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James H Love
Enterprise Research Centre and Warwick Business School
Warwick University
jim.love@wbs.ac.uk

Juan A Máñez
Universitat de València
Juan.a.manez@uv.es

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ABSTRACT

Persistence in exporting matters, because firms with continuous exposure to export markets derive greater benefit from exporting than do sporadic exporters. Conceptually, however, export persistence is poorly understood, and is typically explained by sunk costs leading to high export exit costs. We develop a model which is based around different patterns of learning by exporting: in particular, we show how cumulative previous exporting can help lengthen subsequent exporting spells, but that this can be compromised by the punctuated learning arising from a pattern of sporadic exporting. Firms with episodic exporting exhibit different learning patterns from continuous exporters, and are less likely to develop the deep routine-based learning that comes from constant exposure to managing export markets. Using data from Spanish manufacturers over a 22 year period we find support for this model of cumulative and punctuated learning by exporting. We also demonstrate the importance of firms' reactions to home and overseas demand in determining export duration patterns, and highlight how these effects differ between large and small firms.

Keywords:
Exporting; export persistence; learning by exporting; punctuated learning

CONTENTS

INTRODUCTION

Exporting has a number of benefits, both for the individual enterprise, and also for the economy of which it is part. Exporting firms tend to be more productive and innovative than non-exporters (Love and Roper 2015), while exposure to export markets is important in realising the potential of innovative and high growth firms (BIS 2010). But once a firm sells to overseas markets, what determines how long a period of exporting lasts? This is important both conceptually and practically. Conceptually it matters because although we know a lot about the determinants of entry into export markets we know relatively little about export exit and re-entry (Welch and Welch 2009), and even less about the duration of exporting[1]. Notably, neither of the main theories of internationalization, the process or stages model (Johanson and Vahlne, 1977, 2009) and the international new ventures approach (Knight and Cavusgil 2004; Jones and Coviello 2005), fully addresses the issue of persistence. Export persistence also has practical implications both for businesses and for policymakers seeking to encourage firms to export and to derive the maximum benefit from their exporting experience. There is evidence that persistent exporters derive significant greater productivity benefits from their exporting activity than those which export occasionally (Andersson and Lööf 2009), suggesting that persistence in exporting matters for firm performance. Since smaller firms are more likely to be intermittent exporters (Bernini et al forthcoming), this also has implications for government policy on supporting exporters in general and specifically on support for small and medium-sized enterprises (SMEs).

[1] Sui and Baum (2014) perform a survival analysis of Canadian SMEs in export markets, but do not consider experience effects or the effects of demand changes. The same is true of Deng et al's (2014) analysis of export survival among Chinese manufacturing firms. Analyses of the determinants of different export patterns are frequently unhelpful as they tend to use arbitrary definitions of terms such as sporadic and regular exporters (Samiee and Walters 2002) or occasional and persistent exporters (Blum et al 2013).

Standard trade theory attributes persistence in exporting largely to the existence of sunk costs (e.g. Melitz 2003), that is irreversible investments which cannot be recouped if the firm exits exporting. We show that sunk costs explain only part of export persistence, and that learning effects of different types are significant determinants of the duration of exporting at the firm level. It is well established that learning by exporting can lead to improvements in innovation and productivity (Wagner 2012; Salomon and Shaver 2005a; Salomon and Jin 2010; Love and Ganotakis 2013; Manjon et al 2013; De Loecker 2013; Tse et al forthcoming). Evidence also suggests that previous experience assists export intensity and the geographical scope of exports (Love et al 2016). However, we know very little about how past exporting experience helps firms survive in export markets. Nor do we know whether experience gained in different ways matters: for example, does a firm with many years of continuous exporting obtained the same benefit from that experience as one which has the same total length of exporting experience but gained in a series of discrete exporting events?

We develop a model of export persistence and test the model on a large panel of Spanish firms over a 22 year period. Our model hinges on different types of learning effects and on the firms' reactions to changes in both domestic and overseas demand. Based on the concept of organizational learning, we differentiate clearly between different types of learning by exporting effects, purged of the influence of sunk costs. We argue that firms learn from their cumulative previous export experience in ways that lengthens export duration. But we also argue that punctuated spells of exporting leads to a different learning outcome from a pattern of continuous exporting: firms with episodic exporting exhibit different learning patters from continuous exporters, and are less likely to develop the deep routine-based learning that comes from constant exposure to managing export markets. We therefore differentiate between cumulative and punctuated learning by exporting, and show that the latter has the effect of reducing export duration. These learning mechanisms are also shown to differ between large and small firms. We also demonstrate that large and small firms react differently to changes in foreign and domestic demand in

systematic ways, with smaller firms more likely to react to export market shocks in ways that make their patterns of export duration different from their larger counterparts.

Our findings therefore show the key determinants of persistence in exporting, and how and why these differ between large and small firms. In doing so we make three contributions to the literature. First, we distinguish conceptually between different forms of learning by exporting, crucially differentiating between within-spell, cumulative and punctuated learning, and show how these differentially affect export duration. Second, we show that punctuated learning is a particular issue for smaller firms, but that their cumulative exporting experience – even if gained form a series of intermittent exporting episodes – can help offset the drawbacks of punctuated learning by exporting. Third, we demonstrate how firm's reactions to demand changes, both objective and subjective, affect their export duration patterns, and demonstrate that large and small enterprises differ systematically in the way in which they react to demand changes and in the way in which these reactions affect export persistence. This not only aids understanding of persistence in exporting and of learning by exporting, but also helps shed light on the 'puzzle' of intermittent exporting (Bernini et al forthcoming).

THEORY AND HYPOTHESES

In theory, persistence in exporting is enabled by two possible effects, which are not mutually exclusive: sunk costs, and learning by exporting. The sunk cost argument derives principally from the economics literature, as developed in formal models such as Roberts and Tybout (1997), Clerides et al (1998) and Helpman et al (2004). Here, firms entering foreign markets have to engage in a series of activities which are related only to exporting, such as market research, setting up new distribution networks, negotiating with potential new partners, and modifying existing product ranges (Love and Ganotakis 2013). All of these incur sunk costs, which are irreversible investments if the firm exits exporting: these sunk costs tend to lead to persistence in exporting because high sunk entry costs

imply high exit costs where re-entry is possible (Esteve-Pérez et al 2007). The existence of sunk costs of exporting leads in turn to self-selection into exporting, and the likely persistence of larger and more productive firms in export markets. Only those firms with sufficiently low marginal costs are able to afford to incur these sunk costs of export entry. Thus exporters are generally larger and more productive than non-exporters not necessarily because of benefits derived from exporting, but because they are more productive firms to begin with, and can therefore incur the sunk costs of entering foreign markets, a finding supported in numerous empirical studies (e.g. Wagner 2007, 2012).

As a result of these theoretical models, the existence of 'state dependence' in exporting (i.e. the tendency for firms exporting in one period to do so in the next period) is generally attributed to the existence of sunk costs. For example Roberts and Tybout (1997) find that Colombian plants that exported in the preceding year are 60 per cent more likely to export in the present year, while Bernard and Jensen (2004) find that past export experience increases the probability of exporting by about 30 per cent for American manufacturing plants: in both cases this effect is ascribed to the existence of sunk costs. Mañez et al (2008) also find evidence of sunk costs and export persistence for Spain. However, sunk costs are unlikely to be the only explanation for export persistence. Clearly not all firms that enter export markets persist in doing so (Besedes and Prusa 2006; Blum et al 2013; Bernini et al forthcoming), suggesting that other factors must be at work in determining the duration of exporting. We hypothesise that learning effects and the firm's reaction to home and domestic demand shifts will also affect the pattern of export persistence.

A key element of this is the learning by exporting hypothesis. The argument here is that exporting exposes firms both to increased competition in overseas markets, and to new customers with different tastes and preferences from those at home. Exporting can provide firms with two types of knowledge, both of which can help improve future performance – knowledge about markets and knowledge about technology (Salomon and Shaver 2005a; Love and Ganotakis 2013). Firms gain

market knowledge largely from customers, and so exposure to export markets helps them to alter and customise their product range to the needs of different international markets (Clerides et al 1998). Firms may also benefit in terms of technology, with information on product development often being provided directly from customers and indirectly from competitors (Salomon and Shaver 2005a). This is consistent with the process model of internationalization (Johanson and Vahlne 1977, 2009), in which the firm progressively moves to more distant markets (psychically and geographically), and thus learns how to organize production processes, and to adjust its products and levels of service in order to be competitive in international markets (Andersson and Lööf 2009).

There is now considerable evidence that learning by exporting can improve firm productivity directly (Wagner 2007, 2012; Andersson and Lööf 2009) or do so indirectly through its effects on innovation, production capability and human capital (Salomon and Shaver 2005a; Salomon and Jin 2010; Love and Ganotakis 2013; Tse et al forthcoming). However, learning effects can play a role not only in a firm's performance but also in terms of its duration in exporting. Timoshenko (2015) shows formally that the length of recent export experience induces firms to continue exporting, and thus naturally leads to persistence in exporting. Put simply, experienced exporters have learned more from operating in foreign markets than less experienced exporters, and so the profitability derived from a given market typically rises with the length of exporting experience. Hence learning by exporting leads to persistence in exporting. Timoshenko tests for this effect using Colombian data for the period 1981-89 and finds that firms' probability of exporting and amount of export sales increase with each consecutive year of (recent) exporting up to four and eight years respectively, suggesting that the effect of exporting experience accumulates over time. Timoshenko therefore argues that learning effects are at least as important as sunk costs in determining persistence in exporting. This leads to our first hypothesis:

H1a: Export duration is positively associated with the length of the current exporting spell.

Cumulative versus punctuated learning by exporting

Despite its apparent emphasis on learning by exporting, the analysis of persistence described above is restricted exclusively to the learning effects of the *current* period of consecutive exporting: thus it relates to 'within spell' exporting. In our model, we make two key conceptual additions to the role of experience in determining export duration. Specifically, we allow for learning effects arising from exporting before the current exporting episode starts, and for the pattern this takes. We thus differentiate between learning effects arising from the current spell of exporting (H1a), from cumulative previous exporting experience, and those arising from punctuated spells of exporting. We argue that these will have identifiably different effects on subsequent duration in exporting.

If there is some cumulative benefit from learning by exporting, then there is no reason to assume that this will be restricted exclusively to experience gained in the current exporting episode. Previous export experience, even if gained before the current exporting period, may provide knowledge which will be useful in (re)entering foreign markets, and which may help improve subsequent export duration. While specific knowledge about individual markets may be subject to quite rapid decay in non-exporting periods, there are some aspects of exporting to which this is less likely to be the case.

Learning by exporting has a strong element of learning by doing: by performing an activity repeatedly over time, a firm accumulates knowledge not just about markets and technology, but also learns how to organize and manage the activity in an effective manner (Andersson and Lööf 2009). The firm may thus develop routines and knowledge about how to organize the exporting process which are relatively stable through time, and which do not rapidly atrophy. Thus firms with considerable cumulative exporting experience, even when gained in episodes before the current exporting period, may have developed useful routines and capabilities about managing the exporting process, maintaining and developing key

relationships, and accessing and assimilating key market information which make export duration more likely in the future: they have learned how to learn from exporting. Their accumulated knowledge thus results in a lower 'cost of foreignness' than a de novo market entrant. This process of organizational learning in complex tasks not only improves specific managers' skills, but may develop into a dynamic capability in its own right (Zollo and Winter 2002). Thus the organizational routines developed around exporting will help the firm to adapt to new environmental conditions as market conditions change through time (Miller et al 2012; Pentland et al 2012), and as a result may be long lasting in nature. We therefore allow for the cumulative years of exporting experience in the past rather than simply that gained in the latest consecutive period of exporting:

H1b: Export duration is positively associated with total years of previous exporting experience.

However, a firm with a number of years of cumulative export experience can have achieved this in different ways. We argue that there is a difference in the learning arising from different patterns of exporting: specifically, we allow for punctuated learning by exporting. For example, we might expect that a firm with 10 years of exporting split into a number of discrete periods will learn less from its experience than one with 10 years of continuous exporting experience, for two reasons.

First, while both firms may have developed to some extent the routines and techniques to organize and manage the exporting process in general, the firm with episodic exporting is less likely to have developed the deep routine-based learning that comes from constant exposure to managing export markets. This deep routine-based learning derives both from the continuous experience of repeating similar tasks, and from the active context of the firm (Argote and Miron-Spektor 2011). Where this process is interrupted, and where the firm is infrequently actively involved in exporting, both the benefit of cumulative task performances and the active context of the firm is compromised, and thus new episodes of exporting are less likely to lead to new learning. The bank of organizational memory arising from continuous exporting experience, which is important for firms to learn more

effectively (Moorman and Miner 1997), is less well developed and learning thus less effective (Souchon et al 2012). Second, there will inevitably be some depreciation or atrophying of useful knowledge, especially that which is market specific such as information on individual customers, competitors and technology. Knowledge and information flows from foreign customers and competitors are likely to be less useful for firms that export intermittently, and thus have less regular interaction with these key sources of information (Andersson and Lööf 2009). This is exacerbated by the fact that occasional exporters demonstrate different information gathering and learning patterns form those exporting on a more regular basis. Samiee and Walters (2002) find that irregular exporters are both less interested in formal export education programs and are more reliant on the government as a source of exporting knowledge than are continuous exporters. As a result of this, Samiee and Walters find that the information channels used by irregular exporters make only a limited contribution to organizational learning. In their analysis of exporting in Colombian plants Fernandes and Isgut (2015) find indirect support for this, demonstrating that the effect of export experience on productivity exhibits a high rate of depreciation and is actually insignificant for exporters that stopped exporting in the previous year. Thus punctuated spells of exporting will lead to less learning by exporting and thus shorter export duration in the future than longer or continuous exporting experience.

A firm with several discrete episodes of exporting will thus exhibit punctuated learning, which has implications for learning by exporting. First, the firm it is unlikely to develop deeply embedded routine-based exporting learning; second, it has to keep re-learning what it has forgotten in periods of non-exporting because its bank of organizational memory is compromised; and third, the specific knowledge it has accumulated in the past may not be as useful the next time around when it has to re-enter exporting. This leads to our next hypothesis:

H1c: Export duration is negatively associated with the number of previous exporting spells.

Empirical support for hypotheses H1b and H1c would constitute very strong evidence for the learning by exporting hypothesis, as they are much less likely to be related to sunk costs than the standard 'state dependence' estimation found in the economics literature, or indeed Timoshenko's analysis of the effect of current (i.e. within-spell) exporting experience on export duration.

Export intensity

Just as cumulative exporting experience is more likely to lead to learning, so the extent of this interaction with customers and exposure to export market competition might be expected to enhance learning and thus future export duration spells. A firm that devotes a large percentage of its production to exporting is likely to devote considerable effort to continuing with exporting because replacing foreign sales with domestic sales is unlikely to be possible in the short run, and may be neither easy nor cheap in the long run (Esteve-Pérez et al 2007). In their analysis of Swedish firms, Andersson and Lööf (2009) find evidence of a (productivity) learning effect among persistent exporters with high export intensity, but not persistent exporters with low export intensity. And Fernandes and Isgut (2015) show that the effect of export experience on productivity is almost non-existent for plants that participate marginally in export markets but is substantial for the most export-intensive plants. We anticipate that this enhanced learning from intense export activity will manifest itself in improved future export duration, leading to our next hypothesis:

H2: Export duration is positively associated with export intensity.

Demand conditions

The duration of exporting cannot be considered independently of firms' reactions to the demand conditions they face. Clearly overseas demand matters for exporting – the key issue, however, is whether demand conditions at home also matter. Recent international trade models (e.g. Melitz 2003) suggest not: firms are assumed to face constant marginal

costs and thus maximise profits in home and export markets independently of each other. Of course, exporters have to overcome sunk costs to enter export markets, but once this is done variations in foreign demand do not affect firms' production decisions for the domestic market.

In practice, however, this may not be the case. Exports and domestic sales may, for example, compete for resources within the firm, so that a depressed foreign demand frees production capacity to serve the domestic market, at least in the short run. Several papers suggest the likelihood of such an interdependent or substitute relationship between exporting and domestic sales, including Salomon and Shaver (2005b), Vannoorenberghe (2012) and Belke et al (2015). On the other hand, overseas and home demand could be complements. For example, a reduction in foreign demand may result in damage to a firm's cash flow, which might in turn reduce the firm's capacity to invest in the domestic market and to supply domestic consumers (Berman at al. 2015). More positively, the learning obtained from operating in expanding export markets could help firms improve their offering to domestic customers, leading to rising sales both at home and overseas – assuming, of course, the firm is able to increase its production capacity sufficiently to serve both growing markets. Empirically, the evidence is somewhat mixed, but appears to broadly support the substitute relationship. Salomon and Shaver (2005b) find a substitute relationship among larger and foreign-owned Spanish firms, while for Spanish-owned firms exports and domestic sales are complements. They interpret the latter result as Spanish-owned firms using their strength in the domestic market to drive export sales. Belke et al (2015) find that domestic demand is relevant for the short-run dynamics of exports in five Eurozone countries, with a particularly strong substitute relationship between domestic and foreign sales in Spain, Portugal and Italy. And Bernini et al (forthcoming) provide evidence that for French manufacturing firms, rising home demand increases the likelihood of export exit while rising foreign demand reduces it. They also find that home and overseas demand conditions at the time of exit are crucial in the export re-entry decision. By contrast, Berman et al (2015) find that a reduction in a firm's exports, due to adverse foreign demand conditions, tends to reduce its domestic sales,

suggesting a degree of complementarity.

However, none of these papers specifically considers the influence of home and overseas demand on export duration. We expect the length of time firms spend in export markets to be directly related to demand conditions. When foreign markets grow, profitable opportunities present themselves which both encourage export market entry and will encourage existing exporters to continue to export. When the domestic market grows, exporters may find higher profit margins from arising domestic sales: while some exporters will easily increase production to satisfy both domestic and export demand, at least some exporters will be willing to shift sales from exports back to the home market, and thus rising domestic demand will tend to reduce the duration of export spells on average. Thus:

Hypothesis 3a: Export duration is positively associated with the growth rate in foreign markets.

Hypothesis 3b: Export duration is negatively associated with the growth rate in the domestic market.

Small versus large firms

Learning by exporting relies on the firm's ability to absorb outside knowledge effectively, and is thus rooted in organizational learning. The ability to learn effectively from exporting is likely to differ between large and small firms. In principle, small firms have more to learn from exporting, but may suffer from lacking the capacity to absorb the knowledge gained from learning. In general, small firms will be further from the productivity frontier than their larger counterparts, and so may benefit more from the increased knowledge that exposure to exporting brings. In addition, their weaker internal knowledge resources and ability to invest in in-house knowledge creation may make external sourcing of knowledge especially important for small firms (Leiponen and Byma 2009; Vahter et al 2014). However, small firms may also lack the absorptive capacity to benefit from exposure to this new knowledge. Specifically, their limited top-management teams may make it difficult for smaller enterprises to build the organizational structures

and routines to both identify useful external knowledge, and to absorb externally developed ideas and technologies, even if these were already initially copied or transferred from outside the firm (Vahter et al 2014).

Fernandes and Isgut (2015) argue that learning by exporting effects are likely to be greater for new and smaller firms, largely because they find foreign customers to be markedly more sophisticated and discriminating than their domestic counterparts. “By accessing a significantly larger and more competitive market, those firms are likely to face major technical and managerial challenges, whose resolution may require upgrading production processes, equipment, and technical standards; retraining workers; and improving quality control and inventory management techniques. As workers and managers engage in new activities to meet these challenges, they are likely to learn new skills, resulting in improvements of the firm’s productivity.” (page 65) By contrast, larger and more experienced firms are likely already to have overcome these challenges, and so have less to learn.

The empirical literature certainly tends to suggest that any lack of absorptive capacity among small firms is more than offset by their being more able to benefit from the knowledge obtained by exporting. For example, Baldwin and Gu (2003) find that exporting Canadian plants benefit from increasing export intensity but that gains are larger for younger, smaller and domestically controlled plants. This suggests that the gains from previous exporting experience (H1b) is likely to be greater for small firms than for larger ones. However, it has also been established that small firms are much more likely than large firms to be intermittent exporters (Bernini et al forthcoming) and thus any negative effect of atrophying of knowledge through having a history of punctuated exporting is likely to be greater for smaller firms (H1c). So there is a dual effect: small firms are more likely to be able to benefit from their cumulative history of exporting and from exporting intensity than larger firms, but also more likely to suffer the consequent drawbacks from having a history of intermittent exporting. In their analysis of Swedish exporting firms, Andersson and Lööf (2009) find indirect supporting evidence for this dual

effect: for small firms, they found that exports boost productivity among persistent exporters with both high and low export intensity, but the effect is stronger for persistent export-intensive small firms. In addition, while both persistence and high intensity are required for learning effects among large firms, persistence alone is sufficient for small firms, although the effect of learning by exporting also increases with export intensity among small firms. This suggests that the positive effects on export duration of previous exporting and of exporting intensity are likely to be greater for smaller enterprises, as are the negative effects of punctuated spells of exporting.

There is also good reason to expect smaller enterprises to react more strongly to changes in demand than large firms in terms of export duration. This may be in part strategic, and in part a consequence of the different internal resources of large and small firms. Larger firms, which also tend to be more productive and more capital intensive (Leung et al 2008; Mañez et al 2010), are more able to cope with increased production in times of rising domestic demand without the need to switch out of export markets. In addition, larger firms may have longer-term planning horizons than their smaller counterparts, making them less reactive to short-term changes in demand conditions (Bernini et al forthcoming). By contrast, smaller enterprises may find it difficult to quickly ramp up production in times of rapidly growing demand, and are therefore more likely to switch between domestic and export markets when demand rapidly grows in one of these. In addition, small firms may find themselves becoming opportunistic or almost accidental exporters as they simply react to orders from individual customers abroad – a process described by Love and Ganotakis (2013) as 'export dipping'.

Vannoorenberghe (2012) shows that firm size tends to reduce volatility in both export and domestic sales, suggesting that the domestic/export substitution implied by H3b is indeed more pronounced for small firms. And Blum et al (2013) find that in Chile, small firms enter exporting when there is a negative domestic demand shock, and that reductions in domestic demand affect the export decisions only of occasional exporters – typically smaller enterprises.

Collectively, therefore, the arguments above suggest that we should expect small firms to react systematically differently from large firms both in terms of their learning by exporting, and in terms of their reaction to demand changes. Thus in terms of export duration, this leads to our next hypothesis:

H4: Hypotheses 1b, 1c, 2, 3a and 3b apply more strongly to small firms than to large firms.

DATA AND DESCRIPTIVE STATISTICS

Data

The data are drawn from the Spanish Survey of Business Strategies (ESEE) an annual survey of Spanish manufacturing sponsored by the Ministry of Industry and carried out since 1990. The ESEE is a representative sample of Spanish manufacturing firms classified by industry and size categories that provides information at the firm level.[2]

The ESEE has some relevant characteristics that make it well suited for using survival methods to analyse firms' persistence in exporting. First, this survey provides wide information on firms' characteristics on a yearly basis, which may be relevant to disentangle the determinants of the duration of export spells. Second, the ESEE supplies the necessary information to identify firms that export in a continuous way, quit exporting or stop answering the survey during our 22 years long follow-up period under analysis (from 1992-2013).[3] Our estimation sample is composed of 23,053 observations corresponding to 3,767 export spells. These spells correspond to 3,401 firms: 2,235 (65.75%) of these are SMEs – defined as firms with fewer than 200 employees – and 1,166 (34.25%) are large firms. As regards SMEs, our estimation sample consists of 13,242 observations corresponding to 2,538 export spells. About 91% of the firms experience a

[2] For further detail visit http://www.fundacionsepi.es/investigacion/esee/en/spresentacion.asp.
[3] Our period of analysis starts in 1992 due to the lack of information to build some of the relevant variables for 1990 and 1991.

unique export spell. With respect to large firms, our estimation sample is composed of 9,811 observations corresponding to 1,166 firms that are responsible of 1,229 export spells. The percentage of large firms that experience a unique export spell, 95%, is 4 percentage points above of that corresponding to SMEs

As a first approach to the data, in Table 1 we report by size group the transition probabilities of starting/stopping to export along the period of analysis (1992-2012).[4]

[Insert Table 1 about here]

The data unambiguously reveal that both exporting and non-exporting are highly persistent, whereas transitions between exporting and non-exporting (and vice versa) are quite limited. For the full sample of firms, virtually 92% of non-exporters in one year continued in the same status during the next year, while only 8% started exporting. As for exporters, persistence is even higher: about 96% of the firms exporting in a given year also export the following year, and transitions out of the exporting status are even more limited (only 3.73% of the firms exporting in *t* do not export in *t* +1).

Column 1 of Table 1 reveals stronger non-exporting persistence among SMEs compared to large firms. Almost 93% of the non-exporting SMEs in year *t* continue without exporting in year *t* + 1 compared to only 82% among large firms non-exporting. Conversely, column 2 of Table 1 shows stronger persistence in exporting among large firms in comparison to SMEs (the percentages of large firms and SMES exporting both in *t* and *t* +1 are 98.7% and 94.7% respectively).

Export experience, punctuated exporting and firm size

As mentioned in the theory section, we allow for learning effects arising not only from accumulation of exporting experience within the current exporting episode (e.g. Timoshenko 2015) but also from previous exporting

[4] In our estimations samples we require non-missing values for all the relevant variables in the analysis

experience and the pattern of this behaviour when we observe punctuated spells of exporting for a given firm.

Figure 1 describes the non-parametric Kaplan-Meier estimator of the survival function for exporting at the firm level. This plots the fraction of exporting spells that are still 'alive' after a given number of years since they started, and thus describes the pattern of within-spell experience accumulation. Of firms that started as exporters in a given year, 95.8% of large firms and 87% of SMEs continue to exporting the following year. Further, it is possible to observe in Figure 1 that the fraction of firms that quit exporting decreases with the length of the exporting spells. Thus, whereas for SMEs the fraction of export starters that stop exporting during the first five years of exporting is 33%, in the following five years it is only 12%. Analogously, these figures for large firms are 14% and 9%, respectively. Overall, the observed survival patters are consistent with the hypothesis relating within-spell export experience accumulation to learning, as the survival rate (between consecutive survival years) increases with the number of years exporting.

[Insert Figure 1 about here]

In Figure 1, the survival function corresponding to large firms is always above that corresponding to SMEs, revealing much stronger persistence in exporting among large firms compared to SMEs. Thus, whereas the median duration of the export spells among SMEs is 13 years, more than 50% of the large firms continue exporting after 21 years (observed mean durations for SMEs and large firms are 12.18 and 16.49 years, respectively). Further, a log-range test for equality of the survivor functions rejects the hypothesis of equality of the survivals functions of SMEs and large firms at any conventional level of significance (χ^2=159.46 with p-value=0.000).

Next, we provide evidence on the possible accumulation of previous export experience for firms experiencing punctuated spells of exporting. We use two variables as proxies to measure previous export experience, namely the number of previous exporting spells and the number of years of export

experience before the start of the current spell (measured as the total number of years that the firms has exported either continuously or intermittently before the beginning of the spell under analysis). Table 2 demonstrates the existence of episodic exporting: although most of the firms in our sample experience a single export spell during our sample period, 11% of the SMEs and almost 5% of the large firms undergo punctuated spells of exporting. Thus, among SMEs (large firms) we observe firms that experience up to five (three) spells of exporting.

[Insert Table 2 about here]

Figure 2 depicts the average duration of first, second and third spells for firms that experience punctuated spells of exporting along the sample. As can be seen from the figure, the average duration of the seconds and third spells of exporting is substantially longer than the duration of the first spell. This observation is consistent with the hypothesis that export duration is positively associated with previous export experience, and suggest a process of learning-by-exporting that spills over into the firm's whole exporting history. Further, it is possible to observe in Figure 2 that average duration of exporting spells among large firms is longer than among SMEs.

[Insert Figure 2 about here]

Finally, we provide evidence on the relationship between export experience and export intensity as we expect that the degree of exposure to international markets might enhance learning and thus the duration of exporting spells. Figure 3 illustrates that: i) export intensity is always higher for large firms than for SMEs; and ii) for both SMEs and large firms export intensity increases with the duration of the spell of exporting.

[Insert Figure 3 about here]

THE EMPIRICAL MODEL

Methodology

We use survival techniques to analyse the drivers of firms' decisions to

export persistently. Our unit of observation is the export spell. We define an export spell as a period of uninterrupted exporting, that is, the number of consecutive years of exporting. A spell is computed as starting in year *j* if the firm did not export in year *j*-1 but exports in year *j*. Analogously, a spell is considered to end in year *j* when this is the first year in which the firm declares not exporting, after one or more consecutive years of exporting. Therefore, we measure export persistence by the length of continuous exporting, so that the duration of a spell of exporting captures persistence in exporting.

To investigate the factors determining the duration of export spells, we carry out 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. Specifically, we use discrete time proportional hazard models to account for the fact that, although the underlying transitions in and out of exporting may occur at any moment in time (continuously), we only observe them yearly (interval censored data).[5] In estimation, to better single out the pattern of duration dependence (i.e. the effect of the passage of survival time on export spells persistence), we allow for a flexible specification of the baseline hazard and control for export firms' spells unobserved heterogeneity.

We estimate the discrete time representation of the following underlying continuous time proportional hazard model:

$$\theta\left(j, x_{ij}\right) = \theta_0\left(j\right)\exp^{\beta_0 + x_{ij}\beta} \cdot v_i \qquad (1)$$

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. In this kind of models, unobserved heterogeneity (v_i) is

[5] Our data is not intrinsically discrete but we only know the year in which an export spell starts or ends, which in survival econometrics is known as "interval censored data" (see Jenkins 2005).

incorporated multiplicatively, so that it measures a proportional increase or decrease in the hazard rate of a given firm, relative to an average firm. As proposed by Meyer (1990), we assume that the frailty (unobserved heterogeneity) component follows a gamma distribution.

If we log linearize equation (1), we obtain equation (2),

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

It is possible to observe in equation (2) that the baseline hazard $\theta_0(j)$ is the hazard that, after controlling for the covariates and unobserved heterogeneity, can be attributed to the passage of survival time (in our case the degree of persistent exporting) and that is common to all export spells.[6]

The dependent variable of the survival model that we use to analyse export persistence is not measured directly (in terms of number of years of continuous exporting) but consists of a binary variable taking value 1 for the survival period in which the firms exits from export markets and 0 as long as it remains exporting.

There are two important issues that should be taken into account when building this binary variable. First, one should take into account the existence of right-censored exporting spells, i.e. exporting spells that continue into the last year of our sample. For right-censored spells our binary dependent variable takes value 0 for all the survival years. Second, our data allows us to distinguish whether an export spells terminates because the firm stops exporting or as a result of firm failure. Treating those export spells that end as a result of firm failure as completed spells (and changing the value of our binary dependent variable to one the last survival year they are observed) would imply assuming that the underlying process driving export duration is the same than that driving firm survival. In order to avoid this problem, we will consider these spells as right-

[6] For a detailed description of the methodology used to estimate discrete time proportional hazard models with a frailty component see Jenkins (2005, ch 8). These models can be estimated if a gamma distribution is assumed for the unobserved heterogeneity using Jenkins' (1997) Stata routine *pgmhaz8*.

censored, what amount to explicitly acknowledging that the drivers of export persistence differs from those determining firm survival.

Independent variables

We start this section introducing the variables that we use to test the hypotheses posed in the theory section. Then, we present other variables included as controls. The definition of all variables can be found in Table 3, and descriptive statistics and correlations in Table 4.

[Insert Tables 3 and 4 about here]

The baseline hazard of our survival model (log(SURV. TIME)) allows us to test the hypothesis that export duration is positively associated with the length of the current exporting spell (*H1a*). A significant negative estimated coefficient for this variable should be interpreted as evidence of negative duration dependence, i.e. the risk of export spell termination decreases with the length of the spell (and so as evidence of learning by exporting).

We use two variables to explore the incidence of punctuated exporting on learning-by-exporting, and so in export spells duration. The variable PREVIOUS EXPORT EXPERIENCE, measured as the number of years that the firms has exported before the start of the spell of interest, tests whether previous exporting experience, even if gained in non-consecutive years of exporting, improves subsequent export duration prospects (*H1b*). The variable PREVIOUS NUMBER OF SPELLS (a count of the number of previous exporting spells) tests the hypothesis that punctuated spells of exporting lead to less learning-by-exporting and so shorter export duration (*H1c*). Including EXPORT INTENSITY (measured as the ratio of exports to sales) allows us to test whether the learning process associated with high export intensity has a positive impact in firms' exporting spells survival prospects (*H2*).

To test hypotheses 3a and 3b (relating export duration to demand conditions) we include two sets of dummy variables. First, in line with Bernini et al (forthcoming), we include variables to proxy the demand conditions faced by a firm in domestic and foreign markets. These are the

DOMESTIC ABSORPTION UPTURN and FOREIGN ABSORPTION UPTURN dummy variables. We consider that the absorption (defined as domestic production plus exports minus imports) of the Spanish economy is in upturn – and so the DOMESTIC ABSORPTION UPTURN will take value 1 – when the absorption growth, calculated from the cyclical component of absorption, is positive (meaning that the economy absorption grows more than its long-term trend) and in a downturn when it is negative. Analogously, we consider than the foreign absorption is in upturn when the foreign absorption growth (where foreign absorption is the one corresponding to Spain's 5 most important export destinations – France, Portugal, Italy, UK and Germany), calculated from their cyclical component is positive (and in these cases the FOREIGN ABSORPTION UPTURN dummy will take value 1). [7]

Furthermore, using information available in our database, we include in our estimation a set of dummy variables that aim to capture the firm-level cycle. The aim is to account for a possible component of the business cycle that is not common across firms. They are based on how firms' managers assess the evolution of their main market demand, and which is the geographic scope of this market. Using managers' assessment of the evolution of their main market, we can build a set of three dummy variables RECESSIVE, EXPANSIVE and STABLE. They take the value 1 when the firm declares that the demand in its main market is recessive, expansive or stable respectively. Information on the geographic scope of firms' main market allows us to build another set of two dummies DOMESTIC and FOREIGN. The DOMESTIC dummy takes value 1 when a firm main market is the domestic one; analogously, the FOREIGN dummy takes value 1 when a firm main market is either the foreign market or a combination of the foreign and the domestic market. Interaction of these two sets of dummies gives rise to a set of six dummy variables which combine information about the evolution of firms' main market and the geographic

[7] Beneito *at al* (2015) use a similar measure of the business cycle (based on GDP growth) when analysing the effect of cyclicality on firms R&D investment. See Appendix A for a more detailed explanation of the procedure used to build these variables.

scope of this market: STA_DOM, EXP_DOM, REC_DOM (taking value 1 if firms' main market is the domestic one and market demand is stable, expansive or recessive respectively); and STA_FOR, EXP_FOR, REC_FOR (taking value 1 if firms' main market is either the foreign one or a combination of the foreign and the domestic market; and, market demand is stable, expansive or recessive respectively) .[8]

In addition to the variables used to test our hypotheses, we include in our estimations a substantial number of control variables. The first of these reflect firm resources that are commonly used in the literature on firm selection into exporting. First, we proxy for a firm's resources by firm size (measured by the log of the number of employees (*log*(EMPLOYMENT)), and firm total factor productivity (measured as the residual from the estimation of a production function by the method proposed by Wooldridge, 2009 – log(TFP)). As a standard indicator of firm vintage we use the log of age, log(AGE).

There is considerable evidence of a positive link between innovation and exporting (e.g. Love and Roper 2015). We allow for firm's innovation resources using a set of three dummy variables that capture whether the firm has introduced process innovations, product innovation or patents (these are the variables PROCESS INNOVATION, PRODUCT INNOVATION and PATENTS). Further, we control for firm financial resources by means of two variables aimed to proxy for internal and external financial constraints. Our measure of external financial constraints is measured as the deviation of the cost of firms' new long-term debt with respect to the year mean (EXTERNAL FINANCIAL CONSTRAINTS). Large and positive values of this variable should correspond to firms with high financial costs, and large negative values should correspond to firms that may access external financing at a lower cost. Analogously, our measure of internal financial constraints is firm cash flow in deviations with respect to the average by year (EXTERNAL FINANCIAL CONSTRAINTS). Large negative values should correspond to firms facing tight internal financial

[8] The variable STA_DOM is taken as the reference category and thus omitted in the estimation.

constraints; large positive values should correspond to firms with a large availability of own funds. [9]

We also control for ownership, regional distribution of exports and industry specifics including the variables FOREIGN PARTICIPATION, EXPORT REMOTENESS INDEX and DIFFERENTIATED INDUSTRIES. Foreign participation is a dummy taking value 1 if the capital of the firm has foreign participation. The EXPORT REMOTENESS INDEX takes higher values the larger is the fraction of firms' exports to more distant countries. Finally, to investigate variations in export persistence across industries we use the DIFFERENTIATED PRODUCTS dummy to classify industries as differentiated or homogeneous product industries following Rauch (1999) classification of industries.[10]

Finally, we include two additional sets of control variables. First, as firms' restructuring processes (such as mergers and spin-offs) may affect persistence in exporting we control for them in estimation to avoid potential biases related to these issues (these two dummy variables are ABSORPTION and EXCISION respectively). Second, for the purpose of robustness, in estimation we include a dummy variable taking value one for the left-censored spells: that is, those exporting spells of firms that export in the first year they are in the sample, but where we do not whether they were already exporting before the first observed year.

5. Results

Tables 5 to 7 present the results obtained from the estimation of the discrete time proportional hazard model described in section 4 for the full

[9] We introduce the financial cost variables in deviation with respect to their corresponding year mean to avoid contamination from changing macroeconomic policies (such as over time changes of interest rates) in the link between the cost of debt/cash-flow availability, and tighter financial constraints (Mañez et al. 2014).

[10] According to the Rauch (1999) classification a product is considered as homogeneous if it is traded in an organized exchange or its price is quoted in a trade publication. Other products are classified as differentiated (in this respect, most consumer products are classified as heterogeneous). Rauch (1999) finds that exporting differentiated product involves higher sunk costs as it requires relationship-specific investments to adjust products to local consumer tastes or to establish distribution networks.

sample, SMEs and large firms respectively. Estimated coefficients in these tables represent the effect of covariates on the hazard of termination of the export spell. Negative coefficients should be interpreted as a decrease in the hazard (i.e. an increase in the expected duration of the export spell). Conversely, positive coefficients should be interpreted as an increase in the hazard (i.e. a decrease in the expected duration of the export spell). [11]

[Insert Tables 5, 6 and 7 about here]

Each set of results include three specifications. In specification 1, we do not control for either the existence of left-censored spells or for the possible influence of firm restructuring processes (see section 4). In specification 2, we control for the existence of left-censoring by including the LEFT-CENSORED dummy. Finally, in specification 3, we control both for left-censoring and for firms' restructuring processes that can affect export duration. One can observe in Tables 5 to 7 that the estimate of the duration dependence parameter (estimate of log(SURV. TIME) is substantially lower in specifications 2 and 3. This suggests that not controlling for the existence of left-censored spells produces a downwards bias in the estimated coefficient for duration dependence: however, this result does not depend on whether we control for firms' restructuring processes.[12] As regards the choice between specifications 2 and 3, the fact that the one of the dummy variables proxying firms' restructuring (EXCISION) is significant in the estimations for the whole sample of firms and for large firms (see column 3 of Tables 5 and 7) suggests specification 3 as our preferred specification.

At the bottom of Tables 5 to 7 we can observe that for all specifications and regardless of the estimation sample, we reject the null that the variance of the unobserved heterogeneity component is equal to zero. This suggests the existence of unobserved heterogeneity, such as variations between

[11] We present the estimated coefficient instead of the hazard ratios because in proportional hazard models accounting for unobserved heterogeneity, the interpretation of the hazard ratios becomes awkward (see Gutierrez 2002, p. 32).
[12] Mañez et al (2015) find a similar result.

firms in the ability of managers, and thus the need to control for this when estimating a survival model.[13]

As explained in section 4, after controlling for firms' observed and unobserved heterogeneity, the baseline hazard captures the hazard that depends exclusively on the passage of survival time and that is common to all the export spells. Thus, the estimated parameter for the log of survival time (our baseline hazard function) provides an estimation of the pattern of duration dependence. Regardless of the sample used for estimation, the estimates for this variable are negative and significant suggesting, both for SMEs and large firms, the existence of negative duration dependence i.e. the hazard of termination of the export spell decreases as within-spell export experience grows. These results should be interpreted as evidence in favour of *H1a*, as the survival prospects of the (current) export spell increase with its length. In line with Timoshenko (2015), negative duration dependence should be interpreted as evidence of within-spell learning-by-exporting that leads to export persistence.

However, we are principally concerned with cumulative versus punctuated learning effects. For the whole manufacturing sample (Table 5), we find that firms with greater cumulative exporting experience enjoy longer export spells (the coefficient of the variable PREVIOUS EXPORTING EXPERIENCE is negative and significant). This result provides evidence consistent with *H1b*: it suggests that it is not only learning effects arising from the current spell of exporting but also those arising from the cumulative export experience of firms experiencing punctuated spells of exporting that are important to explain export persistence. However, observation of column 3 of Tables 6 and 7 reveals that results differ between SMEs and large firm. Whereas the coefficient of the variable PREVIOUS EXPORTING EXPERIENCE is negative both for SMEs and large firms, for large firms it is not significant. Hence, our estimation results suggest that previous export experience reduces the risk of termination of

[13] If one mistakenly ignores unobserved heterogeneity when it is relevant, as it is in our case, the estimated coefficients of both the baseline function and the covariates are biased (Jenkins 2005)

SMEs' export spells, but it does not influence the survival prospects of large firms' export spells. This result is in line with H4 that the impact of previous export experience in export spell duration should be stronger for SMEs than for large firms.

As for the variable PREVIOUS NUMBER OF SPELLS, we do not find any significant effect for the sample of large firms. Nevertheless, for SMEs the estimate of this variable is positive and significant (as it is for the whole manufacturing sample) suggesting that the larger the number of previous exporting spells the shorter the survival prospects of SMEs' export spells. Hence, we find empirical confirmation of *H1c* only for SMEs. Therefore, our results suggest that for SMEs punctuated exporting moderates the process of learning by exporting: learning for punctuated exporters is less intense than for those that export continuously, leading to lower persistence in exporting. This result also provides support for *H4* that hypothesizes a larger negative impact of the previous number of spells for SMEs in comparison to large firms. Overall, the joint consideration of the estimates for PREVIOUS EXPORTING EXPERIENCE and PREVIOUS NUMBER OF SPELLS for SMEs suggest that punctuated exporting makes it likely that the next exporting spell will be shorter, but that the knowledge gained from previous years' exporting helps offset that effect even if those years do not occur in a single spell.

Regardless of the estimation sample (and so both for SMEs and large firms), we find that export intensity increases the survival prospect of export spells (the coefficient of export intensity is negative and significant). Hence, our results provide empirical support to *H2.* The positive effect of export intensity on export persistence is probably linked both the relationship between export intensity and learning-by-exporting intensity, and to the fact that for firms devoting a large percentage of their production to exporting, substituting domestic for foreign markets is quite difficult in the short run.

As regards to the variables capturing the evolution of domestic and foreign demand conditions, we allow for both objective and subjective consideration of demand changes. Neither large firms' nor SMEs' export spells duration is significantly affected by the evolution of domestic demand

(the estimates of the DOMESTIC ABSORPTION UPTURN dummy are not significant either for large firms or SMEs). Thus although it is probably a determinant of the likelihood of exporting, once we take into account export experience the evolution of domestic absorption does not turns out to be a significant driver of persistence. There is thus no support for H3b. With respect to the evolution of foreign demand, the estimate for the UPTURN FOREIGN ABSORPTION dummy is negative and significant for the whole sample and for SMEs but not for large firms, suggesting support for H3a and H4. Therefore our results suggest that the exporting spells of SMEs are longer when there is growth in the economies of Spain's main trading partners. However, the duration of the exporting spells of large firms seems to be independent of the evolution of foreign demand. This result is consistent with an intrinsic (stable) export-oriented strategy of large firms (as shown in Table 1, 98.7% of large firms exporting in period *t-1* also export in period *t*): being persistently in export markets is simply a natural state for large firms. By contrast, there appears to be a possible (foreign) demand-pull explanation for SMEs' export persistence.

However, it would be mistaken to infer from these results that demand conditions are completely unimportant for export duration among larger firms. In relation to the indicators of firms' subjective perception about the evolution of its main market taking into account whether their main market is either the domestic market the foreign market, the results are mixed for SMEs and large firms. As for SMEs (Table 6), it is important to note three interesting results. First, whether the firm's main market is the domestic or the foreign market matters. Regardless of managers' perception on the evolution of main market demand (stable, expansive or recessive) exporting spells corresponding to firms whose main market is the foreign market (alone or in combination with the domestic market) enjoy longer export survival prospects. [14] Second, for these SMEs our estimation

[14] On the one hand the estimated coefficient corresponding to STA_FOR is negative and significant. In the other hand, pairwise test reject the null of equality of the estimated coefficients of EXP_DOM and EXP_FOR (EXP_DOM-EXP_FOR=0.769 with p-value 0.006); and, REC_DOM and REC_FOR (0.902 with p-value 0.000)

suggest that the subjective perception on the evolution of market demand does not influence the duration of the exporting spells, as pairwise tests of differences of the estimated coefficients of STA_FOR, EXP_FOR, REC_FOR do not reject the null of equality of the estimated coefficients.[15] Thus export-oriented SMEs have longer spells of exporting than domestically-oriented SMEs, regardless of how the former set of firms view the state of their potential export markets. Third, among SMEs whose main market is the domestic market, those that detect an expansive demand experience longer export survival prospects, and those that detect a recessive demand experience shorter export spells (for SMEs the variable EXP_DOM is negative and significant, however the REC_DOM is positive and significant). This suggests that rising (falling) domestic demand is linked to increases (decreases) in the export duration period, contrary to H3b: this in turn suggests that exports and domestic markets are complements rather than substitutes for Spanish SMEs, echoing the findings of Salomon and Shaver (2005b).

For large firms, the only firms that enjoy longer duration of spells are those firms that perceive growing demand and have as their main market the foreign market (alone or in combination with the domestic market), as only the estimated coefficient corresponding to EXP_FOR is statistically significant. This result is evidence in favour of H3a hypothesizing that export duration is positively associated with the growth in foreign markets.

As regards firm resources, our estimates suggest, as one would expect, that the export spells of larger, more productive and older firms have lower chances of ending.[16] Among the estimates of the variables that proxy for firm's innovation resources the only one that turns out to be significant in the full sample estimation (Table 5) is PATENTS. The negative sign of this estimated coefficient suggests that patenting reduces the hazard of termination of the export spells. For SMEs, in addition to the PATENTS

[15] STA_FOR-EXP_FOR=0.395 with p-value 0.194; STA_FOR-REC_FOR=0.041 with p-value=0.874; EXP_FOR-REC_FOR=-0.354 with p-value=0.277

[16] An exception is the coefficient on age that is not significant in the large firm sample.

dummy, the PROCESS INNOVATION dummy is also negative and significant (see Table 6). These estimates suggest that SMEs that implement process innovations and/or have been granted patents enjoy longer exporting spells. However, for the large firms none of the three variables used to proxy innovation resources is significant. This different result for SMEs and large firms could be due to the fact that implementing innovations and patenting is a much more common activity among large exporting firms than among their SME counterparts.[17] Furthermore, the fact that for SMEs only the process innovation dummy is significant whereas the product innovation dummy is not could be suggesting that for Spanish SMEs export persistence the introduction of process innovations that could result in lower costs/higher productivity is more important than the introduction of new products.

The estimates on financial resources variables suggest that both SMEs and large firms mainly rely on own funds to finance their export strategies. The negative and significant estimates of the variable INTERNAL FINANCIAL CONSTRAINTS suggest that firms with large cash-flow availability show higher export persistence.[18] In relation to other control variables we find that: (i) foreign participation extends the duration of large firms' exports spells but not that of SMEs; (ii) firms operating in differentiated industries enjoy longer export spells, consistent with the finding of Timoshenko (2015) that learning is the most important factor explaining persistence in differentiated product industries; and (iii) consistent with a greater cost of foreignness in more distant locations, exporting a higher proportion of sales to more remote destinations has a negative impact on the survival prospects of SMEs export spells. Finally, both for the sample of all firms and for that of large firms we find that firms involved in sell-offs (EXCISION) have a higher risk of termination of export

[17] The percentage of firms that introduce product or process innovations or have been granted patents is substantially larger for large firms than for SMEs (process innovations 39% vs. 25.2%; product innovations 51.32% vs. 32.6; patents 12.74% vs. 6.5%).
[18] The variable proxying EXTERNAL FINANCIAL CONSTRAINTS is insignificant in all estimations.

spells, suggesting that restructuring has a negative effect on export persistence.

DISCUSSION AND CONCLUSIONS

Persistence in exporting matters: firms with continuous exposure to export markets derive greater benefit from learning by exporting than do sporadic exporters, even after allowing for other potential influences on performance (Andersson and Lööf 2009). Rather than ascribing the existence of persistent exporting to the usual explanation of sunk costs, we develop a model which is based around different patterns of learning by exporting: in particular, we show how cumulative previous exporting can help lengthen subsequent exporting spells, but that this can be compromised by the punctuated learning arising from a pattern of sporadic exporting. We also demonstrate the importance of firms' reactions to home and overseas demand, and highlight how these effects differ between large and small firms. Our conceptual contribution therefore comes in identifying the separate effects of within-spell and punctuated learning by exporting, and in explaining why punctuated and cumulative experience will have different learning effects in terms of their effects on export persistence. In addition, we explain theoretically, and demonstrate empirically, that these effects differ between small and large enterprises, especially with respect to the extent and effect of punctuated exporting for SMEs.

These findings help to explain the tendency for intermittent exporting among smaller firms. Bernini et al (forthcoming) show that smaller and less productive firms react more strongly to foreign demand changes, and that this helps explain their exit and re-entry into export markets. Our findings support this interpretation, but also suggest a complementary mechanism to explain intermittent exporting. While previous exporting experience makes export persistence more likely, if this experience is gained in a series of spells rather than continuously the process of knowledge decay and need to renew learning about abandoned markets reduces the value of this accumulated knowledge. Thus firms with a history of repeated entry and exit from exporting will tend to have shorter exporting spells in the

future than identical firms with accumulated experience arising from continuous exporting: intermittent exporting in the past leads to intermittent exporting in the future because of the different pattern of accumulated previous learning. Note that this effect is independent of sunk costs and self-selection into exporting, or of any learning effects arising from the current exporting spell of the individual enterprise. Our results also demonstrate that the (positive) cumulative effects of previous exporting experience and the (negative) effect of previous intermittency are only experienced by SMEs, while the benefits of export intensity improve the export durations of all firms. Thus the intermittent exporting behaviour of SMEs is caused not simply of the limited resources available to smaller firms, but by their punctuated learning in previous periods: SMEs do learn by exporting, but frequently do so in a way that lessens the effect of their accumulated exporting experience. This is a problem not faced by continuous exporters, which also tend to be larger and more productive enterprises.

The fact that cumulative export experience in previous exporting spells has no effect on export duration for large firms does not suggest that they fail to learn from exporting: they simply do so differently from smaller firms. As the descriptive statistics demonstrate, large firms have greater exporting experience are much more likely to export continuously, and thus a lot of their learning will already be captured by the 'within-spell' learning effect: larger and more experienced firms are likely already to have overcome the challenges posed by exporting, and so have less to learn from each additional period of exporting than SMEs (Fernandes and Isgut 2015). Note also that export intensity is highly significant as a predictor of export duration for both large and small firms.

Large and small firms also react quite differently to actual and perceived changes in demand. SMEs react to an upturn in foreign demand by lengthening their subsequent period of exporting, consistent with the findings of Bernini et al (forthcoming) that SMEs react to an increase in foreign demand by being less likely to exit exporting. But large firms and SMEs also react quite differently to perceived changes in their main

market. For SMEs whose main market is the domestic market, a subjective evaluation of expansion in their market increases the length of exporting spells, but the perception that their main market is declining reduces the expected duration of the exporting spell. However, if the SME's main market is the foreign market, the subjective perception on its evolution has no effect on export spell duration. For large firms precisely the reverse is true: perceptions of main market demand do not seem to matter when this is the domestic market; however, if the main market is the foreign market perceiving an expanding market lengthens the duration of exporting spells. This might be another indicator that exporting is a 'natural' state for larger firms: they are natural exporters, and while their export persistence is not affected by a negative perception of the evolution of the foreign market, they will try to profit from favourable conditions in foreign markets to remain in exporting.

These separate effects have implications for firm strategy. Our findings suggest that, in learning terms, the pattern of exporting matters a lot. While entering and exiting export markets may be strategically useful, it has costs: these are not simply the sunk costs involved in export exit and re-entry, but also arise from the compromised learning effects that punctuated learning induces. But can even episodic learning nevertheless reduce the costs of re-entry? The answer is yes, because cumulative exporting experience still matters in terms of export persistence, even where it is accumulated over a number of exporting episodes. All exporting, even intermittent exporting, can be a useful way of acquiring useful knowledge that helps with future exporting episodes. Thus (small) firms can acquire learning from episodic exporting, even if this is non-strategic or 'accidental' (Welch and Welch 2009): the learning acquired in this way is still useful in extending the length of future exporting periods, even if it is partly compromised by the drawbacks of punctuated learning. This suggests that any exporting event can be potentially useful not just for the revenue it generates, but for the learning effect it develops which may assist with increased export persistence in the future. Indeed, there may be benefits linked to punctuated learning by exporting. While routines can be useful in aiding learning, they can also be the source of inflexibility and actually be

an impediment to change (Teece 2012): for example, Casillas et al (2010) show that the ability to *unlearn* routines is an important precursor to the intention to initiate export activities for the first time. In our study, smaller firms are both more likely to react to changes in demand and to have punctuated spells of exporting, which may suggest that the learning derived from their exporting activity helps to make them more flexible to market changes. Thus they may not learn less that larger firms from their exporting experience, but learn differently: since the knowledge they acquire through punctuated exporting is not embedded in routines, they can also unlearn certain behaviours and adapt to market changes more readily.[19]

As with all empirical research, our analysis is subject to a number of limitations, and has pointers for future research. While we are able to distinguish between three different forms of effect (within spell, cumulative and punctuated learning), as with all econometric studies of learning by exporting we can only infer the process underlying the observed effects. More detailed qualitative or case study work is required to understand fully the underlying mechanisms which link learning to persistence in exporting, and to internationalization generally (e.g. Bunz et al forthcoming). In particular, it would be useful to distinguish more clearly between learning from routines (which can help embed useful knowledge but may lead to path dependency) and learning to transfer knowledge to new areas of internationalization which may involve unlearning previous prior knowledge (Casillas et al, 2010). Our analysis does not observe the entire lifecycle of the sampled firms, and so we cannot establish, for example, whether different learning effects occur at different times of the lifecycle. The fact that age is positively related to export duration for small firms (but not for larger ones) does suggest that older SMEs have longer exporting spells, but we cannot be certain that this is necessarily related to the way in which younger and older SMEs learn from exporting. Further work in this area could well be insightful. For the same reason we must also acknowledge that, by definition, our measure of cumulative learning inevitably relates

[19] We are grateful to Irina Surdu for pointing out this possible interpretation.

only to the observed time period: however, the fact it is an unusually long panel (22 years) plus the fact that we allow explicitly for left-censored observations helps give us confidence in the results.

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TABLES

Table 1: Transition probabilities between export states

Status in *t* - 1	Status in *t*	
	Non exporter	Exporter
All firms		
Non-exporters	91.99	8.01
Exporters	3.73	96.27
SMEs		
Non-exporters	92.71	7.29
Exporters	5.58	94.71
Large firms		
Non-exporters	81.80	18.20
Exporters	1.34	98.66

Table 2: Number of export spells by firm

	All firms		**SMEs**		**Large firms**	
Number of export spells	Number of firms	% of firms	Number of firms	% of firms	Number of firms	% of firms
1	3101	91.18	1991	89.08	1110	95.20
2	244	7.17	195	8.72	49	4.20
3	48	1.41	41	1.83	7	0.60
4	6	0.18	6	0.27		
5	2	0.06	2	0.09		

Table 3: Variables description

Hypothesis 1	
log(SURV. TIME)	Log of survival time (baseline hazard). From 1 to 22 (máximum spell duration)
PREVIOUS EXPORTING EXPERIENCE	Number of (observed) previous years exporting at the year of the start of the current spell
PREVIOUS NUMBER OF SPELLS	Number of (observed) previous exporting spells
Hypothesis 2	
log(EXP. INTENSITY)	Log of exports over sales
Hypothesis 3	
DOMESTIC DEMAND UPTURN	See Appendix A
FOREIGN DEMAND UPTURN	See Appendix A
EXP_DOM	Dummy=1 if the firm declares to face a expansive demand in its main market and this is the domestic market; 0 otherwise
REC_DOM	Dummy=1 if the firm declares to face a recessive demand in its main market and this is the domestic market; 0 otherwise
STA_DOM	Dummy=1 if the firm declares to face a stable demand in its main market and this is the domestic market; 0 otherwise (omitted in estimation)
EXP_FOR	Dummy=1 if the firm declares to face a expansive demand in its main market and this is the foreign market or a combination of foreign and domestic market; 0 otherwise
REC_FOR	Dummy=1 if the firm declares to face a recessive demand in its main market and this is the foreign market or a combination of foreign and domestic market; 0 otherwise
STA_FOR	Dummy=1 if the firm declares to face a stable demand in its main market and this is the foreign market or a combination of foreign and domestic market; 0 otherwise
Controls 1: Firms' resources	
log(EMPLOYMENT)	Log of the number of the firm's employees
log(TFP)	Log of firm's total factor productivity. Calculated following Wooldridge (2009) method
log(AGE)	Log of the number of years since the firm was born
Controls 2: Firms' innovation resources	
PROCESS INNOVATION	Dummy=1 if the firm reports to have introduced at least a process innovation; 0 otherwise
PRODUCT_INNOVATION	Dummy=1 if the firm reports to have introduced at least a new product; 0 otherwise
PATENTS	Dummy=1 if the firm reports to have registered a new patent; 0 otherwise
Controls 3: Firms' financial resources	
INTERNAL FIN. CONSTRAINTS	See Appendix A
EXTERNAL FIN. CONSTRAINTS	See Appendix A
Other characteristics	
EXPORT REMOTENESS INDEX	See Appendix A
DIFFERENTIATED PRODUCTS	Dummy=1 if a differentiated product industry according to Rauch(1999) classification (meat industry; food and tobacco; beverages, textile and clothing; leather and shoes; vehicles, cars and motors; other transport equipment; furniture; other manufacturing goods); 0 otherwise
FOREIGN PARTICIPATION	Dummy=1 if the capital of the firm has foreign participation; 0 otherwise
Other controls	
LEFT-CENSORED SPELL	Dummy =1 if the spell is left-censored; 0 otherwise
ABSORPTION	Dummy =1 1 if the firm has absorbed other firms; 0 otherwise
EXCISION	Dummy variable taking value 1 if the firm has experienced an excision of a part of it; 0 otherwise

Table 4: Descriptive statistics (*N*=23,053)

	Correlation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	log(SURV. TIME)	1																									
2	PREV.EXP. EXP	-0.08*	1																								
3	PREV. NUM OF SP.	-0.09*	0.73*	1																							
4	log(EXP. INT)	0.25*	-0.10*	-0.17*	1																						
5	DOM. ABS. UPT	0.05*	0.01	0.01	0.00	1																					
6	FOR. ABS. UPT.	0.07*	0.00	0.01	0.01	0.63*	1																				
7	STA_DOM	-0.07*	0.04*	0.05*	-0.21*	0.00	0.02*	1																			
8	EXP_DOM	-0.08*	-0.01	0.01	-0.16*	0.03*	0.04*	-0.22*	1																		
9	REC_DOM	-0.07*	0.02*	0.04*	-0.15*	-0.03*	-0.06*	-0.23*	-0.16*	1																	
10	STA_FOR	0.11*	-0.02*	-0.04*	0.21*	0.00	0.01	-0.3*	-0.2*	-0.21*	1																
11	EXP_FOR	0.03*	-0.04*	-0.04*	0.19*	0.02*	0.05*	-0.23*	-0.15*	-0.17*	-0.21*	1															
12	REC_FOR	0.08*	0.00	-0.02*	0.14*	-0.03*	-0.07*	-0.22*	-0.15*	-0.16*	-0.2*	-0.16*	1														
13	log(EMP)	0.15*	-0.02*	-0.07*	0.22*	-0.01	0.00	-0.09*	-0.01	-0.11*	0.09*	0.09*	0.03*	1													
14	log(TFP	0.08*	0.01*	0.01	0.03*	0.03*	0.02*	-0.04*	-0.03*	0.01	0.02*	0.02*	0.04*	-0.04*	1												
15	log(AGE)	0.3*	0.07*	0.05*	0.08*	-0.01	0.00	-0.02*	-0.09*	0.01*	0.05*	-0.01	0.06*	0.31*	0.03*	1											
16	PROCESS INN.	-0.01*	-0.01*	-0.03*	0.07*	0.01	0.01	-0.06*	0.05*	-0.05*	-0.01	0.08*	0.00	0.24*	0.00	0.04*	1										
17	PRODUCT INN.	0.00	-0.04*	-0.06*	0.07*	-0.01	0.00	-0.06*	0.04*	-0.04*	-0.01	0.06*	0.02*	0.19*	0.05*	0.04*	0.33*	1									
18	PATENTS	-0.01	-0.01	-0.02*	0.05*	0.00	0.00	-0.03*	0.03*	-0.01*	-0.01	0.04*	-0.01	0.14*	0.04*	0.05*	0.12*	0.2*	1								
19	INT. FIN CONST.	0.00	-0.01	-0.03*	-0.04*	0.00	0.00	0.03*	0.03*	-0.05*	0.01*	0.01	-0.05*	0.01	0.09*	0.00	0.04*	0.01	0.02*	1							
20	EXT. FIN. CONST.	-0.04*	0.01	0.01	-0.07*	0.00	0.00	0.05*	0.01	0.03*	-0.03*	-0.04*	-0.02*	-0.22*	-0.02*	-0.1*	-0.08*	-0.05*	-0.03*	-0.01*	1						
21	FOREGIN CAPITAL	0.08*	-0.03*	-0.06*	0.16*	-0.01	0.00	-0.07*	-0.02*	-0.07*	0.07*	0.07*	0.03*	0.42*	-0.02*	0.11*	0.1*	0.06*	0.01	0.02*	-0.13*	1					
22	EXP. REM. INDEX	-0.02*	-0.01	-0.01	0.03*	0.02*	0.02*	0.01	0.01*	0.02*	-0.02*	-0.01*	-0.01	-0.02*	0.02*	0.02*	0.00	0.03*	0.01*	-0.01	0.03*	-0.09*	1				
23	FINAL GOODS	0.01	-0.01*	-0.01	-0.08*	0.00	0.00	0.04*	-0.01*	0.05*	-0.03*	-0.05*	0.00	-0.06*	-0.03*	-0.02*	-0.03*	0	-0.03*	0	0.05*	-0.1*	0.01	1			
24	LEFT CENSORED	0.12*	-0.46*	-0.6*	0.35*	-0.01*	-0.02*	-0.12*	-0.04*	-0.04*	0.08*	0.08*	0.06*	0.2*	-0.01	0.04*	0.06*	0.1*	0.06*	0.02*	-0.04*	0.14*	0.04*	-0.01*	1		
25	ABSORPTION	0.00	0.01	0.01	-0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	-0.01*	0.1*	0.00	0.04*	0.02*	0.03*	0.03*	0.00	-0.02*	0.07*	0.00	-0.02*	0	1	
26	EXCISION	0.00	0.00	-0.01*	0.01	0.00	0.00	-0.02*	0.00	0.01	0.01	0.00	0.00	0.07*	-0.01	0.04*	0.02*	0.02*	0.00	-0.01	-0.02*	0.05*	0.00	-0.01	0.02*	-0.01*	1
	Mean	1.47	0.34	0.11	-1.97	0.40	0.48	0.25	0.13	0.14	0.21	0.14	0.13	4.80	5.33	3.23	0.41	0.31	0.09	0.00	0.00	0.29	1.17	0.38	0.79	0.02	0.01
	S.D.	0.90	1.42	0.36	1.64	0.49	0.50	0.43	0.33	0.35	0.41	0.35	0.34	1.45	0.84	0.83	0.49	0.46	0.29	23.41	1.11	0.46	0.22	0.48	0.41	0.14	0.10
	Minimum	0.00	0.00	0.00	-14.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-4.94	0.00	0.00	0.00	0.00	-2354.3	-12.76	0.00	1.00	0.00	0.00	0.00	0.00
	Maximum	3.05	18.00	4.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.10	8.99	5.60	1.00	1.00	1.00	70.92	27.20	1.00	3.47	1.00	1.00	1.00	1.00

Table 5: Determinants of the duration of exporting spells. All firms

	(1)	(2)	(3)
	Coefficients	Coefficients	Coefficients
log(SURV. TIME)	-0.411***	-0.346***	-0.341***
	(0.063)	(0.069)	(0.069)
PREVIOUS EXPORTING EXPERIENCE	-0.0995**	-0.113***	-0.116***
	(0.040)	(0.042)	(0.042)
PREVIOUS NUMBER OF SPELLS	0.525***	0.236*	0.244*
	(0.131)	(0.138)	(0.139)
log(EXP. INTENSITY)	-0.459***	-0.435***	-0.438***
	(0.026)	(0.027)	(0.027)
DOMESTIC ABSORPTION UPTURN	0.143	0.162	0.160
	(0.104)	(0.105)	(0.105)
FOREIGN ABSORPTION UPTURN	-0.150	-0.206**	-0.202*
	(0.103)	(0.104)	(0.104)
EXP_DOM	-0.220*	-0.227*	-0.232*
	(0.120)	(0.123)	(0.123)
REC_DOM	0.171*	0.243**	0.239**
	(0.102)	(0.106)	(0.106)
STA_FOR	-0.621***	-0.590***	-0.599***
	(0.163)	(0.165)	(0.166)
EXP_FOR	-1.059***	-1.040***	-1.047***
	(0.236)	(0.240)	(0.240)
REC_FOR	-0.460**	-0.396**	-0.397**
	(0.179)	(0.182)	(0.183)
log(EMPLOYMENT)	-0.429***	-0.402***	-0.411***
	(0.043)	(0.044)	(0.044)
log(TFP)	-0.085*	-0.095**	-0.095**
	(0.046)	(0.048)	(0.048)
log(AGE)	-0.145***	-0.171***	-0.177***
	(0.052)	(0.055)	(0.055)
PROCESS INNOVATION	-0.138	-0.142	-0.144
	(0.093)	(0.095)	(0.096)
PRODUCT_INNOVATION	-0.129	-0.093	-0.092
	(0.107)	(0.109)	(0.110)
PATENTS	-0.471**	-0.420**	-0.424**
	(0.207)	(0.211)	(0.212)
INTERNAL FINANCIAL CONSTRAINTS	-0.005***	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)
EXTERNAL FINANCIAL CONSTRAINTS	0.044	0.049	0.047
	(0.033)	(0.034)	(0.034)
EXPORT REMOTENESS INDEX	0.248	0.293*	0.288*
	(0.159)	(0.164)	(0.165)
FOREIGN PARTICIPATION	-0.225	-0.190	-0.205
	(0.142)	(0.147)	(0.148)
DIFFERENTIATED PRODUCTS	-0.270***	-0.304***	-0.306***
	(0.090)	(0.095)	(0.096)
LEFT-CENSORED		-0.844***	-0.849***
		(0.119)	(0.119)
ABSORPTION			0.442
			(0.323)
EXCISION			1.036**
			(0.408)
Constant	-1.427***	-0.836**	-0.795**
	(0.373)	(0.396)	(0.399)
Observations	23,053	23,053	23,053
Unobserved heterogeneity: LR Test of Gamma Variance=0			
Chibar2(01)	26. 431	38.065	39.533
Prob≥chibar2	0.000	0.000	0.000

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 6: Determinants of the duration of exporting spells. Small firms

	(1)	(2)	(3)
	Coefficients	Coefficients	Coefficients
log(SURV. TIME)	-0.320***	-0.228**	-0.228**
	(0.077)	(0.087)	(0.087)
PREVIOUS EXPORTING EXPERIENCE	-0.139***	-0.154***	-0.155***
	(0.050)	(0.052)	(0.052)
PREVIOUS NUMBER OF SPELLS	0.622***	0.338*	0.336*
	(0.156)	(0.164)	(0.164)
log(EXP. INTENSITY)	-0.416***	-0.455***	-0.456***
	(0.033)	(0.034)	(0.034)
DOMESTIC ABSORPTION UPTURN	0.132	0.153	0.152
	(0.114)	(0.115)	(0.116)
FOREIGN ABSORPTION UPTURN	-0.164	-0.219*	-0.217*
	(0.112)	(0.111)	(0.111)
EXP_DOM	-0.251*	-0.270**	-0.272**
	(0.133)	(0.137)	(0.137)
REC_DOM	0.136	0.216*	0.215*
	(0.113)	(0.118)	(0.118)
STA_FOR	-0.665***	-0.641***	-0.646***
	(0.186)	(0.189)	(0.190)
EXP_FOR	-1.046***	-1.036***	-1.042***
	(0.265)	(0.270)	(0.270)
REC_FOR	-0.734***	-0.685***	-0.687***
	(0.217)	(0.221)	(0.221)
log(EMPLOYEES)	-0.524***	-0.503***	-0.506***
	(0.065)	(0.067)	(0.0678)
log(TFP)	-0.050***	-0.059***	-0.059***
	(0.022)	(0.023)	(0.022)
log(AGE)	-0.169***	-0.209***	-0.211***
	(0.060)	(0.064)	(0.064)
PROCESS INNOVATION	-0.194*	-0.198*	-0.199*
	(0.107)	(0.110)	(0.110)
PRODUCT_INNOVATION	-0.141	-0.103	-0.102
	(0.123)	(0.128)	(0.128)
PATENTS	-0.514**	-0.458*	-0.459*
	(0.245)	(0.251)	(0.251)
INTERNAL FINANCIAL CONSTRAINTS	-0.005***	-0.005***	-0.005***
	(0.002)	(0.002)	(0.002)
EXTERNAL FINANCIAL CONSTRAINTS	0.048	0.053	0.053
	(0.037)	(0.039)	(0.039)
EXPORT REMOTENESS INDEX	0.382**	0.435**	0.433**
	(0.177)	(0.183)	(0.183)
FOREIGN PARTICIPATION	-0.194	-0.140	-0.145
	(0.193)	(0.201)	(0.203)
DIFFERENTIATED PRODUCTS	-0.278***	-0.317***	-0.319***
	(0.104)	(0.111)	(0.111)
LEFT-CENSORED		-0.914***	-0.915***
		(0.139)	(0.140)
ABSORPTION			0.280
			(0.483)
EXCISION			0.650
			(0.627)
Constant	-1.436***	-0.769	-0.755
	(0.444)	(0.476)	(0.477)
Observations	13,242	13,242	13,242
Unobserved heterogeneity: LR Test of Gamma Variance=0			
Chibar2(01)	19.88	29.772	30.117
Prob≥chibar2	0.000	0.000	0.000

Standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1

Table 7: Determinants of the duration of exporting spells. Large firms

	(1)	(2)	(3)
	Coefficient	Coefficient	Coefficient
log(SURV. TIME)	-0.636***	-0.611***	-0.606***
	(0.123)	(0.127)	(0.122)
PREVIOUS EXPORTING EXPERIENCE	-0.002	-0.007	-0.018
	(0.080)	(0.080)	(0.075)
PREVIOUS NUMBER OF SPELLS	0.273	-0.199	-0.137
	(0.353)	(0.390)	(0.381)
log(EXP. INTENSITY)	-0.448***	-0.426***	-0.434***
	(0.038)	(0.042)	(0.044)
DOMESTIC ABSORPTION UPTURN	0.264	0.268	0.267
	(0.288)	(0.291)	(0.308)
FOREIGN ABSORPTION UPTURN	-0.075	-0.148	-0.141
	(0.285)	(0.291)	(0.314)
EXP_DOM	-0.110	-0.0729	-0.0847
	(0.305)	(0.306)	(0.305)
REC_DOM	0.330	0.324	0.279
	(0.271)	(0.278)	(0.267)
STA_FOR	-0.490	-0.429	-0.441
	(0.358)	(0.365)	(0.363)
EXP_FOR	-1.051*	-1.005*	-1.008*
	(0.546)	(0.556)	(0.557)
REC_FOR	0.342	0.450	0.461
	(0.345)	(0.361)	(0.344)
log(EMPLOYEES)	-0.368**	-0.355**	-0.397**
	(0.160)	(0.175)	(0.180)
log(TFP)	-0.234**	-0.242**	-0.240***
	(0.099)	(0.099)	(0.080)
log(AGE)	-0.082	-0.079	-0.102
	(0.127)	(0.158)	(0.103)
PROCESS INNOVATION	0.068	0.103	0.124
	(0.212)	(0.213)	(0.217)
PRODUCT INNOVATION	-0.120	-0.120	-0.119
	(0.228)	(0.228)	(0.225)
PATENTS	-0.307	-0.239	-0.236
	(0.401)	(0.406)	(0.396)
INTERNAL FINANCIAL CONSTRAINTS	-0.003**	-0.004**	-0.004**
	(0.002)	(0.002)	(0.002)
EXTERNAL FINANCIAL CONSTRAINTS	0.069	0.073	0.073
	(0.069)	(0.071)	(0.071)
EXPORT REMOTENESS INDEX	-0.473	-0.464	-0.485
	(0.500)	(0.881)	(0.759)
FOREIGN PARTICIPATION	-0.364*	-0.360	-0.383**
	(0.207)	(0.204)	(0.205)
DIFFERENTIATED PRODUCTS	-0.388*	-0.363*	-0.362*
	(0.215)	(0.220)	(0.221)
LEFT-CENSORED		-0.808***	-0.803***
		(0.284)	(0.290)
ABSORPTION			0.476
			(0.429)
EXCISION			1.461***
			(0.526)
Constant	-0.346	0.272	0.516
	(1.368)	(2.818)	(1.271)
Observations	9,811	9,811	9,811
Unobserved heterogeneity: LR Test of Gamma Variance=0			
Chibar2(01)	29.161	40.672	40.805
Prob≥chibar2	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

FIGURES

Figure 1: Kaplan-Meier survival estimate by size group

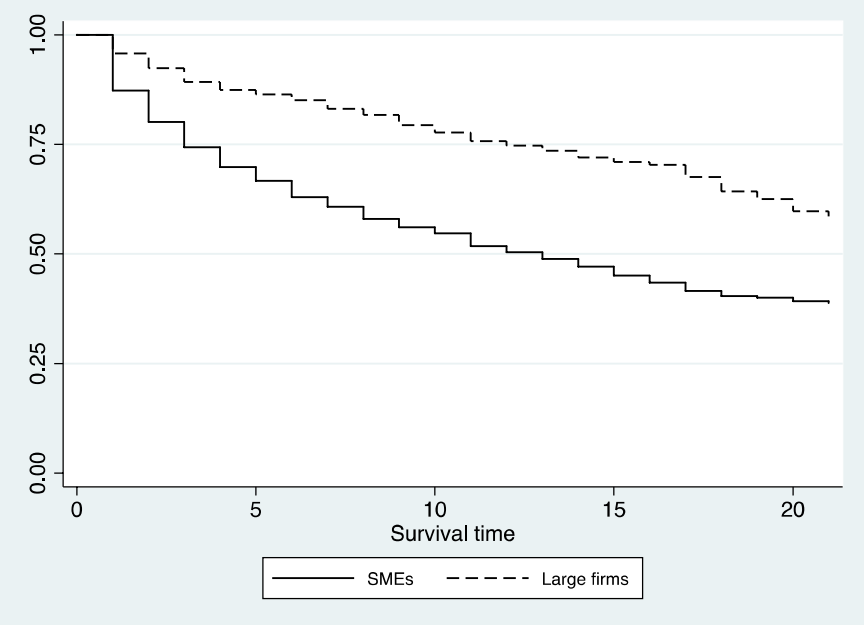
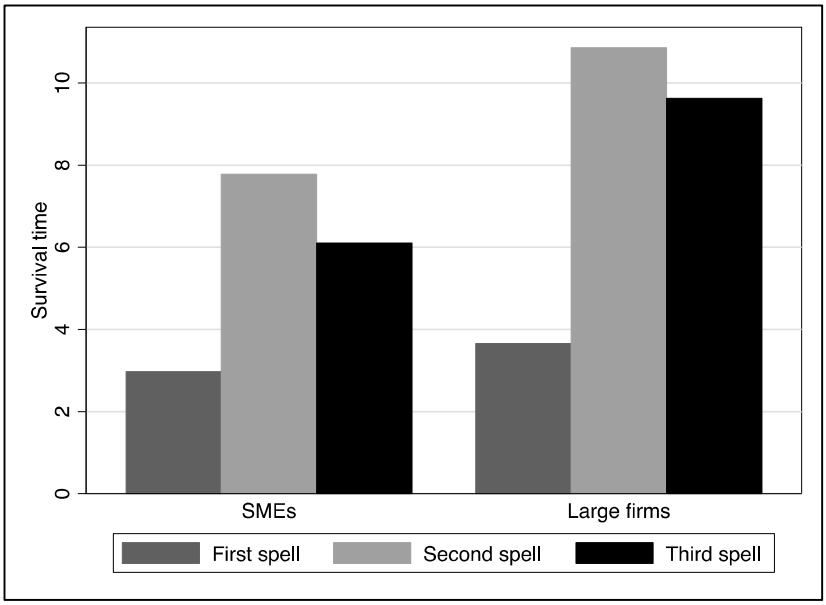
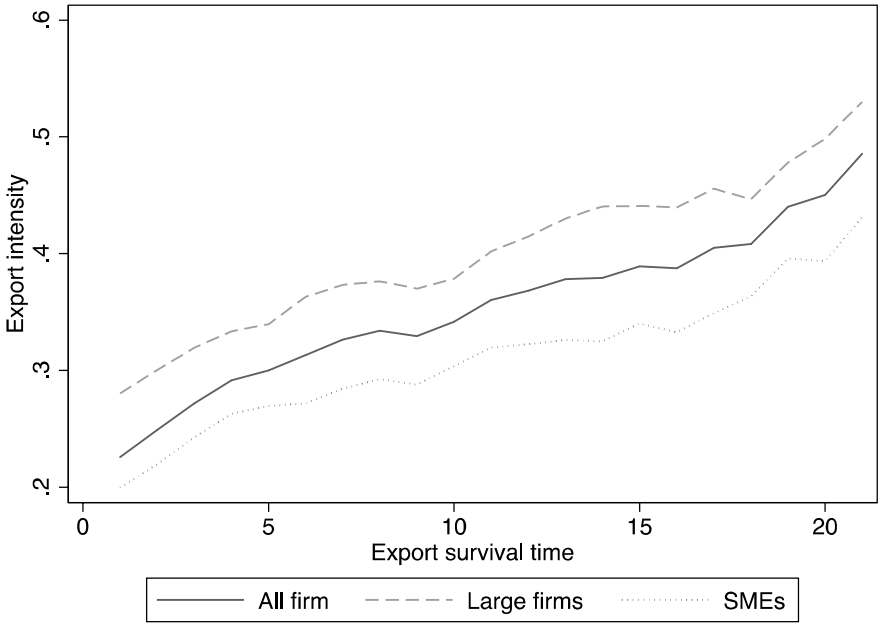


Figure 2: Average observed durations of export spell for episodic exporters



Note: We do not give figures for fourth and fifth spell because the reduced number of spells would make them scarcely reliable.

Figure 3: Export intensity and within-spell export experience



APPENDIX A

Absorption variables

To build the DOMESTIC ABSORPTION UPTURN variable, the rate of growth of absorption (defined as domestic production plus export minus imports) of the Spanish economy has been filtered using the Hodrick-Precott filter, as it is standard in the literature (see e.g. Jan-Benedict et al, 2011) to separate the cyclical component of this variable from their time trend. Then, following established practice in macro business cycle economics (Hodrick and Prescott 1997; Jan-Benedict et al. 2011), we consider that absorption is in a downturn when the absorption growth, calculated from the cyclical component of absorption, is negative (meaning that the economy absorption grows less than its long-term trend) and in an upturn when it is positive. Thus, our DOMESTIC ABSORPTION UPTURN variable is a dummy variable taking value 1 for the upturn periods and zero for the downturns. To calculate the FOREIGN ABSORPTION UPTURN dummy variable, we use as starting point the rate of growth of foreign absorption (defined as domestic production plus export minus imports for Spain's 5 most important export destinations – France, Portugal, Italy, UK an Germany), and use the same procedure described above to generate our FOREIGN ABSORPTION UPTURN dummy variable. This dummy variable takes value 1 for the upturn periods and zero for the downturns. All the data necessary to build the DOMESTIC ABSORPTION UPTURN and FOREIGN ABSORPTION UPTURN variables has been obtained from the World Development Indicators database of the World Bank.

Financial constraints

a) External financial constraints

In this work, we use an objective measure of firms' financial costs. Following Beneito et al. (2015) and Mañez *et al.* (2014), we use the cost of firms' new long-term debt. This cost is calculated as a weighted average of the unit cost of debts the firm has borrowed in a given year both from

banks (the bulk of debt) and from other long-term lenders:

$$cost_{it} = \frac{\left(cost_{it}^{Banks} \cdot Banks_{it}\right) + \left(cost_{it}^{Other} \cdot Other_{it}\right)}{Banks_{it} + Other_{it}}$$

where $Banks_{it}$ and $Other_{it}$ are firms' new long-term debts with banks and other long term lenders, respectively. Further, $cost_{it}^{Banks}$ and $cost_{it}^{Other}$ stand for their associated costs (as a percentage).

To avoid contamination from changing macroeconomic policies (such as over time reductions of interest rates) in the link between the cost of debt and tighter financial constraints, in our estimation specifications we will introduce the financial cost variable as the deviation (EXTERNAL FINANCIAL CONSTRAINTS$_{it}$) of the current firm's cost of financing with respect to the average cost paid by manufacturing firms in the same year:

$$\text{EXTERNAL FINANCIAL CONSTRAINTS}_{it} = cost_{it} - \sum_{i} \frac{cost_{it}}{N_{it}}$$

b) Internal financial constraints

We will use firm's cash flow as a proxy for internal financial constraints. Our measure of firm's cash flow has been calculated as firm's sales minus the sum of purchases, external services, and labour costs. This variable is deflated using industrial price indexes. Using similar arguments to those used for financial constraints, in estimation we will use our measure of internal financial constraints in deviations with respect to the average by year (INTERNAL FINANCIAL CONSTRAINTS$_{it}$).

Export remoteness index

The ESEE provides information on the geographical distribution of firm's export using a three-area classification: European Union (EU), other OECD countries (OECD) and Rest of World (ROW). Using this information we build an export remoteness index following a two-stage procedure.

In the first stage we build an effort difficulty index under the assumption that, the more difficult exporting to a given geographical area the smaller will be the percentage of firms in a given industry that export to this geographical area. First, we calculate the average percentage of firms of industry *j* (for j=1,...,20, two digit NACE industries) that export to area *k* (for k = EU, OECD, ROW), and name this average percentage p_j^k. Then, we define $p_j^{\max} = \max p_j^k$. $p_j^{\max}$ allows us to identify the geographical area at which exports by firms of industry *j* are more common. Then, we calculate the export difficulty index to area *k* for firms belonging to industry *j* as the ratio:

$$\tilde{p}_j^k = \frac{1}{p_j^k} p_j^{\max}$$

This index takes value 1 for the geographical area to which firms of industry *j* are more likely to export (the easiest export market) and values larger than for the other two areas. The value of this index is inversely related to the fraction of firms of industry *j* that export to area *k* (and so directly related to the difficulty of exporting to that area).

In the second stage, we calculate the export remoteness index (*ERI*) for firm *i* belonging to industry *j* as the weighted geometric mean of the effort difficulty indexes for the three areas. We use as weights the fractions of firm *i* total exports that represent the exports to each of the areas (w_{it}^k)

Thus, the ERI for firm *i* belonging to industry *j* in period *t* is given by:

$$ERI_{it} = \left(\frac{\sum_{k=UE,OECD,ROW} w_{it}^k \ln\left(\tilde{p}_j^k\right)}{\sum_{k=UE,OECD,ROW} w_{it}^k} \right)$$

The ERI index takes value bound below by 1. This is the case when a firm concentrate all its exports in the destination area more common to the industry it belongs to. However, the higher is the fraction of a firm's export

concentrated in geographical area that are less common across firms in a given industry, the higher is the value of this index.

ERC
Enterprise Research Centre

Centre Manager
Enterprise Research Centre
Warwick Business School
Coventry, CV4 7AL
Enquiries@enterpriseresearch.ac.uk

Centre Manager
Enterprise Research Centre
Aston Business School
Birmingham, B1 7ET
Enquiries@enterpriseresearch.ac.uk