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AN EMPIRICAL ANALYSIS BASED ON THE MELITZ MODEL

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Keywords: Banking liberalisation and deregulation, firm heterogeneity, firm performance and productivity, First and Second Banking Directives

JEL classification: F14, D21, G21, L25

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I. INTRODUCTION & LITERATURE REVIEW

The European banking markets have been markedly transformed during the past two decades through several important strands of legislation related to the 1992 Single Market Programme (SMP), which was one of the most dramatic and significant liberalising events of modern banking and financial services history. It had the objective to move away from protective regulation and collusion towards freeing-up international trade in financial services thereby considerably increasing banks' international activities. At the same time, innovation in financial products, technological advances in information systems, data processing and risk management as well as the introduction of the Euro contributed the same way to radically increased competition among banks.

This paper adds to the existing empirical literature an analysis of bank-level productivity and profitability effects caused by sector liberalisation and deregulation. The analysis focuses on banking liberalisation repercussions in seven European countries during the 1988 to 2003 period testing several propositions of the more recent heterogeneous-firm trade model as set out by Melitz (2003).

Adapting Hopenhayn's (1992) dynamic industry model to a monopolistic competition setting, Melitz' (2003) key contribution is that this is a general equilibrium model with productivity heterogeneity across firms. Export entry is again costly. As a result the firms with higher ex ante productivity self-select into export markets, whilst those with lower productivity produce only for the domestic market. Falling trade costs through liberalisation lead to an increase in aggregate productivity because they trigger firm-level reallocations – more productive (exporting) firms expand whilst less productive (non-exporting) firms contract or exit. Hence this theoretical framework establishes a direct relationship between liberalisation, firms' exporting activities and their productivity, also underpinning a causal link between trade openness and aggregate productivity growth. Building on this model, Baldwin and Forslid (2004) demonstrate that liberalisation also widens the profitability gap between firms operating only at a domestic and at an international level, implying a

classical Stolper-Samuelson-like income-redistribution result. Other important theoretical contributions include Bernard, Eaton, Jenson and Kortum (2003), Helpman, Melitz and Yeaple (2004), Bernard, Redding and Schott (2004), Bernard, Eaton, Jensen and Schott (2003), Melitz and Ottaviano (2005) and Yeaple (2005).

Until fairly recently, empirical work on the liberalisation-exporting-productivity link was essentially macroeconomic, underlying models being aggregate growth models and empirical data being aggregate country- or industry-level figures. In 1995 Bernard and Jensen started to publish a series of papers that changed this macroeconomic research perspective (see Bernard and Jensen 1995, 1999 and 2004a). Using large comprehensive longitudinal data from surveys performed regularly by official statistics in the United States, they looked at differences between exporters and non-exporters in various dimensions of firm performance, including productivity. These papers started a considerable microeconometric research literature analysing the productivity characteristics of firms that enter export markets, also investigating whether export market entry changes these characteristics. Other important early contributions include Bernard and Wagner (1997) and Clerides, Lach and Tybout (1998).

Greenaway, Gullstrand and Kneller (2003) and Wagner (2005) provide surveys of empirical microeconometric studies in this field that used firm- or plant-level data. Table A3 in the appendix presents an overview over the sample frame, methodology and key results of 17 microeconometric studies on exporting, productivity and firm performance. This literature encompasses a considerable number of countries, methodologies and hypotheses. Methodologically some studies rely on standard cross-section techniques, others use panel techniques of one form or another, or non-parametric techniques. Despite diversity in terms of methodology and sample, there are some striking empirical regularities in these microeconometric studies. In general, it was consistently found that exporting firms were different from non-exporting firms. Specifically they tended to be larger, more capital intensive and paid higher wages. Furthermore and most important, all studies report that exporters are more productive and higher productivity is manifest before entry to export markets takes place. This suggests that self-selection occurs, with potential exporters being

more productive even before the liberalisation occurs and they eventually export. This is consistent with the Melitz model assumption that there are sunk costs associated with exporting, so firms have to be more productive before they can enter export markets. Also, these studies report a mixed result on whether exporting and exporting intensity make a difference. Most studies fail to find evidence of exporting leading to a further increase in productivity. In spite of this, Clerides, Lach and Tybout (1998) detect evidence of a learning-by-exporting effect: Firms engaging in international activities benefit from knowledge transfers from clients and competitors, are exposed to more intense competition and must improve faster than firms that operate only at a domestic level. Hence exporting makes firms more productive. In addition, Castellani (2002), Girma, Greenaway and Kneller (2003) and Hanson and Lundin (2003) found that firm productivity increases as the share of output exported increases. Finally, some studies focus on the characteristics of firms that exit from export markets and find that these were typically less productive firms.

We are not aware of studies that look specifically at the bank-level liberalisation-exporting-productivity and profitability link distinguishing between international and regional banks. Nevertheless, there is a large literature in economics and political science that touches upon that subject. Most of the studies found address the potential benefits of foreign bank entry for the domestic banking sector and economy in developed and developing countries. In a systematic econometric study of how foreign bank presence has affected the domestic banking markets in 80 countries for the 1988 to 1995 period, Claessens, Demirgüç-Kunt and Huizinga (2000) found that the entry of foreign banks reduces the profitability of domestic banks, while there is some evidence that the non-interest income and the overall expenses of domestic banks are also negatively correlated with foreign bank entry. An EC (1997) study explored the impact of the 1992 SMP on the performance and strategic reactions of European banks. Within this wide-ranging study, an integrated programme of econometric research was undertaken. It compares what actually happened since the SMP with an assessment of what would likely have happened without the SMP, trying to disentangle the SMP-impacts from other important changes that took place in the banking environment. The EC econometric study comprises work that has not

been undertaken before on this scale for European banks in cooperation with leading banking and finance academic experts, including the use of a wide range of data sources. However, although confirming that the European banking market has become much more competitive and market-oriented during the past decade, it doesn't present exploitable bank-level results. Prior and in contrast to this EC (1997) *ex post* study, the Cecchini Report (EC 1988) adopted an *ex ante* approach: It modelled a post-SMP scenario in conformance with a theoretical (or idealised) model, which it compares with the pre-SMP situation. The problem with this approach is that the chosen idealised post-SMP scenario did not rely on very realistic assumptions. For instance, it presumed that every country's banking system would react the same way, although the institutional frameworks differed markedly among EU members. Since it cannot be relied upon theoretically, it lacks real or practical meaning.

The paper is organised as follows: The next section reviews the Melitz (2003) productivity and the Baldwin and Forslid (2004) income-redistribution theoretical framework, which forms the starting point of our empirical analysis. Following this is a brief description of the European banking environment and the key deregulation measures during the 1988 to 2003 period. This sets the scene for the subsequent formulation of the theoretical propositions to be tested. The empirical analysis in section five describes the data, testing methodology and econometric issues. It also presents the regression results together with a short interpretation and discussion. The last section summarises and concludes the paper.

II. THEORETICAL FRAMEWORK: THE MELITZ MODEL

In order to explain the vast majority of international trade – which is intra-industry trade – the "new" trade theory incorporated imperfect competition and increasing returns to scale. However, its models kept on assuming identical firms, which – as empirical evidence reveals – neglects many important aspects of reality: To begin with, firms are not identical, i.e. they are not all equally productive. In most observations productivity differences between firms within a particular sector are larger than productivity differences between sector averages. Furthermore, most firms – even in export sectors – don't export at all. More recently a new literature has emerged (known as the "*New new" trade theory*) to account for these findings. In an important paper, Melitz (2003) presents a general equilibrium model with productivity heterogeneity across firms. Over and above of providing a theoretical underpinning to a causal link between liberalisation, exporting and aggregate productivity growth, this paper also generates new empirically testable propositions.
The following theoretical presentation of the productivity and income-redistribution impacts related to liberalisation builds on this theoretical framework developed by Melitz (2003) sticking to - with slight modifications – Baldwin's (2005) heterogeneous-firms model which is very similar to Melitz (2003).

III.1 The basic model

Greatly simplifying the real-world and complex interactions among markets and industries, the model is characterised by a 2x2x1 assumption with two symmetric countries (Home and Foreign), two sectors (T- and M-sector) and one primary factor of production (labour). The T-sector is a Walrasian, homogeneous-goods sector, which produces traditional goods with costless trade. The M-sector produces manufactured goods and is marked by increasing returns, Dixit-Stiglitz monopolistic competition and iceberg trade costs (where selling one unit in the export market requires a shipment of $\tau \geq 1$ units). The model focuses on the steady state equilibrium

and ignores discounting. Wages have the same level in the two identical countries and, labour being taken as the numeraire, are equal to one. The firms operating in the single sector face a constant probability of going bankrupt equal to δ. Marginal costs of production in the M-sector are constant but there are increasing returns to the three possible types of fixed costs, of which firms need to pay at least two even before starting to sell their products. The first indispensable fixed cost is the standard Dixit-Stiglitz investment of developing a new variety and will in what follows be denoted as $\mathbf{F_I}$. The second necessary fixed cost reflects the cost of introducing a new variety into the domestic market, henceforth referred to as $\mathbf{F_D}$. The third fixed cost is a market-entry cost only incurred by a firm selling its variety in the export market, referred to as $\mathbf{F_X}$. It can be interpreted as the cost in modifying products to meet export-market specific standards and regulations, licence fees, establishing a brand name and distribution channels, hiring personnel with skill to manage foreign operations etc. These costs provide an entry barrier that less productive firms cannot overcome. The product innovation investment F_I is sunk whereas F_D and F_X can be sunk or overhead-kind periodically reoccurring fixed costs. For the study case $F_X > F_D$ is assumed. As usual, there is an inverse relationship between a firm's relative price and its revenue assuming a constant elasticity of substitution $\sigma>2$. The lower a firm's relative price, the higher are its sales and revenues. Operating profit corresponds to the standard Dixit-Stiglitz proportional share $\frac{1}{\sigma}$ of a firm's sales.

As mentioned above, the Melitz model allows for marginal production cost differences between firms within the same sector with each firm having its own particular labour input coefficient a_j (for firm j) in the production of its variety. A firm's a_j is "assigned" randomly to each firm once it has invested the fixed and sunk product-innovation entry cost F_I. As Baldwin (2005) puts it, "*at the cost of F_I units of labour, one gets the "blueprint" for a new variety with certainty, but the associated marginal cost is random*"[1]. As all wages are equal to one, it follows that all differences in firms' marginal costs stem from the differing labour input coefficients a_j.

[1] Baldwin (2005), p. 3

The individual labour input coefficients a_j allow distinguishing firms into three groups:

1) N-types: Firms with a very high a_j that do *not* produce and sell at all.
2) D-types: Firms of an intermediate a_j-level that produce and sell only in the Home market.
3) X-types: Firms characterised by a low a_j that sell in the Home and Foreign market.

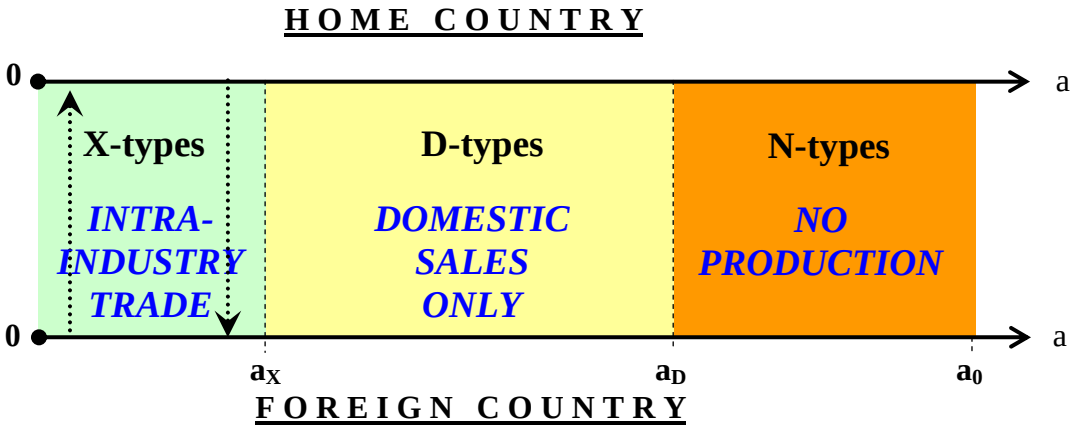
After having invested F_I required to develop a new variety, the X-types have been randomly allocated the lowest and the N-types the highest labour input requirements. The N-types' a_j is so high that they won't even start producing, while the X-types' a_j is so low that they are able to pay F_X to enter the Foreign market and sell their varieties. In other words, only firms with sufficiently low marginal costs will enjoy operating profits that allow covering the Foreign market-entry fixed costs F_X.

The two types of market-entry fixed costs F_D and F_X determine two marginal cost cut-off points: One separating N-types from D-types – denoted as $\mathbf{a_D}$ - and the other dividing D-types from X-types, designated as $\mathbf{a_X}$. Since firms that want to export have to incur F_X in addition to F_D, it follows that the maximum marginal costs for exporting firms (the X-types) has to be lower than the maximum marginal cost for firms that sell only in the domestic market (the D-types), hence $a_X \leq a_D$. The luckiest firms are assigned a very low marginal cost that makes it profitable to enter both the local and export markets. The other firms have been allocated an intermediate marginal cost such that they will be able to cover no more than F_D selling only in the Home market. Since their operating profit would not cover F_X, they are not in a position to sell in the Foreign market. Entering the Home market will only be profitable if firm j's allocated marginal cost a_j is below or equal to a_D. It will export only if its a_j is such that $a_j \leq a_X \leq a_D$. If $a_j \geq a_D$, the firm will never produce and sell, neither in the domestic nor in the export market. For these unlucky firms (the N-types), the F_I investment was a waste.

The trade pattern is shown in Figure 1, which includes standard intra-industry trade in differentiated varieties produced by X-type firms. Importantly, the varieties of D-type firms are not traded even though they are in a "traded-goods" sector. This

corresponds to reality, in which many firms - even in internationally traded-goods sectors - do not export at all.

Figure 1: The trade pattern



Source: Baldwin (2005)

III.2 The productivity impact of liberalisation

Melitz (2003) and Bernard, Eaton, Jensen and Kortum (2003) focus on the productivity impacts of trade liberalisation. The model can distinguish between two types of trade liberalisation, one concerning the variable trade costs $\varphi \equiv \tau^{1-\sigma}$ ($0 \leq \varphi \leq 1$) and the other concerning fixed trade costs as expressed by the ratio $T \equiv \frac{F_X}{F_D}$. φ and T are combined into a single aggregate measure of trade openness, denoted by Ω. Assuming the regularity condition $a_X < a_D$ we have:

$$\Omega \equiv \varphi^{\beta} T^{1-\beta} \quad \text{with} \quad 0 \leq \Omega \leq 1 \quad \text{and} \quad \beta \equiv \frac{k}{\sigma - 1} > 1 \qquad (1)$$

where k corresponds to the *shape* parameter of the Pareto distribution according to which the labour input requirements (the "a_j's") are distributed. k = 1 implies a

uniform distribution. Both types of trade barriers usually have the same basic impact on the cut-off points a_D and a_X[2].

Ω captures the joint protective effects of higher variable and fixed trade costs. Ω = 0 if τ and/or T is infinite, indicating "zero" trade. Ω = 1 if there are no variable trade costs (τ = 1) and exporting does not involve higher fixed costs than selling in the domestic market ($F_X = F_D$ hence T=1). This is considered as "perfectly" open trade. Note that as long as $a_X < a_D$ and $F_X/\varphi > F_D$ we have $0 \leq \Omega \leq 1$.

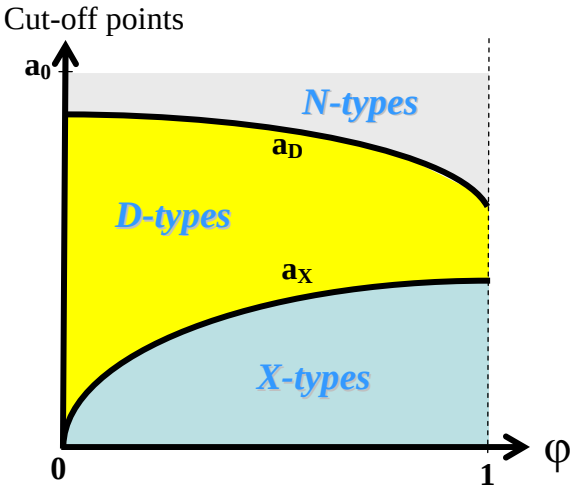
Baldwin (2005) formally defines the closed form solutions for the two cut-off points a_D and a_X as:

$$a_D = a_0\left(\frac{F_I(\beta-1)}{F_D(1+\Omega)}\right)^{\frac{1}{k}} \quad \text{and} \quad a_X = a_0\left(\frac{\Omega(\beta-1)F_I}{(1+\Omega)F_X}\right)^{\frac{1}{k}} \qquad (2)$$

where a_0 corresponds to the *scale* parameter of the Pareto distribution according to which the labour input requirements (the "a_j's") are distributed.[3]

The impact of trade liberalisation resulting in a change of trade openness parameter Ω is illustrated in Figure 2:

Figure 2: The effect of liberalisation on the cut-off points



Source: Baldwin (2005)

[2] As variable trade costs τ increase, φ is lowered which in turn lowers Ω. Higher fixed costs to exporting F_X increase T, which also lowers Ω. Both mean that trade activity is slowed down.

[3] Without loss of generality, we can choose units such that $a_0 = 1$. See Baldwin and Robert-Nicoud (2004)

Prohibitive trade costs imply φ and Ω = 0, a situation in which even a firm with zero marginal cost of production would not be able to export. As impediments to trade decrease, φ and Ω increase gradually which in turn raises a_X, the minimum productivity necessary to export. As a consequence, more and more firms will start to sell in the Foreign market. At the same time competition is intensified, lowering a_D (the maximum marginal cost of producing firms) due to increasing competition with the consequence that the least productive firms are driven out of the Home market. The mass of N-types increases. Given perfectly free trade (φ=1), a_D and a_X would only meet if there is no regulatory protection T = $\frac{F_X}{F_D}$ = 1. Figure 2 illustrates a situation where $F_X > F_D$, where not all varieties are exported even when trade is costless (since $a_D > a_X$).

The productivity effect of liberalisation is intuitively clear: Since the least productive firms exit the market, liberalisation implies a positive impact on average productivity of an industry. Melitz (2003) decomposes this productivity effect further into a *selection effect* and a *market-share shifting effect*. The former follows from what has been illustrated above: Liberalisation increases Ω, lowering the cut-off marginal cost of producing firms a_D squeezing the least productive firms out of the market thereby increasing overall industry productivity. Baldwin's definition of labour productivity

$$\frac{1-\frac{1}{\sigma}}{a_D}\left(\frac{L}{\sigma\delta F_D}\right)^{\frac{1}{\sigma-1}}$$

illustrates that liberalisation lowering a_D increases the industry's average productivity[4].

It is important to note that the above productivity effect holds for both variable and fixed trade cost liberalisations. A variable trade cost liberalisation dφ > 0 and/or a fixed cost liberalisation dT < 0 resulting in dΩ > 0 lower a_D and increase a_X.

[4] See Baldwin (2005) for a formal proof. Labour productivity is measured as real output per worker. L corresponds to the total labour input per country.

III.3 The income-redistribution impact of liberalisation

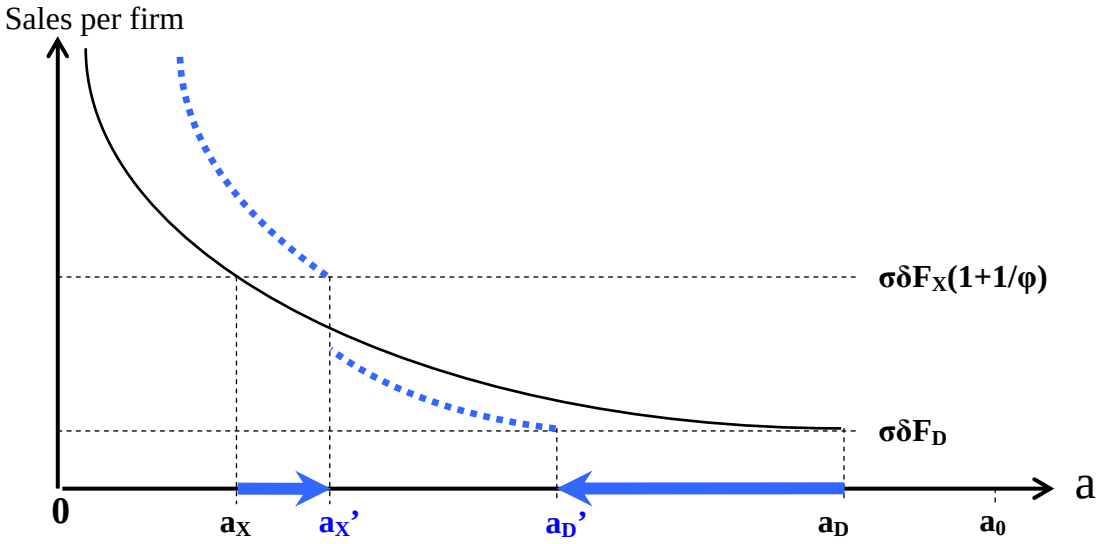
The income-redistribution impact of freer trade builds on Melitz' market share shifting effect. Baldwin (2005) defines firm's sales formally as:

$$s_X[a] = \left(\frac{a}{a_D}\right)^{1-\sigma}(1+\varphi)\sigma\delta F_D \quad \text{and} \quad s_D[a] = \left(\frac{a}{a_D}\right)^{1-\sigma}\sigma\delta F_D \quad \text{where}$$
$$\hat{s}_X[a] = \frac{\varphi-\Omega}{(1+\varphi)(1+\Omega)}\hat{\varphi} > 0 \quad \text{and} \quad \hat{s}_D[a] = \frac{-\Omega}{1+\Omega}\hat{\varphi} < 0 \quad \text{as long as } T > \varphi \tag{3}$$

The standard "hat" notation indicates proportional changes (e.g. $\hat{s} = \frac{ds}{s}$).

As trade gets freer, D-types experience a fall in their market share s_D and a loss in total revenues whereas X-types' market shares s_X increase and their total revenues rise. This is the market-share shifting effect where firm market-shares are reallocated from the least productive to the most productive firms, assuming that the high productivity firms sell at a lower price and therefore gain a higher market share[5]. The effect is illustrated in Figure 3.

Figure 3: The selection and market-share shifting effects



Source: Baldwin (2005)

[5] More precisely, greater openess ($d\Omega>0$) lowers the market share of all D-type firms. X-types market shares rise with φ as long as $\varphi>\Omega$ and $F_X > F_D$. See Baldwin and Forslid (2004) for a formal proof.

This reallocation of market shares implies an *income-redistribution* among the D- and X-type firms. Baldwin and Forslid (2004) illustrate a classic Stolper-Samuelson-like effect of marginal trade cost liberalisation. Including *knowledge capital* in addition to the only primary factor of production (labour) in the M-sector, we can think of three types of capital in this model, each *specific* to one of the three types: X-type capital, D-type capital and N-type capital.

Operating profit of a firm being the standard Dixit-Stiglitz share $\frac{1}{\sigma}$ of a firm's sales, the reward to capital is s_X/σ and s_D/σ for X-types and D-types respectively. The proportional change in firm sales *s* implies a proportional change in operating profits. From (3) we can derive:

$$r_X[a] = \left(\frac{a}{a_D}\right)^{1-\sigma}(1+\varphi)\delta F_D \qquad \text{and} \qquad r_D[a] = \left(\frac{a}{a_D}\right)^{1-\sigma}\delta F_D \quad \text{where}$$
$$\hat{r}_X[a] = \frac{\varphi-\Omega}{(1+\varphi)(1+\Omega)}\hat{\varphi} \qquad \text{and} \qquad \hat{r}_D[a] = \frac{-\Omega}{1+\Omega}\hat{\varphi} \tag{4}$$

where r_D and r_X are defined as the reward to D-type and X-type capital respectively.

The zero profit condition implies that the reward to the three types of knowledge capital must be zero *on average* as pure profits for some firms are balanced by pure losses for others. X-type and D-type firms earn pure profits whereas N-types lose F_I. This is again an implication of the Melitz Model that matches industry-level evidence very closely.

The income-redistribution impact of freer trade on r_X and r_D can easily be derived: As variable trade costs decline, φ and Ω gradually increase, which has a negative impact on r_D assuming a constant elasticity of substitution $\sigma > 2$. On the other hand, the same increase of φ and Ω lead to a rise in r_X, we have $\hat{r}_D < \hat{r}_X$. Wages have the same level in the two symmetrical countries and, labour being taken as the numeraire, w = 1. Trade liberalisation has no impact on the wage in terms of the

numeraire good: $\hat{w} = 0$. If the elasticity of substitution among varieties is sufficiently high, then we should observe the following Stolper-Samuelson chain[6]:

$$\hat{r}_D \quad < \quad 0 \quad = \quad \hat{w} \quad < \quad \hat{r}_X \qquad (5)$$

As we can see, variable trade cost liberalisation enlarges the income gap between X-type firm-owners and D-type firm-owners by raising r_X and lowering r_D. The factor used intensively in exporting gains in absolute terms whereas the import-competing factor loses.

Treating the income-redistribution impact of pure fixed cost liberalisation separately, examination of (4) reveals that its effect for X-type firms is not identical to a variable cost liberalisation. Lowering F_X by the means of regulatory liberalisation has no impact on φ whereas it increases Ω by lowering $T = \frac{F_X}{F_D}$. Considering firms' income, this reduces both r_D and r_X by the same proportion.

This theoretical framework offers a number of propositions that can be subject to an empirical testing. But before formulating our study questions, the next section presents a sketch of the European banking environment and the key liberalisation and deregulation measures during the 1988 to 2003 period. This sets the scene of our empirical analysis in the subsequent sections.

[6] Note that this Stolper-Samuelson chain holds as long as $F_X/F_D > \varphi$ which is necessarily the case as long as
$F_X > F_D$. Even if σ would violate the condition $\sigma > 2$, the real gain to X-types would still exceed the real gain to D-types.

III. LIBERALISING EUROPEAN BANKING

Liberalisation in the European banking sector during the 1988 to 2003 period was mainly driven by deregulation measures at the national level, coupled with European directives abolishing capital controls and establishing the freedom of cross-border financial services. These European Directives provided the foundation of the Single Market Programme (SMP) in banking and financial services.

Prior to the start of the SMP in 1992, the regulatory structure and competitive environment of European banking ranged from highly regulated (mostly in less developed sectors like Portugal, Greece and Italy) to much less regulated (in highly developed sectors like the UK). According to Gardener et al. (2000), anti-competitive regulations, direct interference by the state and other bodies in banking operations together with highly bureaucratic systems (dampening initiative and slowing down innovation and change) set the framework for a generalised lack of domestic competition. This in conjunction with oligopolistic and nationally segmented market structures resulted in low levels of productive efficiency and high operating costs. In most countries, furthermore, there was a lack of highly trained banking staff. An important objective of the SMP was to alter the strategic mindset of European banks away from protective regulation and collusion towards greater competition and the discipline of a more liberalised market-place. The underlying economic aim of the SMP on an EU-dimension was to level the competitive playing fields among EU members.

The SMP implied both freedom to trade and freedom of location for banks in EU member countries. Molyneux et al (1996) cites following five main elements that characterise a single market in financial services:

1. freedom to locate anywhere in the single market area whether by branches or incorporated subsidiaries;
2. freedom to supply services anywhere in the single market without the necessity of specific authorisation;
3. freedom of consumers to buy financial services from anywhere in the single market and from any nationality of suppliers;

4. absence of exchange controls limiting the free movement of capital;
5. a single securities market in which investors can freely issue and trade securities across national frontiers.

Table A1 in the appendix summarises the main pre-SMP barriers to the completion of the internal market in EU banking. Essentially, the SMP was designed to eliminate – or at least reduce – these barriers seeking to integrate financial services markets (through deregulation) and to facilitate cross-border trade in financial services. Its centrepiece is the Second Banking Directive (dated 1989 and in effect from 1993) declaring that the integration technique chosen was based on the concept of *minimum harmonisation*, brought about through the basic principle of *mutual recognition*. It states that a banking license obtained in a member country shall be recognised by other member states. Mutual recognition relies on the concepts of "*home country control*" and "*single passport*". The principle of home country control requires that the authorities in each of the EU member countries will recognise that a bank licensed in any EU country is effectively supervised by its home (licensing) country. The single passport principle means that a bank established (licensed) legitimately in any EU member country can deliver its financial services in other EU countries on the same basis as domestic banks within these host countries. Table A2 in the appendix summarises further key directives and laws associated with the rather complex legislative banking liberalisation and deregulation package. All of these had clear integration and internationalisation dimensions.

It is important to emphasise that since the SMP meant strong deregulation and liberalisation of structure and conduct rules, it also embodied an important and equally strong re-regulation of supervisory and prudential rules in key areas like capital adequacy[7]. In strong contrast to other industries, bankruptcies in the banking sector due to new competitive asymmetries and released market forces had to be prevented. Corresponding prudential rules as well as deposit insurance and lender of last resort have been adjusted and retained throughout the EU. The major economic justification for this kind of re-regulation is to reduce systemic risks during the

[7] Capital adequacy refers to the amount and kind of internal capital that a bank should hold in relation to the risks it is running within its own portfolio of business.

liberalisation period. During this phase, banks are taking on new kinds of business, new risks, and adjusting other portfolio positions. As a result, the potentials for possible excessive, inappropriate and/or imprudent risk-taking by banks are increased.

Supervisory re-regulation in Europe was based on the Basle (BIS) 1988 accord on international bank capital adequacy. The motives were primarily to ensure that no bank would escape capital adequacy supervision, to level the European playing field by making banks subject to the same capital adequacy requirement and to reduce contagion and related systemic risks in European banking. Complete deregulation and liberalisation in banking would involve unjustifiable risks and may not be a wise undertaking. Even nowadays, banking remains a highly regulated industry despite of the present liberalisation talks in financial services within the WTO.

IV. THE PROPOSITIONS TESTED EMPIRICALLY

The liberalisation and deregulation of the European banking sector during the past two decades provides a potentially useful "laboratory" in which we can attempt to empirically test the following questions that can be derived from the Melitz (2003) and Baldwin and Forslid (2004) theoretical framework:

1) Are international banks more productive than regional banks?
2) Self-selection hypothesis: Were future international banks already more productive prior to liberalisation?
3) Did the 1992 SMP lead to an increase in aggregate banking productivity?
4) Has the implementation of the SMP led to a narrowing of the productivity gap between international and regional banks?
5) Are international banks more profitable than regional banks?
6) Has the implementation of the SMP led to a widening of the profitability gap between international and regional banks?
7) Is there a link between a higher exporting intensity and higher productivity?

These questions are derived from both *assumptions* as well as *predictions* of the Melitz theoretical framework. For example, the model *assumes* that international banks are more productive prior and after liberalisation (a necessary condition for a bank to get involved in international activities). Likewise, it *predicts* a narrowing of the productivity gap through a shift of the cut-off points. The inclusion of both assumptions and predictions in our empirical analysis implies a thoroughgoing test of the Melitz model. Question seven is based on studies like Hanson and Lundin (2003) that investigated the *learning-from-exporting* and *export intensity* hypotheses, finding that firms not only became more productive after they started exporting, but also that firm productivity increases with a higher share of exports in total sales.

Before we can proceed to the empirical test, the next section first describes the data as well as the econometric methodology and issues.

V. EMPIRICAL ANALYSIS

V.1 Data and the distinction between international and regional banks

The empirical study focuses on seven European countries and comprises the time period between 1988 and 2003; a choice that is based on the availability of data. Our econometric analysis is based on the OECD *Bank Profitability* dataset. It provides unbalanced panel data on bank financial statements for the years 1979 to 2003, including supplementary information on the number of banks covered, their branches and number of employees. Most countries' figures start in 1988. To ensure a maximally balanced dataset, our analysis comprises data from Finland, France, Germany, Norway, Spain, Sweden and Switzerland[8], covering a total of 6'298 banking institutions in 1988, declining to 3'773 in 2003[9]. The bank-level figures included are aggregated into several groups (such as large commercial banks, commercial banks, cooperative banks, savings banks, agricultural savings and loans associations, cantonal banks, etc).

In our analysis we are specifically interested in the different behaviour of (future) exporting banks and (future) non-exporting banks before and after liberalisation. Since the OECD database does not include data on export sales, we need to fall back on an alternative method to distinguish between exporters and non-exporters by looking at the share of modern banking activities in bank gross income. This distinction relies on the difference between two basically separate banking activities, namely *ordinary* and *modern* banking:

⇒ *Ordinary* or *traditional* banks take deposits from the public at large and provide these as loans for a wide range of purposes. As numerous studies like

[8] Norway and Switzerland are included in the sample, even though strictly speaking they are not part of the Single Market and therefore not bound by the EU Directives. However, both countries have adopted very similar banking deregulation measures and are highly integrated in the Single Market through trade and financial flows.

[9] The falling number of banking institutions is due to an increase in merger and acquisition activities spurred by liberalisation. It is illustrated in Figure B1 in the Appendix and lends support to another Melitz proposition, claiming that "*raising the freeness of trade unambiguously lowers the range of varieties produced in each nation*". See Baldwin (2005), p. 13.

the 1997 EC study confirm, the business of taking deposits and providing loans takes place on a geographically small scale. With the exception of very rich people, individuals prefer to deposit their money in a (regional) bank nearby.

For our purposes, banks for which the interest rate spread is the primary source of income are referred to as *ordinary* or *regional banks* denominated as *REG*.

⇒ *Modern* banks offer modern banking services (MBS) such as asset management, investment and private banking services which are mostly "exported" to foreign countries and form the largest part of a bank's international activities. Correspondingly, these banks are highly exposed to international competition. Their primary sources of income are fees and commissions earned on the provision of MBS. For the rest of this paper, we will call these exporting banks *modern* or *international banks* referred to as *INT*.

In our empirical analysis, a bank is labelled as an exporter – or *INT* - if its share of modern banking services (MBS) amounts to more than 60% of gross revenue. All remaining banks with a share of MBS amounting to less than 40% of gross revenue are referred to as non-exporters or *regional banks* denominated as *REG*[10].

V.2 Regression specifications

To investigate the productivity and profitability differences between international and regional banks and to find answers to the above stated questions, we follow the methodology introduced by Bernard and Jensen (1995, 1999). It has been applied successfully in numerous studies on the exporting-productivity linkage. The longitudinal data from the OECD Bank Profitability database are used to document differences in levels and growth rates of productivity between exporters and non-

[10] Over all observations in the panel, about 20% of all banks have a share of MBS in total sales of more than 60%, whereas more than 60% have an MBS share amounting to less than 40%.

exporters. For questions one to four, we proceed by looking at differences in average labour productivity between international and regional banks. Average labour productivity can be expressed as total gross income per employee, average wage per employee or value added per worker. The goal is to find a so-called exporter premium, defined as the ceteris paribus difference of labour productivity between international and regional banks.

In a first step, this premium is computed from a regression of log labour productivity on the current bank-status dummy and a set of control variables:

$$\ln lp_{it} = \alpha_1 + \beta_1 intbank_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (1)$$

where *lp* is labour productivity[11] (we will use average wage per employee as the dependant variable), *i* is the index of the bank-type[12] and *t* is the index of the year. *intbank* is a dummy variable for the bank-type status (1 if it is an international bank, 0 else). *control* is a vector of control variables. To avoid too many variables, the number of control variables integrated in our analysis is limited to the most widely used variables as reported in previous empirical studies. These include GDP growth rates and firm characteristic measures such as gross income, average total assets and number of employees. Furthermore we include the interest margin (*int_margin*) defined as the net interest income (i.e. total interest income minus total interest expenses) divided by total interest income. Avoidance of the endogeneity problem has been taken into account in the choice of the independent variables. ε is the white noise disturbance term. The exporter premium β shows the average percentage difference between international and domestic banks controlling for the characteristics included in the *control* vector. It is computed from the estimated coefficient β as $100 \cdot \left(\exp^{\beta} - 1\right)$.

In the following specifications (2) to (4) we try to test the robustness of the exporter premium result to the inclusion of other variables assumed to have a strong influence on productivity and profitability. The goal is to disentangle the exporter premium

[11] A detailed description of variables, data and sources can be found in table A4 in the appendix.

[12] The banks are grouped in categories such as Large commercial banks, Commercial banks, Savings banks, Co-operative banks, Regional giro institutions, Foreign commercial banks, Loan associations and agricultural co-operatives, Cantonal banks, Other banks.

from other effects such as technological progress as well as economic and political developments.

In equation (2) we add the variable *finint*, an International Financial Integration index. This variable describes the exposure to financial globalisation and is measured *de facto*, intending to capture the actual degree of financial liberalisation and openness. It is based on the estimated gross stocks of foreign assets and liabilities as a share of GDP as constructed by Lane and Milesi-Ferretti (2006). The new specification is:

$$\ln lp_{it} = \alpha_1 + \beta_1 intbank_{it} + \delta_1 finint_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (2)$$

An alternative possibility is given by assigning a separate dummy for each of the four main steps towards a liberalised and deregulated banking sector in Europe. These four steps include the liberalisation of capital controls (*kmvmt*), interest rate deregulation (*irlib*), implementation of the First Banking Directive (*fbd*) and the implementation of the Second Banking Directive (*sbd*). The dummies take the value 1 when a financial deregulation measure has been implemented, 0 else[13]. This specification gives the possibility to identify the impact of each liberalisation and deregulation step separately. The specification looks as follows:

$$\ln lp_{it} = \alpha_1 + \beta_1 intbank_{it} + \delta_2 kmvmt_{it} + \delta_3 irlib_{it} + \delta_4 fbd_{it} + \delta_5 sbd_{it} + \gamma_1 control_{it} + \varepsilon_{it} \quad (3)$$

Another standard approach is to include year dummies in the basic model (1):

$$\ln lp_{it} = \alpha_1 + \beta_1 intbank_{it} + \theta_1 y89_{it} + \theta_2 y90_{it} + \ldots + \theta_{15} y03_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (4)$$

To study empirically the questions five to seven related to the profitability impact of liberalisation we only need to replace in equations (1) to (4) the dependent variable *lp* by *profit* which stands for profitability as expressed by income after taxes as percentage of average total assets.

[13] The information on the years of implementation has been taken from Gual (1999).

V.3 Econometric issues

Equations (1) to (4) could be estimated by OLS for each year or by pooling these cross-sections across time, but these methods would yield biased estimates failing to take into account heterogeneity between countries. There are many determinants such as political, technological, cultural, historical, economic and geographic factors that may have an impact on the relationship studied. Some determinants can be controlled for by including dummy variables in the model. However many of them are difficult to observe and even harder to quantify. In consequence, many variables we should control for cannot be included in the model and are transferred to the error term. This implies that the estimated exporter premium β and all other coefficients are biased due to the omitted variables. Moreover, we face the problem of measurement errors since it is difficult for instance to measure the degree of financial integration and openness. All explanatory variables have been chosen to circumvent the endogeneity problem causing biased coefficient estimates. Although the use of Instrumental Variables (IV) is a standard solution, it is often difficult to find suitable instruments; hence even IV techniques may lead to biased estimates.

We will use panel data regression methods. The analysis builds on the Fixed Effects (FE) method rather than on the Random Effects (RE) method since we are estimating productivity and profitability impacts between a designated sample of countries and banks. The RE method would imply a randomly selected sample of countries and/or banks, which is not the case in our analysis. The FE method also allows going around the omitted variables and measurement error problem. Assuming that the unobserved and not included determinants are constant over time and within a particular country, they would drop out in any case by using the FE technique. Like first differencing, FE uses a transformation to remove the unobserved effect prior to estimation. Although not yielding the most efficient estimates, the FE method has the advantage to lead to consistent estimates even in the case of correlation between the unobserved determinants with the explanatory variables. Estimates based on the RE method would generate more efficient estimates, but it relies on the crucial assumption of no correlation between the unobserved determinants with the explanatory variables. In our model this is implausible. A formal Hausman test confirms our choice of the FE

method. Since the White test rejects the null hypothesis of homoscedasticity, the FE method also allows correcting for heteroscedasticity. The Wooldridge test for autocorrelation in panel-data models rejects the null hypothesis of no first-order autocorrelation. This problem is dealt with by specifying a dynamic model through the inclusion of a lagged dependant variable as an additional independent variable in all specifications (1) to (4).

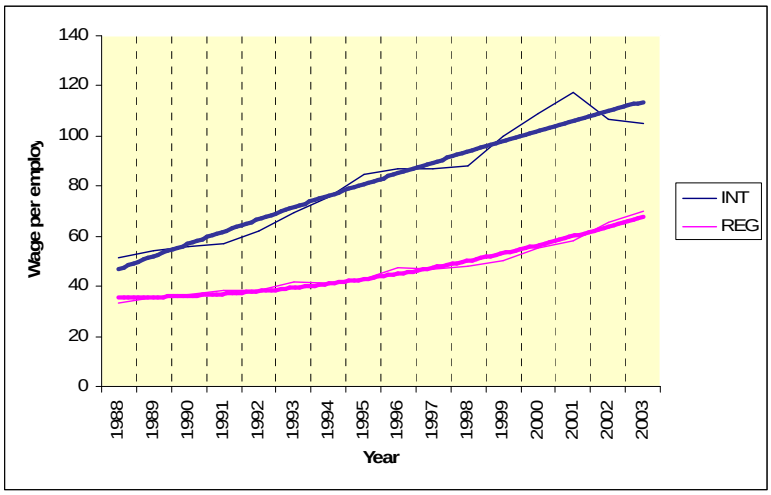
V.4 Regression results and discussion

In what follows we are going to present the answers to the propositions presented in section four. The tables A6 to A9 in the appendix report the fixed effects regression estimates given the specifications presented previously.

1) Are international banks more productive than regional banks?

Before studying the regression results, a look at Figure 4 below gives a clearly affirmative answer to this question: As we would expect, international banks have been more productive than regional banks since the beginning and throughout the period from 1988 to 2003.

Figure 4: Development of average productivity for international and regional banks, 1988 to 2003



Source: OECD Bank Profitability and own calculations. Figure displays pooled averages for both bank types. Bold lines are trend lines.

The estimated exporter productivity premia reported in Table A6 in the appendix confirm what the Melitz Model predicts: The coefficients on the *intbank* dummies in the four specifications have the expected positive sign; international banks are more productive than regional banks. The country- and year-specific fixed effects regressions compute the exporter productivity premium amounting to around 8%. This result is statistically significant at the 1%-level and robust to the alternative model specifications.

2) The self-selection hypothesis: Were the future international banks already more productive prior to liberalisation?

As we have noticed by looking at Figure 4, international banks were already more productive prior to liberalisation, giving support to the self-selection hypothesis. To find a quantitative estimate for the exporter premium of future exporters, we estimate the basic model (1) restricting our panel to the cross-sectional observations for the years prior to liberalisation. For our purpose, when talking of the period prior to liberalisation we are referring to the period before full implementation of the 1992 SMP legislative package (as detailed in table A2 in the appendix). Further discussion below of the liberalisation impact on aggregate productivity supports this choice.
Running the fixed effects regression $\ln lp_{it} = \alpha_1 + \beta_1 intbank_{it} + \gamma_1 control_{it} + \delta_1 finint_{it} + \varepsilon_{it}$ with the condition $sbd_{it} = 0$ yields the expected positive sign for the coefficient on the *intbank* dummy variable. The result implies that future international banks were about 6% more productive than regional banks already prior to liberalisation. This result is statistically significant at the 5% level[14].

3) Did the 1992 SMP lead to an increase in aggregate banking productivity?

To answer this question, we focus on the productivity impacts of the two major SMP-regulations, namely the First Banking Directive (*fbd*) on banking structure and

[14] See the first regression in table A7 in the appendix.

the Second Banking Directive (*sbd*) on banking conduct. The estimated coefficients of the FE panel regression (3) in table A6 report the expected positive signs for both the *fbd* and *sbd* dummy variables, confirming that the implementation of the SMP has contributed to an increase in aggregate banking productivity. A 1.5% is attributed to the implementation of the First Banking Directive, a 4% to the implementation of the Second Banking Directive. The results are statistically significant at the 10%- and 5%-level respectively. Interestingly, the abolition of capital controls (*kmvmt*) and the deregulation of interest rates (*irlib*) had no statistically significant impact on bank productivity.

4) Has the implementation of the SMP led to a narrowing of the productivity gap between international and regional banks?

Recalling Figure 2 when we discussed the Melitz model, we expect the SMP leading to a decrease in international banks' productivity and an increase in regional banks' productivity, resulting in a narrowing of the productivity gap between international and regional banks. However, due to technological progress and other factors it is unlikely to find this result, as a simple inspection of Figure 4 confirms. Therefore we need to ask the question differently: Have regional banks experienced a higher productivity growth than international banks after liberalisation? In other words: Do we observe $\hat{a}_D > \hat{a}_X$?[15]

To find an answer to this question we modify our basic model (2) as follows:

$$\ln lp_{it} - \ln lp_{it-1} = \alpha_1 + \beta_1 intbank_{it} + \delta_1 finint_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (5)$$

Running the regression over the period before the implementation of the SMP, the four years following the implementation of the SMP and over the remaining period allows comparing the evolution of the productivity growth differential between international and regional banks. Unfortunately this method does not yield any statistically significant results (not reported). We need to fall back on a different

[15] In absolute terms.

strategy: Running equation (2) over the three periods before, four years after and the remaining time period and comparing the exporter premia should allow finding an answer to our question. Table A7 in the appendix lists the regression results, indicating– against to what we would expect – that the exporter premium increased during the four years following the implementation of the SMP. This result lends support to the *learning from exporting* hypothesis stating that banks should become more productive once they have started to engage in international activities (i.e. exporting their services). For the last period until 2003, the exporter premium estimate is not statistically significant and does not give any clear indication as to whether the productivity gap increased further or even lowered.

All in all, we cannot conclude that liberalisation in the European banking sector has led to a narrowing of the productivity gap as the Melitz model suggests. More readily, we have found evidence in favour of a widening of the productivity gap. This result – which is supported by our graphical analysis in figure B3 in the appendix – can to a large extent be explained by the substantial re-regulation of supervisory and prudential rules that paralleled the implementation of the SMP in banking and financial services. These re-regulations were directed at preventing banks going bankrupt, hence only very few of the least-productive banks had to stop business. The least-productive banks either "survived" or were taken over during the remarkable M&A wave that followed the banking liberalisation.

Having discussed the productivity impacts of liberalisation, we will now turn to the profitability and income-redistribution related questions.

5) Are international banks more profitable than regional banks?

This question examines whether liberalisation and export-market participation is linked to higher profitability. We will proceed similarly as in the first question by computing a profitability premium ψ for international banks, defined as the ceteris paribus percentage difference of profitability between international and domestic banks. Analogously to specification (2), this premium is computed from a regression of log profitability on the current bank-status dummy (1 if it is an international bank,

0 else), the International Financial Integration index (*finint*) and the same set of control variables:

$$\ln profit_{it} = \alpha_1 + \psi_1 intbank_{it} + \delta_1 finint_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (6)$$

where *profit* stands for profitability (defined as income after taxes as percentage of total average assets), *i* is the index of the bank-type and *t* is the index of the year. The modern bank profitability premium ψ shows the average percentage difference between international and regional banks and is computed from the estimated coefficient ψ as $100 \cdot \left(\exp^{\psi} - 1\right)$.

We can read from Table A8 in the appendix that the profitability premiums of international banks in the four specifications have the expected positive signs. Over the whole period, international banks are about 93% more profitable than regional banks. This result is statistically significant at the 1%-level and robust to alternative model specifications. Note that the international banks were more profitable already prior to banking liberalisation, a necessary condition to incur F_X in order to establish international operations.

6) Has the implementation of the SMP led to a widening of the profitability gap between international and regional banks?

Following Baldwin and Forslid (2004), the liberalisation induced reallocation of market shares should have initiated an income-redistribution among international and regional banks: As variable trade costs declined, the profits of international banks are supposed to have increased whereas the profits of regional banks eventually even decreased. However, in the case of a pure fixed cost liberalisation such as a deregulation (not affecting the variable costs of trade), both r_X and r_D should have changed in the same proportion.

To find an answer to the above question, we first investigate whether there was a change in the profitability growth rates of international and regional banks, using the specification

$$\ln profit_{it} - \ln profit_{it-1} = \alpha_1 + \psi_1 intbank_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (7)$$

The coefficient ψ provides an estimate of the difference in profitability growth between international and regional banks. Running specification (7) analogously to question four over the period before the implementation of the SMP, the four years following the implementation of the SMP and over the remaining period allows comparing the evolution of the productivity growth differential. However, these regressions do not yield to any statistically significant results. This is plausible since bank profitability is volatile and typically directly related to economic cycles, hence we cannot expect profitability growth rates to move into the same direction over a longer period.

Still trying to assess whether the profitability levels of international and regional banks have changed following the SMP, we run specification (6) over the three periods before, four years after and the remaining time period. Evaluating the resulting exporter premia estimates shows that the implementation of the SMP has not altered the income gap between international and regional banks. This may allow the conclusion that the profitability of international and regional banks has changed in the same proportion delivering evidence for a „pure“ fixed cost liberalisation. Indeed, the SMP in banking almost exclusively encompassed deregulation measures, leading to lower fixed trade costs without affecting the variable trade costs.

A visual inspection of the graphs in figure B4 in the appendix (illustrating the development of profit after taxes in absolute terms) may suggest a widening of the profitability gap between international and regional banks following implementation of the SMP. However, bearing in mind that in our analysis we used income after taxes as percentage of total average assets as our dependent variable, the only conclusion we can draw from the graphs is that the international banks have been able to increase total assets managed by more than regional banks. This provides an indirect proof of the Melitz (2003) market share shifting effect as illustrated in section II.

In sum, defining profitability as income after taxes as a percentage of total assets managed, we are not in a position to firmly conclude on the income-redistribution proposition not having found any statistically significant estimates.

7) Is there a link between a higher exporting intensity and higher productivity?

As mentioned previously, this question is derived from several microeconometric studies also examining the *learning-from-exporting* hypothesis. These not only found that firms became more productive after they had started exporting, but also that export intensity can make a difference. In particular, firm productivity may increase as the share of exports in total income increases.

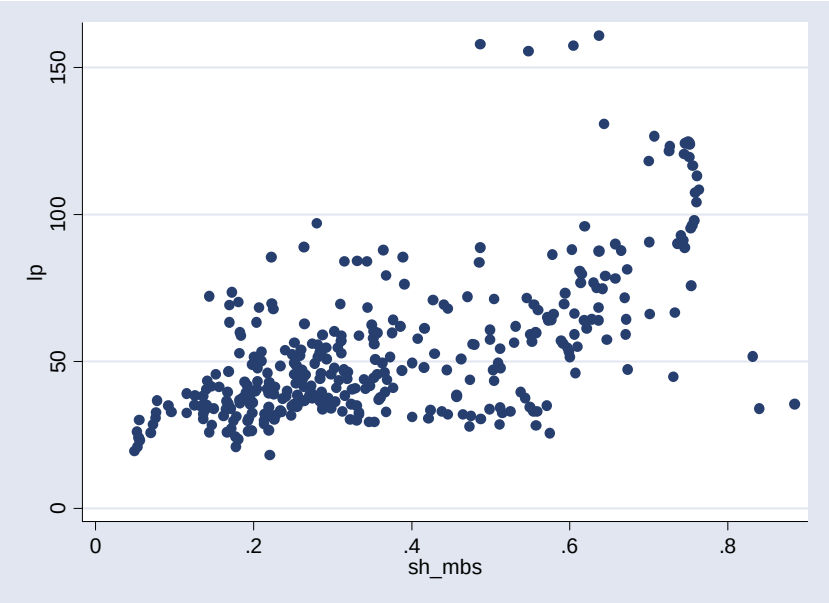
In the following regression based on specification (2), we try to find out whether there is a significant positive link between the share of modern banking services in total income (*sh_mbs*) and productivity:

$$\ln lp_{it} = \alpha_1 + \lambda_1 sh\_mbs_{it} + \delta_1 finint_{it} + \gamma_1 control_{it} + \varepsilon_{it} \qquad (8)$$

where *lp* is again labour productivity. *sh_mbs* indicates the share of MBS income in total gross income (such as fees and commissions stemming from international wealth management, investment and private banking activities). The other independent variables including the control vector are same as in specification (2).

Inspection of the regression results in Table A9 reveals that there is a clearly positive relationship between the extent of a bank's international activities in total income and its productivity level: The coefficient on *sh_mbs* has a positive sign and is statistically significant. Inspection of Figure 5 below underpins this finding.

Figure 5: The link between export intensity and productivity



Source: OECD Bank Profitability and own calculations. Figure displays a scatter plot between wage per employee and the share of modern banking services revenue in total gross sales.

This result confirms our finding of question four: Banking deregulation stimulated international banks' export market activities, increasing their MBS income and turning them more productive. At the same time, following Claessens et al (2000), the regional banks' international activities rather declined which held back their productivity. Altogether, this resulted in a widening of the productivity gap as observed in question four.

VI. CONCLUSION

This paper discussed the productivity and profitability impact of deregulation and market integration on international and regional banks in seven European countries. While describing briefly the competitive environment in these banking markets, we showed that the Mutual Recognition Principle such as embedded in the Second Banking Directive implied a significant fall of barriers to trade in banking services resulting in notably higher competition levels in European banking. The Melitz (2003) and Baldwin and Forslid (2004) heterogeneous-firm trade model as well as related empirical studies offered several testable propositions with respect to bank-level productivity and profitability characteristics before and after liberalisation.

Against this background, this paper investigated a number of these propositions empirically using OECD Bank Profitability data over the 1988 to 2003 period. The empirical analysis confirmed that international banks are generally more productive and profitable than regional banks. It also found support for the self-selection hypothesis and a positive link between exporting and productivity. Accordingly, we were not able to reach the conclusion that liberalisation has led to a narrowing of the productivity gap between international and regional banks. More readily, our estimates are in favour of the learning-from-exporting hypothesis resulting in a widening of the productivity gap. Furthermore, we did not find strong empirical evidence in favour of or against the widening of the income gap proposition. Both findings can be accounted for by the particular regulatory environment in the banking sector and the deregulatory nature of banking liberalisation implying a lowering of fixed trade costs without altering the variable trade costs.

In conclusion, this paper showed that overall the Melitz model works well in an empirical analysis. On an econometrical note, while the fixed effects method allowed controlling for omitted variables, further studies may consider integrating banking technology indices and employing alternative methods to deal with endogeneity and autocorrelation issues causing biased estimates and calling for a cautious interpretation of the regression estimates. Going forward, more empirical studies on other sectors should be undertaken not only restricting themselves to the investigation of the productivity impacts, but also analysing profitability and income-redistribution effects of sector liberalisation and deregulation.

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VIII. DATA SOURCES

International Monetary Fund, various years, *International Financial Statistics*, (Washington D.C.)

Oanda.com: Foreign exchange rates to the EUR (respectively ECU) from 1988 to 2003.

Organisation for Economic Cooperation and Development (OECD): *Financial Statements of Banks* (formerly *Bank Profitability*); unbalanced panel covering period from 1979 to 2003.

Thomson Financial Services: *DataStream*.

IX. APPENDIX: TABLES AND FIGURES

Table A1: Pre-SMP barriers to integration in European banking

A. Barriers to establishment in banking

(1) Restrictions on the legal form banks may adopt
(2) Limitations on the number of branches that may be established
(3) Restrictions on the takeover of domestic banks
(4) Restrictions of equity or other control of domestic banks

B. Barriers to operating conditions in banking

(1) The need to maintain separate capital funds
(2) Differences in the definition of "own capital" funds
(3) The need to maintain certain capital-asset ratios
(4) Exchange controls

C. Barriers to competing for business in banking

(1) Limitations on services offered
(2) Restrictions on local retail banking
(3) Restrictions on acquisition of securities and other assets

Source: Molyneux et al. (1996. Table 2.1)

Table A2: SMP-related legislation and rules

Subject	***Focus***	***Subject***	***Focus***
Interest rate de-regulation	Conduct	89/646 Second banking directive	Conduct
73/I 83 Freedom of establishment	Structure	89/647 +91/31 Solvency ratio directives	Prudential
77 /780 + 85/345 + 86/I 37 + 86/524 First banking directive	Structure	91/308 Money laundering directive	Conduct
83/350 Consolidated surveillance	Prudential	91/633 Modifications to 89/299 (own funds directive)	Prudential
86/635 Consolidated accounts	Prudential	92/121 Large exposures directive	Prudential
1988 - Article 76 of the EEC treaty Liberalisation of capital movements	Structure	92/30 Modifications to 83/350 (consolidated surv.)	Prudential
89/I 17 Branch establishment and head offices outside EU	Structure	94/7 Modifications to 89/647 (solvency ratio)	Prudential
89/299 + 92/16 Own funds directive	Prudential	94/19 Deposit insurance directive	Prudential

Source: EC (1997, Table A.10)

Table A3: Selected Microeconometric Studies on Exporting and Productivity (focus Europe)

Study	Country	Sample	Methodology	Results
Bernard and Jensen (1999)	US	50-60,000 plants 1984-92	Linear probability with fixed effects	• Self selection of exporters • Absence of learning from exporting • Higher productivity of exporters
Delgado, Farinas and Ruano (2001)	Spain	1,766 firms 1991-96	Non-parametric analysis of productivity distributions	• Higher productivity of exporters • Self selection of exporting firms • Inconclusive evidence on learning
Aw and Hwang (1995)	Taiwan	2,832 firms 1986	Translog production function Cross section	• Higher productivity of exporters • Self selection • Absence of learning from exporting
Castellani (2002)	Italy	2,898 firms 1989-94	Cross section	• Higher productivity of exporters • Self selection of exporters • Productivity growth higher in firms with a higher share of exports in total sales
Kraay (1999)	China	2,105 firms 1988-92	Dynamic panel	• Higher productivity of exporters • Learning from exporting
Clerides, Lach and Tybout (1998)	Colombia Mexico Morocco	All plants 2,800 firms All firms 1981-91 1986-90 1984-91	FIML of cost functions Panel data	• Exporting firms more efficient than non-exporting firms • Quitters less productive • No learning from exporting in Colombia and Mexico • Some learning from exporting in Morocco • Spillovers from exporters to non-exporters
Bernard and Wagner (1997)	Germany	7,624 firms 1978-92	Panel data	• Higher productivity of exporting firms • Self selection of exporters
Wagner (2002)	Germany	353 firms 1978-89	Panel data; matching	• Higher productivity of exporting firms • Absence of learning from exporting
Alvarez (2002)	Chile	5,000 plants 1990-96	Ordered probit; Pooled data	• Higher productivity of exporting • Self selection of exporters

Greenaway, Gullstrand and Kneller (2003)	Sweden	3'500 firms 1980-1997	Panel data; matching differences in differences	• Higher productivity of exporting firms • Absence of learning from exporting
Farinas and Martin-Marcos (2003)	Spain	1990-1999	Panel data; matching	• Higher productivity of exporting • Self selection of exporters • Absence of learning from exporting
Girma, Greenaway and Kneller (2003)	UK	8,992 firms 1988-99	Panel data; matching differences in differences	• Higher productivity of exporting firms • Self selection of exports • Learning from exporting
Girma, Greenaway and Kneller (2003)	UK	658 firms 1988-99	Panel data; matching differences in differences	• Lower productivity of quitters
Baldwin and Gu (2003)	Canada	1974-1996	Panel data: Ordered probit; Pooled data	• Higher productivity of exporters • Difference increasing over time • Learning from exporting leading to higher productivity • Exiters had slower productivity growth than continuers
Sinani (2003)	Estonia	1994-1999	Panel data	• Higher productivity of exporters • Higher productivity growth of exporters
Arnold and Hussinger (2004)	Germany	1992-2004	Panel data; matching differences in differences	• Higher productivity for exporters • Self-selection of exports • Productivity gap between exporters and non-exporters doesn't widen
Hanson and Lundin (2003)	Sweden	3'275 firms 1990-1999	Panel data; differences in differences, probit	• Higher productivity of exporting firms • Self selection of exports • Exporting further increases firm productivity, also in relation to export intensity

Source: Wagner (2005) and Greenaway, Gullstrand and Kneller (2003)

Table A4: Variable description and sources

Variable	Description	Source
lp	Labour productivity, as measured by average wage per employee. It is constructed by dividing total staff cost by the number of employees. Assuming that wages correspond to their marginal productivity, numerous microeconometric studies rely on this measure of productivity[16].	OECD Bank Profitability
profit	Profitability; measured as income after taxes divided by total average assets managed.	OECD Bank Profitability
intbank	Dummy variable for an exporter or international bank. The dummy takes the value 1 if a bank is considered as an exporter which is the case if the share of wealth management, investment and private banking income amounts to more than 60% of gross income. It is computed by dividing non-interest income by gross income. If this share amounts to 40% and less, the bank is considered as non-exporter or regional bank; the dummy takes the value 0.	OECD Bank Profitability
finint	Index for financial liberalisation and openness as presented in Lane and Milesi-Ferreti (2006). For exact description of the computation of the index please refer to the paper. See Figure 2 for a graphical illustration.	Lane and Milesi-Ferreti, 2006 Data can be found at: http://www.tcd.ie/iiis/pages/people/planedata.php
kmvmt	Dummy variable for liberalisation of capital. 1 for full liberalisation, 0 else.	Gual (1999)
irlib	Dummy variable for interest rate deregulation. 1 for full liberalisation, 0 else.	
fbd	Dummy variable for the implementation of the First Banking Directive. 1 for implementation, 0 else.	
sbd	Dummy variable for the implementation of the Second Banking Directive. 1 for implementation, 0 else.	
sh_mbs	Share of Modern Banking Services in total income. It is computed by dividing non-interest income by gross income.	OECD Bank Profitability
int_margin	Interest margin: Net interest income (i.e. total interest income minus total interest expenses) divided by total interest income.	OECD Bank Profitability

[16] See Wagner (2005) and Hannson and Lundin (2003). Alternative productivity measures used in the empirical literature include total value of shipments or value-added per worker and total factor productivity (TFP), usually calculated as the residual from an estimated Cobb-Douglas-type production function.

grossinc	Net interest and non-interest income of banks. Amounts in are translated into EUR at year average rates.	OECD Bank Profitability and Oanda.com
totas	Average of total assets at the beginning and the end of year. Amounts in are translated into EUR at average year rates.	OECD Bank Profitability and Oanda.com
nb_emp	Number of employees	OECD Bank Profitability
gdpgr* and *gdpgr_lag1	Annual growth rate of GDP per capita.	IMF, International Financial Statistics

Table A5: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
lp	53.61	25.36	18.02	160.68	1.6245	6.0237
profit	0.0047	0.0087	-0.09	0.0354	-3.8478	43.012
grossinc	8388.2	10584	9.3	52723	1.7459	5.8116
totas	306479	476420	773.3	2415928	2.5298	9.6987
nb_emp	63.42	82.79	0.1	291	1.3499	3.4293
sh_mbs	0.38	0.1943	0.0498	0.884	0.4876	2.1701
int_margin	0.3395	0.1418	0.0124	0.701	0.4206	3.1866
gdpgr	2.1782	2.3615	-6.387	13.22	0.2433	7.1427

lp, *profit*, *grossinc*, *totas* and *nb_emp* are expressed in thousand units (i.e. Euros and number of employees).

Table A6: Exporter Productivity Premium

Dependant Variable: ln *lp*				
Regression method	**Fixed effects regression (country and year)**			
Specification	**(1)**	**(2)**	**(3)**	**(4)**
Independent variables				
intbank	0.0885*** (3.41)	0.0743*** (3.10)	0.0866*** (3.32)	0.0612*** (2.60)
finint		0.0014*** (7.46)		
kmvmt			-0.004 (-0.12)	
irlib			-0.0032 (-0.09)	
fbd			0.0134* (1.72)	
sbd			0.0401** (2.12)	
Year dummies *y89* to *y03*				F-test rejects possibility that multiple year coefficients could all be zero: F(14,284)=6.78 Prob >F= 0.0000
int_margin	0.0311 (0.37)	-0.2*** (3.02)	-0.0258 (-0.29)	-0.3655*** (-3.98)
grossinc	0.0000*** (2.72)	0.0000*** (3.02)	0.000** (2.50)	0.0000*** (2.68)
totas	0.000 (1.15)	0.000** (-2.18)	0.000 (-0.88)	0.000** (-2.27)
nb_emp	-0.001 (-0.96)	-.0014 (-1.52)	-0.0011 (-1.11)	-0.0018** (-1.96)
gdpgr	-0.0014 (-0.51)	-0.0032 -1.27	-0.0015 (-0.55)	-0.0056* (-1.91)
ln_lp_lag	0.7884*** (23.76)	0.5999*** (15.15)	0.7605*** (20.55)	0.5414*** (12.35)
Constant	0.8146*** (6.20)	1.4481*** (9.81)	0.9220*** (6.50)	2.1704*** (10.59)
Number of observations	328	328	328	328
R^2 (Within/Between)	0.837/0.967	0.8630/0.945	0.839/0.978	0.878/0.839

* =significant at 10% level; ** = significant at 5% level; *** = significant at 1% level
t-values in parentheses are based on heteroscedasticity-robust standard errors

Table A7: Narrowing of the productivity gap

Fixed effects regression (country and year) Specification (2)			
Period	**Prior to SBD-implementation**	**Four years following SBD-implementation**	**Remaining years until 2003**
Independent variables			
intbank	0.0545** (2.18)	0.127** (2.07)	0.019 (0.64)
finint	0.005* 1.82	0.008*** (5.06)	0.002*** (6.21)
grossinc	0.000** (2.16)	0.000*** (0.1)	0.000* (1.80)
totas	0.000 (1.22)	0.000 (0.56)	0.000 (0.77)
nb_emp	-0.004** (-2.06)	-0.004 (-0.43)	0.000 (0.19)
gdpgr	-0.005 (-1.42)	-0.016 (-1.53)	-0.007 (-1.41)
ln_lp_lag	0.2076*** (2.84)	0.0249 (0.19)	0.451*** (6.23)
Constant	2.2458*** (5.07)	2.942*** (6.24)	3.493*** (23.92)
Number of observations	77	91	160
R^2 (Within/Between)	0.643/0.724	0.408/0.008	0.790/0.746

* =significant at 10% level; ** = significant at 5% level; *** = significant at 1% level
t-values in parentheses are based on heteroscedasticity-robust standard errors

Table A8: Exporter profitability premium

Dependent Variable: ln *profit*				
Regression method	**Fixed effects regression (country and year)**			
Specification	**(1)**	**(2)**	**(3)**	**(4)**
Independent variables				
intbank	0.6708*** (3.83)	0.6912*** (3.93)	0.6505*** (3.68)	0.6516*** (3.64)
finint		-0.0005 (-0.57)		
kmvmt			-0.2084 (-1.04)	
irlib			0.1437 (0.67)	
fbd			0.3723 (1.41)	
sbd			0.1224 (0.98)	
Year dummies *y89* to *y03*				F-test rejects possibility that multiple year coefficients could all be zero: F(14,239)=1.79 Prob >F= 0.0408
int_margin	1.8993*** (4.45)	2.1911*** (4.00)	1.5128*** (2.90)	2.0235*** (3.15)
grossinc	0.0000 (1.4)	0.0000 (1.55)	0.0000 (0.68)	0.0000 (0.68)
totas	0.000** (-2.56)	0.000** (-2.46)	0.000** (-2.27)	0.000** (-2.27)
nb_emp	0.0048 (1.17)	0.0046 (1.13)	0.0051 1.23	0.005 (1.22)
gdpgr	0.0493*** (3.06)	0.0485*** (2.99)	0.0568*** (3.32)	0.03656* (1.85)
ln_profit_lag	0.3609*** (5.21)	0.3422*** (4.88)	0.3497*** (4.99)	0.3843*** (5.37)
Constant	-4.7090*** (-8.33)	-4.9193*** (-8.56)	-5.033296 -7.88)	-4.4179*** (-7.03)
Number of observations	283	283	283	283
R^2 (Within/Between)	0.344/0.199	0.345/185	0.356/0.182	0. 406/236

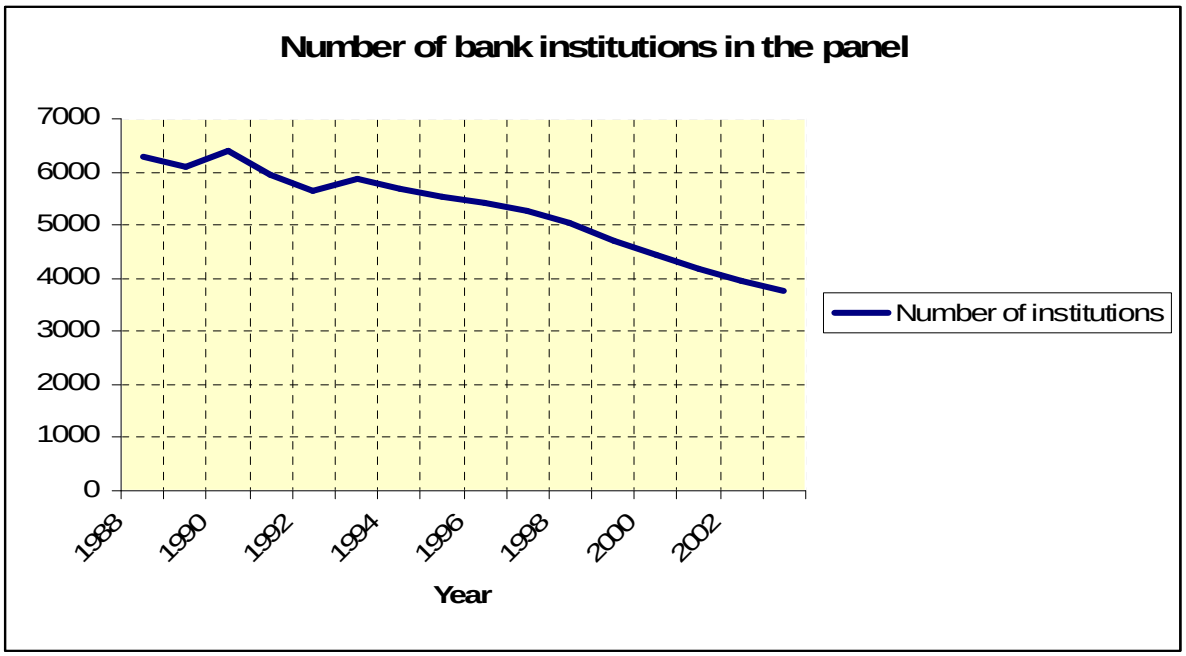
* =significant at 10% level; ** = significant at 5% level; *** = significant at 1% level
t-values in parentheses are based on heteroscedasticity-robust standard errors

Table A9: Export intensity link

Regression method	**Fixed effects regression (country and year)**
Dependent Variable	**ln *lp***
Specification	**(8)**
Independent variables	**Productivity level**
sh_mbs	0.1633** (2.18)
finint	0.0013*** (6.98)
int_margin	-0.2379*** (-2.50)
grossinc	0.000*** (2.77)
totas	0.000** (1.99)
nb_emp	-0.0013 (-1.39)
gdpgr	-0.0032 (-1.27)
ln_lp_lag	0.6029*** (15.08)
Constant	1.3963*** (9.29)
Number of observations	328
R^2 (Within/Between)	0.8608 / 0.9013

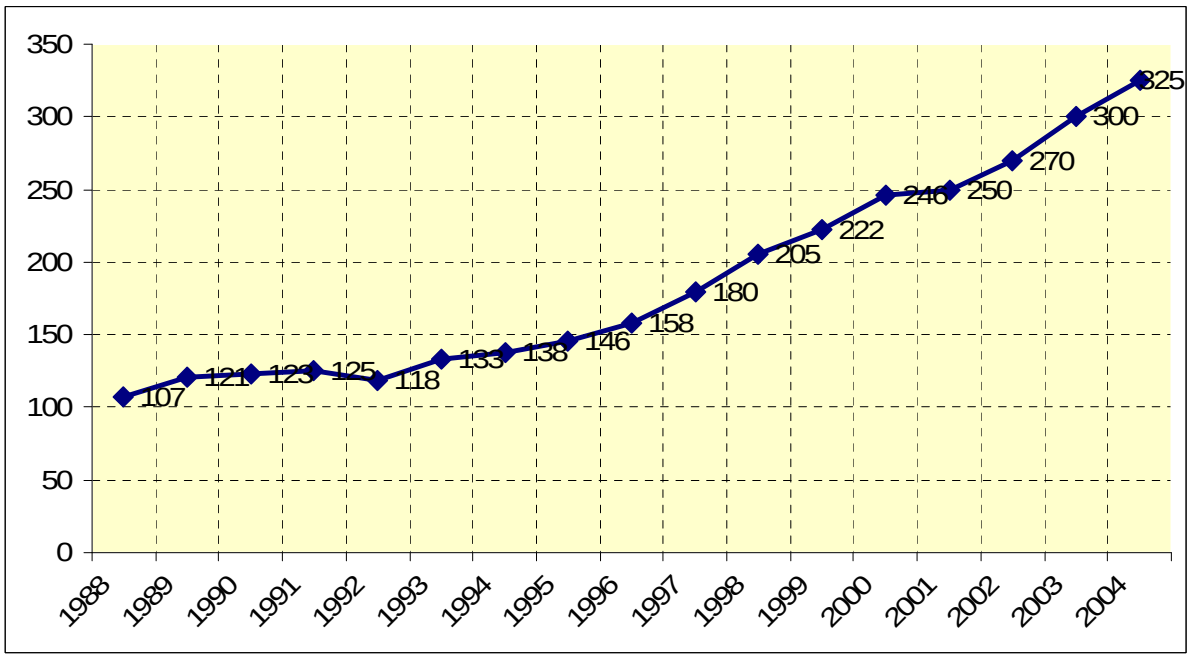
* =significant at 10% level; ** = significant at 5% level; *** = significant at 1% level
t-values in parentheses are based on heteroscedasticity-robust standard errors

Figure B1: Number of banking institutions included in the panel



Source: OECD Bank Profitability

Figure B2: Financial Integration Index for industrial countries



Source: Lane and Milesi-Ferretti, 2006

Figure B3: Productivity levels and growth rates

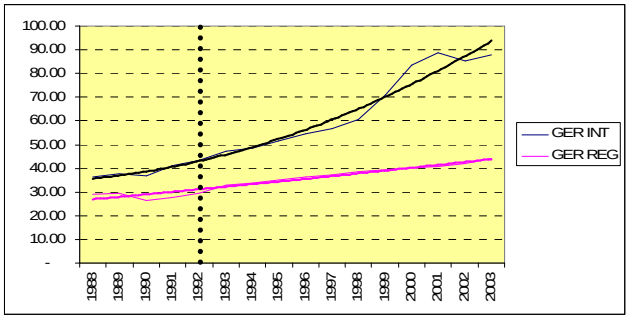
In the graphs below the two groups are set up to document visibly the differences in levels and growth rates of productivity between international and regional banks. The graphs in the left column illustrate the average labour productivity levels between the two types in terms of average wage per employee. The graphs in the right column show the productivity growth rates of the two types. The bold lines are (two period polynomial) trend lines, the dotted lines show the year of implementation of the Single Market Programme (SMP).

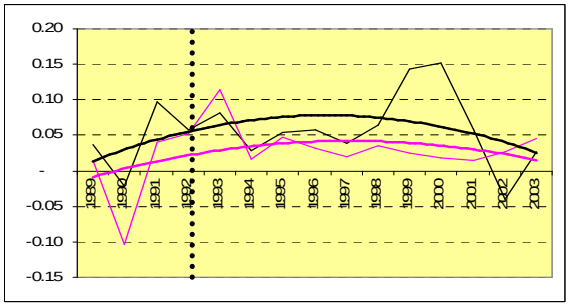
For the whole period and all countries in consideration, international banks were generally more productive than regional banks. Since this was the case even before deregulation and liberalisation occurred, this lends support to the self-selection hypothesis. With respect to the proposition of productivity convergence between international and regional banks, we rather find evidence for a widening of the productivity gap between international and regional banks. In almost all cases the international banks' productivity growth rates are higher than the regional banks' productivity growth rates.

Productivity levels
(expressed as average wage per employee, in thousand units of local currency)

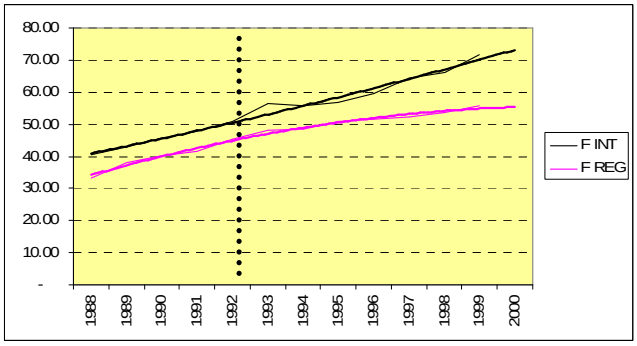
Productivity growth rates

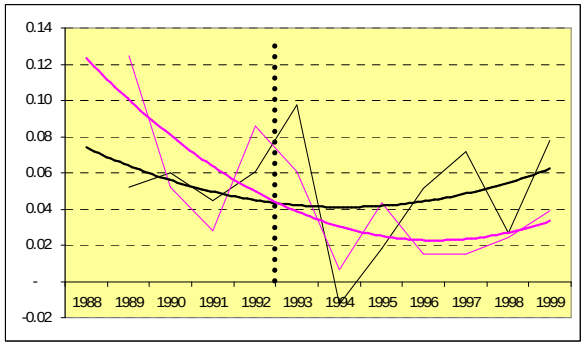
Germany



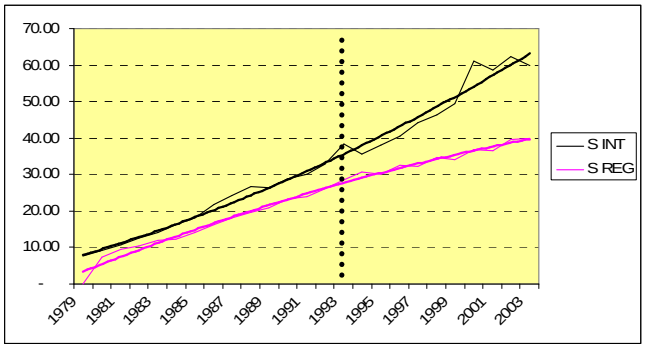


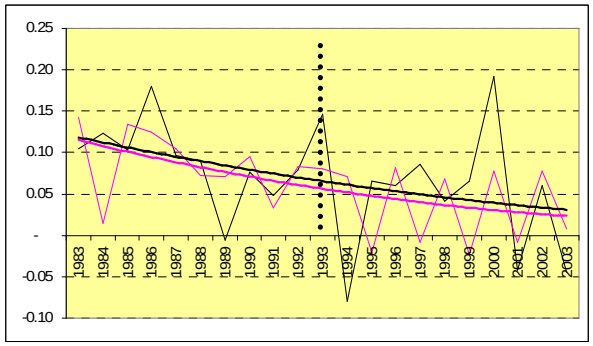
France



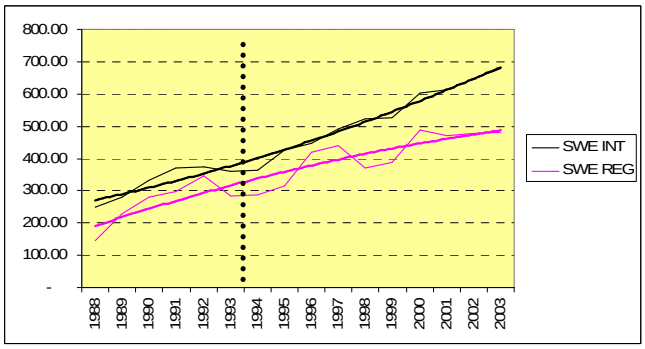


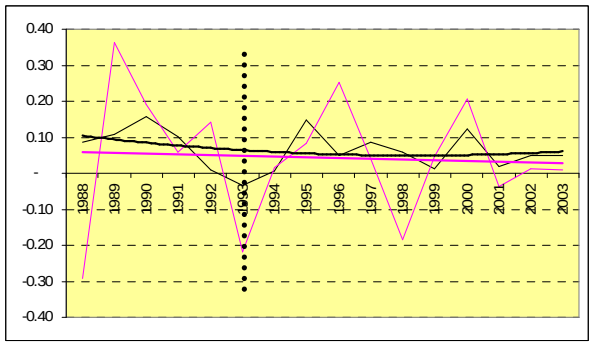
Spain



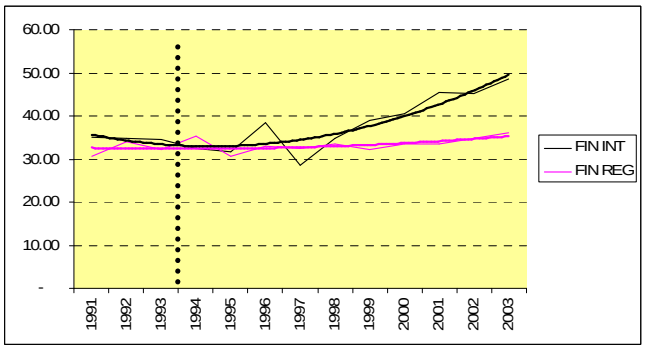


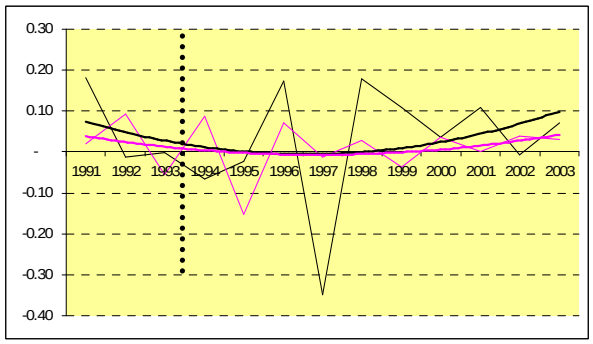
Sweden



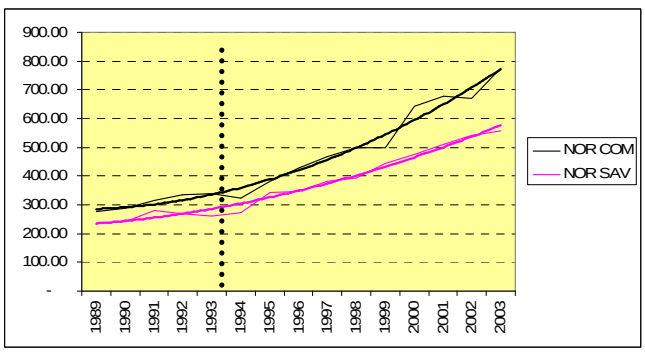


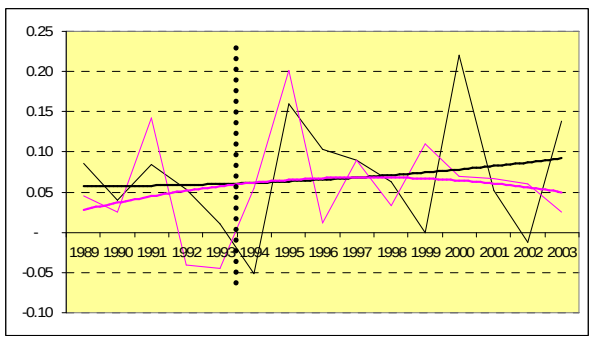
Finland



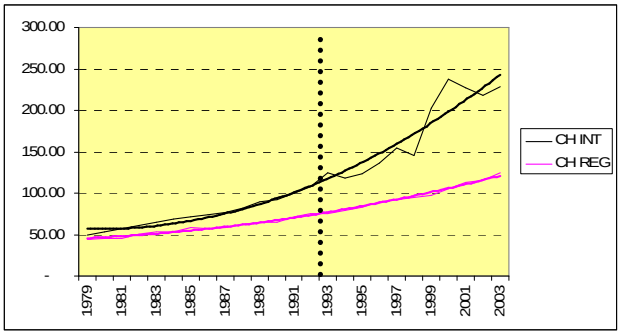


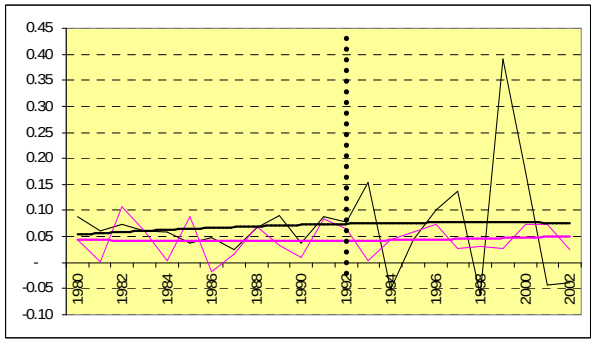
Norway





Switzerland





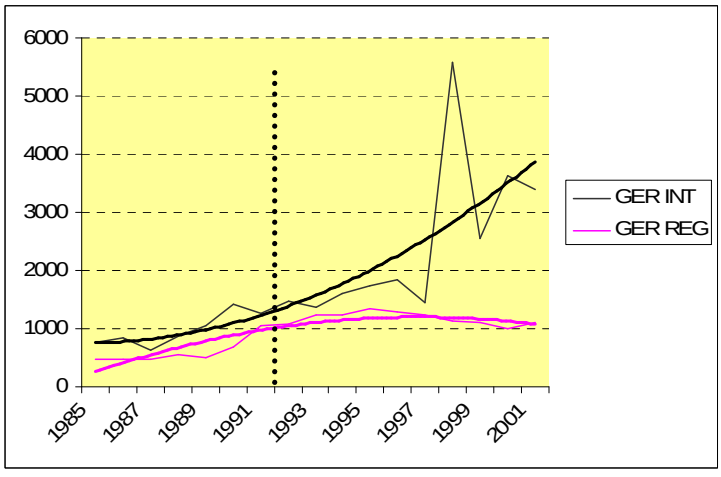
(Source: OECD Bank Profitability for bank figures and Gual [1999] for implementation years of the SBD)

Figure B4: Profitability gap

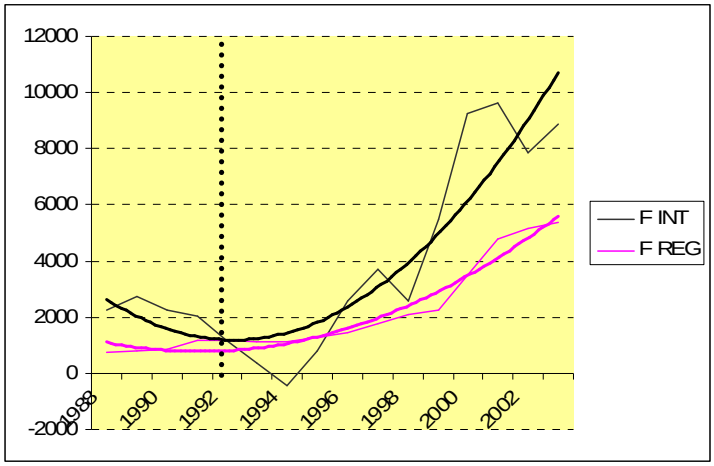
The graphs below illustrate the development of profit after taxes in thousand units of local currency. The bold lines are (two period polynomial) trend lines, the dotted lines show the year of implementation of the Single Market Programme (SMP).

For the whole period and all countries in consideration, international banks had higher profits than regional banks. This was the case even before the deregulation occurred. The graphs seem to support the proposition of a widening profitability gap (in terms of absolute profits) between international and regional banks. However, bearing in mind that in our econometric analysis we used income after taxes as percentage of total average assets as our dependent variable, the only conclusion we can draw from the graphs is that the international banks have been able to increase total assets managed by more than regional banks. This provides an indirect proof of the Melitz (2003) market share shifting effect as illustrated in section II.

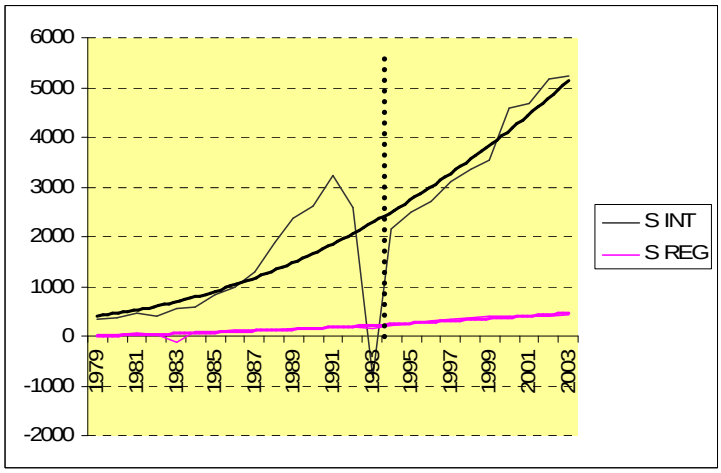
Germany:



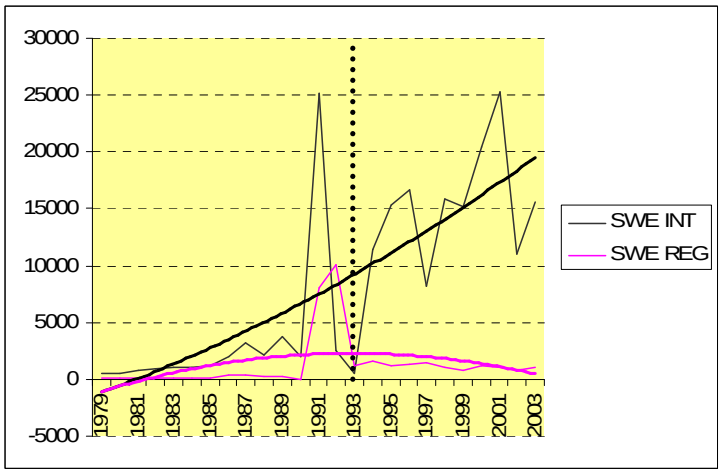
France:



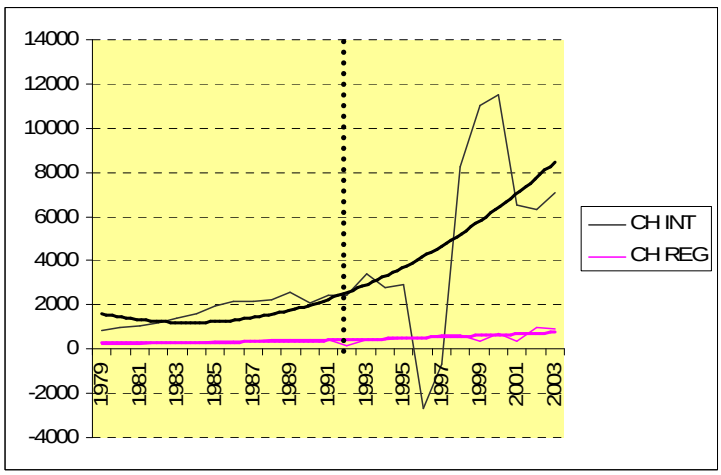
Spain:



Sweden:



Switzerland:



(Source: OECD Bank Profitability for bank figures and Gual [1999] for implementation years of the SBD)