Firm-level export duration. The importance of market-specific ownership linkages.

Abstract

This paper explores the impact of a firm's market-specific ownership linkages and trade complementarities on different dimensions of its exporting longevity. Unlike previous studies that were mostly based on country-product level data, this paper uses transaction-level trade data on the population of firms in Slovenia in the 2002–2011 period, matched with detailed origin/direction of inward/outward FDI information to determine a firm's integration in international production networks. Our results indicate that firm's bilateral inward and outward FDI flows with an export-destination country have a strong positive effect on a firm's export survival in that market. Importance of market-specific ownership linkages for export duration is exclusively driven by intermediate goods which suggests prolonged export duration through production network involvement. However, the perseverance effect of bilateral FDI ties on export spells has been weakened during the crisis period. We find pronounced market- and product-related trade complementarities as either exporting or importing experience with the relevant market/product substantially improves the chances of a product-market export spell continuing. Finally, the risk of exports termination is lower for a firm's core export products.

Keywords: export duration, FDI, production networks, sunk costs, survival, product-market spells

JEL: F23, F14, L25, C23, C41

1. Introduction

During the recent global economic and financial crisis and its immediate aftermath, export success has come to play an even greater role in the economic well-being of nations. With sagging domestic demand, most economies on the EU's periphery have needed to rely on exports to boost their overall economic performance. Continuing exporting success has hence been counted on to supplement drops in domestic demand. While new exporters continually enter foreign markets, their initial contribution to export volume is generally small, with incumbent exporters accounting for the vast majority

of export turnover. In particular, inexperienced exporters appear to be less equipped to deal with the uncertainties of exporting, such as those associated with search costs, contract enforcement, access to financing etc. The duration of export-market relationships is thus a key factor impacting the long-run export performance of countries.

The issue of the prevalence of short-lived trade flows was brought to the attention of empirical research relatively recently by Besedeš and Prusa (2006a, 2006b, 2007) and Brenton and Newfarmer (2007). This line of research highlights the importance of the sustainability margin of exporting on top of the traditional margins: intensive (growth in volume) and extensive (diversification of products and markets). Since then, several studies confirm the very low survival rates of new trade flows using very diverse datasets (Besedeš, Prusa, 2006a on the USA, Nitsch, 2009 on Germany, Hess and Persson, 2011 on the EU, Besedeš and Blyde, 2010 on Latin America, countries at different stages of development Brenton et al. 2011, Fugazza and Molina 2011, and Besedeš and Prusa, 2011).

Recently, empirical studies have emerged that link longevity in export markets to participation in global value chains (GVC). Obashi (2010) shows that the trade spells of East-Asian nations at the product level are more stable for intermediate inputs than for final goods. Compared to machine-finished products, machinery parts and components are traded in longer-lasting and more stable relationships among East-Asian countries. Corcoles et al. (2014) focus on automotive industries and find the level of integration in international-scale networks reduces the risk of trade interruptions. Córcoles et al. (2015) further confirm that exports associated with global production networks are more stable and enjoy higher survival rates than goods destined for the consumer market.

The above-mentioned studies are based on aggregate country-product level data where GVC participation is determined based on the distinction between final goods and parts or components within specific industries. To the best of our knowledge, there are no firm-level studies that explicitly account for supply chain trade status either through contract-based outsourcing relationships that give rise to arm's length type of supply chain trade or vertical integration that results in intra-firm trade transactions. This paper aims to bridge two important empirical gaps in the literature. First, by exploring transaction-level data (i.e. firm-product-destination) in analysing the duration of firm-specific trade spells, and secondly, by complementing transaction-level trade data with information on firms' inward and outward foreign ownership stakes. The former allows us to avoid the trap of aggregating a number of issues pertinent to trade between firms (length of individual firm trade spells, firm-level determinants of trade duration, substitutability of export spells at the firm level etc.). While the latter permits us to explore the ways in which market-specific ownership ties and vertical integration in international production networks influence the longevity of firm-market-product specific trade in a more direct manner than has been done in the

literature so far.

Several theoretical arguments in favour of longer duration of the export arrangements of firms with ownership linkages to the destination/origin markets have been proposed in the literature. One rests on Békés and Muraközy's (2012) findings on the exporter's endogenous choice between variable- and sunk-cost trade technologies. The likelihood of enduring trade spells is higher for exporters opting for sunk-cost trade technology characterised by an initial sunk-cost investment leading to subsequently lower variable trade costs, which is typically the case for firms with outward and inward FDI in a certain partner country.

Similarly, the positive impact of participation in global production chains and foreign-ownership on export survival may result from the relative size of sunk market-entry costs versus annual fixed costs of exporting. In the exporter dynamics model by Albornoz, Fanelli and Hallak (2016), the probability of surviving in an export market increases along with the ratio of the sunk to fixed export cost. [1] The lower export-termination hazard for vertically integrated firms would therefore imply that vertically integrated exporters in a certain market face a higher ratio of sunk to fixed exporting costs compared to non-integrated exporters. This is in line with Grossman and Helpman's (2002) notion of fixed-search costs associated with outsourcing where non-integrated buyers need to search for a suitable supplier and incur fixed search costs, suggesting lower fixed costs for vertical integration. In choosing the optimal way to organize production firms therefore weigh the costs of running a larger and less specialized organization against the costs associated with search frictions and imperfect contracting in the open market.

Finally, in Grossman, Helpman and Szeidl (2006) the use of complex strategies involving a mix of FDI and exports sees a multi-product firm's exports positively correlated with FDI if there are horizontal or vertical complementarities across product lines. The choice of integration strategy and volume/composition of trade is dictated by fixed and variable production costs, idiosyncratic firm productivity and relative size of the markets.

To test the role of the ownership linkages and trade complementarities for export duration we adopt the survival analysis approach on transaction-level data for the population of Slovenian firms in the 2002–2011 period, matched with detailed origin/direction of inward/outward FDI information and the firms' balance sheets. As an open CEE economy whose companies are extensively involved in production networks[2], we believe Slovenia provides a suitable setting for a study of export duration. The period considered in the

[1] A key finding is that the idiosyncratic market-profitability parameter does not affect the probability of survival upon entry as firms compensate a higher ability to make profits in a specific market with a lower entry and exit value of the general profitability process.

[2] According to the WTO (2016), Slovenia is classified among the high-GVC (global value chain) participation economies with a recorded GVC participation index of 58.7 in 2011, which is significantly above the average value for developed and developing countries, i.e. 48.6 and 48.0, respectively, mostly on account of its strong backward participation.

survival analysis further supports testing whether and how the role of FDI linkages changed during the last crisis period.

We find strong support for the positive role of ownership ties (either inward or outward) with the exporting market on the duration of exporting spells. While certainly not conclusive, this offers support to the notion that participation in production networks stabilizes firm trade flows. The FDI's export persistence effect is robust to several checks except for inward FDI through M&A where we are not able to rule out the contribution of selection effect of MNEs acquiring or merging with those incumbents predisposed to more persistent supply of intermediates. Further, we show that export-termination risk decreases with an increasing share of a particular product in a firm's exports, indicating the importance of firms focussing on their core competencies for export survival. Lastly, we detect several dimensions of positive export complementarities both across export products, export markets as well as importing activity. Knowledge about the export market and a deeper insight into product performance greatly contribute toward more durable product-destination specific export spells.

The rest of the paper is organised as follows. Section 2 provides a literature review summarising the factors and evidence of the persistence of firm export performance and adjustments to the export product-market mix. Section 3 describes the transaction-level data and provides descriptive statistics on export duration. In Section 4, we present empirical methodology for the survival analysis of firm product-market export spells. Section 5 shows the estimates and discusses the results of the export survival specifications while Section 6 provides some robustness checks. Section 7 concludes the paper.

2. Related literature

Since the late 1990s, improved access to firm-level data has sparked a flurry of research looking into the performance of exporting firms. The early studies primarily focused on the observed productivity gap between exporters and non-exporters (Bernard and Jensen, 1997, 1999, Bernard and Wagner, 1997, Clerides et al. 1998), finding that: (i) exporters are in the minority; (ii) they tend to be more productive and larger; and (iii) they tend to export only a small fraction of their output. Later research found corroborating evidence for a variety of different country datasets, at the same time providing far more detail on the fundamental differences between exporters and firms that only sell locally (see Wagner 2007, Greenaway, Kneller, 2007 for surveys). Exporters were found to be more innovative, more capital-intensive in production, to pay higher wages, have a better employee skill structure, be less financially constrained etc.

Another empirical regularity across a number of very diverse firm-level datasets has been the persistence of exporter status (Bernard and Jensen,

2004; Andersson and Lööf 2009). This fact is attributed to the existence of substantial sunk costs of exporting, learning-by-exporting and/or firm heterogeneity (Roberts and Tybout, 1997, Timoshenko 2015). Despite fast-growing empirical literature based on different country datasets, evidence of firm-duration patterns in specific foreign markets with distinct products remains scarce.

This is even more surprising given that the little evidence that exists on export duration suggests that average export spells tend to be exceedingly short with very low initial survival rates for new exporters. Besedeš (2008) found the majority of trade relationships at the country-product level start comparatively small and last a short time, thus conforming to the predictions of the search-cost model of bilateral trade relations. Eaton et al. (2008) show that about half of new exporters discontinue their exporting activity within the first year. Esteve-Pérez et al. (2007) report a median duration of 6 years for export spells of Spanish manufacturing firms, with 25% of the spells ending after the first year. Similarly, Volpe and Carballo (2009) report the median export duration for Peruvian firms to be just 1 year, while noting an exporting death rate of 54.5% in the initial year of exporting. Crucially from the perspective of this paper, Estéve-Perez et al. (2007) find that the median duration of export-destination spells falls to 2 years, with 47% of spells ending after the first year. Albornoz et al. (2016) likewise find a survival rate of only 24% after 2 years for exporters entering a new export destination. Since we are mainly interested in export-product-destination survival, we can expect our data to yield even lower survival rates.

Several recent studies have looked at the determinants of export survival. Cadot et al. (2013) find that firms from Malawi, Mali, Senegal and Tanzania benefit from informational spillovers from exporting. The probability of surviving upon entering a new market rises with the number of competitors from the same country already serving that market. Békés and Muraközy (2012) show that productivity, financial stability and the GDP of the destination country are key determinants of export survival. Albornoz et al. (2016) use Argentinian customs data to show the survival probability decreases with distance and is higher for experienced firms. Further, Besedeš and Prusa (2006b) and Brenton et al. (2011) show that the median duration of the trade relationship for differentiated products is longer and they have a higher survival probability than homogenous products. Finally, Córcoles et al. (2014) find that product sophistication, measured by Hausman's sophistication index and the Hidalgo-Hausman product complexity index, reduces the risk of interruption to trade relationships.

For multi-product firms, the duration of product-market export spells tends to be correlated across destinations and products. As demonstrated by Albornoz et al. (2012) in their sequential exporting model, brief export spells are mostly observed among first-time, single-market exporters of differentiated products, implying the existence of positive trade externalities over time across both products and destinations. Regarding cross-product

correlations, not only trade externalities but also the hierarchy of the products seems to be important. In line with Eckel and Neary (2010), when manufacturing technologies are highly flexible, multi-product firms in the presence of the "cannibalisation effect" respond to shocks by downsizing their product range based on their competencies rather than in a random manner. Similarly, Bernard, Redding and Schott (2011) show that multi-product firms adjust to trade liberalisation pressures by dropping their least-productive products first and focussing on their core competencies. Görg et al. (2012) confirm that multi-product exporters are more successful in exporting their core product.

3. Data and descriptive statistics

We explore the determinants of product-market export spells persistence using transaction-level data[3] for the universe of Slovenian firms in the 2002–2011 period. The database we use consists of three distinct datasets covering the complete population of Slovenian firms. Detailed transaction-level trade data at the 8-digit European Combined Nomenclature (CN8) code are provided by the Statistical Office of the Republic of Slovenia (SURS)[4]. Firms' financial statements and business register data come from the Agency for Public Legal Records and Related Services (APLR). Finally, we also rely on data on direct cross-border financial flows provided by the Bank of Slovenia to construct both a complete map of foreign-owned enterprises and local enterprises with foreign-held assets. We are able to merge the three datasets using unique firm identifiers.

For the purpose of the duration analysis, we define products at the 6-digit level of product group CN classification that fully complies with the 6-digit HS code. In 2007, the HS classification underwent a substantial revision, therefore it was necessary to pair the HS6 2007 and HS6 2002 codes. In converting the HS2007 to HS2002 codes, we rely on Van Beveren et al.'s (2012) concordance approach but assign one single code of the HS 2002 edition to each HS 2007 code. This requires certain simplifications where the HS 2007 code is the result of either merging (1-to-n type of relationship) or splitting and merging (n-to-n relationship) of several codes in the previous 2002 classification. In this case, we follow the United Nations Statistics Division (2009) and give priority to one subheading among several with the same code as the HS 2007 subheading (if one exists). The retained code rule

[3] While data is at transaction level it, unfortunately, does not include information on the identity of the foreign trade partner. Every transaction is recorded as either an export or import flow to/from a certain destination with value and quantity shipped.

[4] The reporting threshold (officially known as the exemption threshold) for the intra-EU trade flows of Slovenian firms is set at EUR 200,000 for dispatches and EUR 120,000 for arrivals annually but had been set at EUR 200,000 and EUR 85,000 before 2009. Before Slovenia joined the EU (2004), there were no reporting restrictions for either intra- or extra-EU trade.

is based on the general World Customs Organisation's practice to only retain the existing code if no substantial changes have been made to its scope.
Some of the key characteristics of the data with respect to export duration are shown in Table 1. Crucially, there is a noticeable difference in the average length of product-market specific export spells compared with the duration of product exports and exports to a specific destination. One point of particular interest is that the duration of exporting the same product (to any market) is shorter than that of exporting any product to a particular market. Finally, the average number of exported HS6 products is 53.49, with the median being substantially lower at 18, while the average number of export markets is 6.66.

Table 1: Export duration and extensive export margins for 2010

	Average (median)
Export duration product-destination (in years)	3.00 (2.00)
Export duration product (in years)	4.50 (6.00)
Export duration country (in years)	5.50 (6.00)
Export duration total (in years)	8.90 (10.00)
Number of HS6 products exported	53.49 (18.00)
Number of export markets	6.66 (3.00)

Sources: Slovenian Statistical Office, Bank of Slovenia

Properties of the sample with respect to the number of product-destination specific spells are presented in Table 2. The median spell length is 2 years, with only 32.5% of the spells exceeding 2 years. The longest product-destination specific spells in our sample are 9 years long and occur in 0.24 per cent of cases. The vast majority of firm-product-destination triplets only occur once, meaning that firms do not re-enter the same market with the same product within the sample time frame, but in 24.61 per cent of the cases we notice the re-entry of firms into the same product-destination node. At most, there were five entries by firms with the same product in a single destination within our sample time span.

Table 2: Composition of product-destination exporting spells

Longest spell per firm-product-destination			No. of export spells per firm-product-destination		
Length of export spell	No. of observations	Share of total	No. of spells per firm	No. of observations	Share of total
1	517,948	45.98	1	849,337	75.39
2	242,284	21.51	2	239,094	21.22
3	138,383	12.28	3	35,943	3.19
4	87,891	7.80	4	2,173	0.19
5	58,633	5.20	5	30	0.00
6	37,027	3.29			
7	21,961	1.95			
8	19,745	1.75			
9	2,702	0.24			
Total	1,126,577	100	Total	1,126,577	100

Notes: No correction for survival or other types of censoring
Sources: Slovenian Statistical Office, Bank of Slovenia

Figures 1 and 2 show the Kaplan-Meier survival estimates[5] for the sample split between BEC categories and across foreign-owned and domestic firms (Figure 1) and firms that did not make outward direct investments and those that did (Figure 2). Foremost, it is evident that export survival rates are higher for foreign-owned and firms investing abroad. Outward-investing firms, in particular, exhibit more than 10 percentage points higher survival rates after the first year of the product-destination exporting spell. In addition, exports of intermediate and consumption goods to a particular market appear less likely to be terminated, while the likelihood of exit is substantially higher for capital goods. This could be an artefact of the specific nature of trade in capital goods, which may be more intermittent than consumer and intermediate goods. Finally, apart from the initial year where the difference is minimal, intermediate products appear to display the lowest risk of export failure.

[5] The Kaplan-Meier estimator is a non-parametric statistic used to estimate the survival function from lifetime data. In this instance it is used to depict the fraction of firms exporting for a certain time. It is one of the most often used methods of computing the survival over time and is robust to data censoring. The probability that a firm survives longer than t periods is given by $S(t) = \prod_{i:t_i \leq t} \left(1 - \frac{d_i}{n_i}\right)$, where d_i/n_i is the share of firms that stop exporting at time t_i.

Figure 1: Kaplan-Meier survival estimates by BEC and foreign ownership status

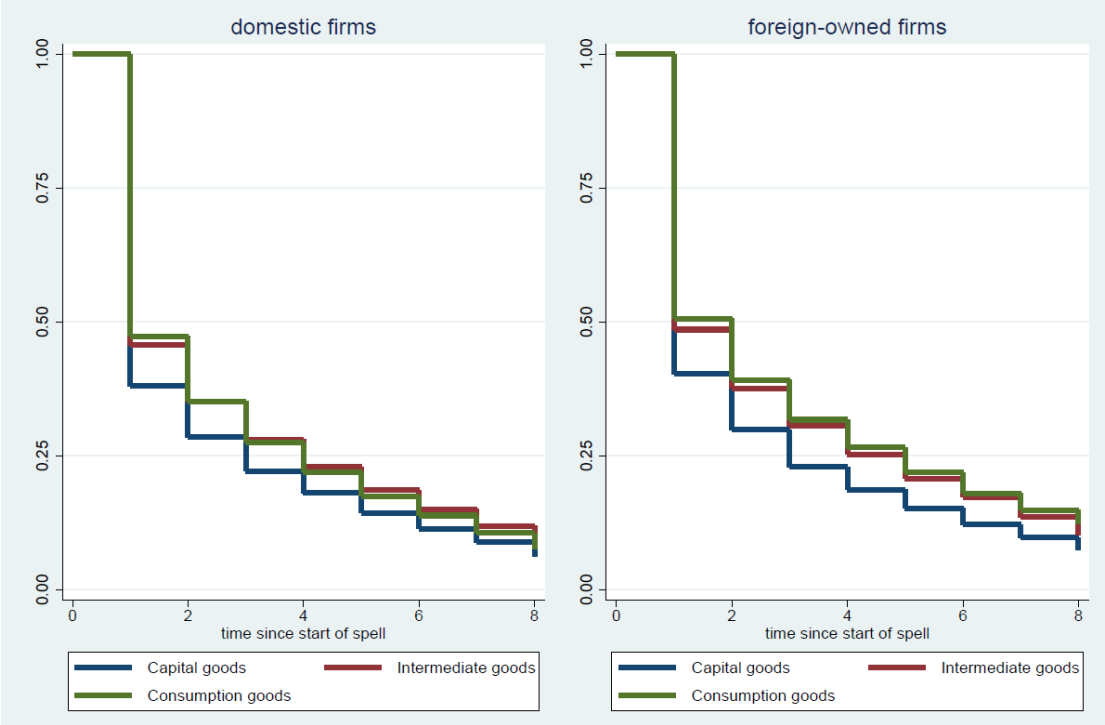
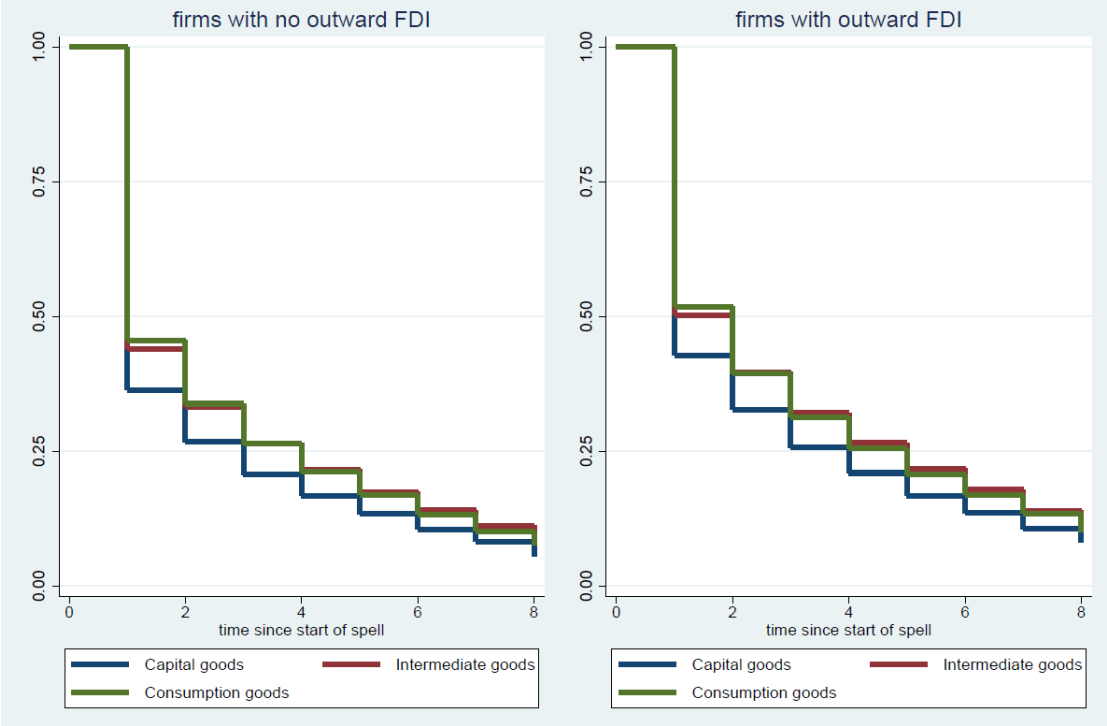


Figure 2: Kaplan-Meier survival estimates by BEC and outward direct foreign investment



4. Empirical methodology

The primary estimation method we employ in the remainder of the paper is survival analysis. We use survival techniques to analyse the determinants of export duration in a particular product-destination pair. Our unit of observation is a firm's export spell of a certain product to a particular market. We define an export spell as a period of exporting, that is, the number of years of exporting a given HS6 product to a specific market between the first and last observed year of the firm's particular product-market export spell in our database.

Related to firm exit from a certain product-destination node, we define the hazard rate as the probability of the cessation of exports conditional on export survival (in a particular product-destination pair) up to that period. As with any sample period, our data are subject to left- and right-censoring. Left-censoring occurs for firms that are already exporting in the initial year of the sample, meaning that we cannot establish the starting point of those spells. To deal with this issue, we only consider those export spells that started within our period and, hence, exclude spells present in the initial year of our period, i.e. in the year 2002. Right-censoring, on the other hand, occurs at the end of the sample as we cannot determine when or whether the spell ended. Hence, the size of our sample is reduced by 2 years.

We perform robustness tests by imposing restrictions regarding interruptions in the export spells. We start only considering uninterrupted spells, i.e. a spell is considered to end in year *t* if a firm is no longer exporting in *t+1* irrespective of any later positive exports of the same product to the same market. As a robustness check, we allow for 1- and 2-year gaps in the export spell, respectively, and accordingly shorten the effective period under investigation. Survival methods consider the evolution of the exit risk and its determinants over time since they account for both whether and when an event takes place. They are based on the concept of conditional probabilities that an export flow will last *t* periods, given that it already lasted *t-1* periods, rather than unconditional probabilities of the flow lasting exactly *t* periods.

To investigate the factors determining the duration of export spells, we conduct a multivariate analysis to assess the impact of each covariate on the hazard risk of export spell termination, controlling for the effect of other observed explanatory variables, and unobserved heterogeneity. Although firm exit from a product-market pair may occur at any particular instant in time (as the stochastic processes occur in continuous time), the annual format of the dataset means that survival times have to be grouped into discrete annual intervals. Namely, survival times include a set of positive integers j=1,2,3..., and the observations of the transition process are summarised discretely rather than continuously [6]. Further, we control for firm-export spells' unobserved heterogeneity by using the random-effects probit.

[6] This is known as interval censored data (Jenkins 2005).

We estimate complementary log-log model (*cloglog*), which is a discrete time representation of the following underlying continuous time proportional hazard model:

$$q\left(j, x_{ij}\right) = q_0\left(j\right)\exp^{b_0 + bx_{ij}} v_i \tag{1}$$

where j is survival time in years, $\theta(j, x_{ij})$ is the hazard function, $\theta_0(j)$ is the baseline hazard function (that is, a function of the number of the years of continuous exporting) and x_{ij} is a vector of spell, firm and industry covariates. Here, unobserved heterogeneity (υ_i) incorporated multiplicatively so that it measures a proportional increase or decrease in the hazard rate of a given firm relative to the average firm. We assume the unobserved heterogeneity follows a random distribution.

Log linearizing (1), we obtain:

$$\log\theta\left(j, x_{ij}\right) = \log\theta_0\left(j\right) + \beta_0 + \beta x_{ij} + \log(v_i) \tag{2}$$

As argued by Jenkins (2005), the complementary log-log model is the most commonly used discrete-time model for dealing with intrinsically continuous but grouped data. Following Prentice and Gloeckler (1978) and Jenkins (2005), the discrete-time hazard function takes the following form when a complementary log-log distribution is assumed:

$$h\left(j, X_{ij}\right) = 1 - \exp[-\exp\left(\beta_0 + \beta' X_{ij} + \gamma_j\right)] \tag{3}$$

where $h(j,X_{ij})$ indicates the interval hazard for the period between the start and end of the j^{th} interval (year) and γ_j is the interval baseline hazard defined as the log of the difference between the integrated baseline hazard $\theta_0(t)$ evaluated at the end of the interval (a_{j-1};-a_j) and the start of the interval,

$$\gamma_j = \log \int_{a_{j-1}}^{a_j} \theta_0(t)dt \tag{4}$$

The dependent variable in our regressions is a binary variable $dEXexit_{ikmt}$ that takes the value 1 for the survival period in which firm i exits market m with a specific 6-digit HS product k and 0 as long as it remains exporting to the destination with that product. The spells that are no longer active in $t+1$ are assumed to suffer an exit shock in t (assume value 1 in period t). Right-censored observations, where the exporting spell is ongoing in the last period of our sample or left-censored spells, which are continuing from the pre-sample period are excluded.

The explanatory variables are split into four groups. The first set of variables proxies for **vertical integration in production network through FDI.** We account for firm participation in a vertically-integrated production network using indicator variables for (*i*) foreign ownership ($dInFDI_{it}$) and (*ii*) ownership of foreign affiliates ($dOutFDI_{it}$). We also explicitly distinguish inward and outward FDI at the bilateral trade level and FDI with third countries. That is, we introduce binary indicator variables for (*iii*) inward/(*iv*) outward FDI matching the trade destination, $dInFDI\_bilat_{imt}$ and $dOutFDI\_bilat_{imt}$, and (*v*) inward/(*vi*) outward FDI coming from/directed to other countries than the particular export market, $dInFDI\_third\_cntry_{imt}$ and $dOutFDI\_third\_cntry_{imt}$, respectively.[7]

The second set includes varied **trade complementarities.** Potential trade externalities are tested with: (i) the number of other products a firm exports to a certain market ($Ln(\#prod\_ex\_other_{it})$); and (ii) the number of markets supplied with the same product ($Ln(\#mar\_ex\_other_{it})$). Due to potential multicollinearity of these two regressors with certain firm-specific explanatory variables, we also test the trade externalities by including binary indicators of whether the firm serves the same market with other products ($d\_prod\_ex\_other_{ikmt}$) and exports the same product to other markets ($d\_mar\_ex\_other_{ikmt}$). The role of core competencies/markets is tested with: (iii) the revenue share of the respective market in total export revenue ($ex\_mar\_share_{imt}$); and (iv) the revenue share of the respective product in total export revenue ($ex\_prod\_share_{ikt}$). In order to control for the possibility of pass-on trade[8], we also account for firms that: (v) import the same product from the export partner country ($d\_im\_prod\_mar_{ikmt}$); (vi) import the product in question from any source country ($d\_im\_prod_{ikt}$); and (vii) import any product from the export destination market ($d\_im\_mar_{imt}$).

Third, we control for a broad set of **firm characteristics** deemed fundamental to a firm's (export) performance, e.g. a firm's size, age and productivity. The size of a firm (emp_{it}) is measured by the number of employees, while age_{it} is defined with reference to the formation year according to the Business Register of the Republic of Slovenia. Productivity is measured in terms of value added per employee (va_emp_{it}). Specifications further include capital-intensity (k_emp_{it}), measured by fixed assets per worker, and financial leverage, defined as firm debt-to-assets ratio ($debt\_asset_{it}$). We expect that, in line with general firm survival, smaller and younger firms are less likely to survive in export markets. Moreover, a firm's productivity and capital-intensity are expected to improve the learning process and information management about the foreign market and, hence, negatively affect the likelihood of an exit from exporting.

[7] Given that we do not have information on the identity of foreign trade partners, we cannot know for certain whether trade of firms with foreign holdings or firms that are foreign owned implies within-firm trade. It could just as easily be trade with unaffiliated parties. On the other hand, firms that are neither foreign-owned nor have outward FDI could also be trading with a production network.

[8] We expect that imported products that are passed on to export markets would, all else considered, tend to have higher survival probabilities in those markets.

However, these firm-level variables may not be entirely exogenous because if a firm starts downscaling its product-market export portfolio before closing, these variables may change and this change might be a predictor of the export-exit decision. We therefore use lagged values of these variables in the model specifications. *Ln* prefixes in variable names denote the natural logarithm of a particular variable.

Finally, we account for **product and export destination specifics** using several sets of indicator variables. To control for product specifics, the estimation model also includes controls for broad economic categories to distinguish among capital goods, intermediates and final consumer goods (*i.bec_cat*) along with 1-digit level HS product group dummy variables. Destination-country specifics are accounted for with a set of destination country dummies and, alternatively, gravity features, e.g. the export destination market's GDP and its distance from Slovenia.

As is common in the literature, we also control for the length of the spell, as the hazard rate tends to diminish with the length of time a firm is present in a given market. We report results for specifications in log (time) functional form (*lnex_spell*) in the next section. The results are robust to alternative functional forms for the baseline hazard function, e.g. a fully non-parametric specification of the baseline hazard function with duration-interval-specific dummy variables. All regressions also include time controls.

5. Empirical results

Table 3 shows results for export product-market spell survival in the aggregate sample, while Table 4 presents results separately for three broad categories of products according to their broad economic purpose (BEC classification), i.e. intermediates, capital and consumer goods.

Coefficients are presented in exponentiated form for ease of interpretation. All coefficients above 1 indicate an increase in the hazard rate, while those less than 1 indicate a decrease of the underlying hazard. In all specifications, standard errors are adjusted for firm-market-product clusters.

The coefficient on log spell length (*lnex_spell)* is consistently smaller than unity, therefore indicating that the baseline hazard decreases with elapsed survival time. The significant impact of inward and outward FDI on export survival likelihood confirms the importance of market-specific ownership linkages, and potentially production network involvement for export duration. A general measure of firm investment status (*dOutFDI, dInFDI*) offers some indication that outward investment ties actually increase the hazard rate of export spells' termination. While this could in fact hint at the substitution effect between trade and foreign-based production, a closer look reveals that firms' bilateral FDI with the export destination country and FDI with third countries behave very differently. As can be seen in columns 4 and 5, bilateral outward FDI ("upstream position") increases the likelihood of export survival

in an affiliate's host country market by 2 to 6 per cent while the effect of inward FDI tends to be even stronger, i.e. up to 13 per cent. The positive and significant impact of FDI to and from third countries on the probability to end a product-market export spell (column 4) indicates that FDI contributes to a higher hazard rate of terminating export spells to other (potentially non-related) markets, which may be an indication that ownership changes lead to a shift from existing to new trade relationships, likely within the structure of the multinational firm. This contributes to the stronger regional concentration of firm trade. However, the negative impact of outward FDI on export spell duration to third countries is not robust to the alternative specification reported in column 5. As far as the product specific characteristics are concerned, export duration proves to be longest for intermediates and lowest for capital goods. On average, the export termination hazard for intermediates is lower by around 12% than for capital goods, all else being equal. Significant interaction terms between BEC indicators and bilateral FDI variables (specification 3) further emphasise that the impact of bilateral FDI on the probability of ceasing product-market export spells varies across broad economic categories. In particular, the positive effect of bilateral FDI on export survival is most pronounced for intermediate goods, while it even becomes negative for consumer goods in the case of bilateral inward FDI and for capital goods in the case of bilateral outward FDI, which is further explored and confirmed in Table 4. These results provide strong albeit indirect indication of a longer export duration where within-firm or supply-chain trade is involved.
In line with the trade complementarities predicted by Albornoz et al. (2012), the results show the hazard rate of termination of a firm's particular product-market export spell is around 6 per cent lower for firms that serve a certain market with other products as well and even more, by 47 per cent, when they export a given product to other markets (specification 5 in Table 3). Doubling the number of exported products to a particular market and doubling the number of export markets for a particular product leads respectively to a 12% and 40% reduced risk of export termination (columns 1–4).
We find support for the predictions of Eckel and Neary (2010) and Bernard, Redding and Schott (2011) that export-termination risk is lower for core export products, i.e. the higher the export share of a certain product, the longer the duration of a particular product-market export spell. Moreover, a strong (negative) relationship between export hazard and imports is also evident. The exit hazard is lower when firms are: (i) importing the same product from the export partner country; (ii) importing the product in question from any source country; and (iii) importing any product from the export destination market. Damijan et al. (2013) find that between 1995 and 2008 almost 70 per cent of Slovenian exporting firms engaged in pass-on trade (POT) whereby firms imported and exported the same 8-digit CN products. They suggest that POT firms either: (i) serve as intermediaries within the multinational-firm network benefiting from logistical network externalities; (ii) engage in price arbitrage for a range of imported products due to complementarities in demand scope

with their own production; and (iii) place imported products in export markets as proprietary products.

Table 3: Complementary log-log export-exit model at the firm-market-product level (exponentiated coefficients)

	Clog-log (1)	*Clog-log (2)*	*Clog-log (3)*	*Clog-log (4)*	*Clog-log (5)*
Ln(ex_spell$_{ikmt}$)	0.459***	0.459***	0.459***	0.459***	0.451***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
FDI linkages					
dOutFDI$_{it}$	1.017***				
	(0.004)				
dInFDI$_{it}$	0.997				
	(0.004)				
doutFDI_bilat$_{imt}$		0.966***	0.985	0.978***	0.940***
		(0.005)	(0.010)	(0.006)	(0.006)
dinFDI_bilat$_{imt}$		0.922***	1.177***	0.868***	0.867***
		(0.022)	(0.050)	(0.022)	(0.022)
dOutFDI_third_cntry$_{imt}$				1.033***	0.996
				(0.005)	(0.005)
dInFDI_third_cntry$_{imt}$				1.014***	1.017***
				(0.004)	(0.004)
Product characteristics (BEC)					
2.bec_cat (intermediates)	0.880***	0.879***	0.888***	0.879***	0.878***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
3.bec_cat (consumer g.)	0.954***	0.954***	0.956***	0.950***	0.933***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
1.bec_cat#1.doutFDI_bilat			1.035**		
			(0.015)		
2.bec_cat#1.doutFDI_bilat			0.957***		
			(0.011)		
1.bec_cat#1.dinFDI_bilat			0.819***		
			(0.056)		
2.bec_cat#1.dinFDI_bilat			0.678***		
			(0.035)		
Trade complementarities					
Ln(#prod_ex_other$_{imt}$)	0.879***	0.881***	0.880***	0.883***	
	(0.002)	(0.002)	(0.002)	(0.001)	
Ln(#mar_ex_other$_{ikt}$)	0.594***	0.593***	0.593***	0.595***	
	(0.002)	(0.002)	(0.002)	(0.002)	
ex_mar_share$_{imt}$	1.000***	1.000***	1.000***	1.000***	0.998***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ex_prod_share$_{ikt}$	0.997***	0.997***	0.997***	0.997***	0.997***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
d_im_prod_mar$_{ikmt}$	0.553***	0.553***	0.553***	0.556***	0.669***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
d_im_prod$_{ikt}$	0.667***	0.667***	0.667***	0.669***	0.643***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
d_im_mar$_{imt}$	0.957***	0.960***	0.960***	0.960***	0.942***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
d_prod_ex_other$_{imt}$					0.939***
					(0.007)
d_mar_ex_other$_{ikt}$					0.529***
					(0.002)
Firm characteristics					

Ln(va_emp$_{it-1}$)	0.993***	0.994***	0.994***	0.938***	0.917***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Ln(k_emp$_{it-1}$)	0.989***	0.990***	0.990***	1.003**	0.999
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln(emp$_{it-1}$)	1.021***	1.024***	1.024***	1.017***	0.968***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
(Debt/asset)$_{it-1}$	1.092***	1.093***	1.092***	1.147***	1.113***
	(0.016)	(0.016)	(0.016)	(0.008)	(0.008)
Ln(Age$_{it}$)	1.056***	1.046***	1.045***	1.071***	1.133***
	(0.010)	(0.010)	(0.010)	(0.011)	(0.012)
(Ln(Age$_{it}$))^2	1.000	1.003	1.003	0.998	0.986***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	1.532***	1.480***	1.479***	2.198***	1.981***
	(0.060)	(0.058)	(0.058)	(0.091)	(0.083)
Time eff. Incl.	YES	YES	YES	YES	YES
Product eff. Incl.	YES	YES	YES	YES	YES
Country eff. Incl.	YES	YES	YES	YES	YES
Log pse.likelihood	-574698	-574681	-574633	-563994	-570437
Wald test	chi2(122) = 2.11e+05***	chi2(122) = 2.11e+05***	chi2(126) = 2.11e+05***	chi2(124) = 2.07e+05***	chi2(124) = 2.02e+05***
Observations	1,038,642	1,038,642	1,038,642	1,019,656	1,019,656
Nonzero outcomes	409964	409964	409964	401395	401395
Zero outcomes	628678	628678	628678	618261	618261

Notes: BEC categories: "1" capital goods, "2" intermediate goods, and "3" consumer goods. Robust standard errors in parentheses; Std. Err. adjusted for clusters in firm-market-product; *** p<0.01, ** p<0.05, * p<0.1

The core firm-specific determinants of export survival are largely in line with the theoretical expectations. The results indicate that more productive firms with less financial leverage are more likely to survive in exporting, which is in line with Békés and Muraközy's (2012) finding that firm productivity and financial stability increase the likelihood of long-lasting trade. Interestingly, firm size appears to increase the exit hazard but, as we show in column 5, this is mainly a consequence of the correlation between firm size and the number of products and markets it serves. Once we replace the two measures of extensive export margins with simple dummy variables indicating whether a firm exports the same product to other markets or other products to the specific market, firm size positively affects export survival (column 5). In contrast, results suggest that the likelihood of export exit increases with firm age, suggesting that learning effects are product- and market-specific rather than more generally related to the overall length of a firm's existence.

Results for the subsamples of different product categories according to BEC in Table 4 confirm our prior that ownership ties contributes to greater stability and a longer duration of exports chiefly on account of vertical trade. Namely, the export-persistence-reinforcing effect of bilateral FDI is driven exclusively by intermediate goods that experience a 6 per cent lower export-exit hazard in an affiliate's host country, while with inward FDI they benefit from a 22 per cent drop in the export-hazard rates in foreign owners' local markets. While we realize that bilateral FDI of a firm with the trade partner-country market does not guaranty a trade flow is within firm, we believe it likely that these flows were at the very least aided by the sphere of influence of parent/affiliate

present in the country. On the other hand, no evidence of a bilateral FDI-related enhancing effect on export duration is found for the other two product categories, i.e. capital and consumer goods. Moreover, bilateral outward FDI tends to increase the export-termination hazard for the category of capital goods, and bilateral inward FDI increases the export-exit likelihood for consumer goods. However, FDI to/from third countries has a more homogenous impact on export duration across the three categories of goods, contributing negatively to export spell longevity for all product categories, except for consumer goods in case of inward FDI where the effect is non-significant. Similarly, export and import complementarities seem to be relatively uniform across different product categories, with the notable exception of importing from the export-destination country that reduces the export-termination hazard for intermediate and capital goods but not for consumer goods. Likewise, firm-specific factors exhibit relatively even effects on the export-exit hazard across different BEC product groups with the exception of the non-significant effect of firm size for consumer goods and the impact of capital intensity that varies from significantly positive for intermediates and capital goods to significantly negative for consumer goods.

Table 4: Complementary log-log export-exit model at the firm-market-product level for BEC categories (exponentiated coefficients)

	Capital goods (bec=1) (1)	Intermediates (bec=2) (2)	Consumer goods (bec=3) (3)
$Ln(ex\_spell_{ikmt})$	0.443***	0.447***	0.510***
	(0.004)	(0.002)	(0.003)
FDI linkages			
$doutFDI\_bilat_{imt}$	1.042***	0.941***	1.015
	(0.015)	(0.008)	(0.013)
$dinFDI\_bilat_{imt}$	0.916	0.780***	1.101*
	(0.056)	(0.027)	(0.056)
$dOutFDI\_third\_cntry_{imt}$	1.045***	1.031***	1.030***
	(0.012)	(0.006)	(0.010)
$dInFDI\_third\_cntry_{imt}$	1.028***	1.015**	0.990
	(0.011)	(0.006)	(0.009)
Trade complementarities			
$Ln(\#prod\_ex\_other_{imt})$	0.858***	0.884***	0.900***
	(0.003)	(0.002)	(0.003)
$Ln(\#mar\_ex\_other_{ikt})$	0.568***	0.604***	0.589***
	(0.004)	(0.002)	(0.004)
$ex\_mar\_share_{imt}$	1.001***	1.000***	0.999***
	(0.000)	(0.000)	(0.000)
$ex\_prod\_share_{ikt}$	0.998***	0.995***	0.997***
	(0.000)	(0.000)	(0.000)

$d\_im\_prod\_mar_{ikmt}$	0.515***	0.560***	0.569***
	(0.009)	(0.005)	(0.008)
$d\_im\_prod_{ikt}$	0.677***	0.682***	0.643***
	(0.006)	(0.003)	(0.005)
$d\_im\_mar_{imt}$	0.979**	0.929***	1.018**
	(0.010)	(0.005)	(0.009)
Firm characteristics			
$Ln(va\_emp_{it-1})$	0.956***	0.928***	0.943***
	(0.007)	(0.004)	(0.005)
$Ln(k\_emp_{it-1})$	1.009***	1.007***	0.991***
	(0.003)	(0.002)	(0.003)
$Ln(emp_{it-1})$	1.034***	1.020***	0.997
	(0.003)	(0.002)	(0.003)
$(Debt/asset)_{it-1}$	1.205***	1.152***	1.109***
	(0.021)	(0.011)	(0.016)
$Ln(Age_{it})$	1.114***	1.080***	1.047**
	(0.027)	(0.015)	(0.022)
$(Ln(Age_{it}))^2$	0.991	0.996	1.001
	(0.006)	(0.003)	(0.005)
Constant	2.740***	2.335***	2.124***
	(0.840)	(0.158)	(0.157)
Time eff. Incl.	YES	YES	YES
Product eff. Incl.	YES	YES	YES
Country eff. Incl.	YES	YES	YES
Log pse.likelihood	-89634.51	-329052.84	-143967.12
Wald test	chi2(115) = 37608.71***	chi2(121) = 1.22e+05***	chi2(122) = 47005.51***
Observations	163,781	599,759	256,112
Nonzero outcomes	74812	226056	100524
Zero outcomes	88969	373703	155588

Notes: BEC categories: "1" capital goods, "2" intermediate goods, and "3" consumer goods. Robust standard errors in parentheses; Std. err. adjusted for clusters in firm-market-product; *** p<0.01, ** p<0.05, * p<0.1

6. Robustness checks

In this section, we present further robustness tests of (4). First, we test alternative empirical model specifications and estimators to deal with potential econometric concerns in our baseline estimations (Table 5) and, second, we consider alternative definitions of the dependent variable with respect to the treatment of observable gaps in the product-market export spells (Table 6).

In column 1 of Table 5, we first forego destination-fixed effects in favour of "gravity parameters" (the destination-country's GDP and distance between Slovenia and the destination country). Columns (2) and (3) present the estimates of the second stage IV regression where bilateral outward and inward FDI are instrumented by their respective probabilities. In the first stage, bilateral FDI variables are regressed on partner countries' characteristics (i.e. GDP, their physical distance from Slovenia, and the governance indicators from the Worldwide Governance Indicators (2015) database on voice and accountability, political stability and absence of

violence, government effectiveness, regulatory quality, rule of law, and control of corruption), while among firm characteristics we include firm age and a dummy variable for lagged exporter status. In column (4) we present results of extended probit model with endogenous inward FDI treatment assignment to deal with potential endogeneity and reverse causality in case of MNEs being inclined towards acquiring or merging with those incumbents predisposed to more persistent supply of intermediates. Treatment assignment variable $InFDItreat_{it}$ takes value of 1 in case of being acquired by foreign-owned firm, while a list of covariates predicting treatment assignment includes pre-acquisition averages of firm-specific factors proved significant predictors of export duration, i.e. firm size, age, productivity, capital intensity of production, financial leverage, the number of other products a firm exports to a certain market and the number of markets supplied with the same product during the period prior to the (potential) M&A by foreign owned firm. Finally, given that the proportional-hazard assumption may in fact be violated and thus prevent use of a complementary log-log regression, we present the RE probit estimates in column (5), while in (6) we present RE cloglog to control for the unobserved heterogeneity in the benchmark model. The likelihood-ratio test fails to reject the hypothesis of $\rho = 0$ in both the RE probit and RE cloglog specifications, hence the importance of the unobserved firm-product-market level heterogeneity ("frailty") is not confirmed.

Table 5: Complementary log-log export-exit model at the firm-market-product level (exponentiated coefficients in specifications (1) – (3), regression coefficients elsewhere)

	(1) gravity	(2) IV	(3) IV	(4) Extended probit regression		(5) RE probit	(6) RE cloglog
				InFDItreat = 0	InFDItreat = 1		
Ln(ex_spell$_{ikmt}$)	0.436***	0.442***	0.442***	-0.640***	-0.432***	-0.617***	-0.792***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.033)	(0.002)	(0.003)
FDI linkages							
doutFDI_bilat$_{imt}$	0.950***			-0.045***	-0.158***	-0.023***	-0.025***
	(0.007)			(0.006)	(0.047)	(0.005)	(0.006)
dinFDI_bilat$_{imt}$	0.868***					-0.110***	-0.129***
	(0.023)					(0.019)	(0.026)
dOutFDI_third_cntry$_{imt}$	1.066***		1.070***	0.037***	0.029	0.046***	0.064***
	(0.006)		(0.005)	(0.005)	(0.042)	(0.004)	(0.005)
dInFDI_third_cntry$_{imt}$	1.019***		1.020***			0.010***	0.012***
	(0.005)		(0.005)			(0.004)	(0.004)
ofdi_hat		0.885***	0.884***				
		(0.00552)	(0.006)				
ifdi_hat		0.963***	0.963***				
		(0.00393)	(0.004)				
Trade complementarities							
Ln(#prod_ex_other$_{imt}$)	0.890***	0.899***	0.900***	-0.084***	-0.077***	-0.105***	-0.136***
	(0.002)	(0.00169)	(0.002)	(0.002)	(0.015)	(0.001)	(0.002)
Ln(#mar_ex_other$_{ikt}$)	0.636***	0.622***	0.620***	-0.326***	-0.328***	-0.339***	-0.471***
	(0.002)	(0.00205)	(0.002)	(0.003)	(0.025)	(0.002)	(0.003)

ex_mar_share$_{imt}$	1.000	0.999***	0.999***	0.000**	-0.003***	-0.001***	-0.001***
	(0.000)	(7.05e-05)	(7.05e-05)	(0.000)	(0.001)	(0.000)	(0.000)
ex_prod_share$_{ikt}$	0.997***	0.997***	0.997***	-0.003***	-0.002***	-0.003***	-0.004***
	(0.000)	(0.0001)	(0.0001)	(0.000)	(0.001)	(0.000)	(0.000)
d_im_prod_mar$_{ikmt}$	0.566***	0.580***	0.578***	-0.411***	-0.227***	-0.440***	-0.607***
	(0.004)	(0.00420)	(0.004)	(0.005)	(0.051)	(0.005)	(0.007)
d_im_prod$_{ikt}$	0.670***	0.667***	0.666***	-0.356***	-0.118***	-0.360***	-0.403***
	(0.003)	(0.00282)	(0.003)	(0.004)	(0.028)	(0.003)	(0.004)
d_im_mar$_{imt}$	0.935***	0.957***	0.958***	-0.058***	-0.000	-0.128***	-0.147***
	(0.004)	(0.00449)	(0.004)	(0.004)	(0.030)	(0.003)	(0.004)
Firm characteristics							
Ln(va_emp$_{it-1}$)	0.948***	0.944***	0.942***	-0.050***	-0.043*	-0.051***	-0.054***
	(0.003)	(0.00299)	(0.003)	(0.003)	(0.024)	(0.002)	(0.003)
Ln(k_emp$_{it-1}$)	1.001	0.999	0.998	-0.003**	0.064***	-0.002*	-0.001
	(0.002)	(0.00156)	(0.002)	(0.001)	(0.013)	(0.001)	(0.001)
Ln(emp$_{it-1}$)	1.021***	1.018***	1.013***	0.016***	0.021	0.023***	0.028***
	(0.001)	(0.00139)	(0.001)	(0.001)	(0.014)	(0.001)	(0.001)
(Debt/asset)$_{it-1}$	1.148***	1.147***	1.148***	0.114***	0.014	0.131***	0.153***
	(0.009)	(0.00919)	(0.009)	(0.007)	(0.060)	(0.006)	(0.007)
Ln(Age$_{it}$)	1.085***	0.871***	0.877***	0.094***	0.169	0.051***	0.057***
	(0.012)	(0.0158)	(0.016)	(0.010)	(0.218)	(0.009)	(0.010)
(Ln(Age$_{it}$))^2	0.996	1.080***	1.078***	-0.011***	-0.093**	0.001	0.001
	(0.003)	(0.00598)	(0.006)	(0.002)	(0.042)	(0.002)	(0.002)
Product characteristics (BEC)							
2.bec_cat	0.870***	0.872***	0.872***	-0.115***	-0.043	-0.149***	-0.179***
(intermediates)	(0.005)	(0.00476)	(0.00476)	(0.005)	(0.038)	(0.004)	(0.004)
3.bec_cat	0.953***	0.944***	0.944***	-0.040***	0.007	-0.083***	-0.099***
(consumer g.)	(0.006)	(0.00624)	(0.00624)	(0.006)	(0.047)	(0.070)	(0.005)
Gravity features							
lnGDP	0.974***			-0.022***	-0.022***		
	(0.001)			(0.001)	(0.008)		
lnDist	1.123***			0.098***	0.034**		
	(0.002)			(0.002)	(0.015)		
Constant	2.615***	2.136***	2.208***	1.163***	3.755***	1.661***	1.568***
	(0.123)	(0.130)	(0.134)	(0.041)	(0.472)	(0.026)	(0.031)
Time eff. Incl.	YES	YES	YES	YES	YES	YES	YES
Product eff. Incl.	YES	YES	YES	YES	YES	NO	NO
Country eff. Incl.	NO	YES	YES	NO	NO	NO	NO
Log pse.likelihood	-459418	-457265.5	-457174.2	-459119.1		-576470.7	-574871.2
Wald test	chi2(38)= 1.6e+5***	chi2(113) = 1.61e+5***	chi2(115) = 1.61e+5***	chi2(72) =	173471***	chi2(27) = 1.88e+5***	chi2(27) = 1.87e+5***
Corr(e.inFDItreat, e.dEXexit)				-0.721*** (0.034)			
ATE inFDItreat(1 vs 0)				0.558*** (0.012)			
Observations	826,772	826,208	826,208	755,088		1,020,205	1,020,205
Nonzero outcomes	313,980	313,458	313,458				
Zero outcomes	512,792	512,750	512,750				

Notes: BEC categories: "1" capital goods, "2" intermediate goods, and "3" consumer goods. Robust standard errors in parentheses; Std. err. adjusted for clusters in firm-market-product; *** p<0.01, ** p<0.05, * p<0.1

The baseline results presented above are also confirmed by Table 5. Like before, the longer an export spell is maintained, the lower the hazard of its cessation. Bilateral FDI relations with the export-destination country decrease the exit hazard, but FDI with third countries unrelated to the export destination increases the exit probability. The results on export and import

complementarities are robust and fully in line with the baseline. The addition of gravity variables (market size and distance) does not change any of the key coefficients and, in line with predictions, confirms the positive impact of export market size and negative impact of distance on the duration of product-market export spells. Accounting for the potential endogeneity of the inward and outward bilateral FDI variables also maintains the signs and significance of FDI coefficients. Next, based on extended probit regression (results are reported in column (4)) we reject the null hypothesis of no endogeneity since the estimated correlation between the errors from the outcome and treatment equations is significantly negative (i.e. -0.72***(0.033)). The negative correlation between the errors suggests unobservable factors that increase the likelihood of being acquired by a foreign-owned firm tend to be positively associated with export duration as well. Indeed, the estimated average treatment effect (ATE) of foreign acquisition is significantly positive which indicates higher likelihood of export spell termination in case of treated firms confirming the selection effect in case of new acquisitions of subsidiaries. However, we cannot account for the difference between the effect in the market of foreign investor's origin and in the third country markets within this specification. The extended probit regression results in column (4) further indicate relatively uniform effects of other factors on export spell duration between treated and non-treated firms. In particular, the export persistence effects of trade complementarities are confirmed for both groups of treated and non-treated firms with the exception of import status from the particular market in case of treated firms, while the impact of firm characteristics is slightly less significant for treated firms. Most interestingly, the impact of bilateral outward FDI on export stability becomes significantly higher for group of treated firms and moreover, the negative effect of outward FDI from the third markets turns into insignificant one. Inward FDI therefore reinforces the export stability effect of the outward FDI ties. Finally, in columns (5) and (6) we control for the unobserved heterogeneity with RE probit and RE cloglog estimates. As before, the results remain robust.

As shown in Table 2, approximately one quarter of all product-destination specific export spells are reoccurring within our sample period. On one hand, the observed gaps in exporting may indicate the termination of a product-market spell subsequently followed by re-entry by the same product-destination pair. On the other hand, gaps are not necessarily a sign of export termination, i.e. they might be explained by the specific nature of a particular good or as a purely statistical phenomenon due to reporting ceilings. Since we cannot discriminate between the two cases, we test the robustness of the results to the alternative considerations of such observable gaps in the product-market spells. In column 1 of Table 6, we therefore only consider uninterrupted spells while column 2 considers spells to be continued if there is at most a 1-year gap in exporting to a destination with a specific product. The last column considers spells to be unbroken if there is at most a 2-year gap in exporting a specific product to the destination market. Due to the

change in the definition of continued export spells, we reduce the sample by the first (2002) period in column 2 and the first two periods in column 3. This is done to account for the different length of gaps in export spells when capturing the moment and export spell started/ended.

Table 6: Complementary log-log export-exit model at the firm-market-product level accounting for interrupted spells

	(1) no gaps allowed	(2) 1y gaps allowed	(3) 2y gaps allowed
$Ln(ex\_spell_{ikmt})$	0.397***	0.388***	0.373***
	(0.001)	(0.00133)	(0.00152)
FDI linkages			
$doutFDI\_bilat_{imt}$	0.975***	0.978***	0.986**
	(0.005)	(0.00596)	(0.00670)
$dinFDI\_bilat_{imt}$	1.007	0.845***	0.750***
	(0.029)	(0.0407)	(0.0426)
$dOutFDI\_third\_cntry_{imt}$	1.013***	1.012**	1.003
	(0.004)	(0.00492)	(0.00549)
$dInFDI\_third\_cntry_{imt}$	0.984***	0.984***	0.986***
	(0.004)	(0.00450)	(0.00511)
Trade complementarities			
$d\_prod\_ex\_other_{imt}$	0.719***	0.620***	0.607***
	(0.006)	(0.00552)	(0.00602)
$d\_mar\_ex\_other_{ikt}$	0.528***	0.476***	0.450***
	(0.002)	(0.00205)	(0.00216)
$ex\_mar\_share_{imt}$	0.997***	0.996***	0.996***
	(0.000)	(6.56e-05)	(7.30e-05)
$ex\_prod\_share_{ikt}$	0.994***	0.994***	0.994***
	(0.000)	(0.000105)	(0.000118)
$d\_im\_prod\_mar_{ikmt}$	1.214***	1.191***	1.176***
	(0.007)	(0.00774)	(0.00868)
$d\_im\_prod_{ikt}$	0.694***	0.661***	0.627***
	(0.002)	(0.00247)	(0.00261)
$d\_im\_mar_{imt}$	0.958***	0.947***	0.945***
	(0.004)	(0.00398)	(0.00442)
Firm characteristics			
$Ln(va\_emp_{it-1})$	0.973***	0.973***	0.965***
	(0.002)	(0.00183)	(0.00205)
$Ln(k\_emp_{it-1})$	0.989***	0.983***	0.981***
	(0.001)	(0.00143)	(0.00162)
$Ln(emp_{it-1})$	0.961***	0.957***	0.956***
	(0.001)	(0.00129)	(0.00145)
$(Debt/asset)_{it-1}$	1.068***	1.069***	1.072***
	(0.016)	(0.0161)	(0.0166)
$Ln(Age_{it})$	1.145***	1.127***	1.116***
	(0.011)	(0.0111)	(0.0124)
$(Ln(Age_{it}))^2$	0.974***	0.979***	0.978***

	(0.002)	(0.00232)	(0.00261)
Product characteristics (BEC)			
2.bec_cat		0.887***	0.879***
(intermediates)	0.894***		
	(0.004)	(0.00457)	(0.00504)
3.bec_cat (consumer g.)	0.952***	0.974***	0.966***
	(0.005)	(0.00592)	(0.00657)
Constant	11.900**	9.454***	11.96***
	(6.858)	(0.321)	(0.458)
Time eff. Incl.	YES	YES	YES
Product eff. Incl.	YES	YES	YES
Country eff. Incl.	YES	YES	YES
Log pse.likelihood	-625419.99	-589155.03	-487744.22
Wald test	chi2(124) = 2.20e+05***	chi2(122) = 2.07e+05***	chi2(121) = 1.76e+05***
Observations	1,126,577	1,085,761	923,937
Nonzero outcomes	476,767	423,320	333,867
Zero outcomes	649,810	662,441	590,070

Notes: BEC categories: "1" capital goods, "2" intermediate goods, and "3" consumer goods. Robust standard errors in parentheses; Std. Err. adjusted for clusters in firm-market-product; *** p<0.01, ** p<0.05, * p<0.1

The results shown in Table 6 by and large conform with the baseline estimates corroborating most of the effects of FDI and trade externalities as well as showing firm-specific factors on export survival are not sensitive to these alternative model specifications. However, there are certain notable exceptions to this general conclusion. Like before, the longer the exporting spell, the less likely it is that it will stop. This likely implies that firms learn by staying in a given market and gain a more secure foothold in it the longer they remain in it. The hazard-reducing effect of bilateral FDI flows is largely confirmed; we find significantly negative coefficients on bilateral FDI regressors in all specifications but for inward bilateral FDI in the case of no gaps allowed (1), while the duration-shortening effect of FDI with third countries tends to be less robust. It remains significant only for outward FDI when no or at most 1-year gaps are allowed, while the impact of inward FDI with third countries on the export-exit hazard becomes significantly negative, suggesting the export-duration enhancing effect of inward FDI not only in foreign investors' markets but in general.

Further, contrary to the baseline results, export duration tends to be shorter in the case of the 'pass-on trade' phenomenon when firms are exporting the same product as they import to the country of origin of the imports, while still – in line with the baseline specifications – export survival chances are higher for firms involved in importing either the same product or from the export-destination country.

The final set of robustness checks (presented in Table A2 of the Appendix) explores alternative specifications of the baseline regression equation. We

include firm age squared to deal with the potentially non-linear effect of age on export survival (column 1). In column 2, we account for the potential of time-variant industry specific effects such as common demand shocks with the industry-time interaction dummies. In column 3, we replace the absolute measure of the number of export markets and exported products with a relative one (number of export products (markets) relative to the maximum achieved by any exporter). Next, column 4 decomposes the effects of bilateral inward and outward FDI by country-group (developed/developing countries) of origin and destination. Qualitatively, the results fully confirm our benchmark findings, while high-income country FDI (both inward and outward) appears to be more highly correlated with a lower export-exit hazard than that of low-income countries. Finally, in column (5) we test whether the impact of the global economic and financial crisis on the duration of export spells differs in case of existence of the FDI linkages. The results indicate significantly higher hazard of export termination during the crisis period in general. However, the significantly positive interaction terms of crisis dummy variable with both inward and outward bilateral FDI variables indicate that persistence effect of bilateral FDI ties on export spell duration has been eroded during the crisis period. The opposite effect holds for the incoming FDI from third countries' investors which contributes to increased resilience of the export spells during the crisis period. This might indicate faster reorientation and restructuring of trade within the MNE group, an observation in line with Altomonte et al. (2013)'s finding on so-called "bullwhip effect" of a faster drop but also recovery of intra-firm trade in intermediates in the wake of crisis.

7. Conclusions

In this paper, we test several theoretical predictions linking firm internationalisation modes to export duration at the firm-product-market level. Using a comprehensive dataset on Slovenian firms (2002–2011) at the level of trade transactions coupled with detailed firm accounting information and data on cross-border ownership, we explore the effects of firm's inward and outward FDI linkages on the duration of firm-HS 6 product-destination export spells. In contrast to most of the empirical literature on global value chains, we do not focus on the profitability or division of value added along the production chain, but on the effect on the duration of related production spells.

Overall, we find robust, if indirect, support for the role of production networks in maintaining supply-chain trade and therefore the duration of product-destination specific export spells. As ownership ties (either inward or outward) may indicate participation in global value chains or membership of a production network, we interpret the positive correlation between spell duration and bilateral foreign-ownership indicators as indirect evidence in favour of trade stability of vertically integrated firms. Bilateral outward FDI

reduces export-hazard rates in an affiliate's host country market on average by 2 to 6 per cent primarily due to the enhanced persistence of intermediate goods exports. However, the positive effects of FDI on export duration tend to be country-specific (bilateral), especially for outward FDI, since we find higher hazard rates of terminating exports to other markets. These results suggest the effect might be driven by a bias towards foreign-owned-firm sunk-cost trade technologies rather than being an outcome of learning/efficiency effects in general. The effect of inward bilateral direct capital flows with the country of export destination is of an even higher magnitude. However, extended probit regression model confirms the existence of a reverse-causality channel in case of new acquisitions of subsidiaries confirming MNEs are inclined towards acquiring or merging with those acquisition targets predisposed to more persistent supply of intermediates. Once we account for this source of endogeneity the impact of inward FDI on export duration becomes significantly negative. On the other hand, inward FDI reinforces the export stability effect of the outward FDI ties.

Further, we show that the export-termination risk decreases with an increasing share of a particular product in a firm's exports, indicating the importance of firms focussing on their core competencies for export survival. Estimates also confirm the existence of significant positive market-specific and product-specific synergies resulting from both exporting and importing experiences. We find that the risk of an export product-market spell's coming to an end falls by up to 6 per cent when a firm serves a particular market with other products and even more, by 47 per cent, when it exports the same product to other markets. We detect these positive effects of export complementarities for all broad economic categories.

Substantial positive externalities arise from importing activity alone as well as existing imports of the same product reduce its export-hazard rate by approximately 33 per cent, while the probability of terminating exports is lower in the range of 4 to 6 per cent when firms have established import relations with the export-destination country. With respect to the impact of the pass-on trade phenomenon on the duration of the export arrangements, our results are not robust to alternative considerations of observable gaps in the export spells.

The finding that the export spells of new exporters are often very brief not only called for a rethink of the way economists thought about the evolution of trade links, but also fundamentally changed the approach to trade policy. In terms of policy advice, we believe there is a strong need for policies that aim to help firms maintain reliable trade relationships by reducing the uncertainty inherent in international trade. The broad areas that require policymakers' attention are strengthening contract enforceability between exporters and their suppliers, addressing market imperfections in trade financing, improving transport efficiency and logistic systems, and finding mechanisms to reduce the uncertainty of new trade relationships.

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Appendix

Table A1: Description of the values of the regression variables

VARIABLES	N	mean	sd
dexit_ex	10195656	0,394	0.489
Ln(ex_spell)	10195656	0,626	0,675
dinFDI_bilat	10195656	0.006	0.074
doutFDI_bilat	10195656	0,136	0,343
dOutFDI_third_cntry	10195656	0,253	0,435
dInFDI_third_cntry	10195656	0,195	0,397
Ln(#prod_ex_other)	10195656	2,926	1,361
Ln(#mar_ex_other)	10195656	1,383	0,847
ex_mar_share	10195656	27,937	33,451
ex_prod_share	10195656	8,009	20,464
d_im_prod_mar	10195656	0,177	0,381
d_im_prod	10195656	0,674	0,469
d_im_mar	10195656	0,530	0,499
d_prod_ex_other	10195656	0,926	0,261
d_mar_ex_other	10195656	0,601	0,490
Ln(va_emp-1)	10195656	10,338	0,690
Ln(k_emp-1)	10195656	10,420	1,309
Ln(emp-1)	10195656	3,993	2,073
(Debt/asset)-1	10195656	0,602	0,414
Ln(Age)	10195656	2,643	0,691
bec_cat	10195656	2,091	0,635
lnGDP	966122	24,731	2,134
lnDist	826790	6,182	1,085

Table A2: Complementary log-log export-exit model at the firm-market-product level (robustness check with alternative specifications)

	Clog-log (1) w/ size squared	*Clog-log (2) w/ industry-year dummies*	*Clog-log (3) normalized other mkts and prod*	*Clog-log (4) high/low-income bilateral FDI*	*Clog-log (5) Crisis-FDI interaction*
Ln(ex_spell_{it-1})	0.460***	0.459***	0.459***	0.459***	0.464***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
FDI linkages					
$doutFDI\_bilat_{it}$	0.962***	0.963***	0.943***		0.942***
	(0.006)	(0.006)	(0.006)		(0.007)
$dinFDI\_bilat_{it}$	0.872***	0.875***	0.911***		0.763***
	(0.022)	(0.023)	(0.023)		(0.056)
$dOutFDI\_third\_cntry_{it}$	1.027***	1.028***	0.997	0.996	0.961***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
$dInFDI\_third\_cntry_{it}$	1.018***	1.018***	1.026***	1.026***	1.022***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)
$doutFDI\_bilat_{it}$ high income				0.910***	
				(0.015)	
$doutFDI\_bilat_{it}$ low income				0.945***	
				(0.006)	
$doutFDI\_bilat_{it}$ high income				0.764***	
				(0.032)	
$doutFDI\_bilat_{it}$ low income				1.019	
				(0.033)	
dcrisis					1.455***
					(0.007)
dcrisis#$doutFDI\_bilat_{it}$					1.074***
					(0.011)
dcrisis#$dinFDI\_bilat_{it}$					1.312***
					(0.101)
dcrisis# $dOutFDI\_third\_cntry_{it}$					1.159***
					(0.010)
dcrisis# $dInFDI\_third\_cntry_{it}$					0.976***
					(0.008)
Trade complementarities					
Ln(#$prod\_ex\_other_{it}$)	0.881***	0.880***			0.883***
	(0.001)	(0.002)			(0.001)
Ln(#$mar\_ex\_other_{it}$)	0.594***	0.594***			0.594***
	(0.002)	(0.002)			(0.002)
$ex\_mar\_share_{it}$	0.999***	0.999***	1.000***	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ex\_prod\_share_{it}$	0.996***	0.996***	0.998***	0.998***	0.997***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$d\_im\_prod\_mar_{it}$	0.553***	0.552***	0.668***	0.668***	0.553***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$d\_im\_prod_{it}$	0.672***	0.671***	0.646***	0.647***	0.670***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$d\_im\_mar_{it}$	0.960***	0.961***	0.953***	0.953***	0.960***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Ln(prod_ex_other/max)			0.176***	0.176***	
			(0.005)	(0.005)	
Ln(mar_ex_other/max)			0.013**	0.013***	
			(0.000)	(0.000)	

Firm characteristics					
Ln(va_emp$_{it-1}$)	0.935***	0.935***	0.919***	0.919***	0.936***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ln(k_emp$_{it-1}$)	1.003*	1.002	1.005***	1.005**	1.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln(emp$_{it-1}$)	0.966***	0.966***	0.931***	0.931***	1.016***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
(Ln(emp$_{it-1}$))^2	1.007***	1.007***	1.011***	1.011***	
	(0.000)	(0.000)	(0.000)	(0.000)	
(Debt/asset)$_{it-1}$	1.148***	1.149***	1.150***	1.150***	1.142***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Ln(Age$_{it}$)	1.117***	1.117***	1.161***	1.161***	1.047***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
(Ln(Age$_{it}$))^2	0.989***	0.989***	0.982***	0.982***	1.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	2.532***	1.480***	1.479***	2.198***	2.378***
	(0.060)	(0.058)	(0.058)	(0.091)	(0.097)
Time eff. Incl.	YES	YES	YES	YES	NO
Industry_time Incl.	NO	YES	YES	YES	YES
Product eff. Incl.	YES	YES	YES	YES	YES
Country eff. Incl.	YES	YES	YES	YES	YES
Log pse.likelihood	-563783	-563490	-567177	-567159	-565349
Wald test	chi2(125) = 2.06e+05***	chi2(187) = 2.07e+05***	chi2(187) = 1.96e+05***	chi2(189) = 1.96e+05***	chi2(122) = 2.05e+05***
Observations	1,019,656	1,019,656	1,019,656	1,019,656	1,019,656
Nonzero outcomes	401395	401395	401395	401395	401395
Zero outcomes	618261	618261	618261	618261	618261