard of leaving export markets at all spell ages. The results are less compelling on the import side. Third, our conclusions remain unaffected when we explicitly handle the interdependence between export and import decisions in a joint duration model. While we find that the hazards of stopping both forms of trade are positively correlated, the persistence of conditions at entry remains.

We argue that our approach adds new insights that are relevant to get a better understanding of aggregate trade dynamics. While business cycles movements mostly impact trade through the intensive margin in the short-run, their persistent effects on entrants mean that the long-term contribution of the extensive margin is significant. Our results also point to the relevance of 'cleansing effects' of recessions on trade, as entry to and exit from foreign markets productivity

[38] The procyclicality of entry rates would however be consistent with these models and in line with evidence that credit constrained firms are less likely to become exporters (e.g. Berman and Héricourt (2010); Wagner (2014); Muûls (2015); Jaud et al. (2018)).

become tougher. However, we also find some evidence of 'scarring effects' of recessions, in the form of lower employment and sales of firms entering during recessions.

Finally, we want to mention a caveat and several avenues for future research. While we were able to show the influence of business cycle conditions with various indicators, we were not able to isolate macroeconomic developments from governments' policy response. This policy response may take the form of counter-cyclical fiscal policy, possibly targeting certain types of firms, and more protectionist policies. Such policy interventions are likely to affect individual export and import dynamics. It would be desirable to account for such policy responses in future research. We can also mention three other extensions that we plan to pursue in follow-up work. First, we want to carefully explore the case of two-way traders. For these firms, the business cycle of import sourcing country can affect export survival and vice versa. Second, we will further consider the inclusion of lead and lags on business cycle indicators to account for anticipation and lagged effects on export/import decisions. Third, we aim to further explore the product dimension of our native data. So far, we have examined entry and exit from exporting/importing at the firm or firm-country levels. Since adding and dropping products is another quantitatively important channel of trade dynamics, an analysis of its cyclical behavior and possible cohort effects would complement our analysis.

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A Variable definitions and descriptive statistics

A.1 Variable definitions

business cycle indicators	
	bad dummy
*birth*2008_10	=1 if export/import spells started in 2008, 2009 or 2010
*current*2008_10	=1 if current year is 2008, 2009 or 2010
*birth*2008_15	=1 if export/import spells started between 2008 and 2015
*current*2008_15	=1 if current year is between 2008 and 2015
*birth*_01_8910	=1 if export/import spells started in 2001, 2008, 2009 or 2010
*current*_01_8910	=1 if current year is 2001, 2008, 2009 or 2010
b_dgdp0_fr	=1 if France detrended GDP < 0 at age 1
b_dgdp0_d	=1 if main destination detrended GDP < 0 at age 1
b_dgdpt_fr	=1 if France detrended GDP < 0 in the current year
b_dgdpt_d	=1 if main destination detrended GDP < 0 in the current year
bad0_fr	=1 if (France GDP growth - world GDP growth) at birth < mean (France GDP growth - world GDP growth) between 1998 and 2015
bad0_d	=1 if (main destination GDP growth - world GDP growth) at birth < mean (main destination GDP growth - world GDP growth) between 1998 and 2015
badt_fr	=1 if (France GDP growth - world GDP growth) in current year < mean (France GDP growth - world GDP growth) between 1998 and 2015
badt_d	=1 if (main destination GDP growth - world GDP growth) in current year < mean (main destination GDP growth - world GDP growth) between 1998 and 2015
bad_outgap0_imf_fr	France output gap in % of potential GDP < 0 at age 1 (source: IMF)
bad_outgap0_imf_d	main destination output gap in % of potential GDP < 0 at age 1
bad_outgapt_imf_fr	France output gap in % of potential GDP < 0 in current year
bad_outgapt_imf_d	main destination output gap in % of potential GDP < 0 in current year
bad_outgap0_oecd_fr	France output gap in % of potential GDP < 0 at age 1 (source: OECD)
bad_outgap0_oecd_d	main destination output gap in % of potential GDP < 0 at age 1
bad_outgapt_oecd_fr	France output gap in % of potential GDP < 0 in current year
bad_outgapt_oecd_d	main destination output gap in % of potential GDP < 0 in current year
	continuous
lntfp0_fr	ln(France TFP) at age 1
lntfp0_d	ln(main destination TFP) at age 1
lntfpt_fr	ln(France TFP) in current year
lntfpt_d	ln(main destination TFP) in current year
diff0_fr	France GDP growth - world GDP growth at age 1
diff0_d	main destination GDP growth - world GDP growth at age 1
difft_fr	France GDP growth - world GDP growth in current year
difft_d	main destination GDP growth - world GDP growth in current year
outgap0_imf_fr	France output gap in % of potential GDP at age 1 (source: IMF)
outgap0_imf_d	main destination output gap in % of potential GDP at age 1
outgapt_imf_fr	France output gap in % of potential GDP in current year
outgapt_imf_d	main destination output gap in % of potential GDP in current year
outgap0_oecd_fr	France output gap in % of potential GDP at age 1 (source: OECD)
outgap0_oecd_d	main destination output gap in % of potential GDP at age 1
outgapt_oecd_fr	France output gap in % of potential GDP in current year
outgapt_oecd_d	main destination output gap in % of potential GDP in current year

Note: For import spells, the main destination refers to the main sourcing country. The main destination (sourcing country) is the one with the highest export (import) value at age 1, and it remains constant within the export (import) spell. GDP price is at the 2015 level (billion dollars). Detrended GDP is obtained using the HP filter following the Ravn-Uhlig rule, and the sample period is between 1998 and 2015. Country TFP is obtained from the Penn World Table. GDP and GDP growth are sourced from World Bank data. The IMF output gap data is obtained from The World Economic Outlook (WEO, October 5, 2023). The OECD output gap data is obtained from the OECD Economic Outlook (No. 114).

Tab_A.1a: Business cycle indicators: at-birth and current

age dummies	
age1 - age7	year 1 - year 7 of a spell
age 8	year 8 or after
trade related characteristics	
initial size	initial export/import value at age 1. We define three binary variables by terciles (dini1, dini2, dini3)
comparative advantage	comparative advantage quantile (tierce) of France product (main product at age 1) dpto1, dpto2, dpto3
dimp	= 1 if import at age 1 for export spell
dexp	= 1 if export at age 1 for import spell
d_lc1997_fpc_ex	= 1 if firm exported in year 1997 (export left censored)
d_lc1997_fpc_im	= 1 if firm import in year 1997 (import left censored)
lnpre_ex_exp	ln(firm previous export experience at age 1 + 1)
lnpre_im_exp	ln(firm previous import experience at age 1 + 1)
n_pre_spell_ex	number of previous completed export spells at age 1
n_pre_spell_im	number of previous completed import spells at age 1
repeated_spell	if the current spell is a repeated spell within a firm
gap_spell	number of year gap between the current spell and the last spell
r_lngap_spell	repeated_spell * ln(gap_spell)
dpto	= 1 if multiple products at age 1
dcou	= 1 if multiple destinations at age 1
main destination characteristics	
country risk	1 high risk (dcou1), 2 medium risk (dcou2) and 3 low risk (dcou3) (main destination at age 1) based on OECD country risk classification
border	= 1 if main destination at age 1 shares border with France
french	= 1 if language of main destination at age 1 is french
eu_eea	= 1 if main destination at age 1 in EU EEA
euro	= 1 if main destination at age 1 in euro
firm characteristics	
lnTFP	ln(TFP) at age 1
ln(age+1)	ln(firm age) = ln(current year - firm creation year +1) at age 1
lnL	ln(labor force) at age 1
lnwpL	ln(wage per labor force) at age 1
FO	= 1 if owned by foreign at age 1
FA	= 1 if have foreign affiliate at age 1
leverage ratio	total debts/total net assets at age 1 We define three binary variables by terciles within each cohort-year (leverage1, leverage2, leverage3)
nace	1-digit NACE sector at age 1
region	geographic region at age 1

Note: For import spells, destination means sourcing country. Trade related characteristics, main destination characteristics and firm characteristics refer to characteristics at age 1 for each export/import spell. For export (import) spells, initial value is firm export (import) value at age 1. Quantile (tierce) is taken among all age 1 observations. Main product/destination/sourcing country is determined based on value. dexp (dimp) is export (import) spell specific covariate. Previous export (import) experience is the number of years of exporting (importing) from 1997. gap_spell is not included as a covariate. The data on leverage ratio is missing in 2008, and it is imputed using the leverage ratio from the year 2007. There are 17 sectors which include Agriculture, Fishing, Mining, Manufacturing, Energy and Water, Construction, Trade, Tourism, Transportation and Communication, Finance, Real Estate and Prof. Activities, Government, Education, Health, Other Services, Household Services and Nonresident. There are 15 regions which include Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, Bretagne, Centre-Val de Loire, Grand Est, Hauts-de-France, Île-de-France, Normandie, Nouvelle-Aquitaine, Occitanie, Pays de la Loire, Provence-Alpes-Côte d'Azur, Département 20, Département 97, Département 99.

Tab_A.1b: Definition of covariates (for survival analysis at the firm level)

age dummies	
age1 - age7	year 1 - year 7 of a spell
age 8	year 8 or after
firm-country level control (full and restricted sample)	
initial size	initial export/import value at age 1. We define three binary variables by terciles (dini1, dini2, dini3)
dpto1, dpto2, dpto3	comparative advantage tierce of France product (f_cou level main product at age 1)
dcou1, dcou2, dcou3	1 high risk, 2 medium risk and 3 low risk at age 1
dimp	= 1 if import from the same country at age 1 for export spell
dexp	= 1 if export in the same country at age 1 for import spell
d_lc1997_ex	= 1 if firm-country exported in year 1997 (export spell left censored)
d_lc1997_im	= 1 if firm-country imported in year 1997 (import spell left censored)
lnpre_ex_exp	ln(firm-country previous export experience at age 1 + 1)
lnpre_im_exp	ln(firm-country previous import experience at age 1 + 1)
n_pre_spell_ex	number of previous completed export spells in a given country at age 1
n_pre_spell_im	number of previous completed import spells in a given country at age 1
repeated_spell	if the current spell is a repeated spell within a firm-country
gap_spell	number of year gap between the current spell and the last spell
r_lngap_spell	repeated_spell * ln(gap_spell)
dpto	= 1 if multiple products in a country at age 1
border	= 1 if country at age 1 shares border with France
french	= 1 if language of country at age 1 is french
eu_eea	= 1 if country at age 1 in eu eea
euro	= 1 if country at age 1 in euro
firm level control (full and restricted sample)	
dini1, dini2, dini3	initial value quantile (tierce) at age 1
dimp	= 1 if import at age 1 for export spell
dexp	= 1 if export at age 1 for import spell
d_lc1997_ex	= 1 if firm exported in year 1997 (export spell left censored)
d_lc1997_im	= 1 if firm imported in year 1997 (import spell left censored)
lnpre_ex_exp	ln(firm previous export experience at age 1 + 1)
lnpre_im_exp	ln(firm previous import experience at age 1 + 1)
n_pre_spell_ex	number of previous completed firm-export spells at age 1
n_pre_spell_im	number of previous completed firm-import spells at age 1
repeated_spell	if the current firm-spell is a repeated spell within a firm
gap_spell	number of year gap between the current firm-spell and the last firm-spell
r_lngap_spell	repeated_spell * ln(gap_spell)
dpto	= 1 if multiple products at age 1
dcou	= 1 if multiple destinations at age 1
firm characteristics (restricted sample)	
lnTFP	ln(TFP) at age 1
ln(age+1)	ln(firm age) = ln(current year - firm creation year +1) at age 1
lnL	ln(labor force) at age 1
lnwpL	ln(wage per labor force) at age 1
leverage ratio	total debts/total net assets at age 1 terciles within each cohort-year (leverage1, leverage2, leverage3)
FO	= 1 if owned by foreign at age 1
FA	= 1 if have foreign affiliate at age 1
nace	1-digit NACE sector at age 1
region	geographic region at age 1

Note: A spell is defined at the firm-country level. For import spells, destination means sourcing country. Except age dummies, all the other covariates refer to characteristics at age 1 for each export/import spell. At the firm-country level, initial value is firm-country export (import) value at age 1. At the firm level, initial value is firm export (import) value at age 1. Quantile (tierce) is taken among all age 1 observations. The main product is determined based on value (within the firm-country-year). dexp (dimp) is export (import) spell specific covariate. Previous firm-country export (import) experience is the number of years of exporting (importing) from 1997 in a given country. Previous firm export (import) experience is the number of years of exporting (importing) from 1997. gap_spell is not included as a covariate. For the definition of sectors and regions, see the footnote of table 1b.

Tab_A.1c: Definition of covariates (for survival analysis at the firm-country level)

A.2 Descriptive statistics

Characteristic	Mean	Median	N
TFP	2309.6	777.4	724,055
value-added per labor	66066.4	50085.7	739,657
labor force (L)	81.7	12	825,282
wage per labor (wpL)	32303	27678.8	739,709
total sales (catotal)	2.25×10^7	2,035,707	838,755
export value (v_ex)	5,052,536	69,047	838,755
foreign owned (dummy: FO)	0.099	0	838,755
have foreign affiliates (dummy: FA)	0.0105	0	838,755
firm age (age)	19.6	15	836,674
leverage ratio = total debts/total net assets	1.635	0.644	822,296

Note: The sample coverage is between 1998 and 2015. Both left-censored and non left-censored export spells are included. Number of observations varies across characteristics as some of them are missing.

Tab_A.2a: Summary statistics by export-year (Restricted sample)

Characteristic	Mean	Median	N
TFP	2465.8	846.1	749,174
value-added per labor	67681.5	49904.6	765,811
labor force (L)	93.6	12	857,827
wage per labor (wpL)	32485.3	27448.5	765,906
total sales (catotal)	2.49×10^7	2,192,000	875,950
import value (v_im)	4,299,550	148718.5	875,950
foreign owned (dummy: FO)	0.107	0	875,950
have foreign affiliates (dummy: FA)	0.0104	0	875,950
firm age (age)	17.91	13	874,056
leverage ratio = total debts/total net assets	1.245	0.661	858,688

Note: The sample coverage is between 1998 and 2015. Both left-censored and non left-censored import spells are included. Number of observations varies across characteristics as some of them are missing.

Tab_A.2b: Summary statistics by import-year (Restricted sample)

B Further results on performance differences across entrants, exiters, and continuers over the business cycle

In this section, we provide additional evidence on the differences in firm performance of entrants, exiters and continuers between good and bad times. Table 3 displays performance differences for entrants, exiters and continuers using our *Restricted sample*. We carry out simple OLS regressions of the log of three measures of firm-level performance (namely, employment -labor force-, total factor productivity, and total sales) on a dummy capturing whether t is a

"bad year" (i.e., 2008, 2009, 2010) including sector fixed effects.[39] In the columns of this table, we report the results for each measure of firm performance, for each group of firms (entrants on the top, continuers at middle, and exiters at the bottom part of the table).

The regression results for exporters (Table 3a) confirm our previous findings in section 2.2.3 in most of the cases. Firms that begin exporting during recessionary periods are more productive (and smaller) than those starting to export during upturns. However, for entrants' total sales, we get a different result. During bad times, their total sales are actually higher. In addition, continuers have higher labor force during bad times, which is different from our previous result using median. The slight inconsistency may be related to the use of variables in logs rather than levels, the use of median performance in Table 2 (main text), or it may suggest that there exists some heterogeneity across sectors.

[39] There are 17 nace sectors in total. L is labor force and *catotal* is total sales.

	(1) InTFP_ent	(2) InL_ent	(3) Incatotal_ent
year 8910	0.059	-0.104	0.022
	(0.008)***	(0.009)***	(0.010)**
nace	yes	yes	yes
N	153299	157837	199441
ll	-243543.439	-279826.836	-404290.963
r2	0.048	0.038	0.029
	(1) InTFP_con	(2) InL_con	(3) Incatotal_con
year 8910	0.079	0.021	0.076
	(0.005)***	(0.006)***	(0.007)***
nace	yes	yes	yes
N	507394	515775	551965
ll	-815532.538	-951746.332	-1108365.812
r2	0.031	0.102	0.050
	(1) InTFP_ext	(2) InL_ext	(3) Incatotal_ext
year 8910	0.113	-0.041	0.082
	(0.008)***	(0.009)***	(0.010)***
nace	yes	yes	yes
N	147054	152516	193522
ll	-227230.655	-266777.408	-388376.069
r2	0.058	0.034	0.031

Note: The sample coverage is between 1998 and 2015. *year* 8910 = 1 if year 2008, 2009 or 2010. Entrant (_ent) in year t means export in t and not in $t-1$. Exiter (_ext) in year t means export in t and not in $t+1$. Continuer (_con) in year t is the one that exports in t and doesn't belong to entrant or exiter. Left-censored spells are included. We drop those export spells of which the gravity information of their main destination is missing, that are micro firms or in distribution sectors at age 1. Unit of total sales is euro. Standard errors are clustered at the firm level. * p<0.10, ** p<.05, *** p<.01

Tab_A.3a: Exporters' performance

In table 3b, we conduct the same analysis for importers. Concerning TFP, there is no significant differences between entrants at bad times and entrants at good times. In the previous analysis of medians reported in Table 2 (main text), although the difference is significant, the magnitude is actually small. Regarding total sales, continuers have higher total sales at bad times which is different from the finding using median (no statistically different).

	(1) InTFP_ent	(2) InL_ent	(3) Incatotal_ent
year 8910	-0.008	-0.208	-0.060
	(0.009)	(0.009)***	(0.011)***
nace	yes	yes	yes
N	138796	143559	186155
ll	-228944.619	-255449.19	-387345.022
r2	0.036	0.056	0.040
	(1) InTFP_con	(2) InL_con	(3) Incatotal_con
year 8910	0.061	-0.023	0.033
	(0.005)***	(0.006)***	(0.007)***
nace	yes	yes	yes
N	543632	552665	594619
ll	-866774.696	-1019242.187	-1194134.78
r2	0.039	0.144	0.097
	(1) InTFP_ext	(2) InL_ext	(3) Incatotal_ext
year 8910	0.110	-0.084	0.059
	(0.008)***	(0.009)***	(0.011)***
nace	yes	yes	yes
N	134189	139633	181158
ll	-211972.416	-243566.505	-370419.725
r2	0.043	0.053	0.043

Note: The sample coverage is between 1998 and 2015. *year* 8910 = 1 if year 2008, 2009 or 2010. Entrant (_ent) in year t means import in t and not in $t-1$. Exiter (_ext) in year t means import in t and not in $t+1$. Continuer (_con) in year t is the one that imports in t and doesn't belong to entrant or exiter. Left-censored spells are included. We drop those import spells of which the gravity information of their main sourcing country is missing, that are micro firms or in distribution sectors at age 1. Unit of total sales is euro. Standard errors are clustered at the firm level. * p<0.10, ** p<.05, *** p<.01

Tab_A.3b: Importers' performance

C Full regression results

C.1 Hazard of exiting export markets

	full sample	restricted sample
age1	0.580	0.339
	(0.010)***	(0.044)***
age2	0.403	0.259

	(0.008)***	(0.033)***
age3	0.353	0.226
	(0.007)***	(0.029)***
age4	0.328	0.211
	(0.007)***	(0.027)***
age5	0.311	0.202
	(0.007)***	(0.026)***
age6	0.299	0.192
	(0.007)***	(0.025)***
age7	0.278	0.178
	(0.007)***	(0.023)***
age8	0.249	0.159
	(0.005)***	(0.021)***
*current*2008_10	1.204	1.214
	(0.009)***	(0.014)***
*birth*2008_10	0.892	0.904
	(0.008)***	(0.012)***
dini2	0.829	0.843
	(0.005)***	(0.008)***
dini3	0.580	0.610
	(0.004)***	(0.007)***
dpto2	0.934	0.942
	(0.005)***	(0.008)***
dpto3	0.828	0.884
	(0.005)***	(0.009)***
dcou2	0.899	0.893
	(0.007)***	(0.011)***
dcou3	0.713	0.733
	(0.007)***	(0.011)***
dimp	0.587	0.685
	(0.004)***	(0.007)***
d_lc1997_fpc_ex	1.012	0.984
	(0.009)	(0.014)
d_lc1997_fpc_im	1.013	0.976
	(0.009)	(0.013)*
lnpre_ex_exp	0.773	0.735
	(0.006)***	(0.009)***
lnpre_im_exp	1.192	1.111
	(0.007)***	(0.009)***
n_pre_spell_ex	1.043	1.039
	(0.006)***	(0.008)***
n_pre_spell_im	0.982	0.970
	(0.005)***	(0.007)***
repeated_spell	1.002	1.023
	(0.012)	(0.019)
r_lngap_spell	1.121	1.081

	(0.007)***	(0.009)***
dpto	0.666	0.671
	(0.004)***	(0.006)***
dcou	0.521	0.577
	(0.003)***	(0.006)***
border	1.052	1.040
	(0.009)***	(0.015)***
french	0.984	1.010
	(0.005)***	(0.009)
eu_eea	0.897	0.938
	(0.009)***	(0.017)***
euro	0.913	0.998
	(0.008)***	(0.015)
lnTFP		0.896
		(0.005)***
lnage		1.287
		(0.006)***
lnL		0.994
		(0.004)
lnwpL		1.066
		(0.008)***
FO		0.908
		(0.017)***
FA		0.790
		(0.044)***
leverage2		1.064
		(0.010)***
leverage3		1.206
		(0.012)***
nace		yes
region		yes
m2_cons	5.062	4.644
	(0.062)***	(0.093)***
logitp2_cons	4.567	3.696
	(0.109)***	(0.162)***
N	994199	382450
ll	-517120.962	-195145.421

Tab_A.4: Hazard of exiting export markets

Note: The table reports the estimated coefficient of each variable, excluding the NACE sector dummies and region dummies, for the export survival analysis at the firm level. The sample coverage is from 1998 to 2015. $birth2008\_10 = 1$ if export spells started in the years 2008, 2009, or 2010; and $current2008\_10 = 1$ if the current year is 2008, 2009, or 2010. Left-censored spells are excluded. Refer to Appendix A for the definition of all covariates. * p<0.10, ** p<.05, *** p<.01

C.2 Hazard of exiting import markets

	full sample	restricted sample
age1	0.290	0.586
	(0.006)***	(0.082)***
age2	0.223	0.495
	(0.005)***	(0.069)***
age3	0.215	0.473
	(0.005)***	(0.066)***
age4	0.202	0.439
	(0.004)***	(0.062)***
age5	0.190	0.414
	(0.004)***	(0.058)***
age6	0.194	0.411
	(0.004)***	(0.058)***
age7	0.193	0.406
	(0.005)***	(0.058)***
age8	0.192	0.398
	(0.004)***	(0.056)***
*current*2008_10	1.241	1.278
	(0.008)***	(0.015)***
*birth*2008_10	0.990	0.959
	(0.009)	(0.014)***
dini2	0.685	0.707
	(0.004)***	(0.008)***
dini3	0.377	0.413
	(0.003)***	(0.006)***
dpto2	0.984	1.004
	(0.006)***	(0.011)
dpto3	0.955	0.937
	(0.006)***	(0.010)***
dcou2	1.041	0.896
	(0.014)***	(0.028)***
dcou3	1.090	0.898
	(0.016)***	(0.028)***
dexp	0.635	0.704
	(0.004)***	(0.008)***
d_lc1997_fpc_ex	1.055	0.960
	(0.012)***	(0.016)**
d_lc1997_fpc_im	1.011	1.007
	(0.011)	(0.017)
lnpre_ex_exp	1.152	1.105
	(0.008)***	(0.011)***
lnpre_im_exp	0.799	0.751
	(0.008)***	(0.011)***
n_pre_spell_ex	0.987	0.968

	(0.006)**	(0.008)***
n_pre_spell_im	1.012	1.016
	(0.008)	(0.011)
repeated_spell	1.118	1.048
	(0.017)***	(0.024)**
r_lngap_spell	1.100	1.080
	(0.008)***	(0.011)***
dpto	0.617	0.618
	(0.004)***	(0.007)***
dcou	0.645	0.661
	(0.004)***	(0.008)***
border	1.063	1.060
	(0.009)***	(0.015)***
french	1.149	1.110
	(0.007)***	(0.013)***
eu_eea	0.876	0.979
	(0.010)***	(0.018)
euro	0.940	1.010
	(0.008)***	(0.015)
lnTFP		0.887
		(0.005)***
lnage		1.263
		(0.007)***
lnL		0.990
		(0.004)**
lnwpL		1.048
		(0.008)***
FO		0.794
		(0.018)***
FA		0.845
		(0.046)***
leverage2		1.050
		(0.011)***
leverage3		1.230
		(0.014)***
nace		yes
region		yes
m2_cons	6.416	6.356
	(0.074)***	(0.122)***
logitp2_cons	4.012	3.251
	(0.070)***	(0.089)***
N	1052992	380683
ll	-533937.463	-187728.761

Tab_A.5: Hazard of exiting import markets

Note: The table reports the estimated coefficient of each variable, excluding the NACE sector dummies and region dummies, for the import survival analysis at the firm level. The sample coverage is from 1998 to 2015. $birth2008\_10 = 1$ if import spells started in the years 2008, 2009, or 2010; and $current2008\_10 = 1$ if the current year is 2008, 2009, or 2010. Left-censored spells are excluded. Refer to Appendix A for the definition of all covariates. * p<0.10, ** p<.05, *** p<.01

C.3 Hazard of exiting export and import markets - joint estimation

	full sample		restricted sample	
	export	import	export	import
ex/im	5.882	2.808	2.263	6.294
	(0.087)***	(0.058)***	(0.392)***	(1.163)***
age2	0.569	0.710	0.645	0.739
	(0.005)***	(0.006)***	(0.009)***	(0.011)***
age3	0.475	0.675	0.539	0.679
	(0.005)***	(0.008)***	(0.010)***	(0.013)***
age4	0.433	0.626	0.500	0.617
	(0.006)***	(0.009)***	(0.011)***	(0.015)***
age5	0.409	0.588	0.481	0.578
	(0.007)***	(0.010)***	(0.013)***	(0.016)***
age6	0.397	0.611	0.461	0.579
	(0.007)***	(0.012)***	(0.014)***	(0.018)***
age7	0.370	0.618	0.430	0.577
	(0.008)***	(0.013)***	(0.015)***	(0.021)***
age8	0.348	0.651	0.405	0.595
	(0.006)***	(0.013)***	(0.012)***	(0.019)***
$current2008\_10$	1.272	1.363	1.290	1.398
	(0.011)***	(0.011)***	(0.017)***	(0.019)***
$birth2008\_10$	0.861	0.988	0.881	0.958
	(0.009)***	(0.010)	(0.014)***	(0.016)***
dini2	0.760	0.577	0.795	0.637
	(0.006)***	(0.005)***	(0.010)***	(0.009)***
dini3	0.468	0.275	0.531	0.333
	(0.004)***	(0.003)***	(0.008)***	(0.006)***
dpto2	0.905	0.977	0.924	1.003
	(0.007)***	(0.008)***	(0.011)***	(0.014)
dpto3	0.764	0.937	0.844	0.920
	(0.006)***	(0.008)***	(0.011)***	(0.013)***
dcou2	0.853	1.013	0.838	0.842
	(0.009)***	(0.020)	(0.015)***	(0.035)***
dcou3	0.604	1.064	0.645	0.831
	(0.008)***	(0.021)***	(0.014)***	(0.035)***
dimp/dexp	0.559	0.621	0.660	0.712

	(0.005)***	(0.006)***	(0.009)***	(0.010)***
d_lc1997_fpc_ex	0.949	0.854	0.967	0.852
	(0.013)***	(0.014)***	(0.019)*	(0.019)***
d_lc1997_fpc_im	0.800	0.975	0.880	1.006
	(0.011)***	(0.016)	(0.017)***	(0.024)
lnpre_ex_exp	0.993	1.382	0.818	1.177
	(0.012)	(0.013)***	(0.013)***	(0.015)***
lnpre_im_exp	1.413	1.160	1.171	0.905
	(0.011)***	(0.017)***	(0.012)***	(0.018)***
n_pre_spell_ex	0.830	0.851	0.895	0.887
	(0.008)***	(0.007)***	(0.010)***	(0.010)***
n_pre_spell_im	0.847	0.724	0.889	0.800
	(0.007)***	(0.009)***	(0.009)***	(0.012)***
repeated_spell	0.853	0.837	0.893	0.863
	(0.014)***	(0.017)***	(0.021)***	(0.024)***
r_lngap_spell	1.170	1.137	1.137	1.124
	(0.009)***	(0.010)***	(0.013)***	(0.014)***
dpto	0.610	0.547	0.617	0.562
	(0.005)***	(0.004)***	(0.008)***	(0.008)***
dcou	0.457	0.603	0.521	0.635
	(0.004)***	(0.005)***	(0.007)***	(0.009)***
border	1.051	1.086	1.040	1.070
	(0.012)***	(0.012)***	(0.020)**	(0.019)***
french	0.980	1.216	1.012	1.138
	(0.007)***	(0.011)***	(0.012)	(0.017)***
eu_eea	0.887	0.862	0.920	0.996
	(0.012)***	(0.013)***	(0.021)***	(0.024)
euro	0.927	0.911	1.027	1.026
	(0.011)***	(0.011)***	(0.019)	(0.019)
InTFP			0.849	0.841
			(0.006)***	(0.006)***
Inage			1.435	1.396
			(0.010)***	(0.010)***
InL			0.993	0.975
			(0.005)	(0.005)***
InwpL			1.088	1.055
			(0.011)***	(0.011)***
FO			0.879	0.753
			(0.022)***	(0.021)***
FA			0.728	0.788
			(0.054)***	(0.056)***
leverage2			1.090	1.085
			(0.014)***	(0.015)***
leverage3			1.310	1.346
			(0.018)***	(0.020)***
nace			yes	

region		yes
var(ex[firm])	2.586	2.338
	(0.047)***	(0.063)***
var(im[firm])	3.654	3.176
	(0.085)***	(0.110)***
cov(ex[firm]im[firm])	2.165	1.835
	(0.024)***	(0.029)***
N	2047191	763133
ll	-1055898.777	-384325.425

Tab_A.6: Hazard of exiting export and import markets - joint estimation

Note: The table reports the estimated coefficient of each variable, excluding the NACE sector dummies and region dummies, for the joint export/import survival analysis at the firm level. The sample coverage is from 1998 to 2015. $birth2008\_10 = 1$ if export/import spells started in the years 2008, 2009, or 2010; and $current2008\_10 = 1$ if the current year is 2008, 2009, or 2010. Left-censored spells are excluded. Refer to Appendix A for the definition of all covariates. * p<0.10, ** p<.05, *** p<.01

D Survival in foreign markets: some robustness checks

bad dummy	**Firm level**										**Firm country level**									
	2008-2015		2001, 2008-10		GDP g (country - world) < mean across years		output gap_imf < 0		output gap_oecd < 0		2008-2015		2001, 2008-10		GDP g (country - world) < mean across years		output gap_imf < 0		output gap_oecd < 0	
	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted
current bad fr	1.102***	1.152***	1.124***	1.133***	1.073***	1.083***	1.000	1.040*	0.994	1.034**	1.133***	1.102***	1.147***	1.132***	1.022***	1.029***	1.042***	1.029***	1.016***	1.010*
current bad des					1.019***	1.026***	1.078***	1.102***	1.065***	1.056***					1.042***	1.052***	1.044***	1.043***	1.048***	1.037***
birth bad fr	0.837***	0.779***	0.956***	0.958***	0.958***	0.983	0.906***	0.877***	0.906***	0.866***	0.836***	0.863***	0.941***	0.967***	0.954***	0.954***	0.933***	0.942***	0.932***	0.933***
birth bad des					0.974***	0.968***	0.948***	0.969	0.944***	0.956***					0.988***	0.990***	0.924***	0.926***	0.932***	0.937***
N	994199	382450	994199	382450	911309	351391	339721	115194	557166	213867	5834330	3490268	5834330	3490268	5524777	3333477	2272437	1280057	3219239	1871915
continuous	**Firm level**								**Firm country level**											
	ln(country TFP)		GDP g (country - world)		output gap_imf		output gap_oecd		ln(country TFP)		GDP g (country - world)		output gap_imf		output gap_oecd					
	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted				
current fr	1.158	0.917	0.961***	0.961***	1.008	0.996	0.996	0.986**	0.829**	1.411***	0.977***	0.974***	1.000	1.003	0.985***	0.984***				
current des	0.774***	0.836	0.997***	0.995***	0.984***	0.985***	0.988***	0.989***	0.473***	0.488***	0.992***	0.990***	0.988***	0.989***	0.992***	0.995***				
birth fr	12.322***	53.120***	1.028***	1.007	1.030***	1.035***	1.050***	1.063***	2.386***	1.404**	1.047***	1.050***	1.019***	1.014***	1.031***	1.023***				
birth des	1.261**	1.161	1.003**	1.005***	1.015***	1.016**	1.003	0.997	2.474***	2.455***	1.005***	1.004***	1.021***	1.021***	1.013***	1.014***				
N	812715	317570	911309	351391	339721	115194	557166	213867	5022870	3033851	5524777	3333477	2272437	1280057	3219239	1871915				

Note: The sample coverage is between 1998 and 2015. Left-censored spells are excluded. We drop those export spells of which the gravity information of their main destination is missing, that are micro firms or in distribution sectors at age 1. * p<0.10, ** p<.05, *** p<.01

Tab_A.7: Robustness check: export survival

bad dummy	**Firm level**										**Firm country level**									
	2008-2015		2001, 2008-10		GDP g (country - world) < mean across years		output gap_imf < 0		output gap_oecd < 0		2008-2015		2001, 2008-10		GDP g (country - world) < mean across years		output gap_imf < 0		output gap_oecd < 0	
	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted
current bad fr	1.234***	1.290***	1.205***	1.244***	0.894***	0.872***	1.045***	1.087***	1.098***	1.126***	1.175***	1.174***	1.199***	1.213***	0.936***	0.953***	1.028***	1.023***	1.043***	1.032***
current bad des					1.021***	1.022**	1.099***	1.110***	1.100***	1.100***					1.031***	1.029***	1.073***	1.069***	1.086***	1.074***
birth bad fr	0.881***	0.754***	0.992	0.982	1.116***	1.115***	0.921***	0.823***	0.889***	0.804***	0.857***	0.795***	0.978***	0.990**	0.992**	0.985***	0.982***	0.955***	0.927***	0.897***
birth bad des					0.993	0.977**	0.977*	1.004	0.964***	0.980					0.983***	0.980***	0.903***	0.908***	0.935***	0.951***
N	1052992	380683	1052992	380683	958322	346315	522493	195850	656363	256077	4530367	2310914	4530367	2310914	4119965	2113116	2436030	1237361	3020206	1584936
continuous	**Firm level**								**Firm country level**											
	ln(country TFP)		GDP g (country - world)		output gap_imf		output gap_oecd		ln(country TFP)		GDP g (country - world)		output gap_imf		output gap_oecd					
	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted				
current fr	0.107***	0.128***	0.973***	0.966***	0.992*	0.989	0.967***	0.961***	0.397***	0.896	0.954***	0.947***	0.988***	0.996	0.969***	0.973***				
current des	0.397***	0.352***	0.997*	1.005*	0.981***	0.984***	0.992***	0.995	0.338***	0.368***	0.992***	0.992***	0.994***	0.997**	1.000	1.002				
birth fr	10.731***	79.324***	1.003	1.015*	1.020***	1.037***	1.034***	1.054***	1.267**	1.539**	1.073***	1.082***	1.004	1.001	1.024***	1.020***				
birth des	2.598***	2.224***	0.994***	0.985***	1.012***	1.017***	1.003	1.002	3.016***	2.750***	0.991***	0.988***	1.020***	1.024***	1.007***	1.010***				
N	941476	345077	958322	346315	522493	195850	656363	256077	4059909	2090022	4119965	2113116	2436030	1237361	3020206	1584936				

Note: The sample coverage is between 1998 and 2015. Left-censored spells are excluded. We drop those import spells of which the gravity information of their main sourcing country is missing, that are micro firms or in distribution sectors at age 1. * p<0.10, ** p<.05, *** p<.01

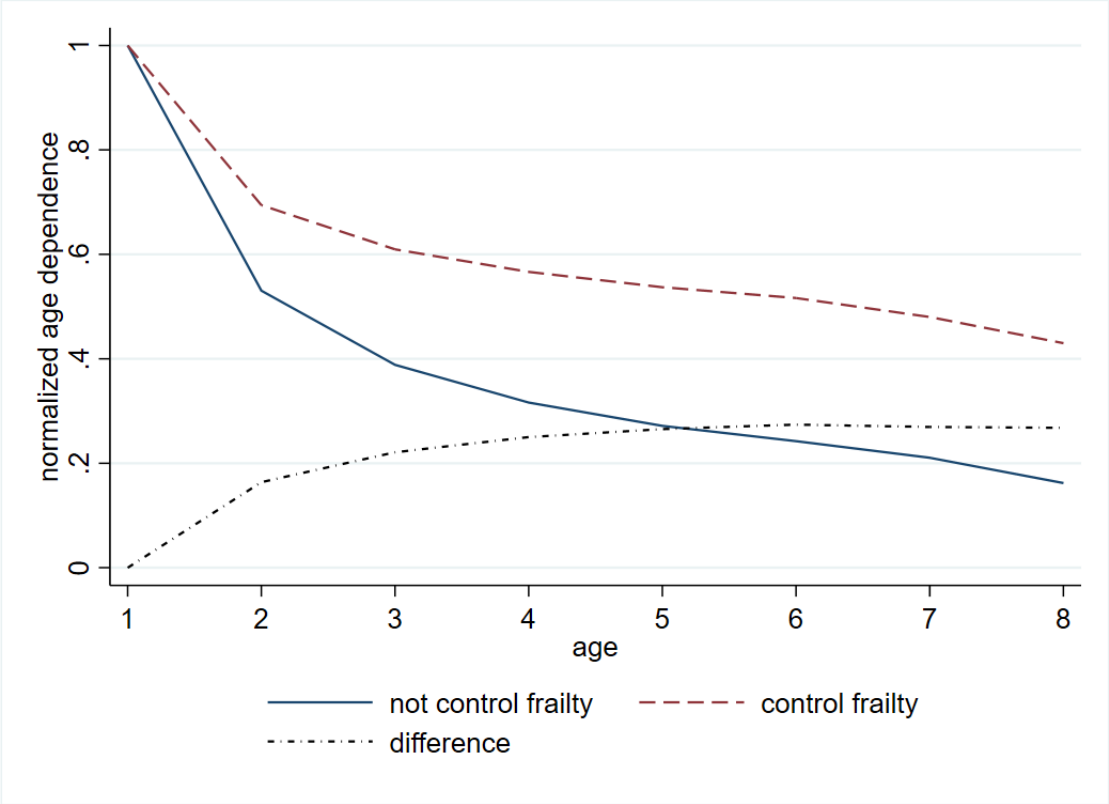
Tab_A.8: Robustness check: import survival

E Negative age dependence: "true" duration dependence vs sorting

In this section, we plot normalized coefficients of age dummies for both specifications with/without controlling for frailty using the *Full sample*. Age 1 coefficient is normalized to 1. Recall that business cycle indicators *birth*2008_10 and *current*2008_10, trade-related characteristics at age 1, main destination/sourcing country characteristics at age 1, and firm characteristics at age 1 are included as covariates for export/import duration analysis.

E.1 Export duration

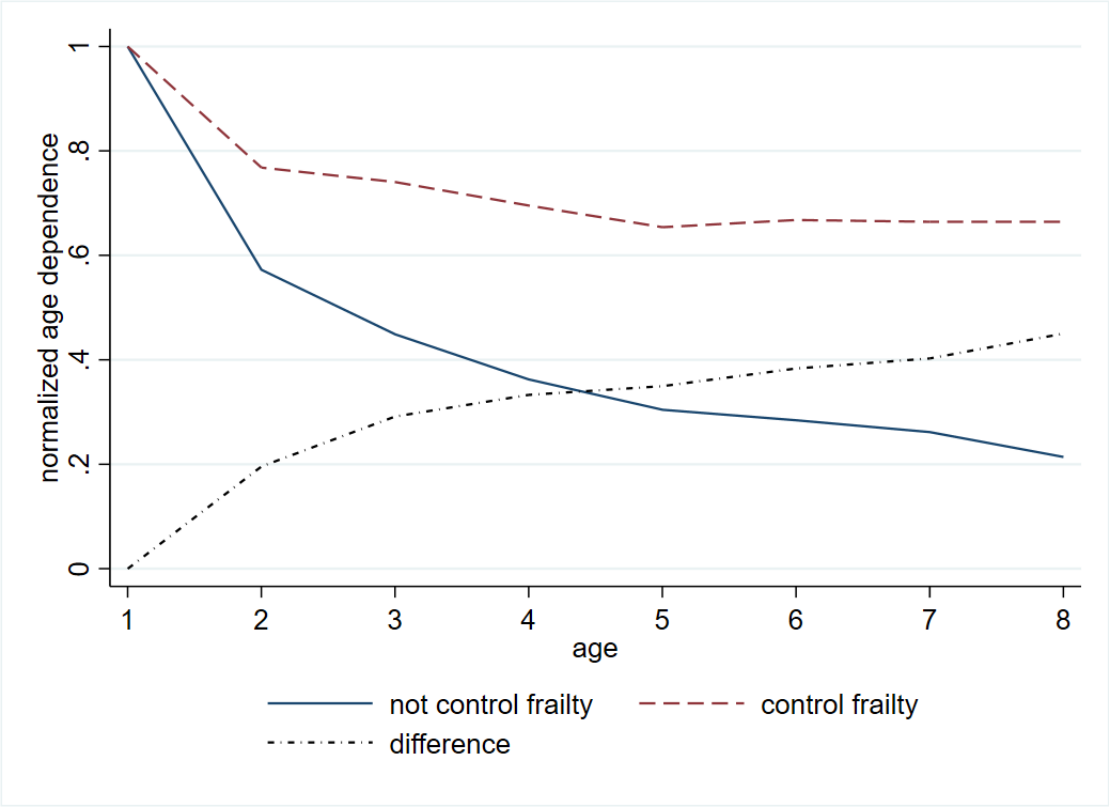
Figure 1 plots normalized coefficients of age dummies of export duration analysis. The blue (red) curve depicts normalized age coefficients of specification without (with) controlling for frailty. The green curve captures the difference between the two.



Fig_A.1: Export age dependence: frailty vs non-frailty

E.2 Import duration

Figure 2 plots normalized coefficients of age dummies of import duration analysis. The blue (red) curve depicts normalized age coefficients of specification without (with) controlling for frailty. The green curve captures the difference between the two.



Fig_A.2: Import age dependence: frailty vs non-frailty