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Global Integration
and the Importance of Trade for Growth

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The interaction of trade and domestic growth has been a long-standing topic in the European and in the global debate – both among policy-makers and in academia – and it certainly is of continuing – if not growing – relevance. In Europe it has gained special prominence in the context of European integration and the opening-up of Eastern Europe, but there is also an important global dimension of the whole debate.

The present volume emerged from a conference organized jointly by the Oesterreichische Nationalbank, the Austrian Federal Economic Chamber and the Vienna Institute for International Economic Studies (wiiw). It was inspired by a previous workshop of the Oesterreichische Nationalbank which dealt with strategies for employment and growth, covering numerous policy areas that are interrelated with economic growth. The concept of this workshop was to deepen the analysis in one specific policy area – namely trade policy and its linkages to domestic growth. The subject matter was the intention to bring recent academic work in the area of *International Trade and Domestic Economic Growth* to the attention of a wider audience and also to address important economic policy issues which have not received appropriate attention up to now in Austria.

Theoretically, increased economic integration via rising trade flows is assumed to promote economic growth by leading to a more efficient allocation of resources, by encouraging competition and by cross-border knowledge spillovers. In reality,

these effects may not show up automatically or immediately and a number of critical questions arise which illustrate the outstanding policy relevance of the topic.
The academic as well as policy discussion of the subject has many strands:
First, the considerable change in the architecture of international integration over the past decades is of crucial importance. The ongoing liberalization of international flows of goods, capital and labor has affected the international division of labor significantly.
Second, modern firms – even smaller ones – nowadays operate on an international level, making the traditional concepts of capital stock, capacity, trade and domestic vs international activities less relevant.
Third, rapid innovation in, both, technology (i.e. information and communication technology – ICT) and institutional arrangements (new processes, new products, and new markets) have become a stylized fact of market integration all over the world.
Fourth and finally, the combined influence of all these factors has created considerable challenges not only for firms competitiveness but for policy makers as well. Therefore, the thorough assessment of the effects of this evolution is an indispensable prerequisite to cope with these in economic policy.
Keeping these elements in mind, the workshop is based on the belief that a broad analytical approach is necessary to advance research on the issue of why specific mechanisms are in place and to what extent they contribute efficiently to the expected or desired overall outcome. This volume contains a selection of papers which cover some of the recent developments in the international economics literature regarding the topic trade and growth. Given the far-reaching processes of international economic integration which continue to take place in the global economy, this topic will no doubt continue to generate new research which in turn will be indispensable to find the right policy responses to the challenges and opportunities emerging from these developments.

This editorial is organized as follows: First, the subject matter is put into the context of various strands of research in international economics. Second, a short introduction to the development and structure of Austrian exports will be given against the background of important trends in global international integration. In the following section the link between export growth and GDP growth will be discussed, followed thereafter by a brief summary of the contributions presented at the workshop. Finally some comments on selected trade policy issues and, in particular, on services exports are provided.

Progress in the Theory of International Trade

The classical approach to international trade is based on two types of models, the first one refers to David Ricardo's theory of comparative advantage which builds

on the differences in relative productivity (or cost) levels of different economies in different sectors, and the second refers to the Heckscher-Ohlin-Samuelson (HOS) model which derives the allocative efficiency gains of international trade from differences of countries in their relative "factor endowments". The classical theory thus derives the "gains from trade" – which are level effects on countries' welfare (or national income) positions – from differences in economies supply characteristics, i.e. either from productivity differences as in the Ricardo model or from differences in the relative availability of factors of production (such as labor, land and capital; skilled and unskilled labor, etc.) Hence, in the classical approach it is the difference in economies' characteristics which gives rise to the benefit from international trade and such benefits are reaped through a pattern of international inter-branch specialization. As such differences across economies are particularly important amongst countries which differ in their levels of economic development (reflected in their relative productivity positions and/or in factor endowments). One can say that the classical approach is particularly conducive to show the benefit of international trade between more developed and less developed economies and hence of so-called "North-South" trade.

In the immediate post-WWII period, however, the striking fact which emerged was that international trade (and also foreign investment activity) expanded most between the advanced (i.e. higher income) economies, and hence between countries which did not differ much in their overall levels of economic development. Hence it was "North-North" trade which accounted for most of the increase in global trade flows and this trade was not based on a strong pattern of inter-industry specialization. International trade theory responded to this challenge which seemed at odds with classical trade analysis by developing what is known as "new trade theory" and the 2008 Nobel prize award to Paul Krugman is a recognition of his timely contribution to international trade analysis (see particularly his classic papers, Krugman, 1979, 1980). Why do gains from trade emerge from intensified trade links between rather similar types of economies? The answer lies in the combination of exploiting, on the one hand, the advantages of economies of scale which can be reaped when a larger market can be supplied and, on the other hand, the benefits to consumers who can purchase a wider range of products ("love for variety") from a larger pool of producers given that each of the products supplied has an advantage to be produced at a higher scale of production. International trade between economies can thus reap, both, the cost advantages of producing at a higher scale and also bring consumers the benefit of offering a wider range of product variants than it would be the case if each country had to find its own compromise solution between reaping economies of scale and consumers' "love for variety".

Hence, if we take the two types of theories together, the classical theories and the "new trade theory", international economics provided the basis for both explaining the (national income) benefits of "North-South" trade and of "North-

North" trade. Regarding the subject matter of international trade and economic growth, however, one should concede that both approaches proved the "gains from trade" only in a comparative static setting, i.e. showing only level effects from intensified trade and no longer-run growth effects. However, from the 1980s onwards there was also a boost in new growth theoretical models and these were soon to be integrated with models of international trade (see particularly Grossman and Helpman, 1991). The important progress made in these models was to show that international economic integration (through trade but also through foreign direct investments) can speed up the rate of (endogenous) technological progress either in the form of increased product diversification and/or changes in process technologies which can have lasting effects on the trend rate of global economic growth. The mechanisms through which such "growth dividends" could be reaped from international economic integration were the same as already recognized in the older, comparative static trade models, i.e. reaping the benefits from international specialization. Thus, the "North" (advanced economies) could specialize on skill-intensive, R&E (research and development) activities or on sophisticated goods-producing branches which require greater skills, while the "South" would benefit from importing a wider range of differentiated inputs which allows its producers to improve their production technologies and would also offer its consumers a wider range of final consumer goods.

The above growth and trade theoretical approaches allow a further deepening of our understanding of the potential growth benefits which could be derived from international specialization and they combine insights from both classical and new trade theoretical approaches. By the mid-1990s another real world phenomenon was increasingly noticed and required addressing by international economists: the increasing incidence of "outsourcing" and of "off-shoring". These phenomena refer to the possibilities that the advances in international transport and logistics technologies opened up for international producers to allow production activities to be split up into more differentiated production stages or "tasks" (see e.g. Grossman and Rossi-Hansberg, forthcoming). A new strand of literature opened up analyzing both theoretically and empirically emerging patterns of "production fragmentation" (see Arndt and Kierzkowski, 2000; Feenstra, 1998). Linked to this literature was also the concern with different organizational choices of internationalization. Questions addressed concerned e.g. whether the outsourced tasks were to be performed within the same firm but in another country or outsourced to other firms, either at arms-length or through a license agreement. Hence a new branch of international economic research evolved which attempted to look not only at fragmentation per se but also at the organizational forms which could be adopted to organize international production and trading relationships (for an excellent overview article, see Helpman, 2006).

The most recent innovation to the international economics literature is the so-called "new, new trade theory" (see the contributions by *Greenaway* and *Kneller*

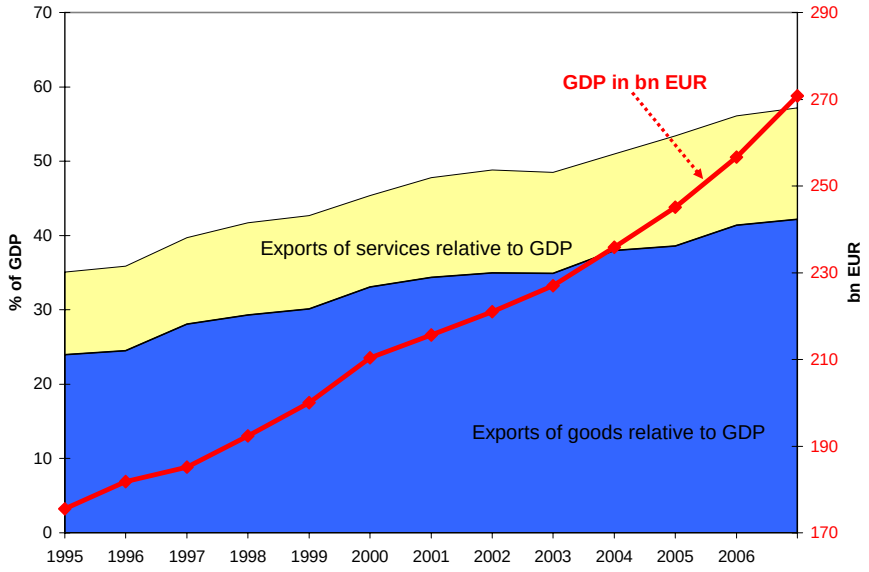
and by *Felbermayr* and *Jung* in this volume). Here an age-old assumption made in the international economics literature has been dropped; namely, the assumption that we can focus on the characteristics of "representative firms" instead of allowing the whole distribution of heterogeneous firms (i.e. firms which are distinguished by different attributes, such as productivity levels) to be looked at in analyzing processes of internationalization. This literature goes back to empirical insights gained by Bernard and Jensen (1999; see also Bernard et al., 2003, 2007) that firms which export (or invest abroad) might have different characteristics than those which only operate domestically. The interesting point which emerges when we look at distributions of firms is that we can show how different segments of the firm population will be involved in different types of international activities, such as in exporting or in foreign direct investment (the pioneer theoretical formulation in this respect is due to Melitz, 2003). It is explicitly recognized that each form of international activity requires additional set-up costs (such as to enter a market, adjust to different regulatory features, acquire new information regarding customers and production sites, etc.) and the ability of different firms to incur such additional costs and make a success of such operations leads to a segmentation of the firm population into those who export, set-up production facilities abroad or continue as firms with only domestic operations. This literature did not only make strong progress in theoretical terms in recent years but the increased availability of firm level information also developed this field into a very intense area of empirical research.

Global Integration Trends and the Development of Austrian Exports

Two more features which are important trends in global international integration and which are covered by contributions in this volume should be mentioned explicitly: the first refers to the much enhanced role which services activities (in contrast to goods production) now play in international trade and the second to the very important role which groups of "successfully catching-up economies" (SUCCESS economies in short) play in the current dynamics of global economic integration. Past trade analysis has almost exclusively focused on goods trade with an implicit assumption that services, with the exception of transport services and tourism, are basically non-tradable (few people would travel abroad to have their hair cut). With the emergence of the fast growing area of international business and financial services this has dramatically changed and trade in services now accounts for close to one third of global trade. It is also clear that the internationalization of business services has much benefited from the advances made in communications, logistics and transport technologies. Service activities also play a crucial role in facilitating "fragmentation" in goods production and in the logistic facilitation of international production networks. In the context of "North-South" trade the "off-

shoring" of services to countries like India has attracted much attention. This area of international trade is thoroughly examined in the contribution of *Francois* and *Woerz* in this volume; the availability of new and better data sources on services trade has also made this a thriving line of new empirical research. The other area, namely the increasingly significant role which groups of SUCCESS economies (such as China, the other South East Asian economies, the Central and Eastern European economies, or Turkey) play in global and regional trade flows is explored in the contribution by *Landesmann* and *Stehrer* in this volume. They base their analysis on a model with a dynamic Ricardian structure (i.e. where comparative advantage positions are determined by relative productivity levels) and which allows for differentiated catching-up processes in productivity levels across economic activities. Such patterns of catching-up shift comparative advantage positions in line with empirically observed trends and they can account for an increased need for skilled workers in both "Northern" and "Southern" (i.e. catching-up) economies. In a detailed examination of "East-West" European integration they examine the characteristics of outsourcing patterns as an application of this model of trade and catching-up.

Chart: Austrian Export Quota from 1995 to 2007



Source: Statistics Austria.

Recent export figures with respect to Austria have been impressive. In 2007, the total of exports amounted to EUR billion 114.8. 72.5% of these exports were directed to the European Internal Market. Overall export in goods rose 10.5% compared to 2006. Growth drivers among others were exports to Asia (16.3%) and the CEE countries (19.8%).

These growth figures are not a recent phenomenon. Since 1995 when Austria became a member of the European Union exports of goods had been on a constant rise. Exports of goods in relation to GDP have risen from 24% in 1995 to 42.2% in 2007. If exports of services were included the respective quota rose from 35.1% to 57.2%. The major part of the increase thus originated in the export of goods. This can also be seen in the chart.

Nominal exports of goods increased by 64% from 2000 to 2007. Exports to the new EU Member States grew above average (97%) and to the old Member States significantly below average (50%). Dynamic export growth was seen to the US (65%) and to Canada (74%) as well as to China (235%).[1]

The link between exports and domestic growth is a positive one. In a recent economic report of the Austrian Institute of Economic Research this is illustrated by the conclusion "External demand remained the main driver of growth" (Steindl, 2008). It is also confirmed by forecasts of the Oesterreichische Nationalbank (Diebalek et al., 2008).

Central Hypothesis: Export Growth Drives GDP Growth

A positive link between trade and growth – in the case of Germany – was questioned by the German economist Hans Werner Sinn who created the expression of the "bazaar economy". He claims that Germany made a shift from an industrial economy to a bazaar economy (Sinn, 2005). The underlying assumption of Sinn's hypothesis is: less and less goods are produced domestically despite growing imports and exports. The home market becomes predominantly a consumer market generating less welfare due to outsourced production. International division of labor would also lead to a division of the value chain generating a relatively larger share of value abroad. Less welfare in the domestic economy and decreasing competitiveness of the domestic industrial sector are the consequence.

The hypothesis of the bazaar economy is challenged by a set of very restrictive assumptions: First, it focuses exclusively on the industrial sector. Therefore, welfare gains by the services sector in general and welfare gains due to exports of services are neglected. Input output analysis e.g. for Austria shows that the export of goods as well as the export of services create value (Schneider and Mahlberg,

[1] The respective growth rates were computed on the basis of Statistics Austria data (www.statistik.at/OnlineAtlasWeb/).

2005).[2] Second, outsourcing and foreign direct investment have the notion as a means of loosing competitiveness but the contrary is often the case. Industries maintain their competitiveness by outsourcing parts of their production in order to maintain other divisions of the firm in the home country (Egger and Egger, 2001; Altzinger, 2002). Third, although intra-industrial trade is very important for Austria (close to 90%) a relatively small share of Austrian goods and services is exchanged with countries with significantly lower wages (OECD, 2005).

The hypothesis of the Bazaar economy is often used to question liberal trade policy but in the end it fails to deliver arguments for a more restrictive trade policy. This workshop was intended to contribute to a more comprehensive view on the link between trade and growth – in the sense of analysing all sectors of the economy and all export channels that is not only goods but also services and foreign direct investment.

The Contributions to the Workshop

The contribution of the key note speaker *David Greenaway (University of Nottingham)* was about firm heterogeneity, exporting and foreign direct investment. He provided a survey and an evaluation of the existing literature. The literature points to a number of regularities: exporting firms tend to be larger and more productive than non-exporters; sunk costs tend to be important; multinational firms tend to be more productive than domestic firms. Besides these findings much research remains to be done, i.e. relating to learning by exporting.
In the first session, a more theoretical and global point of view was taken. Since the papers are quite different in their nature a short description of each is given.

Michael A. Landesmann's and *Robert Stehrer's* presentation (both *Vienna Institute for International Economic Studies*) – *Trade and Growth: South-North Integration, Outsourcing and Skills* – intended to capture the phenomenon of outsourcing and analysed the impact of this type of trade integration on skill demand. They observed changes in skill content and in the shares of imports by low-/medium-income economies in particular in the areas of processed inputs and parts production. Therefore, they see an outsourcing story combined with catching up confirmed.

Gabriel Felbermayer's and *Benjamin Jung's (University of Tübingen)* presentation – *Endogenous Export Modes* – dealt with the optimal choice of export modes on firm level. Foreign markets either require a local foreign partner, who

[2] A more recent study Bayerl et al. (2008) conclude that some bazaar characteristics are evident in the Austrian economy. Nonetheless, the authors cannot find any evidence from their investigation that this development has hurt the Austrian economy so far. Export growth has been sufficiently dynamic in order to raise the share of export-induced value added in total GDP.

acts as a general importer or a trade intermediator or they need to set up an own sales representation. The choice of export modes plays a key role in strategic management decisions and has received considerable attention in the academic business literature.

Joseph Francois (Johannes Kepler University, wiiw and CEPR) and *Julia Woerz* (*Oesterreichische Nationalbank)* with their paper – *Service Sector Linkages: The Role of Services in Manufacturing* – found that increased imports of business services promote manufacturing exports and value added in the most technology and skill intensive industries while they observed a negative effect in labor intensive industries. Overall, they empirically confirmed that the impact of openness to trade in services is gaining in importance.

The second session provided empirical evidence on the economic interlinkages between Austria and a set of other countries. *Gerhard Fenz* and *Martin Schneider (both OeNB)* showed that the Austrian economy is strongly linked to the German eonomy. *Thomas Reininger (OeNB)* analyzed the import demand functions of new Member States and what is of particular interest to what extent import demand is driven by external demand stemming from the main trading partner (via exports).

The third session gave an overview of the quantitative analysis on the impact of further liberalization on welfare. *Przemyslaw Kowalski* from the *OECD* critically analysed among others the accuracy of models estimating such effects and highlighted the fields for further research.

Trade Policy and Creating the Adequate Business Environment for Services Exports

Eventually, this workshop should be regarded as a further stimulus for deepening the analysis and the discussion of international trade and also trade policy. Trade policy is not as present in the national political discussion as it could be.

One reason is probably the institutional setting due to the accession of Austria to the European Union. The sovereignty on trade policy has been transferred to the institutions of the EU. Decision-making has become more complex and the direct influence of the national government on trade policy has declined. In addition, many decisions on trade policy are taken at the WTO level which increases the complexity of decision making still further.

Another possible reason is the variety of trade policy instruments, which are difficult to grasp, be it in the public or be it with economic analysis. In the past public discussion and economic analysis rather focused on tariffs than on non-tariff barriers. In empirical and theoretical analysis often only tariffs are considered since they can be “easier” grasped. A more complete picture is necessary since the story is often told in the area of non-tariff barriers. Interfield, a relatively recent paper by

Daniel Kono (2006) shows that tariffs have overall decreased in democratic countries but the opposite was the case for core non-tariff barriers.

Thus, trade policy should be more present on the national political agenda. More profound analysis on trade and its effects has to be carried out and it is fortunately already on the way. A year ago the research platform Research Centre for International Economics (FIW) was founded. Deepening analysis in the areas of goods exports, services exports, FDI and on international competitiveness in general was undertaken. The larger part of the initial studies is already published. [3] The focus on applied empirical studies deriving political advice should be maintained and ideally even enhanced.

As regards the assessment of the current trade policy at the WTO level there is currently little reason for optimism. The Doha Round shows little progress. After seven years of negotiations results are poor. The current economic downturn would have asked for positive signs which could not be delivered by the recently failed trade talks. It can be expected that WTO members will engage more strongly in bilateral trade agreements which are not a sensible alternative to already established multilateral agreements. Therefore solutions have to be found – maybe an institutional reform of WTO – in order to bring the Doha Round to an end with hopefully encouraging results.

Economic policy in the sense of "Standortpolitik" covers a whole array of policy sectors that cannot be dealt with in a short comment. Thus, concentration should be on one policy area that received too little attention in recent years: the services sector. In the light of Julia Woerz's and Joseph Francois' analysis of the competitiveness of the Austrian services exports efforts of establishing a strong and competitive services industry have to be undertaken. This is even more the case since the neighbor countries are becoming more and more competitive while at the same time Austrian services exports lack dynamics relative to the performance of the goods sector. As a medium-term goal Austria should become an important services cluster for modern and complex services on a regional scale as is – interfield – Munich. Accompanying measures for structural changes in the services sector would be necessary. Education and skills should be fostered, research and development activities should be oriented more strongly towards modern services, subsidies should be redirected more strongly to the services sector and marketing activities for being a destiny country for services outsourcing should be undertaken.

Recently the Ministry of Economics and Labor presented a mission statement for external trade. The mission statement made also clear that the export of services is of central importance. Obviously the awareness among experts concerning the topic is present. Now the next steps have to be taken: first awareness building among politicians and entrepreneurs. Second, the business environment has to be

[3] For the available publications see the website www.fiw.ac.at

improved by concrete political measures, and finally entrepreneurs must be ready to engage more strongly in the development of complex services and to sell them to external markets.

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Firm Heterogeneity, Exporting and Foreign Direct Investment[1]

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A rapidly expanding literature on firm heterogeneity and firm level globalisation strategies has developed over the last decade. There are new insights on why some firms export and others do not, why some firms fail to survive in export markets and some choose to produce overseas rather than export. This article provides a synthesis and evaluation of this literature. It reviews both new theories of firms in an open economy context and the extensive microeconometric evidence base, which has now developed. It highlights the implications of this evidence base for policy and includes an assessment of how the research agenda may evolve.

Interest in a range of aspects of firm and plant level adjustment to trade liberalisation and falling trade costs has exploded in recent years, and a new literature is leading to significant re-thinking of key drivers of the globalisation process: cross-border trade and cross-border investment. Like the last revolution in thinking in international trade (sometimes called new trade theory) which incorporated imperfect competition as a response to empirical observation of intra-industry trade, this new literature was also triggered by empirical observation, particularly the work of Bernard and Jensen (1995). That paper drew attention to the fact that exporting and non-exporting firms co-existed in the same industry but were marked by clear defining characteristics.[2] The development of the literature since then into a progressive research programme has been fuelled by two

[1] The authors acknowledge helpful comments on an earlier draft from three anonymous referees, Roberto Alvarez, Daniel Bernhofen, Ricardo López, Jim Markusen, Horst Raff, participants at the Singapore Economic Review Annual Conference 2005, the Otago Trade Workshop 2006 and at a SUFE-Orebro Conference in Shanghai in 2005. Financial support for The Leverhulme Trust under Programme Grant F114/BF is also gratefully acknowledged.

[2] In so doing this paper fits into a broader literature on the within-industry heterogeneity of firms such as Olley and Pakes (1996), Roberts and Tybout (1996) and Aw et al. (1997).

complementary developments. First, major theoretical break-throughs associated with Melitz (2003), Helpman et al. (2004) and Bernard, Eaton et al. (2003) among others have resulted in new ways of thinking about firm heterogeneity and participation in international markets. Second, the growing availability of micro level datasets has facilitated detailed analysis of firm level adjustment in a large number of countries.

One dimension which has received particularly close attention is the relationship between firm level productivity, entry to and survival in export markets. Following Bernard and Jensen (1995) there is now an extensive body of empirical analyses on a large number of industrialized, transitional and developing countries. This addresses not only the characteristics of firms which enter export markets, but also those markers likely to be associated with survival. In addition, recent analysts have turned their attention to the issue of why firms choose to export rather than engage in direct production overseas. For both, the interaction of sunk costs and productivity heterogeneity is key.

At the most basic level what this literature adds to our understanding of export behaviour is clear: a combination of sunk costs and heterogeneity in the underlying characteristics of firms explains why not all firms export.[3] We have moved from the new trade theory world of representative firms, where all firms export, to one in which firms are heterogeneous and some export, some do not. But the literature goes beyond this, for example to the recognition of potential complementarity between exporting and foreign direct investment (FDI), which challenges the traditional view of multinationals as different from other firms, with exporting and FDI being substitute strategies. Helpman et al. (2004) and others build on the Brainard (1987, 1993) model, which stresses trade-offs between proximity and concentration, but differ in that the export or FDI choice is predetermined by firm productivity. This provides a basis for understanding globalisation in a broader context and therefore in understanding how changes to the costs of exporting or foreign direct investment change production patterns within industries and across countries.

Within this literature, the direction of causation between productivity and internationalisation has been controversial. It has become something of a stylized fact that ex-ante productivity determines the choice of whether or not to export. In other words, firms have to become more productive before they export and causality runs from productivity to exports. Causality in the opposite direction is less clear. One can think of plausible reasons why a presence in export markets might raise productivity after entry, for instance exposure to best practize technology and learning,

[3] Earlier and related insights into the role of sunk costs in sluggish adjustment of trade responses to exchange rate fluctuations are attributable to Baldwin (1988) and Baldwin and Krugman (1989).

but the empirical evidence is mixed. More generally, when studying the determinants of entry and exit from markets, most researchers include measures of international trade in the industry and at the firm level, with the notion that firm death is less likely when the firm is an exporter or in an industry in which exposure to imports is low. Entry and exit then lead to aggregate productivity changes as market shares change.

These are important issues from a policy perspective. Export promotion policies of one form or another are pervasive the world over, as a glance at a random sample of World Trade Organisation (WTO) Trade Policy Reviews would confirm. These can take many (transparent and opaque) forms and are often general rather than targeted. The point to note at this stage however is that if not all firms have the appropriate attributes to export, some may simply self select into export subsidies. So the literature is sharpening this policy debate.

In this article we provide a critical review of this new literature. Because it is growing so fast, we limit ourselves to firm heterogeneity, exporting and FDI. We begin our appraisal with a review of new theories of the firm and international trade. In section 2 we then focus on productivity, entry and survival, taking in evidence on exchange rates, agglomeration and changes in the policy environment. Section 3 moves on to exporting and FDI. In addition to evaluating these as alternative strategies we also examine links between the decision to establish production facilities overseas and exporting. In section 4 we discuss the emerging research agenda including for example new thinking on the boundaries of the firm, outsourcing and offshoring, associated with Antras (2003) and Antras and Helpman (2004). We also look more closely at the policy context in this section. Section 5 concludes.

1. New Theories of the Firm and International Trade

Although the standard workhorse Heckscher-Ohlin model of international trade has profit maximising firms in the background, operating under constant returns to scale, their boundaries are not well defined and they have no deterministic role in determining the pattern or commodity composition of trade. Economic activity takes place in sectors and international competitiveness is fashioned by relative factor endowments between potential trading partners. New trade theory associated with Krugman (1979) and others builds on Dixit-Stiglitz monopolistic competition and explicitly has firms. However in that framework all firms export, because each produces a unique variety that consumers, who have love of variety preference functions, want. In this setting any trade costs just absorb a proportion of a firm's foreign revenue but do not stop it from exporting. Although new trade theory gave us new insights into the determinants of trade, a world where all firms export is manifestly at odds with what we observe in the real world, where some export and

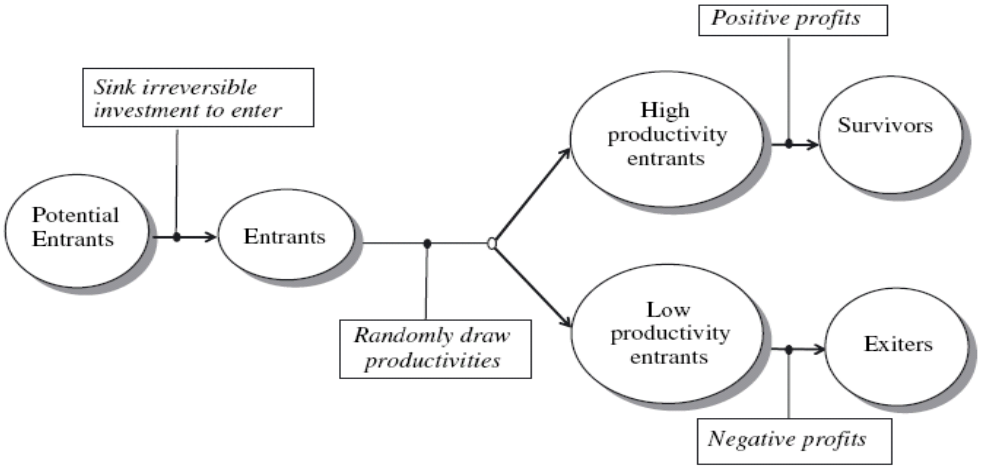
others in the same industry do not. The reason why this happens in the models of Krugman (1979) and others is that firms do not face fixed costs of exporting.

The business community would take it as axiomatic that entering export markets incurs sunk costs: market research has to be done; option appraisals completed; existing products have to be modified; new distribution networks set up and so on. Clerides et al. (1998) were one of the first to model this explicitly in a discrete choice framework. In their model, more productive firms with lower marginal costs earn higher gross profits from producing, but not all firms export. Only those with sufficiently high profits to cover the sunk costs do so. This intuitively appealing result leads to the conclusion that self-selection is fundamental – sunk costs and firm heterogeneity interact and the most productive firms self-select into export markets.[4] Its corollary is that firms have to raise productivity before they enter. So it follows that there is a direct connection between productivity and exporting (but if policymakers want to exploit that, they should target support at potential rather than actual exporters).

But this may not be the end of the story. Clerides et al. (1998) also raise the possibility of learning by exporting. In other words, once a firm has entered export markets, productivity growth may receive a further boost. They model this as an upward shift in the (stochastic) process that determines firms productivity and it can be rationalized in various ways. For example, actual involvement in export markets could sharpen incentives to innovate by raising returns to innovation, apossibility modelled by Holmes and Schmitz (2001). A second possibility is that export markets are more competitive than domestic markets, forcing firms to reduce X-inefficiency. Here, learning results in business process re-engineering for example. The point is that if learning by exporting occurs, firm productivity may grow after entry as well as before. If this were the case, it provides a plausible mechanism underpinning export-led growth, though it also complicates the calculation that faces policy makers. Ultimately it is an empirical issue to which we turn in section 2.

[4] In a muliti-country setting, between firm productivity differences can generate intra-industry trade in these models.

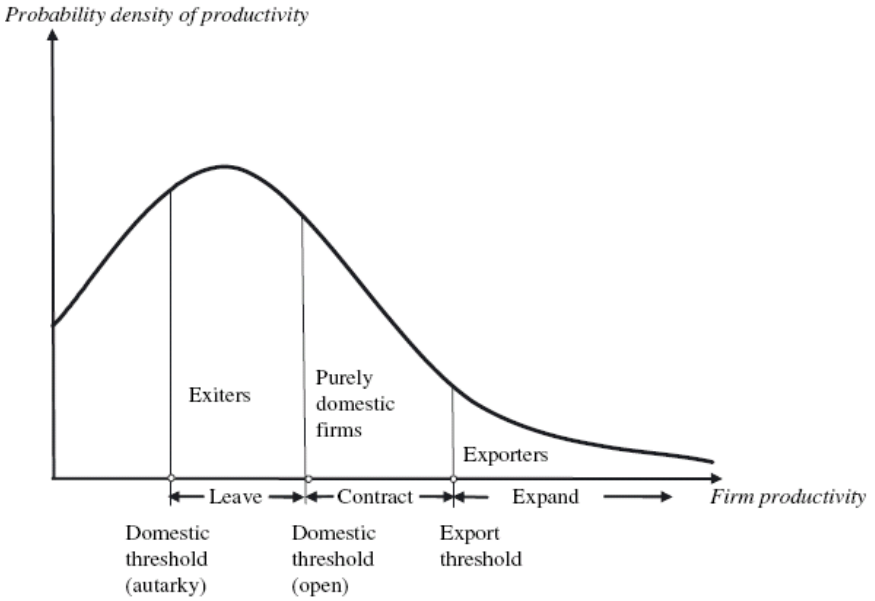
Chart 1: Productivity Uncertainty and Firm Entry/Exit



Everything we have said so far refers to intra-firm productivity. At the macro-level we often associate productivity growth with inter-sectoral reallocation, classically the shift of resources from agriculture to manufacturing. Can we say anything in the current context about inter-firm reallocation and industry productivity growth? The pioneering paper here is Melitz (2003), which is set out schematically in chart 1 from Falvey et al. (2005). He builds a dynamic industry model with heterogeneous firms operating in (Dixit-Stiglitz) monopolistically competitive industries. Firms incur a fixed cost to export. However, each has to make a productivity draw from an exogenous distribution which determines whether they produce and export, and an endogenously determined productivity threshold determines who does and does not export.[5] The interaction of these raises industry productivity. First, there is a rationalisation effect. Exporting increases expected profit, which induces entry, pushes up the productivity threshold for survival and drives out the least efficient firms in a Schumpterian wave of creative destruction. Clearly this raises average industry productivity. Second, exporting allows the most productive firms to expand and causes less productive firms to contract. The productivity distribution that results is set out in chart 2. This reallocation effect again acts to raise average industry productivity. This model, despite its microeconomic structure, helps us understand the correlation between exports and growth widely observed at the macro level.

[5] Ederington and McCalman (2004) develop a model of firm heterogeneity with the opposite outcome. Heterogeneity is a consequence of the decision of some firms to start to export.

Chart 2: Productivity Heterogeneity and Industry Reallocation



Melitz (2003) is an important model linking heterogeneous firms and industry productivity, with exporting being a key factor. It is not the only model to point to causal links between exporting and industry productivity. This is also a key output of Bernard, Eaton, et al. (2003). Their industrial organisation structure is different but they still derive rationalisation and reallocation effects, however, the former is driven by import competition and the latter from exporters penetrating more markets. Jean (2002) also identifies import driven and export driven contributors to industry pro-ductivity growth, in a two-country setting with differences in relative efficiencies across countries.

The core Melitz (2003) model is now being developed in various ways. Helpman et al. (2004) extend it to consider the decision to set up an overseas affiliate. As in Melitz (2003) increased globalisation is likely to lead to firm exit, where the probability is decreasing in whether the firm is an exporter or multinational firm. We return to this in section 3.

A number of recent papers extend Melitz to consider asymmetries between countries. Melitz and Ottaviano (2003) examine differences in the extent of competition between countries (proxied by differences in size) on equilibrium outcomes following trade liberalisation. They find that because competition is tougher in the large country, product choice is greater, average productivity higher, but firm survival lower, because new entrants have a higher probability of failure.

Trade liberalisation increases competition in both countries thereby raising aggregate productivity but these effects are felt disproportionately in the big country (because it attracts a disproportionate number of firms).

In Falvey et al. (2004) countries differ in the efficiency with which they use frontier technology. One interesting finding is that self-selection is stronger for industries in which the degree of substitution across products is higher. Therefore the probability of firm closure may be negatively correlated with the level of intra-industry trade. They also find the higher the average efficiency of the country the more likely firms are to survive in the export market, but the less likely they are to survive in the more efficient country, which leads us to expect that trade structure is important. The pattern of trade is determined by the physical size of countries and size of the efficiency gap. For a given efficiency difference, as the size falls, domestic production of the differentiated product falls. By contrast, for a given size difference, as the efficiency gap rises, domestic production of the differentiated product rises. The effect of falling trade costs is to raise the minimum productivity needed to survive-it raises the self-selection cut-off point. This effect is strongest in the more efficient country.

The approach of Bernard et al. (2007) is to combine heterogeneous firms with Helpman and Krugman (1985) assumptions of imperfect competition and scale economies, and Heckscher-Ohlin differences in factor endowments. The model generates predictions about reallocations of resources across industries by firms. Finally, Bernard, Redding and Schott (2003) develop a model to explain an alternative form of exit to death-industry switching. Productivity levels are again shown to be important, albeit in the context of a closed economy. Here product switching depends on the fixed costs associated with production of different products and heterogeneity in productivity. More productive firms endogenously choose to produce products with higher sunk costs. Although that paper does not identify a role for international competition in firm choices, an effect from increased openness to trade is possible to envisage. Firms alter their output mix towards industries in which they have a comparative advantage and therefore avoid competition from countries in industries where they do not. For OECD countries this is more likely towards the use of technologies with higher costs, where this decision is dependent on firm productivity.

As we can see from this brief review of this theoretical literature,[6] modelling exporting activity at the firm level throws up a range of possible channels through which exporting might be causally linked to firm and industry productivity. We now turn to the econometric analysis of these issues.

[6] A more comprehensive review of the theoretical literature can be found in Helpman (2005).

2. Evidence on Productivity, Export Market Entry and Survival

As we have seen, theory points to differing performance characteristics of exporters and non-exporters. But do these differences result from the decision to export or do only good firms become exporters? This question of causality between exports and productivity, sparked in part by the ongoing debate over the relationship between openness and growth at the aggregate level[7] has, by some margin, received most attention within the micro literature on exports. Thus, we first consider determinants of export market entry and exit as well as evidence on potential feedback from export market participation into firm performance. To provide some structure we begin with evidence relating to participation in export markets more generally.

According to Melitz (2003) and others, participation decisions are determined completely by a combination of sunk-costs and firm productivity. Although in empirical counterparts to this, the set of firm characteristics has been extended to include factors such as size, age, human capital, capital-intensity, ownership and so on, these predictions are supported by the evidence. While there are differences in the exact methodology employed (the choice over logit or probit models and attempts to correct for bias from inclusion of lagged export status of the firm) results are for the most part robust, a point made forcefully in Wagner (2007). Some if not all firm level variables are strongly correlated with export market entry. It follows that episodes of entry and exit should be predicted by periods of change in these characteristics (which we discuss below).

Of the explanatory variables, that relating to persistence (proxied by lagged export status) almost always explains most of the variation in the data. Exporting next period is strongly correlated with exporting this period, even when other determinants of persistence have been controlled for. Its coefficient is usually interpreted as evidence of sunk-costs. While the exact magnitude varies across studies, past participation increases the probability that a firm will continue to export by between 36% in the US (Bernard and Jensen, 2004a) and 90% in Italy (Bugamelli and Infante, 2002). Entry is therefore likely to be determined by changes in sunk-costs. As Das et al. (2001) show these are most relevant for those firms who export little, the fringe players in export markets (Tybout, 2003). But what are these changes that produce waves of entry and exit? The three contributors most often discussed are exchange rates, policy innovation and agglomeration effects.

[7] See for example Rodriguez and Rodrik (2000) and Greenaway et al. (2002) and see López (2005) for an evaluation of micro and macro evidence.

2.1 Exchange Rates

Macroeconomic evidence on the effect on trade of exchange rate levels and volatility suggests effects that are either significant but small in magnitude, or insignificant (Pozo, 1992; Chowdhury, 1993; Parley and Wei, 1993).[8] This implies that exchange rate movements play little or no role as a sunk cost. The micro evidence suggests however that these results are a product of aggregation and exchange rates are important. In the presence of sunk-costs the export responsiveness of exchange rate changes is likely to be higher amongst current exporters compared to non-exporters. That is, changes in exchange rates are more likely to lead to changes in the intensive rather than extensive margin. Bernard and Jensen (2004b) for example, study the export response of US manufacturing plants to dollar depreciation in the 1980s, and report that 87% of the expansion was from increased export intensity and 13% from entry of new firms. A similarly strong correlation is reported by Bugamelli and Infante (2002) and Bernard and Jensen (2004a).

Whilst useful for future comparative work, this approach does not provide a complete explanation of micro responses for three reasons. First, Das et al. (2004) find significant cross-industry variation in the effects of exchange rate movements. Simulating a 20% devaluation for three Colombian industries they report that the magnitude of industry response depends on previous export exposure, homogeneity of expected profit flows between firms and their proximity to the export market entry threshold. Ten years after devaluation the industry level effect varies between 14 and 107% (although unfortunately they do not break this into that generated by new entrants and that from existing exporters).

Second, devaluation can also lead to substantial exit. According to Blalock and Roy (2007) the 2 to 1 devaluation of the Indonesian rupiah against the US dollar between 1996 and 1998 did not lead to an aggregate export boom. Deeper analysis showed that although there was an expansion of export activity by established exporters and new entry by non-exporters, new activity was offset by cessation of exporting by previous exporters. Bernard and Jensen (2004b) also find evidence of exit for the US. Blalock and Roy (2007) offer an explanation: firms that ceased exporting were no more likely to report liquidity constraints, or infrastructure problems, compared to firms that continued to export and were no less productive; they were however less likely to be foreign and less likely to have made R&D or training investments. These same variables predicted which firms would become new exporters.

An alternative explanation can be found in Maloney and Azevado (1995), where in a model in which firms export to diversify revenue streams fitted to Mexican data, exchange rate volatility and the co-movement of domestic and

[8] This contrasts with the large estimated currency union effects of Rose and Stanley (2005).

foreign demand shocks can lead to counter-intuitive movements in export volumes following changes in exchange rates. Finally, as we also note below, all of the detailed micro level analysis of exchange rate movements has been of episodes during which the domestic currency depreciated. It is not known whether the effect of appreciation is symmetric.

2.2 Policy Innovation

Export decisions are likely to be influenced by the environment in which the firm operates, where policy changes may impact on both intensive and extensive margins. For example, were policy to lead to within firm improvement in productivity perhaps because of increased competition or reduced costs of intermediate imports, it may be more likely that non-exporters enter export markets, but also easier for current exporters to increase export sales to existing or new markets. Unfortunately however we have little evidence on what aspects of policy are important for export volumes. In fact the evidence is concentrated in just five studies across two types of policy, trade liberalisation and export promotion, the results for which are summarised in table 1.[9]

Evidence on trade liberalisation suggests an effect on both intensive and extensive margins.[10] Blalock and Gertler (2004) find that liberalisation in Indonesia between 1990 to 1996 doubled the number of exporters, while in their study of the effects of NAFTA on Canadian firms, Baldwin and Gu (2003) report increases in both the number of exporters (the share of plants that export increased from 37 to 53% between 1984 and 1990) and export intensity (in 48% of exporters). Using more sophisticated econometric techniques, they find the effect of policy on the export entry decision to be substantial. The 4.5% reduction in Canadian-US tariffs that occurred increased the probability of exporting by 63%.

[9] We concentrate on evidence of trade liberalisation on export volumes at the firm level. There is a larger literature, see for example Pavcnik (2002), Roberts and Tybout (1996) or Tybout (2003) for references, that discusses the productivity impacts of such changes and Head and Ries (1999) and Roberts and Tybout (1991) for the effect on firm size. Given the link between exports, firm size and productivity these might be seen as indirect evidence of the export effect of policy changes.

[10] The table does not include the results from Blalock and Gertler (2004) because of a lack of formal econometric evidence in the paper.

Table 1: Evidence on Policy Intervention and Firm Export Responses

Authors	Sample	Policy intervention	Outcome
Alvarez (2004)	Chile, 1990–96	Trade shows	No effect on export market success
		Trade missions	No effect on export market success
		Exporter committees	Positive effect on export market success
Baldwin and Gu (2004)	Canada, 1984–96	Canadian-US commodity tariff rates	4.5% reduction in Canadian tariffs increased the probability of exporting by 24% and export intensity by 46% percent
Bernard and Jensen (2004*a*)	US, 1984–92	State expenditures on export promotion	Insignificant effect on export market participation
Görg *et al.* (2007)	Ireland, 1983–98	Capital grants, training grants, rent subsidies, employment grants, feasibility study grants, technology acquisition grants, loan guarantees, research and development grants	In a matched sample large grants lead to additional exports. No evidence of additional entry. Withdrawal of grants does not lead to exit.

Export promotion is pervasive, and most governments intervene in one way or another, ranging from providing infrastructure support to offering direct export subsidies. Empirical evidence is again mixed, although this may be a result of both the question asked and level of detail available. Both Bernard and Jensen (2004a) and Alvarez (2004) find an insignificant effect from export promotion schemes, the former for exporters versus non-exporters; the latter for permanent versus sporadic exporters. Alvarez (2004) does however find differences in detail. Trade missions and trade shows do not increase the probability that a firm will become a permanent exporter, whereas market studies and arranged meetings with clients, authorities and experts do, even when controlling for other firm and industry determinants. Finally, it is worth noting the evidence of self-selection when evaluating export promotion schemes, a problem thus far not dealt with. Alvarez (2004) finds that established exporters are much more likely to have used public instruments for export promotion than sporadic exporters.

More detailed information on the payment of grants to firms is available for Ireland, as discussed by Görg et al. (2007). Using matching to control for selection problems, the authors find only limited success from intervention; large grants can induce existing exporters to expand overseas sales further but fail to encourage additional entry from those that did not previously export.

2.3 Agglomeration

Compared to the scrutiny of productivity spillovers, where some 40 studies were evaluated in Görg and Greenaway (2004), the literature on export spillovers is limited. It also concentrates on spillovers from the presence of other multinational firms within the same industry or region. As can be seen from table 2 only Aitken et al. (1997), Clerides et al. (1998), Bernard and Jensen (2004a) and Greenaway and Kneller (2003) consider spillovers from other exporters and only Greenaway and Kneller (2003), Sjoholm (2003) and Kneller and Pisu (2007) allow for spillovers from outside the region or industry.

In line with evidence of spillovers more generally, results are somewhat mixed. Some studies identify strong positive spillover effects (Aitken et al., 1997; Kokko et al., 1997; Greenaway et al., 2004; Greenaway and Kneller, 2003) others have either found none and in some cases negative impacts (Bernard and Jensen, 2004a; Sjoholm, 2003; Barrios et al., 2003; Ruane and Sutherland, 2005). Kneller and Pisu (2007) and Swenson (2005) find mixed evidence, depending on the channel considered. Beyond country specific differences there is no obvious pattern to these inconsistencies. This is best seen from a comparison of Greenaway et al. (2004), Barrios et al. (2003) and Ruane and Sutherland (2005) which all focus on European countries, measure foreign presence in the same way, and use a similar methodology.

Greenaway et al. (2004) measure foreign presence in the UK as the sum of industry employment or output and, in an attempt to separate competition from information effects, add exports from foreign multinationals as a proportion of total exports in the industry. They find both the likelihood of exporting and export share are increasing in the industry-level foreign presence index, even controlling for firm and industry level characteristics. They report less clear results for the index measuring export activities of foreign firms, this being positive and weakly significant for the export decision and positive and insignificant in the decision of how much to export. By contrast, Barrios et al. (2003) for Spain find no evidence of an effect on the export decision from MNEs or the export share.

Ruane and Sutherland (2005) also use a Heckman selection model to account for interdependence between export participation and export share decisions, but with contrasting results. They find positive effects from foreign presence of multinationals and negative effects from their export share on both export and export share decisions, with a suggestion the latter is due to US multinationals. They attribute this to the use of Ireland as an export platform to the EU. They argue export spillovers are unlikely where the country is an export platform because competition with domestic firms in local markets is limited. The use of spillovers from other exporters does not appear to improve this. Aitken et al. (1997) and Bernard and Jensen (2004a) find no effect from such measures, whereas Greenaway and Kneller (2003) do.

Table 2: Evidence on Agglomeration and Firm Export Responses Agglomeration

Authors	Sample	Measure of agglomeration	Export Participation*	Export Share
Aitken *et al.* (1997)	Mexico, 1986–89	Foreign MNE share of exports by state & industry	+	
		State industry share of national exports	−	
Barrios *et al.* (2003)	Spain, 1990–98	Foreign MNE share of exports by industry	0	0
		Foreign MNE share of R&D by industry	0	+
Bernard and Jensen (2004*a*)	US, 1984–92	No. of exporters in region	0	
		No. of exporters in industry	−	
		No. of exporters in region & industry	0	
Clerides *et al.* (1998)	Colombia, Mexico and Morocco	Exporters per industry or region	+	
Greenaway and Kneller (2003)	UK, 1989–2002	No. of exporters in industry (SIC-3) & region	+	
		New exporters in industry & region	+	
Greenaway *et al.* (2004)	UK, 1992–96	Foreign MNE share of employment by industry	+	+
		Foreign MNE share of exports by industry	+	+
Kneller and Pisu (2005)	UK, 1988–98	Horizontal-industry-region domestic sales	+	+
		Horizontal-industry-region export sales	+	0
		Horizontal industry domestic sales	0	0
		Horizontal industry exports	0	+
		Forward vertical linkages	+	0
		Backward vertical linkages	0	+
Kokko *et al.* (1997)	Uruguay, 1990	Foreign firms created post 1973	+	
Ruane and Sutherland (2007)	Ireland, 1991–98	Foreign MNE share of employment by industry	+	+
		Foreign MNE share of exports by industry	−	−
Sjoholm (2003)	Indonesia, 1980–91	Foreign MNE share of output by region	0	
Swenson (2005)†	China, 1997–2003	No. of multinational firms in city		+
		No. of multinational firms in city and industry		+
		Exports by multinational in a city		+
		Exports by multinationals in a city and industry		−
		Relative transaction density in a city		+

Notes. * + the effect is positive and significant, − the effect is negative and significant, 0 the effect is insignificant and/or changes sign and/or significance through the paper.
†These regressions relate to the 2-stage Probit regressions reported in Table 3 and excluding natural resource intensive sectors.

While positive and insignificant effects are relatively easy to explain in this context, negative effects are more puzzling. Ruane and Sutherland (2005) explain theirs by Ireland being an export platform, thus multinationals have less contact with indigenous firms. It is not clear however why this makes Irish firms less likely to export. Perhaps more plausible is the congestion argument of Swenson (2005): competition with multinationals raises prices in product markets forcing domestic firms up their average cost curves for example; or, perhaps higher costs result from congestion of local infrastructure.

2.4 Consequences of Export Market Entry

Entry can have a number of different impacts on the firm and aggregate economy. Some have provoked less discussion than others. For example there is widespread evidence of an aggregate productivity effect through resource reallocation (Bernard and Jensen, 2004a ; Hansson and Lundin, 2004; Falvey et al., 2004). The area given greatest attention however, is direction of causality between exporting and within-firm changes in productivity. We focus on that, although other important effects might relate to survival probability of exporters (Bernard and Wagner, 1997; Bernard and Jensen, 1999).

At the simplest level this literature can be seen as a test between self-selection and learning, and indeed this was explicit in the earliest studies. The umbrella label learning in fact contains three separate channels. First, interaction with foreign competitors and customers provides information about process and product reducing costs and raising quality, which can be interpreted as learning by exporting. Second exporting allows firms to increase scale.[11] Finally increased competition in foreign markets forces firms to be more efficient and stimulates innovation. However this fails to recognize how the hypothesis under test has evolved, to one of a bi-causal relationship. Self-selection is important, but leads also to endogenous changes in pro-ductivity either as a result of learning by exporting or learning to export.

In the earliest literature the hypothesis under test was clearly one of self-selection versus learning. The arguments in favour of the former are most powerfully put by Bernard and Jensen (1999, 2004b). In their study of US plants they found productivity growth of exporters was not significantly different from non-exporters, independent of whether productivity was measured as labour productivity or TFP. This implies that the productivity distribution of firms in any given industry does not widen continuously over time, or put differently the growth effects from learning are not permanent. They also provided evidence that out of the pool of non-exporters, new exporters were already among the best and differed

[11] Evidence from Tybout and Westbrook (1995) suggests that this may be an unimportant source of efficiency change.

significantly from the average non-exporter. Whilst there is some country specific sensitivity in the magnitude of any difference in performance, a reasonable summary would be that the results of Bernard and Jensen (1999) for the US are replicated for most other countries (see Table 3).[12] Export market entry is associated with significant changes in performance around the point at which export sales begin.

This argument for self-selection is therefore based on a comparison between established exporters and non-exporters and a difference in the performance of new export firms around the point of entry which is not permanent. Future entrants have many of the right characteristics that make them likely to export and faster productivity growth than non-exporters when they do. But, after a short period they become indistinguishable from other exporters. The strong conclusions reached by Bernard and Jensen (1999) in favour of self-selection led quickly to an adaptation of the hypothesis being tested to one of self-selection versus a bi-causal relationship. Recognising that new exporters appeared to already have many of the right characteristics to become exporters one can test whether the surge in productivity associated with entry was explained by the decision to become an exporter, or whether the productivity surge led to the export decision. As a consequence of the change in focus, methodology also evolved, with attempts to control for self-selection using either instrumental variable or matching techniques (alone or in combination with difference in differences). As argued in Van Biesebroeck (2005) not controlling for self-selection will overstate evidence of learning for new exporters in the data.

Instrumental variable approaches have usually been estimated using GMM; see for example Van Biesebroeck (2005); Baldwin and Gu (2003). Whilst they have the advantage of being relatively easy to estimate one faces the perennial question of instrument validity. By contrast, matching attempts to reduce heterogeneity between new and non-exporters by using observable firm characteristics. It has the disadvantage of removing observations from the data set and requiring specific assumptions about non-observable factors such as managerial ability. Establishing causality is probably the most challenging issue facing researchers in this area. Our view is that matching offers the sounder foundation, but we leave arguments to which of these methodologies should be preferred to Blundell and Costa Dias (2000) and focus instead on results from each.

The impact of applying these alternative techniques has been largely to confirm self-selection is more important than learning. For example, comparisons of new exporters and non-exporters without controlling for selection in Germany (Bernard and Wagner, 1997) and the UK (Girma, Greenaway and Kneller, 2004) shows significant pre-entry differences in performance, whereas differences are not

[12] The evidence for Sweden (Hansson and Lundin, 2004; Greenaway, Gullstrand and Kneller (2005) and Slovenia (Damijan et al., 2007) are exceptions.

evident with methods controlling for selection. Yet whilst evidence of post-entry productivity changes are reported for the UK (Girma et al., 2005b) they are not for Germany (Wagner, 2002). Indeed whilst both GMM and matching advance on simply comparing new exporters with all non-export firms, they do not guarantee post-entry productivity changes will be observed. As table 3 shows, more studies report evidence for learning than fail to find such effects, although it is perhaps worth noting these tend to be studies that use matching.

So what explains this divergence? Two issues have been explored, heterogeneity and timing. Some have argued that learning is likely to be specific to some firms, such as those that are young (Delgado et al. 2002; Fernandes and Isgut, 2005), or highly exposed to export markets (Kraay, 1999; Castellani, 2002; Girma, Go¨rg and Strobl, 2004; Damijan et al., 2007). Others have found post-entry changes depend on existing industry characteristics, productivity changes are lower in industries in which current exposure to foreign firms (through arms length trade and FDI) is high (Greenaway and Kneller, 2003). While it is difficult to conclude against such effects, heterogeneity should not be allowed to become an easy excuse for inconsistencies across studies. To establish heterogeneity will require evidence that the same mechanisms (such as age or foreign market exposure) are important across countries.

The learning by exporting hypothesis attributes part of the change in productivity to the endogenous decision to start López (2004) and exporting. More recently Alvarez and López (2005) have questioned the timing issue, arguing that productivity changes occur after the decision to start exporting, that is they may pre-date the point at which export sales begin.[13] Firms invest in new technologies leading to pre-entry changes in productivity: they learn to export rather than learn by exporting. This takes the view that learning effects are neither inevitable nor automatic but require investments in domestic technology (Keller, 2004). While this might be seen by some as an unfair shift of the goalposts, it is consistent with a test of exogenous versus endogenous changes in productivity associated with exporting. It has also existed as an idea within the case study literature for some time (see the review by Pack, 2000) and a number of studies report anecdotal evidence (López 2004; Alvarez and López, 2005; Van Biesebroeck, 2005; and Blalock and Gertler, 2004). Empirical testing of this using micro data sets becomes more difficult owing to the unobservable nature of the time at which the decision to start to export is made, and the likelihood that preparation time varies across firms.

[13] Alvarez and López (2005) label pre-entry effects _as learning to export compared to learning by exporting for post-entry effects. The common element between these is the effect of the decision to export on the firms productivity.

Table 3: Evidence on Export Market Entry Effects and Firms

Authors	Sample	Methodology	Pre-entry difference	Post-entry difference
Self-Selection versus Learning				
Aw *et al.* (2000)	Korea, 1983–93 and Taiwan (China), 1981–91	New Exporters vs. non-exporters	5+% TFP Taiwan ? TFP Korea	6+% Δ TFP Taiwan ? Δ TFP Korea
Baldwin and Gu (2003)	Canada, 1974–96	New Exporters vs. non-exporters	3% ΔLP, 0% ΔTFP	6%ΔLP, 2%ΔTFP
Bernard and Jensen (1999)	US, 1984–92	New Exporters vs. non-exporters	6% TFP, 7–8% LP	3% ΔTFP, 3% ΔLP–short run 1% ΔTFP, 1–2% ΔLP–medium run 1% ΔTFP, 1–2% ΔLP–long run
Bernard and Jensen, (2004*b*)	US, 1983–92	New Exporters vs. non-exporters	3% TFP	6% TFP, 2% ΔTFP
Bernard and Wagner (1997)	Germany, 1978–92	New Exporters vs. non-exporters	5% LP, 0% ΔLP	5% ΔLP
Castellani (2002)	Italy, 1989–94	Exporters vs. non-exporters	+ TFP, 0 ΔTFP	
Damijan *et al.* (2006)	Slovenia, 1994–2002	Exporters vs. non-exporters	0% TFP	0% TFP t_0 0% TFP when export to non-OECD countries t_1 11+% TFP when export to OECD countries t_1
Delgado *et al.* (2002)	Spain, 1991–96	New Exporters vs. non-exporters Stochastic dominance	+ TFP	0 ΔTFP
Greenaway and Yu (2004)	UK chemicals industry, 1990–2000	Dynamic panel		10% increase in exports = 1% TFP, 6% LP
Hahn (2004)	Korea, 1990–98	New Exporters vs. non-exporters	4% TFP	7% TFP
Hansson and Lundin (2004)	Sweden, 1990–99	New Exporters vs. non-exporters	0% ΔTFP, 0% ΔLP	0% ΔTFP, 5% ΔLP
Isgut (2001)	Colombia, 1981–91	New Exporters vs. non-exporters	20% LP, 4%ΔLP	5%ΔLP[1]
Kraay (1999)	China, 1988–92	Dynamic panel		1s.d. increase in exports = 2% TFP, 13% LP
Liu *et al.* (1999)	Taiwan, 1989–93	New Exporters vs. non-exporters	0% ΔLP, 6% ΔTFP	7% ΔLP, 0% ΔTFP
Self-Selection with Endogenous Productivity Change				
Post-entry effects				
Arnold and Hussinger (2005*a*)	Germany, 1992–00	Matched D-i-D	+ ΔTFP non-matched sample	0% ΔTFP matched sample
Baldwin and Gu (2003)	Canada, 1974–96	GMM	3.4% LP, 0% TFP non-matched sample	5.5%LP, 1.7%TFP non-matched sample 11%LP, 1%TFP GMM results

Table 3 Continued: Evidence on Export Market Entry Effects and Firms

Authors	Sample	Methodology	Pre-entry difference	Post-entry difference
Bigsten *et al.* (2000)	4 African countries 1992–95	Dynamic system		+ ΔTechnical efficiency
Blalock and Gertler (2004)	Indonesian firms, 1990–96	1.Fixed effects 2. IV–OP & LP 3. timing	 3. 0% ΔTFP	1. 5% TFP 2. 2–5% TFP 3. 4% ΔTFP
Clerides *et al.* (1998)	Colombia 1981–91, Mexico, 1986–90 and Morocco 1984–91	GMM	Colombia + LP Mexico 0 LP Morocco + LP	Colombia +LP Mexico 0 LP Morocco + LP
De Loecker (2004)	Slovenia, 1994–2000	Matched D-i-D		22%TFP t_0
Girma *et al.* 2003)	UK, 1988–98	Matched D-i-D	0% ΔTFP, 0% ΔLP in matched sample 1% ΔTFP, 0% ΔLP in unmatched sample	ΔTFP:2% ΔLP:2% in matched sample ΔTFP:2% ΔLP:1% in unmatched sample
Greenaway and Kneller (2003)	UK, 1989–2002	Matched D-i-D	0% ΔTFP, 0% ΔLP in matched sample	ΔTFP:3% ΔLP:5.5% Effect stronger when interacted with export share
Greenaway, Gullstrand and Knellar(2005)	Sweden, 1980–97	Matched D-i-D	0% ΔLP 0% ΔTFP	0% ΔLP 0% ΔTFP
Van Biesebroeck (2005)	9 African countries, 1992–96	GMM		35%TFP
Wagner (2002)	Germany, 1978–89	matching	0% LP	0% ΔLP
Self-Selection with Endogenous Productivity Change				
Pre-entry effects				
Alvarez and López (2005)	Chile, 1990–96	Matched D-i-D	+ ΔINV, + ΔSKILL + TFP, + LP non-matched results	0% ΔTFP, ?%ΔLP matched sample
López (2004)	Chile, 1990–96	New Exporters vs. non-exporters	+ ΔINV, 0% ΔDOMSALE + ΔTFP	

Notes: Where possible the results refer to a comparison of new exporters versus non-exporters.
TFP = total factor productivity, LP = labour productivity, Δ = growth
+ the difference relative to the control group is positive and significant, − the difference relative to the control group is negative and significant, 0 the difference relative to the control group is insignificant, ? the difference relative to the control group changes sign and/or significance through the paper.
These results refer to firms that survive in export markets, as reported in Table 10 and for value added per worker.
Castellani (2002) compares exporters versus non-exporters.

As López (2004) notes however, without information on timing of the decision, the time path of an endogenous change in productivity is likely to look similar to that of an exogenous change and it becomes harder to conclude that observed productivity changes are orthogonal to the export entry decision.

Using an econometric approach Aw et al. (2006) study the evolution of productivity and R&D for exporters in Taiwanese electronics. They find that those that do not invest in R&D have lower productivity growth than those that just export, which in turn is lower than those firms that invest in both.[14] They argue these findings are consistent with an interpretation that R&D investments are necessary for firms to benefit from their exposure to international markets. López (2004) develops the same idea for domestic sales and investment. He finds investment and productivity rises in the pre-entry period but domestic sales are flat and argues this is consistent with investment in technology for sales to foreign but not domestic markets.

Endogenous pre-entry changes in productivity offer an interesting possibility for future research, though current analysis raises questions. First, a simple growth accounting approach suggests that if investment rises and output remains flat, productivity should fall. Simultaneous increases in investment and productivity would therefore seem an unlikely combination, unless of course there are reductions in other inputs. Here more detailed data on equipment and R&D investment would help. Second, how are we to interpret evidence of post-entry changes in productivity? The most obvious explanation is overlap between the benefits to new technology with the point at which sales start, perhaps due to lags in their effects due to learning. An alternative might be a difference between firms that are passive and active in their export decision. Discussions with those involved in export promotion in the UK suggest both occur frequently. For those firms that are passive, no pre-entry investments are made and productivity changes are likely to occur with the start of export sales.

Ultimately perhaps issues surrounding timing of the decision and investment in new plant, equipment or personnel are difficult to answer with available data, which offers insufficient detail. While case studies offer one solution, perhaps a more interesting approach is that used by Baldwin and Gu (2004) who combine micro data with questionnaires about export behaviour. They find evidence consistent with changes in scale, increased efficiency through competition and learning. Canadian exporters used more foreign technologies, were more likely to have R&D collaboration with foreign firms and improved the flow of information

[14] A number of papers have found that exporters have higher levels of R&D but do not establish the direction of causality, see for example Bleaney and Wakelin (2002) and Roper and Love (2002) for the UK, Bernard and Jensen (1995) for the US, Aw et al. (2006) for Taiwan and Baldwin and Gu (2004) for Canada.

about foreign technologies to Canadian firms. That also led to increased innovation and investments in absorptive capacity.

2.5 Determinants and Consequences of Exit

As with export market entry, the literature on exit splits into determinants and consequences. A reasonable expectation would be that exit should be symmetric to entry. To some extent this is so. Exit from export markets is correlated with similar firm level variables as entry: it is less likely the larger, more productive and more human capital intensive the firm, and the lower the ratio of exports to domestic sales; see for example Greenaway and Kneller (2003) and Blalock and Roy (2005). Industry determinants have been less well researched. For example, research that focuses on the effect of exchange rate changes considers periods of domestic currency depreciation, when exports are likely to expand (Bernard and Jensen, 2004b, Das et al., 2004; Blalock and Roy, 2005). Thus far no one has considered whether the effect of appreciation is symmetric, although evidence of substantial export market exit in the presence of a depreciation of the Indonesia rupiah by Blalock and Roy (2005) suggests it is not.

The set of industry variables is extended by Greenaway and Kneller (2003) to include import penetration and intra-industry trade, as well as industry sunk costs. Conditional on firm level variables they find exit is more likely in industries with low sunk-costs, (because re-entry is easier) and those with high levels of intra-industry trade. No role for import penetration was found which is consistent with Melitz (2003), where self-selection is driven not by an increase in imports but the pull of export markets.

The literature on consequences of exit is somewhat larger. As with entry, self-selection appears to be important. Export quitters tend to have lower productivity compared to firms that continue (Aw et al., 2000; Baldwin and Gu, 2003; Girma et al., 2003) and no significant difference from, or in some cases, lower productivity (growth) than non-exporters (Bernard and Jensen, 1999; Hansson and Lundin, 2004; Hahn, 2004). Firms seem to self-select out of export markets just as they do into them. One caveat might be made from an often overlooked feature of the data, the comparison of new exporters with entrants: evidence presented across studies comparing entrants and quitters suggests the latter have higher productivity.

As with entry the effect of exit on productivity produces mixed results. Of those not conditioning for self-selection Hansson and Lundin (2004) and Hahn, (2004) find no obvious post-exit productivity changes, whereas Girma et al. (2003) and Blalock and Gertler (2004) report similar results conditioning on self-selection. By contrast, for the US Bernard and Jensen (1999, 2004b) report post-exit changes, not controlling for self-selection. On balance, it would seem that self-selection is important, weaker firms are likely to exit, but unlike entry there is little impact on productivity of this choice.

3. Exporting and Foreign Direct Investment

3.1 Exports versus FDI

At the simplest level, exports and FDI are substitute channels for firms globalising.[15] The conditions for foreign production become more favourable relative to exporting as the size of the foreign market increases and costs of exporting increase; and less favourable as costs of setting up foreign production grow. This is the proximity-con-centration trade-off explained by Brainard (1993). The contribution of Helpman et al. (2004) to this is analogous to Melitz (2003) contribution to the basic model of trade with representative firms. Adding heterogeneity allows this choice to differ across firms within the same industry and thus determines which firms export and which become multinational. The interesting properties of the model in this regard are generated through the assumptions of different costs (largely fixed) associated with serving domestic and foreign markets (through FDI or exports), along with heterogeneity in productivity across firms.

As we have seen sunk-costs of exporting are typically thought to include fixed costs of research into product compliance, distribution networks, advertising and so on. Goods exported are also subject to transportation costs. The fixed costs of FDI are the duplication of costs in establishing domestic production facilities. They are assumed to be greater than those of exporting, FDI eliminates variable transport costs, but involves higher fixed costs. Heterogeneous productivity then ensures self-selection. Only the most productive firms become multinationals; firms whose productivity falls in an intermediate range export and the least productive only sell domestically.

Helpman et al. (2004) assume the decision to establish foreign production facilities is based purely on considerations of market access. All FDI is horizontally motivated. Head and Ries (2003) demonstrate that when there are factor price and market size differentials, firms invest abroad for vertical motives also: the ordering of the pro-ductivity distribution between multinationals and non-multinationals can even be reversed. If the foreign country is small and offers some cost advantage, for a certain range of the parameter of the model, the least productive firms locate abroad whereas more productive ones produce at home. In this case, low productivity enterprises have a greater incentive to pay the FDI sunk costs because they use more intensively the factor whose overseas price is low.

[15] We concentrate here on the evidence at the level of the firm. The issue of complementarity and substitution between exports and FDI has been studied at many other levels of aggregation, a summary of the evidence for which can be found in the Head and Ries (2004).

Empirical tests of the heterogeneous firm model have generally followed one of two lines. First, testing within industries for substitution between exports and FDI related to productivity differences. Second, testing the cross-industry/country predictions – the volume of exports relative to FDI we might expect. Whilst there is a large literature comparing productivity levels of multinationals against non-multinationals and exporters against non-exporters, there are only a small number of studies that compare exporters and multinationals. In part this is because it is a relatively new question, in part because for many countries information on which domestic firms export and which are multinational is not available. As can be seen from table 4 two basic approaches to this question are evident. The first follows Head and Ries (2003) in comparing mean values (in some cases conditional on other firm and industry characteristics), see for example Castellani and Zanfei (2007) and Kimura and Kioyata (2004). The second follows Girma et al. (2005a) in using Kolmogrov-Smirnov tests of stochastic dominance, see Girma, Görg and Strobl (2004), Arnold and Hussinger (2005b) and Wagner (2005). This approach compares the cumulative distribution of productivity for different types of firms and not just the mean. Despite the difference in methodology, the prediction with regard to exports versus FDI would appear to have strong support, Head and Ries (2003) being the exception), while ironically that between exporters and non-exporters less so. Whilst explaining differences across a small number of studies is never easy, several report a bias towards large firms, and therefore a bias against finding significant productivity differences, and there is a suggestion that this is most severe in Head and Ries (2003), who use information on publicly listed firms.

Table 4: Evidence on Relative Productivity of Exporters and Multinationals

Evidence on Relative Productivity of Exporters and Multinationals

Authors	Sample	Methodology	Exporters vs. non-exporters	MNEs vs. exporters
Arnold and Hussinger (2005*b*)	Germany, 1996–2002	K-S tests of stochastic dominance	+	+
Castellani and Zanfei (2007)	Italy, 1994–96	OLS	0	+
Girma, Görg and Strobl (2004)	Ireland, 2000	K-S tests of stochastic dominance	0	+
Girma *et al.* (2005*a*)	UK, 1990–95	K-S tests of stochastic dominance	+	+
Head and Ries (2003)[2]	Japan, 1989	OLS	0	0
Kimura and Kiyota (2004)	Japan, 1994–2000	OLS	+	+
Wagner (2005)	Germany,1995	K-S tests of stochastic dominance	+	+

Notes: + the effect is positive and significant, − the effect is negative and significant, 0 the effect is insignificant and/or changes sign and/or significance through the paper.
Head and Ries do find predictions in support of the model for size characteristics.

The second strand of the literature concerns itself with proximity-concentration predictions, the relative level of exports to FDI. Helpman et al. (2004) predict FDI will be more common relative to exports, the greater the dispersion of productivity levels within an industry. The data requirements of such a test are demanding however, particularly with regard to foreign sales by domestic multinationals and measures of dispersion within an industry. They use US data and regress the ratio of exports to FDI (measured by sales of overseas affiliates) on traditional proximity-concentration variables, unit costs of trade and plant fixed costs, as well as a new variable, within industry dispersion. They consistently find that dispersion has the expected effect on relative sales: industries in which firm size is highly dispersed are associated with relatively more FDI than exports.

3.2 Exports by MNEs

Whilst in a single product world exports and FDI are substitutes, even if this choice is determined exogenously by productivity levels, in practice multinationals also export. Indeed many report that foreign multinationals contribute disproportionately to exports compared to employment or output shares (Baldwin and Gu, 2003; Kneller and Pisu, 2004). To some extent this should be expected, a well-established result is the superior performance of foreign owned firms with respect to employment, wages and productivity, all of which are important determinants of exports. Should the export decision of multinational firms be modelled as identical to that of domestic firms however? What little evidence there is suggests not. Kneller and Pisu (2004) find that even controlling for characteristics, foreign firms are more likely to export than indigenous ones, and export more intensively.

So what explains export decisions of multinationals? Modelling has developed along two lines: export platform FDI and complementarity, broadly distinguished by the number of product lines the firm is assumed to produce.[16] Export platform FDI is typically defined as the establishment of foreign production facilities and allocation of part or all of the output to serve a third country. It therefore refers to exports of a single product line, where these are not to the home country. Complementarity refers instead to multi-product firms, to multiple stages of production and to export and FDI flows from the home to foreign countries: exports and FDI become positively correlated if there are horizontal or vertical complementarities across product lines.

Theories of export platform FDI have developed by adding more countries and stages of production to traditional theories of FDI and in more recent developments in cross-firm heterogeneity, FDI becomes complex. Vertical FDI occurs when the

[16] Helpman (2005) takes a somewhat broader view of this question adding a discussion of the role of incomplete contracts for firms internationalisation and offshoring decisions.

stages of production are located in more than one country; and horizontal when the same stage is located in more than one country. Vertical FDI is factor seeking; horizontal, market seeking. When there are more than two countries and more than two stages of production, multinationals are likely to undertake more complex FDI choices which involve intra-firm trade and export platform FDI. The effect of adding more countries is to allow for the possibility of a horizontal motive for export platform FDI, adding more stages allows for a vertical motive.

Motta and Norman (1996), motivated by the observation that much FDI is between countries in regional trading blocks, consider three identical countries and a single stage of production. Costs of production do not differ between countries but costs of trading do (because two either enter a free trade agreement or raise external barriers against the third). If we start from an equilibrium where each firm exports to the other two countries from its home base, raising external barriers or creating a free trade area encourages the outside firm to set up production facilities inside the free trade area and export to the other country in the bloc. Where the outside country chooses to locate production in and export from is left undetermined. Again, because of identical costs neither of the inside countries choose export platform FDI as a strategy.

The conditions under which export platform FDI is likely have been analysed by Ekholm et al. (2003) where there are two identical countries in the North (A and B) one in the South, and multiple stages of production. Each firm produces intermediates and a final good. Firms must provide headquarter services from their home northern country but can choose where to produce intermediates as well as assembling the final product. Two of the countries, one northern (A) and one southern are members of a free trade area. The drivers of the model include assumptions about the size of the (marginal) cost advantage of southern firms and trading costs between different sets of countries. The free trade area between A and the Southern country means it is always optimal for the northern country to locate production in the South and export home (owing to the cost advantage from doing so). Therefore, unlike Motta and Norman (1996), when there are no vertical motives for FDI, the country inside the free trade area always has a motive to undertake export platform FDI.

For the other northern country (B) the model predicts three outcomes. First, no FDI: firm B produces at home and exports to the free trade area; second, export-platform FDI: firm B produces the good to be sold at home domestically, whereas the final product sold in the other northern country is produced in the South and exported; third, vertical FDI (hybrid MNE): firm B locates all production in the South and exports to both markets in the North. The last is hybrid because toward the home country, the firm undertakes vertical FDI whereas, toward the other Northern country, it undertakes a pure form of export platform FDI. Which strategy is adopted depends on the size of the (marginal) cost advantage to Southern firms, and trade costs. As the cost advantage of Southern firms increases we move from

the first equilibrium to the second and when the cost advantage of locating in the South becomes large enough all production moves there. Similarly as trade costs between the Southern and two Northern countries fall, the Northern firm outside the FTA finds it competitive to move from exporting to the FTA, to export platform FDI, to locating all production in the Southern country. This has similarities to Motta and Norman (1996).

The predictions of these models are driven primarily on cross-country differences in costs. Grossman et al. (2003), developing the complex FDI model of Yeaple (2003), show that firm characteristics may also be important. If firms in the same industry are heterogeneous in productivity they may make different choices, even though costs of exporting and FDI are the same. They assume three countries (two North and one South); firms must provide headquarter services, produce intermediates and assemble the final product. Their analysis allows for the coexistence in the same sector of a rich array of profitable FDI strategies. In brief, the general lesson is that least productive firms will not undertake FDI. More productive firms choose complex strategies that involve a mix of FDI and exports. In most situations these can be classified as neither purely horizontal nor purely vertical, and involve the export of intermediates and/or final products.

Models of export platform FDI simplify the analysis to a single product firm (albeit with multiple stages of production). An alternative set of models consistent with the idea that multinationals may also export comes from the literature on complementarity (Head and Ries, 2004). Again there are horizontal and vertical elements to this. In a multi-product firm, exports and FDI become positively correlated if there are horizontal or vertical complementarities across product lines. For example, in the case of horizontal complementarities increased demand for the good supplied by foreign production may lead to increased demand for all goods produced by that firm, some of which may be supplied through arms-length trade. For vertical complementarities the establishment of a plant in a foreign country to produce or assemble final goods will displace the exports of this product, but at the same time increase exports of intermediates from the home country. Net complementarity may arise if the displaced export of the final good is more than compensated by increased exports of intermediates.

Empirical evidence on the export decision of multinationals has concentrated largely on direction of correlation, whether positive or negative, rather than explanation. In all cases, at the firm level, this relationship has been found to be positive, for example Lipsey and Weiss (1984) for the US, Swedenborg (1985) for Sweden, and Lipsey et al. (2000) and Kiyota and Urata (2005) for Japan. Attempts at understanding the explanation for any correlation are limited to Head and Ries (2003), Kiyota and Urata (2005) and Girma et al. (2005a). The first two test for the effect of vertical FDI on exports using export demand equations for the firm (both for Japan) and find similar results. Head and Ries (2001) find complementarity between exports and FDI for the most vertically integrated firms and substitution

can be found for the least integrated, whereas Kiyota and Utata (2005) find that intra-firm exports grow faster than total exports-with increased FDI some of the inter-firm exports shift to intra-firm exports. By contrast Girma et al. (2005b) test for export platform FDI for the UK. They find foreign multinationals tend to acquire domestic firms that export – they cherry-pick the best firms. However there are differences in the post-acquisition export trajectories of acquired firms according to whether they is inside or outside the EU. For firms outside, export intensity rises, whereas it falls for firms inside. This appears consistent with export platform motives as discussed by Motta and Norman (1996).

4. Future Research Issues and Policy Dimensions

4.1 Future Research Issues

A review of the tables associated with this evaluation and references appended confirm how rapidly the literature has grown. It has also generated genuinely new insights, particularly with regard to the determinants of exporting. However, it is also a progressive research agenda in the sense that there is both unfinished business and new research questions being raised.

As we have seen, some aspects of the export decision have received more attention than others. For example, while much is known about the characteristics of exporters and non-exporters and what happens when a firm enters export markets, relatively little empirical work has been conducted around the question of choices that firms make between exports and FDI. To a degree this is data driven, given the demanding requirements of the underlying models. Since little may change with respect to data availability, or at least change only slowly, this suggests that future empirical work is likely to continue along current lines, with some spread to questions where the data constraints are not so severe. Tests of export-FDI models are also likely to remain specific to more data rich countries such as the US, Japan and Sweden. Anew strand of empirical analysis does appear to be emerging from the predictions of the heterogeneous firm models that provides some insight about the export-FDI choice of firms however. That is the dynamic consequences of changes in the costs of exports and FDI. Perhaps the earliest example of this is by Pavcnik (2002), who studies the within firm and between firm productivity effects of trade liberalisation in Chile.

Although the evidence base points unambiguously to the crucial role of sunk costs, little research has as yet focused on what these are, and how agglomeration, exchange rates and policy changes affect them. Whilst many researchers go through the motions of commenting on (for example) changes in product design, setting up distribution channels and so on as possible sources, that is generally as far as it goes. Sharper insights are needed if we really are to understand firm

heterogeneity. This will rely on merging datasets and/or firm and industry specific survey based enquiry. A recent example of the former, which investigates the role of access to credit is Greenaway, Guariglia and Kneller (2005). A fourth issue, which again depends on merging datasets is the role, if any, of the origin and destination of trade/FDI. As we saw in section 1 (extensions of the Melitz model to incorporate country asymmetries) and section 3 (North-South FDI models) origin and destination are likely to affect outcomes. Moreover, they may be key to understanding some of the empirical findings reported in section 2. For example, it may be that potential learning from exporting is fashioned by the markets into which one exports.

Finally, a new strand of research is being pioneered by Antras (2003) and Antras and Helpman (2004) exploring the implications of heterogeneity for the boundaries of the firm and strategies for outsourcing and insourcing of activities. This is a potentially rich vein of research, yielding new insights into globalisation and industrial organisation. Empirically however research here will be even more challenging given the need for disaggregated data on trade in intermediates, mapped on to firm specific information.

4.2 Policy Dimensions

Intervention to promote exports is very widespread – every WTO Trade Policy Review[17] contains a chapter on Measures Directly Affecting Exports and there are always measures to report. These range from intervention to improve market intelligence (public support for trade missions), to sector specific fiscal intervention (tax concessions or duty drawbacks), to export processing zones (free zones).

Such a widespread commitment to a specific policy agenda is unusual and the commitment to export promotion has historically been driven by a presumption that export growth and output growth are positively correlated. Although theoretical models linking openness and economic growth are not unequivocal, alarge empirical literature points to a positive correlation, even if the direction of causality is controversial. Be that as it may, the key point is that intervention is motivated by macro-econometric evidence. Does the microeconometric evidence we have reviewed reinforce or undermine a case for active promotion? López (2005) asks this question and concludes that it reinforces the macro evidence. He argues that even if self-selection is the key driver of export market entry, it may nevertheless be conscious self selection, especially in developing countries. What he means is that firms consciously improve their productivity with the international

[17] The WTO's Trade Policy Review Mechanism ensures that the trade policies of Members are audited on a regular basis. For the big three (US, EU and Japan) this means every two years; for the smallest Members, it takes place every seven years.

market in mind, rather than the best firms just starting to export. Policy intervention could than stimulate more conscious self-selection and deliver a productivity boost. Clearly if learning by exporting does occur, productivity gains are boosted further. Moreover, if there are spillovers, perhaps because non-exporting firms learn to export from other (domestic or multinational) exporting firms, the case is strengthened.

This is a plausible argument, though it could only underpin a case for general rather than targeted intervention. López (2005) himself stresses the importance of reducing (overseas) barriers to exports, which clearly aligns with other arguments for trade liberalisation. To this should be added internal barriers to export, chief among which is domestic import protection, since as the incidence of protection literature shows, import tariffs are taxes on exporting. If sunk costs are important, one can think of intervention to improve aspects of infrastructure as relevant – improving information flows, promoting clustering and so on. If policy makers wanted evidence to support intervention targeted at specific sectors or firms, that would require much more information than we have access to at present. For example, are entry costs higher for small firms? is access to credit a barrier? and so on. In the absence of more robust evidence, targeted intervention to support exporting firms is subject to the same risks as identifying so-called infant industries and the record on that front is not a good one.

5. Conclusions

This article has synthesized and evaluated a new literature linking firms, trade and cross-border investment. Its starting point was a well-known feature of the real world, firms that export and others that do not co-exist in the same industries. Until recently, this was not well explained by core trade models. This has changed with the development of heterogeneous firm models. These explain how firms that export are more productive and this, together with the reallocation of output which occurs as less productive firms contract or go out of business, points to a direct link between exporting and productivity. The framework has been extended to allow for the fact that some firms choose to produce overseas rather than export. The empirical literature has grown fast and as we have seen extends across a large number of industrialized, transitional and developing countries. Moreover this literature points to a number of regularities: exporting firms do tend to be larger and more productive than non-exporters; sunk costs appear to be important; multinational firms tend to be more productive than domestic firms. Other evidence is less conclusive however, such as that relating to learning by exporting. We have learned a lot in a remarkably short space of time, but as we saw in the last section, a rich research agenda has been thrown-up and this is a literature that will continue to grow.

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Trade and Growth: "South-North" Integration, Outsourcing and Skills

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Introduction

In this paper we shall focus on one particular aspect of growth and international trade: the increasing role which lower- and medium-income economies (the "South") play in the global economy and the role which "outsourcing" plays in the integration of these economies in international trade flows. We shall refer to the stronger position of the "South" in advanced economies' markets (the "North") and also in international production activities more generally as "South-North integration". Linked to this is the issue of the impact of such integration upon labour markets in both the "North" and the "South", in particular on the position of different "skill groups" (i.e. which we shall define in this paper as groups of employed persons with different educational attainment levels).

This paper will therefore focus on the role of lower- and medium-income economies in international trade flows, attempt to capture the important phenomenon of "outsourcing" and look at the impact which such trade integration might have on "skill demand". The paper is structured as follows: section 1 discusses the importance of South-North integration for the recent dynamics of global trade integration; section 2 focuses on the issue of outsourcing and skills, providing a review of the literature in this area and section 3 attempts an empirical assessment of this issue through an analysis of trade statistics concentrating in particular upon the "skill content" of trade flows between "southern" and "northern" economies.

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1. The Phenomenon of South-North Trade Integration

1.1 The Current Era of South-North Integration: an Empirical Assessment

"South-North" integration refers to processes of international economic integration between countries with lower income levels (the "South") and those with higher income levels (the "North"). Such integration processes have played an important role historically e.g. in the period in which colonial empires were formed and in which the economic relationships between colonial "mother" country and colonies were important characterising features. The "new era" of South-North integration refers to a more recent phase in which relationships between countries of different levels of economic development are again an important feature characterising international economic relationships. Amongst the groups of lower or medium-income economies we shall distinguish further a group which we refer to as "successful catching-up economies" (or SUCCESS in short) and other lower or medium-income economies which encompass a large number of countries but which continue to play a marginal role in global trade and production relations. Let us illustrate this in chart 1 which explores the development of SUCCESS and other lower income economies' market shares in three "northern" markets: those of the EU-15, of the USA and of Japan.

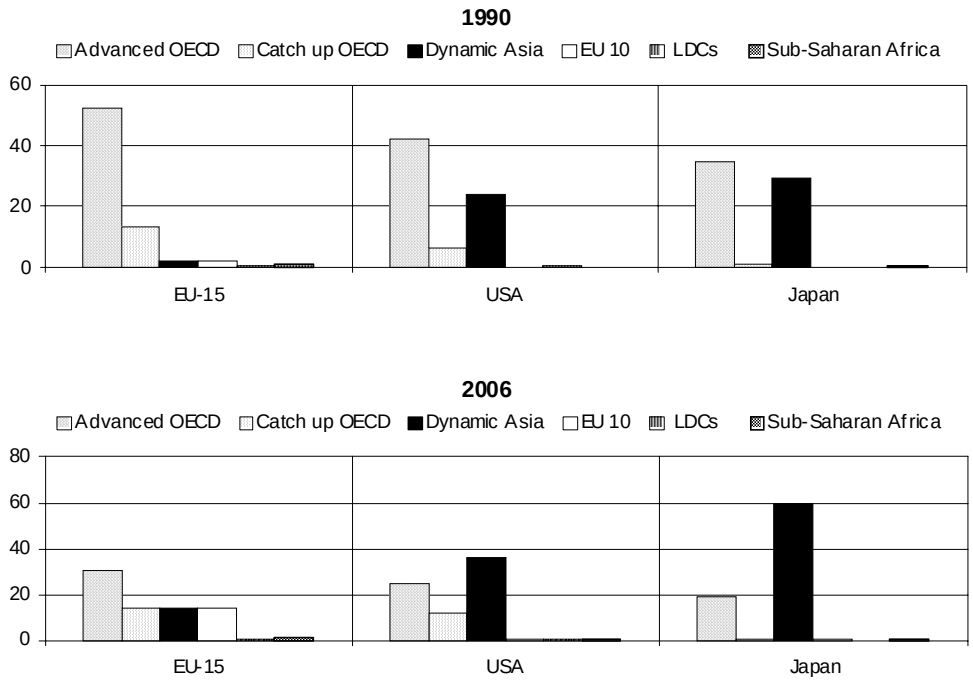
What we can see from chart 1 is that there were substantial changes in market share positions of the SUCCESS economies relative to those of advanced economies. Over the period 1990 to 2006, the market shares in "northern markets" of the SUCCESS economies (Catch-up OECD, EU-10, dynamic Asia) grew dramatically while those of advanced OECD economies declined strongly. There are interesting differences with respect to the three "northern markets" distinguished in chart 1: in the EU-15, three groups of SUCCESS economies were all gaining market shares: the first are the EU-10 which is the group of Central and Eastern European economies which became members of the EU in 2004 or after[2]; then it is the group of "catching-up OECD economies" which includes the EU southern cohesion countries (Greece, Portugal, Spain) as well as Turkey and, important for the US market, Mexico; finally, it is the group called "dynamic Asia"[3]. For the EU-15 markets, all the three groups of SUCCESS economies became equally important by 2006, while for the USA and the Japanese market it is "dynamic Asia" which is by far the most important group of SUCCESS economies. For the USA, the group of

[2] This group consists of the Czech Republic, Hungary, Poland, Slovakia, Slovenia, the three Baltic States (Estonia, Latvia, Lithuania), Bulgaria and Romania.

[3] The 'dynamic Asia' group comprises Taiwan, Hong Kong, Korea, Singapore; Thailand, Malaysia, Philippines, Indonesia; China and India.

"OECD catching-up economies" also occupies a significant market share position and this is due to Mexico's role as an important location for "outsourcing activity" following the NAFTA agreement.

Chart 1: Shares in Total Goods Imports in EU-15, USA and Japan – Excluding Intra-Advanced EU-Trade in %



Source: UN Cometrade; authors' calculations.

Note: Catch-up OECD includes here: Greece, Portugal, Spain, Turkey, Mexico; EU-10 refers to the Central and Eastern European Member States of the EU; Dynamic Asia includes: Hong Kong, Korea, Singapore, Taiwan; Indonesia, Malaysia, Philippines, Thailand; China and India; the LDCs (least developed countries) and Sub-Saharan Africa are UN-defined groupings; in the imports of the EU-15, the intra-advanced EU economies' trade flows are not included in the aggregate and also not in the advanced OECD trade with the EU-15.

Both for the US and the Japanese markets, the groups of European catching-up economies play no significant role as import suppliers. Hence there is evidence for both "regionalist" as well as "global" economic integration and the predominant dynamic is that of a redistribution of market shares in favour of SUCCESS economies. The – often large – group of countries which have not embarked upon successful catching-up (such as the groups of least developed countries, the LDCs,

and sub-Saharan economies in chart 1) have no significant position in international trade in goods.

Let us summarise the main tendencies emerging from chart 1:

(i) the strongest dynamic in trade relations currently is the strong increase in market share positions of "successfully catching-up economies" (which we have termed SUCCESS economies);

(ii) there is quite a strong "regionalist" dimension in international integration processes, i.e. some of the "South-North" integration takes place in a regionally confined setting;

(iii) there are significant groups of low income economies (we might call them FAILURE economies) which do not feature in this process of South-North integration, i.e. they fail to play any significant role in international trade relations.

What we shall try to analyse in the next two sections are the implications of this significant process of "South-North integration" which we are currently witnessing in the global economy.

1.2 Theoretical Approaches to "South-North Integration"

The current phase of intensified "South-North integration" follows a previous phase after WWII when "North-North integration" was the principal pattern of international economic integration. The strong expansion of "North-North integration" (i.e. trade and FDI linkages between economically and technologically advanced economies) immediately after WWII was rather unexpected as classical trade theory (of the Ricardian and Heckscher-Ohlin varieties) would expect the greatest benefit from trade integration between countries with different levels of economic development. Observing, however, the rapid process of trade integration between advanced economies (mostly in the form of so-called "intra-industry trade") from the 1970s onwards a range of international economists (pioneers were William Ethier, Paul Krugman, and Elhanan Helpman) attempted to develop the analytical tools with which one could understand the benefits of trade amongst countries at similar levels of economic development[4]. The demonstration of such benefits was based on models which incorporated various features of imperfect competition, product-specific economies of scale and product differentiation. The body of work which emerged from these developments was called "new trade theory".

[4] Think of the emphasis put in post-war Europe on the economic integration process amongst advanced West European countries. In fact, the new theoretical developments were usefully employed to analyse the likely impact on the ambitious "Single Market" programme of the European Commission which was implemented in 1992.

However, the new phase of "South-North integration" discussed above, requires again a return to an understanding of processes of international economic integration between countries at different levels of economic development. We shall in the following review shortly the approaches developed in the recent literature on this. Classical trade theory (Ricardo, H-O-S) was based on the idea that there is a certain complementarity between countries which are different from each other either in terms of levels of productivity or know-how or in their relative factor endowments; this complementarity can be exploited through international trade. The principal idea here – analysed in the context of comparative static analysis – was that relative specialisation on different types of industries in different economies would lead to the most efficient use of available resources (in both advanced and less advanced economies) and both advanced and less advanced economies would gain from this.

This idea of complementarity is still valid in the current context of global and regional integration. The notion of specialisation has been extended from simply industrial specialisation to specialisation on production stages and on "tasks" (fragmentation approach) and to segments in the product spectrum (theories of vertical product differentiation and specialisation) and the notion of factor endowment complementarity has been extended by considering a more differentiated array of heterogeneous labour inputs (by skills and educational levels) and types of job executions (using information on detailed occupational structures; see also Grossman and Rossi-Hansberg; 2006). Hence the picture of South-North integration which emerges is that of a much greater scope of production specialisation and production integration across economies with differences in technological know-how, productivity and wage levels as well as the impact which such integration could have on job structures and labour demands in these economies[5]. However, in order to capture the increasing role of SUCCESS economies, it is important to capture the issue of "catching-up" (in productivity and income levels) alongside the issue of international specialisation and integration. In the following we shall refer to the basic features of a model of South-North integration which we have been working on for the past few years and which emphasises the importance of considering patterns of catching-up.

[5] One should however be aware that straightforward results are only obtained in relatively simple models (like the 2x2x2 Heckscher-Ohlin model). Going beyond this (in particular in extending the model to more countries or factors) shows that results are less clear. Nonetheless, the insights from these simplified models still have their merits and can be fruitfully used to discuss ongoing trends.

1.3. The Gerschenkron Model of South-North Integration

The model which we shall outline in this section emphasises the relationship between "northern" (NEs) and "catching-up southern economies" (CUEs) and has been developed in a number of contributions by Landesmann and Stehrer (see 2001, 2006, 2007, 2008). The model is basically a dynamic Ricardian model looking at the dynamics of relative cost developments as explanations of changing patterns of international specialization between NEs and CUEs[6]. They link their analysis of comparative cost dynamics to hypotheses regarding productivity catching-up on the one hand and wage-price dynamics on the other hand. These hypotheses are tested empirically and they find rather strong econometric support for them (see Landesmann and Stehrer, 2001). The idea is rather simple: just like in the new growth theoretical literature which studies the problem of convergence in income (or productivity levels) between countries of different initial levels of income (or productivity), there is an underlying hypothesis which goes back to Alexander Gerschenkron's famous notion of "the advantage of backwardness" (Gerschenkron, 1952, 1962). The advantage of less developed economies consists of the fact that they can benefit from technology (knowledge) transfer and hence this would be the motor behind a successful catching-up process. To be successful in benefiting from such an "advantage of backwardness" however, they have to possess or develop the mechanisms which allow such a successful technology transfer. Moses Abramovitz speaks here of "absorption capabilities" (Abramovitz, 1986). This mechanism of technology transfer can operate at the level of the economy as a whole and can be rather widely interpreted not only as technology transfer in the narrow sense but also as the (selective and often modified) transfer of institutional and behavioural schemes and policies. In the Landesmann and Stehrer model, the Gerschenkron hypothesis is applied at the industrial rather than the economy-wide level. In this form it means that productivity growth in CUEs could be particularly high in industries which start from a high initial technology (or knowledge and productivity) gap compared to the more advanced economies. The behavioural hypothesis here is that if technology and knowledge gaps are high in particular areas of industrial activity, then the scope for learning (and hence for productivity growth) is also high. This boils down to an empirically testable hypothesis whether productivity growth is strong in those industries where initial productivity gaps are big. It so happens that industries with high initial knowledge (and productivity) gaps are often those which would count as more "high tech" and also more "skill"- and "R&D"- intensive.

[6] However, the model also includes differences in factor endowments specifically in relation to available labour skills, linking it thus also to HO based arguments. In Landesmann and Stehrer (2008) the model was extended to include the effects of outsourcing on labour markets.

Hence, once the Gerschenkron hypothesis has been empirically tested and supported in the cases of CUEs (for econometric support across a wide range of catching-up economies, see Landesmann and Stehrer, 2001) we obtain the first ingredient of a model with changing comparative cost dynamic. More precisely, it is found that the (relative) productivity (and hence catching-up) dynamic in CUEs is higher in industries with more technology- or skill-content than in industries with lower technology- and skill-content. The faster speed of productivity growth results from both a higher initial gap and a stronger convergence parameter in the medium-/higher-tech sectors. If this is a persistent pattern, then CUEs would loose the comparative disadvantage they originally had in industries in which the initial productivity gaps were very large (i.e. medium- or higher-tech industries). To fully state the argument, however, another component of the model is important: the reason is that if higher productivity gains would simply be absorbed by higher relative labour costs in each industry, then the uneven productivity dynamic would not translate into a changing comparative cost dynamic. Hence another important ingredient is added to the model: wage and price-cost dynamic. In this respect we refer to two empirical findings which characterize dynamic catching-up processes: one is that wage growth is less uneven across industrial branches than is productivity growth (labour economists speak here of a "wage drift" in the sense that wage claims made in one industry have an impact on wage claims in other industries as wage bargaining has an economy-wide dimension) and this means that relative labour unit costs fall more strongly in those industries in which there is relatively fast productivity catching-up. This feature supports the dynamic of changing comparative cost dynamic discussed above.

The other phenomenon which is often registered in catching-up economies is that profitability in those industries which undergo fast productivity catching-up is also higher than in the other industries. The high profitability in the fast catching-up industries results from a particular price-cost dynamic and makes investments into such industries attractive. Hence we observe often in successfully catching-up economies that international investment flows into those industries which benefit from the changing character of the dynamics of comparative advantage (i.e. FDI is directed more into medium- and high-tech industries than into low-tech industries; for an analysis of catching-up processes in Central and Eastern Europe in this respect, see Landesmann and Stehrer, 2002). And since international investment is often the conduit of international technology transfer, it speeds up the above pattern of changing comparative advantage.

The link to labour market dynamics is then easily made in that the industries which undergo the fastest catching-up process (i.e. the more medium- and higher-tech industries) are also the more skill-intensive ones and hence labour demand turns in successfully catching-up (SUCCESS) economies in the direction of a higher skill composition – even without any skill bias of technical change. Depending upon the evolution of skill supplies, there is hence also an argument of

observing a rising skill premium in the catching-up economies[7]; this is also in line with another model which has become a very prominent contribution to the analysis of South-North integration, i.e. the Feenstra-Hanson model (see Feenstra and Hanson, 1996, 1997, 1999, 2001). Empirical analysis (see e.g. EU Skills Study, 2007) strongly confirms this model prediction in that labour demand has shifted in the CUEs strongly in the direction a higher demand for skilled workers (see also Landesmann and Vidovic, 2004, for the case of Central and Eastern European economies). We shall see that the empirical analysis conducted in section 3 of this paper confirms the basic dynamics described by the Gerschenkron model of catching-up and international specialisation. Before moving to the analysis of South-North integration and the insights we can obtain with regard to outsourcing from trade statistics, we shall shortly review the literature on the relationship between outsourcing and labour markets.

2. Outsourcing and Skills: a Short Review of the Literature

2.1 Introduction

The traditional question asked in the literature on outsourcing and labour markets is the impact of outsourcing on income differentiation, either on the income distribution between labour and capital or between different types of labour, in particular, skilled and unskilled labour (both in the tradable sectors). While we shall shortly review this literature, we shall not do so thoroughly as there are already a number of such reviews available (see e.g. Knabe and Koebel, 2006; Morrison-Paul and Siegel, 2001; Feenstra and Hanson, 2001; Geishecker and Goerg, 2004; Stehrer, 2006). An interesting question in this context is whether a change in the supply of skills (through educational or training efforts or a change in migration policy) might affect the outsourcing outcome in relation to the degree and types of outsourcing activities and, in further consequence, competitiveness and labour market outcomes.

The first link (change in the supply of skills and effects on income distribution) is really a question similar to the one addressed in traditional trade theory through the Rybczinski theorem. The second link, to competitiveness, is not really much asked in the theoretical literature but has – to some extent – been addressed in empirical studies.

[7] In this application we assume that potential shifts of skill intensities which may be due to relative wage changes (e.g. higher relative wages of skilled workers would imply a shift in technique) is not strong enough to counteract this effect.

2.2. Theoretical Aspects

Outsourcing at the international level

Outsourcing and fragmentation are now widely covered also in the theoretical literature. A first line of research is based on traditional trade theory and follows closely the Heckscher-Ohlin model (e.g. Arndt, 1997, 1999, Arndt and Kierzkowski, 2001, Deardorff, 2001). In traditional trade theory with two factors (S for skills and L for labour) and two goods (X as the labour intensive and Y as the skill intensive) trade and specialisation patterns are determined by differences of relative endowments in the two countries. The difference in relative endowments leads to a comparative advantage of the skill abundant country in the skill intensive good. Similarly in the Ricardian type models differences in relative productivity levels determines the structure of comparative advantages. It can then be asked what happens if the production of one or both goods can be fragmented into two parts which can be subcontracted (to other firms in foreign countries). These subcontracted activities can either be products or services. In general these fragments require different factor intensities than the composite good. Thus it could be that the more skill intensive fragment of the labour intensive good X is more skill intensive than good Y or as the more labour intensive fragment of good Y. Thus one has to distinguish several cases (see Arndt, 1997). We shall discuss two of them. Let us first discuss the case of offshore sourcing of the import sector. This import sector is – following the idea of comparative advantages – the labour intensive sector in the skill abundant country. Arndt (1997) shows that offshore subcontracting by the import-competing industry (where it is assumed that the labour intensive component is completely outsourced) raises wages of labour relative to skills. In a second stage one can assume that the labour abundant country outsources the skill intensive component of good X to the skill abundant country in the way that each country fully specializes in one segment. Arndt (1997) shows that in this case relative wages are rising in both countries. The effects on general welfare in the two countries are positive and the results are analogous to the Rybczynski effect of technical change or factor accumulation. These results mean that intra-product specialisation can be trade enhancing and welfare improving.

Deardorff (2001) discusses the effects of outsourcing in a Heckscher-Ohlin model. If factor price equalisation holds, it is shown that outsourcing occurs only if it is costless, but this is an uninteresting case. If factor price equalisation does not hold initially then even costly fragmentation is able to produce the good at lower costs as different factor prices can be exploited. This can even be the case if the fragmentation technology uses more resources than the original. In this framework the introduction of fragmentation may lead to factor price equalisation when it did

not obtain initially (Deardorff, 2001). But it could also be that the effect on factor prices goes in the other direction, i.e. they are driven further apart. The direction of factor prices depends systematically on how the factor proportions of fragments compare to the average factor intensities within the cones where the fragments are produced.

Arndt and Kierzkowski (2001) are showing in a framework with Ricardian and Heckscher-Ohlin features that in general fragmentation of production can lead to a situation in which a country is worse off than before fragmentation; this would be the case if a country's terms of trade sufficiently worsens as a consequence of fragmentation. Under the assumption that prices for both fragments fall it could even be that – even if the country was heavily specialised in the former composite product – the country no longer produces either of the two fragments. Jones and Kierzkowski (1990) illustrates this with an Olympic gold winner in a decathlon. If the event would be broken up into separate components, the athlete would return without a medal. This means that even if a country is an effective competitor for the composite product potential rivals could exist which are superior in particular fragments. When breaking up the composite production into fragments these rivals may be more effective than the former country. As a finer degree of specialisation is possible with fragmentation this allows for a greater scope of Ricardian comparative advantages. Further, if consumption is heavily biased towards the commodity which is fragmented than the consumer may be better off as the lower price for this commodity more than offsets the other welfare effects.

Jones and Kierzkowski (1990) also discuss the role of services starting from two stylised facts: Purely domestic service links are less costly than service links across countries and, second, the production of services is characterized by strong increasing returns to scale. Using these assumptions the most efficient way of the organisation of production depends on the output level. At low output levels it is most efficient to organize production in a single block. However, when a certain threshold is reached, a domestically fragmented pattern of production becomes more efficient, and with even higher levels of output international fragmentation becomes the most efficient. This framework also gives an idea regarding other causes of the rapid rise in fragmentation. Technical progress in services (e.g. internet and communication technologies, international banking transactions and reductions in transport costs) allows (or makes it more efficient) to break up production processes into fragments which can then be internationally outsourced. With respect to income distribution it is shown that fragmented trade with the relatively unskilled labour abundant country induces a fall in the level of real wages of the unskilled workers. In this case, fragmentation for such a country is like technical progress in the capital intensive sector. On the other hand, the relatively capital abundant country experiences an increase in the relative wage rate due to losses of the labour intensive fragments. However, under different assumptions it is shown that the results can be opposite. Several other cases are

discussed in Jones and Kierzkowski (2001). These results on relative wage rates suggest that this topic needs a very subtle discussion and popular views might go wrong.

Other contributions for example rely on the specific factors framework (e.g. Kohler, 2001a and 2001b). In these papers the conclusions are somewhat different from the traditional Heckscher-Ohlin based contributions and are somewhat similar to the one-sector model's outcome: unskilled labour loses in a country where the unskilled-labour intensive fragment is outsourced to a foreign economy. (This is the outcome when associating skilled labour with the sector specific factor and unskilled labour with the mobile factor.)

Outsourcing at the firm level

When analysing outsourcing at the firm level one has to start with the question why firms might be vertically integrated at all. Coase (1937) answered this question in arguing that market transactions are not costless and thus some stages of the production process are vertically integrated in "firms". Starting from this point of view might help to understand why firms start to vertically disintegrate. One reason for vertically integrating the production process within one firm is that specifities in production factors exist (e.g. firm specific human capital, specific equipment, ...). The "theory of vertical integration" thus shows that specific investment is a determinant for vertical integration albeit integration itself is not costless (e.g. monitoring, bureaucratic costs, etc.). Fragmentation then occurs if the degree of factor specifity declines e.g. via emerging up- and downstream firms, making usage of other products in the value chain, etc.

In an international context the contributions by Grossman and Helpman (2002, 2003) and Antràs and Helpman (2004) shed light on determinants of the choice between domestic and foreign outsourcing or foreign direct investment. The determinants for these are market thickness, search costs for outsourcing partners, and characteristics of contracts. This is extended to include productivity differences in a firm's outsourcing decision by Antràs and Helpman (2004). From these contributions it follows that "thicker markets" reduce search costs and thus outsourcing activities are expected to be higher. Similary, the availability of search and monitoring technologies (like ICT possibilities) might accelerate outsourcing activities. Further, one expects outsourcing to be more relevant in economic environments which are more interconnected.

In a recent contribution Grossman and Rossi-Hansberg (2006) develop a model of "trade in tasks". Falling costs of off-shoring affect factor prices in a country and have productivity effects benefitting the factor whose tasks are off-shored. The effects of an increased trade in tasks are similar to factor-augmenting technical change.

2.3 Empirical Studies on Outsourcing

In this section empirical studies are summarized with respect to patterns of trade flows and international production integration, including the effects on demand for production factors with special emphasis on the demand for skilled and unskilled workers.

There are already many overviews on the patterns of outsourcing (see e.g. Feenstra, 1998; Yeats, 2001; Kleinert, 2003; Stehrer, 2006) and we thus only shortly summarize the most important facts. All studies on outsourcing – despite relying on different measures of outsourcing – indicate that the amount of international outsourcing has increased substantially over the last few decades. However, these studies also point towards large country differences with respect to levels and importance of outsourcing activities. Larger countries tend to have lower outsourcing activities. Similarly, there are quite large country differences with respect to sectoral reliance on imported intermediate inputs (e.g. Irwin, 1996; Fontagné et al., 1997, Campa and Goldberg, 1997; Hummels et al., 1998; Hummels et al., 2001).

Let us now address the question of the effects of outsourcing on employment. The effects of "globalization" on labour markets are heavily disputed. This debate started in the US in the early 1990s when the NAFTA agreement between US, Canada and Mexico came into being. Whereas in the first phase of this debate trade was blamed as a cause for the rising wage differential between skilled and unskilled workers (see Wood, 1995) it was later argued that skill-biased technical change was the main cause for this rising dispersion (Berman, Bound and Griliches, 1994). However, as Feenstra and Hanson (1996) have argued, outsourcing has a qualitatively similar effect on the demand for unskilled relative to skilled labour within an industry as does skill-biased technological change. Here we focus on empirical studies addressing the effects of outsourcing on labour demand patterns. From a theoretical point of view the effects of outsourcing depend very much on the skill intensities of the outsourcing sectors, the skill intensity of the fragments within the outsourcing sector and the underlying model (e.g. one sector model, general equilibrium models or specific factors model) as outlined above.

There are a number of models which can explain the shifts in relative demand for skilled workers. Feenstra and Hanson (1997) present a model in which outsourcing reduces the demand for unskilled labour in both the skill-abundant and the low-skill abundant country. The reason for this is that the outsourced activities are low-skilled labour intensive relative to those done in the skill abundant country, but skilled-labour intensive relative to those done in the low-skill abundant country. Thus moving these types of activities raises the average skill-intensity of production in both countries. In their study Feenstra and Hanson (1999) found that outsourcing accounts for 20% of the shift in relative employment towards skilled

(measured as non-production) workers in US manufacturing. The increased use of computers and other high-technology equipment within industries account for about 30% of this shift. Autor, Katz and Krueger (1998) uses another measure of computer investment and find that computers explain 30% to 50% of the increase in the relative demand for skilled labour; in this study outsourcing is insignificant for the explanation of the rising relative demand. Görg, Hine and Hijzen (2005) follow the approach by Feenstra and Hanson (1999) and concludes that outsourcing has significantly contributed to the rise of wage inequality in the UK; outsourcing however accounts only for about 12% of the increase. These results are similar to the findings in other studies: there is a significant but small effect on wage levels of unskilled workers and inequality. Studies focusing on employment effects come to similar conclusions, i.e. the effect of outsourcing is small. For example, Anderton and Brenton (1999) find significant negative effects on demand for unskilled workers only for imports from low-wage countries for the UK. On the other hand, Machin and van Reenen (1998) do not find a significant effect on skill structures (again for the UK). Finally, there are only a limited number of studies on the effects in target countries. Egger and Stehrer (2003) find significant impact on the wage structure in three Central and Eastern European countries and conclude that low skill intensive fragments are outsourced to Eastern European countries.

3. Outsourcing and Skills: an Empirical Investigation

3.1 Outsourcing Analysis with Trade Statistics

The basic question we shall be asking in this chapter is which parts of the value chain (distinguished in trade statistics as primary inputs, processed inputs, parts and final goods) are particularly affected by international trade integration. Furthermore, we shall be interested whether international trade integration in these various stages of the production chain are characterized by high-, medium- or low-skill content.

The data set used for this analysis is the UN trade statistics. Furthermore Labour Force Survey (LFS) statistics were used to classify industries by skill content (see box 1 for the classification employed).

We shall start by giving an overview of import structures of the EU-27 by stages of fabrication and skill content and we shall then extend the analysis by looking at sub-groups of EU economies: the EU-North (EU-11), the southern cohesion countries (Greece, Portugal, Spain) and the New Member States (NMS). The reason for this decomposition by country groups is to detect different patterns of intra-EU outsourcing between these three groups of EU economies; apart from this we shall analyse outsourcing patterns of EU economies with a number of country groupings at the global level (for this decomposition see box 2 in this section).

Box 1: Classification of Industries by Skill Types

		High skill share		
Skill type	**NACE code**	**1999**	**2005**	
Low	19	4.8	7.8	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
	18	6.3	7.7	Manufacture of wearing apparel; dressing and dyeing of fur
	17	6.9	8.1	Manufacture of textiles
	20	7.5	8.4	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	37	8.1	10.0	Recycling
	36	9.6	10.8	Manufacture of furniture; manufacturing n.e.c.
Medium	28	10.1	11.7	Manufacture of fabricated metal products, except machinery and equipment
	26	10.3	11.8	Manufacture of other non-metallic mineral products
	15	11.1	12.2	Manufacture of food products and beverages
	25	11.4	13.4	Manufacture of rubber and plastic products
	21	12.6	15.0	Manufacture of pulp, paper and paper products
	27	13.0	13.4	Manufacture of basic metals
	16	15.4	24.9	Manufacture of tobacco products
	34	16.0	19.5	Manufacture of motor vehicles, trailers and semi-trailers
High	29	18.2	20.6	Manufacture of machinery and equipment n.e.c.
	31	20.8	19.8	Manufacture of electrical machinery and apparatus n.e.c.
	22	21.7	26.7	Publishing, printing and reproduction of recorded media
	35	24.9	24.9	Manufacture of other transport equipment
	33	26.1	27.7	Manufacture of medical, precision and optical instruments, watches and clocks
	24	27.8	33.4	Manufacture of chemicals and chemical products
	32	27.8	29.8	Manufacture of radio, television and communication equipment and apparatus
	23	30.5	32.2	Manufacture of coke, refined petroleum products and nuclear fuel
	30	37.2	41.2	Manufacture of office machinery and computers

Shares of industries in EU-27 employment structures and shares of high-skilled employees

	1999		2005	
	High skill share	**Empl. share**	**High skill share**	**Empl. share**
Low	7.49	19.63	9.02	18.54
Medium	11.08	37.17	12.48	38.46
High	22.22	43.20	24.85	42.99

Notes: The industry groupings (high, medium, low) were obtained by ranking the EU-27 industries – in the aggregate – by the shares of high skill employees (those with concluded tertiary degrees) in total employment (see columns 3 and 4 in first table above). The second table shows the shares of the high-skilled in the three groups of industries (columns 2 and 4) and their shares in total manufacturing employment in the EU-27 (columns 3 and 5). Industry 16 (Manufacture of tobacco products) shows a large increase in the share of high skilled worker in a number of countries which might be explained by higher investments in R&D, marketing due to increasing regulations. Despite the large high-skill share in 2005 we decided to keep this industry in the medium group as the number of employed persons is rather low and thus the figures are somewhat unreliable.

For some of the analysis, a more detailed decomposition of industries is employed which differentiates the group of high-skill intensive industries into a "high-medium" group (comprising industries 29, 31, 34 and 35) and the rest which we call "high-high". The employment and high-skill employee shares of these two groups are respectively:

Decomposing the shares of high-skill intensive industries in EU-27 into a "high/medium" and into a "high/high" group:

	1999		2005	
	High skill share	**Empl. share**	**High skill share**	**Empl. share**
High/Medium	18.04	21.18	20.05	21.31
High/High	26.24	22.01	29.56	21.69

Note: The decomposition into these two groups was done by employing a ranking procedure of industries for each EU country by skill-intensity and then taking a cross-country average.

To which extent does the analysis undertaken in this section link up with the debate on the impact of outsourcing on labour markets?

Outsourcing is usually defined by purchases ("sourcing") of inputs from abroad; this could be either done by subsidiaries of companies operating both in the "home" and the "sourcing" country or purchasing inputs from foreign suppliers. Short of direct company information which allows one to distinguish between purchases from subsidiaries and other imports, we shall not be able to distinguish between the two forms of imports. Secondly, limiting oneself to the use of trade

statistics, we shall only be able distinguish between imports of primary and processed inputs as well as parts but not relate these imports to the industries which use these inputs. Rather, we can relate these imports to competing domestic producers of the same types of inputs. The more direct measure of "outsourcing" which would relate the imports to the industries which use these inputs for their production processes would require input-output information which we shall not be using in this analysis. Nonetheless, the analysis will be able to identify the skill content of outsourcing activity and the orders of magnitude in relation to the import-competing domestic industries' production levels.

The first information we shall provide is to check the importance of imports of inputs (primary, processed and parts) in comparison to imports of final stage products. This information is presented in table 1 for the years 1995, 2000 and 2005. We also checked whether the imports of these categories of imports are of the types which can be linked to high-, medium-, and low-skill production activities (see box 1 on how we arrived at a classification of industries by skill intensity; at the end of this section we also use a classification which further subdivides the high-skill group into two groups).

Table 1 shows the following: Of total imports of the EU-27 in 2005, 40% are processed inputs, 21.7% are parts and 36% are final goods imports (a negligible 2.2% are classified as primary – i.e. unprocessed – inputs). Hence if we take processed inputs and parts together, these account for almost 2/3 of total imports of the EU-27 and hence the majority of imports. International production integration (or the international "sourcing" of inputs and parts) is therefore an important phenomenon.

If we look at the skill content of the various import types (primary, processed, parts, final) we can see rather different patterns: given our classification of industries by degrees of skill intensity we see in chart 2 that the supply of Parts falls overwhelmingly into the domain of high-skill intensive industries (96.4% while about 43% of employment is happening in these industries on average in the EU-27 in 2005 – see box 3.1 – and 62.3% of total imports); for Processed Inputs only 37.5% falls into the domain of high-skill industries and 53.5% into that of medium-skill industries and for Primary Products it is only 16% in the high-skill and 80.6% in the medium-skill industries. Hence, amongst the input-supplying imports we have a clear hierarchy with parts production falling almost entirely into the domain of high-skill industries, processed inputs being produced mostly by medium-skill and about one third by high-skill industries and primary inputs mostly by medium-skill industries.

In comparison, final goods imports of the EU–27 are also mostly in high skill categories (72% which is still substantially less than in the case of imports of parts), but there is also a significant share in low skill areas (abut 20%).

Table 1a: Imports of EU-27 – Shares in Total Imports in %, 1995, 2000, 2005

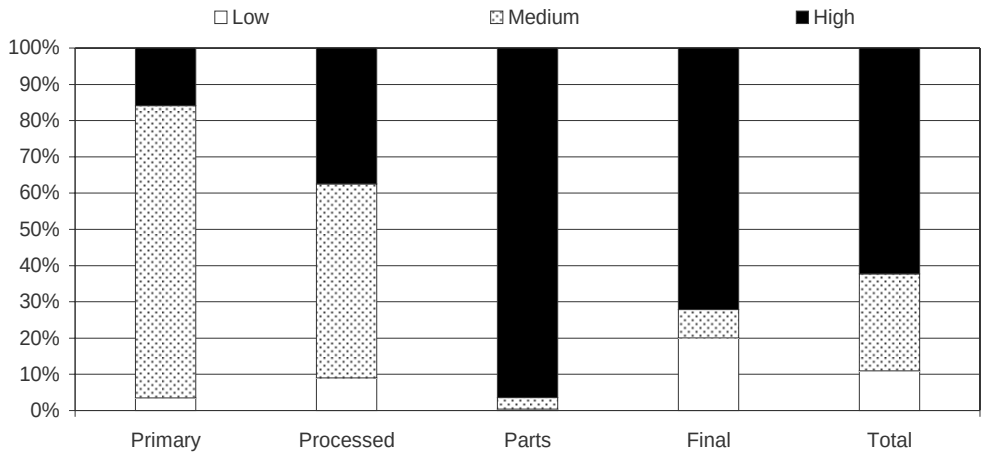
Year	Industry group	Primary	Processed	Parts	Final	Total
1995	Low	0.1	4.9	0.1	7.6	12.8
	Medium	2.2	26.5	0.8	2.8	32.3
	High	0.8	14.7	19.2	20.1	54.9
	TOTAL	3.1	46.1	20.1	30.6	100.0
2000	Low	0.1	4.4	0.1	7.2	11.7
	Medium	1.7	20.8	0.7	2.7	26.0
	High	1.2	13.9	23.4	23.8	62.3
	TOTAL	3.1	39.1	24.2	33.7	100.0
2005	Low	0.1	3.6	0.1	7.3	11.0
	Medium	1.8	21.4	0.7	2.8	26.7
	High	0.3	15.0	21.0	26.0	62.3
	TOTAL	2.2	40.0	21.7	36.0	100.0

Table 1b: Imports of EU-27 – Change of Shares in Total Imports (pp), 1995–2005, 2000 – 2005

Industry group	Primary	Processed	Parts	Final	Total
			2000-2005		
Low	0.0	–0.5	0.0	–0.5	–1.0
Medium	–0.4	–5.7	–0.1	–0.1	–6.3
High	0.4	–0.8	4.1	3.6	7.4
TOTAL	0.0	–7.1	4.0	3.1	
			1995–2005		
Low	–0.1	–1.3	0.0	–0.4	–1.8
Medium	–0.4	–5.1	–0.1	0.0	–5.6
High	–0.5	0.3	1.7	5.8	7.4
TOTAL	–0.9	–6.1	1.6	5.4	

Source: UN trade statistics; author's calculations.

Chart 2: Skill Composition of Import Categories, EU-27 in 2005



Source: wiiw; calculated from UN trade statistics.

If we look at changes over time, there is evidence that over the period 1995 to 2005 (see table 1b) there has been an increase in the shares of final goods and of parts production in the overall imports bill of the EU-27 and a decline (by 6 percentage points) of processed inputs. Within the supplies of final goods and processed goods there was also a significant increase in the shares of goods produced by high-skill industries (see tables 2a and 2b) and a fall of goods produced by medium- and low-skill industries (in final goods there was a sharper fall of the share of goods produced by low-skill industries, in processed inputs a sharper fall of the share of goods produced by medium-skill industries; parts production falls almost completely into the high-skill category so that there is little scope for further up-grading) given our industry classification.

The next point we want to analyze is where processed inputs and parts are sourced from and what the implicit "skill content" is from the different suppliers.

We shall focus in the following analysis on the sourcing pattern of EU northern countries from different "sourcing regions" (see box 2 for the classification of regions upon which the analysis is based). In particular, we shall check whether the sourcing pattern by type of import category (processed inputs, parts, final goods) and by skill content is different from different suppliers (high-income, medium-income, low-income suppliers). The focus on EU-North rather than on the EU as a whole is because we want to focus on the "outsourcing" from high-income to lower-income economies. We shall take initially a global view in the sense of looking at outsourcing patterns to lower- and medium-income countries all over the

world (including the EU lower income countries in these groupings) and then look at the more specific intra-EU patterns of outsourcing.

Table 2a: Imports of EU-27 – Imports by Types of Import Categories and Skill Content in %

Year	Industry group	Primary	Processed	Parts	Final	Total
1995	Low	4.6	10.6	0.5	24.9	12.8
	Medium	69.4	57.4	3.8	9.3	32.3
	High	25.9	31.9	95.7	65.8	54.9
	TOTAL	100.0	100.0	100.0	100.0	100.0
2000	Low	3.4	11.2	0.4	21.3	11.7
	Medium	56.4	53.2	2.8	8.2	26.0
	High	40.2	35.6	96.8	70.6	62.3
	TOTAL	100.0	100.0	100.0	100.0	100.0
2005	Low	3.5	9.0	0.4	20.1	11.0
	Medium	80.6	53.5	3.2	7.8	26.7
	High	15.9	37.5	96.4	72.1	62.3
	TOTAL	100.0	100.0	100.0	100.0	100.0

Table 2b: Imports of EU-27 – Change in Skill Intensity of Imports (in pp), 2000–2005 and 1995–2005

Industry group	Primary	Processed	Parts	Final	Total
			2000–2005		
Low	–1.2	0.6	–0.1	–3.7	–1.0
Medium	–13.0	–4.2	–1.0	–1.1	–6.3
High	14.3	3.6	1.1	4.8	7.4
			1995–2005		
Low	–1.1	–1.7	–0.1	–4.8	–1.8
Medium	11.1	–3.9	–0.6	–1.5	–5.6
High	–10.0	5.6	0.7	6.3	7.4

Source: UN trade statistics; authors' calculations.

Table 3 has three sections: Table 3a shows the composition of imports of EU-North countries by types of imports (primary, processed, parts, final) and from the different sourcing regions, table 3b presents the additional information about the skill content of these various types of imports and table 3c shows the shares which the various import components from high- and low- (plus medium-income) countries have in total imports of EU-North.

The emphasis in the following analysis is on whether sourcing from high- and low-(plus medium-) income countries differs in terms of types of imports supplied, the skill content of these imports and whether there was a shift in the supplies from high- to low-(and medium-) income countries particularly in the areas of parts and processed inputs. The latter shift would indicate an increasing relevance of

"outsourcing" while the former analysis attempts to understand to what extent outsourcing occurs in high-, medium-, or low-skill areas.

Coming to the information contained in table 3a (see also chart 3a) which looks at the composition of imports from different source regions, we can see that both high- and low-(and medium-) income suppliers have been shifting their supplies from processed inputs towards parts and final goods supplies over the period 1995 to 2005. The shift towards parts supplies is strong for the low-(and medium-) income suppliers and negligible for the high-income suppliers.

Table 3a: Imports by EU-North from High-Income and Low-/Medium- Income Countries in % – Imports Distinguished by Import Categories and Skill Content

		Import categories				
Year	**Industry group**	**Primary**	**Processed**	**Parts**	**Final**	**Total**
			Imports from High-Income Countries			
1995	Low	1.32	42.90	1.37	54.41	100.00
	Medium	6.02	83.17	2.42	8.39	100.00
	High	1.16	27.54	34.84	36.46	100.00
	TOTAL	2.79	47.34	21.16	28.72	100.00
2000	Low	0.89	41.07	1.57	56.47	100.00
	Medium	6.01	81.78	2.67	9.53	100.00
	High	2.03	23.24	36.43	38.30	100.00
	TOTAL	3.01	40.25	24.75	31.98	100.00
2005	Low	0.65	35.08	1.58	62.69	100.00
	Medium	6.53	81.58	2.61	9.28	100.00
	High	0.36	26.43	32.03	41.18	100.00
	TOTAL	2.11	42.61	21.75	33.83	100.00
			Imports from Medium- and Low-Income Countries			
1995	Low	0.87	26.81	0.11	72.22	100.00
	Medium	8.70	78.89	2.28	10.13	100.00
	High	3.81	24.15	38.78	33.26	100.00
	TOTAL	4.43	41.02	17.23	37.32	100.00
2000	Low	0.79	26.94	0.21	72.06	100.00
	Medium	8.91	75.70	2.48	12.92	100.00
	High	2.32	21.05	42.23	34.40	100.00
	TOTAL	3.50	35.14	23.31	38.05	100.00
2005	Low	0.59	23.83	0.37	75.20	100.00
	Medium	6.90	77.61	2.68	12.81	100.00
	High	1.11	20.97	36.48	41.44	100.00
	TOTAL	2.33	34.39	21.74	41.54	100.00

Note: EU North refers to the OMS (EU-15) minus Greece, Portugal, and Spain.

Source: UN trade statistics; authors' calculations.

Box 2: Classification of Regional Groupings

Country	Code	Group	Country	Code	Group
Australia	AUS	HH	Spain	ESP	MH
Austria	AUT	HH	Taiwan	TWN	MH
Finland	FIN	HH	Argentina	ARG	ML
Great Britain	GBR	HH	Brazil	BRA	ML
Italy	ITA	HH	Colombia	COL	ML
Netherlands	NLD	HH	Costa Rica	CRI	ML
Norway	NOR	HH	Greece	GRC	ML
Japan	JPN	JPN	Israel	ISR	ML
USA	USA	USA	Mexico	MEX	ML
Bel./Lux.	BELU	HL	New Zealand	NZL	ML
Belgium	BEL	HL	South Africa	ZAF	ML
Canada	CAN	HL	Uruguay	URY	ML
Denmark	DNK	HL	Venezuela	VEN	ML
France	FRA	HL	Bangladesh	BGD	LH
Germany	DEU	HL	India	IND	LH
Germany, West	BRD	HL	Indonesia	IDN	LH
Iceland	ISL	HL	Malaysia	MYS	LH
Luxembourg	LUX	HL	Mozambique	MOZ	LH
Sweden	SWE	HL	Pakistan	PAK	LH
Switzerland	CHE	HL	Sri Lanka	LKA	LH
Bulgaria	BGR	MH	Thailand	THA	LH
Chile	CHL	MH	Tunisia	TUN	LH
Croatia	HVR	MH	Turkey	TUR	LH
Czech Republic	CZE	MH	China	CHN	China
Estonia	EST	MH	Algeria	DZA	LL
Hong Kong	HKG	MH	Côte d'Ivoire	CIV	LL
Hungary	HUN	MH	Cameroon	CMR	LL
Ireland	IRL	MH	Egypt	EGY	LL
Korea	KOR	MH	Ethiopia	ETH	LL
Latvia	LVA	MH	Ghana	GHA	LL
Lithuania	LTU	MH	Jordan	JOR	LL
Poland	POL	MH	Kenya	KEN	LL
Portugal	PRT	MH	Morocco	MAR	LL
Romania	ROM	MH	Nigeria	NGA	LL
Singapore	SGP	MH	Peru	PER	LL
Slovakia	SVK	MH	Philippines	PHL	LL

Note: The classification into country groupings has been made on the basis of income levels (using GDP per capita at PPP for the year 1990 as we wanted to capture catching-up groups of countries) into high-, medium-, and low-income countries and then grouping them again into high-, medium-, and low-growth economies (on the basis of GDP per capita growth estimated over the period 1980-2003) so that we arrive at 6 country groupings HH, HL, MH, ML, LH and LL where the first letter stands for the income group and the second letter for the growth group; apart from these groupings, USA, Japan and China have been separately identified.

Table 3b: Imports by EU-North from High-Income and Medium- and Low-Income Countries in % – Skill Content of Different Import Categories

		Import categories				
Year	**Industry group**	**Primary**	**Processed**	**Parts**	**Final**	**Total**
			Imports from High-Income Countries			
1995	Low	4.14	7.93	0.57	16.57	8.74
	Medium	71.67	58.28	3.79	9.69	33.17
	High	24.20	33.79	95.64	73.74	58.08
	TOTAL	100.00	100.00	100.00	100.00	100.00
2000	Low	2.25	7.76	0.48	13.43	7.60
	Medium	53.41	54.35	2.89	7.97	26.75
	High	44.34	37.89	96.63	78.60	65.65
	TOTAL	100.00	100.00	100.00	100.00	100.00
2005	Low	2.12	5.70	0.50	12.83	6.92
	Medium	86.79	53.81	3.38	7.71	28.11
	High	11.09	40.49	96.12	79.47	65.29
	TOTAL	100.00	100.00	100.00	100.00	100.00
			Imports from Medium- and Low-Income Countries			
1995	Low	5.48	18.25	0.17	54.04	27.93
	Medium	57.85	56.66	3.89	7.99	29.46
	High	36.67	25.09	95.93	37.97	42.62
	TOTAL	100.00	100.00	100.00	100.00	100.00
2000	Low	5.16	17.63	0.21	43.54	22.99
	Medium	59.28	50.21	2.48	7.91	23.30
	High	35.55	32.17	97.32	48.55	53.70
	TOTAL	100.00	100.00	100.00	100.00	100.00
2005	Low	4.99	13.55	0.33	35.39	19.55
	Medium	67.35	51.24	2.80	7.00	22.70
	High	27.66	35.21	96.87	57.61	57.75
	TOTAL	100.00	100.00	100.00	100.00	100.00

Note: EU North refers to the OMS (EU-15) minus Greece, Portugal, Spain.

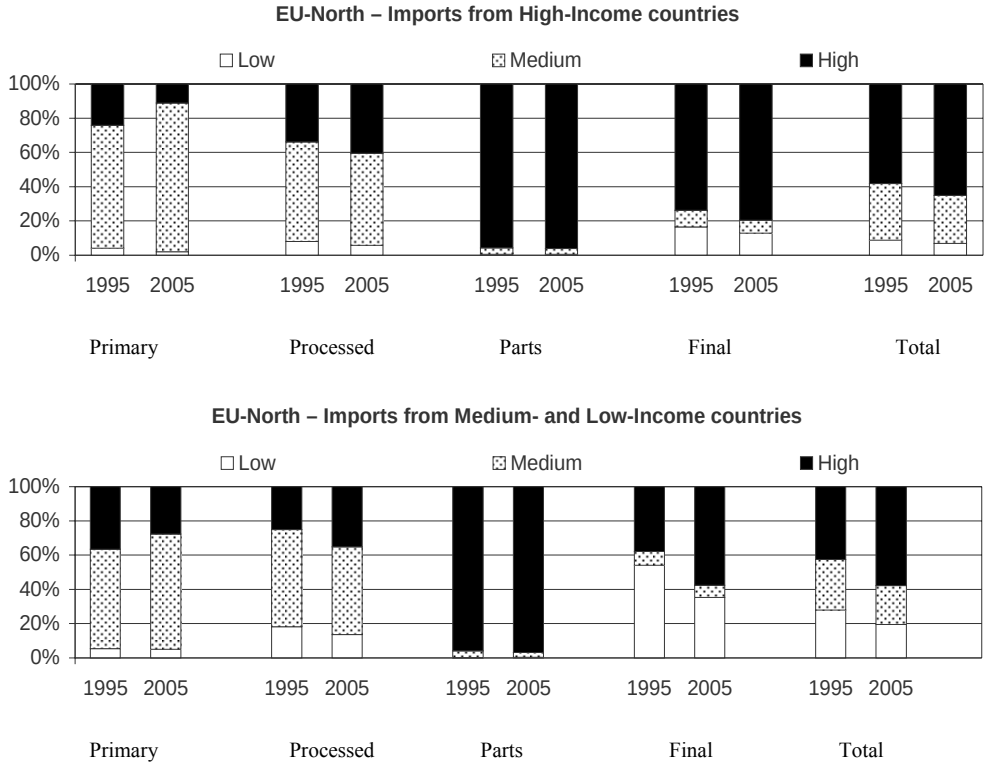
Source: UN trade statistics; authors' calculations.

Table 3c: Shares of High-Income and Medium- and Low-Income Countries in Total EU-27 Imports in % – Imports Distinguished by Import Categories and Skill Content

		Import categories				
Year	**Industry group**	**Primary**	**Processed**	**Parts**	**Final**	**Total**
			Imports from High-Income Countries			
1995	Low	0.09	3.28	0.09	3.64	7.11
	Medium	1.57	21.26	0.62	2.19	25.65
	High	0.48	12.41	15.82	17.04	45.77
	TOTAL	2.14	36.96	16.54	22.89	78.54
2000	Low	0.05	2.70	0.08	3.05	5.90
	Medium	1.14	15.84	0.52	1.92	19.44
	High	0.89	10.88	17.64	18.82	48.25
	TOTAL	2.10	29.44	18.25	23.80	73.60
2005	Low	0.03	2.03	0.07	2.84	4.99
	Medium	1.18	15.41	0.50	1.83	18.93
	High	0.15	11.22	14.55	18.42	44.35
	TOTAL	1.37	28.67	15.12	23.11	68.29
			Imports from Medium- and Low-Income Countries			
1995	Low	0.05	1.61	0.00	3.98	5.66
	Medium	0.59	5.24	0.14	0.64	6.62
	High	0.32	2.32	3.41	3.09	9.16
	TOTAL	0.96	9.18	3.57	7.73	21.45
2000	Low	0.04	1.67	0.01	4.10	5.84
	Medium	0.59	4.93	0.15	0.82	6.50
	High	0.34	3.01	5.74	4.94	14.04
	TOTAL	0.99	9.61	5.91	9.87	26.39
2005	Low	0.03	1.54	0.02	4.40	6.01
	Medium	0.57	5.99	0.18	0.97	7.73
	High	0.19	3.80	6.40	7.55	17.96
	TOTAL	0.80	11.35	6.61	12.93	31.70

Source: UN trade statistics; authors' calculations.

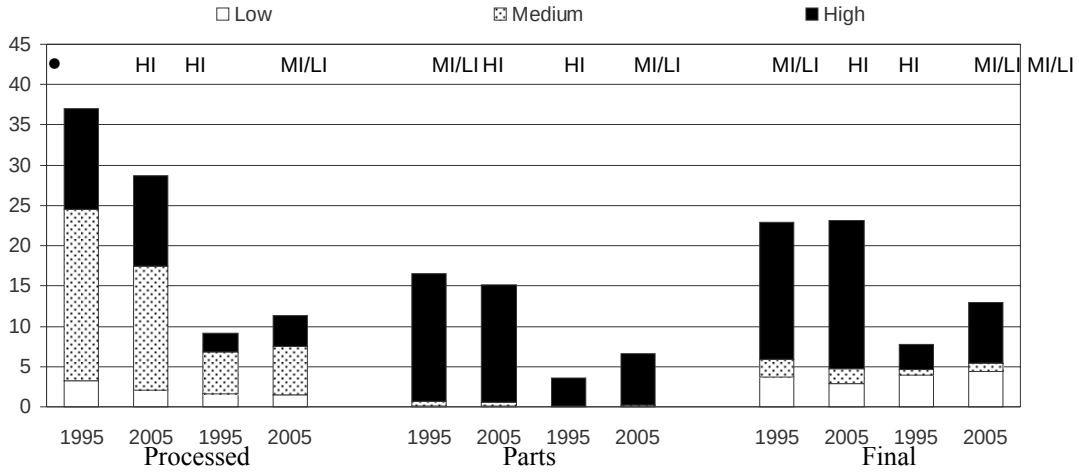
Chart 3a: Imports of EU-North from High-Income and Medium- and Low-Income Countries and by Import Categories and Skill-Content



Source: wiiw; calculated from UN trade statistics; EU North is defined as the High-Income countries of the EU comprising the EU-15 without Spain, Portugal and Greece.

Chart 3b: Shares of High- and Medium- and Low-Income Countries in EU-North Total Imports; by Import Categories, 1995 and 2005

in % of total imports



Note: HI: High-Income countries, MI/LI: Medium- and Low- Income countries.

Source: wiiw; calculated from UN trade statistics.

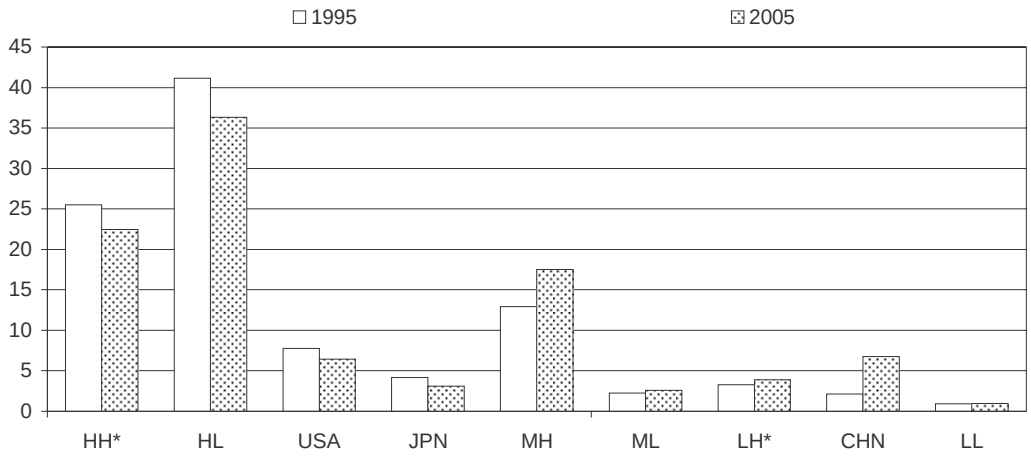
From table 3b (see also chart 3b) we can see another important shift, namely that in the skill composition of imported goods: There is a shift towards higher skill composition in all categories of imports (processed, parts and final) and both in imports from high-income and low-(and medium-) income suppliers, but the shift is much stronger for the supplies from low-(and medium-) income suppliers than from high-income suppliers: thus while the share of high-skill goods in total imports from high-income countries has increased from 58% in 1995 to 65% in 2005 (i.e. by 7 percentage points), that from low-(and medium-) income suppliers has increased from 42% to 58% (i.e. by 16 percentage points); on the other end, the shares of low-skill products supplied by high income producers has declined from 9% to 7% over the period 1995 to 2005, while that from low-(and medium-) income suppliers from 28% to 20%. Hence what we can see is that while there is still a difference in the skill content of goods supplied by high- and low-(and medium-) income suppliers the difference has been declining.

Next, we show the shift in the weights of different suppliers and in this analysis we shift back towards analyzing the import structure of the EU-27 (see table 3c): From the figures in this table we can see that there was a significant shift in the share of EU-27 imports in favour of imports accounted for by low- and medium-

income suppliers and a fall in the share of imports accounted for by high-income suppliers. Thus while high-income suppliers accounted in 1995 for 79% of total imports, in 2005 this share fell to 68%; symmetrically, the shares of low-(and medium-) income suppliers moved from 21% to 32%. Particularly strong was the increase in the shares of low- and medium-income suppliers in high-skill imports which increased from a share of 9% in the total import bill of the EU-27 to 18% (i.e. it more than doubled) while the shares in low- and medium-skill products increased only mildly. The presence of low- (and medium-) income producers in the high-skill segments of both parts and final goods production more than doubled and they account now for slightly less than 50% of supplies in this skill segment.

Hence the analysis shows that there is a significant shift towards higher skill content in all categories of imports, but that this shift is particularly strong in imports from low-(and medium-) income suppliers. We shall now extend the analysis towards a more detailed geographical break-down of source countries (using the detailed grouping discussed in box 2).

Chart 4: Imports of EU-27 by Source Regions, 1995 and 2005



Note: HH …High-Income countries without USA and JPN; LH* … Low-Income countries without CHN.*
Source: wiiw; calculated from UN trade statistics.

In chart 4 we can see the shares of different suppliers and in the different import categories in total EU-27 imports. The different suppliers belong to either the group of high income countries (we distinguished four groups therein; for details see box 2), medium-income countries (where we distinguished high-growth and low-growth economies; the high growth group includes most of the NMS) and low-income countries (where again a high-growth and a low-growth group was distinguished; China was singled out by itself). The main feature of changing

import shares in chart 4 is that the groups of high-income countries are losing market shares and two groups of countries, in particular, are gaining market shares: the group of middle income high growth (MH) economies and China.

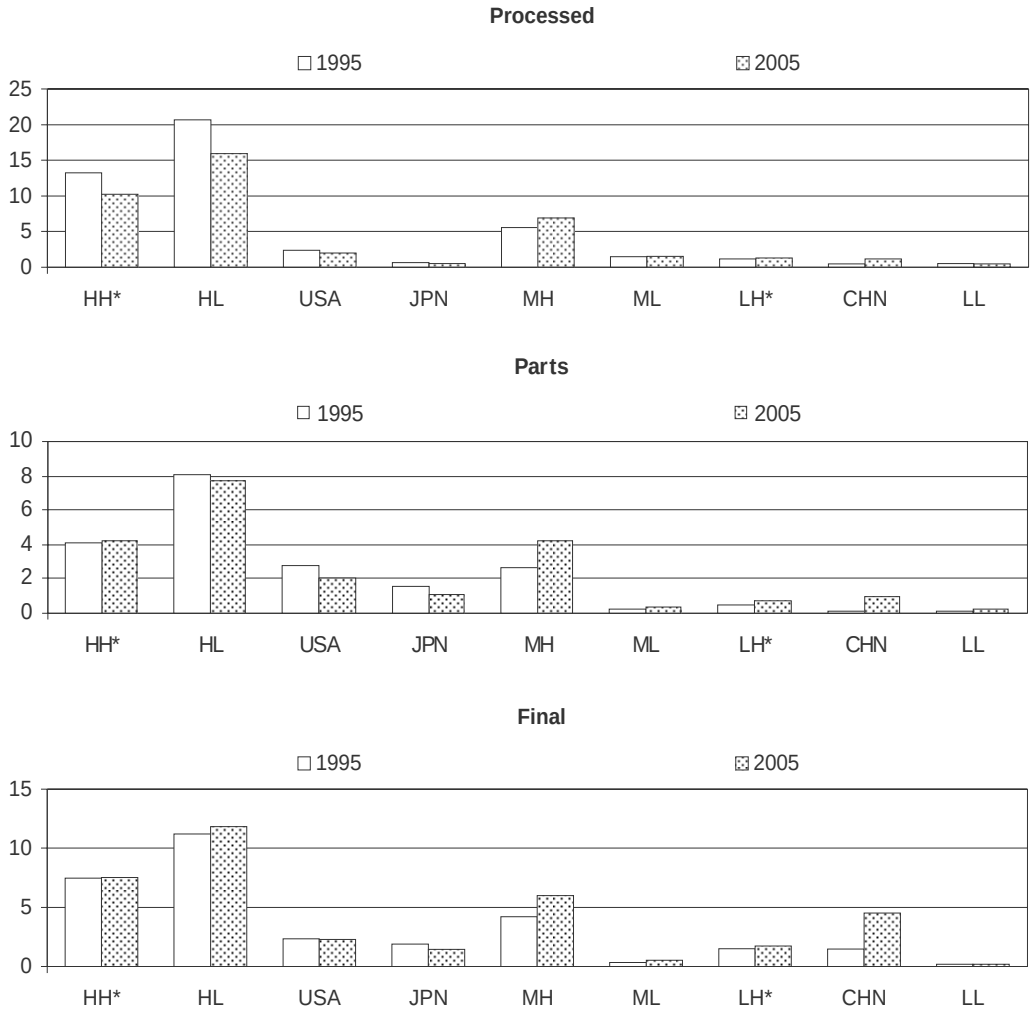
Chart 5 investigates further features in the development of import shares by looking at differences in market share performances of the different suppliers in different import categories (primary, processed, parts, final). The interesting features which emerge from chart 5 is that high-income countries are losing shares in EU-27 total imports especially in processed inputs and parts production (although the group of high-income high-growth economies – HH – are holding their shares) while in final goods their shares (in total EU-27 imports) are maintained. This is clearly evidence for an outsourcing story. The main beneficiaries are the middle income-high growth (MH) economies and China which are both increasing substantially their shares in EU-27 imports. The MH economies are occupying a significant market share position in all three categories of imports and China mostly in final goods. This can be interpreted as evidence for the importance of geography in outsourcing where geographic proximity matters in supplying processed inputs and parts and hence the MH countries (many of which are European) feature strongly in these import categories. It is also clear that other middle- and low-income countries (ML, LL, LH without China) hardly feature in import shares except for the LH without China group (LH without China which consists predominantly of other South and South-East Asian countries); they feature in final goods imports of the EU-27 but not in processed inputs and parts which again supports the idea that geographic proximity matters in outsourcing.

Next we discuss the changing skill content of imports from the different suppliers. We shall focus here on the evidence for skill upgrading by different suppliers, concentrating on the "important players" in EU imports, i.e. the high-income countries on the one hand (HH, HL, USA) and the middle income high growth (MH) economies on the other as well as China. Table 4a presents the shares of these supplier groups in total EU-27 imports thereby distinguishing industries with high-, medium- and low-skill contents in the different import categories; Table 4b shows changes in these shares.

The features revealed in these tables show both an outsourcing and skill upgrading story: First of all, the change in import shares between China and middle income high-growth (MH) economies, on the one hand, and the high-income countries (both of the high- and the low-growth variety as well as the USA) on the other hand, is clearly visible. Secondly, the percentage point increases of import shares of China and those of the MH economies especially in the high-skill segment of industries is clearly in evidence. There is, however, a difference between the MH countries (many of which are European) and China in that China increases its import shares mainly in final goods, while the increases of the MH countries took place across all the three categories of imports (i.e. processed inputs,

Chart 5: Imports of EU-27 by Source Regions and by Import Categories – 1995 and 2005

shares in % of total imports



Note: HH …High-Income countries without USA and JPN; LH* … Low-Income countries without CHN.*
Source: wiiw; calculated from UN trade statistics.

parts and finished goods). Looking at it from the high-income countries point-of-view, we can see that they lose shares in EU-27 imports mostly in processed inputs, and there particularly in the medium skill segment. This indicates that the high-income countries are subject to outsourcing of the processing of inputs, but

maintain a relatively strong position in finished goods trade. Successfully upgrading middle income countries make particularly strong inroads in the high-skill segments of processing and parts production while China's import incursions are concentrated – in contrast to the MH economies – in final goods exports (both at the low skill and the high skill end).

Finally, we focus more explicitly on the pattern of intra- and extra-EU import structures of EU high-income economies (for which we use the term EU-North; see above). Table 5 shows the shares of total EU-North imports which fall into the different import categories (primary, processed, parts, final) and which come from four different sources (the EU northern countries themselves; the southern EU economies – Spain, Portugal and Greece; the New Member States; and the Rest of the World).

The basic pattern which we observed in relation to the global imports analysis of the EU with the different country groups above can be seen here as well although we only focus this time on the sourcing pattern of the EU northern economies. We observe, in the first instance, a shift of import shares from intra-EU North to a stronger import dependence upon imports from the EU medium-income regions (EU South and NMS) and also a stronger import presence of the Rest of the World (which we already know is driven by low- and medium-income regions such as China and other catching-up economies while the richer OECD economies experience declining import shares). Thus the shares of intra-EU North trade in total EU-North imports have fallen from 62.5% in 1995 to 55.1% in 2005, while that of the NMS has risen from 3.5% to 6.2% and that of EU-South from 3.9% to 4.2%. Furthermore, it is interesting to see how the composition of imports has changed by trading partners. In total EU North imports, the import structure has changed towards final goods (which accounted in 1995 for 30% of imports and in 2005 for 36%) while the shares of processed inputs and primary inputs have declined (the latter from 46% to 40%). At the same time we see a distinct shift for the NMS to supply a much higher share of parts (these accounted for 16.5% of imports from the NMS in 1995 and have in 2005 increased to 32.4%) while the share of processed inputs has declined. There is here a distinct difference to the EU southern countries or for the Rest of the World which did not experience such a strong shift in the direction of parts: in fact the share of processed inputs in the southern European exports to the EU-North holds up at a high level of 45% of their exports, while for the Rest of the World there is a strong shift in the direction of final goods and away from processed inputs and from parts.

Table: 4a: Shares in Total EU-27 Imports (%), 1995 and 2005

From country groups:	Industry group	Year	Primary	Processed	Parts	Final	Total
China							
	Low	1995	0.003	0.107	0.000	0.897	1.007
	Medium	1995	0.040	0.164	0.007	0.125	0.336
	High	1995	0.001	0.193	0.134	0.443	0.771
	TOTAL		0.044	0.463	0.142	1.465	2.114
	Low	2005	0.003	0.240	0.001	2.076	2.319
	Medium	2005	0.046	0.495	0.022	0.327	0.890
	High	2005	0.003	0.441	0.986	2.103	3.533
	TOTAL		0.052	1.176	1.009	4.506	6.743
Middle income – High growth (MH)							
	Low	1995	0.017	0.713	0.006	1.698	2.434
	Medium	1995	0.278	3.256	0.095	0.387	4.016
	High	1995	0.187	1.587	2.571	2.130	6.474
	TOTAL		0.481	5.556	2.672	4.214	12.923
	Low	2005	0.017	0.718	0.015	1.177	1.927
	Medium	2005	0.292	3.450	0.116	0.474	4.332
	High	2005	0.114	2.746	4.061	4.343	11.265
	TOTAL		0.423	6.915	4.192	5.995	17.524
High-income – low growth (HL)							
	Low	1995	0.053	1.769	0.055	1.575	3.453
	Medium	1995	0.933	12.130	0.368	1.259	14.690
	High	1995	0.203	6.771	7.641	8.375	22.989
	TOTAL		1.189	20.670	8.064	11.209	41.132
	Low	2005	0.019	1.070	0.044	1.364	2.497
	Medium	2005	0.752	8.871	0.299	1.084	11.006
	High	2005	0.078	6.001	7.349	9.382	22.810
	TOTAL		0.848	15.943	7.692	11.830	36.312
High-income – high-growth (HH) without USA							
	Low	1995	0.028	1.263	0.031	1.776	3.098
	Medium	1995	0.424	7.996	0.161	0.767	9.348
	High	1995	0.259	4.005	3.874	4.917	13.056
	TOTAL		0.710	13.265	4.066	7.460	25.501
	Low	2005	0.015	0.861	0.022	1.313	2.211
	Medium	2005	0.366	5.820	0.140	0.646	6.971
	High	2005	0.065	3.552	4.075	5.581	13.273
	TOTAL		0.446	10.234	4.236	7.540	22.456
USA							
	Low	1995	0.011	0.186	0.007	0.179	0.383
	Medium	1995	0.214	0.944	0.045	0.127	1.329
	High	1995	0.019	1.241	2.747	2.024	6.030
	TOTAL		0.244	2.370	2.798	2.330	7.742
	Low	2005	0.003	0.082	0.006	0.111	0.202
	Medium	2005	0.057	0.585	0.032	0.082	0.756
	High	2005	0.011	1.345	2.027	2.089	5.471
	TOTAL		0.070	2.012	2.064	2.283	6.429

Table 4b: Changes of Shares in Total EU-27 Imports, 1995 to 2005

in percentage points

From country groups:	Industry group	Primary	Processed	Parts	Final	Total
China						
	Low	0.000	0.133	0.001	1.179	1.313
	Medium	0.006	0.332	0.014	0.201	0.554
	High	0.002	0.248	0.852	1.660	2.762
	TOTAL	0.008	0.713	0.868	3.040	4.629
Middle income – high growth (MH)						
	Low	0.000	0.005	0.009	–0.521	–0.507
	Medium	0.014	0.194	0.020	0.087	0.316
	High	–0.073	1.160	1.490	2.214	4.791
	TOTAL	–0.059	1.359	1.520	1.781	4.601
High-income – low growth (HL)						
	Low	–0.034	–0.699	–0.011	–0.212	–0.956
	Medium	–0.181	–3.260	–0.069	–0.175	–3.684
	High	–0.126	–0.769	–0.292	1.007	–0.180
	TOTAL	–0.341	–4.728	–0.372	0.621	–4.819
High-income – high-growth (HH) without USA						
	Low	–0.013	–0.402	–0.009	–0.462	–0.886
	Medium	–0.058	–2.176	–0.021	–0.122	–2.376
	High	–0.194	–0.453	0.201	0.663	0.217
	TOTAL	–0.264	–3.031	0.170	0.079	–3.046
USA						
	Low	–0.008	–0.104	–0.001	–0.068	–0.181
	Medium	–0.157	–0.358	–0.013	–0.045	–0.573
	High	–0.008	0.104	–0.720	0.066	–0.558
	TOTAL	–0.174	–0.358	–0.734	–0.047	–1.313

Source: UN trade statistics; authors' calculations.

Note: For country groups see box 2.

Table 5: Import Shares in EU North Imports in %, 1995 and 2005

		Shares in EU-North imports by partner					**Shares in total EU-North imports**				
	Industry	Import categories					Import categories				
Year	group	Primary	Processed	Parts	Final	Total	Primary	Processed	Parts	Final	Total
						EU-North					
1995	Low	0.10	4.10	0.10	5.30	9.60	0.07	2.55	0.08	3.28	5.98
	Medium	2.00	30.80	0.80	3.10	36.70	1.27	19.25	0.51	1.92	22.95
	Med/High	0.00	1.10	12.30	10.90	24.30	0.00	0.68	7.67	6.83	15.17
	High/High	0.80	15.50	4.70	8.40	29.40	0.49	9.68	2.93	5.28	18.37
	Total	2.90	51.50	17.90	27.70	100.00	1.82	32.16	11.18	17.31	62.47
2005	Low	0.00	2.70	0.10	4.80	7.70	0.02	1.47	0.06	2.66	4.22
	Medium	2.00	25.50	0.80	2.90	31.20	1.11	14.07	0.41	1.60	17.20
	Med/High	0.00	1.00	14.40	11.10	26.50	0.00	0.53	7.95	6.12	14.60
	High/High	0.30	16.10	4.20	14.10	34.70	0.14	8.90	2.31	7.75	19.10
	Total	2.30	45.30	19.50	32.90	100.00	1.28	24.97	10.74	18.13	55.12
						EU-South					
1995	Low	0.10	6.30	0.10	13.00	19.60	0.01	0.25	0.00	0.51	0.77
	Medium	1.90	30.00	1.00	2.60	35.40	0.07	1.17	0.04	0.10	1.39
	Med/High	0.00	1.40	14.70	8.50	24.70	0.00	0.05	0.58	0.33	0.97
	High/High	4.40	9.30	2.50	4.10	20.40	0.17	0.37	0.10	0.16	0.80
	Total	6.50	47.00	18.30	28.30	100.00	0.25	1.84	0.72	1.11	3.92
2005	Low	0.10	4.10	0.10	7.30	11.60	0.00	0.17	0.01	0.31	0.49
	Medium	1.80	29.50	0.70	2.50	34.60	0.08	1.25	0.03	0.11	1.47
	Med/High	0.00	1.40	16.30	10.70	28.40	0.00	0.06	0.69	0.46	1.21
	High/High	2.60	9.90	3.40	9.50	25.40	0.11	0.42	0.14	0.41	1.08
	Total	4.40	44.90	20.60	30.10	100.00	0.19	1.90	0.87	1.28	4.24
						New Member States					
1995	Low	0.10	7.20	0.00	18.00	25.30	0.00	0.25	0.00	0.63	0.89
	Medium	3.70	29.60	0.70	3.20	37.30	0.13	1.04	0.03	0.11	1.31
	Med/High	0.00	1.70	12.00	7.60	21.30	0.00	0.06	0.42	0.27	0.75
	High/High	0.40	9.50	3.80	2.40	16.00	0.01	0.33	0.13	0.09	0.56
	Total	4.20	48.00	16.50	31.30	100.00	0.15	1.69	0.58	1.10	3.52
2005	Low	0.20	6.00	0.10	11.00	17.30	0.01	0.37	0.01	0.68	1.06
	Medium	2.40	18.20	1.00	3.70	25.30	0.15	1.12	0.06	0.23	1.56
	Med/High	0.00	2.20	26.90	9.60	38.70	0.00	0.13	1.65	0.59	2.38
	High/High	0.10	5.70	4.40	8.60	18.70	0.01	0.35	0.27	0.53	1.15
	Total	2.60	32.10	32.40	32.90	100.00	0.16	1.97	2.00	2.02	6.16

Table 5 continued: Import Shares in EU North Imports in %, 1995 and 2005

		Shares in EU-North imports by partner					**Shares in total EU-North imports**				
	Industry	Import categories					Import categories				
Year	group	Primary	Processed	Parts	Final	Total	Primary	Processed	Parts	Final	Total
						Rest of World					
1995	Low	0.20	5.00	0.00	12.20	17.40	0.07	1.51	0.01	3.66	5.25
	Medium	2.60	17.70	0.60	2.00	22.90	0.78	5.33	0.18	0.62	6.90
	Med/High	0.00	0.90	11.30	8.90	21.20	0.00	0.27	3.40	2.69	6.37
	High/High	0.80	11.30	13.80	12.60	38.50	0.23	3.41	4.16	3.78	11.57
	Total	3.60	35.00	25.80	35.70	100.00	1.07	10.52	7.75	10.75	30.09
2005	Low	0.10	3.40	0.00	12.10	15.60	0.03	1.17	0.02	4.16	5.38
	Medium	1.50	14.90	0.50	2.10	19.00	0.52	5.14	0.17	0.71	6.54
	Med/High	0.00	1.00	9.50	9.80	20.40	0.00	0.34	3.28	3.40	7.02
	High/High	0.30	14.20	12.20	18.30	45.10	0.11	4.90	4.21	6.32	15.53
	Total	1.90	33.50	22.30	42.30	100.00	0.66	11.54	7.69	14.59	34.48
						Total					
1995	Low	0.10	4.60	0.10	8.10	12.90	0.14	4.56	0.10	8.08	12.88
	Medium	2.30	26.80	0.80	2.80	32.60	2.25	26.80	0.75	2.75	32.55
	Med/High	0.00	1.10	12.10	10.10	23.30	0.00	1.07	12.07	10.12	23.25
	High/High	0.90	13.80	7.30	9.30	31.30	0.90	13.79	7.31	9.30	31.31
	Total	3.30	46.20	20.20	30.30	100.00	3.30	46.21	20.23	30.26	100.00
2005	Low	0.10	3.20	0.10	7.80	11.20	0.07	3.18	0.10	7.81	11.15
	Medium	1.90	21.60	0.70	2.70	26.80	1.85	21.58	0.68	2.65	26.76
	Med/High	0.00	1.10	13.60	10.60	25.20	0.00	1.07	13.58	10.56	25.22
	High/High	0.40	14.60	6.90	15.00	36.90	0.36	14.57	6.94	15.00	36.87
	Total	2.30	40.40	21.30	36.00	100.00	2.28	40.39	21.29	36.03	100.00

Source: UN Trade Statistics and authors' calculations.

Hence this short analysis of intra-EU and extra-EU trade patterns shows a strong increase of trade flows between NMS and North-EU. There is a particularly strong expansion of exports of parts, while the EU southern countries are more strongly linked to EU North via the supply of processed inputs. This difference in trade composition also implies that a different set of industries and hence skills are involved in these trade flows, as parts are produced mainly by engineering industries (skill group 3) which have a high skill content compared to the skill content embodied in processed inputs. Finally, imports from the Rest of the World into the EU-North have shifted further towards final goods and away from processed inputs and parts supplies which again confirms the hypothesis about geographic dimension of outsourcing activities.

4. Summary and Conclusions

The following provides a summary of the results obtained from the empirical analysis undertaken in section 3 of this paper:

- The decomposition of trade flows to the EU-27 (including intra-EU-27 trade) has shown that there is a significant difference in the skill content of different import categories (primary inputs, processed inputs, parts, final goods).
- Grouping suppliers into high-income and low-/middle-income economies we observed an upward pressure in the skill content of exports to the EU-27 of both types of economies, but the up-grading proceeded more rapidly amongst the low-/medium-income economies.
- Furthermore, there was a significant shift in the shares of EU-27 imports in favour of those supplied by low-/medium-income countries as compared to those supplied by high-income economies. Particularly the medium-income-high growth economies (MH) and China are gaining in market shares.
- The observed changes in skill content and in the shares of imports by low-/medium-income economies particularly in the areas of processed inputs and parts production supports an outsourcing story combined with catching-up. High-income countries are losing market shares particularly in processed inputs and in parts and less in final goods.
- Geography does matter in outsourcing which is shown by the fact that China and other high-growth/low-income economies (mostly outside Europe) make less inroads in processed inputs than in finished goods while MH countries (a lot of them in Europe) increase their shares in intermediate inputs (processed and parts) quite strongly.
- The analysis of intra-EU outsourcing patterns has shown that the NMS do indeed play an important role in the shifts in import structures of EU northern economies. They not only account for a higher share of imports of EU-North, but their export structure to EU-North has shifted significantly towards the supplies of parts (which have a high skill content). EU southern countries are more strongly represented in processed inputs (which have lower skill content). Imports from the Rest of the World into the EU-North are shifting towards final goods imports confirming our hypothesis that geographic proximity is important for outsourcing activities.

The analysis of "outsourcing" activity from trade statistics which has been undertaken in this paper has thus confirmed the increasing importance of South-North integration. It has supported the view taken in this paper that current patterns of trade integration and trade specialisation are strongly affected by the significant role played by SUCCESS (successfully catching-up) economies. An understanding of their role in international economic relations requires the recognition of differentiated patterns of catching-up which are not well captured by traditional

theories of international trade but for which we have attempted to provide some analytical building blocks in section 2 of the paper.

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Endogenous Export Modes

Trade Intermediation versus Wholesale FDI in General Equilibrium

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Empirical evidence and the business literature suggest that exporting requires either a foreign partner or an own foreign sales representation. Standard trade models abstract from this fact. We propose a business-to-business matching model in which heterogeneous producers may seek a foreign general importer. Alternatively, producers may establish a foreign affiliate. Exporters select into either of those modes depending on their productivity, brand reputation, and the tradability of their goods. Market access costs and the size of the non-tradables sector are endogenously determined. The additional trading friction sheds light on the "missing trade puzzle" discussed in the empirical literature.

Keywords: Heterogeneous firms, international trade, export modes, search externalities, business-to-business matching, double marginalization, missing-trade-puzzle

JEL-Codes: F12, F15

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1. Introduction

Firms that are about to enter a foreign export market may do so in various ways. They can either search for a local foreign partner who acts as a trade intermediary or a "general importer" (GI). Or they can establish an own sales representation. The academic business literature pays a lot of attention to this strategic choice; however, formal economic analysis within general equilibrium models is scarce.

A series of articles in the *Journal of International Business Studies* has highlighted the overall importance of trade intermediation, and its relative prevalence across sectors (see, e.g., Peng and Ilinitch, 1998, Peng and York, 2001, and Trabold, 2002). There is also evidence on the huge importance of trade intermediation in history (Greif, 1993) and for small specialized economies such as Hong-Kong or Singapore (Feenstra and Hanson, 2004; Feenstra, Hanson, and Lin, 2004). On the other hand, Kleinert and Toubal (2005, 2006) document the empirical importance of wholesale affiliates as a specific form of foreign direct investment. Fryges (2007) reports that sizeable shares of firms select into different export modes. Recently, starting with Rauch (1999), there is a growing literature on the role of formal and informal networks for the determination of bilateral trade volumes. Empirical evidence presented by Rauch and Trindade (2002) and Combes et al. (2005) lends support to the idea that the international matching of buyers and sellers involves important frictions.[2]

Despite the strong empirical evidence, trade intermediation and wholesale affiliates do not play any role in canonical trade models. The older literature ignores trade costs altogether; the new trade models pioneered by Krugman (1979) have taken variable trade costs serious. Only very recently, Melitz (2003) models fixed costs of foreign market access ("beachhead costs"; see Baldwin, 1988), which can be interpreted as foreign direct investment in wholesale affiliates. However, his model does not allow for trade intermediation as an alternative mode of exporting.[3]

In this paper we model the choice between the indirect (intermediated) and the direct (through own sales affiliate) export modes. In the first mode, producers save

[2] Egan and Mody (1993), Hakansson (1982), and Turnbull and Cunningham (1981) provide descriptive studies on bilateral buyer-seller links in international trade. They report suggestive evidence on highly collaborative, long-lasting trade relationships between producers and intermediators in the manufacturing sector. Schröder et al. (2005) offer a partial equilibrium model of trade intermediation.

[3] There are a number of papers in the industrial organization tradition that study the choice of export modes in partial equilibrium (e.g., Raff and Kim, 2005). However, these models do not allow drawing conclusions on aggregate variables. Nor do they easily lend to empirical verification. Krautheim (2007) discusses wholesale FDI in a version of the Chaney (2007) model. He does not, however, address trade intermediation.

on fixed market access costs but loose discretion over pricing in the foreign market to their partner. Moreover, searching for a partner is costly and takes time. In the second mode, producers have to set up a foreign affiliate. The advantage of that mode is that they retain control over the consumer price of their product. We model the search-and-matching process between business firms (*business-to-business (B2B) matching*) using a matching function approach familiar from the labor market literature (Pissaride, 2000). This approach has been introduced into international economics by Grossman and Helpman (2002), who focus on vertical supply chains. In that setup, search costs are a function of the tightness of the market, which, in turn, depends on the endogenous decisions of both, producers and general importers, to search for a partner.

We embed the export mode choice in a general equilibrium trade model with heterogeneous firms à la Melitz (2003). We offer a slight generalization of Melitz, by allowing firms to differ in terms of the tradability of their goods, their strength of brand name, and their productivity. This framework allows to reproduce important stylized facts on the importance of trade intermediation relative to own affiliates for heterogeneous firms.

Our approach is formally related to Helpman et al. (2004), who study horizontal FDI in a model of the proximity concentration tradeoff. That paper differs from ours as we do not analyze foreign production of multinational enterprises. Rather, the focus is on the matching process between producers and those foreign firms that sepcialize on importing goods; in the following, we refer to those firms as to general importers.[4]

Matching between producers and specialized importers is not immediate. This fact has a crucial implication: when parties finally match, they are locked into a *bilateral monopoly* situation which makes them vulnerable to *hold-up* from the other partner. We assume that the only commitment that producers can make is to engage in *exclusive dealership arrangements*. Otherwise, as in Grossman and Helpman (2002), no enforceable contracts exist. Hence, the price at which the producer sells to the general importers is determined through bilateral Nash bargaining. While the general importer has full discretion to set the price in the foreign market, the producer decides about the supplied quantity. The outcome of that game is that trade intermediation drives up the consumer price in the foreign market. The additional markup is given by the inverse of the producer's bargaining power and measures how strongly the producer's quantity decision reaches through

[4] Our framework is also related to recent work by Rauch and Watson (2003) and Casella and Rauch (2002), who stress the importance of Business-to-Business (B2B) relationships. Compared to those papers, our model is dynamic, features heterogeneous firms, allows for firms to differ with respect to their preferred foreign export mode, and determines the number of general importers and exporters endogenously. Most importantly, our model endogenizes foreign market access costs, since the cost of searching for a foreign general importer is endogenous.

to the foreign consumer price. Hence, variable profits are lower when exporting involves a general importer.

The rate at which producers and firms match depends on market tightness, i.e., the number of searching general importers relative to the number of searching producers. Tightness is driven by producers' and general importers' endogenous decisions to engage into costly search. As in all matching approaches, the matching friction involves a departure from first best, since there is an uninternalized search externality: entry of general importers (producers) drives up the expected cost of general importers (producers) to find a partner.

The mechanism studied in this paper is a promising candidate to square empirical facts with theoretical models, see the work of Alessandria (2004) and Drozd and Nosal (2007) in international real business cycle models, as well as Reed and Trask (2006) in a homogeneous firms trade model. It also provides a point of departure for a series of companion papers (see Felbermayr and Jung, 2008a, b).

The main result of the present paper is that, in equilibrium, producers are endogenously selected into the two export modes according to attributes of their products or of their technology. Firms with high levels of *productivity*, easily *tradable variants*, or strong *brand reputation*, establish own subsidiaries. Firms with intermediate values of the above characteristics choose to search for general importers. Along the steady state, only a fraction of those firms actually is matched and produces for the export market. Intermediation helps producers with good product characteristics to save on fixed foreign market access costs; however, this translates into lower overall export sales, thereby – at least partly – rationalizing the missing trade puzzle.

Moreover, related to the last observation, we find that institutional change may lead to a lower aggregate productivity, since exporters that switch from the direct to the indirect mode achieve smaller export sales, thereby contributing less to per capita GDP, and since relatively unproductive firms start exporting, drawing weight in the calculation of average GDP.

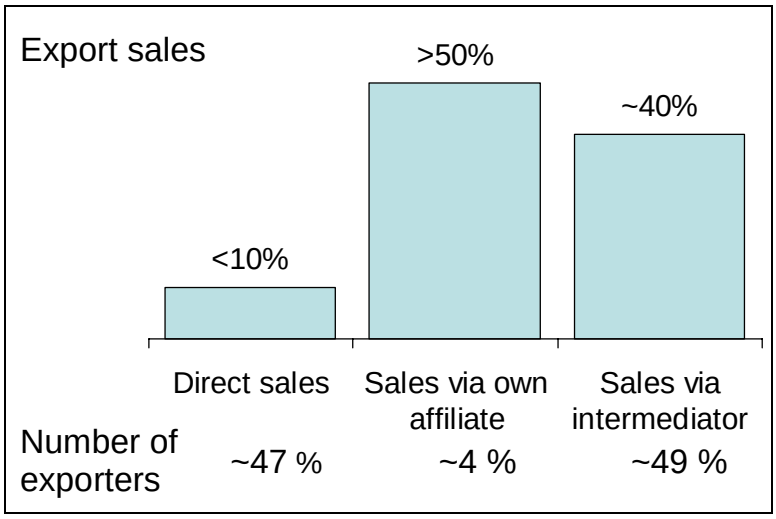
The remainder of the paper falls into four chapters. Chapter 2 gives a short overview over stylized facts, while Chapter 3 introduces the analytical framework and derives a first result on the pricing behavior under trade intermediation. Chapter 4 shows the conditions under which a strictly positive share of the total mass of producers export through trade intermediation. Holding aggregate variables constant, it uses a graphical device to discuss the equilibrium sorting of firms obtained in our model. Chapter 5 sketches the free entry conditions of producers and general importers, and discusses theoretical extensions. Finally, chapter 6 concludes.

2. Stylized Facts

In this section we discuss a few striking stylized facts. Statistical information on the importance of different export modes is difficult to obtain. However, combining information from the MIDI Database entertained at the German Bundesbank, export sales data from the German Statistical Office, and data from a survey undertaken by the ZEW, a German research institute, we are able to sketch the broad picture. The key fact is that direct contact of a producer in one country with the end user in another country is quantitatively not important. Similar patterns exist in the U.S. (Bernard et al., 2006), or in France (Trabold, 2002).

Chart 1 shows the distribution of German manufactured goods export sales over different export modes. Sales via own affiliates in foreign countries amount to over 50% of total exports, with sales via foreign intermediators accounting for another 40%. The residual is direct exports that does not involve foreign direct investment nor a foreign general importer. There are a number of empirical problems, since total export sales by goods provided by the statistical office cannot exactly be mapped into the classification of sectors provided by the Bundesbank. In chart 1, we choose to present the conservative case, where producer-to-consumer exports are most likely overestimated.

Chart 1: Relative Prevalence of Export Modes, Germany, 2003



Source: MIDI Datenbank der Deutschen Bundesbank; Statistisches Bundesamt; Fryges (2007).

Chart 1 also reports the share of actively exporting firms in each mode. This information draws on survey results presented in Fryges (2007). Most producers

export either through an intermediator (49%) or directly to the final client in the foreign country (47%). Only 3% engage in FDI. At first glance, these results seem to contradict our findings on shares in total export volumes. However, taking the data at face value, they imply that the largest share of exports is undertaken by a small number of firms. There is large empirical evidence that this is actually the case (Bernard et al., 2006).

Fryges (2007) documents another important fact, namely that the number of firms that maintains own sales affiliates in foreign countries has increased between 1997 and 2003. This finding comes from a survey of German firms, but it has been replicated in an independent study for the United Kingdom. While in general the number of firms per se is not indicative of the total export volume channeled through some export mode, the fact that own affiliates are the prevailing choice for large firms suggests that also the share of exports channeled through affiliates has increased over time.

The implications of chart 1 can be summarized as follows: (i) Direct sales from the producer to a foreign end client amount to less than 10% of German exports, and are therefore quantitatively negligable. Exporters require either an own foreign sales affiliation or a foreign partner. Moreover, the share of exports through own affiliates has increased over time. (ii) It follows that fixed costs of foreign market access must have important aggregate implications, since the largest share of exports involves some type of fixed costs. (iii) A few firms make up a large share of total export sales. This points to a strong degree of heterogeneity amongst exporters.[5]

In 2005, the stock of outward FDI of the entire German manufacturing sector amounted to a total of 223 billion Euro. About half that sum (104 billion) was invested in some foreign affiliate active in the manufacturing sector. Some 32% (71 billion) was parked in holding companies, or financial affiliate. The remaining 17% (38 billion Euro) were held in affiliate trading companies. Taking out holding companies and the finance sector, German manufacturing firms held about a quarter (27%) of their total FDI in companies classified in the trading sector. While that number includes also investment into foreign purchasing units, it is largely dominated by sales representations, as vertical FDI makes up only a small share of total German outward FDI.

Looking at the sectoral distribution of the quantitative importance of FDI into sales affiliates, one finds that the share of FDI invested in sales affiliates relative to total non-finance investment is highest in the mechanical engineering sector (about 36% on average over the period 2002 to 2005) and the automotive sector (34% on average), while it is rather low in the chemical (18%) or the electric power

[5] The evidence shown in chart 1 is tentative; further research is needed, but requires richer firm-level data than what is available now. However, the pattern is consistent with a number of related facts, e.g., the correlation between firm size and FDI.

equipment industries (11%). Over 2001–2005 the cross-sectoral pattern was fairly stable.

Regarding the geographical dimension of German outward FDI, the Bundesbank publication allows to distinguish between the stock of FDI invested in the U.S.A., EU-25, and the rest of the world. Taking averages over the reported 2002–2005 time period, the share of investment in trade affiliates in total FDI of the manufacturing sector (again, excluding finance), amounts to about 27% for the EU-25, 26% for the U.S.A., and again 27% for the rest of the world.

We may summarize: a substantial share of total outward foreign direct investment (FDI) goes into the establishment or acquisition of foreign sales affiliates. There is little variation across the U.S.A., Europe, and the rest of the world, but significant sectoral variation.

Facts 1 and 2 establish the importance and relative prevalence of own sales affiliates. Empirical information on the role of general importers is more difficult to find. Trabold (2002) is amongst the rare studies that offer quantitative information. His empirical analysis draws on French customs data. His findings can be summarized as follows: import intermediation by general importers is most prevalent (i) the farther away in terms of geography and culture an export market market is, and (ii) the lower the marketing-intensity of a product is. Moreover, (iii) the share of total exports that involve import intermediation has been falling during the 1980s.

Our model can reproduce the stylized facts highlighted above. It is, however, also consistent with the broader evidence on the importance of networks, and search externalities discussed in the introduction.

3.Model Setup

We study a model with two symmetric countries. Following Helpman et al. (2004), in each country there are two active sectors: a perfectly competitive numéraire sector, with unit labor input coefficients and costless tradability; and a differentiated goods sector, with heterogeneous firms operating under conditions of monopolistic competition.

3.1 Demand Structure

Each country i is populated by a representative household, which inelastically supplies L units of labor to a perfectly competitive labor market. The household derives utility from consuming z units of the numéraire good, and a basket of differentiated goods. We assume that preferences are separable over those two items, with an upper Cobb-Douglas nest, and the basket of differentiated goods a Dixit-Stiglitz aggregate:

$$U = (1-\mu)\ln z + \frac{\mu}{\rho}\ln\int_{\omega\in\Omega_i}\left[\zeta(\omega)x(\omega)\right]^{\rho}\mathrm{d}\omega. \tag{1}$$

The household spends the share $0<\mu<1$ on differentiated goods and the remainder on the numéraire. The set of available varieties in country i is given by Ω_i, with ω denoting a generic variety.[6] The parameter $0<\rho<1$ describes the degree of substitutability of any each pair of varieties. However, unlike in the standard Dixit-Stiglitz representation, consumers may attach different weights $\zeta(\omega)\geq 0$ to different varieties, reflecting the fact that varieties may contribute asymmetrically to overall utility. We refer to $\zeta(\omega)$ as to the strength of variety $\omega's$ brand name or the reputation of the producer. It may also be held to denote quality. In any case, a higher value of $\zeta(\omega)$ means that the respective variety yields a higher contribution to utility.[7]

The only source of income for the household is from wages, which we can normalize to unity in all countries thanks to our assumptions on the numéraire sector. Hence, the budget constraint reads

$$L \geq z + \int_{\omega\in\Omega_i} p(\omega)x(\omega)\mathrm{d}\omega. \tag{2}$$

Maximizing (1) subject to (2), we find the following demand function for a variety ω from country j

$$x(\omega) = H\frac{\zeta(\omega)^{\sigma-1}}{p(\omega)^{\sigma}}, \tag{3}$$

where $H \equiv \mu L/\left(\int_0^n\left[\zeta(\omega)p(\omega)\right]^{1-\sigma}d\omega\right)$ is proportional to country $i's$ market size L, n is the measure of the sets Ω_i and Ω_j, and $\sigma \equiv 1/(1-\rho)>1$ is the elasticity of substitution between varieties.[8]

[6] Note that the set of available varieties differs across countries, since fixed costs of exporting prevent some varieties from being traded.

[7] Combes et al. (2005) offer a similar formulation of preferences. However, their ζ is constant across varieties imported from a given country.

[8] Note that by symmetry both sets Ω_i and Ω_j have the same measure n.

3.2 Heterogeneous Production Firms and Export Modes

Firms in the differentiated goods sector differ with respect to a vector of characteristics $\{\zeta(\omega), \tau(\omega), a(\omega)\}$, where $a(\omega) > 0$ denotes the marginal cost of producing variety ω, and $\tau(\omega) \geq 1$ refers to variety-specific variable distribution costs of the iceberg type, which occur regardless of whether a good is traded internationally or not. Whenever one unit of a variety is to be delivered to a foreign partner, $\tau(\omega)$ units of that good have to leave the gates of the producer's factory. We see $\tau(\omega)$ as a short-hand way to introduce marketing and distribution costs that arise when a good is sold. There is no reason to assume that those costs are zero for transactions when the producer and the consumer happen to reside in the same country. However, in international transactions, total variable trade costs are $\tilde{\tau}(\omega) = \bar{\tau}\tau(\omega)$, where $\bar{\tau} \geq 1$ accounts for transportation costs and may be thought of as a function of distance. We refer to $\bar{\tau}$ to the systematic component of trade costs, and of $\tau(\omega)$ as the idiosyncratic component. Note that the systematic component magnifies the idiosyncratic part; hence, more marketing-intensive goods are also more expensive to deliver to foreign markets. The importance of that source of heterogeneity has been recently emphasized by Bergin and Glick (2007).[9]

Producers are also heterogeneous with respect to their marginal costs of production, $a(\omega)$. With the wage rate normalized to unity, $a(\omega)$ is equal to the labor requirement for one unit of output. Heterogeneity along this line has been shown to be empirically relevant, and is core in much recent work following Melitz (2003). For producing $y(\omega)$ units, the firm ω faces incurs total production costs $c(\omega) = a(\omega)y(\omega) + f^D$, where f^D denotes the fixed costs of production..

In much of our analysis, we can summarize the vector of characteristics $\{\zeta(\omega), \tau(\omega), a(\omega)\}$ in a single scalar $A(\omega) \equiv a(\omega)\tau(\omega)/\zeta(\omega)$, since $A(\omega)$ is a sufficient statistic to describe firm behavior (see details below). Higher values of $A(\omega)$ are equivalent to higher marginal costs of production, lower tradability, and a lower degree of brand reputation. Following Melitz (2003), the entry of producers requires payment of a cost f^E. Only after paying the entry fee

[9] However, in contrast to our formulation, his model has zero trade costs for deliveries within a same country.

do firms learn about their characteristics $A(\omega)$. We assume that $A(\omega)$ follows some c.d.f. $G(A)$.[10] We can then rank firms with respect to their realization of A. The advantage of our broader definition of firm heterogeneity relative to the focus in the literature on productivity is that empirical evidence suggests that productivity (or, closely related to it, firm size) are poor predictors of exporting behavior once one controls for unobserved firm characteristics (such as $\zeta(\omega)$ or $\tau(\omega)$), see Fryges (2006).

A key object of the present paper is to understand the sorting of firms into different export modes along their A-dimension. The first mode – direct exports – requires the setup of a sales representation in the foreign country, which implies some additional fixed investment f^F. This is the situation studied by Melitz (2003). The investment f^F has been referred to by Baldwin (1988) as *beachhead costs*, and usually turns up in FDI statistics under the guise of wholly owned sales affiliates.[11]

The second export mode – indirect exports – requires a match with a specialized trade intermediator, which we call general importer (GI). GIs know the foreign market better than the foreign producer. Hence, fixed costs of market entry are lower for the GI. However, the producer has to invest into costly search for a GI and – once matched – looses control on the consumer price of its output. Along the A dimension, we focus on the empirically relevant case where producer with the lowest realizations of A (low marginal costs, high reputation, high tradability) choose the direct export mode, producers with lower-intermediate realizations go for the indirect export mode, producers with upper-intermediate realizations do not find it optimal to export in either mode, and producers with the highest values of A quit the market upon drawing their vector of characteristics. Before turning to a detailed description of the of the indirect export mode, we briefly discuss the monopolists' pricing problem for domestic and indirect export sales.

Operating profits from *domestic sales* are $\tau(\omega)\cdot H\left[\tau(\omega)\,p(\omega)\right]^{-\sigma}\zeta(\omega)^{\sigma-1}\cdot\left[p(\omega)-a(\omega)\right]-f^D$. The first part in that

[10] Note that we do not need to impose any restrictions on the correlation between the different components of $A(\omega)$.

[11] The empirical literature on foreign direct investment (FDI) stresses the importance of wholesale affiliates (Kleinert and Toubal, 2006). Somewhat surprisingly, this fact has not provoked theoretical research; in theoretical models, FDI relates to foreign production activities carried out by some multinational firm (see Helpman, 2006). Our paper offers a theory of FDI into wholesale affiliates.

expression, $\tau(\omega)$, reflects the fact that domestic sales of x require $\tau(\omega)x$ units of the respective variety to be produced. The second part, $H\left[\tau(\omega)p(\omega)\right]^{-\sigma}\zeta(\omega)^{\sigma-1}$, gives the level of demand that the household has for a variety ω with c.i.f. price $\tau(\omega)p(\omega)$. The third part, $\left[p(\omega)-a(\omega)\right]$, refers to the per unit margin of the price over marginal cost. To maximize profits, the firm sets the f.o.b. price $p(\omega)=a(\omega)/\rho$, where $1/\rho>1$ is the markup over marginal costs. With our choice of preferences, the f.o.b. price does not depend on $\zeta(\omega)$. Inserting the optimal price in the monopolist's objective function, domestic profits can be written as

$$\pi^D(A)=BA^{1-\sigma}-f^D, \tag{4}$$

where it becomes apparent that profits depend only on $A(\omega)$ and not independently on the different components of $A(\omega)$. In the following we drop the dependence of A on ω since it is sufficient to know A in order to identify a specific producer. We follow Helpman et al. (2004) and write profits in terms of $B\equiv(1-\rho)H\rho^{\sigma-1}$, which is an aggregate magnitude, that involves the endogenous price index and exogenous parameters. Clearly, profits from domestic sales decline in A since $1-\sigma$ is a negative number. They rise in B, which captures the size of the market, and fall in fixed costs of production, f^D.

The monopolist generates non-negative profits from *direct exporting*, if export revenues suffice to cover additional variable production costs and foreign investment f^F. The objective function now is $\tilde{\tau}(\omega)\cdot H\left[\tilde{\tau}(\omega)p(\omega)\right]^{-\sigma}\zeta(\omega)^{\sigma-1}\cdot\left[p(\omega)-a(\omega)\right]-f^F$. Maximum profits from direct exporting are

$$\pi^F(A)=B(\bar{\tau}A)^{1-\sigma}-f^F, \tag{5}$$

where the systematic part of trade costs (independent from A), $\bar{\tau}$, appears as an additional determinant of variable profits, along with the foreign measure of market size B and the costs of investing abroad, f^F. Clearly, foreign profits are lower the higher the systematic component of trade costs.

3.3 Trade Intermediation and General Importers

Our slight generalization of the notion of firm heterogeneity apart, the setup discussed in section 3.2 above is the same as in Melitz (2003). In this section, we

model the endogenous emergence of a new type of firms that misses in most standard trade models: trade intermediators or, using our preferred term, general importers. Following Spulber (1998, p. 3), an intermediator is "*...an economic agent who purchases from suppliers for resale or who helps sellers and buyers to meet and transact*." We focus on the first function of a GI and on the matching problem between the GI and the producer of a certain variety. The second function refers to the activity of trade brokerage, where the intermediator confines to matching producers and consumers and does not incur any entrepreneurial risk. Trade brokers are empirically elusive institutions that are difficult to model.[12]

We can think of the GI as a firm that is located in a foreign market and has superior knowledge of local market conditions, legal institutions, idiosyncratic consumer preferences, etc. Hence, we assume that the GI has lower fixed costs of market access, f^M, than the direct exporter would have $\left(f^F\right)$. Without loss of generality, we may set $f^M = 0$, but refrain from doing so for the time being.[13]

A key complication when using a GI is that relationship-specific investment is needed. This comes in terms of search costs. Conceptually, search costs are essential to allow for a meaningful sorting of firms along the A dimension; if a producer would have free access to GI's comparative advantage (low market access costs), every active producer would use that opportunity. We model the emergence of GIs in equilibrium as an explicit trade-off between costs and benefits. In particular, we assume that both GIs and producers have to search for foreign varieties to import, and that this search is costly. Search costs arise due to the participation at international trade fairs, correspondence and direct contact to potential partners, etc. Search costs are endogenous, as they depend on the number of searching firms and GIs. When a search is successful, GIs and producers find themselves in a bilateral monopoly situation which endows the GI with market power that allows to recoup the search costs.

We assume that all firms are *single product firms*. While this is in line with most recent trade models, this assumption is not very realistic. In reality, many GI's have diversified product portfolios, possibly originating from different countries. In principle, the GI should take this fact into account when deciding about which price to charge to consumers, at least if the different goods are substitutes. If the GI in some country j controls a sufficiently large share of the

[12] The *raison d'être* of trade brokers is the existence of asymmetric information. This is an interesting issue in itself, which we take up in Felbermayr and Jung (2007).

[13] One could also think that the GI's specific knowledge of the foreign market translates into lower variable (distribution) costs. While this is a theoretical possibility, it is clear the largest portion of variable distribution costs consists in tariffs and transportation costs, which in principle are the same across export modes. However, one could allow for the idiosyncratic component of trade costs $\tau(\omega)$ to differ across export modes.

market, it would internalize the cannibalization effect induced by additional varieties and charge a higher markup (Feenstra and Hong, 2007). In turn, this constitutes an incentive for GIs to expand. Apart from the pricing issue, multiproduct GIs may also benefit from economies of scope. The endogenous emergence of multi-product GIs is certainly worth to look at. However, it also lends to a number of additional complications, so that in the present paper we rule this possibility out.

To endogenize search costs, we follow the standard practice in search and matching models of unemployment (Pissarides, 2000) and assume the existence of a matching function. This approach has been fruitfully applied by Grossman and Helpman (2002) in a model of vertical supply chains. Our model differs in that we study exporting rather than sourcing behavior and allow for heterogeneous firms. Let n^S be the number of producers searching for an opportunity to export, and n^G the corresponding number of GIs searching for an opportunity to import goods. As long as they are unmatched, producers and GIs incur per-unit-of-time search costs c^P and c^G, respectively. At each instant, $N(n^S, n^G) \leq \min\left\{n^P, n^G\right\}$ trade relationships are formed, where $N(.,.)$ is linear-homogeneous, as well as increasing and strictly concave in both arguments.

We model GIs as *ex ante* identical; moreover, since producers differ with respect to their characteristics A, GIs are *ex post* heterogeneous. Firms' heterogeneity does not have any bearing on search costs, so that the rate at which a searching producer is matched with a GI does not depend on A. With our assumptions on the matching technology, matching rates depend only on the degree of *market tightness* $\theta \equiv n^G/n^P$, i.e., the number of searching GIs relative to searching producers. Exploiting the properties of $N(.,.)$, we can write the rate at which a producers are matched to a GI as $\eta(\theta) \equiv n^M(1,\theta)$ and the rate at which GIs are matched to producers as $\eta(\theta)/\theta$. Clearly, the concavity of $N(.,.)$ implies that $\eta(\theta)$ strictly increases in θ while $\eta(\theta)/\theta$ falls. This illustrates the standard search externality associated to entry of producers and GIs on their respective peers.

The empirical work of Besedeš and Prusa (2006) suggests that in trade relations there is a substantial amount of turnover. We introduce this fact into our analysis by allowing for some exogenous separation rate $\delta^G > 0$. Moreover, to ensure convergence to an ergodic equilibrium distribution of productivities, we require an

exogenous death shocks for producers, δ^P. If δ^G and δ^P are independent, the total rate of match destruction is $\delta \equiv \delta^P + \delta^G$.[14]

3.4 The Game between Producers and General Importers

We consider a framework where no enforceable contracts can be written ex ante. Producers and GIs can credibly commit to a single promise: to stick to exclusive dealership arrangements. Without this commitment, intermediated trade can only be an equilibrium outcome under very special circumstances. Producers can be held up by GIs, since the production costs are sunk at the bargaining stage and the producer cannot make any alternative use of the quantity manufactured with the view of selling on the foreign market (i.e., the producer's outside option is zero). Expected search costs are $c^P/\eta(\theta)$ from the producer perspective and $c^G\theta/\eta(\theta)$ from the perspective of a generic GI. When a match happens to be formed, these costs are sunk. This implies that, when a match occurs, both parties find themselves in a situation of bilateral monopoly. Otherwise, we follow Grossman and Helpman (2002) or Antras and Helpman (2004), assuming that bargaining over the joint surplus of a match to be an asymmetric Nash problem, where $\beta \in [0,1]$ is the bargaining power of a producer.

The game implies the following staging: first, the producer decides about the quantity of output to provide to the GI. Second, both parties bargain about the joint surplus from selling the good at the foreign market at price $p^G(\omega)$. As usual, the game is solved by backward induction.

Denoting the ex post joint surplus by $J(\omega)$, we have $J(\omega) = p^G(\omega)x\left[p^G(\omega)\right] - f^M$. At the time of the bargain, variable production costs (which also account for transportation costs) have already been incurred, so that they do not turn up in the *ex post* surplus. The Nash bargaining results in a sharing of the joint surplus according to the two parties' relative bargaining powers, where the producer appropriates $\beta J(\omega)$, and the general importer $(1-\beta)J(\omega)$.

Predicting its share of the surplus at the bargaining stage, the producer choses her optimal quantity to supply to the GI. She solves

[14] Time is continuous. Hence, destruction rates and rates of match creation take values on the entire real line. The matching rates refer to the rate by which a match occurs in the next infinitesimally short time period. The death rates δ^P and δ^G relate to the survival rate into the next infinitesimally short time period.

$$\max_{x(\omega)} \beta J(\omega) - a(\omega)\tilde{\tau}(\omega)x\left[p^G(\omega)\right]$$

subject to the demand function (3), taking into account that in order to supply a quantity x to the GI, she has to produce $\tilde{\tau}(\omega)x$ units of her variety, where $\tilde{\tau}$ denotes the total iceberg transportation costs from shipping abroad. Plugging in the expression for $J(\omega)$, and using the inverse demand function derived from (3), the first order condition of the producer implies a pricing rule $p^G(\omega) = a(\omega)\tilde{\tau}(\omega)/(\beta\rho)$. Importantly, the standard markup over effective marginal costs $1/\rho$ is magnified by an additional factor $1/\beta$ which is endogenously pinned down by the parameter governing bargaining between the producer and the GI.

We may summarize: the price charged for imports by a general importer (GI) is given by

$$p^G(\omega) = \frac{1}{\beta\rho} a(\omega)\tilde{\tau}\ (\omega), \tag{6}$$

with $(\beta\rho)^{-1} > 1$ the total markup over effective marginal costs. The proof of this assertion is in the Appendix.

As in Grossman and Helpman (2002), the consumer price indicated in equation (6) reflects the presence of *double marginalization*: the price paid by the foreign consumer is driven up by the usual markup $1/\rho$ earned by the GI, and by the markup $1/\beta$ that results from Nash bargaining. Note that the additional distortion depends on β: the larger the producer's bargaining power, the closer (6) comes to the price obtained if the producer would sell directly to the foreign market, i.e., $a(\omega)\tilde{\tau}\ (\omega)/\rho$. Also note that the bargained transaction price is independent from the market tightness θ, which is a direct corollary from the fact that both parties' outside options are driven to zero on the one hand by free entry of GIs and on the other hand by the absence of any alternative use of the output quantity delivered by the producer to the foreign market.

The value of the joint surplus can be obtained by substituting (6) into the definition of $J(\omega)$:

$$J(A) = \sigma B\left(\overline{\tau}\beta^{-1}A\right)^{1-\sigma} - f^M. \tag{7}$$

The joint surplus is larger the bigger the size of the export market adjusted for transportation costs $\overline{\tau}^{1-\sigma}B$, and the smaller the match-specific fixed costs f^M. The surplus is larger the stronger the producer's bargaining power β: the closer

β is to unity, the smaller is the detrimental effect of double marginalization. Clearly, higher marginal costs, lower tradability and lower brand reputation also reduce the surplus, since they translate into a higher value of A.

Similarly, we can now express the additional profits from *selling abroad through a general importer* by inserting $p^G(\omega)$ into the producer's objective function:

$$\pi^{MP}(A) = \beta^{\sigma} B(\overline{\tau} A)^{1-\sigma} - \beta f^M. \quad (8)$$

Note that we use the superscript MP to make clear that only matched producers have access to those profits. When talking about producers' choice of export modes, we will have to link $\pi^{MP}(A)$ to the additional profits that a producer expects to make when engaging into the costly search for a partner.

Comparing (8) to $\pi^F(A)$, the profits of direct exporting to the foreign market, it is clear that the term $B(\overline{\tau} A)^{1-\sigma}$ appears in both expressions. But, since $\beta^{\sigma} < \beta < 1$ for given distance-adjusted market size $B\overline{\tau}^{1-\sigma}$ and firm characteristics A, intermediated exporting (8) involves lower variable profits than direct exporting (5). However, fixed costs of direct exporting have to be shouldered by the producer alone, while fixed costs (if any) are shared by both parties in the indirect mode.

4. Choice of Export Modes with Given Market Tightness

4.1 Zero Cutoff Profit Conditions

Firms select endogenously into different export modes. However, as in the standard Melitz (2003) model, the presence of fixed production costs implies that some firms with the highest realizations of A will choose not to start production at all, and some firms with high values of A prefer to sell only on the domestic market. Finally, firms willing to export face a choice between direct exporting, which is fixed cost intensive but yields high unit revenues, and indirect exporting via a GI, which saves fixed costs but involves lower unit revenues. Hence, we expect that firms with intermediate realizations of A prefer indirect exports and those with lowest A sell directly through own sales affiliates. Under conditions to be made explicit below, there is a unique sorting of firms along their A characteristics, with all possible regimes being active in equilibrium. Firms with realizations $A > A^D$ have so high marginal costs, low brand reputation and tradability, that their revenue generated from the domestic market cannot suffice to cover the fixed costs of

production. *A fortiori*, they cannot find it optimal to export, neither. Firms with characteristics $A^{SP} < A \leq A^{D}$ produce only for the domestic market. Either way of serving the foreign market involves too high entry costs and too little revenue. Firms with characteristics $A^{F} < A \leq A^{SP}$ find it optimal to start searching for a GI. At any point in time, a fraction of those firms will be matched and therefore generating export revenues in top of domestic income. Firms with $A \leq A^{F}$, that is the best firms (with lowest marginal costs, highest tradability and strongest brand names) establish own sales affiliates.[15] Note that the same firm can find it optimal to serve different markets using different modes.

The thresholds A^{D}, A^{SP}, and A^{F} are determined by a series of indifference conditions, which, given the sorting described above, can be described by *zero cutoff profit conditions*. The marginal firm A^{D} that finds entry into operations worthwhile is defined by setting domestic profits (4) zero:

$$\left(A^{D}\right)^{1-\sigma} = \frac{f^{D}}{B}. \tag{9}$$

That threshold A^{D} is lower the higher f^{D} and the lower B, reflecting the fact that higher fixed costs and smaller market sizes make it harder for firms with bad (i.e., high) realizations to survive.

The value of A below which firms find it worthwhile to search for producers (and ultimately be matched to a GI) is slightly more involved to pin down, because of the inherently dynamic nature of the search and matching process: searching for a GI involves an uncertain investment, as the duration of costly search is uncertain. Hence, the producer has to trade off immediate search costs against future profits from foreign sales. Denote the value of a producer that searches for a GI by V^{SP} and the value of a matched producer by V^{MP}. Then, we can establish the following system of value equations:

$$\delta^{P} V^{SP}\left(A\right) = -c^{P} + \eta(\theta)\left[V^{MP}\left(A\right) - V^{SP}\left(A\right)\right], \tag{10}$$

$$\delta^{P} V^{MP}\left(A\right) = \pi^{MP}\left(A\right) + \delta^{G}\left[V^{SP}\left(A\right) - V^{MP}\left(A\right)\right]. \tag{11}$$

Since δ^{P} is the only source of discounting from the producer's perspective, $\delta^{P} V^{SP}$ is the flow return to searching. That return has to be equal to the flow costs of searching $-c^{P}$ and the expected capital gain when the search has been successful. That gain $\left[V^{MP}\left(A\right) - V^{SP}\left(A\right)\right]$ occurs with Poisson rate $\eta\left(\theta\right)$ so that

[15] To break ties, we assume that firms that are indifferent between two regimes, chose the next highest (in terms of the ranking of regimes discussed above).

equation (10) follows. In turn, the flow value of a matched producer $\delta^P V^{MP}$ is given by the flow profits of selling through a GI, $\pi^{MP}(A)$, and the expected capital loss of being separated from the GI, $\delta^G\left[V^{SP}(A)-V^{MP}(A)\right]$.

We can solve for V^{SP} from the system (10) and (11), which yields an expression for the flow value of a searching producer:

$$\delta^P V^{SP}(A)=s(\theta)\pi^{MP}(A)-\left[1-s(\theta)\right]c^P, \tag{12}$$

where the term $s(\theta)\equiv\eta(\theta)/\left[\delta+\eta(\theta)\right]$ denotes the average fraction of time that a producer expects to be matched and earning profits π^{MP} and $1-s(\theta)$ is the fraction of time that she is searching and hence incurring search costs c^P. We determine the producer, who is just indifferent between engaging into searching for a GI and concentrating on exclusively domestic sales, by the condition $V^{SP}\left(A^{SP}\right)=0$. Using the expression for profits $\pi^{MP}(A)$, (8) in (12), we obtain the zero cutoff profits condition for entry into search as

$$\left(A^{SP}\right)^{1-\sigma}=\frac{\overline{\tau}^{\sigma-1}}{\beta^\sigma B}\left[\frac{c^P}{\eta(\theta)}+\beta f^M\right]. \tag{13}$$

The effective fixed costs of foreign market access consist of two terms: expected total search costs $c^P/\eta(\theta)$ and the producer's share of match-specific fixed costs βf^M. The threshold A^{SP} is lower the higher the sum of those fixed costs is; i.e., the marginal searching producers needs to exhibit lower marginal costs, higher tradability and a stronger brand name. If the distance-adjusted market size $\overline{\tau}^{1-\sigma}B$ goes up, the threshold goes up. Similarly, when the size of the double marginalization distortion, captured by β, falls (i.e., β goes up), the threshold rises, and the marginal searching producer can features a worse realization of A.

Finally, we determine the remaining cutoff level, A^F, by solving $V^{SP}\left(A^F\right)=V^F\left(A^F\right)$. The marginal direct exporter is exactly indifferent between searching for a GI or establishing her own subsidiary. Equating (12) and (5), and using (8) one gets

$$\left(A^F\right)^{1-\sigma}=\frac{\overline{\tau}^{\sigma-1}}{B}\frac{f^F-\left[1-s(\theta)\right]c^P}{1-\beta^\sigma s(\theta)}. \tag{14}$$

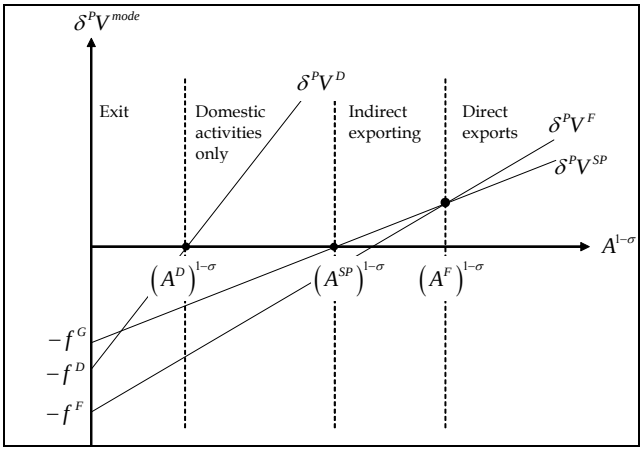
Again, higher distance-adjusted market size $\overline{\tau}^{1-\sigma}B$ allows for firms with worse (i.e., higher) realizations of A to select into direct exporting. The higher the term

$f^F - \left[1 - s(\theta)\right] c^P$, the higher are the opportunity costs of direct exporting relative to the next best alternative, and the lower the maximum realization of A can be. Also, the lower β, the larger is the double marginalization problem that arises in the indirect export mode, and the lower the threshold A^F becomes.[16]

4.2 Equilibrium Sorting of Firms over Export Modes

Before turning to a full general equilibrium analysis with θ and B endogenous, it is worthwhile to illustrate the sorting of firms over different regimes as a function of their characteristics $A^{1-\sigma}$ in chart 2, which is a modified version of figure 1 in Helpman et al. (2004). Expressing flow profits as annuities using the producers' discount rate, we associate an `expected profit line' $\delta^P V^{\text{mode}}$ to each mode, where $mode$ either takes the value D (domestic sales only), SP (search for a GI) and F (direct exports through an own affiliate). Note that for modes D and F we have $\delta^P V^{\text{mode}} = \pi^{\text{mode}}$; this is however not true for the SP mode. The chart plots (4), (5), and (12), taking aggregate variables B and θ taken as constant.

Chart 2: Equilibrium Sorting for Given Tightness



Source: Authors' calculations.

[16] For (14) to be well defined, i.e., $\left(A^F\right)^{1-\sigma} > 0$, we need that $f^F - \left[1 - s(\theta)\right] c^{SP} > 0$. This implies $\delta c^{SP} / \left[\delta + \eta(\theta)\right] < f^F$, an inequality that will be verified in condition (14) below.

The lines differ with respect to their respective intercepts (representing fixed costs) and slopes (representing net revenues for unit productivity). In the chart, the flow profits (4) associated to purely domestic operations have an intercept of $-f^D$ and slope B. Expected additional (on top of the profits from the home market) flow profits of searching for a GI involve expected fixed costs consisting of the producer's share in match-specific fixed costs and expected search costs, $f^G \equiv s(\theta)\beta f^M + \left[1-s(\theta)\right]c^P$, and a slope $B\overline{\tau}^{1-\sigma}\beta^\sigma s(\theta)$. Finally, additional profits (5) from direct export sales involve fixed costs f^F and a slope $B\,\overline{\tau}^{1-\sigma}$. Clearly, the slope of the $\delta^P V^{SP}$ line is smaller than the one of the $\delta^P V^F$ line due to the existence of double marginalization, $\beta^\sigma < 1$ and due to the fact that positive sales revenue accrues only if the producer is actually matched to a GI, which is not always the case. The $\delta^P V^D$ line is steepest: compared to the other regimes, marginal net revenues are higher as there are no transportation costs.

For given θ, a non-zero mass of firms is active in each of the three regimes (D, SP, F) if the hypothesized ranking $\left(A^D\right)^{1-\sigma} < \left(A^{SP}\right)^{1-\sigma} < \left(A^F\right)^{1-\sigma}$ holds. This requires that the effective fixed costs of searching for a GI lie in a bracket between the fixed production costs f^D and the costs of establishing an own foreign sales affiliate f^F.

For given market tightness θ, a partial sorting equilibrium exists if the following condition holds

$$\overline{\tau}^{1-\sigma} f^D < \beta^{-\sigma}\left[\beta f^M + \frac{\delta c^P}{\eta(\theta)}\right] < f^F. \qquad (15)$$

That is, strictly positive non-overlapping masses of producers find it optimal to sell domestically only and to sell both domestically and in the foreign market. Among exporters, there are strictly positive, non-overlapping masses of producers that search for a general importer and that own foreign sales subsidiaries.

This condition follows directly from using the definitions of $\delta^P V^D, \delta^P V^F$, and $\delta^P V^{SP}$ in chart 2. Note that for a segmentation of firms into non-exporters and owners of own sales affiliates, it is enough that $\overline{\tau}^{1-\sigma} f^D < f^F$, which is exactly the respective condition in Melitz (2003). Also as in Melitz, we do not require the existence of variable trade costs $\overline{\tau} > 1$; neither the sorting of firms into exporters and non-exporters, and the sorting of exporters into direct and indirect exporters

hinges on $\overline{\tau}$. The only reason to allow for $\overline{\tau} > 1$ is for the purpose of conducting comparative statics.

Condition (14) has a fairly intuitive interpretation. The term in square brackets amounts to the expected effective costs of accessing the foreign market through a GI, since βf^M are match-specific fixed costs to be borne by the producer, and $\delta c^P / \eta(\theta)$ are the expected, annuitized search costs. The term $\beta^{-\sigma}$ that premultiplies effective expected search costs is related to the elasticity of expected profits of a searching producer with respect to $A^{1-\sigma}$. Hence, the condition requires that adjusted expected costs of market access in the intermediate mode should neither be too larger nor too small. Clearly, we can restate the above condition in terms of market tightness θ. If θ is high, producers find GIs quickly, expected search costs fall, and so do total effective GI-mediated access costs. However, as long as $f^M > 0,$ indirect exporting remains viable, at least for some combinations of parameters, even if θ approaches infinity. However, if θ falls to zero, search costs become infinite and so do GI-mediated access costs: indirect exporting is no longer feasible. Hence, from the producers' perspective, condition (14) implies a lower bound for θ. However, for high θ, fewer GIs find it optimal to enter, which puts an upper bound on the equilibrium θ.

Note the difference of the proposed theory to the *proximity-concentration* model in Helpman et al. (2004). There, the sorting of firms into foreign direct investment and exports depends crucially on systematic transportation costs. In their model, as transportation costs fall, exporting becomes more attractive relative to local production. This is an empirically counter-factual implication (Neary, 2007), that our model does not have. Rather, a change in systematic transportation (distance) costs does not directly affect the sorting of firms into different export modes, but would have indirect implications through the market tightness (see below). However, since we allow firms to differ with respect to the genuine tradability of their varieties, we can make statements on how the idiosyncratic (variety specific) transportation costs affect the sorting of firms. We can now state the following:

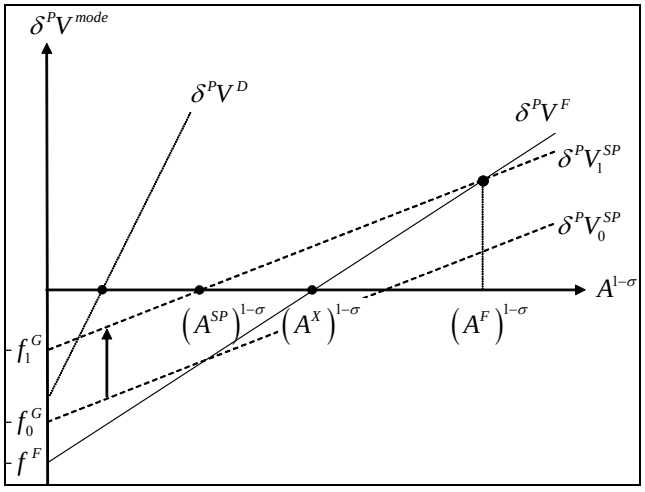
Under the condition stated in equation (14), producers endogenously select into export modes according to their product characteristics. Firms with high levels of productivity, easily tradable variants, or a strong brand reputation, establish own subsidiaries, while those with intermediate values of the above characteristics search for general importers. Firms with low values of the above characteristics do not export.

Chart 3 looks at the comparative statics of an increase in θ. From (12), both the slope and the intercept of the $\delta^P V^{SP}(A)$ line change. The reason is that a higher θ implies a higher matching rate for producers. Hence, the fraction of time that

any producer is actually matched goes up. This leads to a stronger marginal effect of a change in $A^{1-\sigma}$: as firms have better characteristics, their export profits rise faster if they are more frequently matched. Hence, the slope of the (12) line is steeper if θ goes up. The effect on the intercept, however, is ambiguous. On the one hand, a higher θ rises the fraction of time in which a firm with characteristics $A^F < A \leq A^{SP}$ is matched and hence paying its share of match-specific costs βf^M. On the other hand, a higher θ also means that the firm finds itself less frequently paying search costs c^P. Whether the first effect dominates the latter depends on the sign of $\beta f^M - c^P$. Since $f^M = 0$ is perfectly compatible with a meaningful equilibrium but $c^P = 0$ is not, we set $f^M = 0$ in the following analysis.

We can now do comparative statics with respect to θ: if $f^M = 0$, an increase in market tightness θ makes indirect exporting more attractive relative to both, the purely domestic mode, and direct exports through own affiliates. That is, the lower cutoff in the indirect exports mode, $\left(A^{SP}\right)^{1-\sigma}$, falls while the upper cutoff, $\left(A^F\right)^{1-\sigma}$, rises. The proof of this statement is in the Appendix.

Chart 3: Increasing Market Tightness and Equilibrium Sorting



Source: Authors' calculations.

4.3 Intermediation, Missing Trade, and the "Mittelstand"

We can use chart 3 to discuss a number of interesting implications that result from the option of producers to export via GIs. To that end, we compare the standard Melitz (2003) model, in which intermediation is not a feasible option, to a model where that latter option exists. Condition (14) suggests that there are several ways to render indirect exporting an option which is always dominated either by non-exporting or by exporting through own affiliates: either β is too small, or c^P and/or f^M are too high, or θ is too low. In all those cases, the intercept of the $\delta^P V^{SP}(A)$ line in chart 3 is so large (in absolute values), that the cutoff level $\left(A^{SP}\right)^{1-\sigma}$ does not exist. We focus on the case of a reduction in search costs c^P, either through technological change (the improvement of information and communication technologies) or through measures of indirect trade promotion (e.g., through the construction and public maintenance of trade fairs, or trade missions in consulates or embassies).[17] There is ample empirical evidence for both facts, see Cummins and Violante (2002) and Rose (2007).

In chart 3, if c^P is prohibitively high, only three regimes exist: firms with the lowest values of A export, firms with intermediate values of A are active only domestically, and firms with the highest A never take up operations. Hence, the cutoff $\left(A^D\right)^{1-\sigma}$ is not affected by the parameter c^P. However, if c^P is prohibitively high, the exporting cutoff $\left(A_0^F\right)^{\sigma-1}$ is determined by the condition $\delta^P V^F\left(A_0^F\right)=0$. This is the case where the $\delta^P V^{SP}(A)$ line cuts the x-axis.

When c^P falls, the intercept of the $\delta^P V^{SP}(A)$ starts to fall in absolute values, and at some point indirect exporting becomes an option for firms. This has two consequences. First, the "best" firms (those with high $A^{1-\sigma}$) that have not exported before start selling abroad. This generates additional exports. Second, the "worst" firms that have been exporting through an own affiliate before now prefer to use the GI instead. This switch of mode is optimal for producers: they give up some variable revenue, but in turn save fixed market entry costs (associated to FDI). Holding $A^{1-\sigma}$ constant, firms achieve higher export sales in the direct relative to the indirect mode. Hence, the switch into indirect exporting leads to a contraction

[17] Any change in c^P triggers an adjustment in θ if it is not offset otherwise. However, there exists a scalar λ such that $dc^P = \lambda dc^G$ for which θ remains constant even in full general equilibrium.

of trade. The overall effect of the fall in c^P on total export values – new firms take up exporting, while switchers export less – is a priori ambiguous. In contrast to received wisdom, ignoring the existence of GIs and the mechanism discussed in this paper, the effect of technological or institutional change on trade can be smaller (and, theoretically, negative).

Another implication of the existence of GIs is that variance in c^P (or any other exogenous determinant of the $\delta^P V^{SP}(A)$ line) affects the exporting behavior of different types of firms differently. Business surveys reveal that there is sizeable cross-country variance in the export behavior of firms of given productivity. For example, while in Germany medium-sized companies, the so-called "Mittelstand", are very active exporters, in France this is much less the case: only 5% of all small and medium sized firms in France export, while that number is 18% in Germany (The Economist, February 8th, 2007). On the other hand, large firms seem to achieve higher international sales in France than in Germany. Our model can relate this empirical fact to cross-country heterogeneity in the drivers of the expected fixed costs of exports through GIs. Exporters that for some reason face high expected costs of market access through GIs have less exporting firms, but those that export are on average more productive and, hence, larger.

Finally, and related to the last observation, we can use our model to make claims on the aggregate productivity of countries. Closing down $\tau(\omega)$ and $\zeta(\omega)$ heterogeneity, the emergence of GI intermediated exports makes large exporters that switch from the direct to the indirect mode achieve smaller export sales. Therefore, they contribute less to per capita GDP (which is proportional to a measure of average productivity). On the other hand, some relatively small firms that have preferred to sell domestically only, now find it optimal to export. They receive additional weight in the calculation of average GDP. Again, the overall effect is ambiguous. However, there is the possibility that the emergence of GIs actually lowers the aggregate productivity level. In other words, export promotion need not be good for GDP even if there are more exports. *A fortiori*, a welfare perspective that accounts for resources used in foreign market access, delivers an even bleaker picture.

5. Closing the Model

In the above discussion, we have treated θ and real income level B as given. However, θ is itself an important endogenous variable, since it reflects the entry of GIs and producers into searching mode. Moreover, free entry of both GIs and producers is crucial to close the model: the free entry conditions hold in expectations so that entry occurs until expected profits are zero.

5.1 Free Entry of GIs

Free entry of GIs implies that in an equilibrium situation, the expected gains from starting a new GI firm are just zero. That condition pins down the equilibrium number of GIs. When GIs decide to start searching for a foreign producer, they incur search costs. They are matched according to the matching technology described above, with $\eta(\theta)/\theta$ the Poisson arrival rate of a successful match. However, any GI faces *ex ante uncertainty* since the characteristics of the producer that it will ultimately be matched to are known only when the match has occurred. Clearly, since the size of the joint surplus is strictly decreasing in A, a GI is strictly better off with a partner featuring a lower A.

The value equations of a GI can be written as

$$\delta^G E[V^{SG}] = -c^G + \frac{\eta(\theta)}{\theta}\left(E[V^{MG}] - E[V^{SG}]\right), \tag{16}$$

$$\delta^G E[V^{MG}] = (1-\beta)E\left[J(A)\right] + \delta^P\left(E[V^{SG}] - E[V^{MG}]\right), \tag{17}$$

where $E[V^{SG}]$ denotes the expected value of a searching GI and $E[V^{MG}]$ that of a matched GI. As with producers, there is no discounting other than through the exogenous separation rate δ^G, which measures the rate at which a match is broken and the GI goes out of business. Equation (16) shows that the expected flow return to searching consists of a flow search costs $-c^G$, and a positive capital gain $E[V^{MG}] - E[V^{SG}]$, which materializes when the GI switches from searching to being matched. This happens with Poisson rate $\eta(\theta)/\theta$. Equation (17) shows that the expected flow value of a matched GI consists of the GI's share of the joint surplus generated in the match, $(1-\beta)E\left[J(A)\right]$, and the capital loss $E[V^{SG}] - E[V^{MG}]$, which happens when the producer is hit by an exogenous exit shock δ^P.

Free entry implies that the GIs' ex ante value of searching for a producer $E[V^{SG}]$ is zero. Using equation (16), this implies that the expected value of a matched GI $E\left[V^{MG}\right]$ just equals expected search costs of a GI $c^G\theta/\eta(\theta)$. Moreover, it follows from equation (17), that the expected value of a matched GI is equal to the GI's share of the joint surplus, appropriately discounted $E[V^{MG}] = \frac{1-\beta}{\delta}E\left[J(A)\right]$. Thus, the free entry condition for GIs is given by

$$\frac{c^G}{\eta(\theta)/\theta} = \frac{1-\beta}{\delta} E\left[J\left(A\right)\right]. \tag{18}$$

This condition equates the expected search costs of a GI on the left-hand-side with the present value of the share of the expected surplus that accrues to the GI.

Note that the GIs' entry decision is formally isomorphic to the producers decision whether or not to pay the fixed costs that reveal their characteristics A. However, while the producers draw from a sampling distribution $G\left(A\right)$, GIs sample the characteristics of their partners from a distribution that is endogenously truncated by the producers' decisions whether or not to search for a GI. Producers who have drawn characteristics $A \leq A^F$ find it optimal to establish a foreign sales representation. Firms with characteristics $A > A^D$ do not find it worthwhile to take up operations at all: their entry fee is simply foregone. In contrast, GIs always find it optimal to start cooperating with the producer $A \in \left[A^F, A^{SP}\right]$ that they have been randomly matched with. The reason for this is straightforward. A necessary and sufficient condition for producers to search for a GI is that their share of the surplus is larger than expected search costs, i.e., $\beta J\left(A\right) \geq \delta^P c^P / \eta\left(\theta\right) > 0$. GIs, in turn, take up cooperation with their producer if their share of the ex post surplus is non-negative, i.e. $\left(1-\beta\right) J\left(A\right) \geq 0$. Hence, the producers' condition is also sufficient for GIs not to refuse cooperation with a randomly matched producer. Search specific fixed costs f^M are collectivated in the bargaining process and are therefore paid by both parties in the match. It follows that in a rational expectations equilibrium, the criterion of producers to enter into searching for a GI, and of GIs not to reject a successfully matched producer, coincide. Hence, in equilibrium, a general importer never finds it optimal to reject a producer once a match has occurred.

At this point, the crucial assumption that producers can credibly commit to *exclusive dealership arrangements* becomes clear. The problem without such an arrangement is that producers have an incentive to sell to more than one GI, since competition among GIs would allow them to sell larger quantities to the foreign market. However, if one variety is sold by at least two importers, they would enter into Bertrand competition. This would annihilate any ex post profits so that GIs' would never find it worthwhile to start searching for a producer in the first place. Hence, the mode of exporting through a GI can only exist if producers can credibly commit to *exclusive dealership arrangements*, that grant the GI the exclusive right to sell the producers specific variety in the foreign market.

5.2 Free Entry of Producers

Free entry of producers ensures equality between the present value of average profit flows of a potential entrant and the entry costs f^E. Recall that the value of a searching producer consists of two components: a first that collects profits from exporting when being matched to a GI, and a second that comprises search costs, occurring regardlessly of the characteristics A. Then, the fee entry condition can be expressed as

$$\begin{aligned} \delta^P f^E &= \int_0^{A^D} \pi^D(A)\,dG(A) + \int_0^{A^F} \pi^F(A)\,dG(A) \\ &\quad + s(\theta) \int_{A^F}^{A^{SP}} \pi^{MP}(A)\,dG(A) - \left(1-s(\theta)\right)\left(G\left(A^{SP}\right)-G\left(A^F\right)\right)c^P, \end{aligned} \tag{19}$$

where the first and second integral of the above expression reflect, respectively, the expected profits of domestic operations and from exporting through an own subsidiary, and the remaining expressions capture the value of a searching producers.

5.3 Equilibrium Existence and Uniqueness

The system of equilibrium conditions (9), (13), (14), (18), and (19) implies the equilibrium cutoffs A^D, A^{SP}, A^F, the equilibrium market tightness θ, and the equilibrium real income level B. Assume that all components of A are random realizations from independent distribution functions following the Pareto law. Then, A is also Pareto distributed. More precisely, we let the c.d.f. $G(A) = A^k$, with a shape parameter k and the support $(0,1]$.[18] Under our Pareto assumption, the expected surplus is independent of B, which immediately leads to recursivity. More precisely: if A follows the Pareto distribution with shape parameter $k > \sigma - 1$, the zero cutoff profit conditions plus the free entry condition of GIs, solve for the equilibrium cutoff points A^D, A^{SP} and A^F as well as for the market tightness θ independently from $\bar{\tau}$ and B. The value of B then adjusts such that the free entry condition of producers is met. The proof of this recursivity property is relegated to the Appendix.

[18] The Pareto assumption has been made in a large number of related papers (e.g. Helpman et al. (2004), Helpman et al. (2007), Bernard et al. (2006).

Given recursivity, in order to show existence of the equilibrium, it is sufficient to substitute the zero cutoff profit conditions (9), (13), and (14) into the GIs' free entry condition and search for the value of θ that solves that equation. Since expected search search costs are increasing in θ, for uniqueness it is sufficient to show that the expected surplus is increasing in θ. While our simulations suggest uniqueness of the equilibrium, it is hard to prove it formally, since the expected surplus is a fairly complicated function of the market tightness.

A change in the cost of search of either the producers of the GIs has direct and indrect effects in this model. Focusing on direct impacts, it is clear that any reduction in c^G makes it less costly for GIs to operate, and therefore leads to more entry. It follows that θ has to go up, which, in turn, lowers expected search costs from the producers' perspective. With lower expected foreign market access costs, more producers choose to export through intermediaries. As shown in the graphical illustration above, and made more explicit in Felbermayr and Jung (2008b), the emergence of new exporters and the switching of incumbent ones from wholesale FDI into intermediation has ambiguous consequences for average productivity and for total export sales.

A reduction in c^P is more complicated, since its effect on θ is not clear. However, the total effect on expected search costs is usually negative, so that the overall consequences are similar to what we have described above: the effect on average productivity and export sales is ambiguous. Similarly, if the matching efficiency rises, productivity and export sales need not go up. However, our simulations show that an increase in export sales is very likely while negative effects on average productivity are probable, too (see Felbermayr and Jung, 2008b, for more details). It follows that trade promotion by subsidizing the matching process, e.g., through publicly financed trade fairs, may appear superficially successful in that exports go indeed up, but may turn out to fail with respect with the intended productivity and growth effects.

6. Conclusions

The model is close to the frontier of analytical tractability. Hence, theoretical extensions require to restrict the analysis to certain channels, thereby reducing complexity in some elements and enriching the setting in some other areas. This has be done in some companion papers. In Felbermayr and Jung (2008a) we set up a general equilibrium model, where GIs endogenously emerge, but following Chaney (2008) the number of producers is fixed. However, in that framework producers are given an outside option in the bargaining, namely to recycle a certain fraction of the goods produced if the match fails. We analyze the role of distance and country size for the relative prevalence of export modes.

Second, in Felbermayr and Jung (2008b), we find that a reduction in fixed foreign market entry costs may lower industry productivity. This result qualitatively continues to hold in the framework of the present paper, where market conditions endogenously determine market access costs, and also affect variable trade costs simultaneously.

This paper provides a general equilibrium framework with heterogeneous firms, in which trade in goods may occur in an indirect mode, via specialized general importers, or directly, via producers' sales affiliates in foreign countries. We therefore offer a theoretical explanation for a key stylized fact, namely, the existence of trade intermediation. This fact has not been explored systematically in the recent trade literature.[19]

In our extension of the Melitz (2003) model, producers have the option to search for foreign general importers and use them as trade intermediaries or access the foreign market through an own sales affiliate. Relative to the second option, the first option saves fixed costs but requires sharing profits with the intermediary. Importantly, our model partly endogenizes trade costs, since expected the expected costs of searching for a general importer are endogenous in the model and determined by the entry decisions of both producers and importers. Hence, our framework contributes towards a better understanding of trade costs that are not covered by tariffs or transportation costs and that may differ systematically across countries.

Compared to the received literature, we broaden the notion of firm heterogeneity and allow firms to differ with respect to the degree of tradability of their goods, the strength of their brand names, and their marginal costs of production. Our key result shows that exporting via a general importer is an attractive way to access foreign markets when firm characteristics lie in an intermediate range.

Another central result is that the effect of institutional change, such as improving the access to trade fairs, on the volume of trade can theoretically be negative, since some firms that have been exporting through a sales affiliate may find it optimal to use the GI instead, thereby giving up variable revenue, but saving fixed market entry costs. Moreover, our model can relate cross-country heterogeneity in export behavior to the drivers of expected fixed costs. Finally, we find that the emergence of GIs may lower the aggregate productivity level. This result is related to Felbermayr and Jung (2008b), where we analyze the direct effect of fixed-cost liberalization on productivity,

We believe that there are two main avenues of developing the model further. First, general importers usually are multi-product firms. This is true for producers, too, but the incentives to develop product portfolios is stronger for GIs. Eckel and Neary (2006) and Feenstra and Hong (2006) offer promising frameworks to tackle

[19] There are, of course, some notable exceptions, e.g., Schröder et al. (2005).

this extension. Second, we have not modeled the rich incentive problems that arise when a general importer has to exert effort to sell a producer's goods to a foreign market. A formalization of that issue is promising since the fruits of investment in marketing and sales promotion would be shared with the producer. Third, and related to the second potential extension, in the present paper, we have restricted our analysis to the case where contracts are not enforceable altogether. A natural extension lies in a more flexible approach, where the degree of contractability is variable. In reality there is a rich panoply of different arrangements between producers and foreign retailers, ranging from licensing to franchising agreements. All this alternative forms of interaction involve some way of solving the double marginalization problem inherent in our analysis. We believe that bringing the rich industrial organization literature into a model of our type could further cast light on the structure of trade costs between two countries.

Regarding empirical analysis, the present paper would motivate a formal econometric study that analyzes the choice of export modes in the presence of heterogeneous firms. As firm level data becomes more widely available for a larger array of countries and a richer set of variables, empirical analysis of our mechanism should become viable in the close future.

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Appendix

Proof of Equation (6)

The problem of the producer is

$$\max_{x(\omega)} \beta J(\omega) - a(\omega)\tilde{\tau}(\omega)x\left[p^G(\omega)\right] \tag{20}$$

subject to $x(\omega) = H\dfrac{\zeta(\omega)^{\sigma-1}}{p(\omega)^{\sigma}}$, where $J(\omega) = p^G(\omega)x\left[p^G(\omega)\right] - f^M$. The first order condition

$$\frac{\sigma-1}{\sigma}\beta H^{\frac{1}{\sigma}}\zeta(\omega)^{\frac{\sigma-1}{\sigma}}x(\omega)^{-\frac{1}{\sigma}} = a(\omega)\tilde{\tau}(\omega) \tag{21}$$

implies $p^G(\omega) = a(\omega)\tilde{\tau}(\omega)/(\rho\beta)$..

Proof of Equation (14)

We need to establish the parameter restriction that ensures that for given θ ensures a interior solution to the equilibrium sorting problem. We can write the flow profits associated to each mode of operation, $mode \in \{D, SP, F\}$ as the following set of equations:

$$\delta^P V^{SP}(A) = s(\theta)\beta^{\sigma}B(\overline{\tau}A)^{1-\sigma} - \left\{s(\theta)\beta f^M + \left[1-s(\theta)\right]c^P\right\} \tag{22}$$

$$\pi^F(A) = B(\overline{\tau}A)^{1-\sigma} - f^F \tag{23}$$

$$\pi^D(A) = BA^{1-\sigma} - f^D, \tag{24}$$

We establish a lower and an upper bound, $\underline{f}$ and $\overline{f}$, respectively, to the expected fixed costs of the search mode SP. First, to pin down $\underline{f}$, we search for the intercept of $\delta^P V^{SP}(A)$ that solves $\delta^P V^{SP}(A_D) = 0$. That condition yields $s(\theta)\beta^{\sigma}B(\overline{\tau}A)^{1-\sigma} - \underline{f} = B(A^D)^{1-\sigma} - f^D$. Recognizing from (9) that $(A^D)^{1-\sigma} = f_D/B$, we find the lower bound

$$\underline{f} = s(\theta)\beta^{\sigma}\tau^{1-\sigma} f^{D}.$$

The upper bound is found by finding the intercept $\overline{f}$ for which $\delta^{P} V^{SP}\left(\tilde{A}\right) = 0$ with $\tilde{A}$ determined by the condition $\pi^{F}\left(\tilde{A}\right) = 0.$ We have $s(\theta)\beta^{\sigma} B\left(\tau\tilde{A}\right)^{1-\sigma} - \overline{f} = 0.$ Recognizing from (5) that $\tilde{A} = \tau^{\sigma-1} f^{F}/B^{j},$ we find the upper bound

$$\overline{f} = s(\theta)\beta^{\sigma} f^{F}.$$

Collecting results, the condition on the intercept of (22) $-\underline{f} < s(\theta)\beta f^{M} + \left[1 - s(\theta)\right]c^{P} < \overline{f}$ can be written as

$$\tau^{1-\sigma} f_{D} < \beta^{-\sigma}\left[\beta f^{M} + \frac{\delta c^{P}}{\eta(\theta)}\right] < f^{F}, \tag{25}$$

where we have made use of the definition $s(\theta) \equiv \eta(\theta)/\left[\delta + \eta(\theta)\right].$ Condition (25) is the one that appears in condition (14).

Proof of Comparative Statics with Respect to θ.

Consider how an increase in θ affects the $\delta^{P} V^{SP}(A)$ locus (22): first, the locus becomes steeper since $s'(\theta) > 0;$ second, the locus shifts up (down) if $\beta f^{M} < (>) c^{P}.$ Focusing on the case where $f^{M} = 0,$ the locus always shifts up.

Using "hats" to denote proportional changes, the cutoff levels A_{ij}^{SP} and A_{ij}^{F} change as follows:

$$\hat{A}^{SP} = \frac{\gamma}{\sigma - 1}\hat{\theta}, \tag{26}$$

where γ is the elasticity of the matching function with respect to the number of searching GIs. Similarly, we have

$$\hat{A}^{F} = -\frac{\gamma}{\sigma - 1}\frac{\delta}{\delta + \eta(\theta)}\beta^{\sigma}\hat{\theta} < -\hat{A}^{SP}, \tag{27}$$

where the inequality follows from the fact that both $\delta/\left[\delta + \eta(\theta)\right]$ and β^{σ} are strictly smaller than unity.

Proof of the Recursivity Result

Consider again the GI's share of the expected surplus. Using (7) and the Pareto assumption, we find an expression for the expected surplus

$$E\left[J\left(A\right)\right]=\frac{k\sigma B\left(\overline{\tau}\beta^{-1}\right)^{1-\sigma}}{k-\left(\sigma-1\right)}\frac{\left(A^{SP}\right)^{k-(\sigma-1)}-\left(A^{F}\right)^{k-(\sigma-1)}}{\left(A^{SP}\right)^{k}-\left(A^{F}\right)^{k}}. \tag{28}$$

The independence of expected surplus of the demand level B and the homogeneous part of the trade costs $\overline{\tau}$ directly follows from inserting the cutoff profit conditions (9), (13), and (14) into (28). The in dependence of θ of B and $\overline{\tau}$ immediately follows from the free entry condition (18).

Service Sector Linkages: The Role of Services in Manufacturing[1]

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Abstract

We provide empirical evidence for the increasing importance of services as inputs into manufacturing production on the one hand and on the emergence of international trade in services on the other hand. These two facts taken together imply that the impact of openness to trade in services is also gaining importance. At the detailed industry level, we relate openness to trade in individual service sectors to the performance of individual manufacturing sectors distinguished by their skill and technology intensity. We find that increased imports of business services promote manufacturing exports and value added in the most technology and skill intensive industries while we observe a negative effect in labour intensive industries.

JEL: F14, O11, O57
Keywords: producer services, trade in services, linkages, multiplier effects, manufacturing trade.

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1. Introduction

The economic landscapes of modern, developed economies are dominated by large services sectors. For the OECD members, about 70% of value added and employment are generated in the service sectors (Wölfl, 2003). For the New EU-Member States this share is slightly lower, but still ranges between 60% (Czech Republic) and more than 70% (Cyprus). The rise in the importance of services in modern economies is driven by both final and intermediate demand factors. With national and international outsourcing by – mostly manufacturing – firms, the demand for services as intermediate inputs in production has grown. The disintegration of production processes – also called "splintering" of production - together with technological progress, particularly in information and communication technologies has allowed services to become increasingly tradable. In line with the general expansion of international trade, global services exports and imports have more than doubled over the past decade.

In this article we focus on the link between openness to trade in services and the performance of the manufacturing sector. We start by examining the role of services as inputs in manufacturing and then turn to the related interaction between service sector openness and the relative performance of different industries in the overall pattern of manufacturing exports. The next section illustrates the role of services in the domestic economy. Section 3 examines the existing data on trade in services and emphasizes also current measurement problems. It further describes global and European services trade patterns. Section 4 reports some results concerning the impact of openness in the service sector on individual manufacturing sector's performance within the OECD. Section 5 concludes.

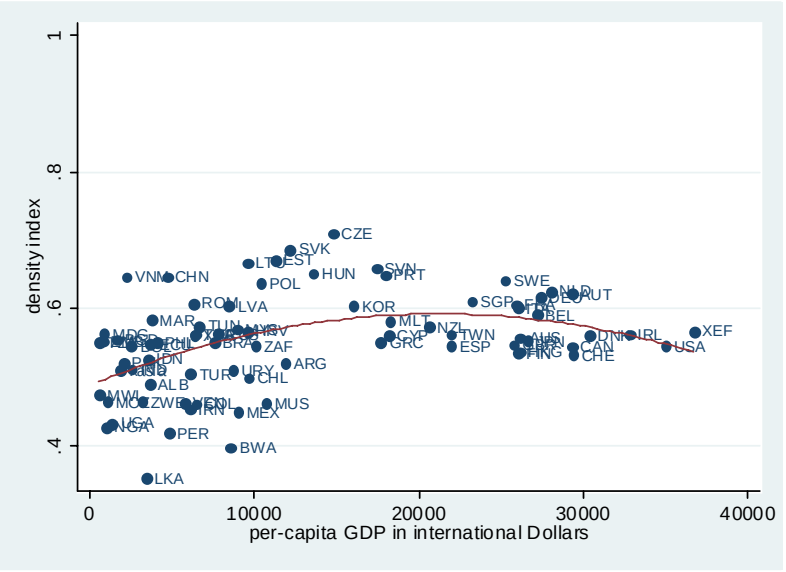
2. The Role of Services in the Economy

While both final and intermediate demand factors are important in explaining the growing share of services in the economy, the rise of services in the economy was initially attributed to final demand factors (Clark, 1940; Baumol et al., 1985). Demand-side explanations have focused on final-demand services and relate the pattern of rising final or consumer service prices to relative productivity differentials. The result is a prediction of stagnating overall productivity growth – Baumol Disease. Related literature on demand-side factors, linked to the Balassa-Samuelson hypothesis, includes Hunter and Markusen (1988), Bhagwati (1984) and Panagariya (1988). These papers focus on final demand factors and predict a shift toward final service production and rising non-tradable prices driven by final demand factors. In contrast, some authors have stressed analytical linkages between intermediate or producer services and the manufacturing sector, assigning both a direct and indirect role for services in the economy and making contrary predictions to those linked to the Baumol Diesease. Katouzian (1970), Francois

(1990a), and Hoekman (2000) have adopted the view that rising demand for producer services as inputs into manufacturing implies overall productivity growth along with a rising share of the service sector.

On the empirical side, authors like Park (1989), Park and Chan (1989), Uno (1989), and Francois and Reinert (1996) also stress the intermediate demand created by the increasing disintegration of production, which implies a rising demand for producer services in countries at higher levels of economic development. A stylized fact that emerges from this empirical literature is that in the long-run, the share of services in the economy follows a U-pattern, where the service sector in general shows an initial decline when a country shifts toward a more industrialized structure of production and then starts to increase its share in the economy again as the country moves further towards a more modern, service-based economy. Final and intermediate demand factors are interacting to generate this pattern. In earlier stages of development final demand services dominate the demand for services, while the economy exhibits a greater importance of intermediate services at later, more advanced stages. The rise in international trade in services is above all strongly linked to intermediate demand factors as a result of an increasing complexity of intermediate linkages – the overall "roundaboutness of production." (See Francois and Reinert, 1992, and Francois and Woerz, 2007.) This so-called density of production encompasses the overall linkages in the economy. Since service sectors have in general fewer linkages as compared to manufacturing sectors, an inverted U-shaped relationship emerges with respect to the density of intermediate use in the economy over time (or across economies at different stages of development). Chart 1 plots this density by plotting direct input coefficients in the cross-section of countries. The graph reflects the importance of backward linkages between sectors, relative to the total level of production activity in the economy.

Chart 1: Density of Intermediate Use Matrix, 2001



Source: Francois and Woerz (2007), based on GTAP Database V6.2.

2.1 Direct Importance of Services in the Economy

Although the density of backward linkages in the economy starts to fall again after a certain level of development, the direct demand for producer related services is unambiguously increasing with the stage of development. Table 1 gives some crude evidence for this observation. For each manufacturing industry, the demand for business services (measured as the share of intermediate demand for services out of total input demand) is explained by per-capita GDP at purchasing power parities in 2001. The demand for total services is not significantly related to the level of GDP, as had been expected. However, when the focus is limited to producer related services only, a positive, non-linear relationship is revealed for most industries. The results are shown in Table 1 for an aggregate of producer services, which includes transportation, financial, insurance, communication, and other business services.[3] Similar results are found for individual producer related service sectors. However, the patterns point towards some differences across

[3] This definition is unusual as it includes transportation services. It was motivated by the consideration that the shipment of goods is also relevant for well functioning of the manufacturing sector.

individual manufacturing industries. At the sector level, a significant, U-shaped correlation between income levels and service intensity emerges only for the following labor and resource intensive industries: food, textiles, clothing, leather, paper, coke, chemicals, and metals.

Table 1: Manufacturing Demand for Producer Services

	GDP	***t-stat***	**GDP^2**	***t-stat***	**R^2**
Food	–3.14	*–5.18***	0.19	*5.45***	0.39
Textiles	–2.93	*–2.20***	0.17	*2.30***	0.07
Clothing	–2.98	*–2.38***	0.18	*3.02***	0.19
Leather	–3.91	*–2.40***	0.23	*2.49***	0.07
Wood	–1.21	*–1.20*	0.07	*1.29*	0.03
Paper	–3.02	*–3.23***	0.18	*3.39***	0.16
Coke	–3.69	*–2.11***	0.20	*2.04***	0.10
Chemicals	–4.47	*–4.86***	0.27	*5.02***	0.21
Minerals	–0.64	*–0.54*	0.04	*0.68*	0.07
Metals	–3.32	*–3.39***	0.19	*3.38***	0.10
Machinery	0.27	*0.18*	0.00	*–0.01*	0.13
Electrical equipment	0.52	*0.42*	–0.02	*–0.29*	0.08
Motor vehicles	–0.88	*–0.93*	0.05	*1.00*	0.03
Other transport equipment	–1.01	*–0.87*	0.07	*1.08*	0.10
Other manufacturing	–1.99	*–1.42*	0.13	*1.65**	0.10

*Note: Dependent variable is the intermediate use share of producer services from the use matrix for use of intermediates of each manufacturing industry in 2001; GDP p.c. is per-capita income level, measured at purchasing parities; ** (*) denotes statistically significant at the 5% (10%) level; robust standard errors.*

Source: Francois and Woerz (2007).

2.2 Indirect Importance (Roundaboutness of Production)

The above considerations do not reflect the full importance of services for manufacturing production. If for instance the pharmaceutical industry increases its output, it not only requires additional services directly as inputs (management, advertising, legal services, and such), but also more output from the chemical industry which also uses services as inputs into production. Table 2 below considers these direct and indirect effects. The dependent variable here is the additional direct and indirect demand for business services generated by an additional unit of output in one of the listed manufacturing industries. Again we relate this direct and indirect demand for business services to GDP, which serves as a proxy for the level of development. We observe a linear and positive relationship

for all manufacturing industries, except the leather industry. Similar results are found for other producer related industries. All this reflects the increasing importance of producer related services for more advanced economies.

Table 2: Direct and Indirect Multiplier Effects in Business Services

	GDPpc	*t-stat*		$GDPpc^2$	*t-stat*	R^2
Food	0.0396	*4.02*	**			0.13
Textiles	0.0256	*3.43*	**			0.12
Clothing	0.0161	*1.93*	*			0.04
Leather	0.2142	*1.98*	**	–0.0117	*–1.82*	* 0.06
Wood	0.0218	*2.38*	**			0.05
Paper	0.0452	*4.56*	**			0.2
Coke	0.0151	*2.15*	**			0.04
Chemicals	0.0384	*4.48*	**			0.2
Minerals	0.0369	*4.1*	**			0.15
Metals	0.0318	*3.47*	**			0.12
Machinery	0.0411	*5.21*	**			0.26
Electrical equipment	0.0353	*4.91*	**			0.2
Motor vehicles	0.0347	*4.71*	**			0.19
Other transport equipment	0.0298	*3.65*	**			0.11
Other manufacturing	0.0294	*3.6*	**			0.11

*Note: Depend variable is the multiplier coefficient in business services in the respective manufacturing industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.*

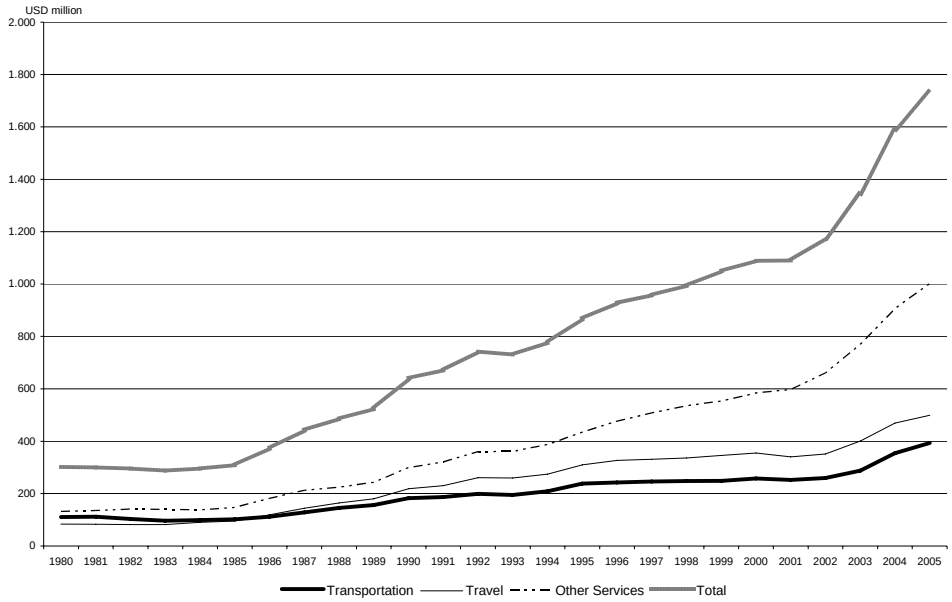
Source: Francois and Woerz (2007).

3. Trade in Services

The increasingly important role of services in modern, post-industrial economies partly arises from the externalization of business and other producer services, as has been shown above. The same development, namely outsourcing of service activities by manufacturing firms, has also led to increasing international trade flows in services. Together with technological progress in information and communication technologies this splintering of production has led to a surge in international trade in services as illustrated in chart 2 below, amounting to USD 2.7 billion in 2006. The rise in services trade is particularly pronounced in the category of "other services". More than half of total trade in services falls into this category, comprising commercial, personal and government services. Growth in this category was most dynamic as well. Within other services, about 50% constitute other business services. Financial services are the second most important category

(8%), followed by computer and information services (5%). Thus, producer related services are mainly responsible for the rise in cross-border trade in services.

Chart 2: Growth of Cross-Border Trade in Services, 1980–2005



Source: IMF BOP Statistic.

3.1 Data and Problems of Measurement

Chart 2 points to a serious shortcoming in the current measurement practice with respect to trade in services. While data on merchandise trade is traditionally well recorded through customs statistics, trade in services is less well documented for obvious reasons. First of all, the definition of trade in services is far more wide reaching than that for trade in goods. The GATS (General Agreement on Trade in Services) defines four modes of trade for services, only one of which is the cross-border provision of services. Due to the intangibility and non-storability of many services, also consumer and producer movement, as well as sales of services through foreign affiliates are considered as modes of trading services across borders. The balance of payments statistics (BoP), which are generally used as the only source of data on trade in services, cover some of these modes more comprehensively than others. Cross-border trade and trade through the movement of consumers (travel, parts of transportation) is captured fairly well, while trade through foreign affiliates is captured only to a rather small extent. Parts of construction services listed in the BoP belong into this mode. The majority of trade

through foreign affiliates would however be measured adequately through Foreign Affiliate Trade in Services (FATS) statistics. Unlike BoP statistics, these statistics do not yet exist for a wide range of countries. The fourth mode - trade though the movement of the service providers - is also captured very badly in existing statistics. Again, comprehensive FATS statistics would be helpful, but also other sources need to be taken into account here. Recent estimates by the World Bank suggest that BoP statistics record about 60% of total trade in services according to this very wide definition of trade through four different modes. The remaining 40% are almost entirely remaining trade through foreign affiliates, while trade through the movement of service producers appears to be negligible. Of course, this is also related to the fact that little knowledge exists about this type of trade due to poor definitions and missing statistical sources. Taking into account all four modes of international services supply would consequently raise the share of services in total trade from the well-known 20% up to almost 30%.

In this section, we work with a mix of panel data on goods and services trade for the 30 OECD Members from 1994 to 2004, which are taken from the IMF BoP statistics and UN COMTRADE statistics. These data are based on balance of payment statistics and correspond mainly to what has been described above as GATS mode 1 – cross border trade - and mode 2 – movement of consumers. We combine this trade data with the social accounts data (i.e. data on intermediate linkages) used in the section above for 78 countries inclusive of our OECD sample and benchmarked to the year 2001 (GTAP Database, Version 6.2). In the following we give a brief overview of the most recent developments of trade in services.

3.2 Recent Developments and Trade Patterns in Services

Regionally, trade in services is more concentrated among the economically well integrated EU Member States as compared to trade in merchandise goods. About 50% of global service exports originate from the EU, while the same region accounts for "only" 40% of goods exports. The second most important trading hub for services is between the EU and the USA. Asia plays a substantially smaller role in services trade as compared to goods trade. Nevertheless, China has already emerged as the fourth most important single exporter of services in 2006, after the EU (excluding intra-trade), the USA and Japan.

Table 3 illustrates the importance that trade in services has for EU economies. With roughly 10% of exports in 2004, services trade plays a marginally greater role in the New Member States compared to the Old Members States. This hints towards differences in comparative advantages between the two groups of countries. However, also within the Old Member States, substantial differences can be observed between manufacturing based exporters like Germany and countries like the UK, which are strongly specialized in services trade.

On the import side, the data are more similar, pointing towards similar demand structures for services in all European countries. This underlines the importance of services for the functioning of modern economies.

Table 3: Trade-to-GDP-Ratios, Total Services (Cross-Border Trade & Consumer Movement)

	Exports		Imports	
	1995	***2004***	***1995***	***2004***
EU-12	10.3	9.2	7.2	7.7
EU-15	6.0	8.4	5.8	7.7
Germany	3.3	5.2	5.1	7.1
UK	6.7	9.3	5.8	7.0

Note: EU-12 stands for the EU Member States which joined the EU in 2004, EU15 for the incumbent EU Member States.

Source: Eurostat, World Bank WDI.

A decomposition of services by the three broad categories (tables 4 and 5) reveals that the greater importance of service exports for the New Member States arises from relatively high export ratios in transportation and travel services, the two categories which are loosing importance globally. Clearly, exports are underrepresented in the most dynamic category of other services. However, especially here, again import demand is comparable to the figures for the old members, reflecting the importance of producer related services as inputs for the economy.

Table 4: Trade-to-GDP-Ratios, Other Services (Cross-Border Trade)

	Exports		Imports	
	1995	***2004***	***1995***	***2004***
EU-12	3.0	2.9	2.9	3.5
EU-15	2.1	4.4	2.0	3.6
Germany	1.8	3.0	2.0	3.0
UK	3.6	6.5	2.1	2.8

Note: See table 3.

Source: Eurostat, World Bank WDI.

Table 5: Trade-to-GDP-Ratios, Transportation Services (Cross-Border Trade)

	Exports		Imports	
	1995	*2004*	*1995*	*2004*
EU-12	2.5	2.7	1.8	2.0
EU-15	1.4	1.7	1.5	1.7
Germany	0.8	1.2	0.9	1.5
UK	1.5	1.4	1.5	1.6

Note: See table 3.

Source: Eurostat, World Bank WDI.

Finally, table 6 shows FDI stocks in relation to GDP. This is used here as a crude proxy for the economic importance of trade in services through mode 3 – commercial presence abroad. Cleary, this form of services trade is mainly of importance for the more advanced Old Member States and still negligible (on both, the export and the import side) in the case of the new members. Estimates from the US-data suggest that the ratio of FDI stocks to sales of foreign affiliates (what constitutes trade through mode 3) is about 3 to 1. Applying this ratio to the European data, trade through mode 3 would amount to roughly equal importance to trade through modes 1 and 2 combined for the Old Members States. Due to lack of data for this mode of trade, we will focus on cross-border trade of producer services in what follows.

Table 6: FDI-to-GDP-Ratios, Total Services

(proxy for commercial presence)

	Outward		Inward	
	1995	**2003**	**1995**	**2003**
EU-12	0.0	0.7	1.5	8.1
EU-15	7.4	24.0	6.0	19.0
Germany	6.9	24.7	5.8	24.2
UK	10.8	42.3	8.2	22.3

Note: See table 3.

Source: Eurostat, OECD, World Bank WDI.

4. Services Trade and Manufacturing Performance

The evidence on the role of domestic services in the economy presented above together with the observed rise in trade in services suggests that this increased openness towards producer services may show an efficiency enhancing effect on other sectors of the economy, as argued in Markusen (1989); Francois (1990a,b); van Marrewijk et al. (1997); and Markusen Rutherford and Tarr (2005). The empirical literature on this question is rather limited up to date. From Javorcik et al. (2006) we have case-study evidence (for the Czech Republic) that service sector inward FDI can contribute to firm efficiency. Here we look for similar evidence of the direct and indirect effects of increased producer service imports on manufacturing sector performance across the OECD.

We evaluate the role played by service imports within the OECD over the time period from 1994 to 2004, whereby we differentiate between different types of services: core business services, communication, financial and insurance services.[4] We further include total FDI inflows into the service sector as an alternative route for service inputs from abroad through sales of foreign affiliates. All these variables are in logs. In addition, we control for implicit trade barriers as represented by domestic barriers to competition. For this we include indices of product market regulation from the OECD (Conway et al. 2005) for three broad dimensions: barriers to entrepreneurship, state control and barriers to foreign trade and investment. Tables 7 to 9 display the results from the following empirical model:

$$(1) \qquad DepVar_{ikt} = \alpha_i + \beta 1_i Mbusiness_{ikt} + \beta 2_i Mcomm_{ikt} + \beta 3_i Mfinance_{ikt} + \beta 4 Minsurance_{ikt} + \beta 5_i FDI_{ikt} + \beta 6_i Bentrepreneur + \beta 7_i Bstate_{ikt} + \beta 8_i Btrade_{ikt} + \mu_k + \varepsilon_{ikt}$$

We are looking at the effect of trade in services on both, the domestic performance as well as exports of manufacturing industries. The dependent variable is constructed as follows:

[4] Data for economy-wide service imports in each category (taken from the IMF) is interacted with the share of the respective service category used in each manufacturing industry. The latter is obtained from the social accounting information provided through the GTAP database.

(2) $$DepVar_{ikt} = \log\left(\frac{\theta_{ikt}}{1-\theta_{ikt}}\right)$$

where $\theta_{ikt} = \frac{X_{ikt}}{\sum_i X_{ikt}}$ and X_{ikt} is one of the following: exports, value added or employment of manufacturing industry *i* in country *k* in year *t*. This should give a comprehensive picture of the full effects of economic integration within service sectors on the manufacturing sector. The importance is here to distinguish between individual manufacturing industries.[5] For industries which are strongly using producer services as inputs into production, we expect positive effects of increased openness. However, this does not necessarily have to be the case in all industries. Thus, we group manufacturing industries into one of three groups: technology intensive, labor intensive and resource intensive. What emerges from the results is that imports of business services are an important determinant of the pattern of manufacturing exports in the most advanced industries. While no significant effects from service imports on total manufacturing exports on average can be detected, there are clear positive effects in the most technology intensive industries (here defined as chemicals, electric equipment, machinery and motor vehicles). Again, as was to be expected, it is the imports of core business services that play a role here, while the coefficients on communication, insurance and financial services do not turn out to be significant for the group as such. On the other hand, a negative effect from increased business service imports emerges when we are restricting our attention to labor intensive industries only. This holds true in particular for the textiles, clothing and leather industries. Finally, no effects are found for resource intensive industries. This points to the more advanced industries being vertically integrated, not only nationally but also internationally through the off-shoring of business services. Indeed, the results in table 3 support the notion that off-shoring of business services does actually promote the competitiveness of the most skill and technology intensive industries.

The same results are found for the domestic performance of manufacturing industries (as measured through value added and employment, see tables 8 and 9). Hence, we can expect not only positive output effects, but also positive

[5] Most of our control variables are highly correlated among themselves. In addition, there may also be a serious problem of endogeneity, especially between openness on the export side of the manufacturing sectors and their openness to service imports. Therefore we employ a 2SLS estimation, with the following variables as instruments for imports of services and the regulatory indicators in the first stage: initial values, country dummies and value added of the respective industry.

employment effects from off-shoring of services in the most skill and technology intensive industries. However, these positive effects are in contrast to negative output and employment effects in labor intensive production activities, especially so in the textile and clothing sector. Thus, the impact of business service imports differs greatly between individual manufacturing activities. The effect on the economy as a whole is ultimately a result of the sectoral structure of the economy.

Table 7: Effects of Off-Shoring on Manufacturing Exports

	Industry group					
	Tech intensive		**Labour intensive**		**Resource intensive**	
Imports of business services	0.2199	*	-0.2319	**	-0.1637	
	1.68		*-1.96*		*-1.26*	
Imports of communication services	-0.0819		0.2183		0.1875	
	-0.36		*0.91*		*0.99*	
Imports of financial services	0.1618		0.0986		-0.0365	
	1.10		*0.67*		*-0.3*	
Imports of insurance services	-0.1716		-0.0266		-0.1270	
	-1.01		*-0.13*		*-0.86*	
Total FDI inflows	-0.0016		0.0289		0.0095	
	-0.04		*0.54*		*0.22*	
Barriers to entrepreneurship	0.0093		0.4122		-0.0319	
	0.02		*1.45*		*-0.08*	
State control	-0.0806		0.2361		0.0244	
	-0.35		*1.05*		*0.13*	
Barriers to trade and investment	-0.1129		0.0643		0.1762	
	-0.43		*0.27*		*0.78*	
Constant	-3.1994	**	-4.6532	**	-3.3768	**
	-4.29		*-5.08*		*-4.67*	
Observations	182		182		182	
Groups	23		23		23	
within R2	0.2845		0.1956		0.0219	
between R2	0.3740		0.4129		0.3660	
overall R2	0.3073		0.3809		0.3094	

*Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.*

Source: Francois and Woerz (2007).

Table 8: Effects of Off-Shoring on Manufacturing Value Added

	Industry group					
	Tech intensive		**Labour intensive**		**Resource intensive**	
Imports of business services	0.1580	**	-0.2328	**	-0.0047	
	(3.43)		(-3.22)		(-0.11)	
Imports of communication services	0.1227		0.3692	**	0.0191	
	(1.55)		(3.1)		(0.29)	
Imports of financial services	0.0713		0.1152		-0.0820	*
	(1.32)		(1.33)		(-1.95)	
Imports of insurance services	-0.1815	**	-0.1924	*	0.0568	
	(-2.66)		(-1.86)		(1.15)	
Total FDI inflows	-0.0204	*	-0.0703	**	-0.0107	
	(-1.72)		(-3.36)		(-0.94)	
Barriers to entrepreneurship	0.0313		0.1343	*	0.1140	**
	(0.62)		(1.68)		(2.59)	
State control	-0.0746	*	0.1311	*	-0.0454	
	(-1.67)		(1.78)		(-1.15)	
Barriers to trade and investment	0.0588		-0.0002		0.0549	
	(1.34)		(0)		(1.61)	
Constant	-3.2654	**	-3.0549	**	-2.9601	**
	(-13.89)		(-8.45)		(-15.63)	
Chi-squared	55.34		66.17		37.04	
within R^2	0.0847		0.2081		0.1594	
between R^2	0.4580		0.2133		0.0341	
overall R^2	0.3588		0.2021		0.0228	
Observations	182		182		182	

*Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.*

Source: Francois and Woerz (2007).

Table 9: Effects of Off-Shoring on Manufacturing Employment

	Industry group					
	Tech intensive		**Labour intensive**		**Resource intensive**	
Imports of business services	0.1484	**	-0.1705		0.0226	
	(2.51)		(-1.52)		(0.6)	
Imports of communication services	0.0030		0.2229		-0.0024	
	(0.04)		(1.39)		(-0.04)	
Imports of financial services	0.0166		0.1373		-0.0479	
	(0.24)		(0.97)		(-1.32)	
Imports of insurance services	-0.0732		-0.2321		0.0270	
	(-0.89)		(-1.5)		(0.62)	
Total FDI inflows	-0.0041		-0.0335		0.0002	
	(-0.63)		(-1.46)		(0.04)	
Barriers to entrepreneurship	0.0368		0.0094		0.0035	
	(0.89)		(0.11)		(0.15)	
State control	-0.0607	**	0.1220	*	0.0186	
	(-2.16)		(1.86)		(0.89)	
Barriers to trade and investment	0.0303		0.0383		-0.0047	
	(0.65)		(0.43)		(-0.22)	
Constant	-3.2772	**	-2.8969	**	-3.2611	**
	(-12.63)		(-5.46)		(-21.8)	
Chi-squared	79.95		48.33		9.49	
within R^2	0.2403		0.1843		0.0675	
between R^2	0.4571		0.3002		0.0001	
overall R^2	0.3547		0.2695		0.0001	
Observations	182		182		182	

*Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.*

Source: Francois and Woerz (2007).

5. Conclusions

The tertiarization of the economy (a shift to rising dominance of services in the share of overall activity) implies not only an increased role for domestically produced services, but also for trade in services. In this paper we have emphasized in particular the role of service imports as efficiency enhancing inputs in manufacturing production. Based on social accounts data from the GTAP database, we have illustrated that the service sector – and here especially producer service sectors – is increasingly linked with the manufacturing sector, implying a greater roundaboutness of production. We have illustrated that the direct as well as the indirect demand for services is strongly increasing in the level of overall economic development. This is above all true for producer related services, in particular for business services (such as professional services, management and accounting services, etc.).

Another seminal development apart from the increasing splintering of production, resulting in a stronger role for the service sector domestically, is growing international trade in services. Technological progress, most importantly in information and communication technologies, has rendered services increasingly tradeable across larger distances and across international borders. This paper gives some evidence on the rise in trade in services over the past years, which is again particularly pronounced in the area of producer related services. Business services feature prominently in international trade flows of services, as do financial and computer and information services. Thus, in addition to an increased role for domestically produced services through the externalization of service activities by manufacturing firms, we also witness a strong internationalization of service activities.

Drawing together these two pieces of evidence, we then investigate the impact of service sector openness on the performance of the manufacturing sector. Restricting our attention to OECD members for reasons of data limitations, we find that increased import penetration by producer services has a positive effect on the skill and technology mix of exports, with greater openness in producer service sectors implying better export performance by skill and technology intensive industries. We also observe a negative impact of more producer service imports on value added and exports in labor intensive manufacturing industries. These indirect effects on the least skill-intensive industries may also explain the public resistance against opening up service sectors to trade. Protecting intermediate service sectors places high wage manufacturing sectors at a competitive disadvantage, but also implies a protection of low-wage sectors against potential negative effects. Resisting to opening up trade in services thus shows the same effects as resisting to structural change in general. It may act as a means to safeguard those sectors, which are bound to loose from long-run structural change, thus postponing but not solving current structural problems. Overall, our results - based on econometric

work with panel data on trade and a cross-section of social accounts data - complements and supports the results emerging from the current literature based on individual country/case studies.

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Synchronization of Business Cycles of Germany and Austria

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Abstract

In this paper, we analyze the synchronization of the German and the Austrian business cycles for the time span from 1972 to 2007. We find a high comovement of the output gaps of both countries, which increases over time. Looking at demand components, we find the highest degree of comovement between German and Austrian exports as well as imports. Austrian GDP was lagging behind German GDP by one quarter in the 1970s and is now leading by two quarters. Looking at the production side, we find the strongest comovement for the industrial sectors, whilst the construction and the service cycles exhibit only a weak correlation.

JEL classification: E32, F41
Keywords: business cycle, synchronization, Austria, Germany

1. Introduction

Austria as a small open economy always had a strong orientation towards its largest neighbor Germany. The existence of a common border, a common language, similar institutional settings and last but not least a tempestuous common history have created strong economic ties between these two countries. Consequently, there is a considerable impact of the German business cycle on the Austrian one. 30% of Austrian exports are going to Germany and 40% of its imports are coming from Germany. The German share in Austrian inward foreign direct investment reaches 40%. Since the early 1980's, the nominal exchange rate between both countries is de facto fixed. Whilst trade and financial links between

[1] We would like to thank all the participants of the workshop in helpful comments and discussions.

the two countries have steadily increased over the past decades, the relative importance of Germany has declined since the opening up of Eastern Europe und the surge of Austrian trade volumes and foreign direct investments in this region. This could give rise to the hypothesis of a gradual decoupling of the two business cycles. At the same time, the increasing integration of both countries into the world economy and the occurrence of global shocks could trigger an increase of the business cycle synchronization. The aim of this paper is therefore to evaluate whether one of these effects is dominating. To this end, we analyze the synchronization of the German, the Austrian business cycle, and its changes over the last 35 years.

At a global level, the literature on the synchronization of international business cycles finds that the degree of comovement among developed economies evolved remarkable stable over the past decades, whilst the volatility of the cyclical fluctuations has decreased considerably.[2] According to Stock and Watson (2003a) output fluctuations in developed countries declined on average by one third over the past 30 years. More than half of the decline in volatility is due to smaller global macroeconomic shocks and therefore potentially only of a temporary nature.[3] Given smaller international shocks, it is surprising that the correlation of output fluctuations is not decreasing. This indicates that the strength of the transmission mechanism of shocks has become stronger in the course of globalization.[4]

Several aspects of the business cycle links between Germany and Austria have been analyzed so far. Brandner and Neusser (1992, 1994) determine the static correlation between different macroeconomic variables. They find a high contemporaneous correlation for GDP and investment but only a small correlation for private consumption. Winckler (1993) emphasizes that the strikingly high comovement of the two economies is mainly the result of Austria's policy orientation towards Germany. Against the background of a constant bilateral exchange rate social partners in Austria closely followed German developments in the wage bargaining process in order to preserve Austria's price competitiveness. Hochreiter and Winckler (1995) identify sector-specific shocks for the period 1973 to 1989 and find no evidence for an increase of symmetry between the two countries. Cheung and Westermann (1999) study the economic relations between Germany and Austria using an error correction model and find a stable long-run relationship for industrial production. Moreover, changes in German industrial production Granger-cause changes in the Austrian industrial production but not vice versa. Finally, the International Monetary Fund (Epstein and Tzanninis, 2005)

[2] See also Helbling and Bayoumi (2003), Kose (2004), Kose, Prasad, and Terrones (2003, 2004), Bordo and Helbling (2003), Heathcote and Perri (2003), Stock and Watson (2003a, 2003b).

[3] See also Dalsgaard, Elmeskov and Park (2002), Monfort et al. (2003) and Helbling and Bayoumi (2003).

[4] See Kose (2004) for a compact review of the literature.

analyses the economic linkages between Germany and Austria and finds a marginal decrease of the static correlation between German and Austrian GDP over the last ten years. Fenz and Schneider (2006, 2007) have analyzed the transmission of German structural shocks to Austria within a two-country VAR framework. Using sign restrictions on impulse response functions, they have identified German supply, demand and monetary policy shocks. The average reaction of the Austrian economy to German shocks amounts to around 40% of the German reaction and remains broadly stable over time. German demand shocks have, relative to the size of the shock, the smallest impact on the Austrian economy, while German monetary shocks have an almost equally strong output effect in Austria as in Germany itself.

Our contribution to the literature is an analysis of the comovement of the business cycles of the two countries. We therefore look at GDP and its demand components as well as on the production side of GDP. We employ different measures of comovement. The paper is organized as follows. The degree of comovement is analyzed in section 2. Section 3 gives a brief overview over the economic links between Austria and Germany. Finally, we summarize the results in section 4.

2. Synchronization of Business Cycles of Germany and Austria

In this section, we analyze the comovement between the Austrian and the German economy and its change over time. We look at the output gaps of GDP and its demand components in the period 1970Q1 to 2007Q3. We have computed the output gap as percent deviation from a HP-filtered trend of seasonally and working-day adjusted data. We employ a variety of different measures of comovement, which we compute for two subsamples (1970Q1 to 1989Q4 and 1990Q1 to 2007Q3) as well as for ten-year rolling windows. The break point between the two subsamples can be justified by the historical event of the fall of the iron curtain. In addition, we look at the production side of GDP for which data since 1991 are available.

Measures of Comovement

We use five different measures of bivariate comovement between Austrian and German output gaps. Our first measure is the static *contemporaneous correlation coefficient*. Besides the strength of the contemporaneous comovement, we are interested in the lead/lag relationship between the two economies. Therefore, we look at the *maximum correlation at different leads and lags* (measure two). This gives us a first hint of the relative position of the series in time. These static correlation measures in the time domain can be supported by frequency domain

analysis. With the help of spectral analysis, we are able to describe the comovement of two variables for different frequencies. Our main interest lays in business cycle frequencies ($\pi/16$ to $\pi/4$, i.e. frequencies with duration between 6 and 32 quarters). We look at the *dynamic coherency* (measure three), which describes the strength of the comovement at certain frequencies disregarding their relative position in time. The *delay* (measure four) tells us by how many periods one series leads or lags the other series. The details of these spectral measures can be found in appendix A.

In addition, we address the question whether GDP (or one of its components) in one country (y) is helpful for forecasting the respective series in the other country (x). Therefore, we conduct simple Granger-causality tests as presented by Hamilton (1994) for one to four lags. The null hypothesis is that y does not Granger-cause x. We present the *p-value* of the Granger-causality test (measure five). A p-value smaller than the critical value implies that y does Granger-cause x.

Results for GDP and Demand Components

A visual inspection of the output gaps of GDP and its demand components (chart 1) reveals some first immediate results. First, the output gaps in Germany and Austria showed a smaller degree of comovement in the second half of the 1970s and the 1980s than thereafter. In Austria, this period was characterized by the adoption of a hard currency policy coupled with Keynesian deficit spending. In addition, the German economy suffered stronger from the first oil price shock in the 1970s than Austria. From 1990 onwards, the business cycles of both countries were much more synchronized. At the beginning of the 1990s, the economic effects of German reunification caused – not only in Germany itself but also in Austria – an economic boom followed the recession in 1993. The boom in 2000 and the following downturn as well as the recovery were largely driven by global factors and affected Germany and Austria to a similar extent.

Table 1 reports the measures of comovement presented above for the time from 1970 to 2007 as well as for both subsamples. The increase of the static correlation coefficient from 0.54 to 0.79 documents the strong increase in the synchronization of the two business cycles. Besides this increase in synchronization, their relative position in time has shifted. Whilst the Austrian business cycle was lagging behind the German cycle until the first half of the 1980s, it is now leading the German one. According to the average delay at business cycle frequencies, Austrian GDP was lagging behind German GDP by one quarter in the 1970s and is now leading by two quarters (chart 1). Overall, the cyclical position of Austrian GDP relative to Germany has moved by 3 quarters. Looking at the two subsamples, we see an average lag of 0.86 quarters for the period from 1970 to 1989 and an average lead of 0.99 quarters for the period from 1990 to 2005 (see table 1). Looking at maximum correlations at different leads/lags, we get a similar – albeit less precise

– result. The German economy was leading by one quarter in the period from 1970 to 1989. From 1990 to 2005, the maximum correlation is found at a lead of the Austrian economy of one quarter. The results from the Granger-causality test (table A-2) confirm our hitherto results. Whilst German GDP had predictive power for Austrian GDP in the first subsample, the change in the relative position in time has caused the Granger-causality to vanish (at least for up to two quarters). On the other hand, Austrian GDP does Granger-cause German GDP in the second subsample but not in the first one.

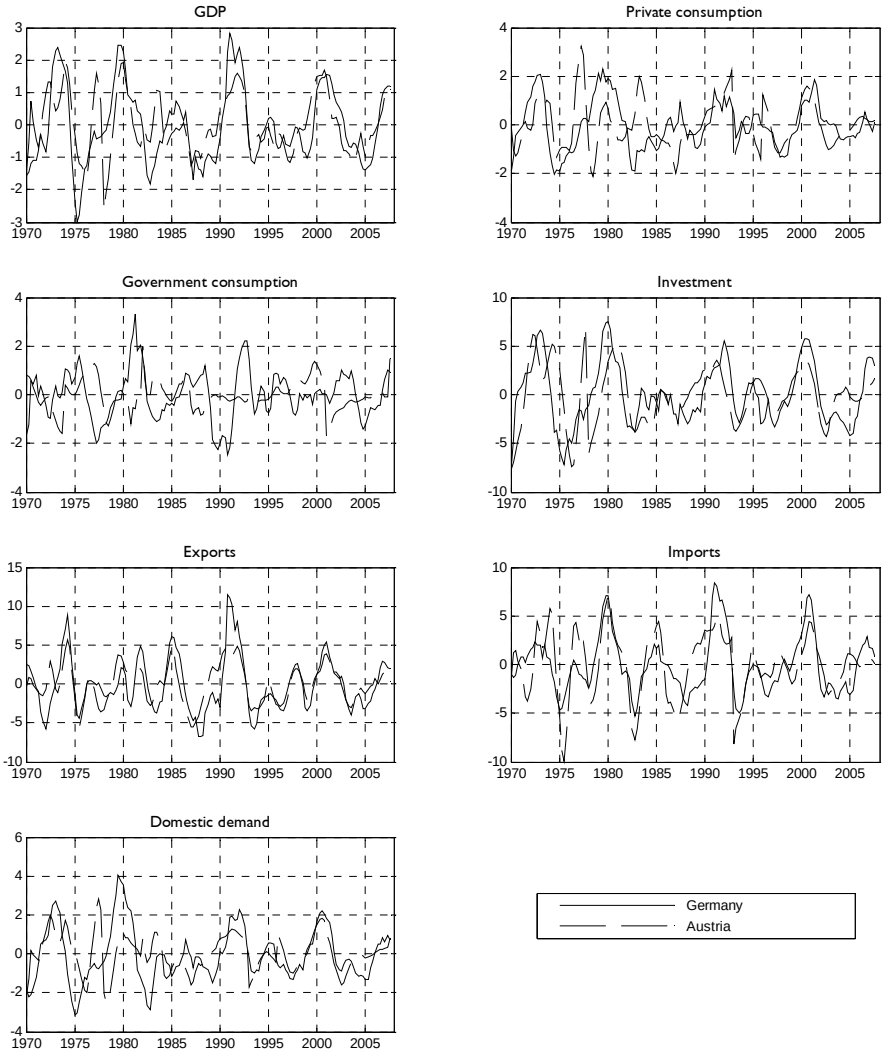
This increase in synchronization can be observed in almost all demand components, but is strongest in *private consumption*. Whilst consumption in both countries was almost uncorrelated in the first subsample, its comovement increased from 1990 onwards. A rising correlation of consumption patterns across countries can be well explained from a theoretical perspective. Under the assumption of strong wealth effects, cross border portfolio diversification can lead to highly correlated consumption patterns between countries.[5] Thus, the increasing financial linkages between Austria and Germany may have triggered the increase in synchronization in private consumption between both countries.

Government consumption behaved very differently in both countries. The second half of the 1970s in Austria was characterized by the increase in deficit spending to dampen the negative effects of the first oil price shock. In the 1980s, some efforts to consolidate the budget were undertaken. In the first half of the 1990s, German fiscal policy was clearly influenced by re-unification, which pushed up government expenditure and consequently increased the fiscal burden. Initial consolidation through spending restraint – given increasing debt and requirements for EMU accession – was undertaken from the mid-1990s onward. In Austria this consolidation phase started already in 1993, but was mainly driven by a rise of the fiscal burden.

Since Germany and Austria are both very open economies highly integrated into the international production process, it seems natural that *exports* are the demand component with the highest degree of comovement. Especially in the second subsample, the export performance of the two countries developed in parallel. A similar picture can be obtained for *imports*. The increasing synchronicity in foreign trade over time is a consequence of global trends that are also strongly visible in the bilateral trade flows between Germany and Austria. As shown in chapter three the share of intra industry trade flows and vertical integration between both countries is steadily increasing over time thereby boosting business cycle synchronization.

[5] Imbs (2004) gives an overview of theoretical and empirical results. For the increasing financial links between Austria and Germany see chapter 3.

Chart 1: Output Gaps for GDP and Demand Components in Germany and Austria from 1970 to 2007



Source: WIFO, Bundesbank, authors' calculations.

The fact that the Austrian business cycle was lagging the German one in the first subsample but is leading it in the second subsample seems to be mainly driven by the behavior of *investment*. Investment activity in Austria considerably lagged behind Germany until the mid-1980s and now leads the German investment cycle (chart 2). The erratic fluctuations of the delay of private consumption in the 1970s and 1980s and of government consumption over the whole horizon in chart 2 is due to the weak correlation (and hence to the low power of the spectral estimate) and can therefore not be interpreted.

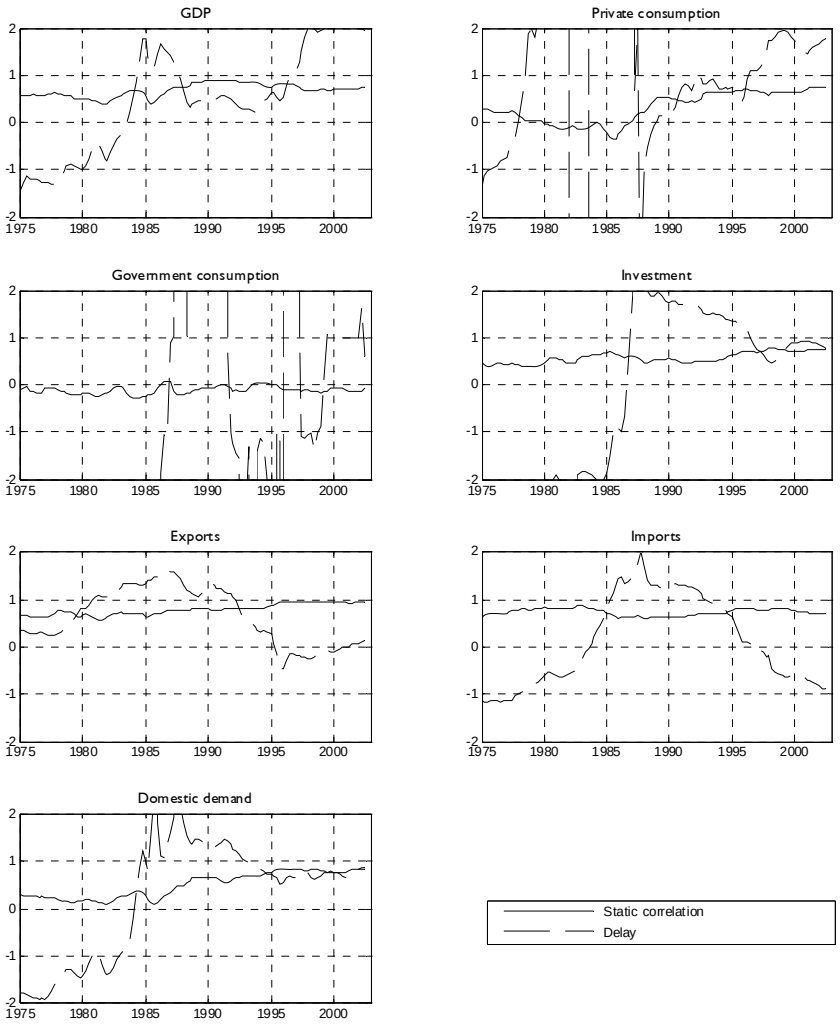
Table 1: Comovement between the Austrian and the German Economy between 1972 and 2007

	Static correlation			Dynamic	Dynamic	Delay
	Contemp.	Maximum		correlation	coherency	(quarters)
GDP						
1970Q1-2007Q3	0.64	0.64	0.00	0.66	0.66	-0.05
1970Q1-1989Q4	0.54	0.56	(-1)	0.56	0.56	-0.86
1990Q1-2007Q3	0.79	0.83	(1)	0.80	0.81	0.99
Private consumption						
1970Q1-2007Q3	0.29	0.39	(0)	0.30	0.31	0.22
1970Q1-1989Q4	0.14	0.16	(-1)	0.14	0.15	-0.77
1990Q1-2007Q3	0.64	0.72	-1	0.69	0.71	1.31
Government consumption						
1970Q1-2007Q3	-0.10	-0.25	(3)	-0.11	0.17	-6.02
1970Q1-1989Q4	-0.17	0.40	(-4)	-0.18	0.27	-5.38
1990Q1-2007Q3	0.00	-0.15	(4)	-0.01	0.04	-0.86
Investment						
1970Q1-2007Q3	0.52	0.58	(-2)	0.53	0.54	-1.77
1970Q1-1989Q4	0.48	0.71	(-3)	0.49	0.55	-2.58
1990Q1-2007Q3	0.64	0.67	(1)	0.65	0.66	1.01
Exports						
1970Q1-2007Q3	0.76	0.77	(1)	0.77	0.78	0.65
1970Q1-1989Q4	0.67	0.70	(1)	0.67	0.70	0.79
1990Q1-2007Q3	0.87	0.87	(0)	0.88	0.88	0.26
Imports						
1970Q1-2007Q3	0.66	0.66	(0)	0.67	0.68	-0.26
1970Q1-1989Q4	0.67	0.68	(-1)	0.67	0.68	-0.64
1990Q1-2007Q3	0.75	0.75	(0)	0.79	0.79	0.24
Domestic demand						
1970Q1-2007Q3	0.42	0.43	(-1)	0.43	0.43	-0.79
1970Q1-1989Q4	0.27	0.37	(-3)	0.27	0.30	-1.82
1990Q1-2007Q3	0.78	0.80	(1)	0.80	0.81	0.80

1) Numbers in brackets refer to lead (+) resp. lag (-1) (both in quarters) of Austria relative to Germany, at which the maximum correlation can be obtained.
2) At business cycle frequencies (i.e. 6 to 32 quarters).
3) +(-): Austria leads (lags) Germany.

Source: WIFO, Bundesbank, authors' calculations.

Chart 2: Comovement between German and Austrian GDP Demand Components between 1972 and 2007 (10 Year Rolling Windows, Centered [a])



[a] *The years refer to the centre of the 10 year window.*
Source: WIFO, Bundesbank, authors' calculations.

Production Side

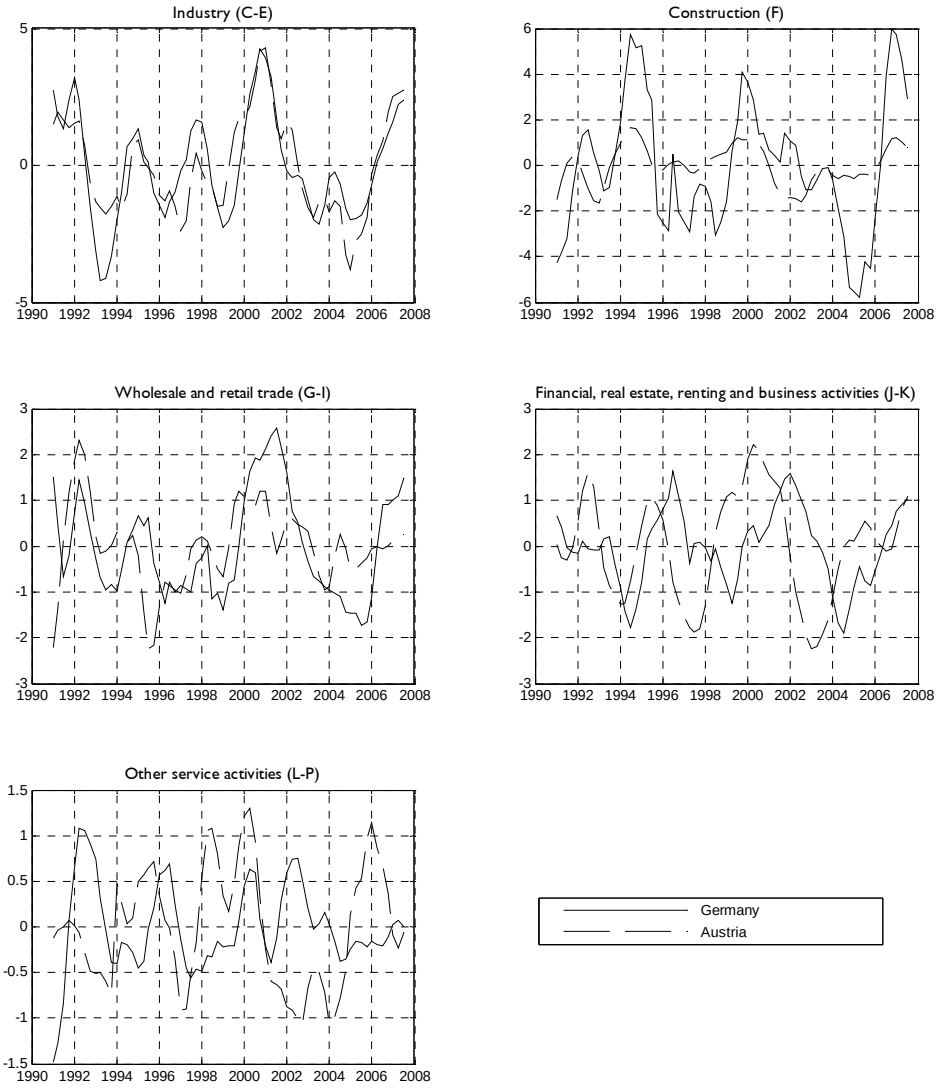
Now we turn to the production side of GDP. Our data set covers the period from 1991Q1 up to 2007Q3 for five sectors. Due to the short time span, we refrained from computing the comovement measures for subsamples and rolling windows. A look at chart 3 shows that the *industry* sector is the one with the highest degree of comovement. In addition, there is no systematic lead of one country. The *construction* cycles have a relatively high correlation coefficient of 0.54 (table 2), but very different amplitudes. The comovement of services is much weaker than for industry. The different behavior of d*istribution services* (NACE G-I) can be partly attributed to the special role of tourism in Austria. Although the *financial, real estate, renting and business activities sectors* (NACE J-K) are contemporaneously uncorrelated, the Austrian sector seems to lead its German counterpart by two quarters. *Other service activities* (NACE L-P) behave very differently in both countries. This result is not surprising, given the important role of public services in this sector.

Table 2: Comovement between the Austrian and the German Economy between 1991 and 2007 (Production Side)

	Static correlation			Dynamic correlation	Dynamic coherency	Delay (quarters)
	Contemp.	Maximum				
Industry (C-E)	0.81	0.81	(0)	0.82	0.82	-0.02
Construction (F)	0.55	0.60	(1)	0.56	0.58	0.99
Wholesale and retail trade (G-I)	0.36	0.54	(2)	0.41	0.44	1.81
Financial, real estate, renting and business activities (J-K)	0.07	0.66	(4)	0.06	0.36	1.78
Other service activities (L-P)	-0.12	-0.51	(-3)	-0.14	0.28	6.94

Source: WIFO, Bundesbank, authors' calculations.

Chart 3: Output Gaps of the Production Side of German and Austrian GDP 1991 to 2007



Source: WIFO, Bundesbank, authors' calculations.

3. Economic Ties between Austria and Germany

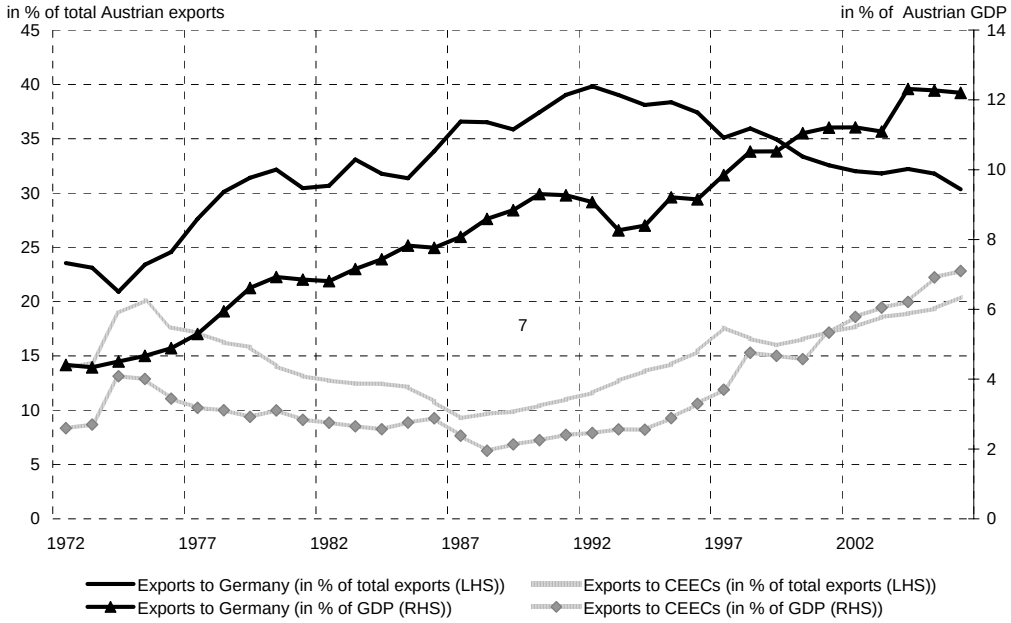
Intensive ties characterize the economic relations between Austria and its largest trading partner Germany. Whilst trade has always played an important role, financial integration became a strong growing link since the full liberalization of the capital account in Austria at the end of the 1980s.

Trade: Internationalization of Production Increases Trade Intensity

The development of Austria's exports over the last decades was characterized by three main trends: an overall strong increase of trade volumes, a surge in intra-industrial trade and a shift in the regional composition. Following a global trend, trade volumes increased markedly over the last decades. In the period from 1972 to 2006 exports grew almost twice as fast as output. Especially trade in goods showed a very dynamic development. The trade share (sum of total exports and imports in percent of GDP) increased from less than 60% to around 100%. Besides global developments like the decrease in transport and communication costs and the removal of trade barriers, the accession of Austria to the European Union and the European Monetary Union and the emergence of new markets in Central and Eastern Europe have played a major role.

Germany is by far Austria's most important trading partner and – in absolute terms – became more and more important over time. Exports of commodities to Germany in percent of Austrian GDP increased steadily from 4% in 1972 to 12% in 2006 (see chart 4). In relative terms, we see substantial changes of the importance of Germany over time. The share of exports to Germany in total exports increased steadily from 21% in 1974 until it peaked at 40% in 1992. Since then – contrary to the absolute role – the relative role of exports to Germany is declining.

Chart 4: Austrian Exports of Commodities to Germany and the CEECs[6]



Source: Statistics Austria.

The development of the export share of the CEECs mirrors this picture. Since the mid-1970s the share of exports to the CEECs shows a U-shaped profile. The declining role in relative as well as in absolute terms in the second half of the 1970s and in the 1980s is a consequence of Austria's policy towards integration into the European Union and the increased indebtedness of the CEECs. Since the opening up of Eastern Europe, the share of the CEECs in total Austrian exports is steadily increasing at the expense of Germany.

The surge in total trade volumes is also associated with the trend to intra-industrial trade and the phenomenon of vertical integration. According to the Grubel-Lloyd-Index, the share of intra-industrial trade with Germany increased from 47% in 1972 to 79% in 2004[7]. A high degree of intra-industrial trade is

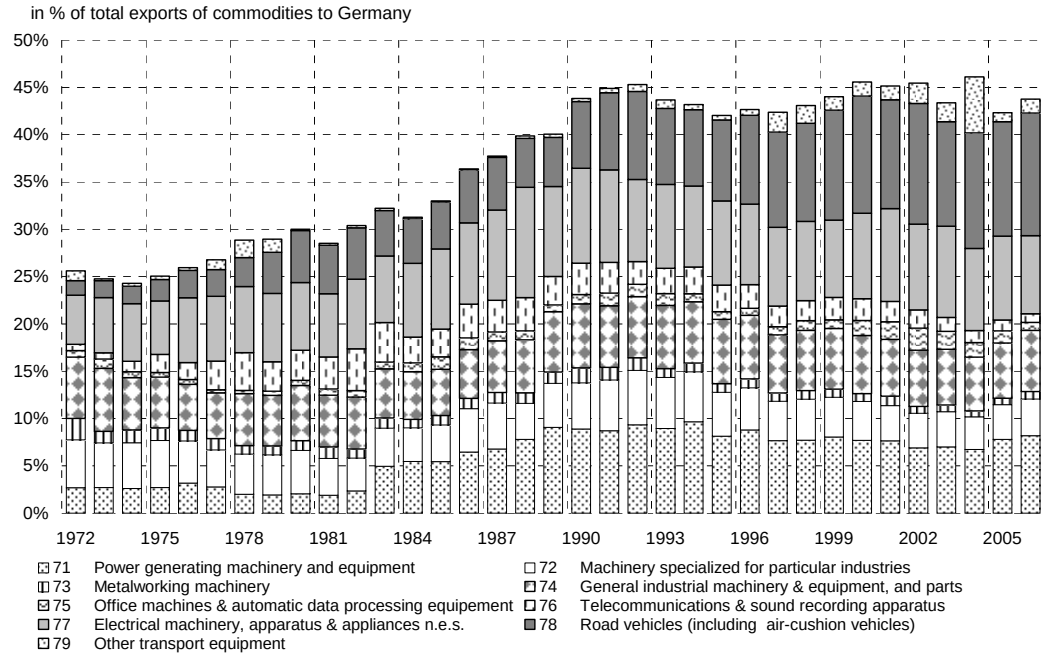
[6] CEECs includes Albania, Bulgaria, Croatia, Czech Republic, Slovakia, Poland, Romania, Hungary, Estonia, Latvia, Lithuania, Macedonia, Slovenia, Bosnia-Herzegovina, Russia, Ukraine, Belarus.

[7] The Grubel-Lloyd-Index measures the share of intra-industrial trade (IIT) as: $IIH = 1 - \sum_i |X_i - M_i| / \sum_i (X_i + M_i)$, where X_i und M_i denote the exports and imports

characteristic for developed economies with similar production structures and economies of scale in the production and leads to an increase in the synchronization of business cycles.

At the same time, the phenomenon of vertical integration as reflected by the emergence of cross-border production-chains gained importance. Hummels, Ishii and Yi (2001) show for a panel of 14 OECD countries that since the 1970s vertical integration accounts for 30% of export growth. Moreover, sectors that experienced the strongest export growth are those with a high degree of vertical integration. In the economic relations between Germany and Austria the dynamic development of the Austrian automotive supply industry is a prominent example. The sharp rise of the share of machinery and transport equipment in total exports from 26% in 1972 to 44% in 2006 and of the subcomponent road vehicles from 2% to 13% reflects that fact (see chart 5).

Chart 5: Composition of Austrian Exports of Machinery and Transport Equipment (SITC 7) to Germany



Source: OECD – OLIS database.

of commodities of sector i. The Grubel-Lloyd-Index is reported for two-digit SITC-commodities.

Foreign Direct Investment: Steady Growth of Outward FDI to CEECs

Financial integration developed even more dynamically than trade integration over the last 17 years. A detailed and comprehensive regional breakdown of international capital flows from and to Austria from 1990 onwards – the period of a fully liberalized capital account in Austria – is only available for foreign direct investments. Stocks of total inward and outward FDIs increased from 3% respectively 6% of GDP in 1990 to more than 20% each in 2005 (see table 3). Germany plays a dominating role in inward FDIs with a stable share of around 40%. Outward FDI is dominated by investment in the CEECs which grew very rapidly in recent years. Inward and outward portfolio investment grew at a similar pace as FDI.

Table 3: Stocks of Austrian Foreign Direct Investment

	1990	1995	2000	2003	2005
in % of total inward (outward) FDI					
Inward from Germany	38.2	41.9	46.8	39.9	38.2
Outward to Germany	24.4	19.4	19.0	16.1	12.7
Inward from CEECs	1.3	1.4	1.1	1.5	1.0
Outward to CEECs	11.0	28.0	30.1	36.8	43.6
in % of Austrian GDP					
Inward from Germany	2.4	3.5	7.3	7.5	9.2
Outward to Germany	0.7	1.0	2.4	3.2	2.9
Inward from CEECs	0.1	0.1	0.2	0.3	0.2
Outward to CEECs	0.3	1.4	3.8	7.2	9.9
Total FDI (mill. EUR)					
Total outward FDI (mill. EUR)	3,683	8,674	26,674	44,308	55,476
Total outward FDI (in % of GDP)	2.7	4.9	12.7	19.6	22.6
Total inward FDI (mill. EUR)	8,513	14,458	32,704	42,632	58,874
Total inward FDI (in % of GDP)	6.2	8.2	15.5	18.8	24.0

Source: OeNB.

4. Summary

In this paper, we have analyzed the comovement of the German and the Austrian economy. We find an increase of synchronization of the two business cycles over time. The relative position in time has shifted. Whilst the Austrian output gap was lagging behind the German one by one quarter at the beginning of the 1970s, it is now leading by two quarters. The increase in synchronization can be observed in all demand components with the exception of government consumption. Especially exports exhibit a nearly perfect comovement since 1990. Turning to the production side of GDP, we identify industry as the sector with the highest degree of comovement, whilst construction and the service sectors show much less

comovement. Summing up the results, we see no indication of a decoupling of the Austrian economy from Germany.

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Appendix A: Bivariate Spectral Analysis

Bivariate spectral analysis allows us to describe the relation between two time series by decomposing their covariances into components for different frequencies. Therefore we consider the multivariate spectrum $F_{\{x_t y_t\}}(\omega)$, which can be obtained by a Fourier transformation of the autocovariance matrix of the time series. The diagonal elements of $F_{\{x_t y_t\}}(\omega)$ are the spectra of the time series ($f_x(\omega)$, $f_y(\omega)$), whilst the off-diagonal elements capture the cross-spectrum ($f_{xy}(\omega)$). Since the cross-spectrum is in general a complex number, we can decompose it into a real and an imaginary part

$$f_{xy}(\omega) = c_{xy}(\omega) - iq_{xy}(\omega),$$

where the real part $c_{xy}(\omega)$ is the *co-spectrum* and the imaginary part $q_{xy}(\omega)$ is the *quadrature spectrum*. The *coherency* $C_{xy}(\omega) = \left| f_{xy}(\omega) \right| / \sqrt{f_x(\omega) f_y(\omega)}$ is the frequency domain analogue to the static correlation coefficient. It describes the

correlation between the two series at frequency ω. However, it gives us no information about their relative position in time, i.e. shifting one series in time does not affect the coherency. The phase $\varphi_{xy}(\omega) = \tan^{-1}\left(-q_{xy}(\omega)/c_{xy}(\omega)\right)$ measures the phase shift between the two series in radians. If the phase is > 0 then x_t leads y_t at frequency ω. The time delay $-\varphi_{xy}(\omega)/\omega$ transforms this information and tells us by how much periods series x_t leads/lags y_t. In addition to these well-known measures, Croux, Forni and Reichlin (2001) have proposed the dynamic correlation coefficient

$$\rho_{xy,0}(\omega) = \frac{c_{xy}(\omega)}{\sqrt{f_x(\omega) f_y(\omega)}},$$

which measures the contemporaneous correlation between the two series at frequency ω. Note that the dynamic correlation coefficient equals the static correlation coefficient when the two series move contemporaneously.

Appendix B: Tables

Table B1: Correlations for Different Lags and Leads between the Output Gap of German and Austrian GDP and Its Demand Components[1]

	GDP	Private consumption	Government consumption	Investment	Exports	Imports	Domestic demand
1970Q1-2007Q3							
4	0.29	0.14	-0.24	0.07	0.34	0.16	0.06
3	0.41	0.18	**-0.25**	0.19	0.50	0.31	0.16
2	0.51	0.23	-0.24	0.31	0.67	0.46	0.27
1	0.60	0.28	-0.18	0.42	**0.77**	0.59	0.36
0	**0.64**	**0.29**	-0.10	0.52	0.76	**0.66**	0.42
-1	0.61	0.27	-0.02	0.57	0.63	0.65	**0.43**
-2	0.53	0.20	0.03	**0.58**	0.40	0.54	0.39
-3	0.41	0.12	0.13	0.55	0.15	0.37	0.33
-4	0.26	0.04	0.19	0.46	-0.07	0.17	0.25
1970Q1-1989Q4							
4	0.10	-0.03	-0.32	-0.10	0.29	0.01	-0.14
3	0.21	-0.01	-0.34	0.04	0.45	0.18	-0.05
2	0.32	0.03	-0.35	0.17	0.61	0.37	0.06
1	0.46	0.09	-0.26	0.32	**0.70**	0.55	0.17
0	0.54	0.14	-0.16	0.48	0.67	0.67	0.27
-1	**0.56**	**0.16**	-0.04	0.59	0.49	**0.68**	0.31
-2	0.52	0.12	0.06	0.68	0.20	0.60	0.35
-3	0.44	0.06	0.26	**0.71**	-0.12	0.44	**0.37**
-4	0.32	0.01	**0.40**	0.69	-0.38	0.24	0.35
1990Q1-2007Q3							
4	0.61	0.52	**-0.15**	0.45	0.38	0.34	0.50
3	0.71	0.59	-0.11	0.56	0.57	0.51	0.64
2	0.80	0.66	-0.08	0.64	0.75	0.64	0.75
1	**0.83**	**0.72**	-0.05	**0.67**	0.86	0.73	**0.80**
0	0.79	0.64	0.00	0.64	**0.87**	**0.75**	0.78
-1	0.70	0.52	0.00	0.55	0.80	0.71	0.69
-2	0.57	0.39	-0.03	0.40	0.68	0.59	0.53
-3	0.40	0.29	-0.06	0.20	0.53	0.39	0.31
-4	0.21	0.13	-0.09	-0.02	0.34	0.16	0.09

[1] *'+' ('-'): Austria leads (lags) Germany.*
Source: WIFO, Bundesbank, authors' calculations.

Table B2: Tests for Granger-Causality between the Output Gap of German and Austrian GDP and Its Demand Components (pValues)

	H0: Germany does not Granger-cause Austria at				H0: Austria does not Granger-cause Germany at			
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
GDP								
1970Q1-2007Q3	0.07	0.00	0.00	0.13	0.59	0.08	0.02	0.00
1970Q1-1989Q4	0.04	0.04	0.02	0.56	0.26	0.55	0.36	0.02
1990Q1-2007Q3	0.17	0.13	0.00	0.00	0.00	0.00	0.00	0.35
Private consumption								
1970Q1-2007Q3	0.51	0.26	0.44	0.08	0.65	0.17	0.03	0.29
1970Q1-1989Q4	0.51	0.59	0.40	0.24	0.31	0.71	0.59	0.53
1990Q1-2007Q3	0.49	0.25	0.36	0.00	0.00	0.00	0.00	0.03
Government consumption								
1970Q1-2007Q3	0.17	0.49	0.01	0.02	0.05	0.14	0.03	0.01
1970Q1-1989Q4	0.18	0.54	0.00	0.02	0.04	0.15	0.02	0.00
1990Q1-2007Q3	0.69	0.85	0.94	0.70	0.80	0.66	0.70	0.98
Investment								
1970Q1-2007Q3	0.00	0.00	0.00	0.40	0.01	0.75	0.75	0.00
1970Q1-1989Q4	0.00	0.00	0.00	0.31	0.00	0.41	0.82	0.00
1990Q1-2007Q3	0.11	0.20	0.22	0.12	0.02	0.10	0.11	0.24
Exports								
1970Q1-2007Q3	0.02	0.14	0.00	0.00	0.00	0.00	0.00	0.02
1970Q1-1989Q4	0.01	0.03	0.00	0.02	0.00	0.37	0.00	0.02
1990Q1-2007Q3	0.85	0.01	0.01	0.00	0.00	0.00	0.00	0.03
Imports								
1970Q1-2007Q3	0.01	0.00	0.00	0.75	0.32	0.57	0.70	0.00
1970Q1-1989Q4	0.02	0.00	0.06	0.06	0.02	0.07	0.28	0.09
1990Q1-2007Q3	0.02	0.00	0.00	0.35	0.22	0.37	0.64	0.00
Domestic demand								
1970Q1-2007Q3	0.07	0.07	0.12	0.30	0.31	0.17	0.20	0.17
1970Q1-1989Q4	0.12	0.16	0.17	0.34	0.04	0.31	0.46	0.30
1990Q1-2007Q3	0.78	0.00	0.00	0.10	0.00	0.01	0.12	0.00

Table B3: Correlations for Different Lags and Leads between the Output Gap of German and Austrian GDP Production Side[1]

	Industry (C-E)	Construction (F)	Wholesale and retail trade (G-I)	Financial, real estate, renting and business activities (J-K)	Other service activities (L-P)
1991Q1-2007Q3					
4	0.14	0.22	0.27	**0.66**	0.07
3	0.38	0.39	0.43	0.58	0.07
2	0.60	0.54	**0.54**	0.44	0.07
1	0.76	**0.60**	0.50	0.26	0.01
0	**0.81**	0.55	0.36	0.07	-0.12
-1	0.75	0.40	0.29	-0.15	-0.30
-2	0.59	0.20	0.22	-0.35	-0.44
-3	0.39	0.03	0.14	-0.53	**-0.51**
-4	0.20	-0.11	0.10	-0.62	-0.48

[1]'+' ('-'): Austria leads (lags) Germany.
Source: WIFO, Bundesbank, authors' calculations.

Table B4: Tests for Granger-causality between the Output Gap of German and Austrian GDP Production Side (p-values)

	H0: Germany does not Granger-cause Austria at				H0: Austria does not Granger-cause Germany at			
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
Industry (C-E)	0.53	0.04	0.00	0.08	0.27	0.01	0.03	0.07
Construction (F)	0.02	0.90	0.94	0.10	0.01	0.01	0.03	0.98
Wholesale and retail trade (G-I)	0.83	0.20	0.13	0.01	0.00	0.01	0.00	0.06
Financial, real estate, renting and business activities (J-K)	0.00	0.08	0.00	0.00	0.00	0.01	0.03	0.07
Other service activities (L-P)	0.00	0.01	0.01	0.02	0.07	0.37	0.09	0.01

Source: WIFO, Bundesbank, authors' calculations.

Factors Driving Import Demand in Central and Eastern European EU Member States

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This study presents estimates of country-specific long-run import elasticities for EU Member States from Central and Eastern Europe and for Croatia. Our results confirm (1) the existence of a strong export-import link in most of the countries, (2) the prominent role of fixed investment in determining imports in nearly all countries and (3) with some exceptions, the relatively smaller role of private consumption for imports. Furthermore, this study uses import elasticities to test for economic interlinkages within the EU-27 and provides some indications on the implications of these results for countries with larger external imbalances.

1. Introduction

Research on factors that influence import demand has always been an active area of both theoretical and empirical economic study. This has often been motivated by the issues associated with external imbalances and their culmination into external debt problems. In this respect, appropriate estimates of import demand functions are generally of great interest when considering adequate policy responses.

This study focuses on the EU Member States of Central and Eastern Europe, here abbreviated as CEE-MS. Basically, these include the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia, which entered the EU on May 1, 2004, as well as Bulgaria and Romania, which became EU Member States on January 1, 2007. To the extent that it is possible, we also include Croatia, one of the candidate countries negotiating accession to the EU.

Most of the countries under review had non-negligible levels of current account deficits in recent years. However, a look at e.g. the most recent three-year averages reveals quite important differences between these countries (see table 1). In most countries, the deficit in the goods and services balance, i.e. the main component of the current account, contributed substantially to the current account deficit

(Slovakia, Estonia) or even exceeded it and was only to a minor extent offset by a surplus in the other sub-balances (Lithuania, Latvia, Bulgaria, Romania, Croatia). By contrast, in the Czech Republic, Hungary, Poland and Slovenia, a negative income balance was the main source of the current account deficit, while the goods and services balance posted a relatively small deficit (Hungary, Poland, Slovenia) or even a surplus, that was, however, not (yet) sufficiently high to finance the deficit in the income balance (Czech Republic).

Table 1: Development of the Current Account and the Goods and Services Balance in the CEE-MS and Croatia

	Three-year averages			EU Commission Forecast	
	1998-2000	2001-2003	2004-2006	2007e	2008e
Current account balance as a percentage of GDP					
Czech Republic	-3.1	-5.7	-4.1	-2.5	-2.1
Hungary	-7.5	-6.7	-6.6	-3.9	-1.5
Poland	-5.7	-2.5	-2.2	-3.3	-2.9
Slovenia	-2.2	-0.3	-2.8	-3.3	-2.6
Slovakia	-5.1	-7.0	-8.2	-4.2	-2.7
Estonia	-6.0	-8.6	-11.3	-13.6	-11.2
Lithuania	-9.5	-5.3	-7.3	-12.5	-12.9
Latvia	-7.4	-7.0	-14.4	-22.2	-18.9
Bulgaria	-3.5	-4.5	-10.6	-17	-16
Romania	-4.8	-4.6	-8.6	-12.8	-14.5
Croatia	-10.4	-4.3	-6.7	-8.5	-8.1
Goods and services balance as a percentage of GDP					
Czech Republic	-1.8	-2.2	1.1		
Hungary	-2.6	-2.5	-0.9		
Poland	-6.5	-3.1	-1.0		
Slovenia	-3.0	0.3	-0.9		
Slovakia	-5.4	-5.3	-4.0		
Estonia	-5.9	-5.5	-8.6		
Lithuania	-9.3	-5.5	-8.2		
Latvia	-9.7	-10.9	-17.3		
Bulgaria	-3.6	-9.4	-15.5		
Romania	-5.9	-7.0	-10.5		
Croatia	-12.4	-7.1	-7.4		

Note: The current account balances include the small surpluses on the capital account that stem primarily from EU transfers, except for the forecast values given for Croatia.

Source: European Commission Forecast Autumn 2007, Eurostat, national central banks, author's calculations.

In the study of import demand of these countries, which are all catching-up economies, it is of particular interest to examine the extent to which it is demand effects or price and exchange rate effects that drive import demand.
Moreover, within total demand effects, a further question relates to the relative importance of domestic demand versus that of foreign demand (exports). In other words, how strong is the export-import link? With respect to total domestic demand, another distinction can be made between (private) consumption and investment.
Finally, with respect to foreign demand, the question arises to what extent import demand is driven in particular by foreign demand that stems from a country's main trading partner – the EU-15 states, i.e. the EU Member States before the 2004 and 2007 enlargements, or else those EU Member States that joined the euro area before 2007 (euro area 12, EA-12). In other words, how strong is the interlinkage between imports within the EU-27?
A more profound insight into the factors that drive import demand in the CEE-MS may be helpful for understanding the ongoing process of European economic integration. It may also provide some hints for possible policy responses to address large external imbalances.
This study is structured as follows: Section 2 provides a brief survey of papers published on import demand functions. In section 3, we sketch a simple theoretical model that has been used in the literature to derive import demand equations and we present the main variables used to estimate these equations in practical terms. In section 4, we present some stylized facts on total final demand in the CEE-MS, as background information for interpreting the ensuing estimation results. In section 5, we set out the econometric issues involved in estimating import demand functions and explain the chosen econometric framework. Section 6 presents our estimation results, while section 7 briefly summarizes and concludes. The data we use for the CEE-MS import equations, data availability and limitations as well as possible structural breaks in the time series are outlined in the appendix.

2. Literature Survey

Given the quite comprehensive literature dealing with import demand functions, we will only mention a few papers that are often considered milestones in the analysis of import demand. While there are many country-specific papers in which import demand functions are estimated for one particular country, we focus on those that cover several countries, often grouped into developing versus developed countries.
Hoetthaker and Magee (1969) provided an early paper on income and price elasticities in world trade, in which they concluded that the import elasticity with respect to income is lower in developing countries than in developed economies.

Several years later, Goldstein and Khan (1985) of the International Monetary Fund (IMF) published a comprehensive overview on income and price effects in foreign trade, including estimates of price and income elasticities and related policy issues. Their overview includes both theoretical aspects and estimation methodologies. However, the approaches they described for estimating import demand functions are rather traditional, which is in particular attributable to the fact that the paper was written before cointegration analysis was introduced.

Among the studies that were published after the development of cointegration analysis and thus apply an error correction model (ECM), the earliest papers were by Deyak et al. (1993) for Canada, and Clarida (1994) for the U.S.A. (covering the period from 1968 to 1990, based on seasonally adjusted quarterly data), followed by Carone (1996) for the U.S.A., and Amano and Wirjanto (1997) for Canada and the U.S.A. (covering the period from 1960 to 1993, based on quarterly data).

Reinhart (1995) and Senhadji (1997), both of the IMF, applied a similar approach to a larger number of countries. Reinhart used data of 12 developing countries in the period from 1970 to 1991, pooled into regional blocks (3 African, 4 Asian and 5 Latin American countries). Apart from estimating import demand functions, she estimated also the elasticity of these countries' exports with respect to income in developed countries. Comparing such specific import elasticity with respect to income of developed countries (specific in that it is confined to imports from these developing countries) with her estimates of import elasticity with respect to the income in developing countries, she confirmed the results obtained by Hoetthaker and Magee (1969) that this elasticity is higher in developed economies than in developing countries. Senhadji (1997) came to the same conclusion on the basis of a sample comprising 77 countries.

More recently, Harb (2005) estimated a heterogeneous panel of 40 countries with 28 annual observations for each country. The data series start in different years and range from the mid-1960s to the late 1990s. Splitting his panel into developed economies and developing countries, he could only partially confirm the results obtained by Hoetthaker and Magee (1969).

In a narrower country focus, Tsionas and Christopoulos (2004) applied cointegration analysis to four EU countries (UK, FR, IT, NL) and the U.S.A. for the period from 1960 to 1999.

With respect to the CEE-MS, there are some advanced estimations of import demand functions for individual countries, e.g. Benacek et al. (2003) who performed a detailed study on the factors determining the Czech foreign trade balance by looking at both import and export functions at a disaggregated (two-digit NACE) level. In both functions they included several additional explanatory variables, e.g. the inward stock of foreign direct investment, apart from the main activity variable and relative prices. Moreover, they investigated these functions separately for trade with the EU and for trade with non-EU countries, highlighting the strong interdependence of imports from and exports to the EU.

Mroczek and Rubaszek (2004) estimated the volume of Poland's imports from the EU in the period from 1992 to 2002, taking weighted total final demand as the activity variable, while imposing a unity restriction on the income elasticity for the long-run relationship. Fic et al. (2005) present a multi-equation macroeconomic model of the Polish economy (ECMOD), which incorporates a module on the import volumes that includes a trend variable, potential GDP as activity variable (combined with a unity elasticity restriction) and relative import prices adjusted for oil price fluctuations and enhanced by the rate of customs duties in the cointegrating relationship. This model was estimated on the basis of quarterly data for the period from 1995 to 2004.

Benk et al. (2006) present the Hungarian Quarterly Projection Model (NEM), which incorporates an equation for import volumes that includes weighted total final demand (combined with a unity elasticity restriction) and the real effective exchange rate based on relative import prices in the cointegrating relationship.

The British National Institute of Economic and Social Research (NIESR, 2007) estimated import demand functions for the CEE-MS on the basis of quarterly data in the period from 1993 to 2003 by means of a panel that included the Czech Republic, Estonia, Hungary, Poland and Slovenia, in order to build the respective country modules within the institute's General Equilibrium Model (NiGEM).

However, to the best of our knowledge, no systematic estimates of import demand functions have been made for individual CEE-MS (and Croatia) that follow the same methodological approach.

3. Theoretical Background

Reinhart (1995) uses a simple theoretical model which – like that in Clarida (1994) and Amano and Wirjanto (1997) – serves to derive the import demand equation within a utility-maximizing framework. Harb (2005) provides a summary of this model and briefly outlines the differences in the approaches for estimating the import demand function between Reinhart's paper and that of Senhadji (1997).

In a small and open economy, an infinitely-lived representative rational agent consumes a non-traded home good and an imported good, given a stochastic endowment of the home good and the export good at each period t. Thus, the quantities of home good and imported good are chosen such that an infinite utility function, given in a discrete time setting by

$$(1)\quad \underset{\{h_t, m_t\}}{Max} \left\{ \sum_{t=0}^{\infty} \beta^t \left(\alpha \ln \left(h_t \right) + \left(1 - \alpha \right) \ln \left(m_t \right) \right) \right\}$$

with

h … non-traded home good, and

m … imported good (both consumed),
ß … time-preference parameter (<1)

is maximized, subject to the following budget constraint with respect to the external balance

$$(2)\quad A_{t+1}\left(\frac{p_x}{p}\right)_t = q_t + x_t\left(\frac{p_x}{p}\right)_t + (1+r^*)A_t\left(\frac{p_x}{p}\right)_t - h_t - m_t\left(\frac{p_m}{p}\right)_t$$

with
q … non-traded home good, and
x … exported good (both endowment)
px/p … relative export price
pm/p … relative import price
A … total (net) foreign bond (if debt, then A < 0)
r* … world interest rate

and given that the market clearing condition q = h is fulfilled at any time t.

Obviously, one major simplification is inherent in this model: Imports consist of final goods only, while in the real world they include final goods, intermediate goods and raw materials that are used for producing final goods for domestic consumption as well as investment goods and export goods.

The following two first-order conditions with respect to h and m

$$(3)\quad \frac{\alpha}{h_t} = \lambda_t$$

$$(4)\quad \frac{1-\alpha}{m_t} = \left(\frac{p_m}{p}\right)_t \lambda_t$$

yield the following import demand equation:

$$(5)\quad m_t = \frac{((1-\alpha)/\alpha)h_t}{(p_m/p)_t}$$

or, in its log-linear form:

$$(6)\quad \ln(m_t) = c + \ln(h_t) - \ln\left(\frac{p_m}{p}\right)_t$$

Trying to stick strictly to this simplified theoretical model in his empirical estimates for the U.S.A., Clarida (1994) calculates a proxy for the consumption of domestically produced (nondurable) consumer goods as the explanatory variable and uses imports of nondurable consumer goods as a proxy for consumption of imported nondurable goods.
By contrast, in an effort to adjust for the simplification introduced into this model, Senhadji (1997) equates qt + xt (px / p)t to GDP, effectively including public consumption and investment as well. Thus, by taking into account the market clearing condition, h equals GDP minus exports and the following equation results:

$$(7)\quad \ln(m_t) = c + \ln\left(GDP - x_t\left(\frac{p_x}{p}\right)_t\right) - \ln\left(\frac{P_m}{p}\right)_t$$

In a similar import demand equation like (6), Amano and Wirjanto (1997) construct the sum of private real consumption and aggregate real investment as their activity variable, arguing in favor of excluding public consumption, as "aggregate private [domestic] demand is an appropriate index of market demand for imported goods" (Amano and Wirjanto, 1997, p. 467).
Pointing to her "primary interest (…) to employ cointegration analysis to examine the "long-run" steady-state relationships that describe import demand," Reinhart (1997) develops a steady state solution starting from the budget constraint (see equation 2):

$$(8)\quad A\left(\frac{p_x}{p}\right) = q + x\left(\frac{p_x}{p}\right) + (1 + r^*)A\left(\frac{p_x}{p}\right) - h - m\left(\frac{p_m}{p}\right)$$

Taking into account the market clearing condition (q = h) yields the following import demand equation:

$$(9)\quad m = \frac{\left(x(p_x / p) + r^* A(p_x / p)\right)}{(p_m / p)}$$

or, in its log-linear form:

$$(10) \quad \ln(m) = \ln\left(\left(x + r^* A\right)\left(\frac{p_x}{p}\right)\right) - \ln\left(\frac{p_m}{p}\right)$$

Reinhart interprets (x+r*A), i.e. the sum of the endowment of exports plus the (possibly negative) interest income balance, as permanent income within this simplified model. In turn, specifying permanent income for estimation purposes, she takes GDP as a proxy.

In a similar vein, many other authors (for instance Tsionas and Christopoulos (2004)) also use GDP as the main activity variable when estimating import demand functions.

It has to be noted that these versions of import demand functions (i.e. equations 6 and 7, respectively, as well as 10) imply that imports have (1) a positive relationship with the activity variable, (2) a negative relationship with their relative price, and (3) unitary elasticities with respect to these explanatory variables (i.e. 1 and –1, respectively).

While the former version (equation 6) focuses mainly on domestic demand, the latter (equation 10) stresses the importance of foreign demand and the requirement of an equilibrium between exports and imports that takes into account the possible costs of financing (past) external imbalances.

Harb (2005) uses both Senhadji's and Reinhart's specifications for the activity variable and concludes that GDP (as opposed to GDP minus exports) yields a superior performance.

In building the Central and Eastern European country modules of NiGEM, NIESR combined both approaches by using total final demand for performing its panel estimate of import demand functions.

In this study, too, we do not use real total final demand as the main activity variable. However, for the testing equation, we split real total final demand into its main components: real private consumption (C), real gross fixed capital formation ("fixed investment", I), and real exports of goods and services (X). In doing so, we gain a deeper insight into the driving forces of imports of goods and services.

Following the line of Amano and Wirjanto (1997), we thus exclude public consumption from the estimation.

While the model presented above suggests unitary elasticity for both explanatory variables, according to Reinhart (1995) and Harb (2005), there are good reasons why these elasticities may deviate from unity. Among others, they mention the oversimplified nature of the theoretical model, and, related to this, the model assumption that imports consist of final goods only, and also the noise introduced by the use of proxies and measurement errors.

4. Structure of Total Final Demand in CEE-MS and Croatia: Some Stylized Facts

Table 2 shows the share of the main components of total final demand[1] in 2006.

Table 2: Total Final Demand of CEE-MS and Croatia in 2006

Shares in % (excluding change of inventories and statistical dicrepancy)

	Private Consumption	Public Consumption	Fixed Investment	Exports
Czech Republic	28.2	12.5	14.7	44.6
Estonia*	28.8	8.7	20.3	42.2
Lithuania	39.7	10.5	13.9	35.9
Hungary	30.7	12.7	12.5	44.1
Poland	44.4	12.8	14.0	28.8
Slovenia	32.0	11.4	15.3	41.3
Slovakia	30.6	9.7	14.1	45.6
Latvia	27.7	10.4	21.3	40.6
Bulgaria	39.1	9.8	14.8	36.2
Romania	48.2	12.4	17.0	22.4
Croatia*	36.4	13.1	19.4	31.1
EA-12	41.1	14.7	15.3	28.9

*Note: * "Fixed investment" includes change in inventories in case of Estonia (on a seasonally adjusted basis) and Croatia (on a not seasonally adjusted basis).*

Source: Eurostat, author's calculations.

Exports have the largest weight in total final demand in most of the CEE-MS that acceded to the EU on May 1, 2004, with the exception of Lithuania and Poland, where private consumption is the largest component. In Bulgaria, Romania and Croatia, private consumption has the largest weight, too. The structure of total final demand is quite similar in Lithuania, Bulgaria and Croatia. Poland's structure resembles that of the EA-12, while Romania shows a particularly low weight of exports combined with a particularly high weight of private consumption.

The share of fixed investment is considerably lower than that of exports and private consumption, but it is larger than that of public consumption in all countries, with the notable exceptions of Hungary (both are about equal in size).

The lower share of exports in the EA-12 as well as in Poland and Romania (partly) reflects the smaller degree of openness inherent in the larger size of the respective economic area's population and economy. Conversely, it could be expected that comparatively smaller economies would have larger shares of exports in total final

[1] Here, total final demand excludes the statistical discrepancy in all countries and the change of inventories in all countries except for Estonia and Croatia. The shares are calculated on the basis of nominal seasonally and working-day adjusted data in all countries except Bulgaria, Romania and Croatia, for which no seasonally adjusted data were available.

demand. However, the largest export shares are found not in the Baltic countries, but in the Czech Republic, Slovakia and Hungary. In case of the former two countries, this may be partly explained by the still remaining strong economic integration between the economies of these countries. Moreover, in these three countries the sizeable level of the inward stock of foreign direct investment has probably particularly enhanced the role of exports.
From another perspective, a relatively higher share of exports can be expected for catching-up countries, as exports tend to be valued at world market prices (at least when assuming that the law of one price holds for tradables), while non-tradables are usually still valued lower in these economies than tradables that are integrated in the world market.

5. Econometric Issues in Estimating Import Demand Functions

Since we are interested primarily in long-run import elasticities, we build an error correction model (ECM). The ECM includes the long-run cointegration relationship between the dependent variable and the explanatory variables as non-stationary time series in levels.
We perform unit root tests for all the variables taken so as to determine which variables to include in the long-run relationship as nonstationary in levels.
In performing the unit root tests, we follow the testing strategy outlined by Mosconi (1998). This is a three-step strategy that starts with an augmented Dickey-Fuller (ADF) test on the basis of an autoregressive model that includes both a trend and a constant. If the null hypothesis of a unit root can be rejected at the MacKinnon 5% level at this stage and the trend variable is significant, the time series is regarded as trend stationary. If the null hypothesis of a unit root cannot be rejected at the MacKinnon 5% level, a Fischer test is conducted for the joint hypothesis that both a unit root and no trend exist. If this joint hypothesis can be rejected, the time series is regarded as nonstationary (i.e. integrated of order one, I(1)) with a trend (and a constant).
In case that no significant trend can be established, the second step of this strategy consists in an ADF test on the basis of an autoregressive model that includes only a constant. Following the similar decision-tree as before, the time series is considered to be stationary (I(0)) with a constant or nonstationary (I(1)) with a constant. Alternatively, in case that no significant constant has been found, the third step – an ADF test on the autoregressive model without a constant – leads to the time series regarded as stationary (I(0)) without a constant or nonstationary (I(1)) without a constant.
Basically, only variables that are found to be nonstationary in levels (i.e. integrated of order one, I(1)) are then included in the testable cointegration relationship. However, if the null of the ADF test can be rejected at the MacKinnon 5%, but not

at the MacKinnon 10% level, we additionally examine the cointegration relationship including this variable. Moreover, given the economically ambiguous character of statistical trend stationarity, we also examine the cointegration relationship including the variable that was found to be trend stationary.
In designing the test for cointegration, we took account of the possible endogeneity among the variables in the form of a simultaneity bias. Therefore, we employ the dynamic ordinary least squares (DOLS) method (Stock and Watson, 1993) for estimating the cointegrating vector itself, by including lags and leads of the first differences of the explanatory variables. To the extent possible in view of the short time series, the optimal number of lags and leads is determined on the basis of the Schwarz criterion (SC).
Thus, the employed econometric framework consists of the following DOLS model:

$$(11) \qquad y_t = \beta_0 + \beta_1 x_{1,t} + \beta_2 x_{2,t} + \sum_{i=0}^{iopt} \eta_{1,i} dx_{1,t+i} + \sum_{j=1}^{jopt} \theta_{1,j} dx_{1,t-j} + \sum_{i=0}^{iopt} \eta_{2,i} dx_{2,t+i} + \sum_{j=1}^{jopt} \theta_{2,j} dx_{2,t-j} + e_t$$

The residuals resulting from estimating this model for the variables found to be nonstationary are then tested for stationarity by means of an ADF test. For evaluating the t-statistic of this unit root test (with the null hypothesis of a unit root being equivalent to no cointegration), we take not only the asymptotical MacKinnon critical values, but also the critical values corrected for the small sample size according to MacKinnon (1991), which turns out to have a considerable upward effect on these thresholds.
After having established cointegration, we rebuild the DOLS regression in first differences by including the lagged error correction term (ECT) that was derived from the first DOLS regression. This led to the following error correction representation of the DOLS regression:

$$(12) \qquad dy_t = c_0 + \gamma ECT_{t-1} + \delta_1 dx_{1,t-1} + \delta_2 dx_{2,t-1} + e_t$$

In this way, we estimate γ, i.e. the adjustment coefficient in the case of a disequilibrium in levels (as compared with the long-run relationship).

6. Results

The unit root tests on the stationarity of the involved time series show that all GDP components (M, C, I, X) can be considered nonstationary, i.e. I(1).

Table 3: Relative Import Price Level

Results of ADF-tests for unit roots in the time-series in levels

	nsa 2003		**nsa 2007**		**swa 2003**		**swa 2007**	
	1995q1-2003q4		1995q1-2007q2		1995q1-2003q4		1995q1-2007q2	
	p-value	type	p-value	type	p-value	type	p-value	type
Czech Republic (1)	0.0906	I(1)_t	0.0465	TS	0.0292	TS	0.0081	TS
Estonia	0.3732	I(1)	0.015	TS	0.0107	I(0)	0.1046	I(1)
Latvia (2)	0.2711	I(1)	0.1606	I(1)	n.a.	n.a.	0.6079	I(1)
Lithuania	0.3763	I(1)	0.283	I(1)	0.0001	I(0)_c	0.0115	I(0)_c
Hungary	0.1033	I(1)_t	0.0229	TS	0.034	I(0)	0.0275	I(0)
Poland	0.0012	I(0)_c	0.0005	I(0)_c	0.0155	I(0)_c	0.0071	I(0)_c
Slovenia	0.3435	I(1)	0.4574	I(1)	0.2048	I(1)	0.3886	I(1)
Slovakia	0.0747	I(1)_t	0.1094	I(1)_t	0.2778	I(1)	0.0941	I(1)
Bulgaria	0.0628	I(1)_t	0.0827	I(1)_t	n.a.	n.a.	n.a.	n.a.
Bulgaria 97 (3)	n.a.	n.a.	0.1145	I(1)_t	n.a.	n.a.	n.a.	n.a.
Romania (4)	n.a.	n.a.	0.9995	I(1)_c	n.a.	n.a.	n.a.	n.a.
Croatia (5)	n.a.	n.a.	0.3465	I(1)	n.a.	n.a.	n.a.	n.a.

Notes: The relative import price level is defined as the ratio between the import and the GDP price deflator.
swa: seasonally and working day adjusted
nsa: not seasonally (and not working day) adjusted
p-value: MacKinnon p-value type: Resulting type of time-series that the relative import prices are found to be based on the ADF test at the 5% (Mac Kinnon) significance level and on the Fischer-Test with respect to constant (and trend).
TS: trend stationary
I(1): integrated of order 1, i.e. non-stationary; I(1)tc: I(1) with trend and constant; I(1)c: I(1) with constant.
I(0): integrated of order 0, i.e. stationary; I(0)tc: I(0) with trend and constant; I(0)c: I(0) with constant.
(1): swa time-series starts only in 1996q1
(2): swa time-series starts only in 1999q1
(3): based on nsa time-series starting in 1997q3
(4): nsa time-series starts only in 2000q1
(5): nsa time-series starts only in 1997q1

Source: Author's calculations.

However, with respect to the relative import price level, the results are not fully clear cut (see table 3). In several cases, the relative import price level is found to be stationary.[2]

[2] In particular, the relative import price level can be considered stationary in Poland for both types of data (not seasonally adjusted (nsa), and seasonally and working day adjusted (swa) and in both periods (from 1995 to 2003 and from 1995 to 2007). The same is true for Hungary and Lithuania for swa data in both periods, as well as for Estonia for swa data in the first period. Given the large swings in the exchange rate in both directions in Poland and Hungary and the particularly high pass-through of import prices in very

Moreover, the relative import price level was found to be trend stationary in particular in the Czech Republic, but also to some extent in Estonia and Hungary.
Finally, in Slovakia and Bulgaria and partly in the Czech Republic and Estonia, the null of a unit root could not be rejected at the MacKinnon 5% level of statistical significance, but roughly at the 10% level. For these cases, we examined both possible cointegration relationships, including and excluding the relative import price level. Similarly, we applied the same approach to the cases of trend stationary time series.
According to the results of the cointegration test, the share of countries in which the MacKinnon critical values (increased in absolute terms by correcting for the small sample size) is surpassed (in absolute terms) is considerably higher for seasonally adjusted data than for not seasonally adjusted data (see table 4). In the period up to 2007, 5 out of 11 countries surpass the threshold for nsa data, while 7 out of 8 countries exceed it for swa data. This difference is not very surprising, as the DOLS regression includes lags and leads of the explanatory variables in first differences, which are more meaningful in case of seasonally adjusted quarterly data and thus capture possible endogeneity in a better way.
Moreover, for both types of data, a significant cointegration relationship could be established more often in the period up to mid-2007 than in the period up to 2003. While the lengthening of the time series alone might have produced this result, given the smaller increase of the critical values as a result of the small-sample correction, the effect of this change in the size of the critical values is in fact rather small. Looking at the CEE-MS that acceded to the EU on May 1, 2004, the long-run relationship among the main GDP components seems to have strengthened with EU accession. These results confirm the observation that there was no asymmetric shock to aggregate imports that would have been unrelated to the developments in other main components as a result of EU accession.

small and open economies, this result is economically plausible for the time periods considered.

Table 4: Co-Integration of Imports and Main Components of Total Final Demand

		nsa 2003			**nsa 2007**			**swa 2003**			**swa 2007**		
		1995q1-2003q4			1995q1-2007q2			1995q1-2003q4			1995q1-2007q2		
		t-stat	crit 5%	crit 10%	t-stat	crit 5%	crit 10%	t-stat	crit 5%	crit 10%	t-stat	crit 5%	crit 10%
Czech Republic (1)	A	-2.13	-4.85	-4.46	-2.24	-4.71	-4.35	-2.27	-4.95	-4.53	-3.41	-4.73	-4.37
	B	-0.41	-4.45	-4.07	-1.37	-4.33	-3.98	-2.97	-4.48	-4.09	-2.93	-4.35	-4.00
Estonia	A	**-7.41**	-4.95	-4.53	-2.30	-4.79	-4.42				**-4.61**	-4.77	-4.40
	B				**-6.76**	-4.32	-3.98	**-4.19**	-4.42	-4.05	**-4.88**	-4.32	-3.98
Latvia (2)	A	-3.45	-4.84	-4.45	**-4.86**	-4.71	-4.36	n.a.	n.a.	n.a.	**-4.55**	-4.85	-4.46
Lithuania	A	-2.23	-4.84	-4.45	-2.33	-4.71	-4.36						
	B							**-4.07**	-4.43	-4.06	**-4.22**	-4.33	-3.98
Hungary	A	-2.05	-4.88	-4.48	-1.36	-4.72	-4.36						
	B				-2.25	-4.34	-3.99	-3.31	-4.43	-4.06	**-5.00**	-4.33	-3.98
Poland	B	-0.89	-4.47	-4.08	-2.48	-4.34	-3.99	**-7.91**	-4.42	-4.05	**-6.60**	-4.33	-3.98
Slovenia	A	-1.76	-4.88	-4.48	**-8.62**	-4.71	-4.35	**-6.20**	-4.88	-4.48	**-5.22**	-4.71	-4.35
Slovakia	A	**-6.60**	-4.84	-4.45	**-6.85**	-4.71	-4.36	**-4.90**	-4.87	-4.47	**-5.01**	-4.70	-4.35
	B	**-6.75**	-4.43	-4.06	**-7.40**	-4.33	-3.99				**-4.93**	-4.32	-3.98
Bulgaria	A	**-8.23**	-4.87	-4.47	-3.70	-4.73	-4.37	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	B	-3.10	-4.47	-4.08	-3.45	-4.35	-4.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Bulgaria 97 (3)	A	n.a.	n.a.	n.a.	-2.60	-4.78	-4.41	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Romania (4)	A	n.a.	n.a.	n.a.	-2.18	-4.93	-4.52	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Croatia (5)	A	n.a.	n.a.	n.a.	**-6.41**	-4.79	-4.42	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Note: A: co-integration relationship includes relative import price
B: co-integration relationship excludes relative import price
crit 5%, crit 10%: critical values corrected for the small sample size according to MacKinnon (1991)
swa: seasonally and working day adjusted
nsa: not seasonally (and not working day) adjusted
Values in bold letters indicate significant co-integration relationship.
(1): swa time-series starts only in 1996q1
(2): swa time-series starts only in 1999q1
(3): based on nsa time-series starting in 1997q3
(4): nsa time-series starts only in 2000q1
(5): nsa time-series starts only in 1997q1

Source: Author's calculations.

The estimated adjustment coefficient is found to be negative in all cases in which a significant cointegration relationship can be established. Thus, any disequilibrium in the lagged long-run relationship, i.e. ECT (–1), induces corrective changes in aggregate imports toward the long-run equilibrium ("ECT acts as attractor"). In fact, this is what is required for the stability of the long-run equilibrium.
The long-run import elasticities that are recovered from the significant cointegration relationships are summarized in table 5.

Table 5: Long-Run Elasticity of Imports with Respect to Main Components of Total Final Demand

Coefficients in bold letters (with corresponding p-values in italic letters below)

		nsa 2003 1995q1-2003q4			**nsa 2007** 1995q1-2007q2			**swa 2003** 1995q1-2003q4			**swa 2007** 1995q1-2007q2		
		C	**I**	**X**	**C**	**I**	**X**	**C**	**I**	**X**	**C**	**I**	**X**
Estonia	A	**-0.03**	**0.35**	**0.77**							**0.22**	**0.24**	**0.67**
		0.89	*0.00*	*0.00*							*0.01*	*0.00*	*0.00*
	B				**0.13**	**0.14**	**0.81**	**0.04**	**0.21**	**0.78**	**0.10**	**0.20**	**0.75**
					0.27	*0.06*	*0.00*	*0.70*	*0.00*	*0.00*	*0.20*	*0.00*	*0.00*
Latvia (1)	A				**0.57**	**0.29**	**0.24**				**0.53**	**0.60**	**-0.22**
					0.00	*0.00*	*0.11*				*0.09*	*0.01*	*0.21*
Lithuania	B							**0.18**	**0.32**	**0.57**	**0.23**	**0.31**	**0.62**
								0.08	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Hungary	B										**-0.21**	**0.72**	**0.71**
											0.05	*0.00*	*0.00*
Poland	B							**0.28**	**0.57**	**0.55**	**0.44**	**0.49**	**0.50**
								0.28	*0.00*	*0.00*	*0.04*	*0.00*	*0.00*
Slovenia	A				**-0.10**	**0.21**	**0.80**	**-0.37**	**0.29**	**0.65**	**0.14**	**0.25**	**0.70**
					0.53	*0.00*	*0.00*	*0.51*	*0.04*	*0.00*	*0.54*	*0.00*	*0.00*
Slovakia	A	**0.24**	**0.32**	**0.89**	**1.01**	**0.06**	**0.58**	**0.89**	**0.14**	**0.65**	**1.06**	**0.09**	**0.57**
		0.30	*0.00*	*0.00*	*0.00*	*0.40*	*0.00*	*0.00*	*0.16*	*0.00*	*0.00*	*0.09*	*0.00*
	B	**1.00**	**0.08**	**0.53**	**1.07**	**0.05**	**0.49**				**1.19**	**0.09**	**0.44**
		0.02	*0.53*	*0.00*	*0.00*	*0.50*	*0.00*				*0.00*	*0.11*	*0.00*
Bulgaria	A	**-0.58**	**0.55**	**0.71**									
		0.05	*0.00*	*0.00*									
Croatia (2)	A				**0.50**	**0.66**	**0.09**						
					0.01	*0.00*	*0.10*						

Note: A: co-integration relationship includes relative import price
B: co-integration relationship excludes relative import price
crit 5%, crit 10%: critical values corrected for the small sample size according to MacKinnon (1991)
swa: seasonally and working day adjusted
nsa: not seasonally (and not working day) adjusted
(1): swa time-series starts only in 1999q1
(2): nsa time-series starts only in 1997q1

Source: Author's calculations.

In most countries, the import elasticity with respect to exports was found to be highly significant, and usually also higher than the import elasticity with respect to the other main components of total final demand. This confirms the hypothesis of a significantly strong export-import link in these countries. Apart from the fact that the relatively high share of exports in total final demand supports this result, it is consistent with the observation that each of these countries can be considered a small and open economy that flexibly participates in international trade and division of labor. More specifically, a strong export-import link may be explained – inter alia – by the high stock of export-oriented inward FDI in these countries. It may even partly consist of intra-company trade within transnational corporations. In some cases, the export-import link may reflect a country's role as transit country between the EU-15 and Russia.

However, there are some deviations from this general finding. In Poland (up to 2003), and in Hungary and Slovakia, the import elasticity with respect to exports is clearly significant and high, too, but it is slightly smaller than the import elasticity with respect to fixed investment in Poland and Hungary, and considerably smaller than the import elasticity with respect to private consumption in Slovakia.
A different type of exception is observed in Croatia and Latvia in that the import elasticity with respect to exports on the basis of nsa data is significant only at roughly the 10% level and, in addition, it is relatively small. Moreover, it is insignificant on the basis of swa data for Latvia.
Gross fixed capital formation is found to have generally the second-highest or, in a few cases, as mentioned above, even the highest significant import elasticity impact among the final demand components of these countries, even though its share in total final demand usually ranks only third. In Hungary and Croatia, and partly also in Poland and Latvia, fixed investment is the component with the highest import elasticity, so that exports (Hungary, partly Poland) or consumption (Croatia, partly Latvia) rank second. The notable exception to this pattern is Slovakia, where import elasticity with respect to investment is mostly insignificant or significant only at the 10% level and relatively small.
The import elasticity with respect to private consumption is insignificant in nearly one-half of the established cointegration relationships. Where it is significant, it is generally lower than the import elasticity with respect to both exports and fixed investment, despite the generally relatively large share of private consumption in total final demand. This is certainly not unexpected, given the low income levels of most people that does not allow them to buy large quantities of imported goods or goods with a large import content. The combination of a relatively large share in total demand and a relatively small import elasticity implies that the import content of one (additional) unit of private consumption is far below that of one (additional) unit of fixed investment or exports. However, there are exceptions to this general finding: In Slovakia, Latvia and Croatia, the import elasticity with respect to private consumption is the highest (Slovakia, partly Latvia) or the second-highest (Croatia, partly Latvia) among the demand components' import elasticities.
Summing over these three main components of total final demand yields an import elasticity of total final demand that ranges from 0.6 to 1.7. While the import elasticity is below one only in four cases, Slovakia and Poland showed particularly high import elasticities in all estimations. The median across both types of data and both periods under consideration stood at 1.15. This is close to the result of a panel cointegration for some CEE-MS in the period from 1993 to 2003 (1.24) that was conducted by NIESR (2007) and is used in the NiGEM modules for individual CEE-MS.
Another perspective focuses on import elasticities with respect to the main components of total final demand in particular for countries with larger external imbalances, like Estonia, Lithuania, Latvia, Bulgaria and Croatia.

If these countries show also a high import elasticity with respect to exports (as Estonia, Lithuania and Bulgaria do), it may be quite difficult for them to overcome the gap in the goods and services balance only by increasing exports. At the same time, if countries with large external imbalances display an import elasticity with respect to private consumption that is significant (as our results suggest for most of the above-mentioned countries), this may provide, to some extent, a possible channel for diminishing the gap in the trade balance, even though this elasticity may be smaller than that of other demand components. In fact, in some of the countries concerned this elasticity was found to be even relatively high.

In a final step, we tested for the strength of the economic interlinkages within the EU-27 as measured by CEE-MS import elasticities. The basic idea of this approach is to take into account the asymmetric size relations between the EU-15 (or else EA-12) on the one hand, and the CEE-MS and Croatia on the other. While the former have a large share in the CEE-MSs' total external demand, the reverse is not true. It follows that the total imports of the EU-15 (EA-12) have a decisive impact on the total exports of individual CEE-MS. Hence, we may hypothesize that the total imports of the EU-15 (EA-12) also have a significant indirect influence on total imports of individual CEE-MS, taking into account their generally strong export-import link. To examine this hypothesis, we substitute total exports of individual CEE-MS in the import demand equations of these CEE-MS by total imports of EU-15 (EA-12) that yield testable relationships.

In Estonia, Hungary, Slovakia, Slovenia and Bulgaria, significant cointegration relationships between imports, private consumption, fixed investment and total imports of EU-15 (EA-12) are found. In these cases, the import elasticity with respect to total imports of EU-15 (EA-12) was significant. (As before, some of these cointegration relationships exclude the relative import price level, while some others include it.) This import elasticity is roughly at or above 1 in all cases, with the exception of Slovakia where it is between 0.25 and 0.40. The latter result is also considerably lower than the corresponding import elasticity of private consumption in Slovakia– similar to what is the case in Slovakia when exports are included in the import demand equation.

In general, these results (a strong impact of total EU-15 (EA-12) imports on CEE-MS imports) reflect important economic interlinkages between these country groups within the EU-27 and are indicative of advanced economic integration.

6. Conclusions

In this study we made systematic estimates of long-run import elasticities for individual CEE-MS and Croatia, following the same methodological approach on the basis of two types of quarterly data (not seasonally adjusted and seasonally adjusted) for the periods from 1995 (first quarter) to 2003 (fourth quarter) and 1995 (first quarter) to 2007 (second quarter).

Our results confirm the existence of a strong export-import link in all countries under study with the exception of Croatia and Latvia. This appears to reflect the relatively high share of exports in total final demand, the flexible participation of these small and open economies in international trade and in the international division of labor, the high stock of export-oriented inward FDI in these countries, intra-company trade by transnational corporations and, in some cases, the countries' role as transit countries between the EU-15 and Russia.

Second, we have found confirmation of the prominent role of fixed investment in determining imports in all countries except Slovakia, despite the relatively small share of gross fixed capital formation in these countries' total final demand.

Third, our results show that the role of private consumption in determining import developments is generally smaller than that of exports or fixed investment. However, Slovakia, Croatia and Latvia are exceptions where private consumption has the strongest or second-strongest elasticity impact among these three main components of total final demand.

In countries with larger external imbalances, a strong export-import link (e.g. Estonia, Lithuania and Bulgaria) renders it more difficult to overcome the gap in the goods and services balance by only increasing exports. However, in most of the countries with larger external imbalances, the import elasticity with respect to private consumption has been found to be significant in recent years, which may provide a possible channel for diminishing the gap in the trade balance. This is true in particular for countries where this elasticity was found to be relatively high (e.g. Croatia and Latvia).

We tested for economic interlinkages between the EU-15 (or EA-12) and the CEE-MS within the EU-27 by using total imports of the EU-15 (or EA-12) instead of the individual CEE-MSs' total exports in the estimated import demand equations of these individual countries. In one-half of the countries under study, the impact of total imports of EU-15 (EA-12) on the individual CEE-MSs' imports has been significant and sizeable, which corroborates a high degree of economic integration within the EU-27.

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Appendix

Estimating Import Demand Functions for CEE-MS and Croatia: Data Issues

For most CEE-MS and also for Croatia, annual time series are not available for a sufficiently long period. Moreover, if they are available, the fundamental structural break due to the systemic transformation recession in the early 1990s renders any regression across this break very questionable.

Therefore, to have a sufficient number of observations, we have to use quarterly data. For most CEE-MS, both types of data are available – not seasonally adjusted quarterly time series (which are not working day adjusted, either) as well as seasonally and working day adjusted quarterly time series.
More precisely, not seasonally adjusted (nsa) quarterly data are available from EUROSTAT in level form (as chain-linked volumes with the reference year 2000) for

- Estonia (EE) and Slovakia (SK) for the period from 1993q1 to 2007q2;
- Bulgaria (BG), the Czech Republic (CZ), Latvia (LV), Lithuania (LT), Hungary (HU), Poland (PL), Slovenia (SI) for the period from 1995q1 to 2007q2;
- Croatia (HR) for the period from 1997q1 to 2007q2;
- and Romania (RO) for the period from 2000q1 to 2007q2.

Seasonal and working day adjusted (swa) quarterly data are available from EUROSTAT in level form (as chain-linked volumes with the reference year 2000) for

- Estonia (EE), Lithuania (LT), Hungary (HU), Poland (PL), Slovenia (SI), Slovakia (SK) for the period from 1995q1 to 2007q2;
- the Czech Republic (CZ) for the period from 1996q1 to 2007q2;
- and Latvia (LV) for the period from 1999q1 to 2007q2.

For Bulgaria (BG), Romania (RO) and Croatia (HR) swa data were not yet available.
Thus, while in most cases the quarterly time series are long enough to run least-squares regressions, a "small sample correction" for deriving fully appropriate critical values was required in all cases when testing for cointegration.

We performed estimations of import demand functions using both not seasonally adjusted (nsa) data as well as seasonally and working day adjusted (swa) data.

Clearly, the main advantage of using nsa data was that we could derive comparable results also for Bulgaria, Romania and Croatia.

Concerning the choice of the sample, we tried to get a comparable length for nsa and swa data, implying that we had to shorten somewhat the length of the time series available in case of Estonia and Slovakia as well as the Czech Republic. In the case of Bulgaria, we made an additional estimate based on a sample ranging from 1997q3 to 2007q2, given the severe financial crisis in 1996/1997 and the setup of the currency board regime on July 1, 1997.

For the CEE-MS that acceded to the European Union on May 1, 2004, we additionally performed the estimations on the basis of a shorter sample ranging from the start of the time series up to 2003q4, as one might suspect a potential structural break in the countries' external trade relations in the run-up to EU accession.

Estimates of Gains from Further Multilateral Trade Liberalisation: Should They Differ?

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The multilateral trade negotiation process can be portrayed as having three phases or components: conceptual, technical and political (Meilke *et al*., 1996). Positive economic analysis strives to be objective and, as such, does not directly deal with political aspects of negotiations although, certainly, it is often conducted in a political context or focuses on questions where political stakes are highest. In the context of multilateral trade negotiations positive economic analysis can undoubtedly help to deliver information on the stakes involved in order to help frame the negotiations and to highlight the distribution of costs and benefits of various options. At the same time, however, the analysis can be conducted in a tendentious manner (McDougal, 1993) or the findings can be used selectively by politicians, journalists or economists themselves to support certain predetermined positions or arguments.

Continuing enhancements in economic theory, modelling approaches and data quality are helping analysts to provide ever more integrated views of the implications of changes in the world trading system and levels of trade protection. At the same time the modelling frameworks become more complex and less readily accessible to non-specialists. This and the growing abundance of alternative modelling approaches are important factors underlying the recent concerns about the usefulness of quantitative analysis for policy making (see e.g. Piermartini and Teh, 2005).

[1] This paper presents work in progress. The author is an economist at the Organisation for Economic Co-operation and Development (Przemyslaw.Kowalski@oecd.org) and the material presented here draws on work carried out within the OECD Secretariat, in particular on OECD (2003), Kowalski (2006), Kowalski (2006b), Nordas, Miroduot and Kowalski (2006) as well as on other material. The views presented are strictly those of the author and do not necessarily represent the views of the OECD or its member countries or co-authors of the aforementioned papers. Useful comments by participants of the presentation at the WIIW/OeNB/WKO Workshop "International Trade & Domestic Growth, Vienna, 27. September 2007.

It is argued in the current paper that the richness of these approaches and alternative estimates of gains from further liberalisation is not necessarily undesirable and can in fact be seen as a part of an organic analytical process. The differences in results from alternative modelling approaches can be very often linked to diverging views about economic realities (e.g. the likelihoods of alternative negotiation outcomes) or assumptions about specific economic mechanisms (e.g. model closures) or estimates of behavioural parameters (such as trade elasticities). Also, naturally, the differences can sometimes be traced back to data quality. However, in a limited number of instances the differences in existing results can be artefacts of the employed methodology with, for instance, different regional or sectoral aggregations of the same model generating quantitatively, and occasionally qualitatively, different predictions.

The reminder of this paper first elaborates on various sources of gains from trade in trade theory and the applied general equilibrium models. Next, it discusses a number of recent sets of estimates of gains from the Doha Round and broadly discusses the differences in their underlying economic assumptions, starting with certain specificities of the Doha Round negotiations that contribute to the uncertainty with respect to the likely negotiating outcomes. The paper does not attempt a systematic reconciliation of similarities and differences of specific assumptions, model structures and differences in results but rather identifies certain broad types of differences with a view to help in their interpretation.

2. Sources of Gains from Trade in Theory and in Applied Trade Models

Chart 1 below reproduces a graphical representation of a textbook trade model (see e.g. Caves, Frankel and Jones, 2002) that can be used to illustrate what types of gains from trade are represented well or less well in the currently used applied general equilibrium models. It describes an economy that produces two goods (*X* and *Y*) and has internal terms of trade represented by the *TT* line, the slope of which is determined by tangency to the production possibility frontier (PPF) and the highest aggregate utility curve achievable in autarky (y_0). In autarky the country will produce and consume at point *A* achieving utility y_0. What international trade offers to this country is a possibility to trade goods *X* and *Y* at a relative price that is different form *TT*, for instance TT_1. No matter which good becomes more expensive relative to autarky the country as a whole can benefit from pure exchange at external terms of trade by producing the same bundle *A* as in autarky, trading it at the external terms of trade TT_1 and consuming a bundle *B* that is ranked higher on the preference map (at y_1). In the particular case presented in chart 1 the country imports good *Y* and exports *X*. The difference between y_1 and y_0 represents the so called "gains from pure exchange" since the welfare increase does

not involve a change in production structure of the country, just the trading activity.

It is clear that the country can gain even more by specializing more in the good *Y* that became more expensive with opening up to trade. In such a case utility maximization would take this country to production bundle *C* and consumption bundle *D* characterized by the yet higher utility level y_2. The country would export even more of *Y* and import more of *X* which would require shifting of production factors across sectors.[2] In this case the difference in utility levels (y_2–y_1) represents the additional "gains from specialization" or "allocative efficiency" gains. The latter term refers to an allocation of production factors that is more efficient at locus *C*, than for instance at locus *A*, according to the world terms of trade TT_1. It is also possible to use the same diagram to illustrate the so-called terms of trade effects that can be either positive or negative. On the one hand, if the terms of trade change so that Y becomes even more expensive relative to *X* the country that produces momentarily at point *C* will enjoy even higher level of welfare. On the other hand, if the terms of trade of *Y* fall, the country will be affected negatively.

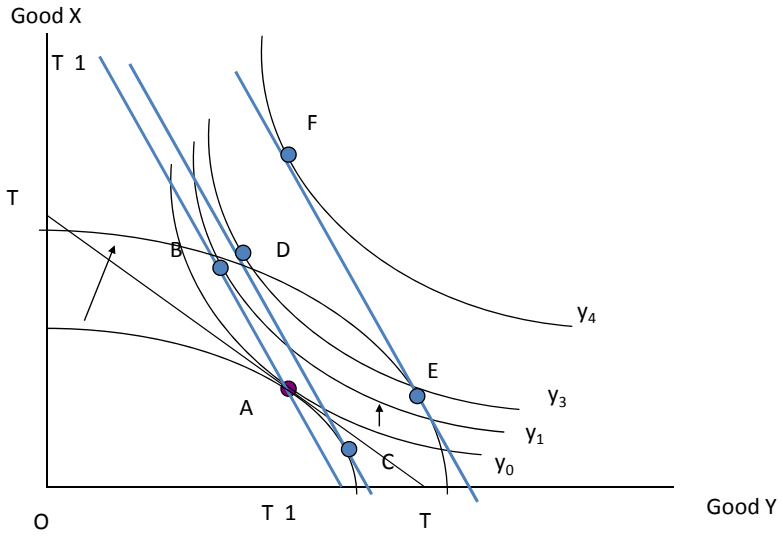
Yet, the situation of trade can lead to further changes in the production possibility frontier of the country. This can happen for many reasons, for instance if a process of learning-by-doing related to exports of good *Y* leads to improvements in the technique of production or if trade related investment triggers accumulation of one or both production factors. Such a change can be represented graphically as an outward shift in the production possibility frontier which at terms of trade TT_1 would lead to production of bundle *E* and consumption of *F* at the utility level y_4.

This very simple graphical model is capable of illustrating the various effects the quantification of which is attempted in applied general equilibrium models used in simulations of potential DDA outcomes. What is captured relatively well are the combined gains from exchange, gains from specialisation or allocative efficiency gains and the terms of trade effects. Of course, how the terms of trade change with the considered trade policy reforms and to what extent economies adjust their production and consumption depends on the chosen functional forms and a large set of assumed[3] elasticities but there is no disagreement with respect to the principles of these mechanisms and the welfare effects of trade shocks are calculated in a way that is similar to the presented basic exchange model.

[2] The current description assumes that full employment of production factors is maintained throughout the shift from A to C but it is possible to demonstrate that the aggregate welfare gains can be maintained even with a certain amount of unemployment.

[3] Many existing estimates have an econometric basis but these are often combined with subjectives rules of thumb such as, for example, the rule sometimes applied with the Armington assumption that substitution elasticity between varieties of products imported from different foreign countries is twice as high as the substitution between domestic and imported products.

Chart 1: Pure Exchange, Mobile Factors and "Dynamic" Gains



Source: Based on Caves, Frankel and Jones (2002).

What is captured less well – typically with the use of relatively crude ad hoc assumptions – is the impact of trade on production possibility frontier, or simply, trade-related productivity changes. Importantly, the estimated welfare effects of productivity changes are typically larger than the effects of the very trade policy changes on which they are predicated. Hence, any uncertainty about the causal link between trade policy and productivity is likely to be yet magnified when it comes to estimates of income effects of such trade policy changes, potentially magnifying uncertainty with respect to estimated gains from the considered trade reform. We will come back to this issue below.

3. Selected Recent Assessments of the DDA: Why Results Differ?

3.1 DDA Negotiations and "Realistic Doha Scenarios"

It can be argued that one particular lesson that modellers of multilateral trade liberalisation should have drawn out of their experience with the Uruguay Round is that they should not try to second-guess the final outcome of the negotiations, and then base their simulations (and policy conclusions) on such speculation. Most of the studies that simulated "likely outcomes" from the Uruguay Round prior to the conclusion of the negotiations missed their mark as they have excluded critical components in the Round and implemented scenarios none of which actually resembled the final Uruguay Round package.

Almost thirteen years after the conclusion of the Uruguay Round of trade negotiations and seven years into the DDA negotiations, scores of analysts and negotiators have considered various formulations and dimensions of a possible DDA accord. Yet, even at this stage it is not easy to characterise what the final modalities in agriculture and non-agricultural market access will look like nor when an accord can be realistically achieved.

The DDA was declared a development round at its birth which meant that the negotiations were expected to put emphasis on economic development of the developing WTO members. Yet, from the outset it was not very clear what this meant with respect to, for example, the extent of trade reform that was expected to be assumed by developing countries. Is it the developing countries that are to undertake the ambitious reforms and reap economic gains or should they to be given an option of reducing their trade barriers by less (or more slowly) than required by the general formula? It is quite clear that even within the developing countries group opinions on these issues are divided. This type of uncertainty largely persists to this day and is one of the reasons for co-existence of a variety of sometimes quite different sets of presumed policy changes that are portrayed as "realistic" DDA scenarios.

Both developing and developed countries' demands in the DDA negotiations are for increased access to partner markets. Their different starting points, specialisation in particular market segments and varying abilities to implement trade reforms help explain the divisions associated with the current tariff negotiations. Indeed, certain countries have expressed concerns about the loss of tariff revenue, adverse terms of trade effects, potential erosion of preferential access margins, impact of openness on certain specific sectors of economy and the overall distribution of gains from this reform.

Kowalski (2006) outlines the estimated structure of world tariffs based on information available in the World Integrated Trade Solution (WITS) database (see

table 1). In general, developing countries tend to impose higher tariffs on imports of both agricultural and non-agricultural products. Particularly high MFN rates are levied on imports in low and middle-income countries of North Africa, the Middle East, and South Asia.[4] One striking feature of post UR schedules is that tariffs on South-South trade are often higher than on North-South or North-North trade. This is particularly the case for trade in agricultural products of LDCs and low and middle-income countries. The tariff profiles of developing countries are also characterised by a higher dispersion of tariff rates and widespread incidence of international tariff peaks.[5]

In general, both in developing and developed economies, tariffs tend to be higher on imports of agricultural products as compared with industrial products.[6] The agricultural sector also suffers from a higher incidence of tariff peaks. Industrial tariffs are in general lower than agricultural ones; however, there is a considerable degree of heterogeneity across the industrial product categories with sectors such as simple textiles and clothing, leather or footwear recording significantly higher rates as compared to other sectors (see e.g. Bacchetta and Bora, 2003).

While many discussions and modelling exercises are centered around applied MFN rates as those directly affecting trade flows, it is crucial to distinguish them from bound tariffs that are at the centre of the WTO market access commitments. The distinction between applied and bound rates is important due to considerable differences between bindings and applied rates (binding overhangs) which bear implications for the trade, welfare impacts associated with any tariff reduction agreed in the WTO. As a result of the tariffication process in the Uruguay Round binding overhangs tend to be very high in the agricultural sector. In LDCs, expressed as a percentage of their applied duties, they reach 365% in agricultural products and around 290% in industrial products (Kowalski, 2006). Among lower and middle income countries, the existing overhangs expressed in relative terms are highest in Latin America and Caribbean, East Asia and Pacific and in the

[4] The gap in MFN tariff rates between developed and developing countries was reinforced by the Uruguay Round that resulted in average tariff reductions among OECD countries of 45%, as compared to 30% among non-OECD countries [OECD, 2001]. Partly, this outcome was the result of the failure or inability of some developing countries to fully engage in the negotiating process.

[5] Tariffs exceeding 15% according to the definition of an international tariff peak used commonly in the WTO context.

[6] Despite agricultural tariffs being generally higher than tariffs on industrial goods several categories of agricultural products enjoy relatively low tariff rates. These include: coffee, fibre, spices, live horticulture (WTO, 2003). Similarly, a few countries do not conform to the general pattern and levy lower import duties on agricultural products than they do on industrial goods. Among them are Australia and New Zealand and Switzerland has a zero tariff policy in both sectors.

agricultural sectors of South Asia. Developed countries maintain single digit overhangs which are, however, significant if expressed as a percentage of the corresponding applied rate.

Larger binding overhangs in developing countries require bolder tariff cuts in order to obtain reductions in applied rates. Indeed, the binding overhang is estimated at three times the average applied rate in the agricultural sectors of South Asian low and middle income countries (Kowalski, 2006); this implies that on average the bound rates would have to be cut by as much as 75% if it were to have an impact on applied rates. This highlights the need to have a robust formula in the context of the Doha round of negotiations in order to secure real market access and resulting welfare gains for participants. At the same time, large binding overhangs imply that unused protection can be significantly reduced, contributing to greater certainty about the future levels of tariff protection, without implying any losses to government tariff revenue (see Kowalski, 2006b).

The sequence of events in the negotiations have not helped analysts pin down their possible outcome with any great accuracy. In the lead up to the Cancún Ministerial, the work of the WTO Negotiating Group on Market Access (NGMA) focused on the issue of "modalities" and particularly on a harmonizing formula for tariff cuts applied on a line-by-line basis. Several countries submitted proposals outlining a range of market access priorities (WTO, 2003). In May 2003, the chairman of the NGMA released a document entitled *Draft Elements of Modalities for Negotiations on Non-Agricultural Product*s (WTO, 2003b) which was meant to bring together members' negotiating positions. Key elements of the proposal included: a distinction between developed, developing and least developed countries (LDCs); a proposed formula for tariff reductions; and proposals for sectoral tariff reductions and special and differential treatment for developing countries. Built into the formula was an element taking into account the current average level of tariffs of each country and a negotiated coefficient implying that countries with relatively high levels of average tariffs would in principle be able to maintain higher tariff rates unless they would agree in the negotiations to accept a lower value of the negotiated coefficient.

The meetings of NGMA in the run up to Cancun revealed different levels of ambition among Members with respect to how deep formula tariff cuts should be.[7] Significant North-South differences on tariff liberalisation and special and differential treatment aspects of the proposal emerged. For some developing countries, the proposal was going too far and did not sufficiently address their

[7] As far as sectoral approach (i.e. the seven sectors proposed for a complete elimination of tariffs) is concerned, positions were far apart. A number of developing countries would see a voluntary approach to participating in these sectoral tariff reductions, while developed countries showed a preference for it to be mandatory. Most Members, however, were willing to address the sectoral approach only once the overall tariff reduction formula had been approved.

concerns. For many developed countries, on the other hand, the proposal would not guarantee effective improvement in market access. A number of proposals drew attention of the negotiating group to exemptions of sensitive products in the cases of vulnerable economies. Concerns were also raised about the need to preserve the existing margins of preference for the developing country exports.[8]

The *July Framework* adopted by the WTO General Council on 1st August 2004 built on NGMA negotiations in the run-up to the Cancún Ministerial stipulating that additional negotiations would be required to reach agreement on the specifics of negotiated modalities. In particular, the July Package stipulated that the negotiations would continue to focus on a non-linear formula approach to tariff cuts applied on a line-by-line basis which shall take fully into account the special needs and interests of developing and least-developed countries, including through less than full reciprocity in reduction commitments. This was later reaffirmed in the Doha Work Programme Ministerial Declaration adopted in December 2005 in Hong Kong with an explicit reference to the *Swiss Formula* with coefficients at levels that deliver meaningful reduction in tariffs, tariff peaks and escalation while taking fully into account the special needs and interests of developing countries, including through less than full reciprocity in reduction commitments.

Agriculture has been portrayed as being at the centre of the deadlock in the DDA negotiations and their suspension in July 2006 even though the negotiations are about a package that covers the far larger economic sectors of services and non-agricultural goods, as well as a variety of other trade-related issues. The uncertainty with respect to the major parameters of a future agreement in these areas is no smaller than in agriculture. The recently revised draft "modalities" papers for agriculture and non-agricultural market access (NAMA) that were tabled by the chairs of the respective negotiating groups almost seven years into the negotiations in February 2008 were seen by many commentators as representing only a limited progress in clarifying the major parameters of a future agreement (see. e.g. ICTSD, 2008).

Reflecting those various uncertainties, which are likely to persist until the final agreement in known, the large body of existing literature on potential welfare gains from the DDA assumes a wide range of policy changes that are thought to be "realistic" DDA scenarios. table 2 describes the main features of a set of recent assessments of gains from trade liberalisation conducted in the context of DDA negotiations in period 1999–2006. Taking the example of tariff reductions in three relatively recent assessments of the DDA (Polaski, 2006, World Bank, 2006 and Fontagne et al., 2005) we can see clearly that these assumptions differ with respect to the relative depth of cuts in agricultural and non-agricultural sectors as well as the relative depth of cuts in developing and developed regions of the world.

[8] See Lippoldt and Kowalski (2006) for a detailed discussion of the preference erosion issues.

Similarly, broad assumptions with respect to the likely outcome of trade facilitation deal range from cost reduction of 1% to 3% of the value of trade. These disparities clearly reflect a different understanding of what a realistic outcome of the negotiations might be and they constitute one of the main reasons why the estimates of welfare gains from further trade liberalisation differ so widely.

It is not hard to accept that a scenario assuming a 100% cut of remaining tariffs on manufactures imports delivers estimates that are different from one assuming, for instance a 30% cut. Fortunately, many existing studies do include a 100% liberalisation scenario across all considered sectors and this scenario is often a better benchmark for comparing results across different models and data sets. Such a scenario is also a natural comparator for other, perhaps more realistic, scenarios as it captures the overall potential gains from dismantling the remaining trade barriers and bypasses the problem of whether the conjectured cuts are specified with respect to applied or bound rates.[9]

3.2 Market Structure

Table 2 identifies a number of features other than liberalisation scenarios with respect to which the selected studies differ. All of the selected studies are in the Walrasian family in the sense that they are based on the optimizing behaviour of representative agents (households, firms) in a framework of welfare economics as contrasted with models that may depart from the optimizing behaviour in favour of ad hoc assumptions designed to increase their empirical relevance (Cline, 2004). Yet, even within this family of models significant differences persist.

One such important difference refers to the assumptions about market structure. Though more than two decades have already passed since the notions of increasing returns and product differentiation have been incorporated into the trade theory (e.g. Helpman and Krugman, 1989) they are not routinely incorporated into the applied trade models. Recent exceptions in the context of DDA assessments include: Brown et al. (2003); Francois et al. (2005); Cline (2004); Fontagne et al. (2005).

[9] Among other effects, running the simulation scenarios on the basis of applied rather than bound rates implies a much deeper reduction in developing countries' protection than both developed countries' and what is actually envisaged under the DDA. In the case of developing countries, applied tariffs are on average one-third of bound duties; and in a large number of countries, applied duties are even below MFN rates. Brief analysis of protection data from the CEPII MAcMaps database suggests that in developing countries there is a lot of "water in the tariffs" or tariff overhang where the difference between bound and applied duties in agriculture can be as high as 150 percentage points as is the case in Bangladesh. With the exception of EFTA agriculture, there is no discernible difference between applied and bound duties in developed countries, whether in agriculture or in NAMA.

All these studies assume a particular, stylised and analytically tractable formulation of imperfect competition, namely, large group monopolistic competition. As its name suggests monopolistic competition combines features of perfectly and imperfectly competitive markets: average profits of firms are driven to zero by an assumption of free market entry of firms while at the same time firms are monopolists within their market niche (variety that they produce) and set prices above marginal costs. With such a market structure output and welfare effects of trade policy reforms are magnified by pro-competitive effects of market opening on price-cost margins (see Francois, 1998). This is an important feature of economic reality but one has to bear in mind that such market structure itself rests on some simplifying assumptions (such as the firms' size symmetry and the free market entry). Additionally the discussed modelling approach requires highly elusive data on the typical differences between average and marginal costs by sector. Francois (1998) points out that the engineering literature on which the used estimates of scale economies are based goes as far back as to the 1950s, 1960s and early 1970s.

The uncertainty with respect to key parameters seems to be an important concern precisely because applied trade models that do incorporate the assumption of imperfect competition tend to generate larger estimates of gains from trade liberalisation. This is illustrated by Francois (1998) who compares the welfare, output and wages results of a trade liberalisation scenario implemented in a model with five different formulations of market structure. It is, however, less clear to what extent the assumption of imperfect competition contributes to the dispersion of estimates of gains from the DDA. For example, two of the three studies based on imperfectly competitive market structures in table 2 (Francois et al., 2005 and Cline, 2004) generate results of the same magnitude as other models based on perfect competition, while estimates of welfare gains in Brown et al. (2003) are ten times the average gains from models based on the assumption of perfect competition.[10] The latter study is also unique in considering an ambitious services trade liberalisation scenario which is likely another feature that may be driving the exceptionally large gains and their attribution to developed countries.[11]

3.3 Model Closure

Variables in economic models can be categorized as endogenous (or determined within the model) and exogenous (or determined outside the model). Mathematically the list of endogenous and exogenous variables has to be chosen so that the system of equations constituting the model can be solved. Economically

[10] See chart 5 in Piermartini and Teh (2005) for a graphical comparison of model results.

[11] Developed countries' shares of services in GDP are higher and they are more open to trade in services.

this list is chosen to reflect how the modeller thinks the economy actually works. Which variables are chosen as endogenous and which as exogenous is what is called a model closure. Of course, even if two different modellers agree on the accounting system of the analysed economy and on the specification of underlying behavioural relationships (model) they do not have to agree on the model closure (see e.g. Pyatt, 1988).

A classic example is a difference between "New classical" and "Keynesian" views of the aggregate supply curve. Simplifying for the sake of exposition, according to the "new classical" view the economy is always under full employment and any demand shifts are reflected in the level of prices but not in output or employment. According to such a closure supply would be determined outside the model while the price would be determined within the model to equilibrate aggregate supply with demand. According to "Keynesian" view prices would be sticky, unemployment would be possible and aggregate output would be determined by demand shocks. Such a closure would be characterised by exogenous prices and endogenous aggregate supply that would adjust to meet aggregate demand.

A prominent example of how a model closure can affect the size and distribution of welfare gains from a trade liberalisation scenario concerns adjustment of labour markets. Consider the assumption of fixed wages of unskilled urban labour in developing countries that Polaski et al. (2006) introduce into the Carnegie model (see table 2). Contrary to the majority of CGE studies that have simulated multilateral liberalisation, the Carnegie model assumes away full employment of urban unskilled labour in developing countries. Such an approach is justified by the authors on the basis of their observation of positive unemployment rates in most developing countries, especially with respect to unskilled labour. As the authors posit, assuming this kind of unemployment is "a reasonable representation of the reality in most developing countries in the short term."

The less-than-full employment of urban unskilled labour implies that (1) any adjustment to a trade shock occurs in quantity of employed labour rather than its price and that (2) manufacturing which is likely to make a more intense use of urban unskilled labour and is an important export activity in many developing countries receives special treatment in the model. In the full employment closure of the model the supply of labour is fixed and any decrease in labour demand (*e.g.* as a result of a negative demand shock) results in an decrease in real wages so that the quantity of labour employed after the trade shock remains unchanged. In the less-than-full employment closure, real wages are fixed and employment is allowed to vary with demand. Consider a negative demand shock such as would be expected, for example, in a developing country that loses access to markets where it previously enjoyed preferential treatment. The full employment closure will result in lowering of real wages while the unemployment closure will result in lowering of employment at unchanged wages. Which of the two situations would

result in a deeper decrease of labour earnings (and thus negative impact on welfare) cannot be determined a priori as it depends on the underlying elasticities that determine the slope of labour demand. However, the evidence from the past CGE literature suggest that in some currently used models and with the available set of elasticities a less-than-full-employment closure often results in deeper welfare and income losses for countries that experience negative market access shocks.

This point can be illustrated by a simple simulation employing a standard GTAP model of the world economy and the version 6 of GTAP database to compare the effects of full removal of tariffs worldwide under the assumption of full and less-than-full employment in one of the regions. To focus the argument, Sub-Saharan Africa (SSA) is chosen to be the region subject to alternative specifications of the labour market closure. Table 3 indicates that the introduction of unemployment lowers the global welfare gains from tariff removal from around USD 41 billion to approximately USD 32 billion, the difference being entirely the differences in gains accruing to the region of SSA. Indeed, while with the full employment assumption SSA stands to gain a moderate USD 1.4 billion, the unemployment assumption changes the result into a welfare loss of around USD 7.7 billion.

The remaining panels in table provide an explanation of the mechanisms at work. While in both cases, the removal of tariffs is predicted to put SSA producers under pressure to reduce output in most sectors, the magnitude of output reduction is larger under the unemployment assumption (table 3, Panel C). This is because with fixed wages SSA producers cannot compensate the negative demand shock by lowering wages and consequently prices. Indeed, the unemployment assumption results in a more moderate reduction of export prices across all sectors. Panel B in table 3 indicates that the output reduction resulting from the analysed tariff shocks is associated with approximately 5% reduction in employment in the region.

To summarise, a low income country that faces erosion in its preference will need to enhance its productivity and cut its export price in an attempt to maintain its market share; it cannot lower its wages with the unemployment closure as assumed in the Polaski et al. (2006) study. A large labour-surplus country such as China for example, can actually move in on this country's market share without creating any upward pressure on its export price given the assumption of fixed wages for unskilled urban workers. Inevitably, the low income country loses market shares and export earnings.

This example shows that closure assumptions may determine whether a certain country or group of individuals will gain or lose out from a given liberalisation scenario. It is true that the full employment closure may be less appropriate in economies with high unemployment or low employment rates, especially if the objective of the study is to inform of potential economic effects in short or medium run. However, it may be seen as equally as questionable to use the unemployment

closure for purposes of an assessment of effects of a global trade deal that is negotiated and implemented with long-term effects in mind.

3.4 Dynamic Gains from Trade

Another element that contributes to the wide disparities in estimates of welfare gains from the DDA is treatment of the link between trade and productivity. The notion of "dynamic gains from trade" has been long present in the applied trade modelling literature concerned with the quantitative estimates of economic gains from trade policy reforms, though the number of approaches that attempt to model this link has grown in the recent decade. This was related to an intense academic debate on to what extent trade liberalization impacts upon economic growth. A recent OECD study (Nordas *et al*., 2006) analysed and summarised the various arguments of the debate. The focus on trade-productivity growth in this literature stems from the fact that productivity growth is the only long term source of growth in the neo-classical growth framework. This is due to the fact that under the assumption of diminishing marginal returns, an increase in capital while holding labour input constant increases output, but at a diminishing rate as the stock of capital per worker increases. Eventually the capital stock reaches a level where investors will only replace depreciating capital in the absence of technological progress.

It should be pointed out at the outset that the income effects derived from the conventional comparative static AGE analyses of trade liberalization already account for one-off average productivity effects that arise as a result of reallocation of economic activity across sectors with different productivity levels (i.e. allocative efficiency gains).[12] While the impact on average productivity is rarely reported as a separate summary statistic the magnitude of average productivity changes induced by reallocation of factors of production can be determined from the figures describing percentage changes to real GDP (since in the absence of factor accumulation in static models, real GDP growth can only come about through productivity changes). For example, Kowalski (2006) employing the standard GTAP model of world trade estimates that the full removal of tariff barriers (with 2001 as the base year) and associated resource reallocation across all trading partners results in an average productivity increase of 0.35%.[13]

In addition to the static effects of trade policies some existing applied studies consider supplementary increases in total factor productivity, which are most

[12] What these models really do, however, is to consider one-off changes in levels of productivity rather than an increase in productivity growth rate that is considered to be the only source of sustained long-term growth in the modern growth theory.

[13] This is a simple average across all regions that are singled out in the model. In some developing regions average productivity is reported to have increased by as much as 0.79% (see Kowalski, 2006).

frequently implemented as exogenous add-ons in "comparative static" modelling frameworks. The hypothesis of a link between openness and productivity level has been at the centre of the sizable literature on the so called export-led growth that attempts to establish the causal link between high growth rates, increasing trade shares in GDP and significant structural changes observed in a number of rapidly industrializing economies post WWII (see e.g. de Melo and Robinson, 1990).

As stressed by Ackerman (2005) the productivity effects included in the vast majority of existing modelling exercises are "off-line calculations, not part of the models per se". Because the productivity increase is not determined by the model itself its inclusion requires crucially a separate estimation of the magnitude of the impact of trade liberalization on productivity outside of the employed CGE model and its implementation as an additional exogenous shock. One example of such an approach is the study of effects of multilateral tariff liberalization and developing countries by Dessus et al. (1999) that uses a version of the LINKAGE model developed at the OECD. While in the original model productivity is exogenous (determined outside the model) Dessus et al. (1999) adopt an additional assumption that the level of TFP is linked positively to the intensity of trade. The magnitude of this effect is established with a separate econometric model that utilizes information on openness and productivity in 63 countries in the period 1961-95. The estimation results indicate that 10% rise in trade intensity (defined as the ratio of trade volume to output) leads to a 0.9% rise in the level of TFP.

As far as the results of Dessus et al. (1999) are concerned, tariff liberalization considered in separation of productivity-enhancing effects is reported to bring about total welfare gains of USD 82 billion in 1995 prices or approximately 0.2% of world GDP. When the estimated impact of trade on TFP is added to the scenario in order to calculate dynamic gains from trade, the total welfare gains increase very significantly to around USD 1200 billion or around 3% of world GDP. Additionally, the increase is most substantial for developing countries. It is clear that in Dessus et al. (1999) the assumption of an additional link between trade and productivity made a big difference in an assessment of gains from multilateral tariff liberalization; in fact this study has come up with one of the highest post-UR estimates of gains from further tariff liberalisation.

Productivity is also assumed to be influenced by changes in trade in one of the scenarios of the extensively debated World Bank study of effects of multilateral trade reform (Anderson et al., 2006) or the study by the Carnegie Endowment (Polaski, 2006). In an associated study one of the co-authors of World Bank simulations acknowledges that the approach adopted in Anderson et al. (2006) is a short-cut as compared to a genuine endogenous model in which changes in productivity could be influenced by changes in research and development, by technology embodied in imports and by pro-competitive effects of trade (van der Menbrughhe, 2006). In contrast to Dessus et al. (1999) where trade-related productivity changes are implemented at the country level, in Anderson et al

(2006) trade-related productivity increases are implemented at the sector level and their magnitude is conditioned on the increase in the export-to-output ratio with the elasticity set at one in manufacturing and one-half in agriculture.[14] As van der Menbrughhe (2006) reports the productivity assumption significantly boosts the gains from trade reform particularly for developing countries which, presumably, record more pronounced expansion of trade volumes. At the global level an inclusion of the trade-related-productivity channel in Anderson et al. (2006) almost doubles estimated total gains from full liberalization of world merchandise trade from USD 287 billion to USD 461 billion.

The marked increases in estimates of benefits of trade liberalization after addition of the productivity effect reported in Dessus et al. (1999) and Anderson et al. (2006) are an indication of a more general predisposition of this type of modelling exercises. Namely, the welfare effects of productivity changes tend to swamp the direct welfare effects of trade policy changes (e.g. tariff reforms). An implication is that results pertaining to overall gains from a trade reform are very sensitive to what one assumes about the relationship between openness and productivity.

Consequently this approach has a number of limitations that all relate to reasonableness of the productivity increase calculations. In some studies simple estimates or rules of thumb are used (e.g. the above-mentioned Anderson et al., 2006 or Polaski, 2006) while in others the relationship between openness and trade is established econometrically (e.g. Dessus et al. 1999). It is often claimed that the existing empirical evidence does not provide a definitive and robust conclusion with respect to existence of trade-related growth effects and that because of this uncertainty they should not be included in the applied trade models simulations (e.g. Hedi Bchir et al, 2002). A more positive conclusion is that there clearly is scope for better understanding and improving the existing estimates of impact of openness on productivity levels.

Even if a robust relationship between openness and productivity could be estimated econometrically and added to the CGE simulation they would usually not be consistent with other calculations performed within a CGE model simulation. For example, an econometric estimation of impact of trade on productivity that is later implemented in a CGE model is likely to already include an impact on average productivity level discussed above. If this is the case, an inclusion of an additional productivity shock may cause a problem of double counting of productivity changes. Generally, if the econometric estimation is not based on a reduced form of a structural model that is consistent with the adopted CGE approach, there is no reason why the results should be consistent with other

[14] For comparison, using the data for Thailand in period from 1980 to 1995 Rattso and Stokke (2002) estimate the short-run elasticities of productivity with respect to foreign trade to be 0.36 for agriculture and 0.55 for industry.

calculations performed within the CGE model. This may need to be more explicitly acknowledged in future econometric work identifying the productivity effects of trade.

An early attempt at preventing this kind of inconsistency can be found in de Melo and Robinson (1990) who developed a relatively simple one-country model that incorporates explicit links between exporting and productivity and importing and productivity that arise as a result of export and import externalities. The export externality in de Melo and Robinson (1990) is introduced by linking the amount of composite domestic production to exports.[15] The import externality is introduced through a link between the import ratio in heavy manufacturing and the productivity of the capital stock. De Melo and Robinson (1990) calibrate the theoretical model so that the initial equilibrium resembles early stages of export-led growth strategy in Korea and consider the optimal policy choices with respect to export subsidies in light and heavy manufacturing and an import subsidy in heavy manufacturing. They argue that models of this type provide a first step towards endogenising the major driving forces generating total factor productivity growth to mimic development paths of countries pursuing export-led growth strategies. They find that an incorporation of import and export externalities makes the model better suited to account for the stylized facts of growth and structural changes in these countries.

Unfortunately, endogenous productivity growth is largely absent from contemporary trade modelling literature.[16] This seems to result from the difficulty of unifying the concepts of specialization and structural change present in multisector comparative static trade models with the concept of balanced growth in literature on long-run economic dynamics. Indeed, Ngai and Pissarides (2004) write that "structural shifts are usually studied in models that do not satisfy the conditions for balanced aggregate growth. Conversely, balanced aggregate growth is normally studied in models that do not allow structural change."

While a number of alternative theories exist on what balanced growth is (Beirwag, 1964), this term is usually used in the modelling literature to describe, quoting Solow and Samuelson (1953), "a state of affairs in which the output of each commodity increases (or decreases) by a constant percentage per unit of time, the mutual proportions in which commodities are produced remaining constant. The economy changes only in scale, but not in composition." The condition of balanced growth, when applied to a multisector model, implies that in the dynamic

[15] This is an externality since the producers do not see the benefits of exporting beyond the competitively determined level and do not internalize this benefit in their production decision. Government on the other hand is interested in the maximization of the overall income level and internalizes the pro-growth effect of exporting.

[16] One exception is the one country model of trade and growth in Thailand by Diao et al (2002), see Annex Table 1.

equilibrium sectoral outputs and trade must grow at the same rate and that relative prices and relative factor rewards do not change.

In conventional trade models, where often different factor intensities are assumed across sectors, balanced growth conditions place constraints on productivity growth, i.e. productivity growth paths that are consistent with balanced growth are determined by factor intensities and factor supplies. This limits the possibilities of incorporation of trade-related endogenous productivity growth into applied trade models. To give an extreme example, if factor endowments are assumed to be fixed the rates of sectoral TFP growth that are consistent with the balanced growth path must be equal to each other and to the rate of growth of sectoral outputs. Some research is being pursued to determine the properties of utility and production functions that allow coexistence of differences in sectoral TFP growth, balanced aggregate growth path and structural change (e.g. Ngai and Pissarides, 2004). This could allow endogenous productivity growth become a more widespread feature of applied trade models.

Overall, the issue of inclusion of trade-related productivity gains in CGE simulations of trade policies is rather delicate. The income effects of productivity changes are of an order of a magnitude larger than the effects of the very trade policy changes on which they are predicated. Hence, any uncertainty about the causal link between trade policy and productivity is likely to be yet magnified when it comes to estimates of income effects of such trade policy changes, potentially shedding negative light on modelling approaches to trade policy analysis. Therefore, there is a need for a thorough empirical verification of links between trade and productivity and the way they are being implemented in CGE analyses.

3.5 Aggregation

Model (and database) aggregation is another reason for which the estimates of welfare gains from the DDA differ across studies. A recent paper by Decreux and Fontagné (2006) of CEPII includes a comparison of results of two liberalisation scenarios using different sector and region aggregations. Scenario 1 in table 4 resembles "Central Doha Scenario" of Polaski et al. (2006): in NAMA, tariffs are cut by 36% except for the G90 countries; in Agriculture, export subsidies are eliminated, domestic support levels are halved, and tariffs are cut by 36% on average except for sensitive products whose tariffs are cut by 25%, and the G-90 are exempt from any liberalisation. In scenario 2, tariffs on NAMA products get cut using the Swiss formula with a coefficient of 10, with the exception of the G-90; in agriculture, the policy experiment is exactly the same as in scenario 1 except that no separate treatment is accorded to sensitive products. Aggregation choice clearly affects the results of the simulation.

While the GTAP database that is most widely used in the modelling profession contains a total of 57 sectors (20 agricultural, 22 manufacturing and 15 services sectors) and 111 countries or regions it has to be aggregated up so that the model can be solved with currently available computer hardware and software in a reasonable time. There is no standard sector and region aggregation and the aggregations are very often tailored to the specific needs of studies in question. For example in OECD (2005) where one level of analysis included household impacts of agricultural policy reforms the aggregation used for a CGE simulation reflected the choice of countries on which the analysis of household level impacts was to be based (Brazil, Italy, Malawi, Mexico and the USA) and the choice of sectors for which the detailed information on agricultural policies was available. Kowalski and Shepherd (2006) who addressed a host of issues pertaining to South-South trade chose an aggregation the allowed a rich representation of individual developing countries.

The two studies, despite using a relatively similar modelling approach[17] and tariff cuts scenarios, generated quantitatively and qualitatively different results. For example, the two sets of results implied different shares of gains accruing to developing countries. OECD (2005) estimated that around 30% of total welfare gains would accrue to developing countries while in Kowalski and Shepherd (2006) this share was more than 50%. Upon additional analysis of both sets of simulation results, this discrepancy was later attributed to differences in model aggregations. Kowalski and Shepherd (2006) considered 44 separate regions of which the majority were developing countries while the OECD countries were relatively aggregated. OECD (2005) considered 18 separate regions with a number of major developing and OECD countries treated separately and the rest aggregated to the rest of the world category.

These alternative aggregation approaches caused differences in results because aggregating regions with relatively different levels and patterns of tariff protection removes some of the potential sources of gains from trade liberalisation. To give an extreme example, aggregating two otherwise similar countries, one with a positive rate of effective protection in a certain sector and one with a negative effective rate of protection in the same sector, yields an artificial region where, after averaging, the effective protection in the sector is close to zero, implying much smaller gains from trade liberalisation than would be obtained if the two countries were treated separately. As discussed above the highest and most dispersed tariff rates are observed in developing countries and this is a why parsimonious aggregation of developing country regions is going to result in smaller world gains and a smaller share of gains accruing to this country grouping. A similar reasoning can be

[17] OECD (2005) used the GTAPEM model which is a version of GTAP model and Kowalski and Shepherd (2006) used the standard GTAP model.

conducted in the context of aggregating sectors with contrasting protection structures.

3.6 Zero Flow Data

The final set of qualifications that need to be born in mind when interpreting the estimates of gains from the Doha Round using CGE models relates to model structure and the so-called "small shares" problem. The small shares problem is particularly relevant in the context of quantitative assessments of the DDA because it puts developing countries, and more particularly the least developed among them, at a critical disadvantage. CGE models assume a certain structure of the economy with functional forms and parameter values, calibrate the initial equilibrium around a base year and then change the trade policy parameters to solve for the change the model implies. Thus, only the data from the base year are used to calibrate the model. With the Constant Elasticity of Substitution (CES) preferences predominantly adopted in the considered set of DDA assessments the implication is that if in the initial equilibrium there is no trade between country A and country B, no "new" trade will be created following the policy shock. This biases the results concerning particularly the least developed countries that have a limited number of trading partners and a narrow export base. Table 5 provides an idea of the extent of such a problem; for example, some 82% of Bangladesh's export are destined to the EU+EFTA and the US markets; it has limited or no trade with the majority of GTAP individual countries or groups. It is thus unsurprising to see, for example, that Polaski et al. (2006) find net losses for Bangladesh given the country's overwhelming dependence on markets where in the baseline scenario it enjoyed preferential access. A similar story applies across the majority of LDCs.

In a recent paper Komorowska et al. (2007) explain that the continued use of CES preferences in modelling studies, despite their unfitness for dealing with the small shares problem, had been determined by their analytical tractability and the limited set of estimated parameters it requires. They also describe some existing approaches to dealing with the small shares problem as well as propose a new such approach of their own.

In fact, this problem is not unique to any one CGE study as it affects the majority of recent estimates of multilateral trade liberalisation. What one should note here though is that authors should acknowledge it as a shortcoming and caution the reader on its implications.

4. Conclusions

In the context of multilateral trade negotiations positive economic analysis can undoubtedly help to deliver information on the stakes involved in order to help frame the negotiations and to highlight the distribution of costs and benefits of

various options. Continuing enhancements in economic theory, modelling approaches and data quality are helping analysts to provide ever more integrated views of the implications of various policy changes. At the same time the modelling frameworks become more complex and less readily accessible to non-specialists which opens avenues for the analysis to be conducted in a tendentious manner, or selectively, to support certain predetermined positions or arguments.

It is argued in the current paper that, on balance, the richness of approaches and alternative estimates of gains from further trade liberalisation is not necessarily undesirable and can in fact be seen as a part of an organic analytical process. The sequence of events in the DDA negotiations have not helped analysts pin down their possible outcome with any great accuracy. The differences in results from alternative modelling approaches can be very often linked to diverging views about the likelihoods of alternative negotiating outcomes. Also, diverging assumptions about specific economic mechanisms such as the market structure, smoothness of adjustment of factor markets or the nature of relationship between openness and productivity growth are at the heart of differences in results. Also, naturally, the differences can sometimes be traced back to data quality, which, however undoubtedly improves with time. However, in a limited number of instances the differences in existing results can be artefacts of the employed methodology with, for instance, different regional or sectoral aggregations of the same model generating quantitatively, and occasionally qualitatively, different predictions. Similarly, in computable general equilibrium analysis only the data from the base year are used to calibrate the model with the implication that where trade did not exist in the initial period no "new" trade will be created following the policy shock.

Overall, we are light years away from creating the perfect computable model that will be capable of accurately replicating all the linkages between economies through international flows of goods and services as well as through movements in labour, capital and the allocation of investment across the globe. Thus, all applied trade models should always start by explicitly acknowledging the limitations of their results and the assumptions that have been made. It is also critical that all modelling approaches are transparent to allow interested researchers to examine all their aspects, replicate their results and learn from their approaches.

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Appendix

Table 1a: Simple Tariff Averages

	Agricultural products		Non-agricultural products	
	Bound	Applied	Bound	Applied
Reporter:				
Developed countries (DEV)	22.3	7.5	8.5	3.8
Low and middle income countries	58.9	22.6	30.7	11.1
of which:				
East Asian & Pacific countries	40.0	14.9	28.8	13.5
Europe	35.0	28.1	10.2	7.0
Latin America and Caribbean	63.4	16.4	39.1	10.4
Middle East and North Africa	59.4	32.1	34.0	21.3
South Asian countries	98.6	24.6	33.7	18.8
Least Developed Countries	77.4	16.6	51.5	13.2

Source: WITS.

Table 1b: Trade-Weighted Averages of MFN Applied Rates on Agricultural Products

	Country source of imports							
	DEV	LDC	LMEAP	LM Europe	LMLAC	LMMNA	LMSAsia	LM
Reporter:								
Developed countries (DEV)	5.6	10.1	6.7	11.8	5.1	4.9	2.6	5.9
Least Developed Countries (LDC)	11.5	18.9	13.5	12.5	13.5	16.5	10.3	13.3
Low and middle income countries (LM)	19.6	24.0	28.8	22.5	15.9	18.9	15.5	20.3
of which:								
East Asian & Pacific (LMEAP)	11.9	17.3	17.3	15.4	12.6	16.4	12.6	15.1
Europe (LMEurope)	20.7	18.7	15.8	22.2	24.3	19.5	12.6	20.5
Latin America and Caribbean (LMLAC)	23.2	15.9	11.8	34.2	14.6	13.2	9.3	14.8
Middle East and North Africa (LMMNA)	28.8	19.3	28.3	23.4	11.6	17.6	10.7	17.8
South Asian countries (LMSAsia)	19.9	30.6	69.1	23.4	35.9	21.1	22.6	48.3

Source : WITS.

Table 1c: Trade-Weighted Averages of MFN Bound Rates on Agricultural Products

	Country source of imports							
	DEV	LDC	LMEAP	LM Europe	LMLAC	LMMNA	LMSAsia	LM
Reporter:								
Developed countries (DEV)	8.3	14.0	7.2	21.1	6.8	8.7	3.2	7.6
Least Developed Countries (LDC)	66.5	106.1	107.3	72.8	153.1	48.1	149.0	121.3
Low and middle income countries (LM)	39.4	79.2	80.0	37.0	43.7	43.6	68.1	54.6
of which:								
East Asian & Pacific (LMEAP)	25.9	18.4	27.4	30.0	17.3	17.5	27.6	23.1
Europe (LMEurope)	28.0	19.6	23.9	32.2	28.9	26.4	22.4	28.7
Latin America and Caribbean (LMLAC)	45.3	64.2	38.6	32.3	47.7	39.2	35.5	46.8
Middle East and North Africa (LMMNA)	41.0	29.4	27.2	60.6	49.6	23.8	16.4	42.0
South Asian countries (LMSAsia)	79.2	118.0	205.7	86.0	102.5	96.5	132.7	160.2

Source: WITS

Table 1d: Trade-Weighted Averages of MFN Applied Rates on Industrial Products

	Country source of imports							
	DEV	LDC	LMEAP	LM Europe	LMLAC	LMMNA	LMSAsia	LM
Reporter:								
Developed countries (DEV)	2.2	9.8	3.5	3.1	4.0	1.9	6.4	3.7
Least Developed Countries (LDC)	10.8	8.8	17.5	7.5	8.6	8.7	18.7	14.0
Low and middle income countries (LM)	11.0	7.6	10.5	6.4	10.4	6.4	11.4	8.9
of which:								
East Asian & Pacific (LMEAP)	9.6	5.4	8.9	6.2	5.1	6.7	9.0	7.5
Europe (LMEurope)	7.1	6.5	6.6	5.2	4.4	1.0	6.9	5.2
Latin America and Caribbean (LMLAC)	12.8	10.0	12.8	7.6	11.5	2.8	13.0	11.1
Middle East and North Africa (LMMNA)	20.9	18.9	25.9	24.1	21.0	14.7	19.9	20.6
South Asian countries (LMSAsia)	24.3	22.0	19.7	26.7	16.7	17.4	17.8	20.9

Source: WITS.

Table 1e: Trade-Weighted Averages of MFN Bound Rates on Industrial Products

	Country source of imports							
	DEV	LDC	LMEAP	LM Europe	LMLAC	LMMNA	LMSAsia	LM
Reporter:								
Developed countries (DEV)	2.9	10.2	3.7	3.5	3.9	3.4	6.6	3.9
Least Developed Countries (LDC)	28.7	20.3	32.9	28.2	29.4	27.0	33.6	31.2
Low and middle income countries (LM)	19.2	7.3	14.9	9.2	27.4	13.3	14.9	16.5
of which:								
East Asian & Pacific (LMEAP)	8.3	1.7	7.7	7.0	5.2	2.6	6.2	6.4
Europe (LMEurope)	9.1	12.3	7.5	6.9	7.2	7.3	11.8	7.1
Latin America and Caribbean (LMLAC)	33.4	32.7	33.2	26.7	31.9	33.2	32.1	32.1
Middle East and North Africa (LMMNA)	28.8	27.8	31.2	30.5	23.0	28.0	22.1	28.4
South Asian countries (LMSAsia)	31.6	33.2	25.3	33.4	33.7	35.2	26.6	30.4

Source : WITS.

Table 1f: Differences between Bound and Applied Rates

	Agricultural products		Non-agricultural products	
	absolute	as % of applied rate	absolute	as % of applied rate
Reporter:				
Developed countries (DEV)	14.9	199.3%	4.7	124.1%
Low and middle income economies	36.4	161.3%	19.6	176.4%
of which				
East Asian & Pacific countries	25.1	168.7%	15.3	113.6%
Europe	6.9	24.5%	3.2	45.8%
Latin America and Caribbean	47.0	287.3%	28.7	275.2%
Middle East and North Africa	27.4	85.5%	12.7	59.6%
South Asian countries	74.0	300.1%	14.9	79.5%
Least Developed Countries	60.8	365.6%	38.4	291.0%

Source: WITS.

Table 1g: Coefficients of Variation

	Agricultural products		Non-agricultural products	
	Bound	Applied	Bound	Applied
Reporter:				
Developed countries (DEV)	2.0	2.9	1.3	1.7
Low and middle income economies of which	1.0	2.4	0.7	1.1
East Asian & Pacific countries	1.1	17.7	0.8	1.3
Europe	1.4	1.3	1.0	1.1
Latin America and Caribbean	0.6	1.4	0.4	0.9
Middle East and North Africa	2.7	4.3	0.5	0.9
South Asian countries	0.7	0.9	0.8	0.7
Least Developed Countries	0.7	0.7	0.6	0.8

Source: WITS.

Table 1h: Incidence of International Tariff Peaks (% of Total Number of Lines)

	Agricultural products		Non-agricultural products	
	Bound	Applied	Bound	Applied
Reporter:				
Developed countries (DEV)	21.0%	18.7%	4.8%	8.0%
Low and middle income economies of which	72.6%	81.0%	24.1%	36.9%
East Asian & Pacific countries	69.2%	70.2%	25.5%	24.4%
Europe	22.5%	55.1%	9.0%	35.5%
Latin America and Caribbean	94.9%	96.2%	26.5%	33.3%
Middle East and North Africa	86.3%	59.7%	49.8%	47.5%
South Asian countries	86.7%	97.3%	52.5%	59.9%
Least Developed Countries	88.3%	96.7%	35.0%	41.9%

Source: WITS.

Table 2: Selected Studies of Trade Liberalization, Their Treatment of Trade-Related Productivity and Other Dynamic Effects

Study	Scope	Model	Data	Data aggregation	Dynamic features	Productivity treatment	Selected key findings
Anderson et al. (2006)	Agriculture (tariffs and subsidies) Manufacturing	World Bank LINKAGE Model, perfect competition recursive dynamic multicountry multisector	GTAP 6, baseline year 2001, adjusted for recent developments in trade policy and projected to 2015 supplemented by World Bank growth projections	Not specified	endogenous capital accumulation exogenous population and labor supply exogenous labor-augmenting technological change	exogenous levels assumed to increase in proportion to export-to-output ratio 10% increase in this ratio results in 10% increase in TFP for agricultural sectors and 5% in manufacturing sectors	Assuming trade has no impact on productivity: - the benefits of moving to global free trade: USD 287 billion in 2015 - gains higher for developed countries in nominal terms but higher for developing countries in relative terms (as % of GDP) -complete removal of protection in agriculture is responsible for two thirds of global welfare gains Assuming trade has an impact on productivity: - the benefits of moving to global free trade: USD 461 billion in 2015 - the gains for developing countries more than double

Study	Scope	Model	Data	Data aggregation	Dynamic features	Productivity treatment	Selected key findings
Kowalski (2006)	Agriculture (tariffs) Manufacturing Trade facilitation	GTAP, standard, perfect competition comparative static multicountry multisector	GTAP 6, baseline year 2001,adjusted for tariff bindings from WITS	12 regions, 10 sectors	none	exogenous levels not affected by liberalization scenarios	- full removal of tariffs worldwide: USD 42 billion - 1% reduction of trading costs worldwide: USD 120 billion - developing countries: comparatively large proportional effects: on average 0.54% of GDP; developed countries on average 0.08% - results for cuts according to Swiss formula with a coefficient of 5% for developed regions and coefficient of 30% for developing regions: USD 22 billion
Polaski (2006)	Agriculture (tariffs and subsidies) Manufacturing	Modified version of Wang (2003), perfect competition comparative static particular treatment of clearing in labor market	GTAP 6, baseline year 2001, plus additional data from national and intergovernmental resources	13 regions, 27 sectors,	none	exogenous levels assumed to increase in proportion to imports of capital goods 10% increase in real imports of capital goods – increase of 1% (or less in developed countries) in TFP in given sector	- the benefits of moving to global free trade: USD 168 billion approximately equivalent to 0.5% of world GDP - the benefits of so-called 'plausible Doha scenario': USD 59 billion or 0.2 of world GDP with 10% of these gains attributed to liberalization in agriculture - developing countries account for approximately 45% of global gains; most developing countries gain from manufacturing liberalization; many poor countries lose from agricultural liberalization

Study	Scope	Model	Data	Data aggregation	Dynamic features	Productivity treatment	Selected key findings
OECD (2005)	Agriculture (tariffs export subsidies and domestic support) Manufacturing	GTAPEM (modified version of GTAP with a more detailed treatment of agricultural factor specificity and substitution)	GTAP 6, baseline year 2001, plus additional OECD data on export subsidies and domestic support	18 countries 20 sectors (of which 18 within the agricultural sector)	none	exogenous levels not affected by liberalization scenarios	- the benefits of combined 50% reduction in all rates of agricultural budgetary payments and trade protection (tariffs and export subsidies) with a 50% reduction in rates of import protection applying to non-agriculture amount to USD 44.3 billion or 0.14% of world GDP. - policy changes implemented by the OECD contribute 67% of the global gain - 29% of global gains accrue to non-OECD countries - 60% of global welfare gains originate from agricultural policy reforms
Francois et al. (2005)	Agriculture (tariffs) Manufacturing Services Trade facilitation	Modified version of GTAP, imperfect competition comparative static	GTAP 5, baseline year 1997, with tariff data from WTO integrated database supplemented by UNCTAD/ World Bank WITS data, original services protection estimates		endogenous capital accumulation in certain sectors	exogenous levels not affected by liberalization scenarios	- the benefits of 100% reduction in agricultural and industrial tariffs, export subsidies, domestic support for agriculture and tariff-equivalent services barriers; reduction in trading costs of 3% of the value of trade: USD 367,- 50% reduction in agricultural and industrial tariffs and export subsidies, 50% reduction in domestic support for agriculture, 50% reduction of tariff-equivalent services barriers, reduction in trading costs of 1.5% of the value of trade: USD 240

Study	Scope	Model	Data	Data aggregation	Dynamic features	Productivity treatment	Selected key findings
CEPII (2006)	Agriculture (tariffs) Manufacturing Services Trade facilitation	MIRAGE Perfect competition in agricultural sectors and imperfect competition in industry and services Recursive dynamic	GTAP 6 , baseline year 2001, additional estimates of services trade barriers	Two aggregation variants: 24 regions, 35 sectors and 18 regions, 23 sectors	endogenous capital accumulation	exogenous levels not affected by liberalization scenarios	- free trade in goods: USD 232 billion - 25% reduction in services trade barriers brings higher welfare gains than a 70% cut in agriculture by industrialised countries and a 50% by developing countries -liberalisation restricted to agriculture would not benefit developing country regions to a great extent, liberalisation of industrial trade offers larger gains to developing countries than to developed countries
Cline (2004)	Agriculture (tariffs export subsidies and domestic support) Manufacturing	Harrison, Rutherford and Tarr (1997), perfect or imperfect competition variants Comparative static	GTAP 5, baseline year 1997, only selected preferential trading agreements reflected in protection data	22 sectors (of which 8 agricultural), two variants of country aggregation: one with 25 countries with emphasis on big traders and one with 26 countries with emphasis on countries with most poverty	none	exogenous levels not affected by liberalisation scenarios	Under constant returns to scale variant of simulation: -full removal of trade protection worldwide: USD 85.5 billion or 0.35% of world GDP -55% of global welfare gains originate from agricultural policy reforms -combined gains from global free trade accruing to developing countries amount to 1.4% of their GDP as compared to 0.78% of GDP for industrial countries

Study	Scope	Model	Data	Data aggregation	Dynamic features	Productivity treatment	Selected key findings
Fernandez de Cordoba et al. (2004)	Manufacturing	GTAP, standard, perfect competition comparative static	GTAP 5, baseline year 1997, including data on preferential agreements from UNCTAD TRAINS database, additional information on tariff bindings	Not specified	none	exogenous levels not affected by liberalization scenarios	-free trade scenario: USD 42 billion - results for cuts according to so-called Girard formula range, depending on the ambition, from USD 32 USD 41 billion - linear tariff cut of 50% for developed regions and 36% for developing regions: USD 28 billion
Brown, Deardorff and Stern (2003)	Agriculture Manufacturing Services	Michigan Model Perfect competition in agriculture Increasing returns to scale, monopolistic competition in all other sectors	GTAP 4, baseline year 1995, supplemented with UN data on market structure, UNIDO and WB data on employment structure Scaling up of database for 2005 to account for the UR implementation	20 regions, 18 sectors	none	exogenous levels not affected by liberalization scenarios	- 33% reduction in the post-UR agricultural import tariffs, export subsidies, domestic support, tariffs on manufacturing imports and estimated post-UR services barriers results in global welfare gain of USD 574 billion - the net effect of the above reductions in the agricultural sector is negative while the net and individual developing and developed country effects of manufactures liberalisation are positive, increases in welfare due to services liberalisation were substantially greater than increases due to manufactures liberalisation -combined effects were sizable in both absolute and percentage terms for both

Study	Scope	Model	Data	Data aggregation	Dynamic features	Productivity treatment	Selected key findings
							developing and developed regions, the largest absolute gains were for developed countries
Dessus et al. (1999)	Welfare effects of complete elimination of agricultural and industrial tariffs on developing countries	Version of LINKAGE Model developed at OECD, perfect competition, comparative static multicountry multisector	GTAP 4, baseline year 1995, projection year 2010; supplemented by World Bank growth projections and statistics on national savings	16 regions, 4 sectors	exogenous TFP increases	exogenous levels assumed to increase in proportion to trade intensity (ratio of trade volume to output) 10% rise in trade intensity leads to a 0.9% rise in the level of TFP	- complete elimination of agricultural and industrial tariffs in all regions: USD 82 billion without TFP increase and USD 212 billion with trade-related TFP increase -Tariff rates reduced by 50% for non-OECD countries and full liberalisation maintained for OECD countries: USD 74 billion without TFP increase and USD 912 with trade-related TFP increase

Table 3: Comparison of Trade Liberalisation Effects under the Full Employment and Unemployment Assumptions

	Fixed employment assumption for SSA	Fixed real wage assumption for SSA
Panel A. Welfare (equivalent variation)		
Oceania	2,408	2,383
Rest of world	958	961
Asian NICs	18,585	18,539
North & East Asia	8,536	8,644
South East Asia	1,315	1,297
North America	-3,945	-3,812
Latin America	3,215	3,167
Western Europe	3,240	3,205
Rest of Europe	-297	-280
Former Soviet Union	2,147	2,085
Middle East and North Africa	3,894	3,747
Sub-Saharan Africa	**1,389**	**-7,682**
Total	41,444	32,251
Panel B. % change in the use of production factors in Sub Saharan Africa		
Land	0	0
Labour	0	-5.35
Capital	0	0
Panel C. % change in output in Sub Saharan Africa by broad sector		
Natural resources	1.1	2.1
Primary agriculture	0.8	-2.3
Processed agriculture	-1.0	-4.6
Textiles & clothing	-16.8	-20.5
Chemical products	-5.3	-8.7
Wood products	-6.3	-10.0
Motor vehicles & parts	-2.0	-5.2
Other machinery	-7.1	-12.5
Other manufacturing	-1.5	-4.6

Table continued 3: Comparison of Trade Liberalisation Effects under the Full Employment and Unemployment Assumptions

Panel D. % change in export price in Sub Saharan Africa by broad sector

Natural resources	0.6	0.2
Primary agriculture	0.0	0.4
Processed agriculture	-1.2	-0.9
Textiles & clothing	-5.0	-4.6
Chemical products	-2.0	-1.8
Wood products	-1.5	-1.0
Motor vehicles & parts	-3.9	-3.7
Other machinery	-1.9	-1.2
Other manufacturing	-1.6	-1.4

Source: Author's calculations.

Table 4: Welfare Estimates of Two Liberalisation Scenarios Using Different Aggregations

Sectors	Regions	Scenario 1	Scenario 2
35	24	0.09	0.18
25	18	0.07	0.14

Source: Decreux and Fontagné (2006).

Table 5: Export Shares of Four Selected LDCs as Reported in the GTAP 6.0 Database

	Bangladesh		Malawi
EU+EFTA	44.8	EU+EFTA	30.9
United States of America	37.4	United States of America	19.9
Rest of Middle East	2.8	Japan	8.5
Japan	1.9	South Africa	7.4
Canada	1.8	Rest of North Africa	4.3
Singapore	1.1	Mozambique	3.6
Hong Kong	1.1	Rest of Sub Saharan	3.0
India	0.8	Russian Federation	1.8
Iran	0.7	Zambia	1.7
Republic of Korea	0.5	Poland	1.7
Pakistan	0.5	Rest of Former Soviet Union	1.3
Taiwan	0.5	Mexico	1.3
Thailand	0.5	Philippines	1.2
Turkey	0.4	Australia	1.1
Australia	0.4	Hungary	1.0
Brazil	0.4	Zimbabwe	0.8
Mexico	0.4	Croatia	0.7
Rest of Sub Saharan	0.3	Tanzania	0.7
Rest of FTAA	0.3	Taiwan	0.7
Indonesia	0.2	Turkey	0.6
China	0.2	India	0.6
Viet Nam	0.2	Czech Republic	0.6
Malaysia	0.2	Rest of Middle East	0.5
Rest of North Africa	0.2	China	0.5
Poland	0.2	Romania	0.5
Philippines	0.2	Brazil	0.5
Russian Federation	0.2	Canada	0.4
Czech Republic	0.1	New Zealand	0.4
South Africa	0.1	Singapore	0.3
Rest of South Asia	0.1	Argentina	0.3
Hungary	0.1	Bulgaria	0.3
Rest of Former Soviet Union	0.1	Malaysia	0.3
Argentina	0.1	Rest of FTAA	0.3
New Zealand	0.1	Pakistan	0.2
Rest of the Caribbean	0.1	Mauritius	0.2
Sri Lanka	0.1	Rest of Oceania	0.2
Morocco	0.1	Republic of Korea	0.2
Central America	0.1	Botswana	0.2
Rest of SADC	0.1	Morocco	0.2
Rest of East Asia	0.0	Bangladesh	0.1
Zimbabwe	0.0	Central America	0.1
Chile	0.0	Tunisia	0.1
Nigeria	0.0	Slovenia	0.1
Rest of Oceania	0.0	Thailand	0.1
Estonia	0.0	Peru	0.1
Slovenia	0.0	Hong Kong	0.1
Rest of Europe	0.0	Indonesia	0.1
Venezuela	0.0	Slovakia	0.1

Table 5 Continued: Export Shares of Four Selected LDCs as Reported in the GTAP 6.0 Database

	Bangladesh		**Malawi**
Tunisia	0.0	Iran	0.1
Rest of Southeast Asia	0.0	Rest of the Caribbean	0.1
Romania	0.0	Rest of Europe	0.1
Tanzania	0.0	Uganda	0.1
Peru	0.0	Venezuela	0.0
Cyprus	0.0	Nigeria	0.0
Croatia	0.0	Rest of Southeast Asia	0.0
Slovakia	0.0	Colombia	0.0
Uruguay	0.0	Chile	0.0
Bulgaria	0.0	Rest of SACU	0.0
Madagascar	0.0	Latvia	0.0
Colombia	0.0	Viet Nam	0.0
Rest of South America	0.0	Sri Lanka	0.0
Latvia	0.0	Rest of South Asia	0.0
Malta	0.0	Rest of East Asia	0.0
Rest of SACU	0.0	Ecuador	0.0
Uganda	0.0	Uruguay	0.0
Ecuador	0.0	Rest of SADC	0.0
Mauritius	0.0	Rest of South America	0.0
Mozambique	0.0	Lithuania	0.0
Lithuania	0.0	Cyprus	0.0
Zambia	0.0	Estonia	0.0
Rest of North America	0.0	Bolivia	0.0
Bolivia	0.0	Rest of North America	0.0
Albania	0.0	Malta	0.0
Botswana	0.0	Madagascar	0.0
Malawi	0.0	Albania	0.0
Bangladesh	0.0	Malawi	0.0

Table 5 Continued: Export Shares of Four Selected LDCs as Reported in the GTAP 6.0 Database

	Mozambique		Zambia
EU+EFTA	53.0	EU+EFTA	49.5
South Africa	22.0	South Africa	10.9
Zimbabwe	7.3	Rest of Middle East	6.6
United States of America	4.1	Thailand	4.8
Japan	2.9	Japan	4.4
China	1.2	Rest of Sub Saharan	4.1
Malawi	1.1	Taiwan	4.0
Hong Kong	1.0	China	3.2
Russian Federation	0.8	Rest of North Africa	2.9
India	0.7	USA	1.6
Republic of Korea	0.6	India	1.1
Rest of Middle East	0.5	Zimbabwe	1.1
Canada	0.4	Rest of SACU	1.0
Singapore	0.3	Malaysia	0.9
Malaysia	0.3	Malawi	0.7
Rest of SACU	0.3	Pakistan	0.4
Brazil	0.3	Singapore	0.3
Rest of North Africa	0.3	Tanzania	0.2
Rest of Sub Saharan	0.2	Botswana	0.2
Indonesia	0.2	Mauritius	0.2
Thailand	0.2	Republic of Korea	0.2
Rest of Former Soviet Union	0.2	Mexico	0.2
Taiwan	0.2	Canada	0.1
Philippines	0.1	Australia	0.1
Australia	0.1	Russian Federation	0.1
Poland	0.1	Slovenia	0.1
Czech Republic	0.1	Uganda	0.1
Viet Nam	0.1	Hong Kong	0.1
Rest of FTAA	0.1	Brazil	0.1
Turkey	0.1	Cyprus	0.1
Mauritius	0.1	Bangladesh	0.1
Hungary	0.1	Poland	0.1

Table 5 Continued: Export Shares of Four Selected LDCs as Reported in the GTAP 6.0 Database

			Mozambique
Mexico	0.1	Turkey	0.1
Argentina	0.1	Rest of the Caribbean	0.1
Chile	0.1	Central America	0.1
Nigeria	0.1	New Zealand	0.0
Croatia	0.1	Rest of Former Soviet Union	0.0
New Zealand	0.0	Czech Republic	0.0
Rest of SADC	0.0	Argentina	0.0
Venezuela	0.0	Indonesia	0.0
Romania	0.0	Viet Nam	0.0
Zambia	0.0	Rest of FTAA	0.0
Tanzania	0.0	Hungary	0.0
Rest of the Caribbean	0.0	Mozambique	0.0
Central America	0.0	Bulgaria	0.0
Rest of Oceania	0.0	Venezuela	0.0
Peru	0.0	Rest of East Asia	0.0
Slovakia	0.0	Rest of Europe	0.0
Bangladesh	0.0	Nigeria	0.0
Colombia	0.0	Colombia	0.0
Rest of Europe	0.0	Philippines	0.0
Slovenia	0.0	Rest of South Asia	0.0
Iran	0.0	Chile	0.0
Bulgaria	0.0	Rest of SADC	0.0
Morocco	0.0	Lithuania	0.0
Rest of East Asia	0.0	Romania	0.0
Rest of South Asia	0.0	Croatia	0.0
Rest of Southeast Asia	0.0	Slovakia	0.0
Sri Lanka	0.0	Iran	0.0
Uruguay	0.0	Rest of Oceania	0.0
Tunisia	0.0	Peru	0.0
Malta	0.0	Morocco	0.0
Lithuania	0.0	Rest of Southeast Asia	0.0
Pakistan	0.0	Sri Lanka	0.0
Estonia	0.0	Estonia	0.0
Latvia	0.0	Albania	0.0
Uganda	0.0	Uruguay	0.0
Cyprus	0.0	Tunisia	0.0
Botswana	0.0	Rest of South America	0.0
Ecuador	0.0	Latvia	0.0
Rest of South America	0.0	Ecuador	0.0
Bolivia	0.0	Rest of North America	0.0
Albania	0.0	Malta	0.0
Madagascar	0.0	Madagascar	0.0
Rest of North America	0.0	Bolivia	0.0
Mozambique	0.0	Zambia	0.0

Contributors

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Thomas Reininger, born in Vienna in 1964, graduated in economics at the Vienna University of economics in 1992. After working as auditor with Arthur Andersen Vienna for one year, he joined the Raiffeisen Zentralbank (RZB, now Raiffeisen International RI) in 1994, he started to build up the group's economic and financial market research on Central, Eastern and Southeastern European (CESEE) countries, including Russia and Ukraine, and assisted in preparing the foundation of CESEE bank subsidiaries. In 2000, he joined the Oesterreichische Nationalbank (OeNB) and joined the CESEE Countries Unit in the Foreign Research Division of the Economic Analysis and Research Department. There his main tasks were the monitoring and partly forecasting of economic and financial market development in CESEE as well as the assessment of economic policies (in particular with respect to the monetary integration process) and financial market stability in CESEE countries. On the other hand, he has contributed to studies on CESEE financial markets and on CESEE-related economic topics (like price convergence, monetary transmission mechanism, credit growth, etc.). In 2005, Thomas Reininger became Senior Expert of the Foreign Research Division.

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List of "Workshops – Proceedings of OeNB Workshops"

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		published
No. 7	The European Integration Process: A Changing Environment for National Central Banks *Vienna, 21 October 2005*	3/2006
No. 8	Price Setting and Inflation Persistence in Austria *Vienna, 15 December 2005*	4/2006
No. 9	New Regional Economics in Central European Economies: The Future of CENTROPE *Vienna, 30 to 31 March 2006*	6/2006
No. 10	Strategies for Employment and Growth in Austria *Vienna, 3 March 2006*	9/2006
No. 11	From Bretton Woods to the Euro – Austria on the Road to European Integration *Vienna, 29 November 2006*	7/2007
No. 12	Emerging Markets: Any Lessons for Southeastern Europe? *Vienna,5 to 6 March, 2007*	8/2007
No. 13	The Experience of Exchange Rate Regimes in Southeastern Europe in a Historical and Comparative Perspective *Vienna, April 13, 2007*	1/2008

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This quarterly publication, issued both in German and English, offers analyses of current cyclical developments, medium-term macroeconomic forecasts and studies on central banking and economic policy topics. It also summarizes the findings of macroeconomic workshops and conferences organized by the OeNB.

Focus on European Economic Integration *quarterly*
The Focus on European Economic Integration (FEEI) is a channel for communicating the OeNB's ongoing research on Central, Eastern and Southeastern European (CESEE) countries, thus reflecting a strategic regional research priority of the OeNB. Contributions primarily deal with macrofinancial and monetary integration and also include economic country analyses. As from 2009, the FEEI is published quarterly.

Statistiken – Daten & Analysen *quarterly*
This publication contains brief reports and analyses focusing on Austrian financial institutions, cross-border transactions and positions as well as financial flows. The contributions are in German, with executive summaries of the analyses in English. The statistical part covers tables and explanatory notes on a wide range of macroeconomic, financial and monetary indicators. The tables and additional information and data are also available on the OeNB's website in both German and English. This series also includes special issues on selected statistics topics published at irregular intervals.

econ.newsletter *quarterly*
The quarterly English-language newsletter is published only on the Internet and informs an international readership about selected findings, research topics and activities of the OeNB's Economic Analysis and Research Department. This publication addresses colleagues from other central banks or international institutions, economic policy researchers, decision makers and anyone with an interest in macroeconomics. Furthermore, the newsletter offers information on

publications, studies or working papers as well as events (conferences, lectures and workshops).
For further details see *www.oenb.at/econ.newsletter*

Financial Stability Report *semiannual*
Issued both in German and English, the *Financial Stability Report* contains first, a regular analysis of Austrian and international developments with an impact on financial stability and second, studies designed to provide in-depth insights into specific topics related to financial market stability.

Workshops – Proceedings of OeNB Workshops *three to four issues a year*
The *Proceedings of OeNB Workshops* were introduced in 2004 and typically comprise papers presented at OeNB workshops at which national and international experts, including economists, researchers, politicians and journalists, discuss monetary and economic policy issues. Workshop proceedings are generally available in English only.

Working Papers *about ten papers a year*
The OeNB's *Working Paper series* is designed to disseminate, and provide a platform for discussing, findings of OeNB economists or outside contributors on topics which are of special interest to the OeNB. To ensure the high quality of their content, the contributions are subjected to an international refereeing process.

Economics Conference (Conference Proceedings) *annual*
The Economics Conference hosted by the OeNB is an international platform for exchanging views and information on monetary and economic policy as well as financial market issues. It convenes central bank representatives, economic policymakers, financial market players, academics and researchers. The conference proceedings comprise all papers presented at the conference.

Conference on European Economic Integration
(Conference Proceedings) *annual*
This series, published in English by a renowned international publishing house, reflects presentations made at the OeNB's annual conference on Central, Eastern and Southeastern European issues and the ongoing EU enlargement process (formerly East-West Conference).

For further details see *http://ceec.oenb.at*

Annual Report *annual*

The *Annual Report* of the OeNB provides a broad review of Austrian monetary policy, economic conditions, new developments in the financial markets in general and in financial market supervision in particular as well as of the OeNB's changing responsibilities and its role as an international partner in cooperation and dialogue. It also contains the OeNB's financial statements.

Intellectual Capital Report *annual*

The *Intellectual Capital Report* is a review of the OeNB's intellectual capital and its use in the OeNB's business processes and services. The report highlights the interaction between human, relational, structural and innovation capital within the OeNB and reveals the influence of underlying factors. The integrated view of this stock-taking exercise serves to assess the consistency of the OeNB's intellectual capital with its knowledge-based strategic orientation.