

# Testing the Learning-by-Exporting at Micro-Level in light of influence of “Statistical Issues” and Macroeconomic Factors

## *Verifica dell'ipotesi Learning-by-Exporting a livello micro alla luce dell'influenza delle “questioni statistiche” e dei fattori macroeconomici*

Maria Rosaria Ferrante and Marzia Freo

**Abstract** This study aims at testing the Learning-by-Exporting (LBE) on the TFP from the perspective of the evaluation literature. The focus is posed on the distribution of the outcome, the pre-entry selection bias is addressed, and both “statistical issues” and the influence of macroeconomic factors are accounted for. Basing upon a panel of Italian manufacturing firms, we design an experiment by aligning and pooling cohorts of starter, incumbent exporter and domestic firms and we further address the panel drop out. Main findings are that internationalisation has an impact on firms’ TFP, which is larger for best performing firms. Then it is shown that estimates of LBE impact are biased when i) the heterogeneous influence of macro-factors across groups and cohorts, and ii) the drop out of some firms from the panel are not accounted for.

**Abstract** *Il presente contributo indaga l'effetto del Learning-by-Exporting (LBE) nella prospettiva degli studi di valutazione. L'attenzione è posta alla distribuzione dell'outcome, e si tengono sotto controllo i meccanismi di auto-selezione, le questioni statistiche e l'influenza dei fattori macro-economici. Sulla base dell'analisi di un panel di imprese manifatturiere italiane (1998-2007), attraverso un elaborato disegno di ricerca, si verifica che l'internazionalizzazione ha un impatto sulla PTF delle imprese, specialmente sulle migliori. Inoltre viene mostrato*

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Summary of the submitted paper “Detecting Learning by Exporting Effects on Firms’ Productivity Distribution in Presence of Alternate Phases of Export Demand” by same authors.

*che le stime dell'impatto del LBE sono distorte se non si tiene conto i) dell'influenza eterogenea dei fattori macro e della caduta e uscita di alcune imprese dal panel.*

**Key words:** Learning-by-Exporting, TFP, Panel Attrition, Macroeconomic Factors.

## 1 Introduction

During last years, many empirical studies have investigated the hypothesis that firms experience an increase in productivity during the period following their entrance into international markets (the Learning-By-Exporting or LBE hypothesis) and have displayed evidences for different countries with “mixed” conclusions ([4]). To investigate the mechanisms through which LBE may be explained and to identify a number of stylised facts for policy conclusions two meta-analyses have been run ([3], [5]) which highlight the roles played by issues related to sampling and methodological heterogeneity, on one side, and to different country-level macroeconomic environments, on the other side.

This study is a further contribution which aims to test the presence of the LBE effect on productivity growth, taking into account for meta-analysis's findings and going back to the firm-level. With respect to the most of previous micro-level studies, we design an ad-hoc research process which, besides micro-level factors, allows us to explicitly recognize macro-effect and the commonly called “sampling issues”.

Differences between exporters and non-exporters are analysed from the perspective of the evaluation literature, by using counterfactual methods, and enlarging the focus to cover the whole probability distribution of the LBE effects looking at differences on various quantiles.

As far as the “sampling issues” are concerned, we test the LBE effect using a ten year panel data of Italian manufacturing firms observed during the period 1998-2007, and examine six cohorts of firms which started to export from 2000 to 2005. This data allows us to investigate firms behaviour during the pre- and post-entry periods. It is confirmed that the number of firms that may be observed to enter and remain in the international market for some years is quite low, and that the panel data suffer from attrition. Both these sampling issues have frequently emerged within the applied literature ([2]) but, at the best of our knowledge, they have never been jointly afforded.

Coming to the macroeconomic factors, their heterogeneity across domestic and international markets and over time is explicitly recognised. This is made possible by the length of the available panel that allows one to track the performance of firms over time and permits the observation and the control of cyclical movements. At the best of our knowledge in the literature on the evaluation of the LBE effect, the influence of the cycle is not considered at the micro-level.

In summary, in this study, we design a manifold research experiment in order to address these further sources of heterogeneity, concerning sampling and macroeconomic factors, and to obtain reliable statistical results on the LBE effect.

## 2 The Research Design

The detection of the LBE is managed as an empirical evaluation problem by comparing the TFP evolution of the treated group of firms starting to export to two untreated control groups which are respectively formed by domestic firms and by incumbent exporter firms. Exploiting the ten-year panel data, we define the treated “starters exporter” firms all firms observed to export for at least three years after having not exported for the two previous years. Performance of the treated groups is compared to two alternative control groups: the incumbent exporter firms which are always observed to export and the domestic firms which are observed selling their products only to domestic market, during all but one year. In order to take into account for the attrition bias due to drop-out, the study furtherly singles out groups of incumbent and domestic firms which from one year onwards exit from the panel (named “exiter”) according this pattern: exiter firms are continuously present in the panel during the first five year and in some year after drop out. This allows us to run the analysis on the data both when they are balanced and when they are unbalanced. It is worth noting that many further firms in the panel have been considered not eligible for this study because they have not a well-defined pattern concerning the export status.

Since the number of export starters size for each cohort is small, to obtain a group of starters large enough to allow a reliable statistical analysis, we decide to align the sequences of firm-observations at the year in which each firm begins to export, which we fix as the time of treatment  $j=0$  and to pool firms that belong to the six cohorts. In this way we obtain a group of 478 export starters and we consider the time to treatment variable in terms of the advance or delay to the treatment time (from  $j=-2$  to  $j=2$ , where  $j=0$  represents the treatment time). Note that the definition of the starters group leads us to observe a two-year-long period before the treatment ( $j=-2,-1$ ) and a three-year-long period after the treatment ( $j=0,1,2$ ). Moreover after the alignment, observations which share the same value of time-to-treatment variable are generated in different years and therefore they are affected by different level of macroeconomic variables.

Insofar, to detect the LBE effect on TFP, the six singled-out cohorts of starters are compared to the corresponding cohorts of domestic or incumbent firms. Then, the alignment and pooling of the cohorts of starters also requires that five-year-long sequences nested within longer sequence of incumbents and domestics are aligned and pooled. This action involves some caution to avoid deteriorating the comparisons in terms of the relative weights of the observations and in terms of the membership to specific target groups and years. In fact, the comparison is based on five-year-long sequences, and while starters have always five-year-long sequences,

domestics and incumbents, due to their definition, exhibit longer sequences. In order to avoid domestic or incumbent firms being over-represented with respect to starter firms, we apply the following procedure for each comparison of the starter exporter to domestic (or incumbent) firms:

1. for each firm sequence among domestic (or incumbent), we extract all the five-year long sub-sequences; we align the sub-sequences at time to treatment  $j=0$  and append to each sub-sequence the inclusion probability defined as the inverse of the number of sub-sequences which may be extracted by each firm sequence;
2. we sample five-year long sub-sequences according to their inclusion probabilities;
3. we pool the sampled sub-sequences to form the control group and we run analysis over the treated and the control groups.

This three-steps aligning-sampling-pooling procedure is repeated 100 times with a bootstrap.

### 3 The Evaluation Model

Based on the previously reported considerations, to properly measure the premium actually due to entry into the international market, we shall account for: 1) the pre-entry selection bias on TFP levels, 2) the bias due to drop out, and 3) the differential effect of the macroeconomic factors.

To estimate the LBE effect on the whole TFP distribution, we adopt the quantile decomposition methodology (QD, hereinafter) ([1]). According to QD, in the first step two conditional quantile models are used to establish the relationships between the productivity and covariates of the firms in two different groups along the entire distribution. In the second step, the conditional distributions implied by the estimated quantile model for firms in a certain group are applied to the observed covariate distribution of firms in the other state such that a counterfactual unconditional TFP distribution is estimated. Finally, the observed differences among the TFP distributions across the groups are decomposed into a component explained by the differences in the composition of covariates and a component explained by different returns to covariates (coefficients). In this way, it becomes possible to compute the impact of each of the components on the overall outcome distribution. The differences among distributions are evaluated at different quantiles. The component due to the covariates can be interpreted as the effect induced by the heterogeneity in characteristics, that is, by the self-selection mechanism on observables. The component due to the coefficients can be interpreted as the net export productivity premium.

To detect the post-entry TFP premium, we will estimate the net premium of starter firms, by comparing the dynamics of the productivity of the starter firms after entrance into international markets to the dynamics of the productivity of domestic and incumbents firms. These results are attainable by running QD over the bootstrapped samples drawn first over the balanced dataset and then over unbalanced

dataset. These two cases may represent two bounds of values which premiums may attain. In fact, on one side, the measured TFP premium computed over always-present firms is likely to be underestimated because of the observed positive selection of domestic and incumbent always present firms. On the other side, the TFP premium that refers to Unbalanced dataset, which is enlarged to cover drop out observations, is likely overestimated because the premiums of the exiter firms are deteriorated by the crisis pattern.

With the aim of adjusting the TFP of exiters for drop out selection, we modify the QD approach by resorting to the Heckman selection model and to the two-stages Heckman estimator.

We adopt as the outcome variable the TFP change in years after the entrance. Concerning the specifications of conditional models adopted for estimating the net TFP premium, the specified covariates represent the observable characteristics for which outcome is controlled. This specification is chosen to further reduce, at least partially, the bias induced by the selection process on unobservable characteristics, while the QD mainly controls for the selection on the observables characteristics.

The general specification used for the quantile conditional model regresses the yearly rate of growth of TFP at time-to-treatment  $j=-1,0,1$  over the set of structural firm characteristics that are supposed to explain the self-selection mechanism (industrial groupings dummies, macro-area dummies, TFP level, size in term logarithm of number of employees, and per capita wage at fixed time to treatment  $j=-2$ ). Including the TFP pre-entry level allows us to control for unobserved pre-entry heterogeneity. To control for cyclical effects, the specification of the equation includes a vector  $d$  of five-year dummies. This allows controlling for heterogeneity across cohorts and groups differently affected by the diminishing pull of export demand, as the TFP export premium is partially affected by macro-effects, which act differently across groups and cohorts. In the conditional model over unbalanced data as further term is added the inverse Mills' ratio which adjusts for drop out selection.

## 4 Main Results and Conclusions

LBE effects have been estimated as differentials in TFP rates of growth in favour of starter firms against either domestic or incumbents, respectively over balanced and unbalanced data and by adjusting unbalanced data for the drop out.

Estimates over balanced data show differential growth of TFP in favour of starter firms which are suddenly positive for the best-performing firms while they become positive two years after the entry for the slower-performing firms.

When the TFP premium growth rates are estimated over unbalanced data similar findings emerge, with the peculiarity that premiums are always higher with respect to those computed over balanced data and they are remarkably higher when considered versus domestics. They also are in general statistically significant.

The acceleration of premium growth during the third year is still higher when it is adjusted for drop out selection, even if not significant, because it discounts the

higher standard errors of two-step estimators influencing the test results. Also in estimates adjusted for drop out it appears that the initial sunk costs of internationalization could produce lower growth for starter firms during the year of entrance, but during the post-entry periods, these premiums evolve faster. Also in this case, the premiums become positive earlier for the best-performing starter firms, which accelerate versus domestics just after entrance and versus incumbents one year after entrance.

In summary, according to expectations, if post-entry effects had not intervened, the net premiums of starters would have experienced a growth of the same strength of incumbents' or domestics' premiums, resulting in a null differential growth. Thus, starter exporting firms, after an initial deceleration, increase their TFPs more than incumbents and domestic firms. During the period after the entrance, the best-performing starters accelerate compared with domestics and the following period compared with incumbents. Two periods later, even the lesser- and medium-performing starter firms grow faster than the incumbents and even more than the domestics. Moreover, premiums become higher when the comparisons are enlarged to always present and exiter firms and are still higher when they are adjusted for drop-out. These results are evidence of LBE effects that intervene sometime after firms begin to export. Insofar, we are able to show, that neglecting these statistical and economical aspects could lead to hidden the LBE effect or to obtain biased estimation of the effect itself.

Concerning previous research questions, we find support to the LBE effect during the post-entry period. In particular, firms starting to export are in general observed to increase their TFP faster than domestic and incumbent firms two years after their entrance into international markets, and also before when they are best performing firms, that is they are at the top section of TFP's growth distribution. We also find that LBE effects would have been lower or even absent if we had not accounted for the macroeconomic cycle and the drop-out selection.

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