International School of Economics at Tbilisi State University

(ISET)

Master's Thesis

Survival Analysis of Export Spells – Empirical Evidence from Georgia

By Nino Doghonadze

Supervisors: Michael Fünfzig

Karine Torosyan

2012

1. Introduction

According to the export-led-growth hypothesis, growth in export can promote economic growth of the country. Even though modern supporters of export promotion recognize the mutually beneficial nature of international trade both for exporters and importers and do not put much value on exports per se, they still emphasize the distinctive role of exports as a reliable indicator of the exporter's productivity. So, export growth is a fair sign of the country's overall productivity growth, which, in turn, is directly translated into economic growth. While vast empirical literature emphasizes the importance of diversification for developing countries, not much effort has been put into analyzing the persistence of exporting activity on the international markets until very recently. Indeed, diversification helps a country to find its comparative advantage. However, it is also important to study what determines the failure of the firms in foreign markets in order to preserve comparative advantage that has already been discovered and has been carried out successfully. Moreover, according to the learning-by-exporting literature, export is not just an indicator, but also the cause of productivity growth. So, from this point of view, continuous exporting activity is even more valuable.

In the following thesis I analyze the survival of Georgian exporters on the international markets. This is the logical continuation of the work on extensive and intensive margins of Georgian exports (Tsivadze, 2011) and, together with the latter, it aspires to contribute to the knowledge policy-makers need in order to plan and successfully implement any type of export-related initiative. After emphasizing the importance of product as well as spatial diversification for the country based on the product-level data (Tsivadze, 2011), it is relevant to ask what factors hinder Georgian exporters from maintaining their exporting status.

I extend the analysis of Georgian exports by investigating the survival (i.e. ability of a given firm to continue exporting a particular product to a particular destination from year to year) of

Georgian exporter firms as a part of an intensive margin. Doing so, I am able to quantify the effects of variation in spell- (i.e. the continuous number of years a firm exports to a given foreign market), destination- and firm-specific variables on the probability of spell failure (i.e. exit of a given firm from a given export market) conditional on survival up to some point in time. The anonymized firm-level data, provided by the Statistics Office of Georgia, includes almost all the large firms and randomly selected pool of medium-sized and small-scale firms. The empirical model used in this thesis mainly follows Roberts and Tybout (1997) formulation of annual decision about whether to export or not, adjusted to the survival analysis framework. As for the econometric technique, the paper relies on Prentice-Gloeckler (1978) discrete time survival analysis model, which is commonly applied while analyzing trade spells because of the interval-censored (we do not observe the exact times of exiting the export market, we just know the termination year of the spell) nature of trade data and the existence of unobserved individual characteristics. The main model accounts for unobserved individual heterogeneity between the firms in order to avoid inconsistency associated with the inability of observing all the firm-specific variables. Despite the number of advantages of the main model, it is incapable of incorporating fixed effects and duration dependence because of computational issues. That is why the other two robustness checks are conducted which allows controlling for the industry and country fixed effects and parametrizing the baseline hazard together with accounting for a possible serial correlation between the spells of the same firm.

I find that firms with large export volumes and more experience export longer and moreover, even previous failure to export to the same destination enhances the survival of the returnees. As it would be logically expected, preferential agreements as well as destination diversification delay failure, while the Russian embargo in April 2006 and the tandem of the world economic crisis and the August War in 2008 made exporters more prone to failure.

The paper is organized as follows: section 2 reviews the related theoretical and empirical literature, section 3 describes data under consideration, section 4 explains the applied empirical and econometric methodology in details, section 5 presents the results, and finally, section 6 draws conclusions and points out directions for future research.

2. Literature Review

Despite the fact that exports are not valuable per se, we frequently observe many politicians and even economists praising and supporting promotion of exports. Theoretical foundation for the new role of exports stems from the so-called learning-by-exporting literature that emphasized a causality running from export to productivity. This belief was further advanced by the Asian miracle – the fast economic growth in the East Asian countries – that was preceded by active outward-oriented policies. Despite the popularity of this literature, the casual link from export to productivity was not empirically validated, confirming the Melitz's (2002) view that, actually, the opposite is true. However, particular benefits stemming from exporting activity were emphasized, such as increased longevity for exporters (Bernard and Jensen, 1999) and positive externalities for non-exporters in the form of easiness to break into foreign markets and lowered input prices (Clerides et al, 1998). In contrast to the learning-by-exporting literature, according to Melitz (2002) a high share of exporters in a particular industry is simply a good indicator of a productive industry. Even if exporting is just a sign, exit of a firm from the export market is still not good news. According to Clerides et al. (1998), plants that stop exporting have increasingly high costs, i.e. lower efficiency. One might argue that it is exporting in general, rather than exporting to a particular destination, that matters in this case. However, except some very special circumstances, similar to the Russian embargo in 2006, the failure to export to a particular destination has to do with a firm's inefficiency.

The theoretical foundation of the export market participation rule was laid down by Baldwin and Krugman (1989) and Dixit (1989). This rule is based on the export hysteresis hypothesis, which implies that sunk entry or exit costs drive hysteresis in trade flows, i.e. make exporters insensitive to temporary changes while deciding on their export status. This has important implications for trade policy: if measures taken for improving the entry of firms into export markets are successful then removing the stimulus will rarely reverse trade flows if the sunk costs are substantial. To test the hypothesis of export hysteresis on the example of Columbia, Roberts and Tybout (1997) built their empirical model on the basis of the existing theoretical background. In their model, export market participation is an annual decision by the firm that is a function of past exporting experience, sunk costs of entry and expectations about the determinants of future profits from exporting. For the further and more in-depth discussion of their empirical model, see section 4. As for the authors' empirical results, they showed that entry sunk costs are important and reentry cost, after 2 years of absence from the international market, is not significantly different from the initial one.

Besedes and Prusa (2007) were the first researchers who looked beyond the extensive and intensive margins in order to evaluate export success at the product level. Using the survival analysis technique, they found out that the duration of product exports from developing countries does not only fall behind the export duration of developed countries, but also rarely lasts for more than two years. This is an alarming result pointing to the fact that most attempts of product diversification are not really successful.

The reasons behind the low survival rates of developing countries were explored by Brenton, Saborowski and Uexkull (2009). The authors used initial value of trade relationships, foreign exchange rate volatility, preferential agreement, exporting experience and other ordinary gravity variables to uncover the determinants of survival rates. The scholars extended the dataset of the previous research and improved the applied econometric technique by accounting for the

unobserved individual heterogeneity of the products. They confirmed the negative duration dependence, meaning that the longer the product is exported; the lower is the chance of failure. Additionally, they confirmed the results of the usual gravity model that worked the same way for the product survival, as for the trade volumes. The most surprising result of this study is that preferential trade agreement increases the hazard rate, which seems vague and can be questioned. But if it is true, then it implies that attempts of the developing countries to achieve and sustain those trade preferences are not justified. Finally, the authors emphasized that the policies targeted at export promotion should carefully tackle the reasons of the low survival.

Bernard et al. (2007) emphasized the role of the narrowing the focus towards firms from the conventional units of analysis in international trade such as countries or industries. While earlier theoretical models of trade as well as earlier empirical works were mainly state-centric, new developments in theory (Melitz, 2002) and empirics (Pavcnik, 2002), following the increased availability of firm-level data, allowed economists to look at international trade in more detail. The studies below used firm-level data to indentify factors which explain exporter survival.

The investigation of the turnover of Chilean firms in international markets (Alvarez and Lopez, 2006) confirmed the export hysteresis hypothesis by showing that real exchange rate has no significant effect on entry, as well as exit. Additionally, the authors highlighted the importance of industry fixed effects as well as firm heterogeneity. The importance of industry characteristics were also emphasized in the study of the Spanish manufacturing product exporters' survival (Esteve-Perez et al., 2007). The authors concluded that larger, older, more productive producers and exporters of final goods are more long-lived and that export intensity plays significant role in determining export persistence.

A similar study was conducted in Ghana, examining the manufacturing export survival (Adada Mohammed, 2011) that confirmed the negative duration dependence and positive effect of firm size, age and export intensity, while rejected the importance of productivity and foreign

capital participation. As for the product characteristics, this study documented results opposite to those of the Spanish study: final goods producers are more likely to fail sooner. Despite such contradictory results, finding from Ghana is more in line with the previous findings that reported lower survival rates for differentiated goods (Brenton, Saborowski and Uexkull, 2009). So, the result of the Spanish study can be questioned in this aspect. But the Ghanaian exporter study is not perfect either. Most probably, the small sample size is the reason behind the insignificance of productivity and foreign capital participation.

Another survival analysis of African exporters used a combination of probit and OLS estimation (Cadot et al., 2010). Despite such different methodology, the scholars confirmed an important positive effect of experience in products and destinations and a lower survival rate for differentiated products. Besides, they also documented other interesting observations: firms, experienced in destinations are able to export even low-quantity products for a long time, while firms with expertise in products survive thanks to a large quantity exports. Another interesting implication of the findings is that agglomeration, implying joint export of the same good to the same country by a group of firms, increases survival within the group. This finding emphasizes the positive effect of the established exporters on newcomers.

Sabuhoro and Gervais (2004) non-parametrically estimated the exporting duration of the Canadian population of firms with sales amounting to more than 30 000$. They corroborated the common results found in this type of literature which state that larger firms export longer. However, the most interesting finding of this paper is that firms learn from their mistakes, meaning that reentering the market after the previous failure enhances survival.

The very recent survival analysis of the developing economies' exporter firms explored the determinants of firm survival (Tovar and Martinez, 2011). The research pointed to the new variables affecting the probability of survival. According to Tovar and Meier, the number of

products the firm exports has a slightly positive effect on export survival, while variety of export destinations significantly prolongs export persistence of the firm.

I conduct the survival analysis of Georgian exporters and by doing so contribute one more country-specific paper to the existing literature. Besides, if Georgian future industrial policy is to have an export promotion branch, this study will also be valuable for policy planning purposes.

3. Data

The firm-level data for Georgian companies used for the analysis below was provided by the Statistics Office of Georgia. Even though firm-level information is confidential, information about the sample of exporters with anonymized codes became available to me thanks to the Statistics Office. Each firm in the dataset was assigned a unique code in order to track exporters over time. The data consists of two parts: exporter database over the years 2003-2011 and business statistics during the years 2005-2010. The first part includes information about whether a given firm was among the exporters in a given year or not and, if it was, which country or countries it exported to. Even though direct export revenue data is not available, the firms are ranked according to this characteristic each year. The other part of the data includes the registration dates of the firms and annual data about the overall sales revenue, employment, size, the product produced and type of property. The two parts of the data come from different sources: export data is collected from the custom's declarations, while business registry usually includes information about all the large firms and about a randomly selected pool of medium-sized and small-scale firms collected by the Statistics Office of Georgia.

Sampling is a problem because, while the large firm representation varies from 80% to 98%, the share of small and medium-sized firms in the sample, grouped together, amounts to just 7%

to 21% of the corresponding group in the population. But as long as better data is not available, the use of the data in which the two types of firms are underrepresented can be justified as long as they are selected randomly. Possibility of weighting the observations was also considered in order to treat the sampling problem, however as no reliable information was available about the exact composition of the population by size variable, this option was eliminated. Besides, the used data is quite large and even if its external validity is problematic, its internal validity is still enough to make predictions at least about the large firms, which are widely represented. The dynamics of the number of exporters in the population are presented in Chart 1. While the number of big firms is not large, their share has grown over time and in 2010 they have already represented about a third of the whole population. The Russian embargo in 2006 halved the number of Georgian exporters and small and medium-sized firms were the ones that were damaged the most. While large firms with many export destinations stayed among the exporters, two thirds of small and medium-sized enterprises were forced out of the international market. On the other hand, the financial crisis and the war in 2008 affected large firms as well.

I converted the initial data to the survival format, defining an export spell as a continuous number of years a given firm exports to a given destination. So, there are multiple spells per firm in two cases: when a firm exports to two or more destinations or when a firm fails and then resumes exporting again after one or more periods. Failure is meant to indicate the absence of a firm from a given export market after at least a year of continuous exporting. There are 4028 spells useful for the estimation, out of which 1488 are right-censored, meaning that they did not experience failure during the sample period and 236 are left-truncated, meaning that they have already been started before coming under observation. Left-truncation is tolerable under a survival analysis if, at least, information about the length of exporting experience before coming under observation is known. Thus, I am forced to ignore all the export spells starting in 2003 and before, as I do not know for sure when they started. On the other hand, I can maintain the spells started in 2004. The largest observed duration of exporting in the sample valid for the analysis is

7 years. This, as well as the mean and median durations of the sample, is not informative, because of the left-truncation and right-censoring issues mentioned above.

The data is grouped in three categories (spell-, destination- and firm-specific variables) in order not to double-count some observations. The summary statistics of the spell- and firm-specific variables are represented in Table 1.

The spell-specific variables I constructed are two dummies indicating failure experience since 2004. The choice of the year, 2004, is both logical and justified because after the Rose Revolution the regime was changed, which, in turn, changed the overall functioning of the economy and, most probably, also influenced the export pattern. Moreover, as corruption declined substantially, since then the data is more reliable as well. The first dummy is 1 if a firm has failed to export to the exact same destination, while the other dummy captures the failure experience of the firm to any other destination. 555 spells have failure experience to the same destination, while 1723 have failure experience to any other destination.

Another set of variables characterize the export destination country. They include GSP, FTA and exchange rate changes.

Frequency distribution of the export spells by destinations is represented in Table 2. Not surprisingly, most of the exporters target neighboring and the former Soviet Union countries, most probably due to fewer communication and transportation barriers, as well as the existing historical ties, inherited from the centrally planned specialization during the USSR. But the newly-established preferential agreements like Generalized Preferential Agreements (GSP and GSP+) appear to play a role at the margin of entry as well. Mainly because of this, European countries like Germany, Italy and the UK and a strategic partner of Georgia, the USA, are among the top destinations as well.

Georgia has different trade regimes with different export destinations. The country has been a beneficiary of Generalized System of Preferences with the EU, the USA, Japan, Canada, Switzerland and Norway and free trade agreements with Turkey and the former Soviet Union countries during the sample period. Variables GSP and FTA were created in order to account for the trade regime with the export destination. 38% of the spells in the sample at hand are towards countries with a GSP regime, while 40% are towards countries with which Georgia has fully liberal mutual trade agreements.

As for exchange rates, I obtained the daily exchange rates from the website of the National Bank of Georgia, derived annual averages and, in order to control for differences in the units of measurement, took the percentage changes since the last year. For the currencies, we do not have direct exchange rates with and which amount to about 6% of all the observations, I have imputed GEL-USD exchange rate changes in order not to lose the valuable observations. Imputation is justified, as long as Georgia is still a highly dollarized country and USD is a currency widely used in international trade. These percentage changes of the exchange rate normally range from 15% to 12% that is quite stable, with outliers mainly appearing just because of currency changes in other countries.

The last set of variables is firm- and time-specific variables. So, their description is more convenient in terms of firm-years in order not to double-count a firm if it exports to more than one destination in a particular period. In total, there are 2874 such firm-year observations in the sample. Chart 2 shows the number of exporters in the sample over the sample period 2005-2010 by size variable. Another issue with this set of characteristics is that, in order to observe the extent to which the sampling will drive the results, consideration of these variables with respect to the sampling variable (that is size) might be useful. Size itself is defined as large if a firm either has sales above 1.5mln GEL or employment above 101, medium if it does not belong to the large firms and has sales between 0.5mln and 1.5mln GEL or employment between 20 and

100 and small if its sales are below 0.5mln GEL and employment below 20. Other firm-specific variables are industry, number of destinations, ownership structure, employment, sales, ranking and age of the firm. None of the firms in the sample is a successor of the Soviet enterprise, as the earliest observed registration date is year 1995.

Industry characteristics by firm size are presented in Table 3. Not surprisingly, the proportion of large firms is higher in each industry except agriculture and fishing. As for these industries, small firms naturally dominate the exporter firm-years. Additionally, most exporters overall and in each size category operate in manufacturing, trade and repair industries.

The number of destinations per firm-year by size is represented in Table 4. Large firms are leaders in any number of destinations and, additionally, only they are observed to be exporting to more than 20 countries at the same time, while medium-sized firms rarely export to more than 10 countries and small-scale firms to more than 5 destinations.

Ownership status of the firms is cross-tabulated with the size variable in Table 5. The overall frequency distribution as well as distribution by firm size suggests that private firms are more prevalent, while mixed ownership firms constitute only a tiny proportion of the exporters. Unfortunately, I could not obtain information about foreign participation in the firms, even though this information, according to the export survival literature, is an important determinant of the spell longevity.

As for employment, it ranges from 1 up to 15109, with half the firm-years having less than 30 employees and only top 5 percentile having employment above 500. The overall sales are measured in constant GEL for year 2000, with median sales amounting to approximately 3 million GEL. That is another way to see the sample selection. As for the firm age, a median firm in my sample first experiments with exporting after 4 years from its establishment, the most extreme case being when a firm started to export at the age of 15.

4. Methodology

4.1. Empirical Framework

Even though Roberts and Tybout (1997) model is not the exact same compared to what I analyze here, minor changes to it would make it more compatible with the survival analysis framework. So, in this subsection I will mainly follow their formulation of the problem. Firm i's profit from exporting in year t is defined as:

$$R_{it}\left(Y_{it}^{(-)}\right) = Y_{it}\left[\pi_{it} - F_i^0\left(1 - Y_{i,t-1}\right) - \sum_{j=2}^{Ji}\left(F_i^j - F_i^0\right)\tilde{Y}_{i,t-j}\right] - X_i Y_{i,t-1}(1 - Y_{it}) \quad (1)$$

where R_{it} is a payoff from exporting, $Y_{it}^{(-)}$ -- a binary variable equal to one if firm$i$ is an exporter in year t. π_{it} is the difference between gross profits from exporting and not exporting in year t, F_i^0 is the entry sunk cost if a firm has never exported before, F_i^j is a cost of reentry after j periods from the previous exports and X_i is the exit cost. Export participation rule that a firm will export if present discounted value of the future profits from exporting is higher than that from not exporting is formalized below:

$$\pi_i(p_t, s_{it}) + \delta\left[E_t\left(V_{i,t+1}(\Omega_{i.t+1})|Y_{it} = 1\right) - E_t(V_{i,t+1}(\Omega_{i,t+1})|Y_{it} = 0\right] \geq F_i^0 -$$

$$(F_i^0 + X_i)Y_{i,t-1} + \sum_{j=2}^{J_i}\left(F_i^0 - F_i^j\right)\tilde{Y}_{i,t-j} \quad (2)$$

where δ stands for a one-period discount factor, π_i is current payoff from exporting and is a function of the set of variables determined exogenously and represented as vector p_t and plant-specific variables denoted by s_{it}. The term in the square brackets is a PDV of future profits conditioned on the current information set. Intertemporal optimization makes the decision of exporting a function of expectation about the determinants of future profits as well. As for $-(F_i^o + X_i)$, this is what Dixit referred to as "hysteresis band" (1989 a) and this is exactly what makes exporters maintain their exporting activity even if unfavorable economic conditions are in

place, as long as they are expected to be only temporary. Temporary changes affect only current profits, while future profits are not influenced. So, exporters prefer to be in a loss for a while rather than exit and then pay a high exit and sunk cost of reentry again.

When considering the decision about continuation of exporting rather than a general entry decision, it is implicitly assumed that a firm was an exporter last year, so $Y_{i,t-1} = 1$ and the transformed participation rule breaks down to the simpler expression:

$$\pi_i(p_t, s_{it}) + \delta\left[E_t\left(V_{i,t+1}\left(\Omega_{i,t+1}\right)\middle|Y_{it} = 1\right) - E_t\left(V_{i,t+1}\left(\Omega_{i,t+1}\right)\middle|Y_{it} = 0\right)\right] \geq -X_i \quad (3)$$

Defining the right-hand-side of the equation to be a latent variableπ_{it}^*, we observe a success (continuation of exporting activity) if the sum of the latent variable and fixed cost of entry exceeds zero, otherwise firms fail to export in a given year.

$$Y_{it=} \begin{cases} 1 \; if \; \pi_{it}^* + X_i \geq 0 \\ 0 \; otherwise \end{cases} \quad (4)$$

Additionally, even though reentry decision is not my main focus, I am still able to compare the sunk entry cost of a new entrant to that of a reentrant, these, in terms of Roberts and Tybout, are $F_i^0$and F_i^j, respectively. A simplifying assumption I use for the estimation purposes here is that no matter how many years a firm is out of the international market, it gets the same sunk cost of reentry (different from entry cost) and this cost is equal for all the firms. So, $F_i^j = F \neq F_i^0$. This assumption is not very restrictive, in fact, because as the data spans only 6 years there is not much variation in the years out of the market. Besides, I differentiate between the reentry cost to the same and to a different market and compare these two as well.

Despite some minor changes, I follow Roberts and Tybout strategy of estimating the reduced form equation in terms of observable characteristics of type p_t such as: exchange rate fluctuations, trade agreements, 2006 embargo and 2008 crisis and s_{it} type variables, such as firm size, employment, sales revenue, export volume, number of export destinations, failure

experienced, age, type of property and age of the spell. The latter is the variable of duration dependence that will approximate the effect of the annual fixed cost of exporting, like demand and competitor studies, on the decision to quit exporting.

4.2. Econometric Technique

Survival analysis is an econometric technique that, even though frequently used in bio- and social sciences, was recently introduced in economics. This name unifies a range of models from continuous to discrete time, from non-parametric to parametric and from those with or without accounting for unobserved heterogeneity between the subjects. Survival analysis in economics was first adopted by labor economists to analyze unemployment spells but it later became a tool for studying export dynamics as well.

The left-truncation and right-censoring is an issue for almost all kinds of survival data. The former, which is a start of the spell before the firm comes under investigation, leads to a systematic exclusion of some subjects. For instance, in case of the Georgian exporter data, I am forced to ignore all the observations for which I do not exactly observe the age of the spell. Even so, I could save about 200 observations that are left-truncated, as I do not observe any covariates until year 2005, but I do know the age of the spell for sure. Discrete time modeling gives the possibility to incorporate these observations in the model. The right-censoring problem is that we do not observe all the spells terminating. To illustrate this using the example of my sample, this means that there were some firms still exporting in the end of the sample period, in 2010, which are considered as right-censored. All the survival analysis models take account of this by introducing a censoring indicator in the likelihood function.

The peculiarity of trade data is that we observe the variables monthly or annually and the survival literature refers to this as interval-censoring. Exactly this has made empirical economists, who studied trade spells, use discrete time modeling instead of the wide-spread Cox model, which is a semi-parametric continuous time model and which suffers from the problem of tied durations when applied to the interval-censored data (Hess and Persson, 2010). Tied duration, in turn, is the case when several subjects are observed to fail after the same interval of time and their ranking, according to their survival times, becomes problematic.

As for unobserved heterogeneity, it is not a problem of only survival analysis; it is a problem of all kinds of estimation techniques. We rarely observe all the determinants of the variable of interest, but their omission is a source of biased estimates and over-estimation of the negative duration dependence and under-estimation of the positive one in the survival analysis (Jenkins, 1995). While accounting for this problem, a researcher imposes a particular distribution (usually Gamma distribution) on the shape of the unobserved heterogeneity. In case of the data under consideration here, this procedure helps to treat multiple durations properly. I model unobserved heterogeneity between the firms, so, all the spells of a particular firm have a common intrinsic inclination to failure.

Discrete time modeling of the duration was first proposed by Alison (1982). He introduced a complementary log-log link function for modeling the event history for single-spell data. But applying the same model to multiple spell data would have caused, at the very least, biased standard errors and, in some cases, even biased coefficient estimates. Prentice and Gloeckler (1978) proposed to model the unobserved individual heterogeneity between the groups or individual objects under consideration. The usage of this model has a number of advantages. Firstly, it is preferred to continuous time models because of the interval-censored nature of the export data. Secondly, it incorporates the time-varying covariates more conveniently. Thirdly, it allows treating left-truncation properly. And finally, it is more reliable while dealing with multi-

spell data. The only serious drawback of this model is the limiting assumption of proportional hazards, but this is a cost that I should undergo in exchange for all the four good properties discussed above. Even so, exactly this assumption makes interpretation simple and understandable.

In discussing the methodology and deriving the likelihood function, I mainly follow Jenkins (1995). For any discrete time survival model, observed in intervals$[a_1, a_2)$, $[a_2, a_3)$, … $[a_{j-1}, a_j)$ … and so on the probability of failure in an arbitrary interval $[a_{j-1}, a_j)$ is :

$$pr\{T \in [a_{j-1}, a_j)\} = S(a_{j-1};\, X_{it}) - S(a_j;\, X_{it}) \tag{4}$$

where the first term is survival beyond $j-1$ and the second – beyond j. In contrast to continuous time models, in which hazard is a rate, it now becomes a simple probability but is defined similarly as a chance of failure in a given interval of time conditional on survival up to this interval.

$$h_j(X_{it}) = pr(\{T \in [a_{j-1}, a_j) | T \geq a_{j-1}\} = 1 - \frac{S(a_j; X_{it})}{S(a_{j-1};\, X_{it})} \tag{5}$$

As Jenkins (1995) has shown, the log-likelihood function for the arbitrarily distributed hazard with right-censored and left-truncated survival time data is:

$$logL(\beta, \delta) = \sum_{i=1}^{n} (c_i\{log\ [S(t_i - 1;\, X_{it}) - S(t_i\,;\, X_{it})]\} - (1 - c_i)\{logS(t_i, X_{it}))\} \tag{6}$$

where t_i is a time to failure or right censoring, while c_i is a binary variable equal to 1 if firm i contributes a complete spell and 0 if the spell is right-censored, i.e. failure is not observed during the sample period. So, a complete spell contributes the first term in curly brackets and a right-censored one – the second term in other curly brackets to the log-likelihood function. As for the left-truncated spells, i.e. spells that were exposed to the risk of failure before coming under observation, the only thing that matters is to know t_i , that is equivalent to having information about in which year of its exporting history the firm was when it came under observation. For the

complementary log-log distributed hazard with gamma unobserved heterogeneity the above log-likelihood is transformed to:

$$\log L = \sum_{i=1}^{n} \log\{ (1 - c_i)A_i + c_i B_i\}$$

where $A_i = [\ 1 + v \sum_{j=1}^{t_i} \exp[X_{ij}^{'} \beta + \ \theta(j)]]^{-(1/v)}$

and $B_{i=}[1 + v \sum_{j=1}^{t_i - 1} \exp[X_{ij}^{'} \beta + \theta(j)]]^{-(1/v)}$ (7)

where v accounts for the gamma distributed unobserved heterogeneity and $\theta(j)$ is a function of duration dependence.

I estimate this model using STATA 10, but as long as it is computationally complicated, even for the software, I am limited to specifications. So, I am facing the tradeoff between accounting for heterogeneity and accounting for fixed effects. That is why I present alternative specifications with and without destination-specific fixed effects. By doing so, I check the robustness of the results. Robustness checks are the ordinary complementary log-log regressions with clustering between the spells of the same firm which is the special case of the likelihood above, when v → 0, i.e. there is no unobserved heterogeneity.

5. Results

Regression results are presented in Table 6. As was expected, Prentice-Gloeckler (1978) model with unobserved heterogeneity offered the best fit, so I will mainly refer to these results. The discussion of the results is organized in relation to the three sets of characteristics: spell-, destination- and firm-specific.

Spell-specific characteristics capture the effect of sunk entry versus reentry cost on export market. The difference between these two sunk costs is related to the exporting experience of the firm. Even though a discontinuity in the exporting activity of the firm means failure, reentrants are still much more experienced, compared to new entrants, as they have carried out foreign trade activity at least once. But exporting experience can be general or destination-specific. It is interesting to see whether firms learn on their own mistakes and if they do, then we would observe that reentrants export longer than new entrants. The results show that reentry enhances survival. However, while firms with a previous failure to export to the same destination have 55% higher probability of survival as compared to new entrants. The significance of the effect of failure to export to the destination other than the current one on the enhancement of the reentrant survival is sensitive to the econometric model specification. This observation quite logically emphasizes the role of destination-specific experience and fairly understates the importance of the general exporting experience that approximates the effect of Georgian regulations on the exporters. If regulations were complicated, reentry costs would be not very different for the two groups of the firms failed to the same versus different destinations. This would point to regulations as an important barrier for the exporter success. In fact, export regulations are quite simple and favorable and most probably, do not hinder exporters from exporting longer. This is confirmed by the data: the significance of the destination-specific failure to export experience and sensitivity of the significance of the general failure to export experience dummy indicates that it is destination that determines the reentry cost more than local regulations.

As for the duration dependence of the hazard rate, it has something interesting to say about the annual fixed cost of exporting. In the baseline regression I could not control for the duration dependence and left it unparametrized. But, according to any other specification, hazard probability diminishes the longer the firm stays on the international market. In terms of fixed costs, annual fixed cost of exporting, which might, for instance, involve demand and competitor studies, diminishes as the firm gets used to the rules of the game on the foreign market. The

relationship between the age of the spell and probability of survival is almost monotonic, the 6th year being the exception. This strange result might be the consequence of the sample selection.

Survival of exporters is also influenced by country-specific characteristics. I only model the effects of preferential agreements and exchange rate fluctuations in the main model, but in order to carefully observe other country-specific variations than the above destination-specific variables in the survival, I conduct a robustness check by accounting for the country fixed effects as well.

In the earlier study (Brenton, Saborowski and Uexkull, 2009) it was suggested that preferential agreements shorten, rather than lengthen, export durations. The Georgian data suggests an absolute opposite and, obviously, more logical result. Having a free trade agreement with the destination country significantly reduces the chance of failure in every specification. Moreover, when the country fixed effects are accounted for, free trade agreements increase survival probability by 81% versus 36% in the main model.

As for the generalized system of preferences, it is significant in every specification as well, but the magnitude becomes substantially larger once accounted for the country fixed effects, which implies that preferential agreements enhance, rather than prevent, the firms' capacity to export longer. The explanation of this finding might be that firms from developing countries fail on the industrialized markets due to destination-specific patterns rather than because of preferential agreements. Once they are broken into the foreign market, firms need to acquire information about local standards themselves, while when a preferential treatment is formalized it greatly reduces uncertainty and the firm's decision is more precise and less random, as it already possesses a huge amount of knowledge. Of course, uncertainty is not the only factor responsible for this. Usually, preferential agreements include lower import tariffs, so this leads to a decrease in marginal costs as well. Additionally, most probably the firms have quite high sunk costs spent on meeting international standards required in the GSP countries. Consequently,

these firms are more willing to maintain their exporting status to such destinations and that is why export hysteresis takes place.

Some papers (Roberts and Tybout, 1997) which aspire to advice export-promotion policies have deduced that exchange rate appreciation, as compared to depreciation, has a disproportionately effect on export dynamics. Others have simply neglected currency devaluation as an important source of export promotion. I allow for asymmetric modeling of appreciation versus depreciation of the GEL and find that currency depreciation has a significant, but very small, effect on export survival. So, it seems that devaluation is not a good way to promote export longevity in Georgia. As for appreciation, it reduces the chance of failure quite significantly in every specification. Here, appreciation might have been reflecting the favorable macroeconomic conditions and that is why its effect on export duration is substantially positive.

The last set of characteristics is firm-specific and plays an important role in determining the export profits.

Employment, which is a more reliable objective measure of the firm size, as compared to the composite size variable used for sampling, is still significant even if the unobserved heterogeneity and sampling by size (that is, a combination of sales and employment) is taken into account. Even so, it increases, rather than decreases, the hazard significantly. This might be related to labor intensity of production, emphasizing the lack of sophistication and innovation in such economic activities. As for the case of measuring size in terms of the Statistics Office's classification, medium and small firms have less favorable survival prospects as compared to their larger counterparts. Even though this result is internally valid, we should be very careful in generalizing it on the general population, taking sampling into account. Nevertheless, the result is quite logical, pointing to such characteristics of larger firms as increasing returns to scale, capability to bear large fixed costs of meeting international standards and ability to innovate and experiment with many destinations.

The effect of ownership structure was also not surprising. Private firms are the leaders in this respect. The significance of the public and mixed ownership effects is sensitive to changes in specification but, when significant private firms with more private initiative and less bureaucracy are fitter and survive longer.

A quadratic relationship between the firm survival and age was observed in many previous studies. In this study, such a specification also performs better than the linear one. The interpretation is quite simple: very young firms are less experienced and so they are more prone to failure up to some point and as they become sufficiently mature, survival is enhanced from there on. In fact, based on the results, the turning point is less than one year, so it can be said that each subsequent additional year of operation reduces the probability of failure on the foreign market at an increasing rate.

As long as export revenue data is not available, I am not able to estimate its exact effect. But I have a ranking of exporters in my sample according to their export volumes starting from 1, which is the largest exporter. So, I used exporter quartiles as a proxy of export volumes. Although the estimates are going to be quite crude, it is better than nothing. As it appears, hazard probability increases up to the 4^{th} quartile, but then it declines a bit, i.e. bottom quartiles have a higher probability of failure compared to the firms exporting large volumes. Even so, the last quartile is not as prone to failure as quartile 3. This implies that filling and maintaining the very small niches abroad is easier and it guarantees persistence, but not necessarily growth in the export volumes.

The significance of the effect of sales revenue is specification-specific, but the monotonically increasing relationship between the sales revenue and the survival is maintained everywhere. Significance is undermined when ranking quartiles are brought to the regression, implying that it is export revenues that matter for the spell longevity to a larger extent and sales were just appropriating their effect.

The last firm-specific variable is the number of destinations. As it appears, the more spatially diversified the firm is in a given year, the higher the survival prospects for each direction. The number of destinations is not only the way of experimentation, but also a sign of maturity and sophistication. So, experience and special ability to keep ties with many trading partners enhances survival.

There were two important circumstances during the sample period that adversely affected the overall economic situation in Georgia. The first one was the Russian embargo in April 2006 and the second – the world financial crisis of 2008 intertwined with the armed conflict with Russia in August. Both of them substantially increased the chance of failure for the firms in the sample, but the embargo was obviously more harmful for the firms exporting to Russia then the 2008 crisis was for the whole sample of exporters.

6. Concluding Remarks

In this paper I analyze the determinants of survival of a sample of the Georgian firms on particular export markets. I find out that sizable and spatially diversified firms are less prone to failure, initial sunk cost of entry is substantially higher than that of reentry and fixed cost of exporting decreases with years of exporting. Additionally, in contrast to the previous study, preferential agreements do enhance, rather than shorten, the longevity of the firms. More in line with the export hysteresis hypothesis, exchange rate fluctuations significantly, but not substantially, reduce the chance of failure.

Even though almost all the results are logical and close to what economic intuition would suggest, further research could expand the dataset and obtain a sample that would be more representative of the population of exporters, with more covariates and with more variation in

these covariates, which would allow for better specification of the model. One could also use the existing sample and weight the observations accordingly. But to do this one would need to have additional information from the government agencies, which is difficult to obtain. Another improvement would be relaxing the proportionality assumption and comparing the results.

References

Adada Mohammed, A_R. 2011. *Determinants of Export Survival: The Case of Ghanaian Manufacturers.* Working Paper.

Alvarez, Roberto. And Ricardo Lopez. 2008. *Entry and Exit in International Markets: Evidence from Chilean Data.* Review of International Economics, Vol.16(4): 692-708.

Alison, Paul D. 1982. *Discrete-Time Methods for the Analysis of Event Histories*. Sociological Methodology. Vol. 13 : 61-98.

Bernard, Andrew B.and J. Bradford Jensen. 1999. *Exceptional Exporter Performance: Cause, Effect or Both?* Journal of International Economics, Vol.47: 1-25.

Bernard, Andrew B., Jensen, J. Bradford, Redding, Stephen J., and Schott, Peter K. 2007.*Firms in International Trade.* Journal of Economic Perspectives, Vol.21: 105-130.

Besedes, T., and Thomas J.Prusa. 2007. *The Role of Extensive and Intensive Margins and Export Growth.* Journal of Development Economics.

Brenton, P., Saborowski, C., and Erik vonUexkull. 2010. *What Explains the Low Survival Rate of Developing Country Export Flows?* World Bank Economic Review, Vol.24(3): 474-499.

Cadot, O., Iacovone, L., Rauch, F., and Denisse Pierolla. 2010. *Success and Failure of African Exporters.* World Bank Research Project.

Clerides, Sofronis K., Lach, saul. and James R. Tybout. 1998. *Is Learning by Exporting Important? Micro-dynamic Evidence from Colombia, Mexico, and Morocco.* The Quarterly Journal of Economics, Vol.113(3): 903-947.

Dixit, Avinash. 1989. *Entry and Exit Decisions under Uncertainty.* The Journal of Political Economy, Vol. 97(3): 620-638.

Esteve-Perez, S., Manez-Castillezo, J.A., Rochina-Barachina, M.E., and Juan.ASanchis-LLopis. 2007. *A Survival Analysis of Manufacturing Firms in Export Market.* Universitat de Valencia and LINEEX.

Grossman, Gene M. and Elhanan Helpman. 1991. *Trade, Knowledge Spillovers, and Growth.* European Economic Review, Vol.35(2-3): 517-526**.**

Hess, Wolfgang and Maria Persson. 2011. *The Duration of Trade Revisited: Continuous-time vs. Discrete-time Hazards.* Empirical Economics.

Imbs, Jean. And Romain Wacziarg. 2003. *Stages of Diversification.* The American Economic Review, Vol.93(1) : 63-86.

Jenkins, Stephen T. 1995. *Survival Analysis.* University of Essex.

Baldwin, Richard and Paul Krugman. 1989. *Persistent Trade Effects of Large Exchange Rate Shocks.* The Quarterly Journal of Economics, Vol.104(4): 635-654.

Melitz, Marc J. 2003. *The Impact of Intra-Industry Reallocations and Aggregate Industry Productivity.* Econometrica, Vol.71(6): 1695-1725.

Pavcnik, Nina. 2002. *Trade Liberalization, Exit and Productivity Improvements: Evidence from Chilean Plants.* Review of Economic Studies, Vol.69(1): 245-276.

Roberts, Mark J., and James R. Tybout. 1997. *The Decision to Export in Columbia: An Empirical Model of Sunk Costs.* The American Economic Review. Vol.87: 545-564.

Sabuhoro, Jean Bosco and YvanGervais. 2004. *Factors Determining the Success or Failure of Canadian Establishments on Foreign Markets: A Survival Analysis Approach.* Ministry of Industry of Canada.

Tovar, J and Luis Roberto Martinez. 2011.*Diversification, Networks and Survival of exporting Firms* .CEDE.

Tsivadze, N. 2010.*Export Diversification in Georgia: Intensive and Extensive Margins.* ISET Master's Thesis.

Appendix

Chart 1 Number of Georgian Exporters in 2005-2010

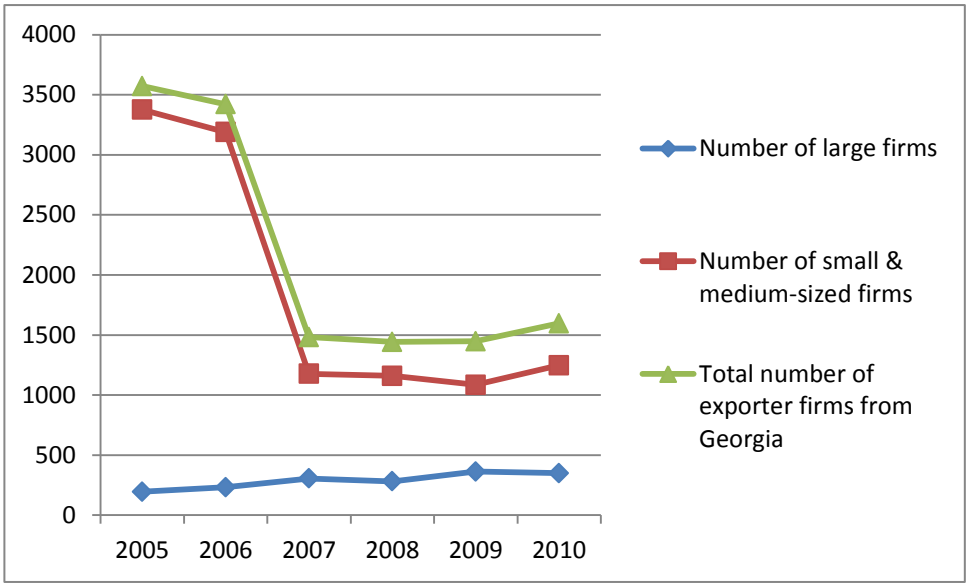

Chart 2 Number of Exporters in the sample over time by size

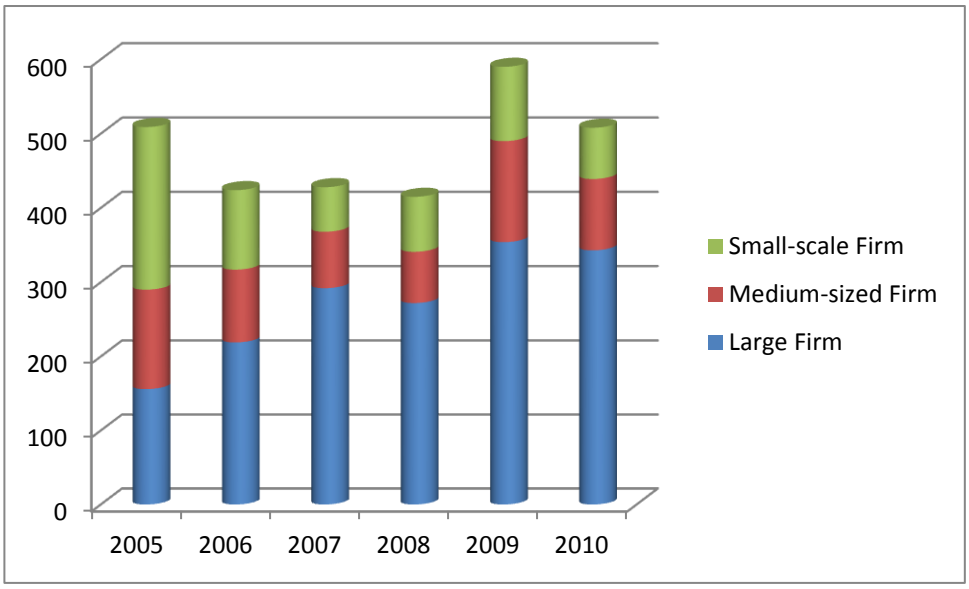

Table 1 Description and Summary statistics of the Variables

a) Spell-specific variables

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Failure	1 if spell was terminated during the sample period	4028	.6305859	.4827061	0	1
Left_censored	1 if spell was started in 2004	4028	.0585899	.2348846	0	1
Failure experience to the other destination	1 if a firm failed to other export market before starting this spell	4028	.4277557	.4948147	0	1
Failure experience to the same destination	1 if a firm failed to the same export market before starting this spell	4028	.1377855	.3447175	0	1
GSP	1 if Georgia benefits from Generalized System of Preferences with the destination country	4028	.3763654	.4845336	0	1
FTA	1 if Georgia has a signed Free Trade Agreement with the destination country	4028	.3964747	.4892258	0	1

b) Firm-specific variables

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Age	Number of years since the firm was registered up to the year under consideration	2874	6.008003	4.088084	0	15
Employment	Number of employees a firm has in a given year	2874	134.1785	613.4297	1	15109
Sales	Sales revenue of the firm in millions of constant GEL of year 2000	2874	20.63035	64.8739	.0018544	770.4758
Number of Destinations	Number of Destinations a given firm exports to in a given year	2874	2.386917	2.889649	1	33

Table 2 Exports spell distribution by destination country

Country	Frequency	Country	Frequency	Country	Frequency
Afghanistan	6	Ghana	1	Pakistan	9
Albania	6	Gibraltar	2	Panama	7
Algeria	1	Greece	54	Peru	2
Angola	2	Guatemala	1	Philippines	3
Argentina	2	Honduras	1	Poland	69
Armenia	428	Hong Kong	19	Portugal	8
Australia	10	Hungary	15	Qatar	2
Austria	51	India	41	Romania	27
Azerbaijan	389	Indonesia	7	Russia	169
Bahamas	2	Iran	63	SaudiArabia	5
Belarus	68	Iraq	25	Serbia and Montenegro	5
Belgium	56	Ireland	18	Seychelles	6
Belize	8	Israel	62	SierraLeone	3
Bolivia	1	Italy	107	Singapore	21
Bosnia and Herzegovina	3	Japan	29	Slovakia	19
Brazil	2	Jordan	3	Slovenia	6
BritishVirginIslands	4	Kazakhstan	101	South Africa	6
Bulgaria	49	Kuwait	2	South Korea	28
BurkinaFaso	1	Kyrgyzstan	14	Spain	54
Cambodia	2	Latvia	45	Srilanka	1
Canada	39	Lebanon	2	Sudan	3
Cayman Islands	2	Liberia	3	Sweden	13
Chile	2	Libya	3	Switzerland	42
China	97	Liechtenstein	1	Syria	13
Colombia	3	Lithuania	36	Taiwan	11
Congo	1	Luxembourg	4	Tajikistan	22
Coted'Ivoire	1	Macedonia	5	Thailand	1
Croatia	3	Malaysia	4	Tunisia	1
Cyprus	20	Malta	5	Turkey	328
Czech Republic	52	Marshall Islands	1	Turkmenistan	32
Denmark	13	Mexico	5	UAE	78
Dominica	3	Moldova	29	USA	141
Dominican Republic	2	Mongolia	8	Uganda	1
Ecuador	1	Morocco	3	Ukraine	223

Egypt	16	Mozambique	2	United Kingdom	104
Estonia	15	Nepal	3	Uruguay	1
Finland	15	Netherlands	99	Uzbekistan	29
France	70	Nigeria	2	Vietnam	9
Frances polinezia	1	North Korea	5	Virgin Islands	2
Germany	244	Norway	2	Zimbabwe	1
		Total	4 028		

Table 3 Frequency distribution of exporter firm-years by industry and size

		Size		
Industry	***Large***	***Medium***	***Small***	**Total**
Agriculture, Hunting and Forestry	13	9	28	50
Fishing and Fish-breeding	3	7	14	24
Mining	26	19	9	54
Manufacturing	555	311	310	1 176
Electricity, Gas and Water Production and Distribution	9	0	0	9
Construction	75	12	8	95
Trade and Repairs	748	171	208	1 127
Hotels and Restaurants	9	5	4	18
Transport and Communication	97	24	22	143
Real Estate	35	25	23	83
Governance	1	0	0	1
Education	6	2	0	8
Healthcare and Social Support	33	14	1	48
Communal, Social and Personal Services	26	10	2	38
Total	1 636	609	629	2 874

Table 4 Frequency distribution of exporter firm-years by number of destinations and size

Number of Destinations	Large	Medium	Small	Total
1 to 5	153	45	34	232
6 to 10	138	24	1	163
11 to 15	50	0	1	51
15 to 20	16	1	0	17
More than 21	30	1	0	31

Table 5 Frequency distribution of exporter firm-years by ownership and size

		Size		
Ownership	*Large*	*Medium*	*Small*	**Total**
Private	1 549	575	622	2 746
Public	72	23	7	102
Mixed	15	11	0	26
Total	1 636	609	629	2 874

Table 6 Regression Results

List of Covariates	Hazard ratios from PGM regression with Gamma heterogeneity	Hazard ratios from cloglog regression with clustering between the firms	Hazard ratios from cloglog regression with clustering and country fixed effects
Failure experience to the same destination	.4495351***	.6810009***	.7038726***
Failure experience to the other destination	.4759413***	.9173113	.9286913
2nd year of export		.6131602***	.6554841***
3rd year of export		.4852826***	.542285***
4th year of export		.3024515***	.3435427***
5th year of export		.1826401***	.2089355***
6th year of export		.2008257***	.2469314***
7th year of export		2.58e-07***	1.76e-07***
FTA	.6444324***	.623483***	.1902847***
GSP	.6889689***	.8559005**	.0838523***
Appreciation of GEL	.9794478***	.9749119***	.9693719***
Depreciation of GEL	1**	1**	1***
Number of employees	1.00016**	1.000097**	1.000095**
medium-sized firm	1.311497***	1.156767**	1.227916***
small firm	1.79575***	1.286838***	1.363432***
public property	.7640325	1.233347	1.330322**
mixed property	1.572039	1.994762***	2.429436***
age	1.125442***	1.074007***	1.100314***
age2	.9926359***	.9941613***	.9927142***
Exporter rank quartile 2	0.5125***	1.259519***	1.376611***
Exporter rank quartile 3	2.093475***	1.786069***	1.961129***
Exporter rank quartile 4	1.864906***	1.451413***	1.585051***
Sales in mlns	.9977964*	.9986564***	.9986533***
Number of detinations	.5080702***	.9728479***	.97115***
embargo	3.57125***	5.409111***	3.353338***
crisis	1.26892**	1.373438***	1.441568***
Industry Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes
Log-Likelihood	-1610.0030957	-3649.2177	-3481.0491
Number of Observations	6171	6171	6171
AIC Criterion	3272.006	7376.435	7278.098

*, ** and *** asterisks above hazard ratios indicate 10%, 5%, 1% significance level respectively.