# Role of EU Harmonization in Explaining the Export-Productivity Premium of Food Processing Firms

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# Background

- Using detailed plant-production data, the discovery of unambiguous, large and persistent productivity differences has been a particular topic of interest.
  - example of a productive distribution for the Dutch food industry:
    - log TFP ratio between the Dutch food industry 90th and 20th percentile plants is 0.58
    - AR regression of TFP yields a coefficient in order to 0.4-0.8
- Research has linked productivity levels to a number of features in order to explain "why" productivity differences and dispersion play such a prominent role across producers
  - the effect of the international trade status/trade liberalization on productivity (e.g. Melitz and Ottaviano, 2008, RES)
    - Import competition
    - Selection of export markets

- Previous research has identified the actual trade gains from exporting: firms tend to be larger, more productive, and more capital intensive than non-exporting firms -
  - such evidence confirms the self-selection explaining why only the best performing firms will be able to enter an overall export market because export costs must be overcome.
  - the role of trade liberalization has a direct effect on productivity (productivity premium), export has a direct impact on productivity (export premium)

- The focus of this research is to look at the role of trade policy in explaining the export-productivity premium. In particular, we look at *EU harmonization of food regulations* (=elimination of technical barriers to trade). Examples include the Cecchini Report, 1988; Henry de Frahan and Vancauteren, 2006; Chevassus-Lozza *et al.*, 2008, showing that indeed the trade promoting effects of the liberalization of TBTs.
- Empirical evidence on the SMP/elimination of TBTs:
  - Reduces market power (Griffith et al. (2006) and Sauner-Leroy (2003) for the EU, Konings et al. (2001) for Belgium and the Netherlands, Botasso and Sembelli (2001) for Italy, Wilhelmson (2006) with particular reference to the Swedish food industry; Vancauteren (forthcoming)
  - Increases productivity (Griffith et al. (2006); Botasso and Sembelli (2001); Henry de Frahan and Vancauteren (2012))
  - Reduces market power/increases productivity: Griffith et al. (2006); Chen et al. (2009); Corcos et al. (2009); Kim (2000); Henry de Frahan and Vancauteren (2012)

# Motivation

- Provide more insights into the empirical tractability that some form of trade liberalization such as TBT liberalization affects the export-productivity premium.
- The specific question is whether trade liberalization, under form of EU harmonization, affects the productivity towards a lower level that is needed to enter EU markets.
- We also analyze how EU harmonization and other firm-level charateristics affect the export decision: if this probability increases among non-exporting firms, this leads to a reallocation of more productive, exporting firms

# Related Literature and the research question

- In heterogeneous-firm models of international trade (e.g. Bernard et al., 2003; Melitz, 2003; Baldwin and Forslid, 2010), the productivity gap between exporters and non-exporters can be explained by self-selection: exporters are more productive because they are able to bear variable and fixed exporting costs.
- The role of symmetric trade cost liberalization is that a productivity gap between exporters and non-exporters becomes lower when the market becomes more integrated: highly productive firms gain access to cheaper markets and grow, lower productivity firms become exporters while the remaining non-exporting firms with the lowest productivity are more likely to exit the market due to import competition

- Evidence:
  - Using U.S. manufacturing data, Bernard et al; (2006), for instance, show that a decline in trade costs (using tariff and freight rates) lead to higher within-plant productivity, higher exit probabilities of low productivity firms, higher entry export probabilities of high productive firms while existing exporting firms increase their shipments.
  - Lileeva and Trefler (2007), considering the impact of U.S. tariff reduction under the Canadian-U.S. Free Trade Agreement (FTA), find that it encourages firms not only to export but also to invest in order to raise productivity.
  - Baldwin and Yan (2010) look at how tariff reductions between Canada and the United States and the Canadian dollar depreciation affect Canadian exporters. The paper also finds that these trade cost reductions increase the probability that more efficient non-exporters will enter export markets. The paper also finds evidence that improved export market access affects the productivity positively.

# Hypothesis 1

*(export probabilities). More EU harmonization of food standards increases the average export probability of Dutch firms to other EU countries, the exporting margin*

- TBT liberalization causes firms to increase their market access by becoming exporters because of cost reduction effects. In other words, firms gain access to the entire EU market when a single compliance costs is overcome. This lowers the productivity threshold for exporting, increasing the number of firms which export (it is expected that compliance cost to export will not be higher than the pre-harmonized fixed cost to align with technical standards)
- In the context of EU standard harmonization, Reyes (2010) study the impact of EU harmonization of standards in the electronic sector to conclude that it increases the probability that U.S. firms enter the EU market. In addition, the author finds that the probability of becoming an EU exporter is higher in industries with greater harmonization of product standards.

# Hypothesis 2

*(export productivity premium) More EU harmonization of food standards lowers the productivity gap between exporters and non-exporters.*

- We expect that more EU harmonization lessens differences in the relative productivity growth of exporters versus non-exporters. Due to EU harmonization, the productivity threshold that cuts off the decision to export or not will be lower due to lower compliance costs. A more open and integrated intra-EU markets will be accessible to a larger number of exporters that were initially less productive.
- In addition, existing exporting firms will also be able to increase their trade to other EU markets as a result of EU harmonization of food regulations as, among others, highlighted by Henry de Frahan and Vancauteren (2006) and Chevassus-Lozza et al. (2008).

# Data

- use an unbalanced panel of firms spanning over 1979-2005 and 15 Dutch food sectors from the production statistics;
- we update a purpose-built database extracted from work originated by Brenton et al. (2002) and Henry de Frahan and Vancauteren (2006) on TBTs at the level of CN 8-digits –
  - product classification of the database follows the detailed CN 8-digit tariff-line identifying products that are covered by the relevant harmonization initiatives in the food industry.
  - construct coverage ratios at the 4 digit-Nace classification
- To make data on EU harmonization firm-specific, we weight each product harmonization coverage by the firm's production level calculated as the ratio of firm $i$ sales in time $t$ divided by the firms' total sales in each three-digit sub-sector $j$.

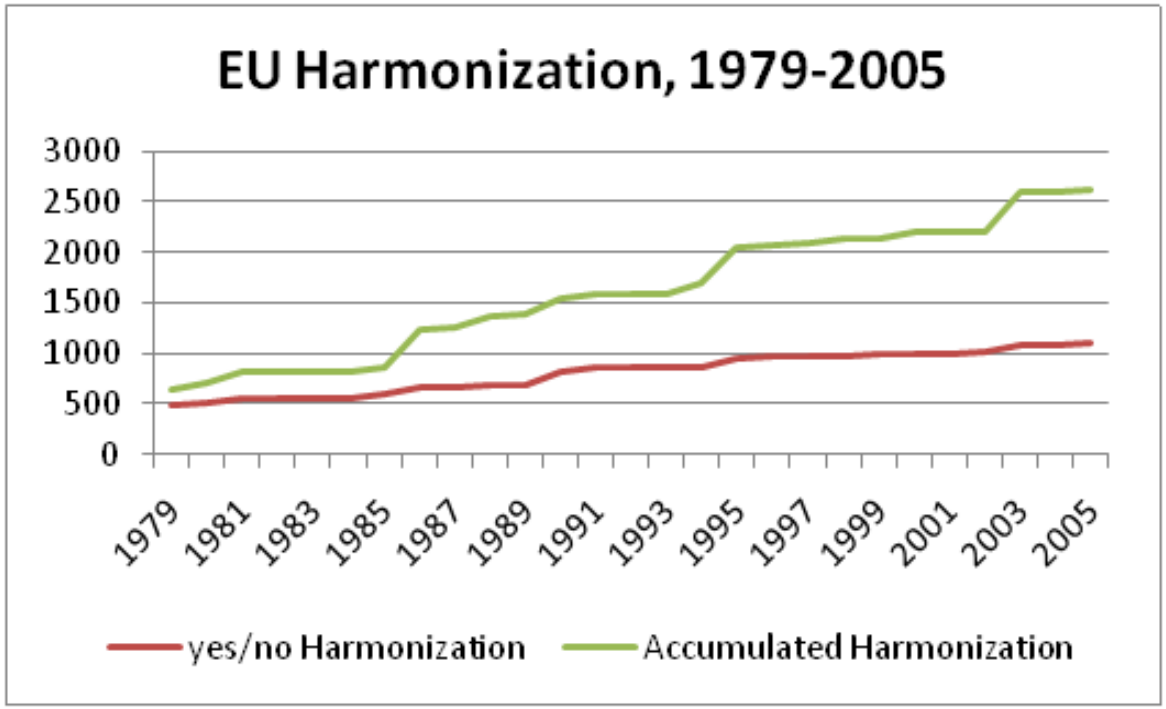
EU Harmonization, 1979-2005
3000
2500
2000
1500
1000
500
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
yes/no Harmonization
Accumulated Harmonization

**Table A1: Share of products regulated by EU harmonised regulations in by food sub-sector (2005)**

| Sector | **Total 2005 CN codes** | **CN Codes subject to EU harmonisation** | **CN codes subject to EU harmonisation as percentage of total CN codes** |
|---|---|---|---|
| | | | |
| Prod., preserving of meat (151) | 293 | 154 | 0.53 |
| Proc. and pres. fish ( 152) | 279 | 145 | 0.70 |
| Proc. and pres. fruits & veget. (153) | 387 | 296 | 0.76 |
| Oils & fats (154) | 126 | 94 | 0.75 |
| Dairy prod. (155) | 137 | 132 | 0.96 |
| Grain mill prod. (156) | 131 | 111 | 0.85 |
| Prep. animal feed (157) | 27 | 26 | 0.96 |
| Sugar (1583) + sugar conf., choc., cocoa (1584) | 58 | 52 | 0.90 |
| Tea & coffee (1586) | 15 | 9 | 0.60 |
| Condiments (1587) | 35 | 25 | 0.71 |
| Misc. foods (158x) | 125 | 79 | 0.63 |
| Food industry (151-158) | 1613 | 1123 | 0.70 |
| | | | |

Notes: (a) miscellaneous (158x) consists of the following sub-sectors: bread (1581), biscuits (1582), homogenised food (1588), food n.e.c. (1589).

Table 1: Summary statistics of production and EU harmonization data of the Dutch food processing firms, 1992-2005

| **Variable** | **Mean** | **Std. Dev.** | **1992** | **1996** | **2000** | **2005** |
|---|---|---|---|---|---|---|
| Weighted Harmonization | 0.007 | 0.038 | 0.007 | 0.008 | 0.007 | 0.008 |
| Herfindahl | 0.07 | 0.14 | 0.05 | 0.04 | 0.07 | 0.10 |
| Capital-labor ratio | 0.28 | 0.26 | 0.26 | 0.28 | 0.25 | 0.24 |
| Employment | 66.99 | 168.51 | 136.74 | 113.69 | 97.41 | 99.41 |
| Production (€ millions) | 32.75 | 12.68 | 78.69 | 78.86 | 30.41 | 36.630 |
| Exports/production ratio | 0.13 | 0.28 | 0.14 | 0.16 | 0.17 | 0.18 |
| TFP level | 47.24 | 32.60 | 39.82 | 46.14 | 52.50 | 51.15 |
| Number of observations | 17,621 | | 662 | 691 | 655 | 785 |

Table 2: OLS regressions of the export premia

| **Firm Characteristics** | $\beta_1$ | SE($\beta_1$) | $R^2$ |
|---|---|---|---|
| TFP growth | 0.021 | 0.007 | 0.588 |
| Sales per worker | 0.262 | .0118 | 0.699 |
| Value-added per worker | 0.089 | 0.008 | 0.526 |
| Capital-labor ratio | 0.118 | 0.015 | 0.179 |
| Employment | 0.688 | 0.020 | 0.471 |
| Average wage | 0.115 | 0.006 | 0.965 |
| Average wage per worker | 0.104 | 0.006 | 0.630 |
| Weighted Harmonization | 0.215 | 0.013 | 0.836 |

Note: All variables expressed in values are deflated by the appropriate sector deflators. All regressions include the log of employment and time dummies (except for the employment equation). Standard errors are adjusted for clustering at the firm-level.

# Empirical Implementation

**EU Harmonization and the export decision**

$$
\begin{aligned}
EXP_{it} &= 1 \text{ if } EXP^{*}_{it} = \alpha_{1i} + \beta_1 HARM_{it} + \beta_2 HARM_{it} \cdot D_{it} + \mathbf{b}\prime\mathbf{x}_{1it} + \varepsilon_{2it} \geqslant \\
&= 0 \text{ otherwise}
\end{aligned}
$$

- the inclusion of unobserved heterogeneity, alpha (should be uncorrelated with the x vector)
- inclusion of dynamics (should be uncorrelated with the alpha) Estimate equation (1) using a random effects probit specification, a pooled probit model, while correcting standard errors for clustering.

- Dynamics and the initial condition problem (Wooldridge, 2005); under this approach, the distribution of the unobserved individual effects, $\alpha_{1i}$ , is modeled as follows,

$$\alpha_{1i} = \alpha_{10} + \delta_1 EXP_{i0} + \delta_2 z_i + \xi_{it}$$

where $\alpha_{10}$ is the constant, $z$ is a vector including the time averages of the variables, $EXP_{i0}$ is the initial value and $\xi$ is assumed to be the independent error following a normal distribution.

# Empirical Implementation

**EU Harmonization and the export-productivity premium**

$$\Delta \ln TFP_{it} = \alpha_{2i} + \gamma_1 \Delta HARM_{it} + \gamma_2 \Delta HARM_{it} \cdot D_{it}^{EXP} + \gamma_3 D_{it}^{EXP} + \boldsymbol{\gamma}' \mathbf{x}_{2it} + \varepsilon_{2}$$

we expect $\gamma 1 > 0$ and $\gamma 2 < 0$
GMM (check levels versus differences)

Table 3: Probability of Exporting

| | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| Exported (t-1) | | | | .724*** (.039) | .731*** (.039) | .751*** (.041) |
| Δ Log ( *HARM* ) | .083*** (.002) | .108*** (.010) | .330*** (.040) | .209*** (.030) | .180*** (.025) | .157*** (.026) |
| Δ Log ( *HARM* ) x High | | | | | | -.038** (.012) |
| Log (Wages) | | .153*** (.022) | .638*** (.102) | .185** (.066) | .713*** (.068) | .710*** (.068) |
| Log(*K/L*) | | .021** (0.010) | .133** (.049) | -.003 (.011) | .096** (.031) | .089** (.032) |
| Log(Employment) | | .132*** (.024) | .284*** (.101) | .188** (.070) | .172** (.070) | .169** (.072) |
| Multifactor Productivity | | .028 (.025) | .170* (.093) | -.060 (.011) | -.038 (.074) | -.039 (.074) |
| Multi-product | | .158*** (.011) | .253*** (.065) | .162*** (.044) | .184*** (.042) | .183*** (.042) |
| | | | | | | |
| Year Dummies | Y | Y | Y | Y | Y | Y |
| Sub-sector Dummies | Y | Y | N | Y | N | N |
| N | 7019 | 7019 | 7019 | 7019 | 7019 | 7019 |
| Log-Likelihood | -4509.4 | -4421.2 | -4179.7 | -3407.4 | -3643.8 | -3637.8 |
| Estimation method | Probit | Probit | Probit | Probit | MLE- | MLE- |

Table 4: Firm-level TFP growth in the Dutch food processing industry, 1992-2005

| Dependent variable | TFP_LP (I) | TFP_LP (II)) | TFP_LP (III) | TFP_LP (IV) | TFP_TQ (V) |
|---|---|---|---|---|---|
| Δ Log ( *HARM*) | 0.034*** (.006) | 0.021*** (.005) | 0.052*** (.008) | 0.081*** (.018) | 0.046** (.014) |
| Dummy Export | | 0.018* (.010) | -.003 (.010) | .085** (.032) | 0.110*** (.021) |
| Δ Log ( *HARM*) x Dummy Export | | -0.0001 (.001) | -0.0009 (.002) | -0.055*** (.007) | 0.023 (.026) |
| Log(*K/L*) | | | -0.086*** (.010) | -0.194*** (.017) | 0.080** (.026) |
| Log(Employment) | | | -0.338*** (.026) | -0.161*** (.022) | -0.080*** (.008) |
| Multi-product | | | 0.003 (.011) | 0.018 (.016) | -0.059* (.031) |
| Herfindahl | | | -0.009*** (.001) | -0.004** (.002) | 0.002** (.0009) |
| | | | | | |
| Observations | 7019 | 7019 | 7019 | 7019 | 7019 |
| | | | | | |
| $R^2$ | 0.206 | 0.235 | 0.236 | 0.249 | 0.198 |
| Estimation method | FE | FE | FE- | GMM-SYS | GMM-SYS |
| Hansen-Sargan test | | | | 16.678 (p=0.115) | 35.990 (p=0.081) |
| Arellano-Bond (AR2) | | | | p=0.231 | p=0.662 |

# Robustness

- consider a new subsample between "new" and "non" exporters.
  - New exporters and non-exporters are defined as follows: firms that changed their export status during the sampling period but did not export during the 1980-1990 period are classified as exporters; similarly, non-exporters are those that did not export since 1980-1992 prior period.

Table 5: Robustness

| | Exporting (1/0) (I) | Exporting (1/0) (II) | TFP Growth (III) | TFP Growth (IV) |
|---|---|---|---|---|
| Exported (t-1) | .613*** (.0) | .731*** (.039) | | |
| ΔLog ( *HARM*) | .238* (.136) | .245*** (.105) | .199*** (.061) | .091*** (.028) |
| ΔLog (Harmonization) x High | | -.077 (.057) | | |
| Dummy Export | | | .778*** (.451) | .568*** (.038) |
| Δ Log ( *HARM* ) x Dummy Export | | | | 0.083 (.122) |
| Log (Wages) | .455*** (.091) | .473*** (.011) | | |
| Log(K/L) | .118 (.092) | .120 (.092) | -.178*** (.024) | .245*** (.105) |
| Log(Employment) | .390** (.202) | .401** (.203) | -.753*** (.045) | -.182*** (.023) |
| Multifactor Productivity | .499** (.227) | .528** (.231) | | |
| Multi-product | -.171 (.127) | -.168 (.126) | -.100*** (.017) | -.009*** (.003) |
| | | | | |
| N | 2566 | 2566 | 2566 | 2566 |
| Log-Likelihood | -393.07 | -392.85 | | |
| Estimation method | MLE-Dynamic Probit RE | MLE-Dynamic Probit RE | GMM-SYS | GMM-SYS |

# Conclusion

- developed a framework where we investigate how export decisions are affected by EU harmonization and how EU harmonization affects the export productivity premium.
- Applying this analysis to Dutch food processing firms over the period 1992-2005, we found that:
  - First, we confirm that more productivity firms are more likely to enter the EU export market. The result of EU harmonization is that this probability increases.
  - Furthermore, it is also shown that this impact is not affected by controlling for firms that belong to low versus high EU harmonized sectors.
  - We also find that product diversification is only significant when we consider the export probabilities for all firms. Using a sample of "new" exporting firms, it is shown that product diversification is no longer significant. This latter result implies that new exporters remain competitive on exporting markets by solely focusing on their core products.

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  - Second, we find a positive and significant export-productivity premium: that is, firms that export to other EU markets are more productive than non-exporting firms. This finding is robust to the estimation technique and the way we measured TFP growth.
  - Third, when we test whether the export-productivity premium is affected by EU harmonization, we do not find any overwhelming evidence that is the case for Dutch food processing firms: much depends on the estimation method, the way we measure TFP growth, and the export definition. For instance, if we only include a subset of export starter firms, EU harmonization does not affect the export-productivity premium gap between exporters and non-exporters.
- Our results imply that export markets may be more competitive than just the trade gains following EU harmonization which reinforce firms even to be more productive. For instance, other effects such as import competition and the trade orientations of firms may play an important role in further understanding the gap between exporters and non-exporters.