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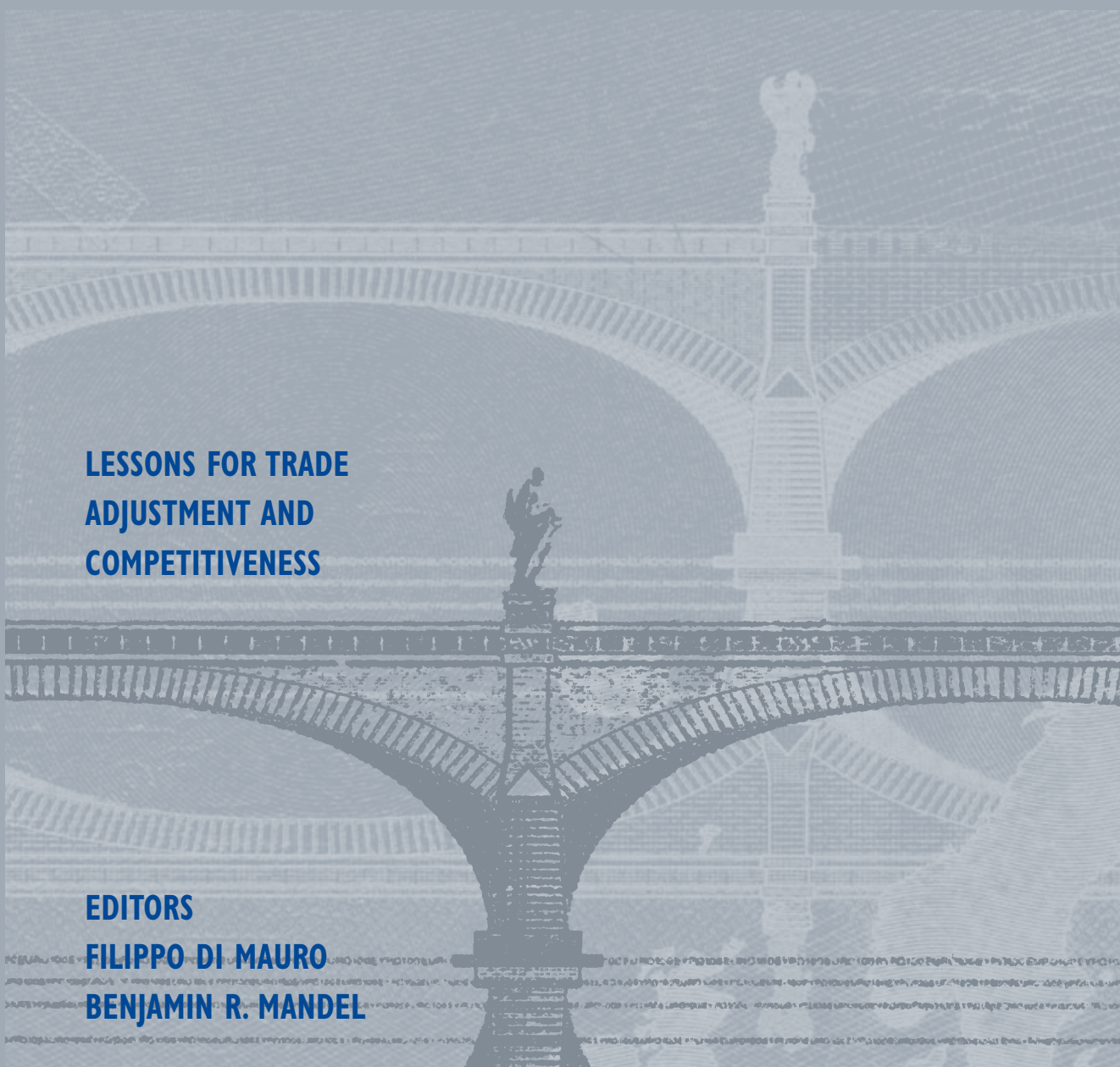

LESSONS FOR TRADE ADJUSTMENT AND COMPETITIVENESS

EDITORS
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BENJAMIN R. MANDEL

EUROPEAN CENTRAL BANK RECOVERY AND BEYOND – LESSONS FOR TRADE ADJUSTMENT AND COMPETITIVENESS

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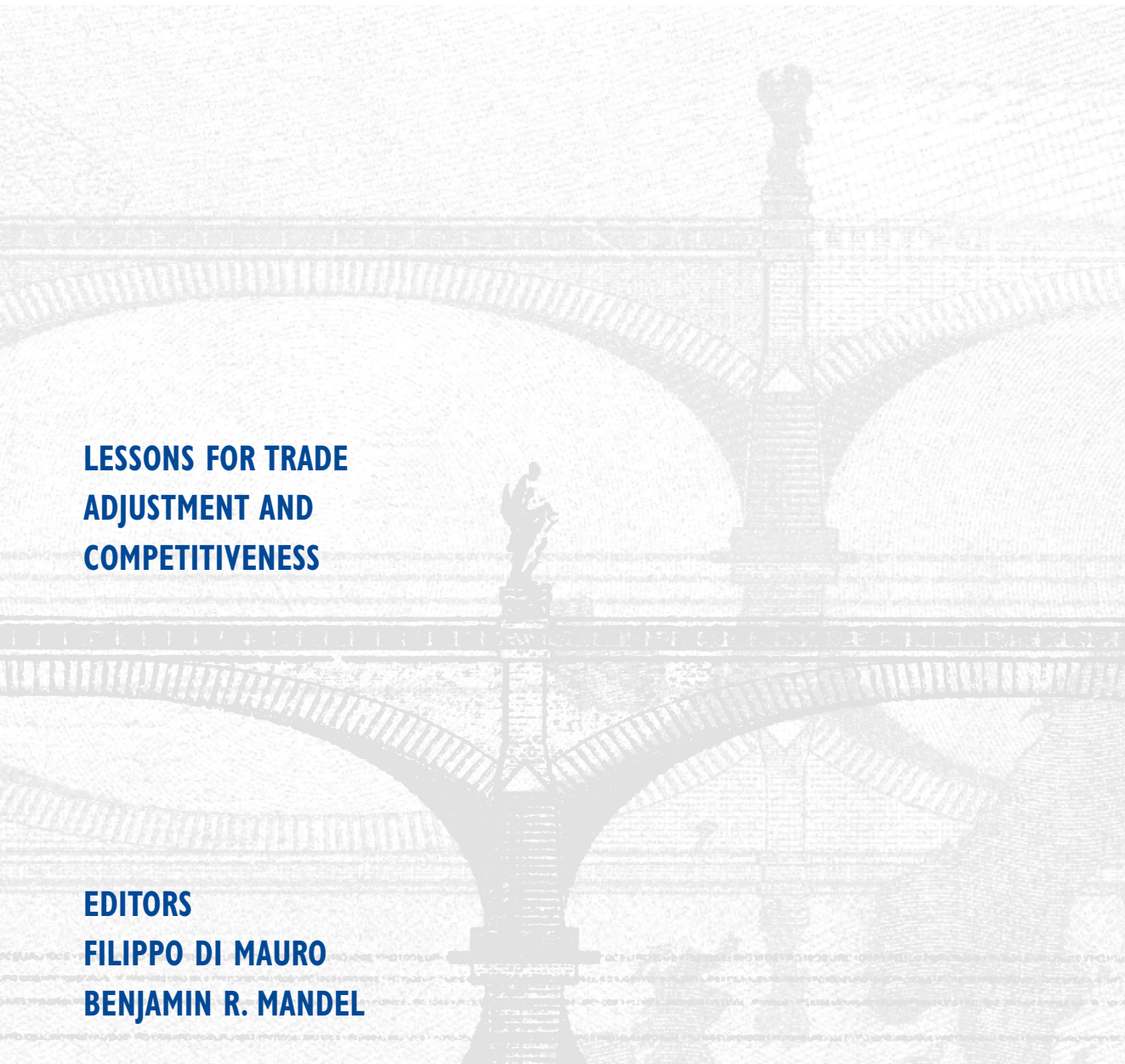

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CONTENTS

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This book is a direct response to the current debate on the strength and sustainability of the trade recovery and its impact on the competitiveness of countries. This debate is particularly relevant in Europe at this time, as governments are discussing how to strengthen their economic governance.

Contributors were asked to compose short essays summarising recent or forthcoming works on the subject of the debate, written from a non-technical and policy-relevant perspective. Some of the chapters are based on papers presented on 27-28 September 2010 at the European Central Bank (ECB) workshop entitled "Trade and competitiveness". Among the authors are ECB staff members, as well as central bankers and academics from both European and US institutions. For their very valuable and insightful contributions, we are indebted to George Alessandria, Jonathan Anderson, Robert Anderton, Jean-Charles Bricongne, Matteo Bugamelli, Vesna Corbo, Massimo del Gatto, Simona delle Chiaie, Hubert Escaith, Lionel Fontagné, Sara Formai, Katrin Forster, Joseph E. Gagnon, Guillaume Gaulier, Joseph Gruber, Joseph P. Kaboski, Daniel Lederman, Nannette Lindenberg, Jaime Marquez, Warwick McKibbin, Virgiliu Midrigan, Sébastien Miroudot, Giorgio Barba Navaretti, Chiara Osbat, Fabiano Schivardi, Bernd Schnatz, Andrew Stoeckel, Tadios Tewolde, Vincent Vicard and Nico Zorell. We are also grateful to Carina Stubenrauch for her careful and competent editorial assistance.

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CHAPTER 1

EDITORS' OVERVIEW[1]

BY FILIPPO DI MAURO, ECB[2]

BENJAMIN R. MANDEL, FEDERAL RESERVE BOARD[3]

1 INTRODUCTION

The great trade collapse in the wake of the 2008-9 financial crisis provided a unique insight into the complexities inherent to international markets, and underlined a number of lessons for us to consider as we evaluate the shape of the global trade recovery. While the factors contributing to the crisis were diverse and multifaceted, it is arguable that persisting imbalances across the globe played a role. How will trade imbalances unwind and what is the role for policies influencing international transactions for goods and services? A precursor to answering this question is a broad understanding of how trade flows react to changes in the macroeconomy, and therefore much of this book will focus on recent assessments of the drivers of trade adjustment. A closely related concept affecting the degree to which countries trade is their relative competitive position. To tie in the chapters with the broader policy emphasis on competitiveness, we will also define and evaluate several drivers of international trade competitiveness.

Conceptually, our point of departure is the long-standing debate on the magnitude of trade elasticities, i.e. the extent to which relative prices and national income affect international trade. In the short run, trade seems surprisingly sensitive to growth and relative price changes, as evidenced by the fallout of the recent financial crisis and the concurrent massive swings in nominal goods flows. Over longer periods these elasticities – and the corresponding Armington elasticity indexing the degree of differentiation across source countries – define both the size of nations in international markets and the magnitude of welfare gains from liberalisation. An important contribution of this book is thus its provision of some direct and indirect quantitative evidence on the size and drivers of trade elasticities.

1 The views expressed in this volume are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System nor those of the European Central Bank or the Eurosystem or any other institution with which the authors are affiliated.

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As trade recovers, revisiting the measurement of trade elasticity becomes critical. Specifically, two main questions need to be tackled as we gauge the strength and sustainability of the trade recovery. First it remains an open empirical question as to what role changes in relative trade prices – most notably exchange rates and/or relative price-cost dynamics – need to play in the readjustment. Second, as the trade collapse was several times stronger than the decline in global output, it remains uncertain whether international transactions will respond too much or too little to enlivening economic activity in the recovery phase. More specifically, how long that response will take – and the implied change in the elasticity of trade – is a matter requiring in-depth research that we will report on here.

In addition to the size and speed of the trade recovery for any given country, many policy-makers are keenly aware of the *relative* position of their exporters in the rapidly changing landscape of international traders; in other words, how is their competitiveness evolving? In contrast to focusing on gross trade flows, assessing competitiveness is not limited to the issue of correctly measuring trade elasticities. Moreover, from the perspective of the policy practitioner, achieving higher exports is not always and everywhere an appropriate objective. We will argue that a better proxy for a given country's competitiveness is the productivity of its firms, and competitiveness-enhancing policies are those that foster this productivity. Thus, macro-based indicators need to be complemented by firm-based tools and analysis. This book will provide theoretical and empirical evidence in support a broader assessment of trade competitiveness, also drawing on the experience of the recent collapse in trade.

In summary, this book documents an array of factors affecting trade adjustment and competitiveness. We view these lessons, motivated by both recent macroeconomic crises and longer-run trends, as instrumental in crafting effective policies to foster balanced growth.

2 CONTRIBUTIONS TO THIS VOLUME

The contributions to this volume are organised in four parts. First, we elaborate briefly on some conceptual issues related to the measurement of trade elasticities and competitiveness. Second, we examine whether the recent trade collapse can give us hints regarding the evolution of (and mechanisms behind) aggregate trade elasticities, and thus about the shape of the trade recovery. Third, we look at selected lessons from the trade performance of the United States, the euro area and China. Finally, we examine how a number of firm and industry-level studies can enhance our understanding of the drivers of trade adjustment and competitiveness. The chapters document a number of findings, as outlined below, which we consider to be highly informative for policy-makers.

(i) Trade elasticities: conceptual issues

- There are large discrepancies between studies regarding estimates of the Armington trade elasticity which do not lend themselves to intuitive interpretation (Chapter 3). This suggests that caution should be taken when assessing model-based policy recommendations which rely on estimates of these elasticities for forecasting, especially for highly open countries such as those in the euro area.

- There are many diverse channels through which a country's exports are affected by national income growth and international trade prices. An important channel which enables fast-growing countries to export more is the production of new varieties of goods; this generates demand from consumers abroad who value variety (Chapter 4). The implication of this channel is that positive shocks to output growth need not lead to trade deficits. Exports may also be affected if the structure of production is itself a function of international relative prices, for example if changes in the real exchange rate induce vertical foreign direct investment (Chapter 9).

(ii) Trade recovery and elasticities: lessons from the crisis

- The trade downturn during the 2008-09 financial crisis was exceptional in many respects, although it can be at least partially reconciled with the inventory cycle (Chapter 10), the particular composition of demand shocks affecting highly import-intensive industries (Chapter 5), or the extent that households and firms reappraised risk in the wake of US housing market volatility (Chapter 8). Importantly, trade was affected in ways unaccounted for by typical measures of price and income sensitivity. Given that that these were cyclical phenomena, measured trade elasticities will likely revert to their lower long-run values from their recent heights.

- However, whether the crisis represented a structural change in those long-run elasticities remains an open empirical question. The crisis opened up an unprecedented gap between the actual level of world trade and its higher "equilibrium" level implied by historical relationships with GDP. This trade gap has been narrowing only gradually during the recovery and part of the gap could persist for some time to come for aggregate world trade (Chapter 6) and the United States in particular (Chapter 7).

(iii) Country case studies

- Over the course of the recovery and beyond, how large a space should particular countries occupy in global trade? To answer this question, country-specific factors such as income growth and product specialisation, as well as policies affecting those factors, are informative. For instance, over the past two decades the US share of world exports of goods fell from 11% to 8%. One possible explanation is that the United States is simply less able to compete in international markets. Alternatively, large parts of the fall in the US share could be attributed to the composition of the US export bundle and the US share in world GDP (Chapter 11), which points to the inadequacy of the aggregate export share as an indicator of a country's competitiveness.

- In addition to export share, relative export prices are also widely considered to be a bellwether for competitiveness. Divergent export performance across euro area Member States over the past decade can be used to evaluate the degree to which relative cost and prices are a proxy for competitiveness. Although relative export prices are indeed important, DSGE model simulations show that they do not fully explain the differences in actual export growth (Chapter 13).

- The responsiveness of exports to relative prices has garnered heightened attention in the case of China, where the effectiveness of currency revaluation for curtailing (what are viewed to be) trade imbalances is being weighed. The sensitivity of Chinese exports to the exchange rate hinges crucially on the degree to which national savings are affected by international prices; if savings are insensitive, then the structural current account will not change with currency revaluation. However, if savings are driven largely by corporate profits dependent on export earnings, then revaluation could be effective in fostering trade adjustment (Chapter 12).

(iv) Industry and firm-level factors

- Firm characteristics such as size, organisational set-up and sector/geographic specialisation have a bearing on trade performance and overall competitiveness (Chapter 15). These impacts are above and beyond those driven by macroeconomic changes in the country where the firm is located, and there is thus a need for a deeper and broad-based view of competitiveness-enhancing factors and policies (Chapter 2).

- Finer details about firms also shed light on the mechanics of trade adjustment. For instance, French firms responded asymmetrically to the gradual expansion of demand prior to the crisis and the rapid contraction of demand during the crisis. While the growth phase was characterised by the formation of new product-destination links, the contraction was predominantly accounted for by the existing trade relationships of larger firms, i.e. dominated by the "intensive margin" (Chapter 16).

- Finally, policy-makers should be mindful that idiosyncratic characteristics of an industry's market structure can convolute the relationship between trade and aggregate prices or income. When market segmentation gives rise to pricing-to-market behaviour, variations in the mark-ups that firms charge can mitigate the pass-through of exchange rate changes to export prices and volumes. Indeed, this is the case in varying degrees for European auto exporters (Chapter 17). Additionally, the degree of an industry's delocalisation of production across national borders affects its trade intensity and, at least in the short run, its responsiveness to changes in final demand (Chapter 14) as well as relative prices (Chapter 17).

PART I

TRADE ELASTICITIES AND COMPETITIVENESS: SOME CONCEPTUAL ISSUES

CHAPTER 2

COMPETITIVENESS AS A MULTI-DIMENSIONAL CONCEPT

BY FILIPPO DI MAURO, ECB

KATRIN FORSTER, ECB

Competitiveness is a multidimensional concept, which requires an adequately broad-based set of indicators. Restoring and enhancing country competitiveness – most notably in Europe – thus requires policy responses that beyond restoring price-cost competitiveness, aim at enhancing aggregate productivity, including in-depth analysis of firm-level characteristics.

1 INTRODUCTION

In spite of being a widely used term in the public debate, there is no consensus on how to define and measure competitiveness. Opinions tend to diverge rather widely on which concept of competitiveness is more appropriate and under which circumstances. Partly as a result, a very broad range of indicators are available. In general terms, competitiveness can be defined as the ability of a country to compete successfully in international markets. Focusing mostly on export performance, traditional approaches usually refer to standard indicators of price and cost competitiveness, as measured by differently deflated effective exchange rate indicators. While developments in price competitiveness have always been important drivers of an economy's ability to compete in international markets, other factors have become increasingly important in the face of the structural changes engendered by globalisation. These relate, among others, to the export specialisation and to the geographical orientation of a country's exports, as well as to the institutional environment prevailing in that country. Increasingly, theoretical literature and empirical evidence now also takes into account a number of factors which are firm-specific, such as size and production organisation. Below, and using Table 1 as a reference, we briefly examine the most common measures of competitiveness, including their pros and cons.

2 PRICE-COST INDICATORS

Since relative prices are an important factor shaping the export performance of an economy, particularly in the short term, relative export prices or the real effective exchange rate constitute standard indicators of cost and price competitiveness. To construct the latter, several deflators are used, such as unit labour costs (either in the manufacturing sector alone or in the total economy), consumer price and producer price indices and GDP deflators. For individual euro area countries,

the ECB calculates harmonised competitiveness indicators (also based on different deflators), which correspond to real effective exchange rates computed on the basis of national trade weights. Conceptual differences across deflators notwithstanding, the trends in price and cost competitiveness developments appear to be broadly invariant to the deflator used, both for the euro area as a whole and for its member countries.

The main advantage of price-cost indicators is that they are relatively easy to compute and readily available for most countries, as well as conceptually rather well established. They are subject, however, to a number of pitfalls, which calls for a careful analysis (see Table 1).

Table 1 Competitiveness is a multidimensional concept [1)]

Type of approach	Objective	Indicators/tools/ models	Pros	Cons
Macro/ institutional	Price-cost based	REER – differently deflated (CPI, PPI, ULC, export prices…)	• Easy to communicate • Macro-based	• Not always able to explain export performance • Overemphasis on export performance maximization as ultimate welfare objective
	Sectoral specialization	Revealed comparative advantage	Provides useful info on overall export structure characteristics	• Unable to explain one to one export performance • Allocation of sectors by technological content (or factor use) is arbitrary
	Non-price competitiveness	(R&D (Education, (Institutional environment)	Relatively easy to measure using national and OECD/WB indicators	• Difficult to establish relation with trade performance • Useful for long – not short-term analysis
Firm Level	Firm level empirical analysis	(e.g. EFIGE survey 16,000 EU firms (see Chapter 15), French firm level data base (see Chapter 16)	Provides direct info on firms characteristics (size, sectoral/geographical specialization, production organization)	• Data intensive and difficult to update frequently • More suitable for structural policy analysis
	Model based indicators	Overall competitiveness (proxied by firm TFP; see Ottaviano et al (2009))	• Allows explicit representation of explanatory factors • Allows policy analysis (e.g. lower tariff)	• Data intensive and difficult to update frequently • More suitable for structural policy analysis

1) The table reports types of approaches and methodologies mentioned in the book. The exception is the last "survey based", which is listed for the sake of completeness.

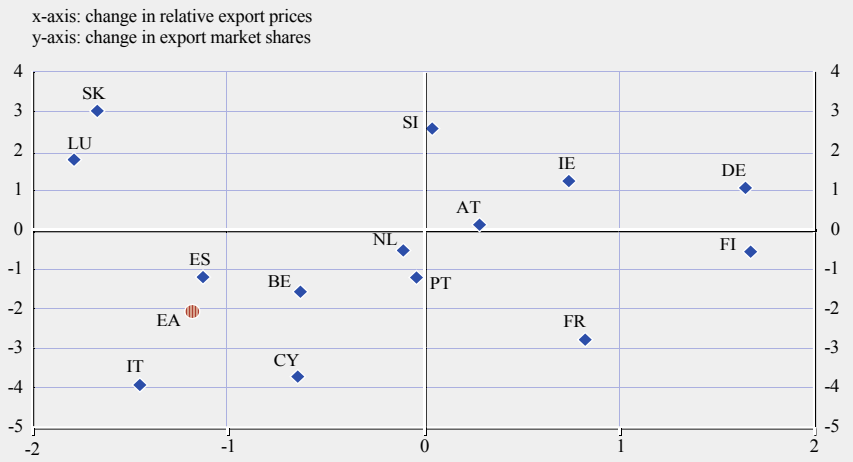
Table 1 Competitiveness is a multidimensional concept [1] (cont'd)

Type of approach	Objective	Indicators/tools/ models	Pros	Cons
Product level analysis	• Calculation sector price levels • Derivation quality adjusted trade flows	• Competitiveness indicators based on price level • Estimation highly disaggregated trade elasticity	• Provides critical info on export structure characteristics • Inputs to improve models calibration	• Difficult to derive aggregate macro results
	• Specific sector/ product studies	Panel analysis on homogenous sectors (see Chapter 3)	• Allows to handle the quality issue ... • Can provide useful case studies for policy relevant sectors (e.g. cars)	Cannot be aggregated at macro level
Survey based	Comprehensive broadly defined competitiveness indicators	World Economic Forum; World Bank, "Doing business" report	Comprehensive assessment using a vast range of indicators (cost, regulations, structural, ...)	Difficult cross country comparison

1) The table reports types of approaches and methodologies mentioned in the book. The exception is the last "survey based", which is listed for the sake of completeness.

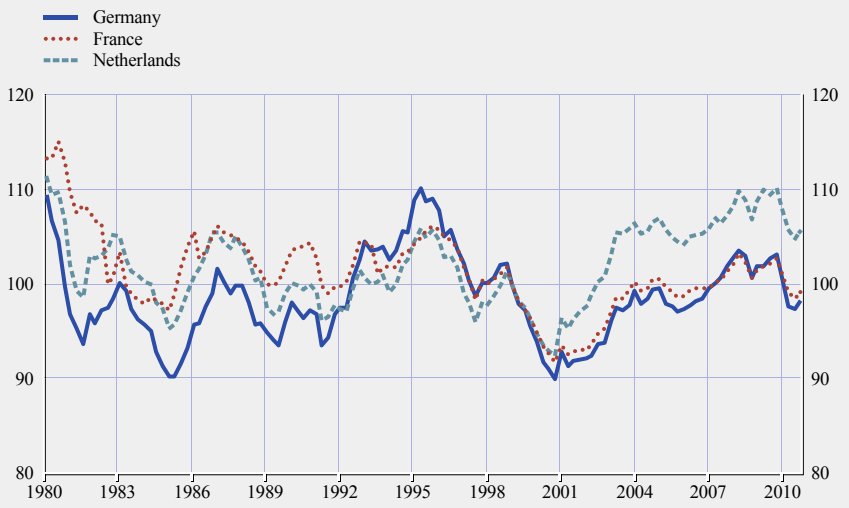
First, price-cost developments are not always an entirely satisfactory determinant for export performance. For the euro area for instance, while price competitiveness has been – in the last ten years – a critical factor shaping the relative export performance of the area as a whole, some countries, such as France, experienced rather significant improvements in price competitiveness (as measured by the change in relative export prices), yet saw steady losses in their export shares (see Chart 1).

Chart 1 Export market shares and price competitiveness (1999-2008)



Source: Di Mauro et al (2010).

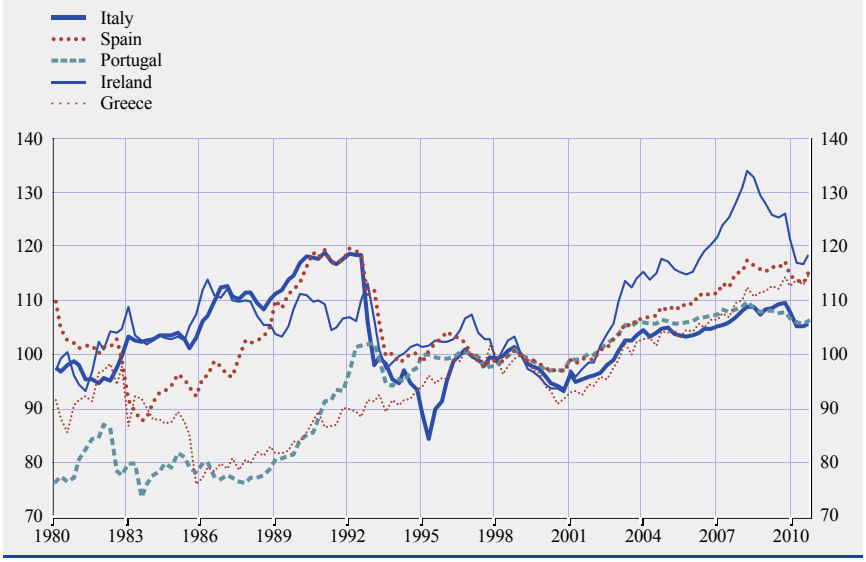
Chart 2 Real effective exchange rates (HICP deflated)



Source: ECB.

Moreover, price-cost indicators are highly sensitive to the base period. For instance, should the starting point of the above analysis be extended backwards to the 1980s, the assessment of the change in the competitive position over time changes rather substantially (see Charts 2 and 3).

Chart 3 Real effective exchange rates (HICP deflated)



Source: ECB.

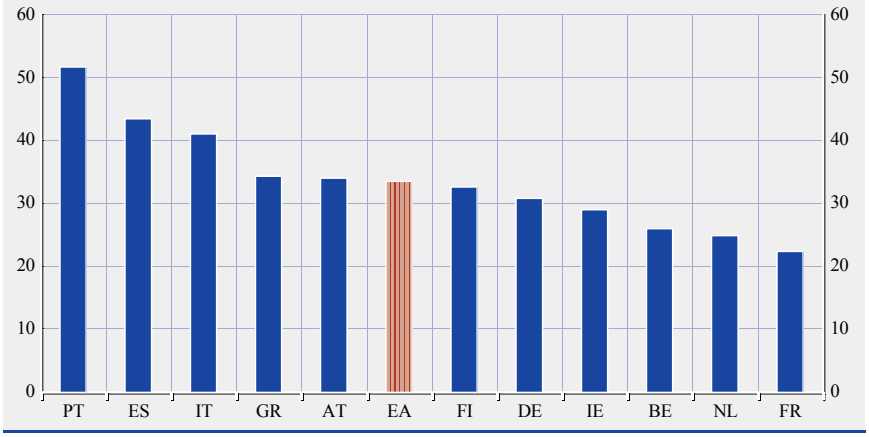
2.1 SECTOR SPECIALISATION

Given the above-mentioned pitfalls, some non-price competitiveness characteristics, and most notably the country's export composition, has often been used to assess whether the export structure is consistent with (perceived) comparative advantage and whether it is concentrated in fast-growing global market segments. As measured by the Balassa Index, the euro area is strongly specialised in medium to high-tech exports, in line with the export structures of Germany, France, Italy and Spain (see di Mauro et al (2010)). While this specialisation has benefited the euro area overall, since world demand has been rather strong for these sectors (particularly for machinery, equipment, motor vehicles and transport equipment), it is striking and somewhat surprising that, overall, euro area countries have not shown an increasing specialisation in fast-growing high-tech sectors. While this might reflect structural rigidities that constrain the ability of euro area firms to adjust rapidly, it could also reflect the fact that euro area firms have so far not been under significant pressure to make substantial changes to their specialisation. By contrast, Greece, Portugal and, to a lesser extent, Italy appear to have specialised rather strongly in low and medium-tech sectors (e.g. textiles), suggesting that these countries are more directly exposed to competition from low-cost countries, and in particular from China (see Chart 4).

Such observations are also consistent with the significant losses, starting in 1999, of export market share by Greece, Portugal and Italy. Nevertheless, such an analysis is also open to questions. First, the puzzle of the declining market share for France remains unresolved, considering that the country has been increasingly leaning towards their apparent comparative advantage, i.e. research

Chart 4 Degree of overlap in export specialisation between selected economies and China

(percentages; average overlap 2005-2008)



Source: Di Mauro et al (2010).

Note: Percent in which sectoral specialisation of a certain country – as indicated by the Balassa index – coincides with the one of China.

and capital-intensive products. Second, and related to it, the classification by resource intensity is rather subjective, given that for individual sectors, resource intensity varies widely depending on the various production stages (see di Mauro et al. (2010)).

2.2 FIRM-LEVEL ANALYSIS

The indicators examined above tend to be at odds with the casual observation that – in sophisticated economies – product quality and branding play an important role. More generally, the traditional approach tends to overemphasise export performance, while, at best, trade has to be considered just as a means to achieve welfare maximisation, as proxied by higher value added per capita or lower unemployment. Against this background, recent literature has underlined the role of analysis at the firm level as a critical complement to macro competitiveness analysis. In a recent paper, Ottaviano et al. (2009) propose a model-based framework where competitiveness is defined as the productivity of the firms located in a given country. In this context, the most competitive economy is considered to be the one with the best prospects for "generating" highly productive firms. Critical elements that enhance competitiveness, as understood in this wider definition, include three broad sets of factors: (i) country-related factors, such as institutional efficiency, barriers to entry in a sector and demand conditions; (ii) geography and trade frictions – i.e. how accessible the country is to international competition and, at the same time, how accessible foreign markets are for domestic producers and exporters; and (iii) firm-level factors, such as the technological ability to utilise a given resource.

To this end, two types of competitiveness measures are computed. The first is an "overall" measure of competitiveness and corresponds to the observed productivity of firms, which would depend on all sets of factors identified by the model. The second – "producer" competitiveness – measures the impact of technology and institutional factors after filtering out the effects of geographical location. This captures the ability of countries to generate highly productive firms, abstracting from their respective market size and level of accessibility. The results of the calibrated model show that the most competitive countries (according to the "overall competitiveness" indicator) are the ones that are centrally located (e.g. Belgium, the Netherlands) or that combine technological superiority with easy market access (e.g. Finland – see Table 2, columns 1 and 2). These findings are in line with a theoretical model predicting that countries that are large or easily accessible for firms located in trading partner countries should exhibit a tougher competitive environment and a stronger ability to channel resources from low to high productivity uses. On the other hand, more peripheral countries such as the Mediterranean countries rank low because of a less central location with respect to their export markets and a possible disadvantage in terms of technology, which may also be a sign of high entry costs for foreign firms. When abstracting from the geographical position and focusing on producer competitiveness (see Table 2, column 2), the Netherlands ranks first: it appears to have a strong technological advantage and a sound institutional environment, thus being able to generate highly competitive firms. As shown, in particular, in the case of the second-ranked country, Sweden, being at the periphery does not

Table 2 Overall/Producer competitiveness. Country ranking

Countries	Overall competitiveness	Producer competitiveness
Finland	1	3
Belgium	2	6
Netherlands	3	1
Sweden	4	2
Germany	5	5
France	6	9
Denmark	7	4
Austria	8	8
United Kingdom	9	7
Italy	10	11
Spain	11	10
Portugal	12	12

Source: Ottaviano et al (2009).

per se represent a problem for a country, unless it is compounded by clear relative technological and institutional disadvantages that hamper firms' productivity. In this context, it is worth noticing that the Mediterranean countries, namely Spain, Italy and Portugal, are consistently in the lower part of the competitiveness ranking, no matter how it is measured. This points to the presence of parallel negative impacts of all the determinants of competitiveness identified in the model, namely geographical location, market access, technological and institutional (dis)advantage. At the same time, some centrally located countries, such as Belgium, show a rather substantial worsening in terms of producer competitiveness compared with their ranking in terms of overall competitiveness, signalling possible technological disadvantages and/or institutional bottlenecks that are partially offset by their central location.

3 CONCLUSION

Competitiveness is a multidimensional concept, which requires an adequately broad-based set of indicators. Restoring and enhancing country competitiveness – most notably in Europe – thus requires policy responses that, beyond restoring price-cost competitiveness, aim to enhance aggregate productivity. Euro area countries should foster innovation and continue to enhance the flexibility of national goods and labour markets, including a healthy process of selection of the most productive firms. At the same time, strengthening market integration within Europe will create larger local markets, attract foreign competitors and foster firm productivity, also through smoother labour force adjustment across sectors. The model-based indicators illustrated in this chapter are derived from a consistent framework that makes its possible to consider macro and firm-level factors together. The main message, also reiterated in the chapters in the latter part of this book, is that in a world in which national boundaries are blurred and firms are increasing in size, firm-level factors cannot be simply collapsed within a residual, non-price component. On the contrary, it is critical to examine the extent to which individual characteristics are important, in order to prop up the productivity of firms and thus of the countries in which they are located.

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CHAPTER 3

MEASURING TRADE RESPONSES TO CHANGES IN INTERNATIONAL PRICES: A SURVEY OF THE MAIN RESULTS

BY VESNA CORBO, ECB

This chapter provides a survey of the main results on estimates of trade responses to international price changes. Some confusion regarding what elasticity measures are relevant in what context arises from the fact that there are several definitions of these responses. In addition to this, the estimates are very sensitive to the estimation method employed, the exact specification used, and the time horizon considered, making it impossible to point out one "correct" value to rely on for a broad range of purposes. Taken together, these facts suggest that it is necessary to perform sensitivity analyses whenever results based on estimates of the elasticity of substitution or trade elasticity are used as the basis for policy conclusions.

I INTRODUCTION

Since the 1950s the trade literature has provided a large number of estimates of trade responses to international price changes. Still, little consensus has been reached so far on the results. Actually, if anything, most recent estimates obtained using disaggregated data and more sophisticated econometric methods tend to deviate even more drastically from earlier estimates.

There is also some confusion regarding what elasticity measures are relevant in what context: this arises from the fact that there are several definitions of these responses. The elasticity of substitution between domestically produced and imported goods is the relevant measure for structural models, such as the EAGLE model used for policy analysis at the ECB. The term "trade elasticity", on the other hand, usually refers to estimates of the reaction of aggregate trade volumes to changes in relative prices. These do not have a clear theoretical interpretation and are not relevant for the calibration of macroeconomic structural models, but they are nonetheless useful empirically for modelling e.g. the response of trade balances to real exchange rate changes.

The implications for policy of this unsettled debate are highly relevant; while moves in relative prices, most notably exchange rates, are often a source of hot debate, the extent of the aggregate real impact on the economy is in fact extremely hard to measure. The very large discrepancies in estimates across countries as well as across studies do not lend themselves to intuitive interpretation.

This chapter provides a (non-exhaustive) overview of some of the methodological considerations, as well as the estimates that are available in the literature, with a focus on the euro area countries.

2 METHODOLOGICAL CONSIDERATIONS

Studies on trade elasticities are usually based on the Armington (1969) assumption that the substitutability between two imported varieties is the same as the substitutability between an imported variety and a domestic one. Trade costs etc. may imply that the varieties are in practice not the same; by assumption, however, they do not differ in terms of substitutability. The Armington (1969) aggregator is given by the following expression:

$$X = \left[\sum_i b_i X_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \quad (1)$$

where b_i is a taste or quality constant, X_i denotes the demand for a specific good and σ denotes the elasticity of substitution (the Armington elasticity).[1]

Under this assumption, there is a direct mapping between the price elasticity of imports, or what we have referred to earlier as trade elasticity, and the elasticity of substitution. However, whenever aggregate data are employed for estimation, several, potentially very severe, biases emerge as highlighted in the literature.[2] Meanwhile, many calibrated simulation models used for policy analysis still largely rely on traditional calibration from earlier studies, not always keeping up with the latest developments in the empirical literature.

3 OVERVIEW OF EXISTING EMPIRICAL WORK

In their review of the literature, McDaniel and Balistreri (2003) point to four robust findings: 1) long-run estimates are higher than short-run ones; 2) estimates from early literature suffered from simultaneity bias; 3) more disaggregated estimates are higher than aggregated ones; and 4) cross-sectional studies generally arrive at higher estimates than time-series analyses. These findings will be further highlighted below.

3.1 LONG-RUN ELASTICITIES ARE LARGER THAN SHORT-RUN ONES

The distinction between short and long run can be made in a time-series setting. The estimation method applied by Gallaway, McDaniel and Rivera (2003) is an

1 The interpretation of X_i can be very flexible; it can be a single variety, a good, or an aggregated basket of goods.
See Armington (1969), pp. 167-8, for a discussion.

2 Examples of studies focusing on this aspect are Feenstra (1994), Imbs and Méjean (2009) and Broda and Weinstein (2006).

example of the "standard" time-series approach found in much of the literature. The estimated equation is:

$$y_t = a_0 + a_1 x_t + a_2 y_{t-1} + u_t, \tag{2}$$

where $y = M/D$ denotes the ratio of imports to domestic goods, a_0 is a constant, a_1 is the short-run elasticity of substitution between imports and domestic goods, $a_1/(1-a_2)$ is the long-run one, $x = p_d/p_m$ is the relative price of domestic goods, and u is an error term. It is derived from a standard consumer's optimisation problem where total consumption is given by an Armington (1969) aggregate of imports and domestic goods, much like the ones commonly used in the international business cycle literature. The estimates range between 0.15 and 4.85 in the short run, with an average of 0.95, and between 0.52 and 4.83 in the long run, with an average of 1.55. These estimates match the earlier literature well,[3] but are much lower than more recent estimates obtained using more advanced econometric methods on sector-level data.

3.2 SIMULTANEITY BETWEEN QUANTITIES AND PRICES RESULTS IN BIASED ESTIMATES

The simple regression above produces biased estimates due to endogeneity: the bias is towards zero because the supply side is not taken into account, implying that the estimates are in fact weighted measures of demand and supply elasticities.[4] Simultaneity bias can also arise from omitting relevant variables, such as quality, from the regression. In a highly influential study, Feenstra (1994) offered a solution to the simultaneity problem exploiting the panel dimension of the data. He estimated the elasticities of substitution directly, rather than through estimating price elasticities, obtaining estimates at the goods level that range from 2.96 to 8.38 for manufactured goods.

3.3 ESTIMATES OBTAINED USING AGGREGATE DATA ARE LOWER THAN MICROECONOMIC ESTIMATES

Studies such as Hummels (1999) and Imbs and Méjean (2009) point to an aggregation bias, observed already by Orcutt (1950). One explanation is that, unlike what is assumed in macroeconomic studies, not all goods respond homogeneously to changes in relative prices. If the goods that have the lowest price elasticities exhibit the highest variation in prices, then the aggregate estimate will be downward-biased. This is also what is found in the data. Imbs and Méjean (2009) develop a model to aggregate microeconomic estimates which takes into consideration this heterogeneity. They find that the estimate of the elasticity of substitution almost doubles compared with the homogeneous case: from 4.1 to 7.2 for the United States. In their 2010 paper, they instead present estimates of homogeneous (constrained) and heterogeneous (unconstrained) trade elasticity aggregates for a larger number of countries. The difference

3 See for example Houthakker and Magee (1969), among many others.
4 See Orcutt (1950) and McDaniel and Balistreri (2002).

between the constrained and unconstrained estimates still prevails, and the authors argue that different estimates may be suitable in different contexts, depending on whether the interest lies in a structural or a reduced-form model. Yilmazkuday (2009) points out another type of heterogeneity, showing that the Armington elasticity of exports is in fact not constant across importer countries: it increases with trade costs and decreases with source price. Using US state export data covering the time period of 1999-2007, he finds that the effect of a price change on the quantity demanded is underestimated by a factor of 3 to 4 when using a constant elasticity of demand compared with importer-specific Armington elasticities.

3.4 TIME-SERIES ESTIMATES ARE IN GENERAL LOWER THAN CROSS-SECTIONAL ESTIMATES

This is largely explained by differences in methodology. Time-series studies generally are silent about the levels of trade flows: to avoid the estimation problems involved in using non-stationary data, only *changes* in trade flows and *changes* in prices are considered. As pointed out by McDaniel and Balistreri (2002), "the very long-run differences in flows observed in the cross-section, and attributed to persistent distortions that affect long-run supply, are muted in the time-series analysis" (p. 8). This tends to create a downward bias in time-series estimates, and is related to the simultaneity issues discussed earlier.

4 EMPIRICAL ESTIMATIONS FOR THE EURO AREA

All the studies discussed above provide estimates of US elasticities of substitution, but estimates for European countries are much scarcer in the literature. Existing studies mostly cover one or a few of the member countries at a time, making comparisons between countries difficult due to differences in methodology and sample choice. Table 1 summarises the estimated elasticities from a selection of the available studies, the details of which are listed in the footnotes to the table.

Table 1 Summary of estimation results for elasticities of substitution for the euro area countries and the US

	Study							
	Broda et al. (2006)	Imbs and Méjean (2010)				Hervé (2001)		
Country	Median ES, exports, struct.	Exports, unconst. struct.[1)]	Exports, constr. struct.	Imports, unconst. struct.	Imports, constr. struct.	Short run, imports, volumes	Long run, imports, volumes	Short run, exports, volumes
Austria	**4.0**	**-2.936**	**-1.772**	**-1.778**	**-0.711**	**-0.41**	0.01	**0.37**
Belgium	-	**-2.862**	**-1.811**	**-1.963**	**-1.282**	-0.16	1.73	**0.46**
Cyprus	**2.8**	-	-	-	-	-	-	-
Finland	**3.1**	**-2.596**	**-1.619**	**-3.041**	**-2.410**	0.06	**0.60**	**0.37**
France	**3.7**	**-2.976**	**-1.666**	**-2.717**	**-1.744**	0.06	0.24	0.15
Germany	**3.9**	**-3.117**	**-1.673**	**-2.386**	**-1.339**	**-0.42**	**-0.11**	**0.42**
Greece	**2.6**	**-3.276**	**-2.009**	**-2.283**	**-0.875**	0.04	**0.34**	**0.92**
Ireland	**3.8**	-	-	-	-	**0.17**	**0.51**	0.27
Italy	**3.7**	**-2.881**	**-1.598**	**-2.951**	**-2.681**	**1.24**	3.11	-0.005
Luxembourg	-	-	-	-	-	-	-	-
Malta	-	-	-	-	-	-	-	-
Netherlands	**3.3**	-	-	-	-	-0.07	**0.18**	**0.13**
Portugal	**3.4**	**-3.680**	**-2.115**	**-2.370**	**-1.375**	-0.10	**0.76**	0.09
Slovakia	**4.0**	**-1.430**	**-0.907**	**-3.124**	**-2.015**	-	-	-
Slovenia	**3.7**	-	-	-	-	-	-	-
Spain	**2.8**	**-3.378**	**-1.926**	**-2.905**	**-1.721**	0.08	**0.51**	**0.65**
US	**2.3**	**-2.390**	**-1.157**	**-4.196**	**-2.091**	0.05	**0.40**	**0.48**

Notes: Numbers in bold indicate that the estimate is statistically significant, while numbers in italics indicate that the significance level was not reported; "ES" indicates an estimate of the elasticity of international substitution, and not a price elasticity; "values" and "volumes" indicate the left-hand-side variable used in the estimation and "struct" indicates that the estimation was structural.

1) The reported estimates for Slovakia and Greece are aggregated using weights for 1991-1996, since no other numbers were available; the rest is aggregated using weights for 1996-2000.

Table 1 Summary of estimation results for elasticities of substitution for the euro area countries and the US (cont'd)

	Study							
	NMCM (2010)		Houtha-kker and Magee (1969)		NiGEM		Other studies	
Country	Imports, values	Exports, values	Imports, values[2)]	Exports, values[2)]	Imports, volumes (Hervé, 2001)[3)]	Exports, volumes (Hervé, 2001)[3)]	Imports	Exports
Austria	-	-	-	**-1.30**	*0.31*	*1.25*	-	**-0.82**[6)]
Belgium	-	-	**-1.02**	0.42	*0.39*	*0.40*	-	-
Cyprus	-	-	-	-	-	-	-	-
Finland	-	-	-	-	*0.36*	*1.20*	-	-
France	**-0.711**	**1.056**	0.17	**-2.27**	*0.59*	*0.63*	-	**-1.18**[6]
Germany	**-0.782**	**1.021**	-0.24	**1.70**	*0.28*	*0.55*	**-0.60**[4] **-0.73**[5]	**-0.66**[4] **-0.73**[6]
Greece	-	-	-	-	*1.49*	*0.88*	-	-
Ireland	-	-	-	-	*0.12*	*4.28*	-	-
Italy	**-1.001**	**1.22**	-0.13	-0.03	*0.73*	*0.49*	-	**-1.72**[6]
Luxembourg	-	-	**-1.02**	0.42	-	-	-	-
Malta	-	-	-	-	-	-	-	-
Netherlands	**-0.576**	**1.314**	0.23	-0.82	*0.37*	*0.40*	-	-
Portugal	-	-	-0.53	-0.07	*0.25*	*2.43*	-	-
Slovakia	-	-	-	-	-	-	-	-
Slovenia	-	-	-	-	-	-	-	-
Spain	**-0.979**	**1.345**	-	-0.65	*0.82*	*0.31*	-	**-1.31**[6]
US	-	-	-0.54	**-1.51**	*0.61*	*0.52*	-	-

2) The estimates reported for Belgium and Luxembourg correspond to the joint "Belgium-Luxembourg" estimate in the paper; the ones for Germany correspond to the West Germany estimate.

3) It is unclear whether these reported estimates are significant or not, since no standard errors or *t*-values are reported by Hervé (2001).

4) The reported values correspond to the OLS estimates of multilateral price elasticities in Marquez (1990). None of the other euro area countries are treated separately; available instead are estimates for the rest of the OECD (ROECD), excluding Canada, Germany, Japan, the UK and the US. The ROECD (US) price elasticity of imports is -0.49 (-0.92) and the corresponding price elasticity of exports is -0.83 (-0.99). The estimation is done with volumes as the left-hand-side variable.

5) This is the median price elasticity of import volumes at the industry level from Anderton (1999). The average over the twelve industry estimates equals 0.64 for Germany. Values for the UK are however higher; the median and average elasticities are now 1.03 and 1.06, respectively. All reported price elasticities, for Germany as well as the UK, are significant at the 5% level.

6) The reported estimates are long-run export elasticities from the European Commission's Quarterly Report on the Euro Area 2010-1. They are obtained using aggregate quarterly data covering Q1 1980-Q3 2008 for all countries but France, for which the data only cover the period Q1 1980-Q1 2000. All estimates are significant at the 5% level.

5 CONCLUSION

The above discussion suggests that there are large discrepancies in measuring trade responses to changes in international prices. There is confusion regarding what elasticity measures are relevant in what context (e.g. elasticity of substitution or trade elasticity). The time horizon of interest is also of high relevance. Moreover, the estimates are very sensitive to the estimation method employed and the exact specification used. Given that these models are used for the evaluation of possible policy outcomes, this implies that there may be considerable flaws in resulting policy recommendations, especially so for highly open countries such as the euro area ones.

At the very least, it is therefore necessary to perform sensitivity analyses whenever results based on estimates of the elasticity of substitution or trade elasticity are used as the basis for policy conclusions.

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CHAPTER 4

GROWTH-LED EXPORTS: SUPPLY CREATES ITS OWN DEMAND IN INTERNATIONAL TRADE

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Fast-growing countries tend to experience rapid export growth with little secular change in their terms of trade. This behaviour contradicts the standard Armington model, which predicts that growth in potential output can increase exports only through a decline in the terms of trade. Krugman (1989) suggested that fast-growing countries may be able to export more because they produce new varieties of goods that generate additional demand. This paper provides strong support for Krugman's hypothesis.

I INTRODUCTION

Few people would be surprised to learn that there is a strong positive correlation between the growth rate of a country's exports and the growth rate of its economy. Indeed, there is an extensive body of theoretical and empirical research on the phenomenon of "export-led growth", which focuses on the benefits for long-run economic growth of encouraging exports and openness to trade.[2] However, in most international macroeconomic models, a permanent increase in demand for a country's exports has no long-run effect on its output and a permanent increase in a country's output increases its exports only through a permanent decline in its terms of trade, which reduces the welfare gains from growth. This paper shows empirically that there is a long-run effect of economic growth on exports and that there is not a long-run effect of growth on the terms of trade.

Chart 1 shows the positive correlation between long-run export growth and long-run economic growth in a sample of 58 countries over the period 1960-2004.[3]

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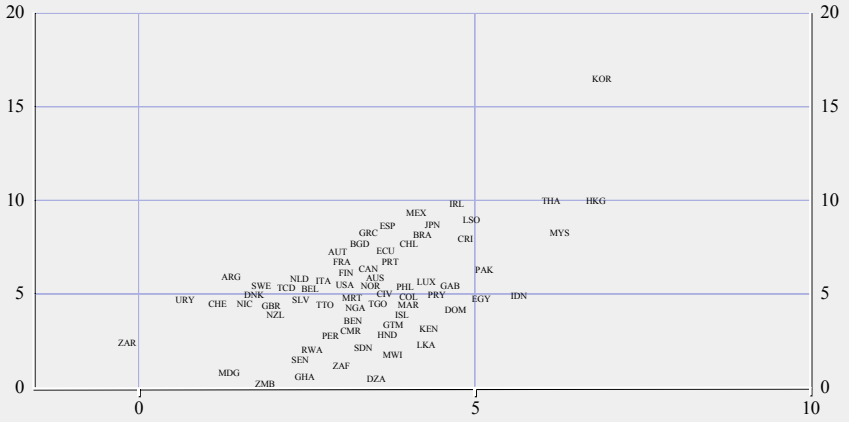
2 This research dates back at least to McKinnon (1964). For subsequent work, see Pereira and Xu (2000) and the references cited therein.

3 Most data in this paper are from the World Bank's *World Development Indicators 2007* database. Initial per capita PPP GDP and population are from the Penn World Tables version 6.2 (Center for International Comparisons of Production, Income, and Prices at the University of Pennsylvania). Initial human capital data are from the Barro-Lee dataset through the National Bureau of Economic Research website.

Chart 1 Export growth and output growth

(1960-2004)

x-axis: output
y-axis: exports



Source: World Development Indicators 2007.

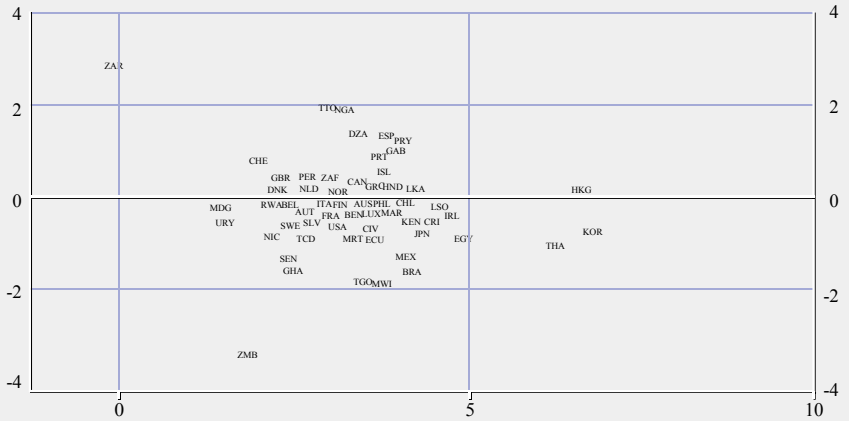
Chart 2 shows essentially no correlation between changes in the terms of trade and long-run economic growth for these countries. Regression analysis presented in this paper demonstrates that these relationships are not affected by simultaneity bias and are unlikely to reflect omitted factors.

One explanation for these empirical findings, proposed by Krugman (1989) and developed further in Gagnon (2008), is that economic growth allows a country

Chart 2 Change in terms of trade and output growth

(1960-2004)

x-axis: output
y-axis: terms of trade



Source: World Development Indicators 2007.

to produce more varieties, and demand for a country's exports is directly tied to the number of varieties it produces. Thus, fast-growing countries can have fast-growing exports without a decline in the terms of trade.

This finding carries important implications for empirical international macroeconomics. In most models of international macroeconomic linkages, permanently higher output tends to lower a country's trade balance through higher imports that are not matched by higher exports, at least not without a permanent decline in the terms of trade. For example, in the Federal Reserve Board staff's multi-country dynamic general equilibrium (DGE) model, SIGMA, a permanent productivity increase reduces a country's trade balance in the short run and lowers its terms of trade (causing a real exchange rate depreciation) in the long run.[4] This result derives from the standard assumption that each country's goods are imperfect substitutes for goods produced in other countries. Higher income raises import demand directly, but, holding foreign income constant, the only way to export more is through a lower price. Most models enforce balanced trade in the long run, and thus permanent shocks to potential output have permanent effects on a country's terms of trade.[5]

The "growth-led exports" view of this paper is complementary to the traditional view of export-led growth. Deregulating, opening up the economy and otherwise encouraging exports may indeed spur growth through technological transfer and more competitive producers. The evidence presented here helps to explain why such growth is all the more beneficial for a country's welfare because it is not offset by declining terms of trade.

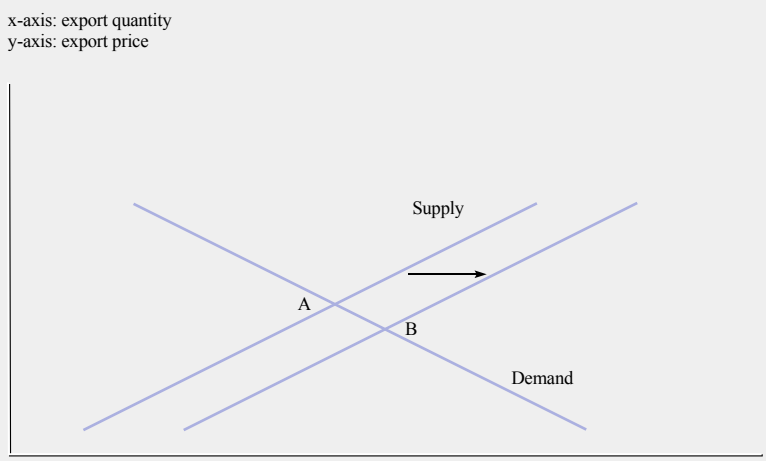
2 TERMS OF TRADE AND ECONOMIC GROWTH

Charts 1 and 2 display a strong link between export growth and economic growth in the long run and essentially no link between changes in the terms of trade and long-run economic growth. The latter finding is not consistent with the standard Armington (1969) model of export supply and demand under the assumption that economic growth is exogenous with respect to the terms of trade. As shown in Chart 3, faster economic growth shifts out the export supply curve and the economy moves down the export demand curve from point A to a new lower

4 See Erceg et al. (2005). The DGE model of Chari et al. (2002) has the same property. (Both of these DGE models allow for a continuum of product varieties, but the variety space is constant across countries and over time.) Other models with this property include New Keynesian models with rational expectations and traditional adaptive-expectations models. See, for example, Laxton et al. (1998), Le Fouler et al. (2001) and Levin et al. (1997).

5 An extreme example is that of Wyplosz (1991), who predicted that German unification, by increasing long-run marketable German output by around 25%, would cause a long-run real depreciation of the German exchange rate of around 25%. In the event, Germany's real exchange rate as measured by the International Monetary Fund had changed little on balance 16 years after unification.

Chart 3 Economic growth with Armington export demand



price of exports at point B.[6] Under Armington demand, we would expect to find a negative correlation between growth and the terms of trade. The lack of such a correlation implies that there is a systematic positive correlation between economic growth and export demand. Gagnon (2008) develops a model of export demand based on Krugman (1989) that includes a positive effect of economic growth, as displayed in Chart 4. In this model, economic growth increases the number of varieties of different products a country produces, which in turn increases demand for the country's exports.[7]

An alternative explanation for the lack of correlation in Chart 2 is that long-run economic growth may not be exogenous with respect to the terms of trade. In particular, positive export demand shocks might raise both economic growth and the terms of trade. It seems unlikely that export demand shocks could have an effect on economic growth which lasts for the entire 44-year period shown in Chart 2, as a country's long-run economic growth is mainly determined by factors that are exogenous to export demand, such as population growth and institutional characteristics that encourage or discourage the accumulation of human and physical capital. Nevertheless, the following regression analysis shows that long-run changes in the terms of trade are not correlated with instruments for economic growth that are clearly exogenous with respect to changes in export demand.

6 An alternative model consistent with the lack of long-run correlation between export growth and the terms of trade is that of a small open economy whose exports are perfectly substitutable for foreign products. However, there is extensive literature to show that for most countries, exports are far from perfect substitutes for foreign products. See, for example, Goldstein and Khan (1985) and Marquez (2002).

7 Feenstra (1994) interprets the increase in varieties as a decline in the true price of a country's exports that is not captured in official data. He models this decline by assuming that the price of new goods is above the consumer's reservation price prior to their introduction. According to Feenstra, Figure 2 would show a downward slope if the terms of trade were measured correctly.

Chart 4 Economic growth with Krugman export demand

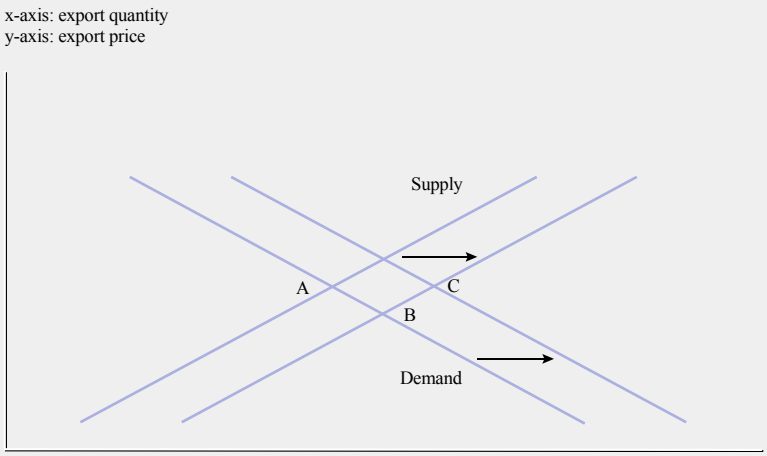


Table 1 presents cross-country, instrumental-variable regressions of long-run changes in the terms of trade on long-run economic growth rates and other variables. (Data used are described in footnote 3.) As described in a paper by Acemoglu and Ventura (2002), long-run economic growth is instrumented by the levels of three variables that are observed at the beginning of the sample: real per capita income adjusted for purchasing power parity (PPP), the average years of schooling of the labour force and the average life expectancy. All of these

Table 1 Change in terms of trade

(1960-2004)

	(1)	(2)
Real GDP growth	0.006	0.044
	(0.184)	(0.150)
Initial years of Schooling		-0.097
		(0.068)
Initial life expectancy		0.059[1)]
		(0.020)
Oil exporter	0.010[3)]	0.009
	(0.006)	(0.006)
R^2	0.10	0.36
No. of obs.	45	45
First-stage R^2	0.53	0.53

Note: Instrumental-variable estimates with robust standard errors in parentheses. 1), 2), and 3) denote significance at the 1, 5, and 10% levels, respectively. See text for a description of the variables and sample.

instruments are predetermined and thus exogenous with respect to subsequent changes in the terms of trade. Because the focus here is on total economic growth rather than per capita growth (as in Acemoglu and Ventura), population growth is added as a fourth instrument, under the assumption that population growth is exogenous to the terms of trade. However, the results are not sensitive to excluding the population growth rate.

Acemoglu and Ventura argue that the human capital variables (years of schooling and life expectancy) may have independent effects on the terms of trade; Table 1 presents results both with and without these variables in the second stage regression. The regressions also include a dummy variable for countries that produced more than twice as much oil as they consumed in 1985.[8] From the point of view of many oil exporting countries, changes in the price of oil represent major exogenous shocks to the terms of trade that may have had lasting effects on economic growth.

Column (1) of Table 1 presents the results of a regression of the change in the terms of trade between 1960 and 2004 on the growth of real GDP over the same period and on the oil exporter dummy. The coefficient on GDP growth is essentially zero and the equation R2 is very low, despite a respectable fit of the first-stage regression. Column (2) adds the human capital variables. It is difficult to understand why schooling should have an (insignificant) negative effect on the terms of trade, while life expectancy should have a (significant) positive effect. But there is no significant effect on the GDP growth coefficient.

The results shown in Table 1 support the conclusion that there is no long-run negative effect of economic growth on a country's terms of trade. Gagnon (2008) shows that this conclusion is robust to changes in the countries and time periods used in the regression.

3 EXPORTS AND ECONOMIC GROWTH

Table 2 presents cross-country regressions of long-run export growth on long-run GDP growth.[9] Using long-run growth rates eliminates the need to model short-run adjustment dynamics. In addition, the relationship between output and the number of varieties is likely to be strongest over long time horizons, as the number of varieties may not move in proportion with output over the business

8 This dummy variable includes all OPEC members plus Cameroon, the Republic of the Congo, Egypt, Gabon, Malaysia, Norway, Trinidad and Tobago, and Tunisia. Using an OPEC-only dummy, as in Acemoglu and Ventura, does not affect the results. Source: Energy Information Administration, *International Energy Annual 2002*.

9 Note that there is no intercept term in the regressions. The data do not permit the addition of an intercept term, as growth of foreign expenditure is nearly identical for all exporters, creating severe collinearity between this term and an intercept. Dropping the intercept introduces a bias in the coefficient on foreign expenditure coming from any omitted variables that are common to all exporters. To the extent that trade barriers and transportation costs have fallen for all exporters, the coefficient on foreign expenditure is biased upward. The remaining coefficients are not affected by this bias.

Table 2 Growth of real exports of goods and services

(1960-2004; robust standard errors)

	Full sample	1960-82	1982-2004	Instrumental variables[4]	Manufacturing and services[5]
	(1)	(2)	(3)	(4)	(5)
Δ Rel. price exports	-0.32	-0.36	-0.35[1]	1.37[3]	0.05
	(0.26)	(0.29)	(0.10)	(0.80)	(0.67)
Δ Foreign expenditure	1.46[1]	1.28[1]	1.56[1]	1.88[1]	1.73[1]
	(0.07)	(0.08)	(0.09)	(0.18)	(0.08)
Δ Ratio of exporter GDP	1.50[1]	1.50[1]	1.10[1]	1.85[1]	1.61[1]
	(0.27)	(0.28)	(0.13)	(0.54)	(0.35)
R^2	0.56	0.48	0.45	0.30	0.59
No.of obs.	58	60	96	45	23

1), 2), and 3) denote significance at the 1, 5, and 10% levels, respectively.

4) Instruments are the same as in Table 1 (except oil dummy). First-stage R^2 = 0.20 for the relative price and 0.53 for the exporter GDP ratio.

5) Sample includes countries for which manufactured goods and services comprised more than 75% of exports in 2004.

cycle. The first three columns of Table 2 display ordinary least squares (OLS) regressions. Column (1) is based on growth rates over the period from 1960 to 2004. Columns (2) and (3) are based on growth rates over the first half and second half, respectively, of these 44 years. In all three samples, the ratio of exporter GDP to world GDP is highly significant in explaining export growth, lending support to the importance of product varieties and growth-led exports.

The estimate of the coefficient on relative price has the correct sign but is rather close to zero in these regressions, suggesting the possibility of simultaneity bias. Simultaneity bias could also be present if exporter GDP growth responds positively to shocks in the growth rate of exports in the long run. Column (4) presents a regression in which initial conditions and population growth are used as instruments, to guard against potential endogeneity of the real exchange rate. The first-stage fit for relative export prices is somewhat poor and the coefficient on the relative price has the wrong sign. Nevertheless, the coefficient on the ratio of exporter GDP is still highly significant. Constraining the coefficient on relative export prices to equal -1 (not shown, using the same instruments) results in a coefficient on the ratio of exporter GDP of 1.00 that is significant at the 5% level.

Column (5) displays estimates over a sub-sample of countries for which manufactured goods and services comprised more than 75% of exports in 2004. This sample is examined because the Krugman varieties model was designed for differentiated manufactures and services, and thus it may not be appropriate for trade in undifferentiated primary commodities. Small countries that specialise in the export of a particular primary commodity may experience growth in both GDP and exports, with little change in relative prices if their production of the commodity is small relative to world consumption. This phenomenon would lead to a positive coefficient on the exporter GDP ratio for reasons other than those embodied in the Krugman model. As seen in column (5),

the coefficient on the ratio of exporter to world GDP remains highly significant in this smaller sample.[10]

Overall, Table 2 provides strong support for growth-led exports and the role of product varieties in trade. The effect on exports of growth in the exporting country is highly statistically significant. Gagnon (2008) shows that it is robust to a range of samples, specifications and instruments.

4 CONCLUSION

The results presented here show that positive shocks to economic growth need not lead to growing trade deficits or to secular declines in the terms of trade, as would be implied by most extant international macroeconomic models. These results suggest that macro models should switch from Armington to Krugman specifications for trade flows. More broadly, these results lend support to public policies that pursue export-led growth by allaying concerns about immiserising effects on a country's terms of trade.

These results also suggest that the large trade imbalances of the past decade or so were not caused by differences in trend growth rates across countries. Gagnon (2011) shows that trend growth rates have only a small effect on medium-term current account balances and this effect is not statistically robust. Fiscal balances, exchange rate policy, net foreign assets and net oil exports are more important and statistically robust factors behind large current account imbalances.

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PART 2

TRADE RECOVERY AND ELASTICITIES: LESSONS FROM THE CRISIS

CHAPTER 5

THE GLOBAL TRADE DOWNTURN AND RECOVERY[1, 2]

BY ROBERT ANDERTON, ECB

TADIOS TEWOLDE, ECB

This chapter provides an empirical assessment of the factors driving the global trade downturn and recovery associated with the "great recession" episode (2008-09). Our main explanation is that sharp movements in the components of GDP that are particularly import intensive constitute the key factor behind the fluctuations in trade over this period.

Going forward, our analysis would suggest that much depends on whether the globalisation process will continue as rapidly as in the period before the crisis, which has implications for the future strength of global trade and whether the role of supply chains will become ever more important in the future.

1 INTRODUCTION

The contraction in global trade during the intensification of the financial crisis from the fourth quarter of 2008 to the first quarter of 2009 was unprecedented in terms of its severity and synchronisation across the world, and particularly pronounced for trade in capital and intermediate goods. Indeed, standard trade equations fail to capture the global trade downturn.[3] In order to assess a possible pattern for global trade going forward, we investigate whether part of the explanation for the big fall in world trade, as well as the subsequent recovery in world trade (from the second quarter of 2009 to the first quarter of 2010), may have depended on the different movements in the components of final expenditure – i.e. consumption, investment, government expenditure, exports, etc. – combined with their different import intensities.

Chart 1 shows the cumulative percentage change in real GDP across the OECD countries as well as export and import volumes of goods and services between

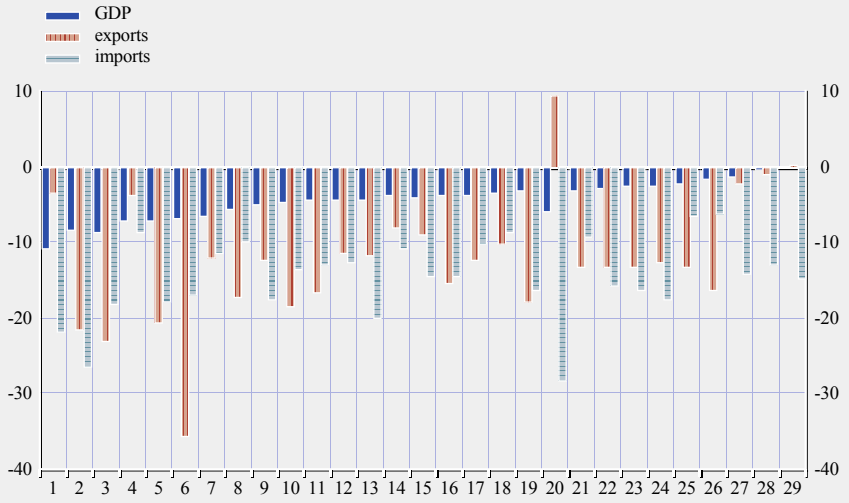
1 We are greatly indebted to Lien Pham for excellent assistance with the econometric estimation and to Rossella Calvi, Ricardo Pereira and Cecilia Nardini for their assistance with research analysis. Robert Anderton is an Adviser in the EU Countries Division of the ECB and Special Professor at the School of Economics of the University of Nottingham. At the time of writing, Tadios Tewolde was an economist at the ECB.

2 This chapter is based on the findings in the forthcoming ECB Working Paper by Robert Anderton and Tadios Tewolde (2011) entitled "The global financial crisis: understanding the global trade downturn and recovery".

3 See, for example, Bussiere et al. (2009) and Cheung and Guichard (2009).

Chart 1 Real GDP and export and import volumes of goods and services

(cumulative percentage change, Q4 2008-Q1 2009)

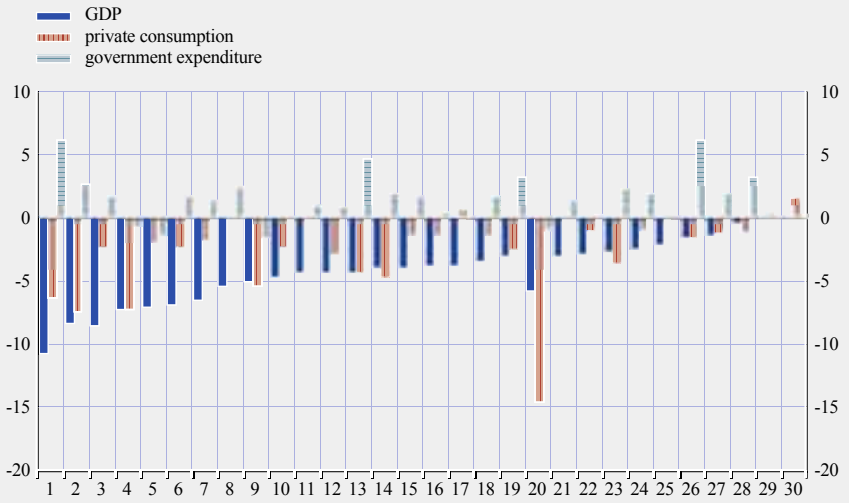


1 Turkey
2 Mexico
3 Finland
4 Ireland
5 Slovakia
6 Japan
7 Sweden
8 Germany
9 Hungary
10 Italy
11 Czech
12 UK
13 Korea
14 Denmark
15 Luxembourg
16 Belgium
17 Austria
18 Netherlands
19 Portugal
20 Iceland
21 France
22 US
23 Spain
24 Canada
25 Switzerland
26 Greece
27 New
28 Norway
29 Australia

Sources: Haver, ECB calculations.

Chart 2 Real GDP, private consumption and government expenditure

(cumulative percentage change, Q4 2008-Q1 2009)



1 Turkey
2 Mexico
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4 Ireland
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6 Japan
7 Sweden
8 Germany
9 Hungary
10 Italy
11 Czech
12 UK
13 Korea
14 Denmark
15 Luxembourg
16 Belgium
17 Austria
18 Netherlands
19 Portugal
20 Iceland
21 France
22 US
23 Spain
24 Canada
25 Switzerland
26 Greece
27 New
28 Norway
29 Australia
30 Poland

Sources: Haver, ECB calculations.

the fourth quarter of 2008 and the first quarter of 2009 (in descending order of the magnitude of decline in GDP). The series are broadly characterised by substantially larger declines in both exports and imports in comparison with GDP, while exports and imports appear to be highly correlated for many of the individual countries.

Meanwhile, the decline in real fixed capital formation during the crisis period also significantly outweighs the decline in GDP for virtually all of the countries in the sample. By contrast, private consumers' expenditure fell significantly *less* than GDP, while government expenditure actually rose in the majority of the OECD countries (see Chart 2).

One key message from these stylised facts seems to be that it was especially the import-intensive components of expenditure which experienced particularly marked declines (i.e. exports of goods and services and gross fixed capital formation), while the less import-intensive demand categories registered smaller declines or actually increased (i.e. private consumers' expenditure and government expenditure).[4]

2 POSSIBLE FACTORS EXPLAINING THE SEVERITY AND HIGHLY SYNCHRONISED DOWNTURN IN WORLD TRADE

A number of factors have been suggested as possibly causing the severity of the downturn, ranging from: vertical specialisation and the internationalisation of production; constraints and costs of trade credit and trade finance; and the decline in global investment. Starting with the internationalisation of production, as a result of a greater international fragmentation of production the same component is traded several times across borders before being included in the final product. This vertical specialisation, combined with the fact that trade is measured in "gross" terms while GDP is measured on a "net" basis, seems to be part of the reason for the much faster speed of the growth in world trade relative to GDP in recent decades.[5]

It thus seems a reasonable hypothesis that the rapid growth in vertical specialisation and widespread global production chains associated with globalisation may have contributed to both the severity and highly synchronised nature of the downturn

4 Although somewhat out of date, approximations of the import intensity of the different components of demand can be calculated from input-output tables. For example, based on input-output tables for the year 2000 for five euro area countries, euro area exports have by far the highest import content (44.2%), followed by total investment (29%), while the import content of private consumption and government consumption was much lower at 19.7% and 7.8% respectively. Source: ESCB (2005).

5 See, for example, Hummels et al. (2001), who estimate that vertical specialisation is responsible for almost one-third of the total growth in world trade over recent decades. In addition, Amador and Cabral (2009) show that the internationalisation of production has grown rapidly since the early 1990s, a claim that is backed up by Miroudot and Ragoussis (2009), who calculate that vertical specialisation trade is responsible for about a third of trade among OECD and related economies.

in global trade between the fourth quarter of 2008 and the first quarter of 2009[6] (see, for example, Yi (2003, 2009)). Against this background, and as highlighted and described by Cheung and Guichard (2009), Chart 1 reveals that the countries which experienced the larger trade declines between the fourth quarter of 2008 and the first quarter of 2009 are those with high or rapidly growing vertical trade according to the Miroudot and Ragoussis (2009) measure (such as Mexico, Germany, Finland, Korea, Spain, Portugal, Hungary, the Czech Republic and Belgium).

Another possible reason for the severity of the downturn in global trade has been the apparent increase in the cost (fall in demand), and reduced availability (lack of supply of credit), of trade finance. Of course, trade finance problems may exacerbate the downturn in trade that may be associated with global supply chains and the international fragmentation of production (i.e. the failure to obtain trade finance by one producer/trading partner can disrupt the whole global supply chain for a particular product). Similarly, sectors more acutely responsive to credit conditions and most affected by the financial crisis, such as motor vehicle production and capital-expenditure (investment) goods, are also those characterised by a high degree of vertical specialisation from an international trade perspective, and which also experienced strong falls in exports and imports between the fourth quarter of 2008 and the first quarter of 2009.

3 ECONOMETRIC FINDINGS REGARDING THE GLOBAL TRADE DOWNTURN

We use a systematic approach to derive an imports specification which reveals the differential effects of the individual components of demand on global imports, as well as the effects of other variables such as trade finance. Using panel econometric techniques by pooling the data across the OECD countries, the econometric results show that all of the variables are statistically significant and have the expected signs (i.e. relative import prices and trade credit conditions have negative signs, while the components of total final expenditure (tfe) are all positively signed). The obtained parameters of the tfe components provide a clear view of the relative importance of imports for the various expenditure components. In particular, exports have the highest estimated import intensity (ranging from 1.8 to 1.9) followed by gross fixed capital formation (ranging from 1.6 to 1.8) and consumers' expenditure (ranging from 1.3 to 1.6), while government expenditure (ranging from 1 to 1.3) seems – as expected – to be a less import-intensive activity. The high import intensity of exports may be partly interpreted as a reflection of the rapid growth of vertical specialisation and the international fragmentation of production. The export of a single good or product

6 This hypothesis is also expounded by Yi (2003, 2009), who argues that trade in a world of global supply chains and growing internationalisation of production may result in amplified and potentially non-linear trade responses to international shocks which are also transmitted more rapidly across countries in a more synchronised manner. Furthermore, Yi (2009) claims that the significantly bigger trade downturn in sectors such as motor vehicles provides additional evidence that global supply chains account for some of the severity and synchronisation of the global trade downturn.

requires numerous stages of production involving the intermediate product crossing the international borders several times, thus being counted each time as an import and export. Taking into account this high import intensity, combined with the large fall in exports, we find that the fall in exports can explain more than half of the decline in world imports, while declines in the highly import-intensive category of investment also explain a notable proportion of the remaining fall in global trade. Calculations also show that stock building, business confidence and credit conditions also played a role in the global trade downturn, but that these factors had relatively smaller impacts.

4 THE GLOBAL TRADE RECOVERY

In this section, we begin by describing the developments in GDP, trade and other expenditure components across the individual OECD countries during the global trade upturn between the second quarter of 2009 and the first quarter of 2010.[7] Chart 3 shows the cumulative percentage change in real GDP across the OECD countries as well as export and import volumes of goods and services between the second quarter of 2009 and the first quarter of 2010 (in ascending order of the magnitude of the rise in GDP). The series are broadly characterised by substantially larger increases in both exports and imports in comparison with GDP, while exports and imports appear to be highly correlated for many of the individual countries.

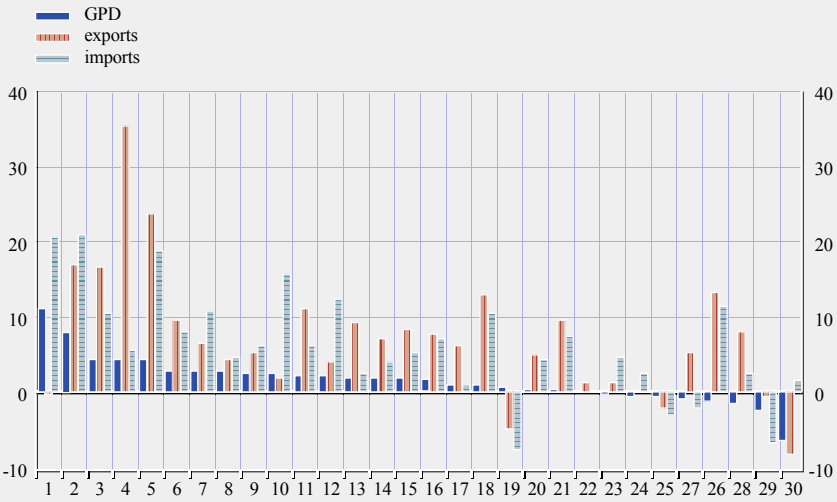
Despite the recovery in GDP, however, gross real fixed capital formation continued to decline significantly for many of the countries in the sample. Meanwhile, positive growth in private consumers' expenditure, and particularly government expenditure, contributed to the recovery in many of the OECD countries and may have been related to various fiscal and private expenditure stimulus measures implemented at the time. Another stylised fact at the global level is that international trade in motor vehicles expanded strongly during the trade upturn between the second quarter of 2009 and the first quarter of 2010 and may have been related to various government car-scrapping policies aimed at stimulating vehicle sales.

One key message is again that import-intensive components of expenditure appear to behave differently, including in the recovery stage. In particular, exports of goods and services rose substantially, and were a strong driving force behind the rise in imports, while gross fixed capital formation continued to fall, thereby exerting a downward impact on imports.

7 It is debatable as to when the global trade recovery precisely began. The data tell us that the quarterly change in OECD GDP and export volumes of goods and services turned positive in the second quarter of 2009, while the quarterly change in OECD import volumes began rising in the third quarter of 2009. However, the quarterly decline in import volumes was fairly small in the second quarter of 2009 (1.9%) compared with much larger falls in, say, the first quarter of 2009 (9.0%). Hence, the base case in this paper is that the OECD trade recovery began in the second quarter of 2009 (although we compared our results with those obtained when assuming the recovery began in the third quarter of 2009 and found that this does not materially affect the outcome).

Chart 3 Real GDP and export and import volumes of goods and services

(cumulative percentage change, Q2 2009-Q1 2010)



1 Turkey	7 Luxembourg	13 Switzerland	19 Finland	25 Denmark
2 Korea	8 Sweden	14 Germany	20 Italy	26 Ireland
3 Slovakia	9 New	15 Portugal	21 Netherlands	27 Hungary
4 Japan	10 Australia	16 Belgium	22 Austria	28 Spain
5 Mexico	11 US	17 France	23 UK	29 Greece
6 Poland	12 Canada	18 Czech	24 Norway	30 Iceland

Sources: Haver, ECB calculations.

The econometric results also show that a return to positive stock building between the second quarter of 2009 and the first quarter of 2010 may have contributed to the trade recovery, while the import intensity of consumers' expenditure may have increased during the trade recovery period. This latter result may be associated with policy measures such as car-scrapping schemes and related measures in many economies which helped to revive the automobile industry and stimulate the trade recovery.[8] These measures contributed to a sharp increase in international trade in cars, which implies that consumers' expenditure may have become more import intensive during the trade recovery period. Nevertheless, one important point to bear in mind is that part of the upturn in trade between the second quarter of 2009 and the first quarter of 2010 is still not fully explained by our econometric specification (i.e. the intercept dummy for the recovery is always positively signed and statistically significant). This may be due to the many policy measures that were implemented to boost global trade at that time and which cannot be captured by the equation.[9] Nevertheless, the equation also directly captures the positive impact of specific policies such as the fiscal stimuli

8 For an overview of the measures to support the car industry, see Haugh et al. (2010).

9 For example, these measures included: policy measures implemented worldwide to stabilise the financial system (particularly the decision of the G20 in April 2009 to make available USD 250 billion for trade finance from 2009 to 2011); car-scrapping schemes; and general fiscal stimulus packages.

implemented by many countries, as these policies are included in the government expenditure and fixed capital formation expenditure components in the equation. Finally, in a mirror fashion in comparison with the downturn, the results confirm that the upturn in OECD imports was amplified by strong export growth and the reactivation of global production chains.

5 CONCLUSION

Panel estimates of imports for a large number of OECD countries, taking the individual components of expenditure into consideration, suggest that the high import intensity of exports at the country level (which also captures the increasing role of global production chains) can explain (unlike aggregate total expenditure) a significant proportion of the decline in OECD imports between the fourth quarter of 2008 and the first quarter of 2009. Also, lower investments – which are highly import intensive – contributed significantly to the remaining fall in global trade. The estimates also find that the deterioration in stock building, business confidence and credit conditions also played a significant but smaller role in the global trade downturn.

Meanwhile, the global trade recovery (from the second quarter of 2009 to the first quarter of 2010) can only be partially explained by differential elasticities for the components of demand. Although the specification includes the fiscal stimulus, it cannot capture all of the many policy measures that were implemented to boost global trade at that time. However, the high import intensity of exports and the implied reactivation of global production chains – as well as the rebound in stock building and an increase in the import intensity of consumers expenditure (owing to car-scapping schemes) – embodied in the equation can explain part of the recovery in OECD imports.

Overall, the policy implications seem to be that forecasts of trade variables are enhanced if the aggregate demand term is broken down into the various components of expenditure, while policy-makers should not be surprised that the increasing relevance of global production chains may be associated with a greater elasticity of trade with respect to changes in activity in comparison with the past.

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CHAPTER 6

EMERGING FROM THE PERFECT STORM: WHERE IS GLOBAL TRADE HEADING IN THE AFTERMATH OF THE TRADE COLLAPSE OF 2008-09?

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BERND SCHNATZ, ECB

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The global crisis of 2008-09 opened up an unprecedented gap between the actual level of world trade and its (higher) "equilibrium" level implied by historical relationships with world GDP. We show empirically that this trade gap has been narrowing only gradually as the economy moves towards recovery and part of the gap could persist for some time to come. We conclude that the impact of the crisis on world trade could be longer-lasting than previously thought.

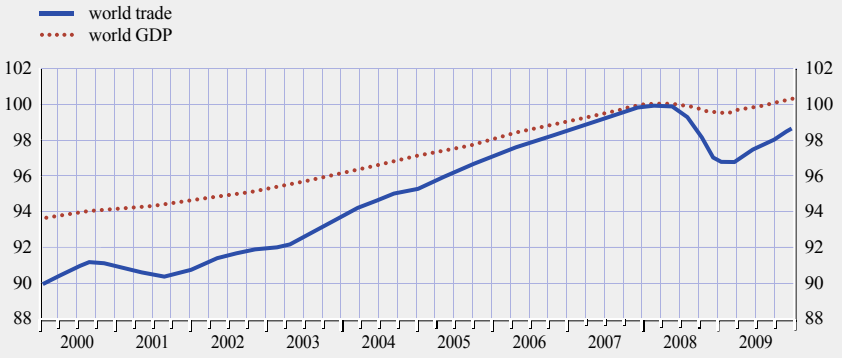
1 EMERGING FROM THE PERFECT STORM

In the fourth quarter of 2008, after more than two decades of extraordinary growth, international trade was hit by the perfect storm. As the global economy entered the most severe downturn in post-war history, world merchandise trade volumes contracted, from peak to trough, by an unprecedented 19%. The trade collapse was truly global in scope and highly synchronised across countries (Baldwin (2009); di Mauro et al. (2010)). Moreover, the contraction in world trade vastly exceeded the contraction in global GDP (see Chart 1), which resulted in a decrease in the global trade-to-GDP ratio of about 15 percentage points. The severity and suddenness of the trade collapse took most forecasters by surprise. In fact, standard reference models for trade, which performed reasonably well in explaining trends in international trade prior to the crisis, clearly missed the magnitude of this downturn.

After reaching a trough in the first half of 2009, world trade staged a forceful recovery, surprising forecasters again, though this time on the upside. In particular, the emerging economies, led by Asia and Latin America, quickly gained enough tailwind to find their way back to the economic fair weather zone. By early 2010 the trade levels of the emerging economies, as a group, had surpassed the pre-crisis

Chart 1 World merchandise trade and world GDP

(indices; Q3 2008 = 100, log scale)



Sources: ECB staff and own calculations.

peak. By contrast, in early 2011 the trade levels of the advanced economies were still below pre-crisis levels. Overall, the recovery in world trade has clearly lost some momentum since mid-2010.

2 A SIMPLE EMPIRICAL FRAMEWORK TO FORECAST WORLD TRADE IN THE MEDIUM TERM

In the light of the exceptional developments since late 2008, it is hardly surprising that the medium-term outlook for world trade is fraught with unusual uncertainty. In particular, it is unclear whether the crisis is having transitory or longer-lasting repercussions on world trade. To shed some light on this issue, we develop a simple empirical model that allows us to organise arguments relating to the medium-term outlook for global trade in a coherent way and explore their implications for the trade recovery quantitatively. It is a standard error correction model, which exploits the fact that global trade (m) and global economic activity (y) tend to move together.[1] Crucially, the model interprets any deviation from the long-term relation between trade and GDP as an "error" that is to be corrected by an equilibrating trade response:

$$\Delta m_t = \gamma_0 + ect\,(m_{t-1} - \beta y_{t-1} - \delta t) + \gamma_1 \Delta y_t + \gamma_2 \Delta m_{t-1} + \varepsilon_t$$

Here, β determines the long-term – or "equilibrium" – relationship between (the log of) trade and (the log of) economic activity. If this coefficient were (well) above one, as occasionally suggested in the literature,[2] trade would grow without bound as a proportion of GDP. This appears unreasonable, at least as a very long-term

1 Technically speaking, the model exploits the cointegrating relationship between world trade and GDP. See Gruber et al. (2011) for technical details.

2 Freund (2009) suggests an elasticity larger than 3, while Cheung and Guichard (2009) find a long-run elasticity of about 2.0-2.5. These results may be biased upwards by the omission of globalisation trends.

representation. Furthermore, *ect* is the equilibrium-correction coefficient, or "speed of adjustment", which determines how fast trade reverts to its long-term equilibrium path after a shock. As regards the short-term dynamics, we include contemporaneous growth in global economic activity (Δy_t) and lagged world trade growth (Δm_{t-1}). ε_t represents the error term. The model also includes a time trend (t) – or "globalisation trend" – to account for the fact that world trade has grown faster than GDP over recent decades. Thereby, we capture several factors that are difficult to measure in a more direct way, such as technological advances, falling transportation costs, the rising importance of vertical specialisation (Kleinert and Zorell (2010)) and the opening up of formerly Communist countries to the global economy (Bussière and Schnatz (2009)).

We estimate the model at quarterly frequency over the period from the first quarter of 1981 to the third quarter of 2008 (based on the Engle-Granger methodology), excluding the actual crisis period to avoid these observations (outliers) steering the results.[3] The key findings are as follows (see Table 1).

- ***Long-run elasticity:*** In the long run, world trade responds proportionally to movements in global GDP once globalisation trends have been accounted for. This remarkable finding is consistent with a stable relationship between world trade and GDP.

- ***Globalisation:*** The globalisation process gives rise to an autonomous increase in global trade of about 0.8% per quarter.

- ***Mean reversion:*** Shocks to global trade are rather persistent and mean reversion is rather slow, according to the error-correction coefficient. The half-life of shocks is about two and a half years.

- ***Overshooting:*** There is overshooting in trade relative to GDP in the short run, as indicated by the fact that the short-term coefficient associated with GDP (y_1) is larger than the long-term elasticity (β). This finding is consistent with the well-known fact that trade is more volatile than GDP. Notwithstanding this, in periods of large swings in global trade the model does not fully account for the peaks and troughs in growth.

- ***Robustness:*** Our key findings are robust to the econometric method, the sample period chosen and the use of the activity variable (GDP versus industrial production).

- ***Structural breaks:*** We do not find any evidence of structural breaks in the sample period.

- ***Fit:*** The overall fit of the relationship is good, explaining around 50-60% of the variation in global trade.

3 It is well known that such outliers can produce misleading inferences in the application of unit root tests (e.g. Maddala and Kim (2003)).

Table 1 Estimation results

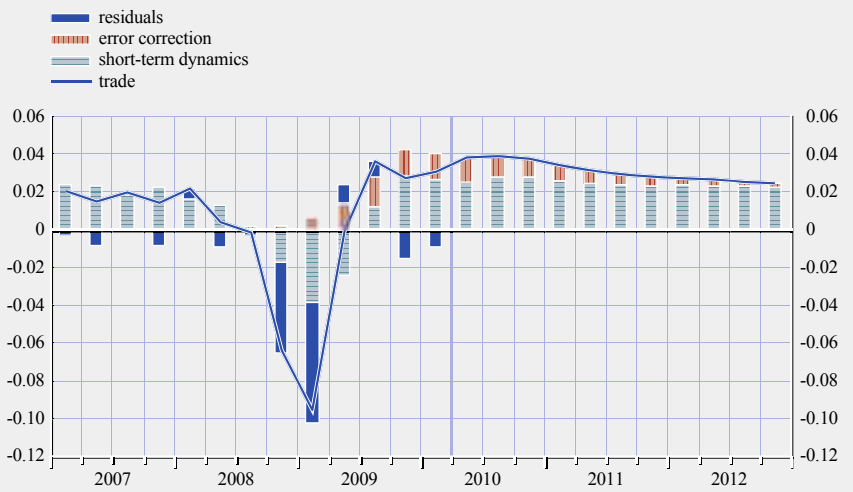
Dependent variable: quarterly growth in world trade	(1) Benchmark	(2) Stock-Watson	(3) Short sample	(4) Industrial production
Sample	Q1 1981-Q3 2008	Q1 1981-Q3 2008	Q1 1995-Q3 2008	Q1 1985-Q3 2008
Methodology	Engle-Granger	Stock-Watson	Engle-Granger	Engle-Granger
Activity variable	GDP	GDP	GDP	IP
Long-term relationship [1]				
Global activity	0.978	0.967***	0.981	1.013
Globalisation trend	0.008	0.008***	0.007	0.008
Speed of adjustment	-0.085***	-0.081***	-0.154***	-0.133***
Short-term dynamics				
Global activity growth	1.229***	1.506***	1.060***	0.887***
Global trade growth (lagged)	0.354***	0.375***	0.442***	0.474***
Adj. R^2	0.54	0.54	0.61	0.52

1) Significance of the long-term coefficients is only reported for the Stock-Watson approach.

Applying this model to developments in trade and GDP in the crisis of 2008-09 suggests that an unprecedented gap between the actual trade level and the "equilibrium" level implied by the long-term relationship between trade and GDP has opened up. In other words, trade declined significantly more than one would have expected based on the actual GDP developments. This is also illustrated by the large residual term at the end of 2008 and in early 2009 in Chart 2. However, the model shares the failure of most standard trade models of not anticipating the trade collapse in the crisis period.

Chart 2 Contributions to the one-step-ahead out-of-sample projections of the global trade model

(quarter-on-quarter growth)



Note: The last observation refers to the first quarter of 2010.

3 WORLD TRADE AT A CROSSROADS: A SCENARIO ANALYSIS

The great trade collapse of 2008-09 was not only hard to anticipate on the basis of standard trade models but also poses major challenges for forecasters in the assessment of world trade going forward. In particular, it is an open question whether the crisis will have transitory or persistent impacts on world trade. We use our model of world trade as a starting point for a comprehensive scenario analysis. More specifically, we analyse in greater detail what the shape of the recovery will look like under alternative assumptions on the future profile of world GDP and the relationship between global trade and GDP.

3.1 A "MECHANISTIC" BASELINE SCENARIO

In our "mechanistic" baseline scenario, we:

(i) assume that the estimated pre-crisis coefficients in our benchmark error-correction model will also apply to the post-crisis era; and

(ii) feed the model with a plausible global GDP profile. In more detail, we assume – for the sake of comparability – that world GDP growth will evolve as projected by the IMF.

Taking these assumptions as given, our benchmark model suggests a very strong recovery of world trade over the next two years (see Table 2). In terms of annual growth rates, world trade is calculated to expand by 12.6% in 2010, 13.6% in 2011 and 10.9% in 2012.

These world trade growth rates are well above those currently forecast by the IMF and other major institutions. In fact, to a notable extent, the results are driven by the error correction mechanism in the model, as shown by the decomposition in Chart 2. The benchmark model interprets the huge deviation of world trade from its equilibrium level in late 2008 and early 2009 as an event that will be corrected by above-average growth in world trade – also compared with GDP – going forward. In the following section, we will explore several ways to bring the medium-term projections of world trade into a possibly more plausible range, which is closer to the projections of international organisations.

Table 2 "Mechanistic" baseline scenario

(annual percentage changes)

	Historical average	2009	2010	2011	2012
World GDP	3.4	-0.8	4.8	4.3	4.3
World trade	6.3	-11.9	12.6	13.6	10.9
Memo: IMF	-	*-11.0*	*11.4*	*7.0*	-

Note: The last observation refers to the first quarter of 2010. The IMF forecast refers to the World Economic Outlook, October 2010.

Table 3 World trade growth under alternative assumptions on world GDP growth

(annual percentage changes)

	2010	2011	2012
Baseline	12.6	13.6	10.9
Δy 0.3p.p. lower	12.0	11.7	9.2
Δy 0.5p.p. lower	11.6	10.4	8.1
Δy 0.8p.p. lower	10.9	8.4	6.4
Memo: IMF	*11.4*	*7.0*	-

Note: The last observation refers to the first quarter of 2010. The IMF forecast refers to the World Economic Outlook, October 2010.

3.2 SENSITIVITY TO THE GLOBAL GDP PROFILE

Ockham's razor would suggest that we should first consider the simplest possible explanation of the seemingly implausibly optimistic trade projections entailed in the mechanistic baseline, namely a misspecified model. However, even though our simple model could certainly be improved in various ways, it did reasonably well in explaining trade developments prior to the crisis and passed the usual robustness tests. So we are confident that this is not the whole story.

If the model is fine, how about the figures input into this model, i.e. the future GDP profile on which our baseline scenario is conditioned? To check whether an overly optimistic GDP profile could be part of the answer, we consider three alternative scenarios in which quarterly world GDP growth is, respectively, 0.3, 0.5 and 0.8 percentage points lower than in the baseline scenario over the entire forecast horizon. These scenarios would be consistent with the fact that recoveries from financial crises tend to be more sluggish than "normal" recoveries, partly due to extensive deleveraging (e.g. Reinhart (2009)).

Of course, the downward shift in the GDP profile also pushes down world trade growth with respect to the baseline. More interestingly, though, even under the extreme assumption of anaemic global GDP growth of less than 0.5% over the next two years (which is well below any available global projection), our simple model predicts that annual world trade growth is significantly above its long-term average of 6.3% throughout 2010 and 2011 and close to this average rate in 2012. Again, this reflects the strong impact of the error-correction mechanism implemented in the model. In the following section, we explore this issue in greater detail.

3.3 IMPACT OF CHANGES IN THE RELATIONSHIP BETWEEN WORLD TRADE AND WORLD GDP

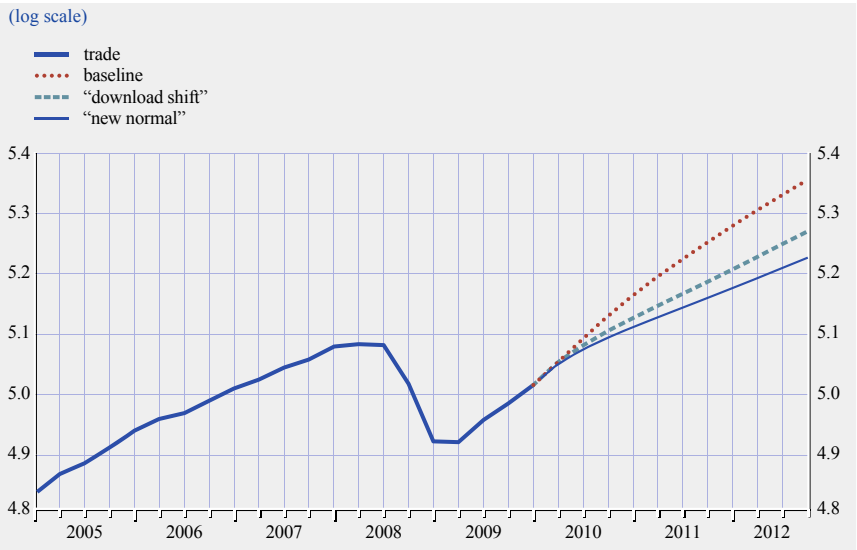
So far, we have implicitly assumed that, in the absence of renewed shocks, world trade will gradually return to levels consistent with its long-run equilibrium relationship with global GDP. In other words, we have assumed that the crisis has had only transitory effects that are unwinding over the horizon. In principle, there are good arguments that could justify this premise. In fact, the model decomposition presented earlier indicates that a significant part of the weakness in

trade relative to GDP during the downturn was transitory and that the mismatch already started to unwind in 2009 (see Chart 2). To some extent, this may reflect the fact that inventory dynamics magnified both the downturn and the subsequent upturn in global trade (see the essay by Alessandria et al. in this e-book). Moreover, fiscal stimulus measures, including car-scrapping schemes, provided temporary support to world trade.

However, the impact from the transitory factors that supported world trade in the early phase of the recovery has been receding over the course of 2010. In particular, scope for further restocking has narrowed considerably and the global impact of fiscal stimuli is waning amid widespread austerity. It is thus hardly surprising that growth in world trade moderated significantly over the second half of 2010. In fact, empirical evidence suggests that the impact of financial crises on trade do not disappear overnight. Imports recover only sluggishly in countries that have undergone a financial crisis, even when conditioning on output (Abiad et al. (2011)). To some extent, this stems from stressed credit conditions, to which international trade is generally more exposed than domestic transactions (Amiti and Weinstein (2009)). The risk of rising protectionism and "currency wars" presents another downside risk to the outlook for world trade (Evenett (2010)). Furthermore, the crisis-induced increase in government expenditure – typically characterised by home bias – across the globe could further reduce the trade intensity of world GDP.

In terms of our simple error correction model, there are several ways to capture these headwinds that could hamper world trade in the months ahead. They all have in common that they are associated with persistent changes in the relationship between trade and GDP.

Chart 3 Impact of changes in the relationship between global trade and GDP



Note: The last observation refers to the first quarter of 2010. Projections up to the fourth quarter of 2012.

Table 4 World trade growth under alternative scenarios

(annual percentage changes)

	2010	2011	2012
Baseline	12.6	13.6	10.9
"Downward shift"	11.7	9.3	8.2
"New normal"	11.2	7.7	6.6
Memo: IMF	*11.4*	*7.0*	-

Note: The IMF forecast refers to the World Economic Outlook, October 2010. See the main text for details on the various scenarios.

In our "downward shift" scenario, we assume that the estimated coefficients will, in principle, also apply to the post-crisis period, but that there will be no further error correction in world trade going forward.

Loosely speaking, we force the model not to interpret the remaining deviation from the long-run relationship of world trade and world GDP over the projection horizon as a transitory event that is to be further corrected in the subsequent quarters. As a consequence, there is a permanent downward shift in the *level* of trade. Under this scenario, the projected profile for world trade growth for 2011 would be much lower than in the baseline, but still above the path projected by the IMF (see Chart 3 and Table 4).

In our "new normal" scenario we thus go one step further, assuming not only that the error correction mechanism is turned off (as in the previous scenario), but also that the elasticity of trade to GDP will be lower than before the crisis, at least for some time.

In more detail, we assume that both the short-run coefficient associated with GDP (y_1) and the long-run elasticity (β) shrink by a factor of 0.8. The resulting trajectory of world trade is indeed significantly flatter than in the "downward shift" or the baseline scenario and very close to the IMF forecast (see Chart 3 and Table 4). Hence, unless one believes that world trade will grow at double-digit rates for several years in a row (which has not been observed for decades), part of the deviation of trade from the equilibrium level warranted by GDP has to be regarded as a longer-lasting phenomenon.

4 CONCLUSION

Our analysis suggests that during the global crisis world trade declined significantly more than would have been expected on the basis of its long-term relationship with economic activity. Moreover, this gap between actual and equilibrium trade is closing only slowly and, under reasonable assumptions, could persist for some time to come. Our analysis highlights that in assessing the near and medium-term outlook for trade, assumptions regarding the speed and degree to which the gap between actual and equilibrium trade closes are absolutely central. It is too soon to say with any certainty whether the crisis will have only transitory or persistent

effects on the relationship between trade and economic activity. However, we have constructed plausible scenarios through which the impact on trade is both long-lasting and meaningful.

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CHAPTER 7

US EXPORTS FOLLOWING THE "GREAT TRADE COLLAPSE"

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As with global trade more generally, exports from the United States plummeted dramatically in late 2008 and early 2009. Although exports soon began a brisk recovery, they still remain below an "equilibrium" level as determined by a simple model incorporating export-weighted GDP and the real exchange rate (similar in structure to the global model discussed in Chapter 6). The continued weakness of US exports raises the possibility that the crisis has had a permanent effect on trade, with the prospect that there has been a shift in the income elasticity of exports. In this chapter we use our model to identify the sources of US export weakness, decomposing the model error across geographies and categories of goods. We find that the weakness of exports is evenly dispersed across advanced and emerging economies, implying that the shift in exports relative to GDP is not idiosyncratic but widespread, possibly reflecting a structural change in the pattern of exports. We also show that the model error is concentrated in exports of capital goods, which, owing to historically sluggish adjustment in that sector, suggests that the financial crisis may have long-lasting effects on US trade.

1 US EXPORTS DURING AND AFTER THE "GREAT TRADE COLLAPSE"

The United States was not an outlier in regard to the worldwide collapse in trade flows that occurred over 2008 and 2009. The declines in US exports and imports were neither exceptionally large nor exceptionally small relative to global trends. Real exports of goods and services fell by 15% from mid-2008 to mid-2009, while real imports contracted by 18% over the same time period. The declines in both exports and imports were widespread across categories of goods and across trading partners.

As with global volumes more generally, US trade has rebounded sharply since mid-2009. By the third quarter of 2010, real exports and imports had returned to within a hair of their second quarter 2008 levels. The rebound in imports has

coincided with relatively weak US GDP growth, and the US import-to-GDP ratio has roughly returned to its pre-crisis trend. In contrast to the modest pace of US GDP growth, foreign growth weighted by share of US exports has been fairly robust, and the level of foreign GDP has surpassed its pre-crisis peak. Thus, for exports, a comparison with the previous peak understates the degree to which exports remain below their pre-crisis trend.

The continued weakness of US exports relative to the pre-crisis trend raises the possibility that there has been a shift in the elasticity of exports with respect to foreign income. Although insufficient time has passed to rigorously test the hypothesis of a shift in elasticities, in this chapter we shed light on the issue by identifying the sources of continued US export weakness across countries and goods. Decomposing the weakness in US exports provides some insight into whether the current underperformance of exports relative to foreign GDP is likely to be permanent or transitory.

2 A SIMPLE EMPIRICAL FRAMEWORK TO ASSESS THE PERFORMANCE OF US EXPORTS

In order to assess the recent performance of US exports, and to provide some indication of the outlook for exports going forward, we constructed a simple empirical model of US exports almost identical in form to that presented for global trade in Chapter 6. The global model in Chapter 6 was modified in two key respects:

- A trade-weighted measure of the real exchange rate was included as an explanatory variable, as relative price changes are an important determinant of US exports in both the long and short run.

- The model does not include a time trend. Attempts to include a trend were met with counterintuitive results.

Table 1 Estimation results

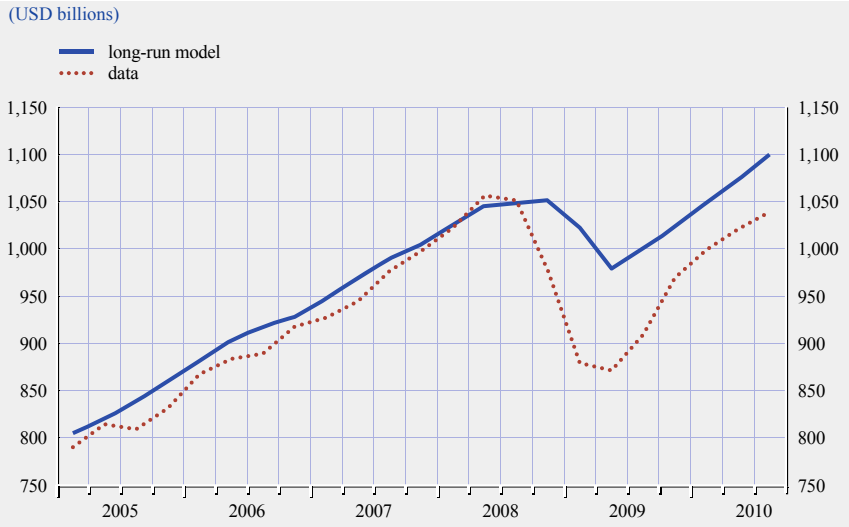
Dependent variable: quarterly growth in real exports of goods	Benchmark
Sample	**Q1 1981–Q3 2008**
Methodology	**Engle-Granger**
Activity variable	**Foreign GDP**
Long-term relationship	
Global activity	1.474
Real exchange rate	-0.725
Speed of adjustment	-0.193***
Short-term dynamics	
Lagged global activity growth	1.755***
Real exchange rate	-0.772***
Adj. R^2	0.48

The estimated parameters are reported in Table 1. The estimated long-run income elasticity is in the vicinity of 1.5: greater than that in the global model, but in line with that in other models of US exports (including the Federal Reserve's US International Transactions model). The real exchange rate has a significant negative coefficient and is estimated to have a long lag structure, with changes in the real exchange rate continuing to affect the level of exports for three years. A lagged dependent variable was included in the regression; however, the coefficient was insignificant and is not reported.

The model solution and the actual level of US exports are plotted in Chart 1. As can be seen by comparing the long-run equilibrium level with the data, a large model error opened up over the 2008-09 period, such that, even given the decline in foreign GDP, US exports appeared exceptionally weak. By the third quarter of 2010, the margin of error had narrowed somewhat compared with the mid-2009 trough, but the gap remains substantial.

Interpreting the model error is central to projecting US exports in the medium term. If the error were to shrink in line with the model's error correction mechanism, we would expect a period of robust export growth in the near and medium term. Alternatively, if the error were to persist, export growth would be relatively tepid. Decomposing the error across trading partners and categories of goods can provide us with further insight into the prospects for US export growth going forward.

Chart 1 US exports of goods



Sources: BEA and own calculations.

3 US EXPORTS BY DESTINATION DURING THE "GREAT TRADE COLLAPSE"

In this section we consider the performance of US exports, disaggregated across advanced foreign economies (AFEs) and emerging market economies (EMEs), using separate models identical in structure to that discussed above. The results of the disaggregated models are reported in Table 2. A few notable differences are apparent between the two groups:

- For US exports, the advanced economies have a higher income elasticity, but a lower price elasticity, than the emerging market economies.

- Exports to the emerging market economies tend to bounce back more quickly to their long-run equilibrium level than exports to the advanced economies.

The models can be used to examine the 2008-09 trade collapse and the current state of the bounce back in exports. As shown in Chart 2, the collapse in exports resulted in roughly equal model errors for the AFEs and EMEs, with exports underperforming relative to GDP by about the same amount in both groups. The model errors in both groups decreased through the second half of 2009, as exports to both groups bounced back; however, exports to the EME countries appear to have regained slightly more of their unexplained weakness. In 2010, neither the AFE nor the EME model errors closed much further, and exports have remained weak relative to GDP in both markets. This does not necessarily imply a loss in US export market share, as it may partly reflect a change in the elasticity of trade to GDP across *all* exporters worldwide. The persistent weakness of exports to EMEs with respect to model predictions (see negative errors in Chart 2) may come as a surprise given the strong growth of exports to the group during 2010; however, EME GDP growth was also robust during this period, and the model would have indicated an even greater increase in exports than actually occurred.

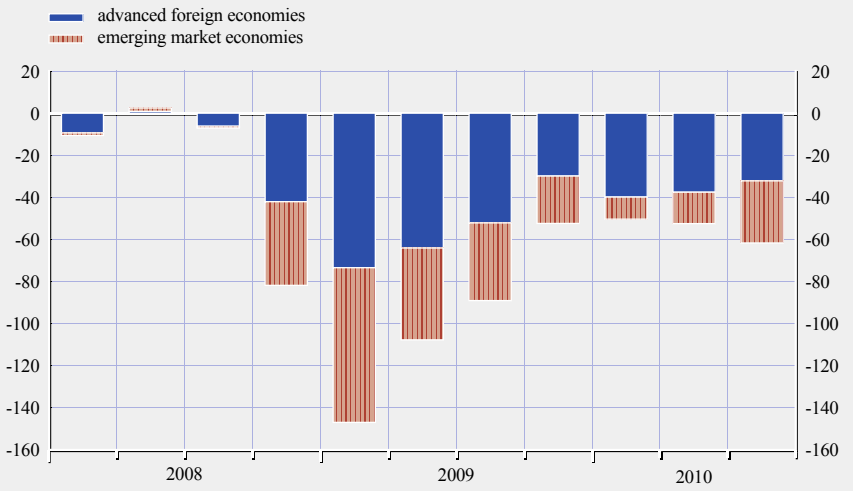
That exports to the AFE countries continue to underperform is not surprising given that a number of trading partners in this group have suffered severe financial crises. Empirical evidence points to only a sluggish recovery of imports

Table 2 Estimation results from the US exports error correction model – disaggregated markets

Dependent variable: quarterly growth in US real exports	(1) AFEs	(2) EMEs
Sample	Q1 1981-Q3 2008	Q1 1981-Q3 2008
Long-term relationship		
GDP	1.656	1.335
Real exchange rate (0 to -12)	-0.484	-0.904
Speed of adjustment	-0.148***	-0.244***
Short-term dynamics		
Lagged GDP growth	2.169***	1.538***
Real exchange rate (0 to -12)	-0.437***	-1.507***
Adj. R^2	0.36	0.33

Chart 2 Decomposition of US export model error across destination markets

(billions of 2005 USD)



Source: Own calculations.

in countries affected by the financial crisis (International Monetary Fund (2010)). The persistence of the EME model error is more surprising, as these countries largely avoided the financial crisis and have had robust recoveries in GDP. It could be that GDP growth in these countries has been boosted largely by sectors that are less import intensive, i.e. government spending and infrastructure, and that as such the model, ignorant of the source of GDP growth, is disappointed by the relative paucity of imports drawn in by such growth.

The persistent gap between actual exports and their estimated equilibrium level might also partly reflect a change in the relationship between trade and GDP. That the weakness of exports has persisted across different regions, which have experienced very different macroeconomic conditions, suggests that a fundamental shift in trading behaviour may have occurred, as opposed to the weakness being merely a function of idiosyncratic weakness in one region.

4 US EXPORTS BY COMMODITY

Having considered destination markets, we now turn to an examination of US exports disaggregated by commodity.

We estimated error correction models of the same style as those in the previous two sections for a comprehensive breakdown of exports into six major commodity groups. For each regression the independent variables, GDP and the real exchange rate, are identical to the series used in the aggregate regression in Table 1.

Table 3 Estimation results from the US exports error correction model – disaggregated commodities

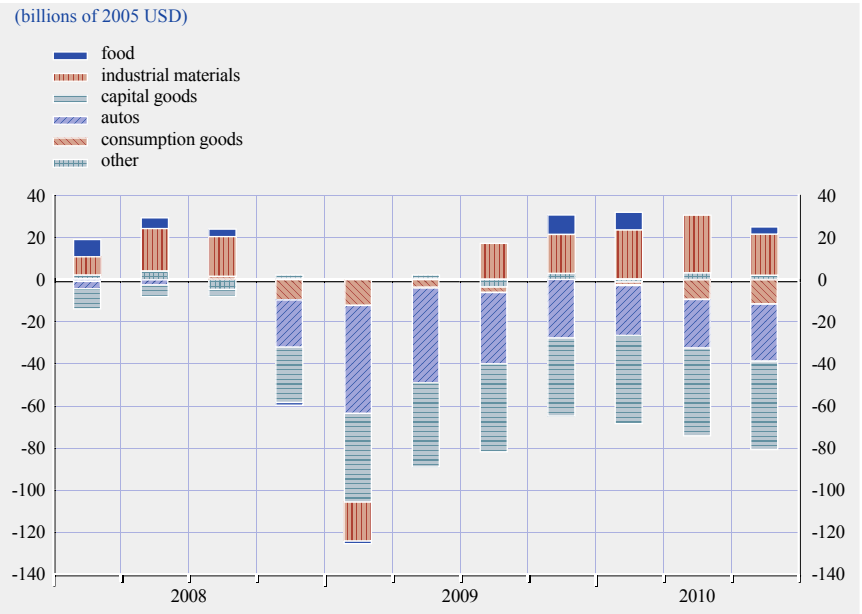
Dependent variable: quarterly growth in US real exports	(1) Food	(2) Industrial materials	(3) Capital goods	(4) Autos	(5) Consumer goods	(6) Other
Sample	Q2 1995-Q3 2008	Q2 1995-Q3 2008	Q2 1995-Q3 2008	Q2 1995-Q3 2008	Q2 1995-Q3 2008	Q2 1995-Q3 2008
Long-term relationship						
Global GDP	0.772	1.316	1.480	1.615	2.105	0.885
Real exchange rate: sum(0 to -12)	-0.318	-0.504	-0.889	-0.715	-0.766	0.0254
Speed of adjustment	-0.431***	-0.315***	-0.183***	-0.754***	-0.319***	-0.446***
Short-term dynamics						
Lagged global growth	0.324	1.219***	1.770***	1.964***	1.813***	1.332***
Real exchange rate: sum(0 to -12)	0.114	-0.295	-.187	-0.345	-0.783***	2.934***
Adj. R^2	0.18	0.26	0.33	0.42	0.32	0.20

As can be seen in Table 3, there is considerable variation in the income and price elasticity of exports across commodities. Exports of capital goods show the greatest price sensitivity, while food and "other" goods are relatively price inelastic. Consumer goods are the most income elastic, while exports of foods and "other" goods (including, importantly, military goods) are less sensitive to changes in income.

On the surface, the higher income elasticity of consumer goods may appear surprising given that consumption, particularly of non-durables, is generally less cyclical than investment. In part, this surprising result is the outcome of the specific composition of US exports of consumer goods. For example, in the second quarter of 2008, fully 20% of US real consumer goods exports consisted of artwork, jewellery and gemstones, probably exceeding the weight on such goods in all but a few consumption bundles.

As with destination markets, using a separate equation for each commodity group allows us to decompose the deviation from long-run equilibrium by individual commodity. As shown in Chart 3, the unexplained decline in exports that occurred over the 2008-09 period was concentrated in two categories: autos and capital goods. The importance of autos in explaining the model error is particularly apparent, given that this sector accounted for only 10% of goods exports in the first half of 2008 and yet accounts for over half of the model error during the trade collapse. The closing of the model error that occurred in the second half of 2009 primarily reflected a narrowing of the large error in autos, while the error in the capital goods model has proven surprisingly resilient. In addition, exports of industrial materials have actually been stronger than the model would have predicted, decreasing the aggregate residual.

Chart 3 Decomposition of US export model error across commodities



Source: Own calculations.

One factor contributing to the sluggishness of the recovery in capital goods exports could be the historical persistence of deviations from long-term equilibrium in this sector. As shown in Table 3, the estimated "speed of adjustment" is slowest in the capital goods sector. Another factor could be that capital goods are impacted more by financial distress than other commodity groups.

5 CONCLUSION

Although US exports have rebounded sharply following the 2008-09 collapse in trade, the level of exports still remains below the equilibrium level implied by the path of foreign GDP and recent movements in the exchange rate. In this chapter we have decomposed the continued weakness of US exports across destinations and commodities. We have found that the weakness of exports is distributed across both advanced and emerging economies, suggesting that the underperformance of exports is not related to idiosyncratic developments in any one region. That the weakness is widespread is loose evidence in support of the contention that the underperformance of exports could be persistent and represent a long-term shift in the relationship between foreign GDP and exports. We have also found that exports of capital goods and autos remain especially weak relative to model predictions, likely reflecting the lingering impact of the financial crisis on these sectors as well as their susceptibility to inventory swings, as discussed in Alessandria et al. (2010 and chapter in this e-book).

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CHAPTER 8

THE GLOBAL FINANCIAL CRISIS AND WORLD TRADE: IMPLICATIONS FOR ELASTICITIES[1]

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The collapse in trade volumes, the compositional effects and the country differences in response to the financial crisis have sparked a debate about the sensitivity of trade to growth and relative price changes. There is a question as to whether the price, income and Armington elasticities have changed. The central thesis of this chapter, based on the research by McKibbin and Stoeckel (2009c), is that when using a dynamic structural model of the world economy it is not necessary to assume changes in trade elasticities to 'explain' the dramatic trade outcomes observed in the course of 2009. Rather, the collapse in the level of trade as well as the compositional shifts and differential country impacts can be accounted for in a structural model by the nature of the shocks that led to the global financial crisis.

1 HOW THE FINANCIAL CRISIS HAS AFFECTED TRADE OUTCOMES

The financial crisis has affected trade outcomes through several channels, some obvious, some less so. One obvious one is the slowdown in demand from both business and households. Imports fall, and hence someone else's exports must fall. Other effects are more complicated, however, as set out in the chart.

A financial crisis causes a sharp reappraisal of risk by households and business. Besides wealth effects and changes to asset prices, banks are no longer happy to lend at the same rates as before, if at all. Trade credit is harder to come by. Such upward reappraisals of risk cause the cost of capital to rise and countries' net savings and investment positions change. This means current account deficits and surpluses will also change and this, in turn, affects trade balances and hence

1 This paper draws heavily on a larger, more comprehensive paper by the authors prepared for the World Bank in 2009 on the impact of the Global Financial Crisis on world trade.

exports and imports. Facilitating all these adjustments will be changes in real exchange rates that affect the relative price of tradeables and non-tradeables and hence the supply of and demand for exports and imports.

Changes in risk also directly affect the demand for and supply of different types of products. For example, demand for durable goods falls sharply because the decision to purchase is based on a present value calculation of future service flows from the goods which, under higher risk, will be heavily discounted. It will not be possible to finance capital intensive goods as capital costs rise sharply. Thus a risk shock changes the composition of demand and supply as well as the overall trade balance. To capture these effects requires a structural model with a particular disaggregation of sectors.

Falling output, trade and employment lead policy-makers to stimulate the economy. There are three ways they can do this. One is to ease monetary policy. Another is to stimulate domestic demand through expansionary fiscal policy by extra borrowing and this again affects capital flows and trade. The third, less helpful way governments sometimes choose to "look after their own" is by protection, either by overt border measures such as tariff increases or more subtle ones such as "Buy Local" programmes. There may also be financial protection, for example where banks or firms are directed to lend at home, and this too will influence capital flows and trade.

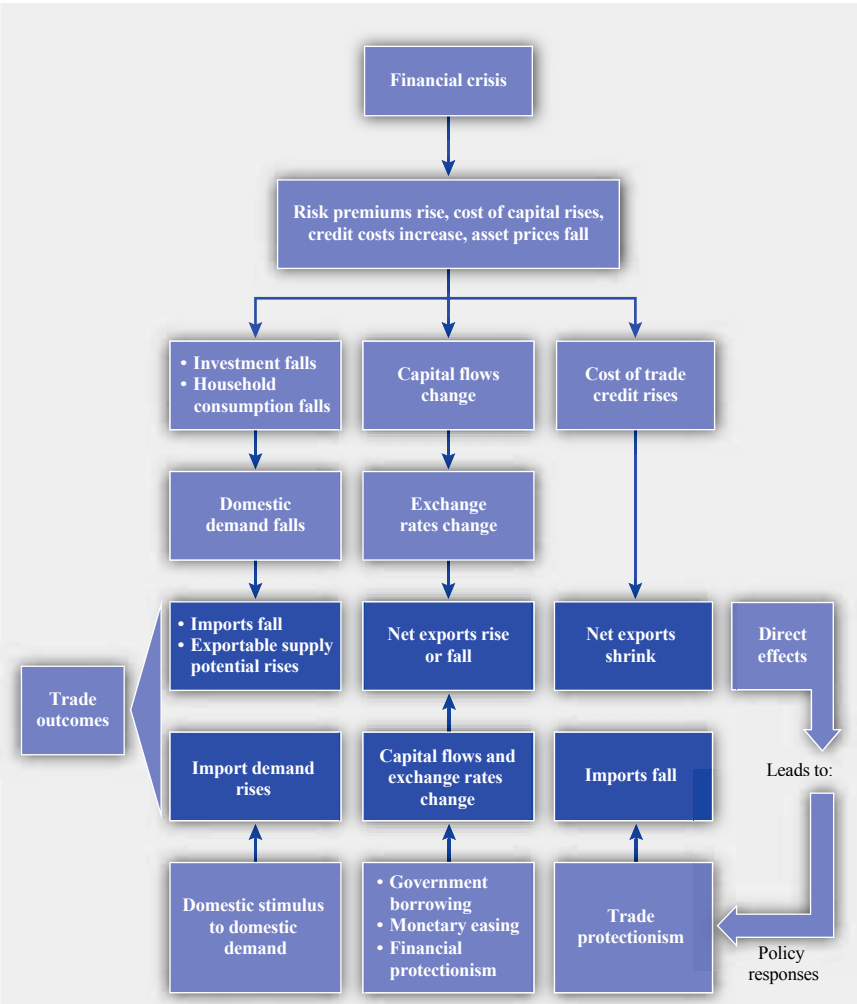
All of the above mechanisms affect the size and composition of trade flows. Some will compound one another, others will be offsetting. To incorporate all of these interactions, we use the G-Cubed model, a dynamic, intertemporal general equilibrium model[2] that fully integrates the financial and real sectors of the world economy. It incorporates wealth effects, expectations and financial markets for bonds, equities and foreign exchange as well as trade and financial flows. It also has substantial sectoral disaggregation across production sectors in the global economy. The theoretical structure is outlined in McKibbin and Wilcoxen (1998).[3] A number of studies summarised in McKibbin and Vines (2000) show that the G-cubed modelling approach has been useful in assessing a range of issues across a number of countries since the mid-1980s.[4]

2 The G-Cubed model is known as a Dynamic Stochastic General Equilibrium (DSGE) model in the macroeconomics literature and a Dynamic Intertemporal General Equilibrium (DIGE) model in the computable general equilibrium literature. In contrast to static computable general equilibrium (CGE) models, time and dynamics are of fundamental importance in the G-Cubed model.

3 Full details of the model, including a list of equations and parameters, can be found online at: www.gcubed.com

4 These issues include: Reaganomics in the 1980s; German Unification in the early 1990s; fiscal consolidation in Europe in the mid-1990s; the formation of NAFTA; the Asian crisis; and the productivity boom in the US.

Chart 1 Global financial crisis and trade responses



Source: Author's assessment.

2 THREE MAIN SHOCKS CAPTURE THE ONSET OF THE GLOBAL FINANCIAL CRISIS

Shock 1: the bursting of the housing bubble

The bursting of the housing bubble is modelled as a surprise fall in the expected flow of services from housing investment – larger in the United States, the United Kingdom and Europe but significant throughout the world. The household invests in housing to maximise consumption from the stream of future service flows that housing provides. We model the housing part of the crisis as a fall in the productivity of the service flow from the housing stock. Housing productivity in the United States is assumed to be 10% lower in 2009 and is calibrated to give, along

with the other shocks, a drop in house prices in the US of the order of 6%, roughly what was observed.[5] A plausible scenario is where productivity returns to "normal" by 2013.

Shock 2: rising equity risk premia

The rise in the equity risk premium since the collapse of Lehman Brothers was initially of the order of 8 percentage points. It is assumed that confidence will gradually be restored to "normal" by 2013. This is quite plausible, since the size and speed of the drop in economic activity has been a salutary lesson for investors that they are unlikely to forget quickly.

Shock 3: a rise in household risk

The reappraisal of risk by firms as a result of the crisis also applies to households. As households view the future as being more risky, so they discount their future earnings and that affects their saving and spending decisions. The increase in household risk in the United States is assumed to be 3 percentage points in the "plausible" scenario in 2009, half that in 2010 and back to "normal" in 2011 and thereafter.

3 THREE MAIN SHOCKS CAPTURE THE POLICY RESPONSES

Shock 4: monetary easing

There is an endogenous monetary response in the model for each economy, where each economy follows a Henderson-McKibbin-Taylor rule. The monetary easing that has actually occurred is close to the endogenous monetary policy response already built into the model so no extra monetary shock is required.

Shock 5: fiscal easing

There is an endogenous fiscal policy response in the model but the rule is a targeting of fiscal deficits as a percentage of GDP. The actual easing of fiscal policy announced by most economies was unprecedented and had to be simulated in line with discretionary stimulus packages announced in the course of 2009 and 2010 and as summarised by the OECD.[6] Details are outlined in McKibbin and Stoeckel (2009c).

Shock 6: increase in trade and financial protectionism

To try and capture a plausible tightening of trade protection, we assume an increase in all tariff rates by 10 percentage points (i.e. if a tariff was 5% it becomes 15%).

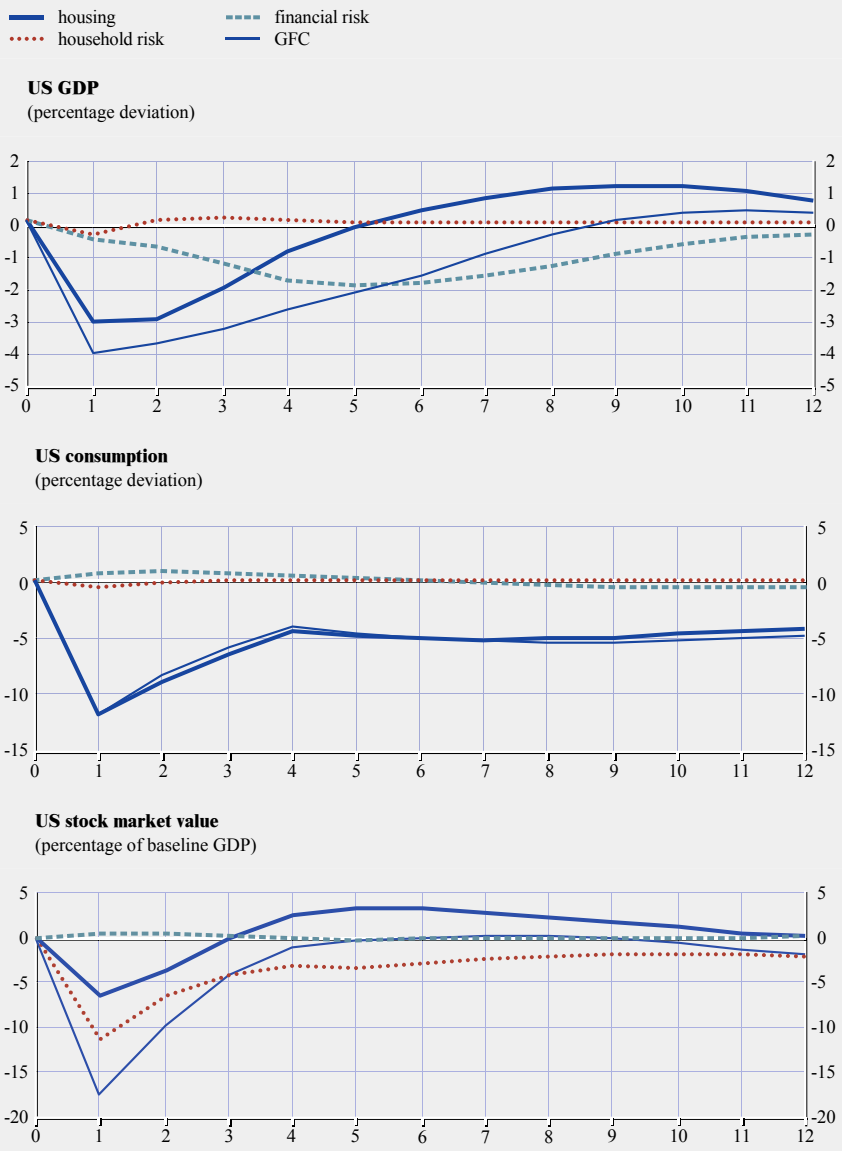
5 A 10% permanent drop in housing productivity in the United States alone gives a 5.4% drop in housing values one year later. See McKibbin, W.J. and Stoeckel, A., "Bursting of the US housing Bubble", Economic Scenarios, No 14, www.economicscenarios.com

6 OECD 2009, *Fiscal Packages Across OECD Countries: Overview and Country Details*, Paris, 31 March.

4 EFFECTS OF CRISIS WITHOUT A FISCAL POLICY RESPONSE

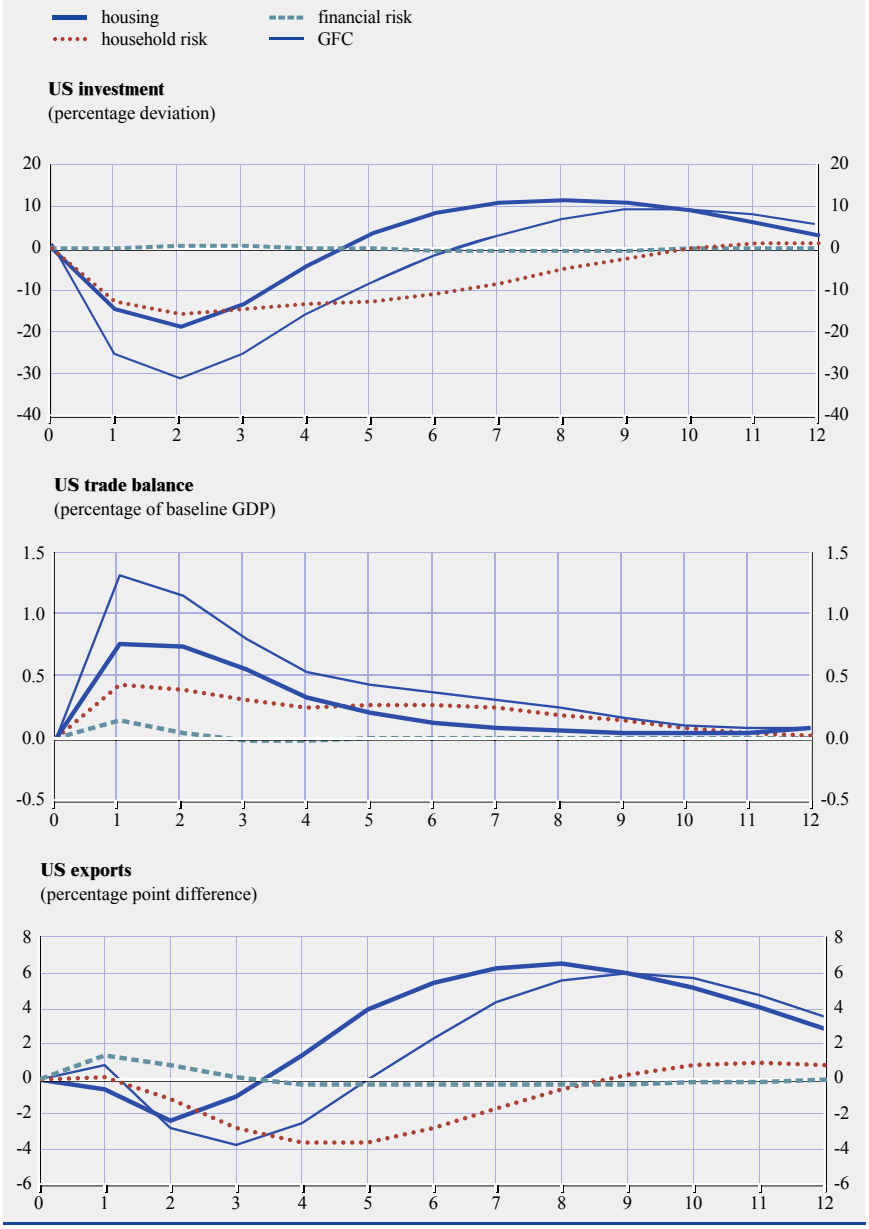
To appreciate the impact of these shocks, we run an illustrative scenario where shocks affect the United States alone (Chart 2). The bursting of the housing bubble has the biggest negative impact on real consumption and GDP. Since the housing shock is assumed to be permanent, consumption is permanently lower in all periods.

Chart 2 Impact of US-only financial crisis on the United States



Source: G-Cubed model simulations.

Chart 2 Impact of US-only financial crisis on the United States (cont'd)



Source: G-Cubed model simulations.

The financial shock has the largest negative impact on stock market values from baseline in 2009 and as large an impact as the bursting of the housing bubble on investment. The equity risk shock causes a move out of equities into other domestic assets, such as housing and government bonds as well as to asset

purchases overseas. The shift into government bonds drives up their prices and pushes down real interest rates substantially. Surprisingly, this raises individual wealth because expected future after-tax income is discounted at a much lower real interest rate. Thus in the US, the equity shock alone is positive rather than negative for consumption in the short run.

Each of the three shocks has a negative effect on the United States and, combined, they have the effect of lowering real GDP by 4% below baseline in 2009, with real GDP not returning to baseline until 2017, nearly a decade later. That is sufficient to put the US into recession in 2009 (baseline growth is 3.4%) but will allow positive growth in 2010.[7]

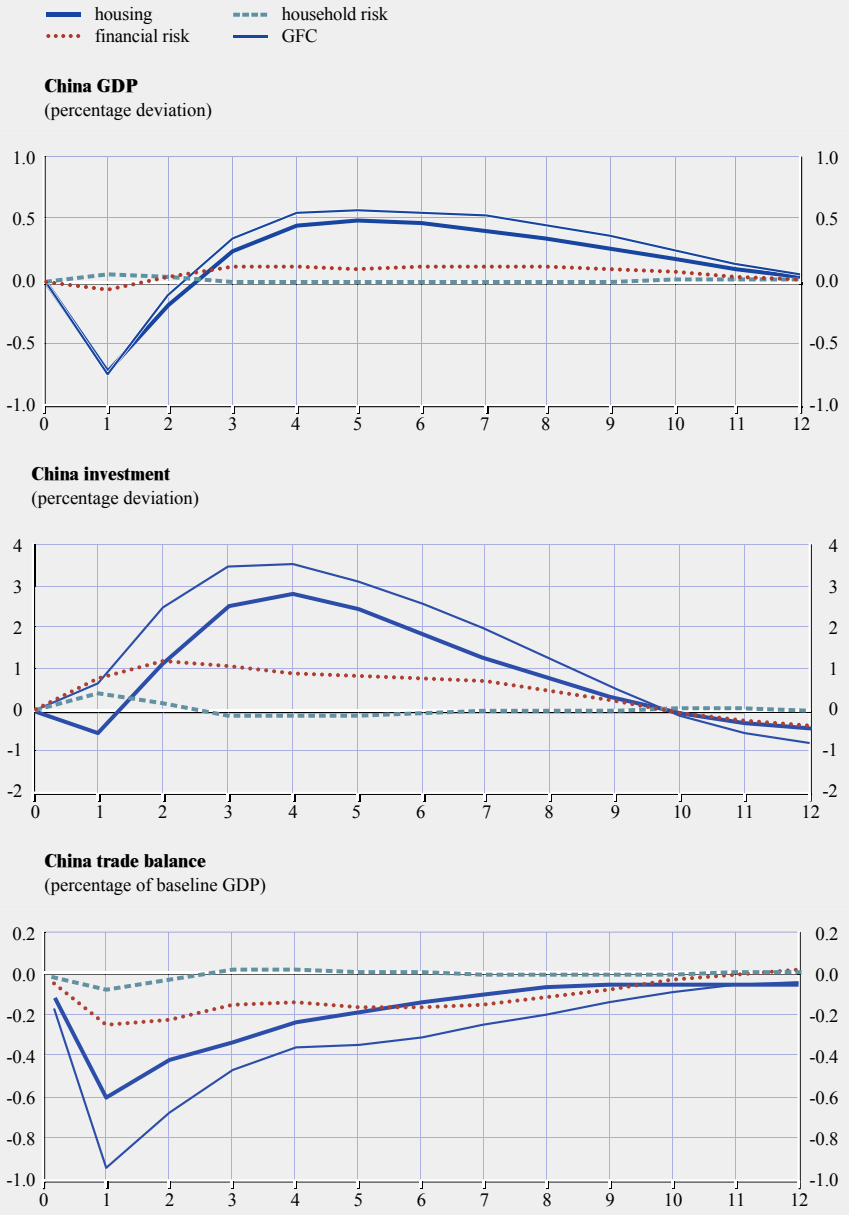
A key compositional effect also occurs when household discount rates and risk premia generally rise. The effect is a much sharper fall in the demand for durable goods relative to other goods in the economy. Imports and domestic production of durable goods fall by more than those of non-durable goods. The high risk-adjusted cost leads to a reduction in the flow of services from durables and therefore the demand for these goods drops sharply. This compositional effect is critical for trade outcomes. Countries that export durable goods are particularly affected by a crisis of the type modelled.

The recession in the United States has two main effects on the world economy. One is the negative knock-on effect from the loss in activity, with those economies most dependent on the United States market affected most. The second effect runs counter to the first. As prospects dim in the United States, so the returns on investment look better elsewhere. Money flows out of the United States (or strictly speaking, in the case of the United States, there is less inflow than otherwise) and into other economies, where it stimulates investment and economic activity. This is illustrated by the effect on China (see Chart 3). The United States is a large importer from China. As US imports fall, China's exports fall (see bottom right-hand panel in Chart 3), with a combined effect from the three shocks of a drop in exports of 5% below baseline in 2009. China's trade balance worsens, but note how small the effect is: barely 1% below baseline (as a percentage of GDP).

The conclusion is that the financial crisis which started in the United States, had it been confined to the US alone, would not have had dire consequences for the world economy. However, contagion and rising risk premiums have changed the picture substantially.

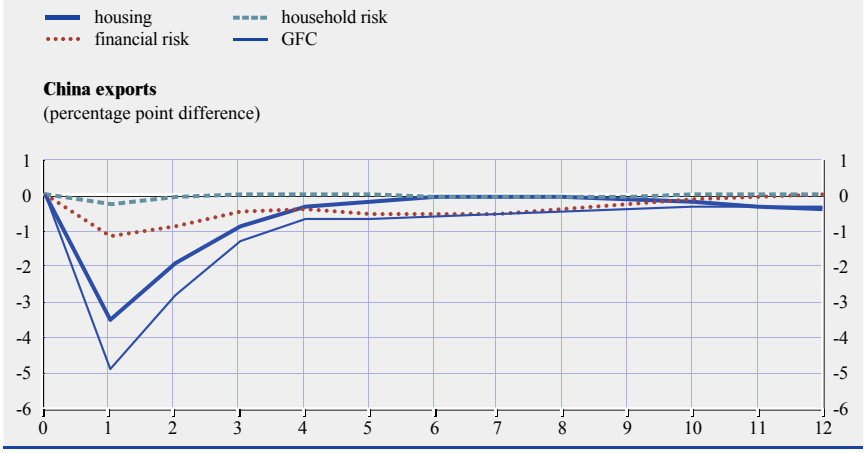
7 Note that all results are presented as deviations from a baseline projection. A fall in GDP of 4% in year 1, relative to baseline, where the baseline growth rate was 3%, gives a new growth rate in the first year of negative 1% (i.e. a recession). If the level of GDP remains 4% lower forever the growth rate of GDP in year 2 is back at baseline growth. Thus in growth rate terms, the crisis is resolved after the first year in many countries although the level of GDP remains below baseline for many years.

Chart 3 Impact of a US-only financial crisis on China



Source: G-Cubed model simulations.

Chart 3 Impact of a US-only financial crisis on China (cont'd)



Source: G-Cubed model simulations.

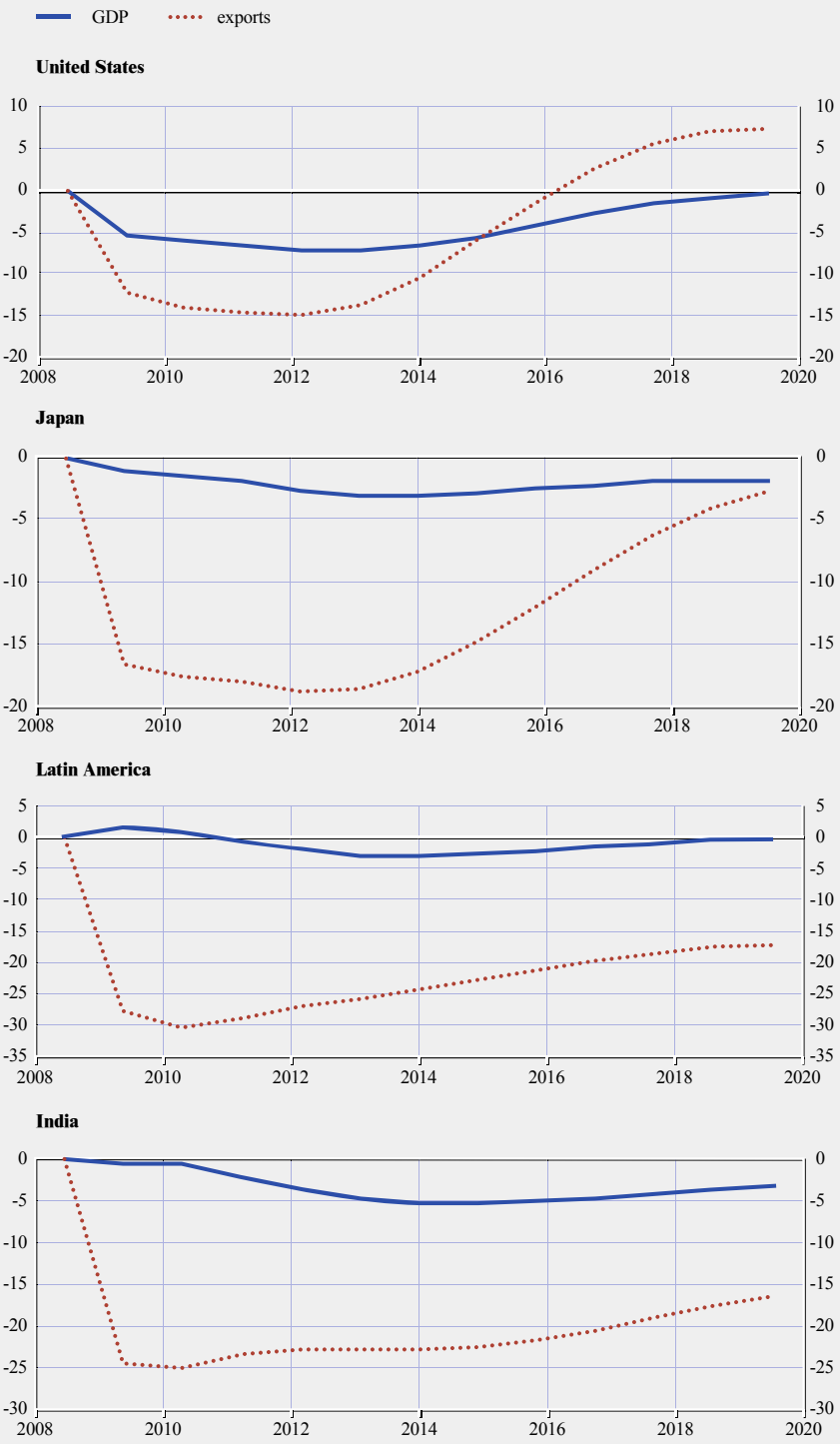
5 PROJECTED OUTLOOK FROM THE GLOBAL FINANCIAL CRISIS WITHOUT FISCAL STIMULUS

When all economies are affected by the global financial crisis through global changes in risk premia and loss of consumer confidence, other countries like China are adversely affected. The cost of capital rises across the globe and, in effect, makes the existing capital stock too large. Investment plummets, but not everywhere because it is relative effects that matter. Whereas Chinese investment rose when only the United States was assumed to be affected by the crisis, now Chinese investment falls to a low of over 8% below baseline in 2010.

One of the key features of the crisis is illustrated in the results in Chart 4. There is a substantially larger contraction in exports relative to the contraction in GDP in all economies. This massive shift in the relationship between trade and GDP is not the result of an assumption about the income elasticity of imports. It reflects some key characteristics of the model. First, imports are modelled on a bilateral basis between countries where imports are partly for final demand by households and government and partly for intermediate inputs across the six sectors. In addition, investment is undertaken by a capital sector that uses domestic and imported goods from domestic production and imported sources. As consumption and investment collapse more than GDP, imports will contract more than GDP. One country's imports are another country's exports and thus exports will contract more than GDP unless there is a change in the trade position of a particular country. The assumption that all risk premia rise and the result that real interest rates fall everywhere implies small changes in trade balances, even though both exports and imports fall a finding consistent with actual outcomes.

Chart 4 GDP and trade effects of global financial crisis

(percentage deviation)



Source: G-Cubed model simulations.

6 EFFECTS OF THE FISCAL STIMULUS ALONE

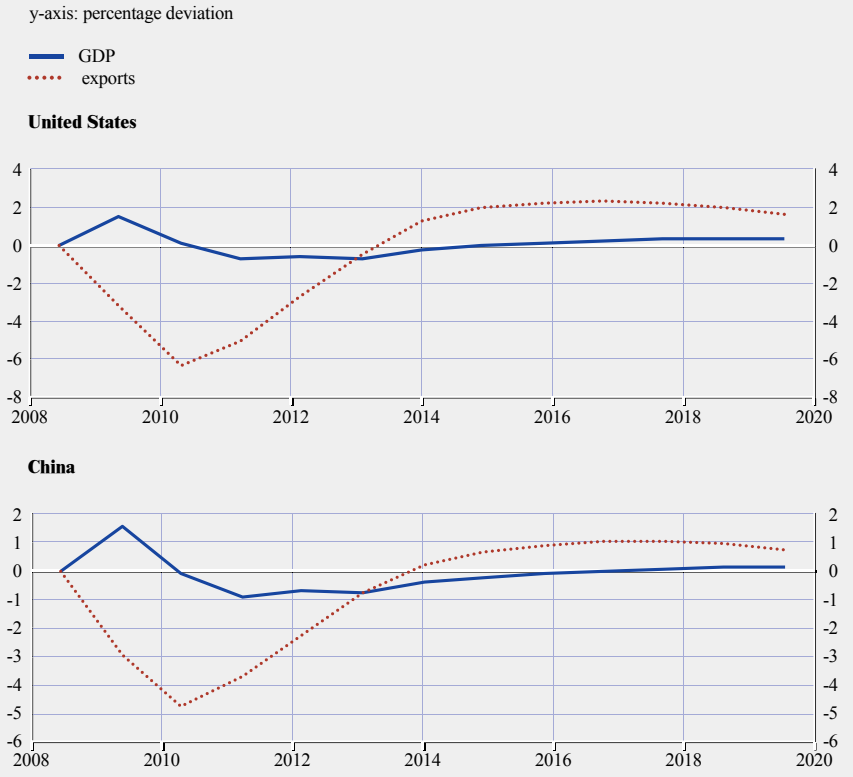
The fiscal stimulus gives a boost to real GDP above baseline for all major economies and China in 2009, the first year of the fiscal packages (see Chart 5).

The fiscal packages also have significant impacts on global trade. In the model the effect of fiscal policy on trade takes a number of forms, operating through both income and relative price effects. If an economy increases government spending, private consumption tends to rise and short-term income increases. However the increased borrowing tends to increase real interest rates, which reduces private investment.[8] These two responses have opposite effects on trade. In particular, the consumption of durable goods falls because of the rise in real interest rates, while the consumption of non-durable goods rises on account of the income increase. The effect is that imports of durable goods fall and non-durables rise. In addition, the higher real interest rate tends to attract foreign capital, which appreciates the real exchange rate, crowding out exports and stimulating income through relative price changes. A country acting alone experiences a substantial change in the mix of the components of final demand, and the effect of the real exchange rate dampening on trade tends to dominate the income effect. If there is a global fiscal stimulus, the real exchange rate (or relative price) effects are muted but still present to the extent that the fiscal packages are not symmetric across countries. However, since all countries are acting, the real interest rate effects are accentuated because the call on global savings is much larger than when any one country acts alone.

Chart 5 tells an interesting story, where exports of the industrial economies (taking the United States as an example) tend to fall as a result of the fiscal package. This occurs for several reasons. Firstly, because the OECD economies have relatively larger fiscal packages (apart from China), their real exchange rate will tend to appreciate relative to the non-OECD economies, crowding out exports. Secondly, these economies tend to export more durable goods, demand for which is reduced by a rise in global interest rates. This effect was also present in the global financial crisis simulation, where the risk-adjusted discount rate rose sharply (even though real interest rates fell) and the demand for durable goods collapsed. Global trade does not contract in 2009 but falls for several years as growth slows after the fiscal stimulus. By 2014 world trade is above baseline.

8 To the extent that there is a substantial supply response through infrastructure, the need for interest rates to rise for a given constrained capacity would be reduced.

Chart 5 GDP and export effects of fiscal response



Source: G-Cubed model simulations.

7 TRADE PROTECTIONISM

The rise in tariffs by 10 percentage points has a significant negative impact on GDP. The decline in real GDP relative to baseline varies in 2009 between 1.4% for the United States and the United Kingdom and 4.0% for Germany. The outcomes reflect the relative openness of the economies and the trade linkages between them. Overall, the effects of a rise in tariffs by 10 percentage points is to reduce trade by nearly 17% by 2012. The hypothetical lift in tariffs has a greater effect on trade than either the global financial crisis alone or the fiscal response.

For many countries the effect of a tariff increase alone is to reduce GDP in the individual country. Acting together reduces GDP even more. The favourable demand-side impact of diverting demand from imports to domestic goods is found to be outweighed by the increase in the costs of production. This is a very important finding from this paper. Tariff increases are not just beggar-thy-neighbour but also beggar- thyself policies. This is because the usual expenditure switching benefits of a country increasing tariffs are more than offset by a fall in investment, owing to the rise in the price of imported capital

goods and a fall in the return to capital in sectors where protection increases. These two supply-contracting effects dominate any demand stimulus in the model. Most simple analytical models take aggregate supply as given and therefore the demand-switching issue dominates. The supply impact of tariff changes found in the current model is supported by the experience of several decades of substantial expansion in output from countries that unilaterally liberalised trade. In a model with endogenous capital accumulation and international trade in durable capital goods, aggregate output is fixed neither nationally nor globally.

8 CONCLUSION

Simulating the effect of the crisis itself on the United States alone (the 'epicentre' of the crisis) shows several things. Had there not been the contagion across other countries in terms of risk reappraisal, the effects would not have been as dramatic. When there is a global reappraisal of risk, output and trade contract considerably. The bursting of the housing bubble has a bigger effect on falling consumption and imports than does the reappraisal of risk, but the reappraisal of risk has the biggest effect on investment. Increasing risk has several effects. The cost of capital is higher and leads to a contraction in the desired capital stock. Hence there is disinvestment by business and this can go on for several years – a deleveraging as the popular business media would have it. The higher perception of risk by households causes them to discount future labour incomes and leads to higher savings and less consumption, fuelling the disinvestment process by business. That in turn affects the composition of imports, with exporters of capital goods such as Germany and Japan bearing the brunt.

The fiscal policy response initially has the desired effect of increasing domestic demand and hence real GDP. While the boost to domestic demand on its own fosters trade, there are other effects that have an adverse effect on trade. The fiscal stimulus and accompanying borrowing causes real interest rates to rise above what they would otherwise be. This effect would be diluted if the global economy remained in recession for a long period. However, the natural recovery from the shocks as shown in the results implies that there will be competition by government and the private sector for scarce funds, either for private investment or to finance fiscal deficits. The rise in real interest rates (relative to what they would have been) and the fall in investment and demand for durable good means that exports fall and do not return to baseline for several years. For the United States this takes until 2013 and exports are 6% below baseline in 2010. The fiscal stimulus does not apparently help trade, largely because of the impact of higher real interest rates on investment and the demand for durable goods.

So far, cases of increasing trade protection have been sporadic. However, policy-makers are right to be worried about trade protection as it would make matters much worse. For example, if countries raise tariffs by 10 percentage points, additional falls in real GDP of between 1% and 4.5% below baseline could occur and exports could variously fall to between 5% and 20% below baseline for major economies. One of the conclusions of this study is that the crisis and trade protection both work to discourage exports. The asymmetric

fiscal expansions redistribute global trade initially, with a small impact overall, but have a medium-term negative impact after the first year as the aftermath of the fiscal responses crowds out global demand and slows the recovery.

The need to avoid a rise in protection as a response to the crisis is a key finding of this paper. Because the model used involves endogenous capital accumulation and trade in capital goods, a rise in tariffs by one country reduces that country's GDP as well as reducing GDP in other economies. A global tariff war accentuates the losses. Although it is tempting for countries to raise tariffs as a way of switching expenditure from foreign to domestic goods to support domestic demand, this research finds that the negative supply consequences on investment and more expensive imported durable goods far outweigh any benefit from expenditure switching.

A final implication is the need to understand what is going on so as to provide the right policy prescriptions. This research shows a combination of several shocks is needed to represent the global financial crisis. By using a structural model with significant sectoral disaggregation, each shock can be traced for its effects on activity and trade. Different relationships between trade and economic activity are shown depending on the type of shock. "Standard" elasticities have been used in the model and the dramatic trade outcomes from the crisis can be explained without changing these elasticities. To understand the relationship between a change in activity and the trade outcome it is necessary to understand the nature of the shocks that led to the change in activity.

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CHAPTER 9

LARGE DEVALUATIONS, FOREIGN DIRECT INVESTMENT AND EXPORTS: A SPECULATIVE NOTE

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This chapter explores the potential role of foreign direct investment (FDI) as an intermediate variable in the process of trade adjustment after large real exchange rate changes. Devaluations might result in increases in FDI inflows, as investors take advantage of changes in the foreign-currency value of domestic assets. The response of exports will thus depend to some extent on the nature of such FDI inflows, with inflows motivated by "horizontal" FDI associated with negligible changes in export growth after devaluation. Data on real exchange rates, FDI flows and exports are used to explore the effects of large devaluations on FDI and exports from 1990 to 2010. The admittedly speculative evidence suggests that there were heterogeneous experiences regarding the timing and magnitude of subsequent changes in FDI and exports, but on average FDI inflows tended to precede export surges within two-year horizons.

I INTRODUCTION

One side-effect of the global financial crisis of 2008-09 was the resurgence of a debate over exchange rates, particularly insofar as they are related to the so-called global imbalances and their role in prompting the crisis.[2] The conventional wisdom is that real exchange rate adjustments are needed in order to bring about changes in trade balances across countries. However, the literature on the effect of exchange rate fluctuations and currency undervaluations on exports is surprisingly ambiguous about the effect of exchange rate fluctuations on exports.

1 The author gratefully acknowledges financial support from the World Bank executed Multi-Donor Trust Fund on Trade. Luis Diego Rojas provided stellar research assistance. Benjamin Mandel (FRB) was polite enough to listen to preliminary discussions about the idea underpinning this note. I am grateful to Tatiana Didier (World Bank), Benjamin Mandel, and, especially, Caroline Freund (World Bank) for providing timely and invaluable comments on a previous draft. All remaining errors are the author's responsibility.

2 See, for example, Obstfeld and Rogoff (2010), Caballero (2010) and Suominen (2010).

Indeed, there are two literatures whose marriage might help shed further light on the effect of exchange rate fluctuations on exports. One concerns the effect of exchange rates on exports, with some evidence and theories pointing to small or diluted effects. The literatures on the pass-through of exchange rate changes into import prices and on the effect of exchange rate undervaluation on growth provide some relevant insights. However, there is also a literature on "FDI fire sales", which attempts to explain why inflows of FDI tend to rise even amidst currency crises or devaluations. In a sense, this chapter brings these two strands of the international economics literature together and provides preliminary evidence suggesting that the FDI fire sale effect could be seen as an intermediate mechanism that affects the magnitude of the export surge after real exchange rate adjustments. That is, if FDI increases after devaluations, then the rise of exports might depend to some extent on whether FDI inflows are driven by a desire to establish a footing for multinational corporations to supply the host (domestic) market or for exporting goods or services to other destinations.[3]

The admittedly speculative empirical exercises discussed in this chapter begin with the identification of episodes of largest quarterly real exchange rate devaluations for each country during 1990-2010. In turn, the analysis describes the behaviour of FDI inflows and exports two years before and after each devaluation episode, classifying each episode in terms of whether they resulted in abnormally high increases in FDI (e.g. whether the change in FDI was higher than the 75th percentile of the distribution of a country's observed changes in FDI during the sample period) or abnormally high increases in exports, and whether the surge in FDI occurred before, during or after the export surge. The data cover sixty devaluation episodes, of which 50% were characterised by FDI surges that preceded or occurred simultaneously with export surges. Furthermore, regression analysis suggests that the magnitude of devaluations tended to affect the magnitude of the change in FDI, especially among developing countries, which in turn were associated with the magnitude of the change in exports. Hence it appears that increases in FDI are associated with subsequent increases in exports, but devaluations per se do not appear to statistically precede export surges after large devaluations. However, exports do appear to be correlated with subsequent FDI inflows.

The rest of this chapter is organised as follows. Section 2 briefly reviews related literatures. Section 3 covers the data, and the stylised facts concerning the behaviour of FDI and exports before and after these large devaluations are presented in Section 4. In turn, Section 5 presents speculative regressions that attempt to link changes in real effective exchange rates (REERs), FDI and exports before and after the identified devaluations. The final section concludes.

3 In the FDI literature, the former type of FDI has been coined "horizontal", whereas the latter has been described as "vertical" because it tends to utilise cheaper factors or domestic inputs to assemble exports for other destinations – Carr, Markusen and Maskus (2001) is the seminal article on these topics.

2 RELATED LITERATURES

This chapter is related to various literatures. The linchpin is the role of changes in exchange rates in determining both trade flows, especially exports, and FDI. As will become apparent, these literatures are deep, but as far as I know, there are no contributions that focus on both exports and FDI simultaneously.

2.1 THE "PASS-THROUGH" LITERATURE

An important literature has focused on the price mechanism that would operate if exchange rate changes are to have an impact on international trade flows. That is, such changes must have an effect on prices observed by consumers, which then affect consumption choices. However, the literature remains dominated by low pass-through estimates. In their literature survey, Goldberg and Knetter (1997) concluded that that a typical estimated elasticity of local goods prices with respect to exchange rate changes is close to one-half in US data, but the elasticity varies across industries. Such a low elasticity relative to the Law of One Price prediction of unity is possibly due to errors in variables, the increasing utilisation of imported inputs (intermediate goods) in domestic production, and, more importantly, monopolistic competition and the existence of markups above marginal production costs by firms selling differentiated manufactured goods. Hence Goldberg and Knetter called for further research on the nature of markups, thus linking the macro and trade literatures to the literature on industrial organisation regarding pricing-to-market behaviour. More recent contributions have also found relatively low pass-through from exchange rate changes into local prices, with the low pass-through persisting over time (see, for example, Gopinath and Rigobon, 2008, and Campa and Goldberg, 2005). For our purposes, it suffices to say that exchange rate devaluations might not yield export surges when firms opt to increase markups through pricing to market.

Notwithstanding the evidence on imperfect pass-through, the existence of fixed costs of exporting can lead to persistent effects of exchange rate devaluations on exports as new exporting firms overcome entry costs in the aftermath of devaluation, but the absence of fixed costs of exit implies that firms do not necessarily exit from exporting even after the exchange rate appreciates, thus causing hysteresis in exports. This was the argument of the seminal papers by Baldwin (1988) and Baldwin and Krugman (1989). Dixit (1989) modelled a firm's decision to become an exporter as a financial option, due to the uncertainty over the value of the exchange rate over time. In his model, firms' option value of exporting rises with exchange rate uncertainty. In any case, the key point of this literature was that asymmetric costs of entry into and exit from exporting are likely to be associated with long-lasting effects of devaluations on exports. Evidence from case studies of developing economies reported by Roberts and Tybout (1997) suggested that episodes of export booms were associated with many firms entering export activities, while incumbent exporters tended not to

increase their exports in response to devaluations. Similarly, Freund and Pierola (2008) analysed over ninety episodes of manufactured "export surges" and concluded that export surges in developing (but not in developed) economies were associated with large real exchange rate devaluations that left the exchange rate undervalued and with the advent of new export products and destinations.[4] Campa (2004) found that export growth associated with hysteresis driven by the extensive margin of trade was small in a sample of Spanish manufacturing firms, which is consistent with Freund and Pierola's finding that persistent devaluations are not associated with export surges in developed economies. New research examining French firms in light of exchange rate changes suggests that responses can vary across firms, with high-productivity firms or firms that sell high-quality goods tending to raise markups during depreciations, while low productivity firms tend to raise their export volumes (Berman, Martin and Meyer, 2009). Hence it seems that overall it is difficult to expect huge impacts of exchange rate devaluations on exports, at least for certain types of countries, because the pass-through can be attenuated by strategic pricing behaviour, while the extensive margin effect tends to be small.

2.2 CURRENCY UNDERVALUATION, EXPORTS AND GROWTH

As mentioned, Freund and Pierola (2008) found that exchange rate devaluations that resulted in significant undervaluation of developing country currencies were associated with export surges in developing countries, based on an examination of 92 episodes of export surges (instead of episodes of REER adjustments). To some extent, these results might be driven by the research design: the authors first identified the episodes of manufactured export surges and then explored correlates of the magnitude of the export growth rate, but they did not ask whether the probability of observing an export surge is partially correlated with real exchange rate fluctuations. In contrast, Hausmann, Pritchett and Rodrik (2005) did find that the probability of observing a sustained and large GDP growth episode was associated with real devaluations. Nonetheless, the fact that episodes of sustained devaluations were systematically correlated with both the size of the export surge and the number of new exported products in Freund and Pierola (2008) is an interesting result. As will become apparent, our approach shares some methodological aspects with the event-study approach, but our focus is on episodes of large real exchange rate devaluations and the performance of FDI and total merchandise exports before and after devaluations.[5]

4 Freund and Pierola (2008, p. 3) define an export surge as "a significant and sustained increase in manufacturing export growth from one 7-year period to the next 7-year period".

5 Freund and Pierola (2008) cite Freund (2005) and Hausmann, Pritchett and Rodrik (2005) as pre-existing studies that use the episodes approach. However, event studies have a long tradition in economics – see the literature review by MacKinlay (1997), which cites studies from the 1930s. The latter emphasises the use of events as a determinant of economic and financial variables. That is, for example, events of news concerning firms can affect firm-specific stock market valuations. In a sense, this approach was meant to identify treatment effects and test whether outcomes before and after were significantly affected by the event or treatment. Our extremely preliminary empirical exercises follow the spirit of this earlier literature.

In any case, it is worth mentioning other contributions that examine the link between exchange rates and economic growth. Levy-Yeyati and Sturzenegger (1997) found that an indicator of exchange rate undervaluation is associated with higher subsequent GDP per capita growth rates, but surprisingly do not argue that this finding works through exports, but rather that it works via capital accumulation. This finding is thus more tightly related to the literature on exchange rates and FDI reviewed below. Rodrik (2008) is perhaps the most complete assessment of the role of undervalued exchange rates in promoting economic growth. The author argued that exports can be hampered by market (coordination) failures, currency undervaluation can provide an impetus to exports and overcome said obstacles, and hence they are associated with faster growth. However, the statistical work presented by Rodrik is far from conclusive regarding the expected link between exchange rate undervaluation and exports as the primary mechanism linking such policies to subsequent economic growth, relying primarily on the econometric evidence presented in Hausmann, Pritchett and Rodrik (2005).

2.3 EXCHANGE RATES AND FDI

Another literature analyses the link between exchange rates and FDI. One strand has focused on an empirical regularity, namely that FDI seems to rise during and after severe balance of payments crises. Krugman (2000) was perhaps the first to coin the term "fire-sale FDI" to describe this phenomenon, but several contemporary theoretical and empirical treatments have provided further support to this notion.[6] Blonigen (1997) advanced our understanding of the link between exchange rates and FDI by proposing a theoretical model in which FDI seeks to acquire "firm-specific" assets, and finds support in data on Japanese acquisitions of US companies during 1975-92. Aguiar and Gopinath (2005) further pursue the hypothesis that FDI in pursuit of mergers and acquisitions increased during liquidity crises (and devaluations) experienced by East Asia during 1996-98 and concluded that this effect was particularly prominent in the tradables sector, thus suggesting that FDI might in fact be a stepping stone for the recovery of trade after such crises. World Bank observers have taken this literature seriously, and some have concluded that we can expect an uptick in FDI in the aftermath of the 2008-09 crisis (see, for example, Calderón and Didier, 2009).

2.4 VERTICAL VERSUS HORIZONTAL FDI

One of the most-cited articles in the FDI literature is Carr et al. (2001), which introduced the terms "horizontal" and "vertical" multinational enterprises (MNEs). The former refers to MNEs with foreign affiliates that sell final goods in the host market, whereas vertical MNEs exploit international differences in factor endowments or relative factor costs to export final goods elsewhere.

6 Krugman's paper was widely circulated about three years prior to its publication in an edited volume in 2000. However, Blonigen (1997) predated Krugman's working paper.

The original motivation for these authors was the emergence of the so-called "new trade theory", which argued that economies of scale can explain the rise of intra-industry trade during the second half of the twentieth century. They argued that an uncomfortable fact about intra-industry trade was that it was dominated by MNEs. Be that as it may, our interest here is solely due to the contrasting predictions regarding trade flows of the two motivations for FDI: vertical FDI is more likely to result in new international trade flows, especially exports from the host country, whereas horizontal FDI seeks to overcome international trade costs by shifting production and sales into the host country. Hence, if exchange rate devaluations affect FDI, the nature of this new FDI will affect the extent to which exchange rate changes affect exports in a reduced-form model.

3 DATA

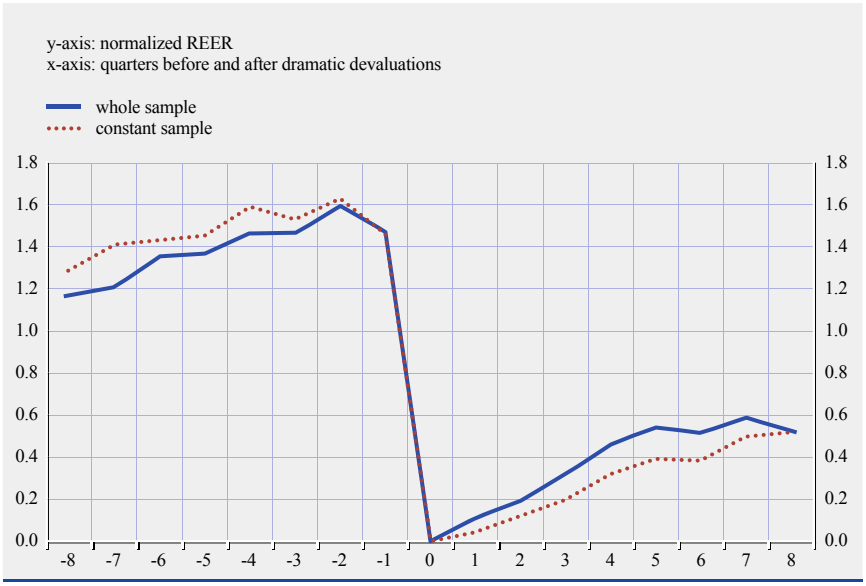
Quarterly data on REERs, FDI and exports of goods and services come from databases maintained by the International Monetary Fund (IMF). The REER is defined by the IMF as the trade-weighted real exchange rate, based on the ratio of indexes of consumer prices between pairs of trading partners.[7] The series cover the period 1990-2010, ending in the third quarter of 2010. The resulting dataset covers 60 countries or episodes of large devaluations. An episode of large devaluation was defined as the largest quarter-on-quarter devaluation of each country's REER. These data come from the IMF's Information Notice System (INS). The value of exports of goods and services and the FDI series come from the IMF's database on International Financial and Trade Statistics.

4 STYLISED FACTS

As a first approach to the data, Charts 1 and 2 present the cross-country averages of the REER, FDI and exports variables, normalised so that they equal zero in the quarter of the large devaluation and the units are in country-specific standard deviations. That is, we subtracted the value of each variable in the relevant quarter and divided the resulting series by each country's standard deviation of each variable. This normalisation facilitates the interpretation of these graphs.

7 An alternative index of real exchange rates often used in the literature is the ratio of price indexes found in the Penn World Tables, in which the United States is the benchmark. However, these data are available only at annual frequencies, not quarterly, which might be a significant disadvantage for the empirical analysis in this case. However, it is worth noting that using annual averages of the REER index and the annual data from the Penn World Tables from 1990-2007, the correlation between the two series is 0.73. Putting the frequency of the data aside, the Penn World Table variable could be more desirable for future work, because the REER depends solely on prices of consumer goods (in each country's basket of goods used to calculate CPI indexes), whereas in principle the PWT index includes consumer goods as well as investment goods and inputs purchased by governments. On the other hand, not all countries in the PWT database conduct price surveys, and the PWT includes observations derived from imputing techniques.

Chart 1 Large devaluations: Average normalised REER before and after selected episodes



Source: Author's calculations based on data from the IMF. See text for details.

Chart 1 illustrates that the identification of large devaluations resulted in a discrete change in the level of the REER before and after the identified maximum devaluations. It is noteworthy that on average during the two years (eight quarters) after each episode the level of the REER was significantly lower than during the preceding two years. That is, the approach yields a significant and persistent devaluation treatment, which hopefully includes devaluations caused by different reasons across the country episodes rather than just reflecting episodes of devaluations driven by financial crises, just the type of unsystematically assigned event suitable for further data analysis. Alternative approaches used in the literature described earlier include the use of proxies for undervaluation or simply examining the effects of exchange rate variations on other outcome variables. Both would be problematic for an event-study approach.[8]

Chart 2 presents time-period averages of the normalised FDI and exports variables before and after the devaluation episodes, based on data from

8 In addition, the estimation of exchange rate misalignment is itself a complex undertaking, replete with potential pitfalls, because it requires a well-specified model of equilibrium exchange rates. For details, see, for example, Levy-Yeyati and Sturzenegger (2007) and Rodrik (2008), among others. Our sample of episodes includes crises that could be driven by sudden stops of capital inflows, such as Mexico's crisis of 1995 and East Asian devaluations during the late 1990s, as well as more recent and less sharp devaluations of high-income country currencies during 2009-10. Consequently, the magnitude of the devaluations varies greatly across countries, but what matters for the FDI fire sale effect is that the devaluations are large relative to the behaviour of each country's REER over the longer time horizon of 1990-2010.

sub-samples of countries with data for all periods before and after the devaluation, and the list of countries for each sub-sample appears in the table below.[9]

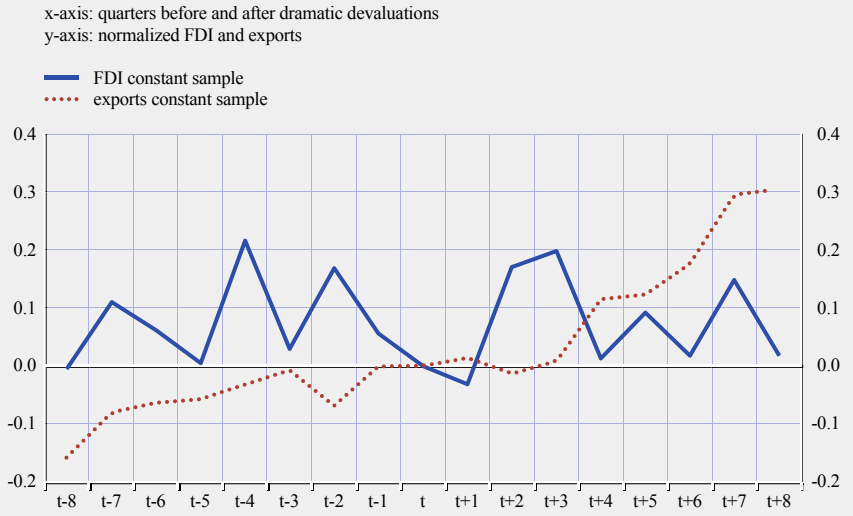
9 Since the date of each episode varies across countries, and some occurred towards the beginning of the sample period or the end, the sample used to calculate these averages changes over the 16 quarters portrayed in the graph. In addition, the coverage of the data for each indicator varies across countries. The series averages with the whole sample paint a different picture. Exports tend to fall immediately prior to the devaluation, bouncing back after the first quarter after the devaluations, and rising steadily thereafter. The FDI series in this sample fall sharply one quarter prior to the devaluation, with a small bounce-back that coincides with the quarter of the devaluations, followed by a mean-reverting process thereafter but with the sharpest surges occurring between the first and third quarters after the devaluation.

Countries in the constant sample of countries by indicator

Exports (37 countries)	FDI (33 countries)	REER (36 countries)
Argentina	Argentina	Argentina
Bangladesh	Bangladesh	Bangladesh
Belarus	Belarus	Belarus
Brazil	Brazil	Brazil
Bulgaria	Bulgaria	Bulgaria
Chile	Chile	Chile
China & Hong Kong		China & Hong Kong
Colombia	Colombia	Colombia
Denmark	Denmark	Denmark
Ecuador	Ecuador	Ecuador
Ethiopia	Ethiopia	Ethiopia
Finland	Finland	Finland
Georgia		Georgia
Indonesia	Indonesia	Indonesia
Ireland	Ireland	Ireland
Israel	Israel	Israel
Italy	Italy	Italy
Japan	Japan	Japan
Korea	Korea	Korea
Lithuania	Lithuania	
Mexico	Mexico	Mexico
Pakistan	Pakistan	Pakistan
Panama		Panama
Papua New Guinea	Papua New Guinea	Papua New Guinea
Philippines	Philippines	Philippines
Portugal	Portugal	Portugal
Russian Federation	Russian Federation	Russian Federation
Singapore	Singapore	Singapore
South Africa	South Africa	South Africa
Spain	Spain	Spain
Sri Lanka	Sri Lanka	Sri Lanka
Sweden	Sweden	Sweden
Thailand	Thailand	Thailand
Turkey	Turkey	Turkey
Uruguay	Uruguay	Uruguay
Vanuatu	Vanuatu	Vanuatu
Venezuela		Venezuela

Chart 2 FDI and exports before and after large devaluations

(constant sample, see appendix table for list of countries)



Source: Author's calculations based on data from the IMF. See text for details.

The trends with constant samples in Chart 2 show that average exports were rising but slowing down prior to the devaluation, but accelerated markedly three quarters after the devaluation. In contrast, the average FDI shows no apparent trend over the period, but it tended to decline for three consecutive quarters prior to the devaluation and recovered with an upswing (the largest in the 17-quarter time period) one quarter immediately after the devaluation. But this FDI series' average appears to be mean-reverting.

On average, it seems that FDI surges after large devaluations, i.e. after t0 in the graph, anticipate upticks in exports, especially in the constant sample. Readers can easily calculate the standard deviations of the corresponding surges, due to the normalisation of the variables. However, the potential existence of trends in the series prior to devaluation (downwards in the average FDI prior to devaluation with the whole sample, and upwards in the export series with the constant sample) implies that further econometric exercises need to control for trends in the series in order to assess the correlation between leads and lags of these series. We return to econometric issues in Section 5 below.

Table 1 summarises the data around the episodes of large devaluations. It classifies each country experience in terms of the timing and magnitude of the FDI or export surges. The notes at the bottom of the table provide the percentage of the 60 cases that experienced FDI surges – defined as an increase that is above the 75th percentile of the distribution of such changes within countries – prior to export surges and vice versa. The sample is evenly divided into both types of episodes. It is noteworthy, however, that the same exercise but using a lower threshold of the 60th instead of the 75th percentile yielded a share of episodes with surges in FDI that was higher than the share of episodes with export

Table I Episodes of large devaluations and the timing and magnitude of FDI and export surges

(quarterly data, 1990-2010)

	REER devaluation			Timing of first increase above the 75th percentile (quarters after)			Growth rate of first increase above the 75th percentile	
Country	Year	Qtr	Growth rate	Exports	FDI	FDI first? *	Exports	FDI
Argentina	2002	1	-0.54	1	6	C	0.19	0.69
Austria	2010	2	-0.02		0	A		0.61
Bangladesh	1996	3	-0.23	0	3	C	0.23	3.87
Belarus	1999	1	-0.37	1	0	A	0.16	3.04
Belgium	2010	2	-0.03			D		
Bolivia	2009	2	-0.08	4	1	A	0.18	1.56
Brazil	1999	1	-0.33	1	2	C	0.23	0.58
Bulgaria	1996	2	-0.26	3	1	A	1.17	0.80
Canada	2008	4	-0.10	3	2	A	0.08	4.03
Chile	2008	2	-0.10	4	1	A	0.12	2.36
China & Hong Kong	1998	4	-0.06	2	6	C	0.15	0.86
Colombia	1999	3	-0.13	0	2	C	0.10	0.43
Costa Rica	2009	2	-0.06	0		C	0.08	
Denmark	1993	3	-0.04	1	3	C	0.11	0.32
Ecuador	1999	1	-0.29	1	3	C	0.12	0.96
Ethiopia	1992	4	-0.54	1		C	0.40	
Fiji	2009	2	-0.19	1	1	B	0.39	0.76
Finland	1993	1	-0.11	3	1	A	0.15	1.19
France	2010	2	-0.04			D		
Georgia	1998	4	-0.13	2	0	A	0.65	1.30
Germany	1991	1	-0.16	3	3	B	0.14	2.72
Guatemala	1990	3	-0.21	2	3	C	0.19	0.48
Hungary	2009	1	-0.11	3	1	A	0.18	11.51
Iceland	2008	4	-0.17	3		C	0.24	
India	1991	3	-0.18	2	0	A	0.17	0.58
Indonesia	1998	1	-0.37	5	0	A	0.15	0.55
Ireland	1993	1	-0.09	1	0	A	0.06	1.90
Israel	2002	2	-0.07	2	3	C	0.08	5.73
Italy	1995	1	-0.09	1	0	A	0.09	1.59
Japan	1995	3	-0.15	7	3	A	0.06	12.44
Jordan	2009	2	-0.04		0	A		2.10
Korea	1997	4	-0.34	4	2	A	0.14	1.31
Lithuania	1995	2	-0.08	0	4	C	0.18	0.67
Luxembourg	2010	2	-0.03			D		
Mexico	1995	1	-0.36	0	1	C	0.11	0.47
Mongolia	2009	1	-0.17	1	2	C	0.37	1.73
Nepal	1991	3	-0.12	1		C	0.40	
Netherlands	2010	2	-0.03			D		
New Zealand	2008	4	-0.10	2	4	C	0.15	1.11
Norway	2008	4	-0.12	3	2	A	0.11	15.53
Pakistan	1998	3	-0.13	5	7	C	0.13	1.00
Panama	1998	4	-0.06	4	0	A	0.11	2.31
Papua New Guinea	1999	2	-0.10	0	2	C	0.21	25.96
Philippines	1997	3	-0.14	4	2	A	0.33	1.77
Poland	2008	4	-0.14	3	3	B	0.10	0.72

Table 1 Episodes of large devaluations and the timing and magnitude of FDI and export surges (cont'd)

(quarterly data, 1990-2010)

		REER devaluation		Timing of first increase above the 75th percentile (quarters after)			Growth rate of first increase above the 75th percentile	
Portugal	1993	2	-0.03	2	1	A	0.12	1.28
Russian Federation	1998	3	-0.38	5	1	A	0.27	2.11
Singapore	1998	3	-0.05	3	2	A	0.13	16.49
Slovenia	2009	2	-0.16	2		C	0.11	
South Africa	2001	4	-0.22	2	7	C	0.22	3.24
Spain	1993	2	-0.08	0	4	C	0.15	0.59
Sri Lanka	1994	2	-0.07	0	6	C	0.16	4.19
Sweden	1992	4	-0.15	4	5	C	0.13	3.04
Thailand	1997	3	-0.24	7	2	A	0.08	0.89
Turkey	2001	1	-0.27	1	0	A	0.10	2.62
United Kingdom	2008	4	-0.15	2	2	B	0.06	0.83
United States	2009	2	-0.07	2	0	A	0.11	7.58
Uruguay	2002	3	-0.29	3	2	A	0.31	1.26
Vanuatu	1995	2	-0.10	1		C	0.24	
Venezuela	1994	2	-0.25	0	6	C	0.28	0.62

Source: Author's calculations based on data from the IMF. See text for details.

Notes:

A = The increase in FDI occurred first or there was an increase in FDI but not in Exports: 43.33%.

B = The increase in FDI and the increase in Exports occurred in the same quarter: 6.67%.

C = The increase in Exports occurred first or there was an increase in Exports but not in FDI: 43.33%.

D = There was not an increase in FDI or in Exports: 6.67%.

surges preceding FDI surges.[10] Hence it seems that there is notable international heterogeneity in terms of the timing of surges, but FDI surges are at least as frequent as export surges. The following section discusses econometric estimates that provide admittedly speculative evidence about whether the correlations between leads and lags of the three variables are partially statistically significant, which can also be interpreted as an assessment of whether the magnitude of REER, FDI and export fluctuations around the time of the large devaluations affected the magnitude of FDI and export surges.

5 ECONOMETRIC ESTIMATIONS

How are the stylized facts related to the literature discussed in Section II? Recall that the FDI fire sale effect should imply that devaluations are followed by surges in FDI, which can be transitory, because the literature views this effect as opportunistic behaviour by foreign investors waiting for the right moment to buy host-country domestic assets at relatively cheap prices, and this is relative to each country's REER trends. Also, the fire sale effect implies that exports should follow FDI increases in countries where FDI is vertically motivated,

10 These results are available upon request.

Table 2 Regression results: the magnitude of devaluations, FDI and exports

(whole sample)

Variables	FDI	FDI	Exports	Exports	Ex-post FDI	Ex-post FDI	Ex-post Exports	Ex-post Exports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged FDI		0.169[1)]	0.0565[1)]	0.0231[3)]		-0.161[1)]	0.0461[2)]	0.0337
		(0.0355)	(0.0151)	(0.0126)		(0.0512)	(0.0224)	(0.0216)
Lagged REER	-0.0202	-0.0130	0.00721	-0.0108	-0.0556	-0.0861[3)]	0.00336	-0.00300
	(0.0407)	(0.0403)	(0.0172)	(0.0143)	(0.0517)	(0.0520)	(0.0234)	(0.0225)
Lagged Exports	0.2890[1)]	0.2450[1)]		0.5800[1)]	0.3100[1)]	0.326[1)]		0.274[1)]
	(0.0864)	(0.0860)		(0.0297)	(0.115)	(0.114)		(0.0460)
Observations	886	882	901	901	445	445	464	464
R-squared	0.055	0.082	0.129	0.405	0.038	0.063	0.214	0.279
Number of countries	60	60	60	60	60	60	60	60

Source: Author's calculations based on data from the IMF. See text for details.

Notes: Standard errors in brackets.

All estimations include period fixed effects and country fixed effects (de-meaning approach).

1) $p<0.01$

2) $p<0.05$

3) $p<0.1$

but not so much if it is horizontal. Finally, if devaluations have a direct effect on exports by changing the relative prices of exports in importing countries, then exports should follow fluctuations in REERs. These predictions are more likely to be valid after the devaluations, precisely because the fire sale effect would be detected only after the large devaluation and not necessarily before. Hence the models were also estimated with ex-post data only, in which case the estimated effect of the REER on the other two variables will be probably driven by the large devaluation episode and perhaps attenuated by the less dramatic REER fluctuations that follow the selected large devaluations (see Chart 1).

The econometric exercises presented below are perhaps the most speculative portion of this chapter and rely on the time-series processes of each variable. For each variable, the estimations focus on the effect of lagged REERs, FDI and exports on FDI and exports. The dynamic versions of the models also include the lagged dependent variable. These dynamic models could be interpreted as Granger causality tests if there were no omitted relevant explanatory variables. Of course, this assumption is hopelessly weak, and hence these exercises remain speculative in nature. However, the specifications do control for country characteristics that did not vary during the 17-quarter period around the episodes of large devaluations, as well as quarter-specific effects that are common across countries for each variable. At best, these are descriptive analyses aiming to identify partial correlations among the three variables of interest.

Tables 2 and 3 present the regression results. The former includes all observations in the dataset; the latter uses only observations from developing countries that exclude OECD high-income countries. Both tables follow the same structure: the first two columns correspond to a static and a dynamic model of FDI,

Table 3 Regression results: the magnitude of devaluations, FDI and exports among developing countries

Variables	FDI	FDI	Exports	Exports	Ex-post FDI	Ex-post FDI	Ex-post Exports	Ex-post Exports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged FDI		0.217[1)]	0.0819[1)]	0.0295		-0.0485	0.0638[2)]	0.0493[3)]
		(0.0451)	(0.0208)	(0.0183)		(0.0673)	(0.0305)	(0.0298)
Lagged REER	-0.0280	-0.0251	-0.00235	-0.0261	-0.100[3)]	-0.105[3)]	-0.0102	-0.0162
	(0.0413)	(0.0406)	(0.0190)	(0.0164)	(0.0595)	(0.0599)	(0.0282)	(0.0273)
Lagged Exports	0.274[1)]	0.196[3)]		0.540[1)]	0.210	0.211		0.248[1)]
	(0.105)	(0.105)		(0.0397)	(0.148)	(0.148)		(0.0593)
Observations	576	572	579	579	306	306	313	313
R-squared	0.048	0.092	0.153	0.375	0.048	0.050	0.188	0.239
Number of countries	38	38	38	38	38	38	38	38

Source: Author's calculations based on data from the IMF. See text for details.

Notes: Standard errors in brackets.

All estimations include period fixed effects and country fixed effects (de-meaning approach).

1) $p<0.01$

2) $p<0.05$

3) $p<0.1$

followed by the models of exports; the last four columns in both tables show results for the post-devaluation period only. The expectation is that horizontal FDI is more common among high-income economies, and thus the correlation between lagged FDI and exports should be less significant in Table 2, which includes these countries in the estimation sample. Similarly, the ex-post models are expected to show more significant effects of the REER on both variables, because that is the period that follows the deliberately chosen large devaluations (at time t=0). Finally, both sets of results were estimated with country fixed effects and quarter-specific effects. The country effects allow us to interpret the results as the effect of deviations from the country mean of the explanatory variable on the dependent variables, which approximate the effect of changes of the explanatory variables.[11] The units of the variables are still the normalised variables, and thus readers can easily perform thought experiments about the economic magnitude of the coefficients.

For the whole sample of 60 countries, lagged exports appear with a significant and positive coefficient as determinants of FDI. However, in columns 3 and 4, lagged FDI appears as a significant determinant of exports. Both variables seem to experience a bit of persistence as evidenced by the significance of the lagged dependent variables in each model. Perhaps more importantly, in these models (columns 1-4 in Table 2) the lagged REER is not a significant determinant of either FDI or exports.

11 Controlling for country fixed effects by de-meaning instead of differences is preferable in this context, because the coefficient on the lagged dependent variable is biased downwards to a lesser extent. The bias is inversely proportional to the number of observations by country, which is close to 17 in this application (i.e. 8 quarters before and after plus the quarter of the large devaluation). In contrast, the bias in the differenced models is not diluted by the number of time periods.

Continuing with Table 2, the estimations of the ex-post models presented in columns 5-6 suggest lagged exports continued to be significant as a determinant of subsequent FDI to a larger extent than prior to the devaluation, because the corresponding coefficients are significantly larger than under columns 1 and 2. The lagged REER is now significant and with the expected negative sign (i.e. increases in the REER are appreciations) in the dynamic FDI model (column 6) but not in any other model.

The results for developing countries in Table 3 tell a slightly more robust story. The REER becomes significant and with the expected negative sign in the ex-post models of FDI as expected (columns 5 and 6 of Table 3). In turn, exports appear significantly related to lagged FDI in the static and dynamic models of ex-post exports (columns 7 and 8 in Table 3). The levels of significance are not overwhelming, but this is expected given the low number of countries (38) in this sample. It is worth noting that the magnitude of the lagged REER coefficient in the FDI models tends to be larger in this sample than in the whole sample that includes high-income countries, and the estimated coefficient of lagged FDI on exports tends to be larger and more significant than in the equivalent specifications with the global sample. This is expected, because high-income countries tend to receive higher shares of horizontal FDI than developing countries.

6 CONCLUSION

This chapter started by acknowledging that the interest in the role of exchange rates in determining trade flows has risen in the aftermath of the global financial crisis of 2008-09, and noted that the existing literature includes studies that find small effects of exchange rates on trade flows. In addition, it noted that there is another literature linking exchange rate fluctuations with FDI, with the term "FDI fire sale" often appearing in the literature. This chapter speculates that the link between exchange rates and exports might be intermediated by the response of FDI, which can be either horizontal or vertical, with the latter tending to raise exports from the receiving countries. Developing countries are thought to receive proportionately more of this type of FDI than rich countries.

The empirical analyses that followed provided a bit of evidence about the behaviour of FDI and exports before and after large devaluations, which were defined as the largest quarterly devaluation of the REER for each country. If there is one word that characterises these episodes, it should be "heterogeneity". We found an equal number of episodes with FDI surges preceding export surges after large devaluations to the number of episodes with export surges leading FDI surges.

The simplistic regressions discussed above further highlighted the potential for future research on the relationship between exchange rates, FDI and exports. As expected, the results were weak, but more robust in the sample of developing countries, which suggested that REER devaluations tend to raise FDI, and FDI and exports appear to feed on each other. These results probably suffer from

omitted variable bias, as the empirical models did not control for much else except country and period fixed effects. Still, future research could pursue more parsimonious econometric strategies to help us identify the effect of exchange rate fluctuations on both FDI and exports. Extending the existing literature on exchange rates and FDI with micro data at the firm level by examining mergers and acquisitions by foreign investors and subsequent exports around episodes of devaluations could also be fruitful.

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CHAPTER 10

TRADE AND INVENTORY DYNAMICS

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The chapter examines the large fall and rebound in U.S. trade in the recent recession. While trade fell and rebounded more than expenditure or production of traded goods, relative to the magnitude of the downturn these trade fluctuations were actually in line with those in previous business cycle fluctuations in the United States and elsewhere. The chapter attributes the high volatility of trade to the more severe inventory management considerations of international transactions; the volatility appears to be an efficient response to an economic downturn given the greater frictions associated with those transactions. Policy efforts should thus focus on reducing the costs and delays in international trade that lead to the stronger inventory needs for international transactions rather than smoothing out cyclical fluctuations in trade.

1 INTRODUCTION

In the Great Recession of 2008-09, international trade fell and rebounded substantially more than measures of production or absorption. For example, for the United States[1] from July 2008 to February 2009 real imports and exports each fell by around 24% while manufacturing production fell only 12%. The rebound was equally impressive, with imports and exports expanding about 20% between May 2009 and May 2010 while manufacturing production rebounded only by 10%.[2] Similar relatively large movements in trade were experienced by many other countries. While these large movements in trade were thought to be unusual, there is evidence from previous episodes of relatively large fluctuations in trade. In this paper, we review the findings of our research examining how inventory management considerations contribute to the relatively large fluctuations in trade as well as their role in the measurement of trade elasticities more generally.

1 For a study of global trade flows, see Bems, Johnson and Yi (2010) and Eaton et al. (2010).

2 This measure of industrial production (IP) is a trade-weighted average of durable and non-durable industrial production. It thus controls for major compositional differences between trade and production.

In a series of papers, we argue that inventory management considerations play an important role in the high short-run sensitivity of trade over the business cycle because inventory holdings are disproportionately large for goods that are internationally traded. In Alessandria, Kaboski and Midrigan (2010a) we show that the frictions involved in international transactions – namely delivery lags and economies of scale in transaction costs – are more severe than for domestic transactions, leading firms involved in international trade to hold a much larger stock of inventories than firms not involved in international trade. The best available evidence indicates that firms that source purely internationally have inventory/sales ratios roughly twice those of firms that source purely domestically. Following a persistent negative shock to costs or demand, firms involved in international trade find themselves with too much inventory on hand and thus cut back sharply on ordering, selling out of the existing stock. Intuitively, since by definition, imports (production) are equal to sales plus inventory investment, and since both sales and inventory investment decline during a recession, imports (production) are more volatile than sales. As importers hold larger stocks of inventories than domestic firms, the response of imports is much larger than that of production.

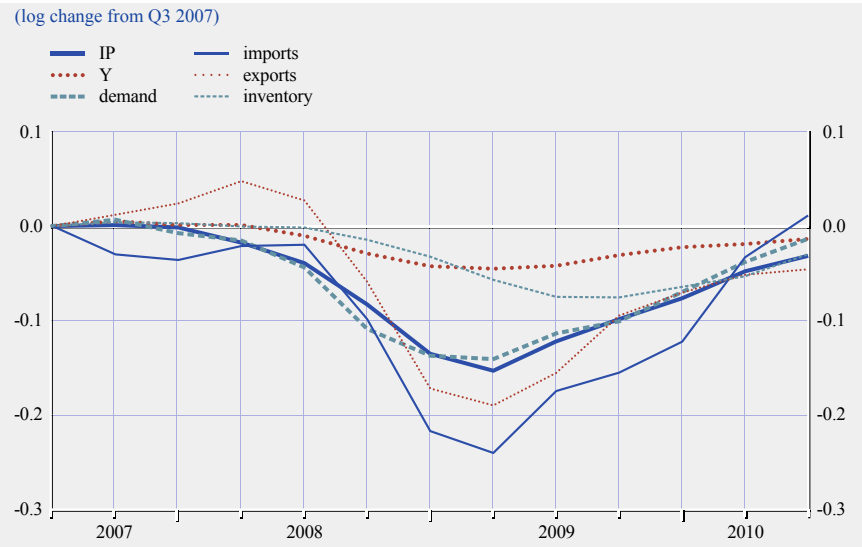
The first question we ask is whether the high sensitivity of international trade to other measures of economic activity in the recent recession was unusual. For the United States, we answer no. Although the size of the recent recession was much larger, the elasticity of trade was typical of earlier recessions. Thus, the high sensitivity of trade in the Great Recession does not appear to be the result of the financial nature of the crisis.[3] Next we consider the importance of inventory adjustment in explaining the large short-run fluctuations in trade relative to expenditure or output of traded goods, especially in the current recession. We present supportive evidence using disaggregate data on imports and sales of foreign produced autos in the United States. We also discuss the findings of our quantitative work. Both empirical and quantitative work support an important role for inventories. We then ask whether inventories respond similarly to large movements in the relative prices of tradables, as in devaluations, and again inventory adjustment appears to be important in explaining large short-run responses. Finally, we ask how inventory adjustment affects the measurement of underlying elasticities of trade with respect to either expenditure or prices. Using both our model and data on the auto industry, we find that accounting for inventories greatly reduces the uncertainty surrounding estimates of "primitive" elasticity parameters.

2 WAS THE RESPONSE OF TRADE IN THE RECENT CRISIS UNUSUAL?

We review work in Alessandria, Kaboski and Midrigan (2010b, and forthcoming) summarising the dynamics of trade and other macro variables in the recent and

3 For example, Chor and Manova (2010) and Amiti and Weinstein (2009) attribute part of the decline in trade to the cost of finance for international transactions rising by more than for domestic transactions.

Chart 1 Recent US aggregate dynamics



earlier recessions, and business cycle fluctuations more generally, over the past 40 years. Chart 1 depicts the recent deviations of US imports, exports and several other macroeconomic variables from a Hodrick-Prescott (1600) trend. From the third quarter of 2007 to the second quarter of 2009 GDP (Y) fell by about 5% relative to trend, while industrial production (IP) and a trade-weighted measure of final expenditure on goods (demand) each fell by about 13%. By contrast, the collapse in trade was much more severe: exports and imports fell by around 20%. Although these numbers are striking, we argue below that the recent decline in trade (relative to the decline in other macroeconomic aggregates) was not unusual compared to past recessions.

Table 1 reports the characteristics of some measures of aggregate activity (GDP, IP, and trade-weighted expenditure) in the current and previous recessions. In the first two columns, we report a trade elasticity as the change in the log of imports or exports relative to the change in the log of each respective variable. The change is computed from peak to trough. The last column reports the relative volatility of imports and exports over the entire sample, measured as the ratio of each series' standard deviation.

Table 1 shows that imports fell about five times more than GDP, twice as much as expenditure on tradable goods and about 60% more than industrial production. Most importantly, compared to the median US recession, the fall in imports in the current recession (Q2 2009 column) does not look unusual. For exports, our findings are similar.

The last column of Table 1 shows that our conclusions are not driven by our focus on recessions, but rather business cycle fluctuations in general. We note that exports and imports are, respectively, roughly 50% and 60% more volatile

Table I US trade dynamics

	Peak-to-trough elasticity		Relative volatility
	Q2 2009	Median	
Imports			
GDP	5.3	4.7	3.8
IP	1.6	1.6	1.6
Demand	1.7	2.4	1.8
Exports			
GDP	5.2	3.3	3.3
IP	1.5	1.5	1.5

Notes: Imports are measured from start of recession based on the NBER dates. Exports are measured from the peak, which may be after the recession has started. Median denotes the median (across all recessions) response of the variable in question and Q2 2009 denotes the dynamics in the current recession. Data is from Q1 1967 and is HP filtered with a smoothing parameter of 1600. Relative volatility is the ratio of the series' standard deviations.

than industrial production, around three and a half times more volatile than GDP, and around 60% and 80% more volatile than expenditure on tradables. Finally, while not reported in the table, exports and imports are also more volatile than consumption, as well as consumption of durable goods (exports and imports are 1.2 and 1.4 times more volatile than durable goods consumption).[4] We thus conclude that the excess volatility of international trade does not simply reflect the fact that trade is more intensive in durable goods.[5]

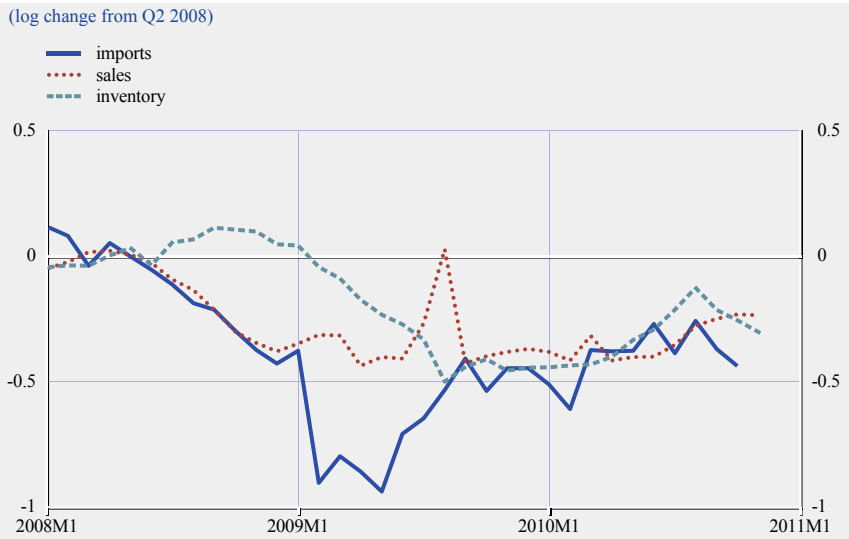
3 HOW IMPORTANT ARE INVENTORIES IN EXPLAINING FLUCTUATIONS IN TRADE?

We review three pieces of evidence that inventories contribute to the large fluctuations in trade. We begin with the most direct evidence on inventories of imported goods, which exists for the auto industry. Autos are an important traded good, accounting for 18% of US non-petroleum imports from 2005 to 2007 and one third of the decline in imports in the recent crisis. Separate data exist on inventories, sales and imports of foreign produced autos.

Chart 2 plots the evolution of imports, sales and retail inventories of autos produced outside North America since 2008. At its worst, over the seven months from February 2009 to August 2009, real imports and sales were, respectively, on average 77 log points and 30 log points below their Q2 2008 averages.[6] Thus, for autos, the drop in imports over this period was over two and a half times the drop in sales. Since, by definition, imports are equal to sales plus inventory investment, the evidence in Chart 2 suggests that inventory adjustment accounted

4 We have also studied more disaggregate measures of trade flows and production and generally find that trade is more volatile than either production or sales of the same goods.
5 Bems, Johnson and Yi (2010) and Eaton et al. (2010) show that about 70% of the global fall in trade relative to GDP in 2008-09 is attributed to this composition mismatch.
6 The abrupt, mid-figure, upward spike in sales is the Car Allowance Rebate System ("cash for clunkers" programme).

Chart 2 US dynamics of foreign autos



for about two-thirds of the drop in imports. Additionally, we see that the recovery in trade did not result from a persistent increase in final sales of autos, but rather from the stabilising of inventory holdings at levels more consistent with depressed sales rates. These import and sale dynamics are similar for other countries and during previous recessions (see Alessandria, Kaboski and Midrigan (2010b)). They provide very strong evidence of a high elasticity of imports relative to absorption, since these data do not suffer from a mismatch between the composition of imports and absorption.

Adding a bit more structure and focusing on aggregate data, theory suggests that inventory adjustment is indeed important in the aggregate. By calibrating a fairly standard constant elasticity demand equation $S_t = P_t^{-\gamma} C_t^{\alpha}$, where imports S_t depend on the relative price of imports, P_t and aggregate expenditure, C_t, we can measure deviations of actual imports from predicted imports. Alessandria, Kaboski and Midrigan (forthcoming) show that distinguishing imports from the sales of imported goods $S_t = M_t - X_t$, where $X_t = I_t - I_{t-1}$ is inventory investment, reduces the predictive errors by more than one third in the baseline calibration.

Finally, in the context of a fully specified two-country general equilibrium model where firms face fixed costs of exporting and a stock-out avoidance motive for holding inventories, Alessandria, Kaboski and Midrigan (2010b) show the quantitative importance of inventory adjustment for international trade. The model, when parameterised to match the evidence on the inventory holding premium of importers, is capable of accounting for the salient features of trade dynamics in the recent recession. In particular, in response to a shock to the cost of carrying inventories, the model predicts a response of imports that is much larger (37% in the baseline calibration) than that of domestic production.

4 DO INVENTORIES AFFECT THE PRICE ELASTICITY OF IMPORTS?

Alessandria, Kaboski and Midrigan (2010a) assess the importance of inventories for trade dynamics in the recent large devaluation episodes in Argentina, Brazil, Korea, Mexico and Thailand. Burstein, Eichenbaum and Rebelo (2005) show that such devaluations are associated with corresponding increases in the dock prices of imported goods. The calibrated model of importers facing inventory management decisions predicts that a sudden, unexpected 50 log point increase in the relative price of imports leads to a 75 log point decrease in imports in the long run, but a 250 log point decrease within the first six months after the devaluation. The prediction of larger elasticities of trade in the short run rather than in the long run is the opposite of the traditional view in the J-curve literature (Magee (1973), and Meade (1988)), but it is substantiated by the dynamics of the aggregate trade data during these devaluation episodes.

The model predicts several other patterns that appear to be consistent with more disaggregate data. First, the extensive margin (i.e. decisions whether to import individual goods) mirrors and explains the bulk of the dynamics in overall import levels. Second, those products that have recently been purchased, so that inventory holdings are likely to be larger, were differentially less likely to be purchased in the wake of the devaluation. Finally, in the model, excess inventory holdings lead to a slow pass-through of dock price increases at the retail level, as inventory holders try to rid themselves of excess inventory. Evaluating these predictions using micro data, we measure slower short-run pass-through for infrequently purchased (i.e. high inventory) goods, storable goods (i.e. those with inventories), and goods with high inventory carrying costs.

5 HOW DO INVENTORIES AFFECT THE ESTIMATION OF TRADE ELASTICITIES?

The adjustment of inventory holdings will lead to trade elasticities that vary by horizon. Here we assess whether they have an impact on the measurement of such elasticities using high frequency variation. Returning to our constant elasticity import demand equation $S_t = P_t^{-\gamma} C_t^{\alpha}$, after substituting in $S_t = M_t - X_t$ algebraic manipulation and the log approximation yields:

$$m_t = -\gamma p_t + \alpha c_t + \frac{\bar{I}}{\bar{S}} x_t \tag{1}$$

where $\frac{\bar{I}}{\bar{S}}$ indicates average inventory/sales ratio; lower case m_t, p_t, and c_t are now logged variables; and lower case x_t is inventory adjustment in percentages of inventory terms.

Import demand regressions are typically run in differences for reasons of stationarity (see Gallaway, McDaniel and Rivera (2003), for example). Motivated by the above expression, we estimate an equation of the form:

$$\Delta m_t = \gamma \Delta p_t + \alpha \Delta c_t + \beta \Delta x_t \tag{2}$$

where lower case variables indicate their logged values.

We start by simulating a variation of our general equilibrium model in Alessandria, Kaboski and Midrigan (2010b), and running regressions of the form (2). Again, this model has been calibrated to match an inventory/sales ratio of one, and a factor two difference in the inventory/sales ratio between internationally and domestically sourced firms, again consistent with the best available data. Here, we focus on business cycle fluctuations arising from productivity shocks alone. The price elasticity is set to $\gamma = -1.5$ and the income elasticity is $\alpha = 1.0$.

Table 2 presents these results, where the left and right panels differ in the composition of trade. On the left-hand side, consistent with the data, trade is modelled as being intensive in capital goods. In these columns, the composition of imports differs from that on overall expenditure or production. The three columns in this panel are, respectively, the standard import demand regression where inventory investment is omitted, a regression where Δx_t is proxied by the change in aggregate inventory investment, and a regression where Δx_t is accurately captured by the change in inventory investment for imported goods only. In absolute value, the estimated coefficients are higher when inventories are ignored. Since inventory investment is negatively related to price, ignoring this term causes an omitted variable bias. Intuitively, the price elasticity of imports exceeds the underlying price elasticity of demand for imported goods because firms respond to prices by adjusting inventory, consistent with the evidence described in the previous section. Likewise, the estimate of the elasticity of demand for traded goods with respect to domestic shipments (our measure of c_t in the model) is also substantially lower, once we control for inventories. This is again consistent with an omitted variable bias, and a response of inventories that is positively correlated with demand shifts. Finally, our estimates of income and price elasticities are more in line with the true parameters when inventory investment is accurately measured using only imported inventories.

The right-hand panel of Table 2 shows the importance of controlling for the differences in the composition of production and expenditure. In particular, here we consider an economy in which the industry composition of trade matches the industry composition of production. There are three striking differences. First, the impact of controlling for inventories is much smaller. Second, using an overall proxy for inventories actually increases the coefficients under this calibration. Finally, with imported inventories, we find that we nearly recover the true price and income elasticity terms.

Table 2 Import demand regressions on model

	Trade intensive in capital			Trade unbiased		
	No inv	All inv	Imp Inv	No inv	All inv	Imp Inv
Price	-5.26	-4.28	-1.88	-1.61	-2.29	-1.51
Domestic shipments	6.18	5.38	2.78	1.62	2.32	0.92
Inventory investment all		-4.84			-9.16	-
Inventory investment imports			1.17			1.49
R2	0.98	0.99	1.00	0.67	0.94	1.00
# obs.	500	500	500	500	500	500

We now explore empirically how estimates of price and income elasticity terms are affected by the presence of inventory holdings. Given the lack of data on imported inventory generally, we focus again on the US imports, sales and retail inventory of foreign produced autos, an industry for which some data on imported inventory are available. We augment our inventory data with data on wholesale and overall retail motor vehicle holdings to capture the holdings of imported inventory at different stages in the supply chain. We focus on the period Q1 1997 to Q3 2010. Note that similar to the right-hand side of Table 1, there is no difference in the composition of imports and final expenditure.

Table 3 reports our estimates of income and price elasticities. Our basic regression in differences shows the important role of inventory investment in explaining the fluctuations in imports, with the R2 rising from 11% to 31%.

Table 3 Import demand regressions on US autos

	A. Basic Regressions									
Variable	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
Δc(t)	0.57	0.61	0.67	0.79	0.83	0.61	0.66	0.69	0.78	0.80
	2.86	3.40	3.92	4.74	4.77	3.63	4.13	4.33	4.69	4.86
Δp(t)	0.17	-0.24	0.13	-0.13	0.12	-0.85	-1.03	-0.63	-0.68	-0.54
	0.13	-0.20	0.12	-0.12	0.11	-0.77	-0.99	-0.60	-0.66	-0.52
Δx(t)		0.44	0.39	0.28			0.37	0.32	0.23	
		3.83	3.59	2.48			2.79	2.09	1.28	
Δx_wholesale(t)			0.62	0.62	0.70			0.51	0.48	0.50
			2.57	2.72	2.95			1.35	1.31	1.56
Δx_retail(t)				0.96	1.30				0.39	0.44
				2.69	3.76				0.78	1.01
Imports(t–1)						-0.50	-0.43	-0.38	-0.31	-0.33
						-5.21	-4.56	-3.77	-3.05	-3.32
c(t–1)						0.71	0.62	0.54	0.46	0.49
						5.24	4.73	3.53	3.03	3.34
p(t–1)						-2.82	-2.54	-2.20	-1.92	-2.08
						-4.51	-4.07	-3.33	-2.94	-3.26
x(t–1)							0.14	0.06	0.05	
							0.78	0.23	0.16	
x_wholesale(t–1)								0.21	0.10	0.07
								0.37	0.19	0.15
x_retail(t–1)									0.53	0.83
									0.86	1.61
Adjusted R2	0.11	0.31	0.38	0.45	0.39	0.42	0.51	0.53	0.55	0.54
# obs	54	53	53	53	53	54	53	53	53	53
	B. Long Run Elasticity Estimates									
Price						-5.71	-5.90	-5.85	-6.20	-6.37
Sales						1.43	1.44	1.43	1.49	1.50

Notes: Based on data from QI 1997 to Q3 2010. c measures retail sales of autos, imports are units imported, p denotes the ratio of the imported price index on motor vehicles to the producer price index on motor vehicles. X denotes investment in retail inventory of imported autos. X_wholesale denotes investment in wholesale inventory and X_retail denotes investment in all retail inventory of autos. Long-run elasticity measures are measured as the ratio of the minus of the lagged coeffecient to the coefficent on lagged imports.

Columns III, IV and V report the results of our regressions with the different inventory measures. Moving from columns II to IV, we see that changes in wholesale and retail inventory investment improve our understanding of import dynamics. Comparing column IV, which includes all the inventory measures, to column V, which excludes the retail inventory of foreign produced autos, we see that knowing the change in inventory investment of imported autos provides additional information beyond that included in overall aggregate inventories. Aside from providing a better explanation of import dynamics, we find that our estimates of the income elasticity change somewhat across our specifications, with the traditional specification yielding an elasticity of 0.54 while the preferred specification in column IV yields an elasticity of 0.79. The price elasticity term varies across specifications but is not significant.

Columns VI to X report the results of the following error correction model:

$$\Delta m_t = \gamma_0 \Delta p_t + \alpha_0 \Delta c_t + \beta_0 \Delta x_t + \kappa m_{t-1} + \gamma_1 p_{t-1} + \alpha_1 c_{t-1} + \beta_1 \Delta x_{t-1}, \qquad (3)$$

The idea here is to capture the gradual response of imports, which is maybe due to adjustment costs or lags between orders and deliveries of goods. Again, we find that including imported and aggregate inventory holdings helps to explain import dynamics, with the R2 rising from 42% to 55%. In terms of our short-run estimates, we find that moving from the baseline specification in column VI without inventory terms to our preferred specification, column IX, our estimated income elasticity rises from 0.61 to 0.78, slightly less than in the regressions in differences. The price elasticity term rises from -0.88 to -0.66, although neither term is significant. Turning to the long-run response, calculated in the bottom panel from the coefficients in the top panel, we find that here the inventory term has a smaller effect on our elasticity measures. Now the price elasticity falls from -5.71 to -6.20 (both are significant) and the income elasticity rises from 1.43 to 1.49. Thus, it appears that inventories have a larger influence on point estimates of short-run elasticity measures than on long-run elasticity measures, although both are affected somewhat.

Our model-based estimates of trade elasticities differ somewhat from our empirical estimates of the auto industry. These differences may arise because the shocks affecting the auto industry differ from those affecting our calibrated model. Alternatively, the reasons for carrying inventory in the auto industry may differ from those in our model. Nevertheless, it appears that including inventory holdings substantially reduces the uncertainty surrounding point estimates of elasticities.

6 CONCLUSION

In our recent research we find that inventory management considerations are particularly important to firms involved in international trade because of greater delivery lags, uncertainty and the economies of scale of transacting internationally. These inventory considerations tend to increase the volatility of international trade relative to production or expenditure and indeed explain a

substantial share of the relatively high volatility of trade. In sum, these inventory considerations lead to strong short-run trade movements to changes in relative prices or income.

Given their role in shaping trade dynamics, we explore how inventories also influence estimates of trade elasticities with respect to prices or expenditure. Applying standard time series methods to simulated data from our model, we recover the true elasticities only when we use data on the stock of imported goods held in inventory. Since changes in inventory investment tend to be strongly pro-cyclical, we find that naive measures of trade elasticities that ignore inventory changes tend to be biased upwards. Similarly, empirically for imports of foreign produced autos in the United States, we find some differences in measures of trade elasticities once one controls for inventory adjustment. In practice, we lack measures of inventory holdings of imported goods and so more effort to collect such data would appear to be necessary to fine tune the estimates of trade elasticities. Given the importance of using these elasticities in policy and forecasting, any data collection efforts are likely to be worthwhile.

Finally, the large collapse and rapid rebound in international trade from 2008 to 2010 appears to be consistent with a more severe inventory cycle for internationally traded goods rather than an increase in trade barriers or policy impediments. Our research suggests that the outsized drop in international trade is the efficient response to a downturn in economic activity given the greater frictions involved in international transactions. In this respect, we believe that there is little role for cyclical policies that seek to smooth out fluctuations in trade. Instead, more effort should go towards policies aimed at reducing the costs and delays in international trade that lead to the stronger inventory needs for international transactions.

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PART 3

COUNTRY CASE STUDIES

CHAPTER 11

EXAMINING THE DECLINE IN THE US EXPORT SHARE

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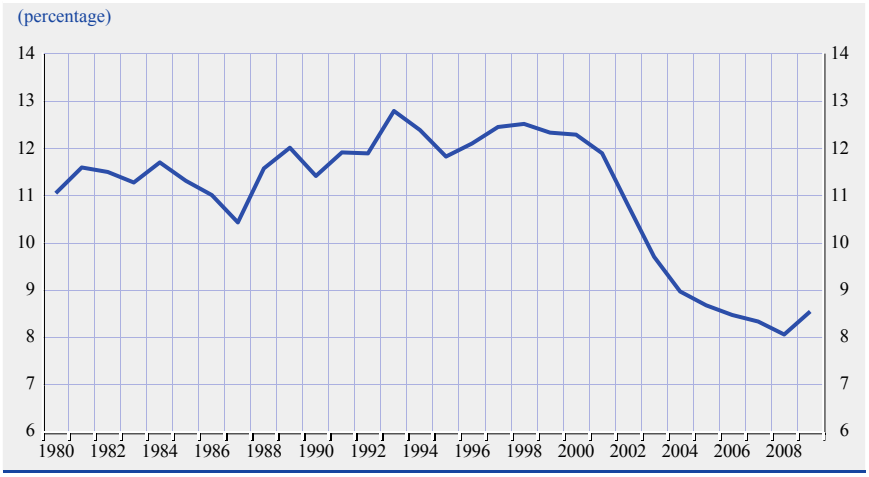
Between 1980 and 2009 the US share of world exports of goods fell by about one-third, from around 11% to just over 8%. In this chapter, we examine the determinants of this dramatic decline. We show that a large part (though not all) of the fall in the US share can be attributed to the composition of the US export bundle. In particular, the relative importance of agricultural and crude materials in the US export bundle, sectors of global trade that have experienced slower than average growth over much of the past three decades, explains much of the overall decline. That said, the United States has also experienced a rapid decline in its share of machinery exports, a decline that appears to owe more to outright declines within narrow sub-sectors than to the particular composition of US exports.

1 THE DECLINING US EXPORT SHARE

From 1980 to 2009 the US share of world exports fell by almost one-third, declining from about 11% to just over 8% of world exports (as shown in Chart 1). What explains the dramatic decline in the US share over the past three decades?

There are a number of potential explanations for the decline. One possibility is that the United States has lost competitiveness relative to other global economies. Another possibility is that widely acknowledged standard determinants of bilateral trade flows, including country size, trade costs and relative prices, have evolved in a manner consistent with the decline in the US share. A third possibility is that the fall in the share reflects the particular composition of US exports, and that the United States tends to export goods that have experienced below average trade growth over the past three decades. This chapter focuses on the third possibility, examining the importance of composition in explaining the decline in the US share. For an assessment of the impact of standard trade determinants and competitiveness on the US share, readers are directed to Del Gatto, di Mauro, Gruber and Mandel (2011).

Chart 1 U.S. share of world exports of goods



Source: Federal Reserve Board.

2 EXPORT SHARES ACROSS CATEGORIES OF GOODS

One way of examining the decline in the aggregate export share is to decompose the decline across categories of goods. The change in aggregate export share can be expressed as the sum of changes across product categories (i) as a ratio of the change in world exports:

$$\frac{\Delta x_{US}}{\Delta x_{World}} = \sum_{i} \frac{\Delta x^{i}_{US}}{\Delta x_{World}}$$

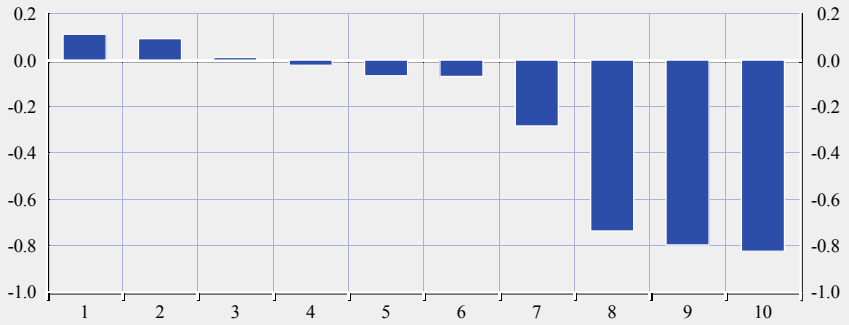
Chart 2 depicts the contributions to the change in aggregate export share for each 1-digit SITC code over the period from 1984 to 2006. Food & live animals provided the largest contribution to the decline in share, accounting for almost one-fourth of the aggregate decline. Almost as large were the contributions of machinery & transportation and crude materials, also each contributing about one-fourth to the overall decline in share.

The importance of raw materials for the decline in the US share raises a note of caution in interpreting aggregate export share statistics. Commodity prices fell over most of the period under consideration, and since the exports of the United States are relatively commodity-intensive, so did the US share of world exports.

The importance of commodities is further illustrated in Chart 3, which depicts the top 10 contributors to the aggregate decline among 4-digit SITC codes. Corn and soybeans contribute a combined one-sixth of the overall decline. However, the 4-digit data also reveal that a number of categories of manufactured goods also contributed to the decline, including motor vehicle parts and digital

Chart 2 Commodity contribution to decline in aggegate export share

(percentage points)



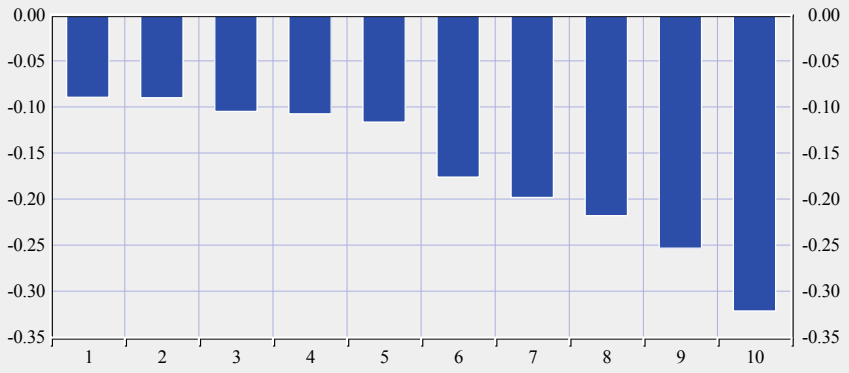
1 chemicals
2 misc. manufactured
3 other
4 manufactured goods by material
5 animal and vegetable products
6 beverages and tobacco
7 mineral fuels
8 crude materials
9 machinery and transportation
10 food and live animals

Source: Federal Reserve Board.

processing units (computers). The message to take away is that a true measure of developments in US competitiveness is more likely to be found by looking at US export performance within relatively narrowly defined categories.

Chart 3 Top 10 4-digit SITC Contributors to decline in aggregate export share

(percentage points)



1 fuel oils, N.E.S
2 cotton, not carded or combed
3 parts of aircraft
4 parts & access. for office & data proc. machines
5 oscilloscopes and spectrum analyzers
6 digital processing units
7 lignite
8 soybeans
9 parts and accessories for motor vehicles
10 corn

Source: Federal Reserve Board.

3 CONSTANT MARKET SHARE ANALYSIS

One established method of assessing the importance of composition for changes in trade shares is constant market share analysis (see ECB (2005) for a detailed description).[1] Constant market share analysis separates changes in aggregate market share into two components, a commodity effect and a competitiveness effect, defined as follows:[2]

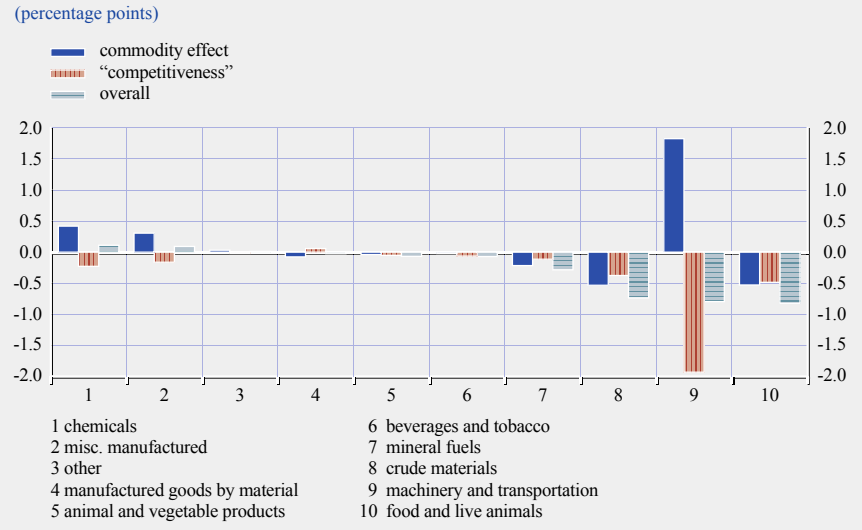
$$\Delta \frac{x_{US}}{x_{World}} = \underbrace{\sum_i \frac{x^i_{US}}{x^i_{World}} \Delta \frac{x^i_{World}}{x_{World}}}_{Commodity\ Effect} - \underbrace{\sum_i \Delta \frac{x^i_{US}}{x^i_{World}} \frac{x^i_{World}}{x_{World}}}_{Competitiveness\ Effect}$$

The commodity effect measures the effect of composition on the change in the aggregate export share, by weighting the change in the composition of world exports by the initial composition of the US export bundle. The competitiveness effect measures the portion of the change in the aggregate share that is due to changes in the category share of US exports.

Chart 4 decomposes the contribution of each 1-digit SITC export category to the change in the aggregate export share (the green bars) into components due

1 Constant market share analysis is beset by a number of well-documented theoretical problems (see Richardson (1971) for an overview). However, the approach remains illustrative and simple to implement, even if interpretation is complicated by relative price changes and other issues.
2 The constant market share approach often includes an additional "market effect" related to the geographical pattern of trade. For ease of exposition, we have focused only on the commodity effect, in a sense wrapping the market effect into our measurement of the competitiveness effect. With declining trade costs, it is likely that the market effect has become a less pronounced determinant of aggregate share in any case.

Chart 4 Contribution to decline in aggregate share



Source: Federal Reserve Board, authors' own calculations.

to commodity effects (the blue bars) and competitiveness effects (the red bars) over the period 1984-2006. The large negative contributions of food & live animals and crude materials largely reflect the declining importance of these goods in world exports (signified by negative commodity effects), although US exports also suffered a negative competitiveness effect in each case. In contrast, the negative contribution to the aggregate recorded by the machinery & transportation sector is completely due to a decline in US competitiveness, as the sector has greatly increased its weight in world exports over the time frame under consideration.

4 CONCLUSION

Interpreting the decline in the US export share is complicated by compositional effects. The primary drivers of the decline in the aggregate US share were raw commodities, with negative contributions that largely derived from their declining weight in the world export basket. That said, the United States did experience a large decline in its share of the machinery & transportation sector, which was not reflected in the composition of US exports but rather in declines within detailed sub-categories. Here, the evidence of a fall in US competitiveness is more compelling.

In Del Gatto et al. (2011), we take a more theoretical and structural approach to examining the evolution of US competitiveness. One component of the paper examines the change in the US export share within 4-digit SITC categories in the context of a gravity model, controlling for standard determinants of bilateral trade flows, including relative country size and trade costs, and defining competitiveness as the unexplained residual portion of the change in share. We find that a large fraction of the decline in the aggregate US export share can be attributed to the United States' declining share of world income, and although competitiveness defined as the residual of the gravity model was falling, the decline has been quite modest.

The paper also outlines a structural model of the US export share in the style of Melitz-Ottaviano (2005). This approach confirms the outcome of our gravity model exercise, that the United States has generally maintained its level of competitiveness within detailed product categories, despite the fall in the overall share. Overall, this analysis points to the inadequacy of the aggregate export share as an indicator of country export competitiveness.

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CHAPTER 12

THE MYTH OF CHINESE SAVINGS

BY JONATHAN ANDERSON, UBS[1]

Whether trade elasticities "work" in China is the source of polarized debate. For the vast majority, China's external surpluses can be reduced through large scale real exchange rate appreciation. However, a sizeable "rear guard" argues that Chinese surpluses are a reflection of structurally inflexible saving rates in the economy. This chapter argues that Chinese savings are not a structurally fixed, inflexible domestic phenomenon – and certainly not driven by household decisions, as many analysts suggest. Rather, the data show that nearly the entire cyclical increase in China's saving/GDP ratio over the past decade came from export earnings in heavy industrial sectors such as steel, other basic materials, machinery and equipment. Under these circumstances, adjusting relative competitiveness through the exchange rate not only "works" in decreasing mainland surpluses, it is arguably the single most effective policy tool for doing so.

1 INTRODUCTION

If there's one thing that absolutely everybody in the global community seems to know, it's that China's economy has been seriously imbalanced for the past five years – and that fixing the problem means fixing the Chinese consumer. Mainland households are no longer counted among the world's poorest but they still generate annual income of less than USD 4,000 per head, less than a tenth of what their US counterparts enjoy, and the vision of low-income Chinese families scrimping and saving in order to subsidise the insatiable American consumer has become so firmly engrained in the collective consciousness of economic observers that it is no longer taken as a point of debate, but rather a fundamental truth.

As a result, much of the "A-list" of the global economics and policy industry, from the US Treasury to the IMF, the OECD, McKinsey, Goldman Sachs and any number of venerable think tanks, has been increasingly involved in generating long lists of policy prescriptions aimed at beating down excessive consumer savings behaviour, mostly through improvements in the domestic social safety net, consumer finance and agricultural reforms. Global financial

1 This article is based on the exceptional analytical work of UBS chief China economist Tao Wang; the tone and conclusions are mine, as are any errors.

investors, as well, have been busily positioning for an inevitable take-off in Chinese consumption, cheered on by broker reports of latent potential waiting to be unleashed as the mainland "turns the corner" from a savings-oriented to a consumer-driven economy.

Amid all the hype, however, it's easy to lose sight of one simple point: the lion's share of China's extraordinary savings explosion since 2003 didn't really come from *Chinese* savings at all. If anything, it would be more accurate to say that China "stole" these savings from the rest of the world … and the true rebalancing of the mainland economy will come as China gives those savings back. As we will see, this has rather different implications for the path of economic growth and related policy prescriptions going forward.

2 A BIT OF BACKGROUND

At risk of covering well-trodden ground, let's begin with a short recap of recent history. China has always had a dynamic, even explosive economy at home, but up until recently it was also a mild-mannered and yawningly predictable player abroad. Between 1982 and 2002 the mainland surplus on the so-called "current account" (the net balance of merchandise goods and services trade vis-à-vis the rest of the world) fluctuated around a level of 1% to 1.5% of GDP per year. For those unfamiliar with international economics, this is a comfortable number but not a particularly impressive one on a comparable basis.

In other words, China was running surpluses – but barely so, and certainly not to an extent that would capture the attention of the global community.

And then, beginning in 2003, something changed. Its external surplus jumped to 2.8% of GDP and then to 3.6% in the following year; by 2005 it had reached 7.2%, and at the peak in 2007 the surplus was an eye-popping 11% of GDP (see Chart 1), a virtually unprecedented level for an economy of China's size. These earnings generated from these surpluses sent China's official FX reserve assets soaring from a humble USD 150 billion at the beginning of the decade to more than USD 2.5 trillion (including funds transferred to the recently-created sovereign wealth fund) as of this writing.

Where did the money go? Some two-thirds of it was channeled directly into the US economy, and particularly into treasury and quasi-official bonds – making China the single largest foreign creditor to the US government. This, in turn, allowed American households to borrow and spend unflaggingly for a full half-decade without having to worry about the impact of sharply rising external deficits on dollar interest rates. If you will, China effectively financed the US consumption and housing boom and eventually the US sub-prime finance bubble.

Chart 1 Current account balance

Source: UBS.

And where did the money come from? Well, those who did study international economics should immediately recognise the following accounting identity:

$CA = S - I$

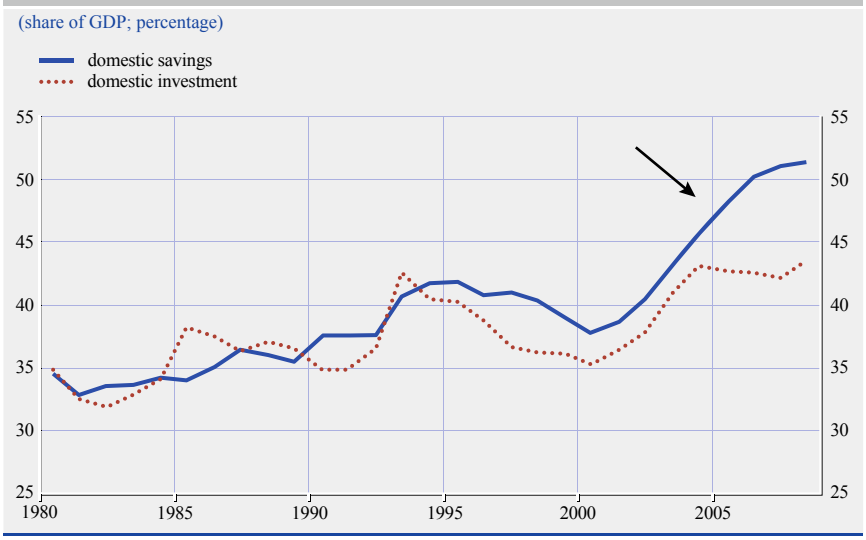
In other words, the external current account balance is equal by definition to gross domestic savings less gross domestic investment. So if households and firms are spending more than the available pool of savings, the economy will necessarily run a deficit vis-à-vis the rest of the world; by contrast, if savings are higher than local demand for investment the economy will run a surplus.

If we look at other cases in post-war history where emerging countries suddenly recorded a large spike in the external balance, the culprit was almost always investment, roughly in line with the following scenario: you had a crisis, long investment demand plummeted, import spending fell alongside and the trade surplus rose sharply as a result. This is a "normal" part of the emerging business cycle – and this story has played itself out again over the past 12 months in countries like Turkey, Vietnam, Ukraine and the Baltics.

China's case, however, is anything but normal. As it turns out, the rising surplus had nothing to do with falling investment; in fact, investment demand *rose* significantly over the last five years. Instead, the culprit has been savings. Just look at the picture in Chart 2 below; China has always had one of the world's highest domestic saving rates, averaging around 40% of GDP over the course of the 1990s – and since 2003 that rate has exploded upwards to reach nearly 52%, a level that very few countries in the world have ever even come close to.

And the mathematical counterpart to this is a consumption ratio that fell off the other way. Total consumption was about 60% of the Chinese economy during the previous decade, but as of last year the figure had fallen to 49%; for household

Chart 2 Savings and Investment



Source: UBS.

consumption the numbers were 46% and 35% respectively. Again, these are extraordinarily low numbers by international standards, making China a very imbalanced economy indeed.

3 FALSE START

And this is where the trouble starts. For most observers looking at these ratios – including many of the best professional economists – the underlying explanation is simplicity itself: for whatever reason, over the past half-decade Chinese consumers "dropped the ball" and began spending less and less, saving more and more. To some the driving force was a severely undervalued exchange rate that eroded overseas purchasing power, for others it was an erosion of social safety protections and rising uncertainty about the future, but the result was both a drop in import spending and a flood of new household savings that flowed directly into overseas assets.

Again, this assumption has led to a heady stream of headlines and editorials in the global financial press, invoking visions of the world's poorer consumers "scrimping and saving" to support the profligate lifestyles of the world's richest. And if this is the case, then the only way to solve the problem is to get China's consumers spending again. Currently favoured policy prescriptions include the introduction of rural pension insurance, an overhaul of the ageing health care system, greater support for public education, better consumer finance incentives and agricultural land tenure reforms. Indeed, the mantra of "making China a consumption economy" is repeated whenever and wherever global imbalances are discussed.

Now, those living in China's cities can be forgiven for scratching their heads just a little bit at the above arguments. Living standards are still rudimentary by developed benchmarks, to be sure, but nearly every available consumption indicator from sales to surveys showed frenetic growth over that same five-year period, with a rapid increase in spending on travel, restaurants and consumer goods. Nor was the rural economy stagnating; in fact, this was the first time in more than a decade that farmers finally saw a "double-punch" of rising food prices from agricultural activity and higher wages for rural migrants in the low-end factory and construction sectors, both of which significantly boosted incomes and spending. And all of these trends pale when we turn to the biggest story of all, i.e. the absolute explosion of household expenditure on housing and automobiles, with sales growth rates of an astounding 35% annually between 2002 and 2007. Simply put, none of the above smacks remotely of consumers "dropping the ball".

As for China's social and financial state, it is simply impossible to find another economy with per-capita incomes under USD 5,000 that can rival the mainland in the coverage of its urban pension system (much less any rural coverage at all), the availability of clinics and hospitals, the sheer size of the banking system as well as the availability of credit cards and mortgages, the relative number of publicly-funded schools and universities, the equality of rural land distribution or the level of per-hectare agricultural yields. Of course none of these indicators can compare with those in advanced economies – but if the "social safety net" is the key factor behind China's savings, then why don't we see even higher domestic saving rates in Algeria, Bolivia, Cameroon, Egypt, Indonesia, Kenya, Mongolia, the Philippines, Thailand or the remaining many dozens of nations with social indicators that fall considerably short of those in China?

And even if we *were* to accept that China's welfare system was particularly to blame … why 2003-07? After all, rural peasants have never had pensions; the biggest wave of urban unemployment had already come and gone more than a decade earlier, as did the initial drop in public health and education spending. By contrast, this decade has seen a resurgence of government spending across all categories, the first major reworking of the urban pension system and the biggest upsurge in consumer leverage the country has ever seen.

In short, from most angles the "weak consumption" story makes little sense – and sure enough, when we take a closer look at the macro data we conclude that it doesn't make any sense at all. And this has led to what surely must be one of the biggest economic misunderstandings of the recent past.

4 WHERE THE SAVINGS REALLY COME FROM

Now before we go on, we should explain that Chinese households *do* save; they save quite a lot, actually, anywhere from 16% to 18% of GDP, which is a very high number by either developed or emerging standards. But here's the crucial catch: when we look at the veritable explosion of *increased* savings coming out

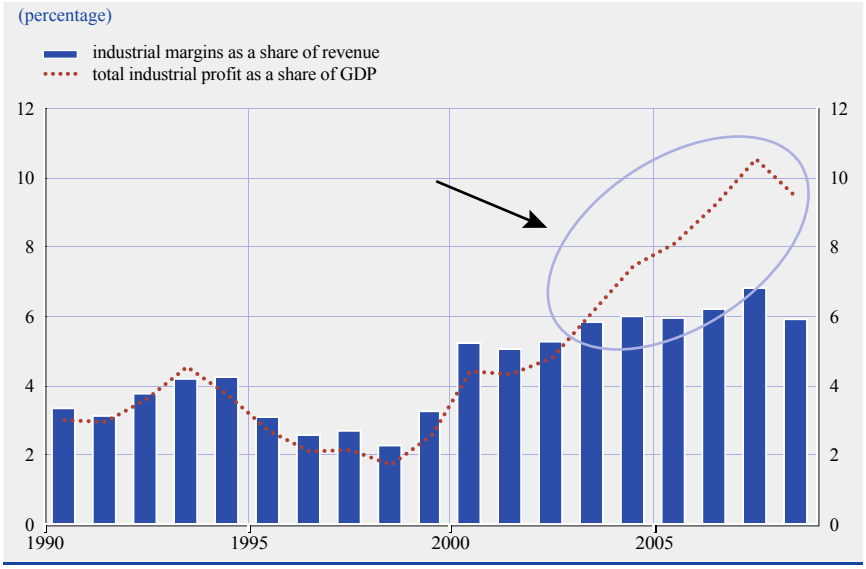
of China over the past five years, virtually none of it came from the household sector. Rather, according to the best available estimates based on flow of funds data, the real story is the sudden rise of gross *corporate* savings, which shot up from something like 15% of GDP at the beginning of the decade to more than 26% of GDP by 2007.

What do we mean by "gross corporate savings"? In national accounts parlance, this is nothing more than total corporate earnings – i.e. corporate profits. So what we're saying is that over the space of a few years Chinese profits shot up dramatically as a share of the economy, and by far more than could be reasonably invested at home.

How did this happen? Did individual Chinese companies suddenly become more profitable? Surprisingly the answer is no, not at all; as best we can measure, unit margins haven't really increased over the last decade. And this leads to the very paradoxical (but absolutely verifiable) picture in Chart 3 below. The green bars show the path of industrial margins in China, and as you can see gross profits as a share of total revenues have been very stable; meanwhile, the blue line shows the path of those very same gross profits as a share of *GDP* … and this ratio has increased very sharply since 2002.

How could aggregate profits go up if individual profit margins did not? The answer is sales volumes, and sure enough Chart 4 documents a truly stunning expansion of industrial sales revenue relative to GDP, more than doubling over the past seven years. So even if mainland companies weren't making any more money on a single dollar of sales, the spectacular increase in total sales

Chart 3 Industrial margins and profits



Source: UBS.

guaranteed an equally spectacular rise in profits – which, remember, are recorded in the national accounts as savings.

Chart 4 also highlights another important trend: the increase in corporate sales volume wasn't across-the-board. And in particular there was no sharp increase in sales coming from traditional export goods such as toys, textiles or IT electronics, i.e. the stuff that goes to feed the voracious US consumer. Rather, the action came from heavy industry – and not just anywhere in heavy industry, as it turns out, but rather specifically concentrated in areas like steel, aluminium, cement and other basic materials, autos and auto parts, machine tools and specialty chemicals, mostly sectors that support the domestic housing and auto boom.

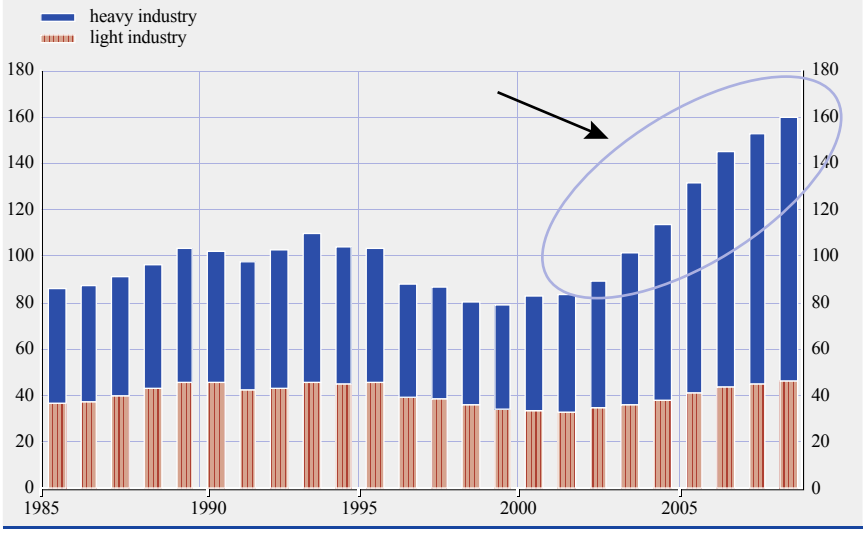
If this is all a bit confusing, then it might help just to think about the steel sector, which was one of the biggest single contributors to the heavy industrial boom. If China used to produce and sell one dollar worth of steel per unit of GDP in 2002, by 2007 it was producing and selling three, an astonishing increase in capacity over such a short period of time.

Where did all that steel capacity go? The short answer is that roughly half of the supply increase was actually "needed" at home, to satisfy China's rising domestic demand for housing and property construction as well as fixed asset investment. The other half was surplus capacity – and ended up being "exported" abroad into the global market.

We say "exported" in quotation marks, since China began in 2002 as a sizeable net importer of steel and steel products, so the first thing that domestic excess capacity producers did was to take over market share at home from foreign

Chart 4 Industrial sales

(industrial sales as a share of GDP; percentage)



Source: UBS.

suppliers. It wasn't until 2005 that Chinese steel companies actually began exporting outright in large quantities. But in terms of the impact on the trade surplus, it didn't really matter; it was precisely the full swing from a net import to a net export position that contributed to the rising external surplus.

And turning to the trade data, once we add together steel, other metals and basic materials and machinery, we find that the shift in the heavy industrial trade balance was predominantly responsible for that stunning move in the mainland current account, i.e. it wasn't low-end consumption goods or US consumer spending that pushed up China's exports so rapidly in the recent past; rather, it was the sudden appearance of new heavy industrial producers.

So in summary, what really happened between 2003 and 2007 is that China expanded in heavy industrial capacity in huge amounts, amounts that it couldn't digest at home – and ended up using the surplus capacity to take away market share from foreign producers, first by displacing imports and taking over the domestic market completely, then by turning around and selling the remaining surplus abroad. And it was this historically unprecedented "market share grab" that allowed the economy to record a much bigger expansion in heavy industrial sales and earnings than it otherwise could have … pushing up both the domestic savings ratio and the trade balance dramatically in the process.

In other words, it's not Chinese households that did the excess saving. There were no families scrimping and scraping together increased funds. No one put off consumption at home, and US households were not exactly borrowing from poor peasants toiling in the fields and factories to make the cheap consumption goods they demanded.

In fact, in some sense these are not really *Chinese* savings at all. Of course the excess income accrued to mainland companies, but that income was earned by taking industrial market share away from foreign producers, i.e. they were effectively "stolen" from abroad.

5 CHINA AND SAUDI ARABIA

Now, this whole thesis may sound more than a bit exotic by the standards of most global economies – but when we said above that China's saving trends have been "virtually unprecedented", we didn't mean that it is completely so. In fact, there is a group of countries that regularly show almost *exactly* the same macroeconomic trends as China.

Think about an economy like Saudi Arabia. This takes us back a bit in time, but what happened to the Saudi national accounts when the country first struck oil? Three things: First, the sudden increase in exportable fuel production would have shipped abroad, leading to a massive increase in the Saudi trade surplus. Second, the counterpart to that rising trade surplus would be an equally large increase in domestic savings, as export earnings piled up in the government and oil companies' coffers. And third, the domestic consumption share of GDP

would have fallen precipitously, as only a small share of those export earnings actually made it to the pocketbooks of average Saudi households.

So we see a sharply rising savings/GDP ratio and a sharply falling consumption/GDP ratio, but does it automatically follow that Saudi consumers suddenly dropped the ball and began saving more – and that the economy can be rebalanced by unlocking hidden reserves of household savings? Not in the least. Again, those savings didn't come from *inside* the Saudi economy at all; they came from selling oil abroad. And the Saudi consumption ratio fell, not because consumers were spending any less, but rather because the size of the overall economy around them suddenly expanded.

The same math applies when oil prices go up. China may have shocked the world with a jump in savings and a fall in consumption, but look at recent trends in selected oil and fuel exporting economies: Russian household consumption fell from 55% of GDP in the late 1990s to nearly 45% a decade later, with an offsetting rise in gross domestic savings from 23% of GDP to 35%. In Kazakhstan household consumption was 65% of the economy in 2000 and only 38% of GDP eight years on; gross saving rates increased from 21% to 50% of GDP over the same period. And in Saudi Arabia the corresponding recent figures were 46% to 26% of GDP for household consumption and 10% to 33% for domestic savings.

Each of these countries recorded an extraordinary whipsaw in domestic consumption and saving ratios, in magnitudes that make China's imbalances seem like child's play. But are global financial and policy institutions showing up in droves in Russia and Saudi Arabia to tell them that the lack of domestic social safety provisions is behind their sudden spike in national saving rates? Of course not, because it's perfectly clear to all involved that those savings came from higher fuel exports, full stop, and that the declining consumption ratio is simply a mathematical result of a rising oil-related denominator.

And so it is in China – with the sole difference that whereas Russia, Kazakhstan and Saudi Arabia struck oil and gas, China "struck" steel and basic materials. The impact on the mainland national accounts is precisely the same: rising heavy industrial capacity leads to a rapid expansion in net exports, GDP growth and gross savings. Meanwhile, Chinese consumer incomes and spending continue to increase at the "same old" pace of 8% to 9% in real terms, i.e. nothing has changed for mainland households and China is still one of the fastest-growing consumer economies in the world, but with excess supply growth pushing overall GDP into the 11% growth range, you nonetheless get a sudden trend decline in the household consumption *ratio*.

6 WHAT IT MEANS GOING FORWARD

Simply put, there's nothing wrong with Chinese demand – it's heavy industrial *supply* growth that was far too strong, and this is the real underlying root of China's problems. But if this is the case, then there are very different implications for eventual policy solutions. In such an environment the most likely and

effective rebalancing does not come from spending more at home; China expropriated those savings from abroad in the form of market share gains, and a "true" rebalancing means giving those savings back.

As you can imagine, these findings lead to a much more jaundiced view about the efficacy of social safety net reforms in China. Of course these improvements are desperately needed in a structural, longer-term sense, but they are almost guaranteed to have no effect on the near-term imbalances that plague the economy today.

What kind of policy measures *can* work? The following three top our list, in increasing order of likelihood and importance.

6.1 EXTRACT SAVINGS FROM COMPANIES AND GIVE THEM TO HOUSEHOLDS

One of the reasons that the Gulf countries, Russia, Kazakhstan and other major oil and fuel exporters can sustain ultra-high saving rates over a protracted period of time is that export earnings accrue to a very concentrated group of entities, usually a few oil majors and the government. Average citizens and households do receive public spending benefits and sometimes mild dividends, but they are not the residual claimant on the exporting assets and as a result have no feasible way of "spending" the surpluses.

Very much the same is true in China. The massive surge in heavy industrial supply and exports did not lead to much of an income boost (if at all) for average consumers; these are mostly state-owned or local government-led companies, and even the word "state-owned" is not really correct in the case of China since there is very often no residual claimant on earnings at all. The state normally doesn't receive dividends, minority shareholders are usually small and fragmented, and in this environment large companies often have nothing to do with profits but reinvest them or simply accumulate assets.

As a result, there is a compelling mandate for corporate ownership reforms that would provide for a more direct and immediate transfer of profits to major shareholders, including the government as well as households. However, just as in the case of the oil majors mentioned above, a compelling argument in theory can take decades to be implemented in practice; Chinese policymakers have been talking about dividend reforms for a very long time already, and we would be shocked to see any significant change in actual flows within, say, the next ten years.

6.2 STOP BUILDING STEEL MILLS (AND MAYBE EVEN CLOSE SOME DOWN)

Next up is the most logical consistent measure of all – and as of 12 months ago the one we would have highlighted as most likely as well: if the source of the problem was a wave of excess capacity creation in key metals and materials

sectors, then why not just stop building that capacity and perhaps even shut some of it down? This would be a nice, neat way to reverse the course of rising surpluses and give some of those "stolen" savings back, as rising Chinese domestic demand gradually ate through the capacity overhang and eventually brought the economy back to a more natural net import position once again.

For a while in 2007 and 2008 it looked as if this was the way China was going, as low capacity utilisation rates in sectors such as steel and autos, together with the weakening global economy, led to a visible slowdown in new investment activity. However, this year two things have happened that make us much more concerned. First, in its panic over the potential effects of the global crisis the government successfully engineered a stunning pickup in private housing construction and state infrastructure spending, both of which have caused an explosion of new local demand for industrial materials. Of course the external trade balance has fallen sharply as productive capacity was quickly diverted to the domestic market, but the resulting sudden rise in capacity utilisation also makes these sectors more attractive as a new investment destination.

This brings us to the second and more important concern, which is that any semblance of new lending discipline seems to have been thrown to the wind as banks were encouraged to lend to anyone and everyone who walked through their doors. We wouldn't mind a big stimulus "burst" that boosted domestic demand in the near term and helped take up slack capacity, even if it were a very temporary phenomenon, as long as we could be sure that it wouldn't result in another wave of productive capacity creation. But the worst of all possible worlds would have to be a short-lived demand stimulus programme that resulted in yet another massive, long-term capacity overhang, and the absolutely crazed money and credit growth numbers of the past 12 months do give us plenty of reason to worry that this may be where we're headed.

6.3 MOVE THE EXCHANGE RATE

It's far too early to be sure, of course, and we could be pleasantly surprised at how moderate Chinese companies are in their new expansion plans. However, if we do wake up with yet another round of credit-fuelled heavy industrial growth and a renewed jump in the external balance back to 2007 highs, this really leaves China with only one possible policy response – to let the renminbi strengthen, and by considerably more than we have seen to date.

The topic of China's exchange rate policy and its role in global imbalances deserves a lengthy treatise in its own right, but let us at least make a few summary points. To begin with, we've never found much logic in the tenets of the "Bretton Woods II" camp, who claim that it was precisely a structurally undervalued exchange rate that caused the growth of industrial capacity in the first place, and that exchange rate factors also artificially suppressed domestic consumption demand as well. But we nonetheless find ourselves agreeing that a much more significant exchange rate adjustment may prove to be the only lasting solution to China's current imbalances.

And this puts us very much on the other side of the debate from "savings fundamentalists" such as Nobel Prize-winner Robert Mundell, who has consistently argued that moving the currency can do nothing to change China's savings rate and thus would have no impact on the external current account. If China's surpluses came from "true" domestic savings, e.g. millions of households putting off purchases and storing away pennies for a rainy day, we would have some sympathy for this view. But since the real story behind rising national savings is essentially a market-share grab, as a flood of new domestic producers steal earnings away from foreign counterparts, letting the renminbi appreciate turns out to be a very efficient way of reducing the savings rate – and giving those savings back.

How does it work? Very simple: By reducing the local-currency equivalent of a dollar's worth of exports, a stronger renminbi immediately makes Chinese heavy industrial producers less competitive vis-à-vis overseas competitors, and this lowers the aggregate amount of corporate savings through two channels: (i) lower domestic margins on every unit of foreign sales, and (ii) lower sales volumes at home and abroad as foreign producers claw back market share. And this, needless to say, has the effect of reducing the external trade surplus as well.

In short, China's massive savings glut is not really what you think – and rather than obsessing about the state of mainland pensions and health care, we suggest that steel capacity and the renminbi exchange rate are two crucial indicators to watch going forward.

CHAPTER 13

THE COMPETITIVENESS OF EURO AREA COUNTRIES: WHAT DO DSGE MODELS TELL US?[1]

BY SIMONA DELLE CHIAIE, BANQUE DE FRANCE

Using a multi-country DSGE model for the Euro Area and the Global Economy (EAGLE), the chapter shows that the relative reduction of prices and costs in Germany vis-à-vis the rest of the euro area explains only part of the German export performance over the pre-crisis period. Therefore, non-price competitiveness factors must have also increased the attractiveness of German goods abroad, as well as boosting productivity, thus further reducing prices and costs. From a policy perspective, these results imply that reforms aimed at restoring competitiveness in member countries with large current account deficits should also be aimed at boosting innovation and raising the product quality and variety, which would relieve the necessary cost and price adjustments.

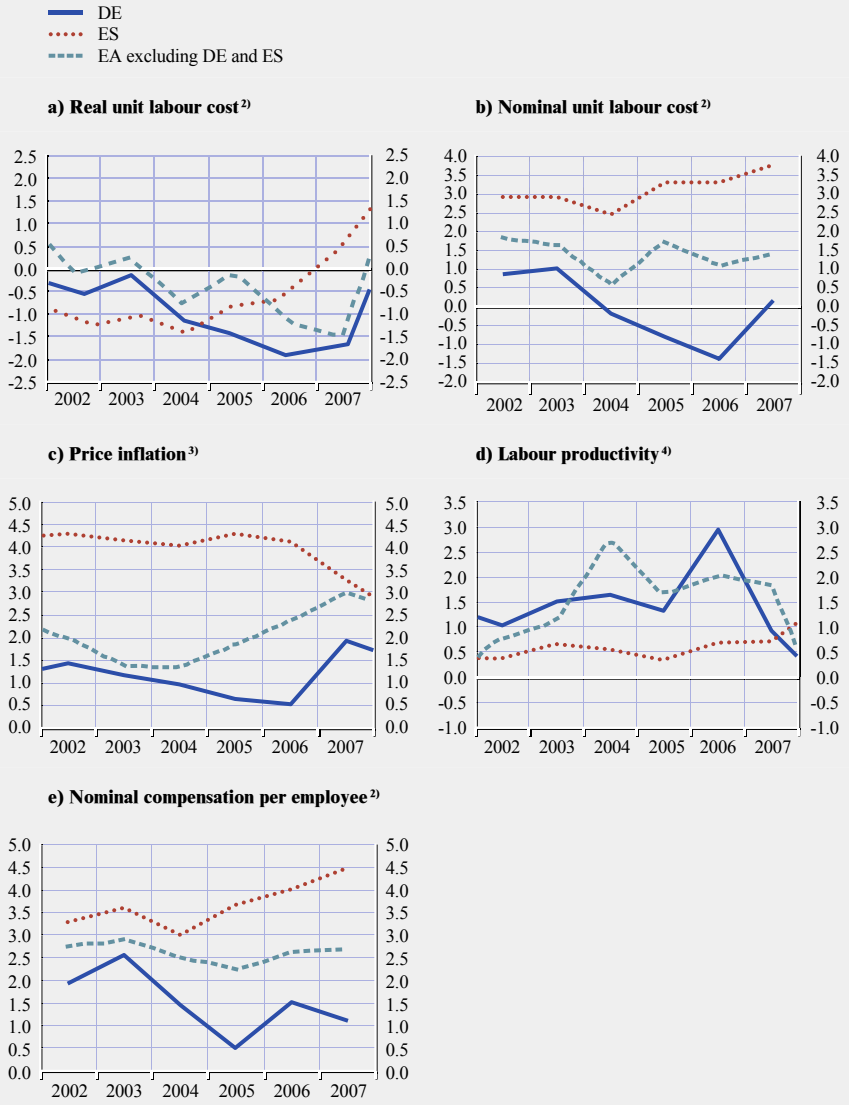
1 UNIT LABOUR COST DEVELOPMENTS: PRE-CRISIS TRENDS (2002-07)

Starting from the early 2000s, euro area countries have witnessed growing labour cost differentials, related to differences in their export performance and increasing imbalances. While some labour cost differentials are not *per se* incompatible with a well-functioning economy, large and persistent increases in nominal wage growth not matched by productivity developments can lead to weaker external price competitiveness and losses in export market shares. For these reasons, policy-makers carefully monitor the unit labour cost (ULC) indicator, which is a measure of the labour costs per unit of output, calculated as the ratio of compensation per employee to labour productivity. The ULC represents a direct link between productivity and the cost of labour used in generating output. A rise in an economy's ULC represents an increase in labour's contribution to output. However, a rise in labour costs higher than the increase in labour productivity may worsen the economy's price competitiveness.

In Chart 1, we present the developments in the unit labour cost and its components (nominal compensation per employee, prices and labour productivity) during the period 2002-07, together with the evolution of nominal wages. As an illustrative example, we focus on Spain and Germany which performed differently in terms of both ULC and trade balances. Chart 1 shows high inflation rates and low real ULC growth in Spain in the first part of the sample. Starting from 2003 when the

1 This work was prepared when the author was working at the External Developments Division of the European Central Bank. I thank Pascal Jacquinot and Matthias Mohr for useful discussions and comments.

Chart 1 Real unit labour cost and its components in Germany, Spain and the euro area [1)]



Source: Eurostat and authors' computations.

1) The euro area in this chart refers to the EA 16 excluding Germany and Spain.

2) Total economy, year-on-year change in percentages.

3) Year-on-year change of the GDP deflator, in percentages.

4) Gross domestic product at constant market prices (100=2,000) per person employed (GDP/Employment); year-on-year change in percentages.

credit boom started and capital poured in, nominal wages increased relative to inflation and productivity, giving rise to an acceleration in both nominal and real unit labour costs. Inflation, as measured by the changes in the GDP deflator, and nominal wages increased by 21.5% and 20%, respectively, in the period 2002-07, while productivity growth (in terms of real output per employee) remained almost flat, at less than 1% per year. In Germany, prices and nominal wages rose modestly during the period 2002-07, by 5.3% and 7.3%, respectively. Therelatively low nominal wage growth is partly explained by the impact of higher competition in the labour market through increases in the effective labour force from emerging economies and eastern Europe, as well as by the effect of reforms of social benefits – both exerting downward pressure on German wages. Over the same period, labour productivity rose substantially (+9% in cumulative terms), leading to a slowdown in both real and nominal unit labour costs.

2 WHAT HAS DRIVEN THE EXPORT GROWTH IN GERMANY?

In light of these developments, we simulate an improvement in price competitiveness in Germany through the reduction of ULC calibrated so as to broadly match the dynamics of the main German macroeconomic data over the period 2002-07. The aim of the model simulations is to shed more light on various factors affecting the international competitiveness of countries participating in the monetary union, as well as the possible spill-over effects on the rest of the euro area. To this end, we show the results of model simulations undertaken with a multi-country DSGE model for the Euro Area and the Global Economy (EAGLE).[2] The four countries or regions forming the model have been calibrated to represent Germany (DE), the rest of the euro area (REA), the United States (US) and the rest of the world (RoW).

In the baseline simulation, the relative reduction of ULC in Germany is introduced into the model through temporary shocks which gradually increase labour productivity and reduce wage mark-ups over a period of five years. The shocks

2 EAGLE is a large-scale dynamic stochastic general equilibrium model, currently calibrated to represent four regions: an individual euro area country, the rest of the euro area, the United States and the rest of the world. Each region covered in EAGLE is modelled in a symmetric fashion. The four areas are linked with each other by bilateral trade relations and international financial markets. Since markets are assumed to be incomplete, there is only imperfect risk sharing across countries. Each region is populated by two types of households which differ in their ability to participate in asset markets. In particular, non-Ricardian households hold only money, whereas Ricardian households can acquire and dispose of other financial and physical assets as well. In order to capture economic dynamics, the model incorporates several real frictions, with economic agents subject to habit persistence and/or adjustment costs. Finally, in each area there are two types of firms. One produces final non-tradable goods under perfect competition using domestic tradable, imported tradable and non-tradable intermediate goods. The final goods can be used for private and public consumption as well as for private investment. The intermediate goods are produced by firms under monopolistic competition using domestic labour and capital. Hence, they set their nominal prices with a view to maximising profits. Prices are sticky, so there is a non-trivial stabilisation role for monetary policy. For tradable intermediate goods, prices are set in the currency of the destination market. In other terms, the local currency pricing assumption holds. This allows the modelling of incomplete pass-through of the nominal exchange rate into import prices in the short run, consistently with empirical evidence. For details, refer to Gomes *et al*. (2010).

Table 1 Annual growth rate differentials: Germany minus rest of the Euro Area

(2002-2007)

	Real ULC	Real Wages	Labour Productivity	Real GDP	Total exports
2002	-0.71	-0.03	0.69	-1.34	3.92
2003	-0.19	0.56	0.76	-1.45	2.88
2004	-0.28	-0.54	-0.32	-1.35	5.32
2005	-1.17	-0.93	0.24	-1.31	4.73
2006	-1.43	0.25	1.73	0.26	7.27
2007	-1.30	-1.54	-0.15	-0.39	3.35
Σ	**-5.08**	**-2.24**	**2.95**	**-5.56**	**27.45**

Note: The rest of the Euro Area in the table refers to the Euro Area 16 excluding Germany. For each variable, this has been computed as a weighted average of the other 15 countries.

have been introduced to the German part of the EAGLE model with a view to matching the changes in some relevant macroeconomic variables, namely real unit labour costs, productivity, wages and total exports over the period 2002-07, relative to the REA.[3] In particular, shocks have been calibrated to broadly match the overall cumulative change over the period 2002-07 (see Table 1 for a summary of the annual growth rate differentials between Germany and the REA over this period). Given the linearity of the model, the steady-state effects as well as the transition dynamics of the two shocks are largely additive.

Chart 2 presents the reaction of selected macro variables to this combination of shocks. The results show that the reduction in wage claims, together with the positive productivity shock, lead to a reduction in real unit labour costs similar to the observed data. The productivity gain triggers a decline in the real marginal cost, which causes domestic prices to fall, as prices of intermediate goods are set as a mark-up over marginal cost. The improvement in the competitive position produces an expansionary effect on total exports (+11% in cumulative terms). Owing to the expansion of economic activity, total imports increase as well, but the net effect on German trade is positive.

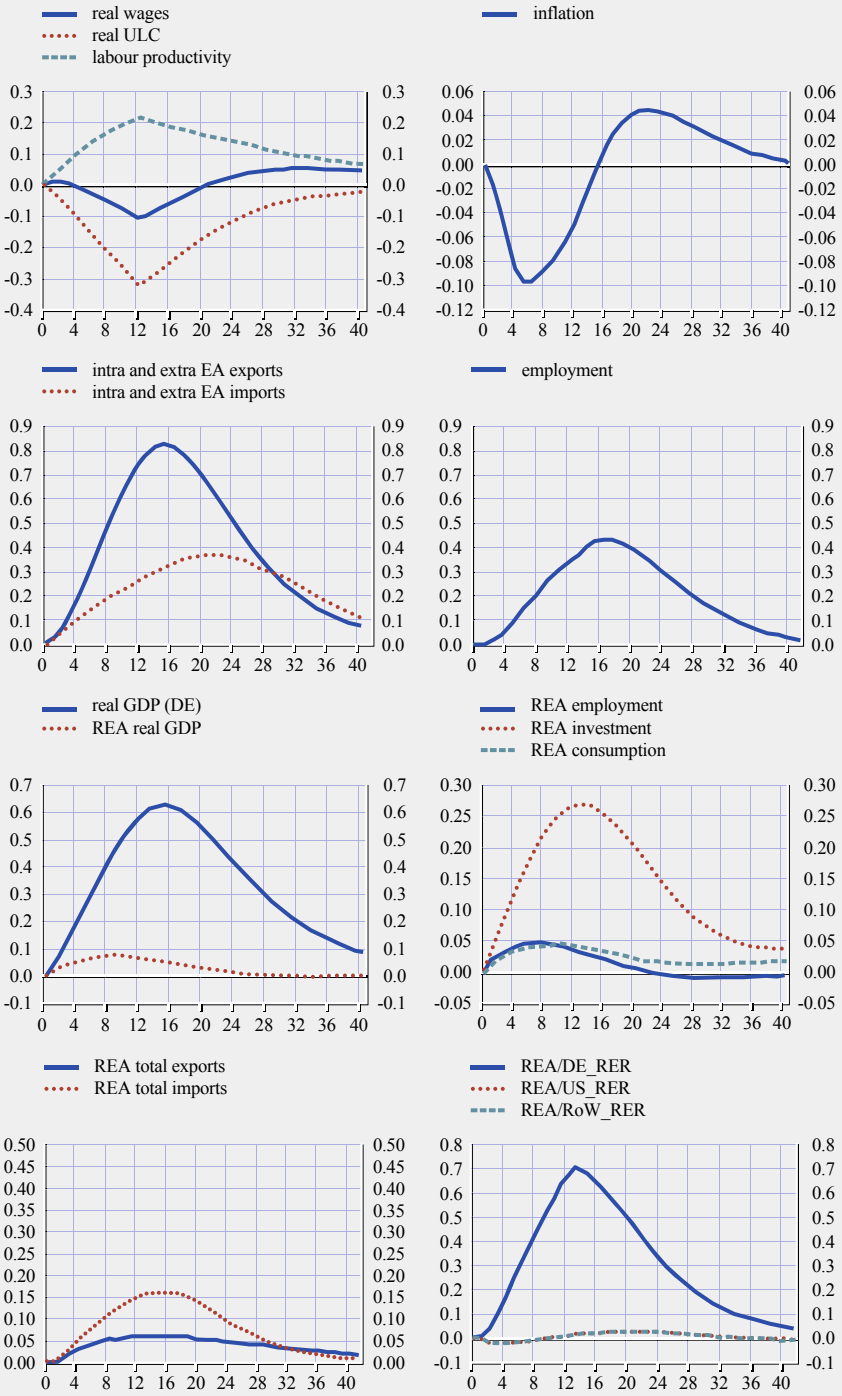
Looking at the rest of the euro area variables, the loss in competitiveness due to a relative increase of real unit labour costs produces a negative impact on net trade, mainly driven by the increase of imported goods from Germany. The REA real exchange rate (based on ULC) against Germany appreciates, whereas it slightly depreciates against the US and the RoW to absorb the excess supply of goods produced in the euro area.[4] In the REA, investment benefits from the lower price of imports from Germany, whereas the effects on the REA consumption and employment are small.

3 We target variables in terms of changes relative to the respective changes in the REA because it simplifies the analysis and presentation as it allows the number of shocks imposed on the model to be constrained.

4 The real exchange rate (based on ULC) is defined as follows:

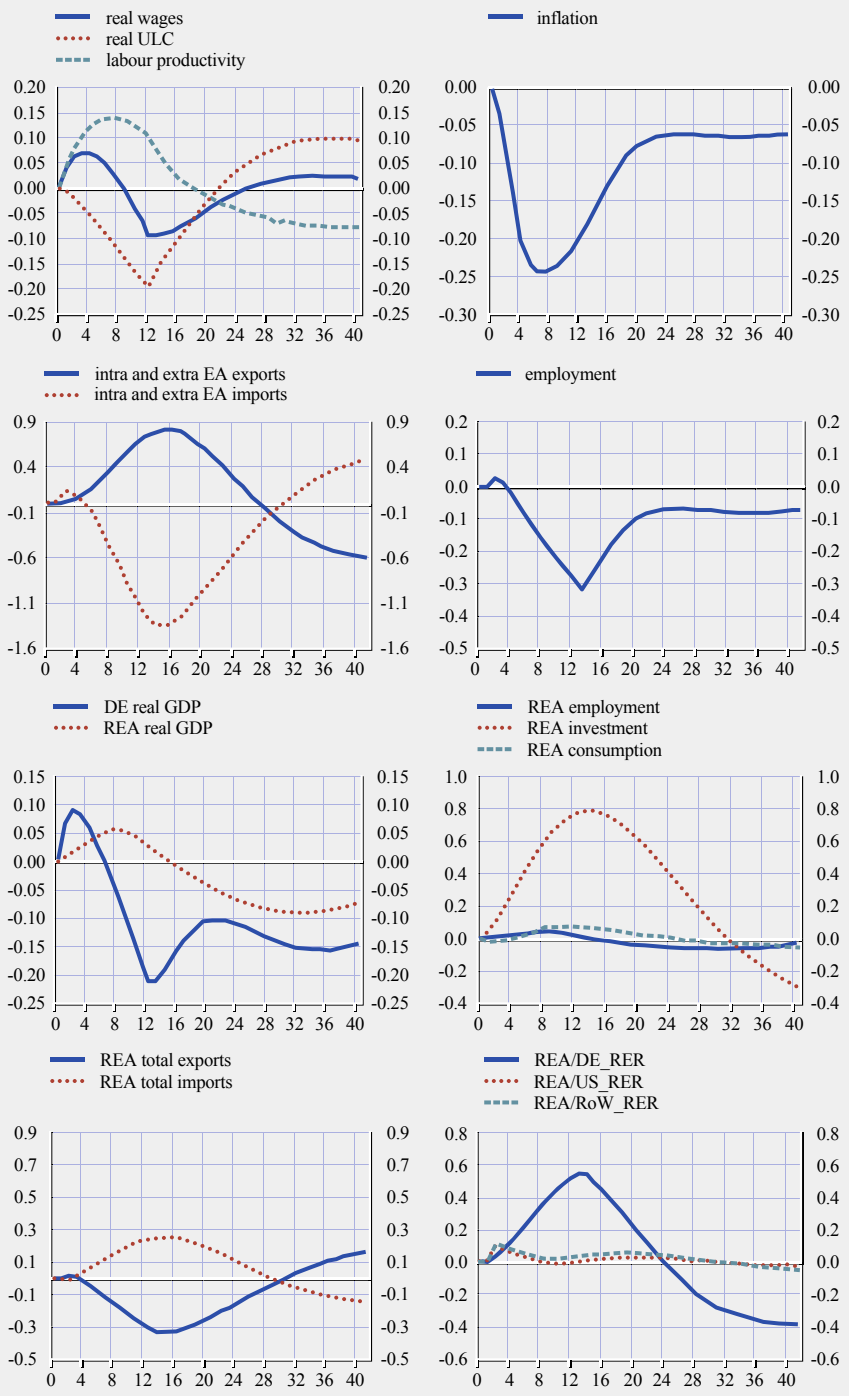
$$DE/REA\_RER = \frac{P^{DE} * ULC^{DE}}{DE/REA\_RER * P^{REA} * ULC^{REA}}$$

Chart 2 Dynamic effects of a decrease in unit labour costs in Germany (a)



Notes: This chart depicts the quarterly adjustment dynamics of selected macroeconomic variables after a shock to increase productivity and to reduce wage mark-ups. These shocks have been calibrated with a view to approximate the developments in the data as closely as possible. The dynamic effects are reported as percentage deviations from the baseline. The HICP is instead reported as year-on-year percentage change.

Chart 3 Dynamic effects of a decrease in unit labour costs in Germany (b)



Notes: This chart depicts the quarterly adjustment dynamics of selected macroeconomic variables after a shock to increase productivity and to reduce wage mark-ups as well as after an adverse negative demand shock. These three shocks have been calibrated with a view to approximate the developments in the data as closely as possible. The dynamic effects are reported as percentage deviations from the baseline. The HICP is instead reported as year-on-year percentage change.

While the model simulation of the combination of these shocks captures the developments in the main German macroeconomic variables over the period 2002-07 reasonably well, only part of the German export performance can be traced in this way. The model simulation implies an increase of the German exports relative to the rest of the euro area by 11% in cumulative terms over the period 2002-07, compared with an observed 27% increase.[5] This result might suggest that even though relative prices are critical factors determining a country's export performance, they only go some way to explaining country differences in export growth. Recent studies have indeed emphasised that a broad range of non-price factors crucially contribute to the ability to compete in international markets. Such factors include, among others, product quality and differentiation, technological advantage, industry specialisation, and the quality of the infrastructures and of the regulatory and tax frameworks. All of them affect the overall export performance through higher productivity growth, thus further reducing prices and costs.[6]

Finally, it is worth noting that our simulation gives rise to a large increase in German real GDP relative to the rest of the euro area. Such an increase is not observed in the actual data due to the subdued German domestic demand over this period. We therefore implement a further shock to private consumption and investment, together with the combination of shocks described above. Chart 3 shows that the introduction of a negative demand shock leads to a reduction of the real GDP relative to the rest of the area. The introduction of the negative demand shock also sheds light on the emergence of current account divergences among euro area countries. The negative demand shock, discouraging economic activity, has a negative impact on total imports in Germany; thus, the overall impact on the current account is bigger than in the previous simulation. On the other hand, this shock produces a downward impact on the REA total exports, amplifying the negative effect on the REA current account.

3 COUNTERFACTUAL SCENARIO: SPAIN

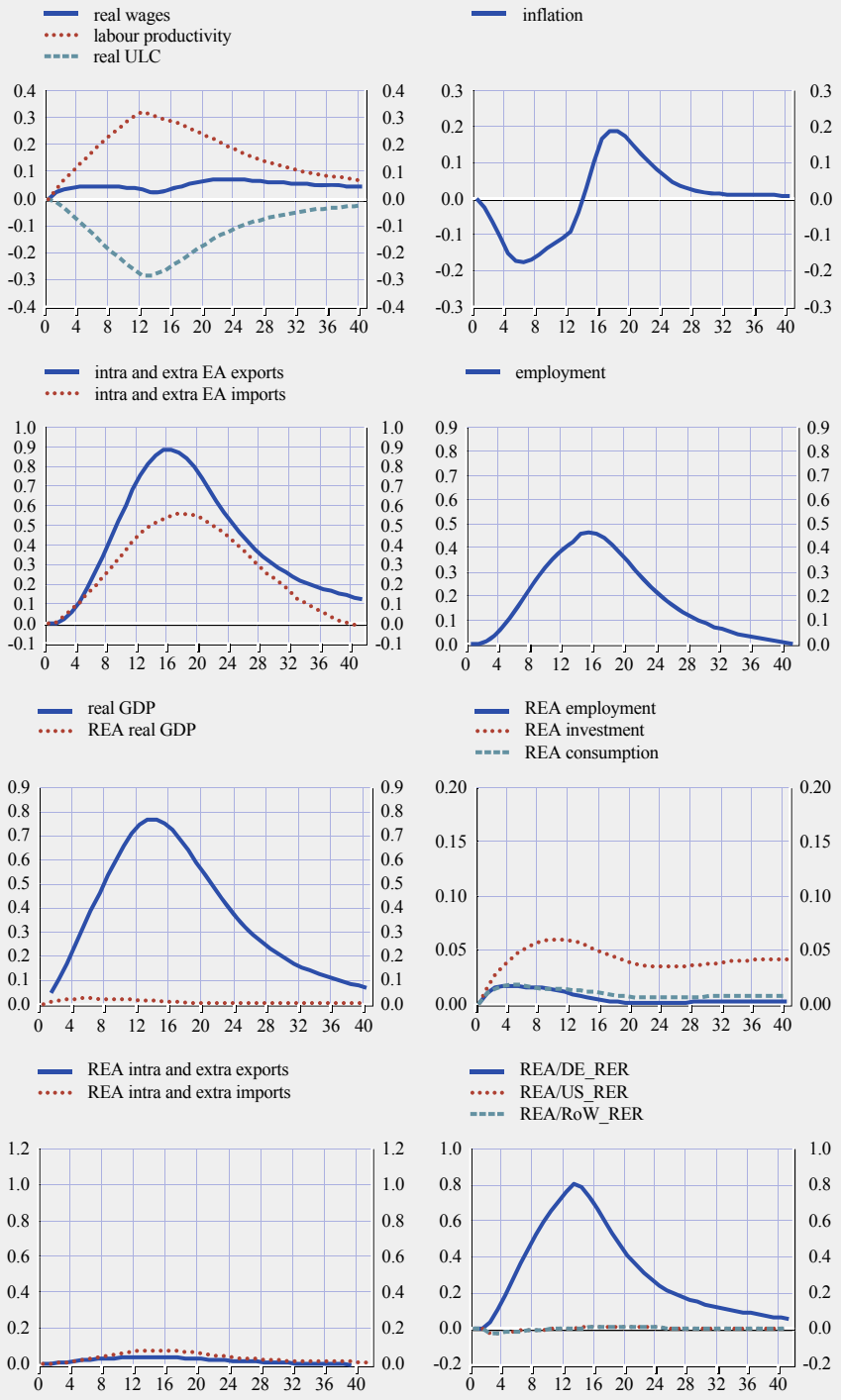
The counterfactual scenario presented in this section implements the same combination of productivity and wage mark-up shocks to the EAGLE model calibrated to represent Spain as a single euro area country and the other regions as described above.[7] The reduction of wage mark-ups and the increase in productivity produce a dynamic in the unit labour cost similar to that obtained with the "German" calibration. Looking at the different components, we observe that for Spain the competitiveness shock of the same size leads to a larger

5 As an overall caveat, the calibration implies certain assumptions on the identification of shocks and their mutual independence which are not necessarily "true". Obviously, the results of the simulation exercise are contingent on these assumptions – another mixture of shocks equally corroborated by the data may give rise to different results. Therefore, the simulation can only be understood as one of several possible narratives of the observed developments in Germany and the euro area.

6 See e.g. Hummels and Klenow (2005), Di Mauro, Forster and Lima (2010) and European Commission (2010).

7 For details of this calibration, refer to Kolasa (2010).

Chart 4 Dynamic effects of a decrease in unit labour costs in Spain



Notes: This chart depicts the quarterly adjustment dynamics of selected macroeconomic variables in Spain after a shock to increase productivity and to reduce wage mark-ups. The dynamic effects are reported as percentage deviations from the value obtained in the baseline without shock. The HICP is instead reported as year-on-year percentage change.

increase in productivity of about +5% in cumulative terms compared with 3% in Germany. This is owing to the higher calibrated value for the investment/GDP ratio in Spain as a consequence of the stronger domestic demand. Since the productivity gain triggers a larger decline in real marginal cost, domestic prices fall by more than in the German calibration. The reduction of the unit labour cost and the depreciation of the real exchange rate produce an expansionary effect on total exports (+12% in cumulative terms). Given the expansion of economic activity, total imports increase as well, but the net effect on trade is positive. Overall, the positive effect on net trade is lower than in the calibration for the German economy due to the lower home bias in Spain and stronger domestic demand.

Looking at the rest of the euro area variables, the improvement in the Spanish competitive position gives rise to positive but negligible spill-over effects to the rest of the euro area since both the REA real GDP and net trade increase marginally (see Chart 4).

4 CONCLUSION

Our results show that the relative reduction of prices and costs in Germany vis-à-vis the rest of the euro area can explain only part of the German export performance over the pre-crisis period. Therefore, non-price competitiveness factors must have also increased the attractiveness of German goods abroad, as well as boosting productivity, thus further reducing prices and costs.

The simulations also show that improvements of a country's competitive position through structural reforms aimed at increasing productivity and competition in labour markets generally produce positive spill-over effects to the rest of the euro area. The resulting reduction in unit labour costs can indeed increase domestic output, consumption, investment and employment in the long run, while part of the additional demand can go into imports, thus directly enhancing output in foreign countries. In the German calibration, these positive effects on foreign output are mitigated by the subdued German domestic demand, which causes a downward impact on REA total exports over the period considered.

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PART 4

FIRM/PRODUCT LEVEL RESULTS

CHAPTER 14

GLOBAL SUPPLY CHAINS, THE GREAT TRADE COLLAPSE AND BEYOND: MORE ELASTICITY OR MORE VOLATILITY?

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The crisis in 2008-09 highlighted the increasing role of global supply chains in international trade. Global outsourcing was blamed for having structurally altered the elasticity of trade to GDP, contributing to global imbalances and amplifying the transmission of external shocks. In this chapter, we present evidence on the long-term trade elasticity which tends to discard the hypothesis of a structural shift. Rather, the apparent increase in trade elasticity observed in the 1990s is related to the transition between two different industrial models. Once the transition to the "global manufacturing" model matures, vertical integration should only affect the level of trade relative to GDP but not its elasticity.

1 INTRODUCTION

The recent phase of globalisation, starting in the emblematic year of 1989, saw the emergence of new business models that built on new opportunities to develop comparative advantages (Krugman, 1995; Baldwin, 2006), while disconnecting once again production and consumption.[1] The opening of new markets and the closer integration of economic models worldwide has developed into a constant flow of investment, of technologies and technicians, of goods for processing and of business services. These global value chains combine

1 1989 witnessed the fall of the Berlin Wall and the post-WWII world barriers, and Brady Bonds, which put an end to the decade-long debt crisis that plagued many developing countries. During the 1990s, the conclusion of the Uruguay Round and the birth of the WTO led to further liberalisation in trade and in key services sectors.

two interlinked networks: a demand chain, typically centred on developed markets, and a supply chain, increasingly internationalised.[2]

The greater industrial interconnection of the global economy has also created newer and faster channels for the propagation of adverse external shocks.[3] Referring to the breakdown of 2008-09, some authors have pointed out that they may explain the abrupt decrease in trade or the synchronisation of the trade collapse. This crisis has been dubbed the "Great Trade Collapse" for its impact on international commerce. The collapse of world trade was unprecedented, even in comparison with the Great Depression of the 1930s (Eichengreen and O'Rourke, 2009).

One reason for blaming global value chains and "trade in tasks" for the depth of the crisis is the inherent magnification effect of global production networks: intermediate inputs may cross the border several times before the final product is shipped to the final customer. Because all the different production stages of the global value chain rely on each other, as suppliers and as customers, an external shock is transmitted quickly to the other stages of the supply chain through both backward and forward linkages. Therefore, global supply chains are expected to influence not only the depth of the variation (trade elasticity) but also its speed (trade volatility).

This chapter explores in Sections 2 and 3 some of the stylised facts that support the hypothesis of a structural change in world trade, exploring import multipliers for a larger selection of countries, regions and sectors. Section 4 develops a formal dynamic model incorporating short-run and long-term components. Section 5 looks into the short-term dimensions of volatility, and the final section concludes.

2 GLOBAL SUPPLY CHAINS AND TRADE ELASTICITY DURING THE GREAT TRADE COLLAPSE

Trade reacted very strongly to the first signs of recession in 2008 (Chart 1), with a decrease of much higher magnitude than the fall in GDP. Similarly, trade rebounded strongly in 2010, much faster than the underlying world economy. Contrary to the fears of deglobalisation which accompanied the large drop of 2008-09, this robust recovery tends to entail the existence of a higher trade

2 Value chain analysis is a concept borrowed from business management (Stadtler, 2008). For the Council of Supply Chain Management Professionals, supply chains include "all activities involved in sourcing and procurement, conversion, and all logistics management activities [including] suppliers, intermediaries, third-party service providers, and customers."

3 Incidentally, by helping US firms to improve their productivity, global manufacturing contributed to the low interest rate policy that paved the ground for the financial bubble which burst in 2008. Thanks to higher factor productivity, the potential output in manufacturing increased in line with actual production, without creating the wage-inflationary pressures that would have forced a change in the lenient monetary policy.

elasticity.[4] Such high elasticity, if confirmed, paves the way for risky exit scenarios. Emerging countries remain coupled with western economies, due to their export-led growth model. Dependent on the global supply chains to sustain their economy, they would collapse as a result of the rebalancing required to reduce the trade disequilibria between western and eastern countries (themselves blamed on the same export-led and global outsourcing strategies).

Over the 1980-2009 period, the world trade elasticity was close to 2.3; in other words, the volume of trade increased, on average, by more than twice as much as world GDP.[5] However, it is probably misleading to consider that this elasticity was constant over the period. To explore possible changes, we redo the estimations using rolling time windows of 10 years, adding one year at each step. As seen in Chart 2, the results point to some sort of bell-shaped curve. From the 10-year period ending in 1989 to the one finishing in 1998, we observe a steady increase in trade elasticity, from 1.6 to 3.0. Afterwards, elasticity decreases again, to a level of about 2.3 between 2004 and 2008.

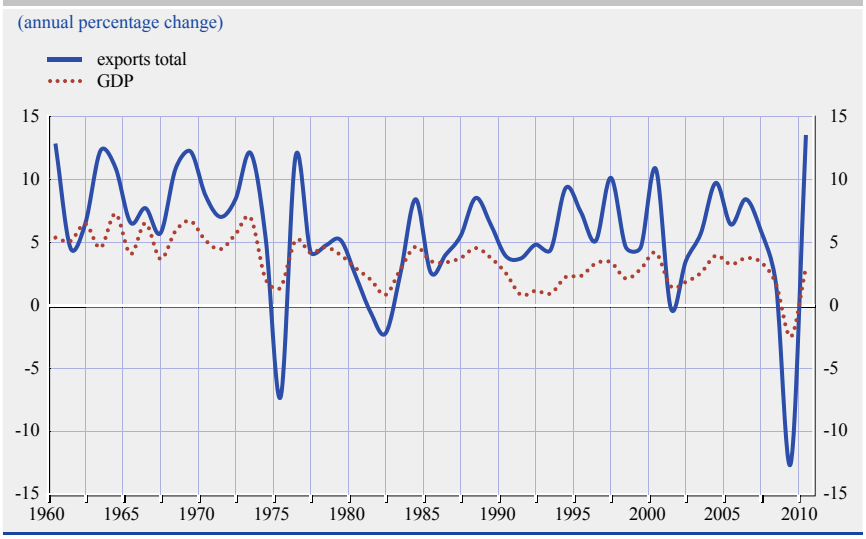
4 Elasticity measures the responsiveness of demand or supply to changes in income, prices or other variables. This chapter focuses on the macro-economic income elasticity of trade.

5 Elasticity refers to the change of imports during a given period related to the corresponding change in GDP. An elasticity of 1 means that changes are strictly proportional. A simple way to calculate the average annual elasticity over a period of time is to estimate the following model through ordinary least squares:

$$m_t = \alpha + \beta\, y_t + \varepsilon_t$$

where β = an estimate of the average elasticity, m_t = logarithms of world imports, y_t = logarithms of world GDP and ε_t = residuals.

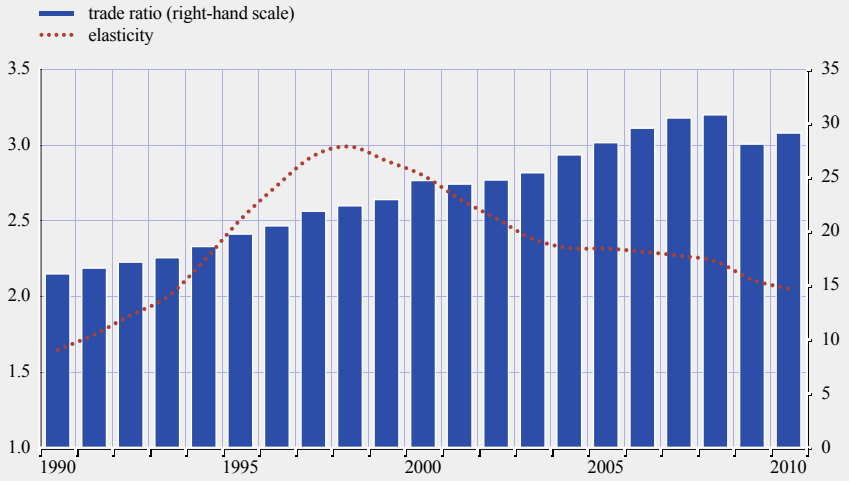
Chart 1 World merchandise exports and GDP, 1960-2010



Sources: WTO, International Trade Statistics and 2011 Press Release.

Chart 2 World: GDP elasticity of imports – rolling windows of 10 years

(GDP weighted at Mkt Xrates; trade GDP at 2005 prices)



Sources: Escaith and Lindenberg, 2009.

What could have caused such a hump-shaped profile? Among the structural changes that have impacted the way trade has been conducted since the last decade of the 20th century is the geographical slicing-up of the value chain into core and support activities, and the emergence of "trade in tasks". An early appraisal of the extent of outsourcing can be found in Feenstra (1998) who compares several measures of outsourcing and argues that all have risen since the 1970s. There are clear signs that export-led growth among developing economies has been associated with a higher reliance on imported inputs.

Referring to production sharing and the value-added content of trade, Johnson and Noguera (2009) observe that countries systematically shift towards manufacturing exports, which have a lower value-added content on average, as they grow richer. This shift depresses the ratio of aggregate value added to export per unit value, and increases the ratio of trade to industrial GDP.[6] These authors show that the largest exporters among developed countries (Germany and the United States) see their value-added content scaled down due to a more integrated production structure with their respective regional partners (NAFTA for the United States, and the European Union for Germany).

While attributing higher elasticity to global supply chains is tempting, the arithmetic of input-output models – the basis of most general equilibrium models used to analyse structural changes in an economy – shows that elasticity

6 Obviously, diversifying into manufacturing allows developing countries to increase labour productivity and generate more income per capita. Richer countries are not characterised by the intensity of the value added created, but by its expansion.

should stabilise close to unity when the economy has settled in its new productive pattern.[7]

From the perspective of global value chains, it is therefore appealing to attribute the stylised fact observed in Chart 2 to a once-and-for-all change in global business models, which took place in the 1980s and 1990s. The geographical fragmentation of international supply chains led to an increase in the trade-to-GDP ratio, as components and goods for processing were increasingly moving across borders. During the transition from one business model centred on the national territory to another one based intensively on global supply chains, the trade elasticity changed: it increased during the years of rising globalisation in the 1980s and 1990s, before decreasing again when a new global state was reached in the mid-2000s. The trade elasticity has stabilised at a higher level than before because some transition is still taking place.

3 GLOBAL, SECTORAL AND REGIONAL TRADE ELASTICITY PATTERNS

The objective of the following sections is to explore more thoroughly the long-term evolution of the trade-to-GDP elasticity, looking for regional or country-specific patterns. The exploratory data analysis is carried out by comparing the evolution of trade elasticity for different sub-groups of countries.

3.1 EXPLORING COUNTRY PATTERNS

The GDP elasticity of imports for each of the 50 most important world exporters is estimated over three periods: 1980-1990, 1990-2000 and 2000-2008. The results provide a first idea of how the elasticity of imports has been evolving for each country over time. Over the possible 3x3 combinations, the results boil down to 5 clusters: cluster 1: countries with an increasing elasticity over the full sample, which overshoot in the middle of the sample; cluster 2: countries with an increasing elasticity over the full sample; cluster 3: countries with an increasing elasticity over the full sample, but with a drop in the middle of the sample; cluster 4: countries with a decreasing elasticity over the full sample, but with an increase in the middle of the sample; and cluster 5: countries with a decreasing elasticity over the full sample. Only the first cluster of countries shows a trend compatible with our hypothesis of global value chains being the cause for the change in elasticity. Yet, many countries known for their participation in global value chains, like Germany, China or Mexico, do not belong to cluster 1.

As clustering by pure elasticity patterns cannot confirm the hypothesis of global value chains being the driving force behind the change in the GDP elasticity of

7 This result, obtained by simulating external shocks on CGE models (Benassy-Quéré et al., 2009) can be derived formally in steady state from their underlying input-output model with complementary production factors: once the economy has adjusted to its new equilibrium, any increase in the production of the bundle of final goods requires a strictly proportional increase in the demand for all inputs, domestic and imported. Shifts between imported and domestic inputs can only be observed during adjustment periods.

imports, we rearrange countries according to their export specialisation: (i) fuel exporters; (ii) ores, metals, precious stones and non-monetary gold exporters; (iii) manufactured goods exporters; (iv) machinery and transport equipment exporters; and (v) other manufactured goods exporters. Again, the patterns of the calculated elasticities change significantly among the different clusters of countries. The elasticity of the group of fuel exporters increases steadily, which is probably the terms-of-trade effect mentioned above and has nothing to do with the globalisation of value chains.

For the manufacturing sector, both for the aggregate (manufacturing exporters) and for the two sub-groups (machinery exporters and other manufactured goods exporters), there have been three peaks in trade elasticity: the first one in 1990, the second in 1998, and the third in 2005. Each time, elasticity has decreased in between. This, however, does not support the hypothesis of an impact of value chains on the elasticity either. Thus, we still do not find overwhelming evidence of the involvement of globalised value chains in the changes in trade elasticity.[8]

4 TRADE AND GDP IN THE CONTEXT OF GLOBAL VALUE CHAINS: A FORMAL ESTIMATION

The previous sections were exploratory and no formal assumption was made on the kind of relationship existing between imports and GDP. We now assume that there is a long-run equilibrium relationship between the growth of trade and the growth of GDP, i.e. the elasticity is stable in the long run. To disentangle the short-run elasticity fluctuations from the long-run equilibrium evolution, we use an Error Correction Model (ECM). We work with quarterly data in constant prices from the OECD National Accounts database over the period 1970-2010.[9]

4.1 STEADY-STATE ELASTICITY

We start with a very simple proportional relationship between trade and GDP: $M_t = QY_t$, where M_t are imports (in volume), Y_t is real GDP and Q is the share of imports in GDP. Assuming that there is a long-run equilibrium relationship between M and Y, and that m^* and y^* are the equilibrium values of m and y, we have – after some manipulation – a classic specification of an ECM:

$$\Delta m_t = \alpha_0 + (\alpha_1 - 1)(m_{t-1} - y_{t-1}) + \beta_1 \Delta y_t + (\beta_1 + \beta_2 + \alpha_1 - 1) y_{t-1} + u_t$$

8 Yet another way of clustering the countries by export specialisation, using the main export products of each country, does not change the result qualitatively either: the hypothesis of an impact of the global supply chains on the changes in the GDP elasticity of imports can still not be confirmed by our exploratory data analysis. The results of this robustness check can be found in Escaith, Lindenberg and Miroudot (2010).

9 Year-on-year change, volumes in USD (fixed PPPs, OECD reference year), seasonally adjusted.

Table 1 Long-run trade elasticity for 25 OECD countries (panel estimation)

	Time period				
	1970-2010	1970s	1980s	1990s	2000s
Dependent variable: Δm_t					
m_{t-1}	-0.024[1)]	-0.214[1)]	-0.115[1)]	-0.100[1)]	-0.119[1)]
Δy_t	1.455[1)]	1.290[1)]	1.404[1)]	1.683[1)]	1.799[1)]
y_{t-1}	0.045[1)]	0.291[1)]	0.198[1)]	0.227[1)]	0.214[1)]
Number of observations	3,974	974	1,000	1,000	1,000
R-squared	0.21	0.24	0.19	0.35	0.39
Long-run trade elasticity (δ_3/δ_1)	1.84	1.36	1.72	2.27	1.80

Note: OLS estimation of the Error Correction Model, with robust standard errors and country fixed effects.
1) p<0.01
2) p<0.05
3) p<0.1

The coefficients β_1 and β_2 indicate the short-run impact of a change in GDP on imports. (α_1-1) is the speed at which trade adjusts to the discrepancy between trade and GDP in the previous period. This is the error correction rate.

After checking for the degree of integration, the regression is run on 10-year panel data for 25 OECD economies (1970-2010), to mimic the approach used in Chart 2. The results are presented in Table 1 above.

Of special relevance to our present concern, the last row of Table 1 reports the implied long-run trade elasticity (γ). Its overall value of 1.84 over the 1970-2010 period is slightly lower than the elasticity measured in the previous section (2.3). The elasticity measured for the 1990s is however close (2.27) despite a different statistical model and different data. As hypothesised, the trade elasticity increased up to the 1990s and appears to have decreased afterwards.

The ECM formulation allows us to simulate the trade response to an external shock, or "impulse response function". On average in the OECD area, a 1% decrease in GDP induces an overshooting of imports, which drop by 3% during the first year. Then, trade recovers during the second and third years; four years after the initial shock, the decrease in trade is about 2%, in line with the long-run elasticity.

Following the same protocol that was used for the exploratory analysis in the previous section, the model is applied to individual country data. Again, ECM disaggregated results tend to differ from the aggregate estimation. While all OECD countries show an increase in trade elasticity up to 1990, the expected decrease in elasticity after 2000 is clearly observed only for France, Greece, Italy, Mexico, the Netherlands, New Zealand, Spain, Turkey, the United Kingdom and the United States. In other countries, either the elasticity is not significant from a statistical perspective, or it continues to increase in the 2000s. Also, the disaggregated results using an ECM tend to differ from those obtained during

the exploratory analysis using the simple OLS model described in Equation 1 (see footnote 6).

4.2 ROLE OF VERTICAL SPECIALISATION

In order to check more precisely for the influence of global value chains on the change in trade elasticity, we introduce a vertical specialisation variable in the model.[10]

The estimated equation becomes:

$$\Delta m_t = \alpha_0 + \delta_1 m_{t-1} + \delta_2 \Delta y_t + \delta_3 y_{t-1} + \delta_4 VS^* y_{t-1} + \delta_5 VS + \varepsilon_t$$

where VS is the country vertical specialisation share, calculated as in Hummels et al. (2001).[11] VS is closely related to the share of imported intermediate goods in exports, from an input-output perspective. The vertical specialisation variables slightly increase the goodness-of-fit of the model for most countries but are not always significant.

The results of formal modelling thus confirm the evidence presented in the exploratory analysis. The long-term elasticity of world trade to world GDP increased in the 1990s before decreasing at the end of the 2000s. This global pattern of lower elasticities in the late 2000s is not systematically reproduced at country level, suggesting that vertical specialisation is not the only factor affecting trade elasticity. Nevertheless, world trade elasticity was much lower in 2008 (when the global crisis started) than during previous financial crises, e.g. in Asia in 1997. Consequently, rising trade elasticity cannot explain by itself the collapse in world trade observed in 2008-09.

5 SUPPLY CHAINS AS TRANSMISSION CHANNELS

If global supply chains do not lead to structurally higher trade elasticity in the long term, their role in explaining the 2008-09 trade collapse should be investigated from a different angle. For example, Bergin et al. (2009) find that, on average, the fluctuations in value added in the Mexican outsourcing firms are twice as high as in the United States. Global manufacturing may have contributed to the Great Trade Collapse of 2008-09 not because of rising structural trade elasticity, but rather by raising the short-term sensitivity of trade to changes in GDP. By interconnecting more closely the supply and demand cycles of an increasing number of economies, the emergence of global manufacturing has created new transmission channels for external shocks, originating in the financial, supply or demand compartments of the world economy.

10 Cheung and Guichard (2009) suggest that the way vertical specialisation affects trade is by raising its elasticity with respect to income.

11 Data come from Miroudot and Ragoussis (2009). Time series have been created over the period 1995-2010, with only 3 observations (1995, 2000 and 2005 for most countries) for vertical specialisation. The assumption is that vertical specialisation remained stable between the three data points.

5.1 COMPOSITION EFFECTS

As mentioned in footnote 7, once an economy has reached a new equilibrium, any change in the bundle of final goods lead to a proportional change in the demand for imported inputs. But the financial crisis did not affect final demand equally across industries. Sectors producing consumer durable and capital goods were on the front line, as demand for these products relies on credit. The collapse in trade mostly affected merchandise; except for financial transactions, commercial services, other than those related to trade in goods, were more resilient. As a result, world trade – mainly composed of goods – dropped five times more rapidly than global GDP, where services dominate.[12] In addition, because supply chains cover various countries, a lot of double-counting takes place, while goods for processing cross borders at each step of the production process.

5.2 INVENTORY EFFECTS

The speed of recent changes in the apparent trade elasticity are also probably linked to global supply chain management practices. Even under "just-in-time" management (production-to-order), geographically fragmented networks need to maintain a minimum level of inventories (buffer stocks) in order to face the usual risks attached to international transportation. While large players try to keep their inventories at the lowest possible level considering their sales plans and the acceptable level of risk, they tend at the same time to force their suppliers to maintain large stocks (production-to-stock) in order to be able to supply them quickly upon request. When a drop in final demand reduces the activity of downstream firms, and/or when they face a credit crunch, their first reaction is to run down their inventories. Thus, a slowdown in activity transforms itself into a complete standstill for the supplying firms that are located upstream. These amplified fluctuations in ordering and inventory levels result in what is known as a "bullwhip effect" in the management of production-distribution systems (Stadtler, 2008). As long as the downstream inventories have not been reduced to their new optimum level, suppliers face a sudden stop in their activity and must reduce their labour force or keep it idle.

5.3 TRADE FINANCE

Some 80% to 90% of world trade relies on some sort of trade finance, mostly of a short-term nature. Financing supply-chain operations – especially for small- and medium-size companies – is crucial to modern trade, and the potential damage to the real economy of shrinking trade finance is enormous (Auboin, 2009). Starting from a dual approach mixing international input-output matrices and monetary circuits, Escaith and Gonguet (2011) study the potential role of international supply chains as transmission channels for financial shocks. In particular, a credit crunch affecting trade finance can have a strong disruptive impact on international supply chains. Nevertheless, Levchenko et al. (2010) do not find support for the hypothesis that trade credit has been important for the 2008-09

12 Trade in services showed some resilience to the crisis when trade in goods was severely affected (Borchert and Mattoo, 2009).

collapse. Available firm-level data in two European countries during the crisis seem also to support the view that the traditional impacts of financial restriction on final demand, through a reduction of the intensive margin, dominated the supply-driven microeconomic disruptions that would have affected specific industrial channels through the extensive margin: Bricongne et al. (2010) show that the impact of credit constraints on the trade collapse has been rather limited for French firms; similarly, Behrens, Corcos and Mion (2010) conclude that the collapse of export volumes for Belgium firms was caused by a standard demand-driven trade shock. Yet the empirical debate remains open, as large firms, dominant in international trade, have not faced particular liquidity problems during the crisis; furthermore, firms located in emerging countries are more exposed to shocks reducing trade finance (Menichini, 2009).

6 CONCLUSION

Looking at the evolution of world trade elasticity over the past two decades, there are clear signs that an important structural change occurred in the middle of the 1990s: elasticity rose during the 1990s, before falling in the late 2000s. This pattern is possibly the consequence of the new "global manufacturing" model, where countries trade intermediate goods for further processing, in the context of global supply chains resulting from the fragmentation of the production process. Once established as the dominant manufacturing model, vertical integration should only affect the level of trade relative to GDP but not its elasticity. Accordingly, from the late 1980s onwards, the internationalisation of production has caused a shift from one economic state to a new one, with trade elasticity rising only during the transition phase. Once the transition is over and the new model reaches maturity, trade elasticity returns to its lower long-run level, even if trade now represents a higher share of GDP.

This pattern observed for the aggregate world economy is also found in many countries, including leading economies like Japan and the United States.[13] However, other countries which are also known for their participation in global value chains, like Germany, China or Mexico, are not showing the expected long-term increase in trade elasticity. Indeed, a more detailed analysis showed significant differences among trade elasticities for different countries and sectors. Overall, we rather tend not to accept without reserve the hypothesis that global value chains explain all by themselves the change in trade-income elasticity.

Other factors are probably also contributing to this structural change. For example, the structural shift of trade elasticity up to the early 2000s could also have been influenced by the gradual emergence in the world economy

13 Using a comparative static approach based on input-output matrices over the 1990-2008 period, Escaith et al. (2010) show that the export elasticity of imported inputs is about 1.7 for the US and Japanese economies, while it remains close to 1 for Asian developing countries. Considering the relative size of these economies, this would indicate that the increase in the weight of intermediate goods in world trade is the result of the change in business models in developed economies, rather than due to the emergence of developing countries.

of large developing countries, with higher trade-to-GDP ratios than the large post-industrialised western economies, even if individual country trade elasticity remained constant. Fast-rising oil and mineral prices in the early 2000s created a terms-of-trade effect between commodity and manufacture exporters, reducing the purchasing power of most importing countries and reversing decades of low commodity prices since the 1980s. The progressive lowering of trade barriers after the conclusion of the Uruguay Round in 1995, or the increasing taste of consumers for diversity as their income increased, could also produce the observed shape of trade elasticity.

These results also indicate that the trade collapse observed in 2008-09 cannot be explained by the long-term structural change observed in the data and that the high trade elasticity measured in the course of the crisis are of a short-term nature. Moreover, two value chain related factors are at work to explain the overshooting of trade elasticity that occurred during the 2008-09 trade collapse. The first one is the composition effect, as the initial demand shocks linked to the credit crunch were concentrated disproportionately on consumer durables and investment goods, the most vertically integrated industrial sectors; the second one is the "bullwhip effect" where inventory adjustments are amplified as one moves upstream in the supply chain. But the disturbance is expected to dissipate and the elasticity to return to its long-run value.

From these findings, several policy implications can be identified. The 2008-09 crisis has highlighted new dynamics between trade and GDP. The severity of the Great Recession is not explained by the higher trade elasticity created by the fragmentation of global manufacturing, but by the sheer size of the initial financial shock and the new microeconomic transmission channels created by global supply chains. It is not because of global supply chains *per se* that industries, such as the automotive industry, were severely impacted, but rather because of underlying trends, in particular shifts in demand and consumer preferences.

Thus it is more a tale of greater economic interdependence and short-term volatility than growing trade elasticity and unwarranted systemic instability. Trade and investment are more and more intertwined, and in the context of vertical specialisation, imports of intermediate inputs are associated with more exports to third countries. Even if this closer interconnection is a new source of shock transmission, from a longer-term perspective, global manufacturing and the internationalisation of value chains remain important sources of productivity gains for both developed and developing economies. The current reorganisation of Asian production networks (Inomata and Uchida, 2009) shows that countries that were originally part of North-South global value chains and specialised in final assembly are now shifting to the production of upstream inputs and are part of regional production networks that produce for domestic consumers who have benefited from increased income in the context of global production. These long-run dynamics should promote a reassessment of the protectionist temptation observed in some developing countries as a result of the crisis.

Moreover, as trade elasticity was not the cause of the 2008-09 Great Trade Collapse, trade "remedies", posing as a disguise for murky protectionism, are certainly not the solution. Imports of intermediate goods can improve firm productivity and export competitiveness; conversely, policies that restrict access to foreign sources of intermediate goods and services are more likely to produce firm closures and job losses – the very outcomes they were designed to prevent. This greater interconnection calls for more cooperative and coordinated solutions to global challenges, and a deepening of the G20 collective effort initiated in April 2009.

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CHAPTER 15

TRADE RESPONSES IN EUROPE: IS THERE ANYTHING WE CAN INFER FROM FIRM HETEROGENEITY?

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This chapter focuses on the microeconomic firm-level factors that might explain the large heterogeneity in trade performance observed among European countries, in particular in terms of sensitivity to exchange rate and foreign demand developments. The chapter highlights the role of industrial structure, and in particular the size distribution of firms. Larger firms are better equipped to enter new distant markets and display a greater elasticity of exports to demand. Given that the average size of German (and, to a lesser extent, French) firms is substantially larger than that of their Italian and Spanish rivals, we would expect the German and French firms to benefit to a greater extent from the expected large increases in demand in emerging economies.

1 INTRODUCTION

The increased integration of real and financial markets at the global level has made a country's overall growth performance more reliant on its trade competitiveness than in the past and, more in general, more reliant on its ability to operate on a global scale. This is particularly true for the European countries that have gone through a process of internal market integration, including, for many of them, the introduction of a single currency. On top of that, the recent crisis has shown that the heterogeneity in trade imbalances (from the German surplus of 6.4% of GDP to the Spanish deficit of 9.7%) is one of the key causes of macroeconomic instability throughout the region. Therefore, understanding the roots of trade performance and global involvement is an essential for policy-makers.

As shown in Chapter 2, there is a high degree of variation in trade performance across EU countries. Germany is by far the most export-oriented, with exports representing 39.9% of its gross domestic product, followed by Italy (23.4%), France (21.3%), UK (17.2%) and Spain (16.7%). Since 1999 and despite the common currency, the main euro area countries have registered very different performances: Germany has increased its world export market share, while those of Italy and France have decreased. During the recent world recession,

the collapse of exports also differed significantly across countries. And in the current recovery, Germany is again outperforming Italy and France.

So what factors can explain such country heterogeneity in sensitivity to exchange rate and foreign demand developments? And how can we explain the ability of individual European countries to respond to the new geography of global demand and to the large exchange rate fluctuations following the crisis?

Some of the variation, of course, resulted and will result from country-specific features such as macroeconomic policies, market size or infrastructure. This chapter takes a different perspective and starts from the idea that it is firms that are at the heart of European competitiveness. Firms carry out global operations, exporting to, importing from and producing in foreign countries. Thus we believe that a crucial issue for policy-makers is to understand to what extent the global reach and the international performance of European economies are determined by the characteristics of their firms, independently of the other features of their national economies. This is especially important because the key characteristics of firms, and their distribution within each country, vary greatly across Europe.

The heterogeneous nature of firms' export behaviour is substantiated by a now large number of empirical studies (Roberts and Tybout (1997); Bernard and Jensen (1999, 2004a, 2004b); and Mayer and Ottaviano (2008)), the findings of which are consistent with the predictions of the theoretical works that first nested firm heterogeneity in trade models (Melitz (2003); Bernard et al. (2003); and Melitz and Ottaviano (2008)). Exporting firms are generally larger, more productive, more profitable and more capital-intensive than non-exporters, and they pay higher wages. It is "harder" to export than to sell in domestic markets and so only the "better" firms are able to do it. The difficulty of exporting is ascribed to the presence of fixed costs specific to export activity, such as product transport, distribution and marketing costs, or the costs of hiring qualified personnel to manage relations with international customers.[1]

The same framework of analysis can be used to gauge potential responses to different types of trade shock, and therefore future trade responses. Specifically, Das, Roberts and Tybout (2008) proposed a structural export model with heterogeneous firms, in order to estimate the impact of changes in trade elasticities on a country's exports from the perspective of firms' adjustments. The aggregate export response depends on the entry costs firms must pay to start

1 The hypothesis of fixed export costs was first put forward by Baldwin (1988 and 1989), Baldwin and Krugman (1989), Dixit (1989) and Krugman (1989), and underlies theoretical models with heterogeneous firms à la Melitz (2003). It posits fixed export costs as a barrier to entry in foreign markets that the less productive firms are unable to overcome. Starting with the work of Roberts and Tybout (1997), numerous empirical studies have corroborated this hypothesis (Bernard and Wagner (1997) for Germany, Bernard and Jensen (2004b) for the United States, Campa (2004) for Spain, Poddar (2004) for India, Girma, Greenaway and Kneller (2004) for the United Kingdom, and Castellani (2002) and Bugamelli and Infante (2003) for Italy). At the same time, even among exporters there is a lot of heterogeneity, with a large number of small exporters and a few "superstars", which alone account for the bulk of the respective national exports (Mayer and Ottaviano (2007)).

exporting in a new market, expectations with regard to the exchange rate process, prior exporting experience, and producer heterogeneity. The response of a country (or a sector) to an exchange rate or foreign demand shock may therefore significantly vary according to each of these factors. In particular, Das, Roberts and Tybout (2008) decompose firm responses into the extensive and intensive margins of trade. Whenever a trade shock hits an economy, firms must decide whether to start or keep exporting (extensive margin) and, given the choice of exporting, how much to export (intensive margin). Importantly, as pointed out by the authors (p. 838), "*These two margins of adjustment – volume and entry – have distinct determinants and lead to different supply elasticities, so seemingly similar industries with different degrees of foreign market experience may respond quite differently to exporting stimuli*". The model is estimated using Colombian firm-level data. The results reveal some interesting heterogeneities. The impact of an exchange rate depreciation, for example, on the extensive margin of exports is non-negligible only in sectors where, before the shock, there were few exporters, little heterogeneity between exporting and non-exporting firms, and in which the level of sunk entry export costs is relatively small. In these conditions, in fact, a shock is more likely to push a substantial number of non-exporting firms above the "export threshold". When these conditions do not hold, the export response is mostly driven by the intensive margin, that is by incumbent exporters increasing their foreign sales. The impact via the intensive margin depends on the exchange rate elasticity of profits: the authors show (p. 857) that since "expected payoffs to large producers are much more sensitive to the exchange rate than payoffs to small producers", the aggregate increase in exports is much larger in sectors that are populated by a greater share of large exporters.

The above approach provides useful insights that allow us to understand the export responses of European firms. Another helpful source in this regard is the new European firm-level survey run within the EFIGE project[2]: the survey provides comparable and homogenous evidence on firm-level exports and many other characteristics of 7 EU countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom).

2 The EFIGE project (*European Firms in a Global Economy: Internal Policies for External Competitiveness*) is funded by the Seventh Framework Programme of the European Union (FP7, for the period 2007-2013, under the theme Socio-economic Sciences and Humanities), under grant agreement No 225551, and by Unicredit Group. The project is coordinated by Bruegel in partnership with various European research institutes (University Carlos III of Madrid, Centre d'Etudes Prospectives et d'Informations Internationales, Centre for Economic Policy Research, Institute of Economics of the Hungarian Academy of Sciences, Institute for Applied Economic Research, Centro Studi Luca d'Agliano and Unicredit). Some European national central banks joined the project as associate partners. The scientific coordinator of the project is Gianmarco Ottaviano (Bocconi University). The survey was conducted by GFK Eurisko. The questionnaire contains a rich section on internationalisation: firms were asked several questions on exports, imports, foreign direct investments and international outsourcing, which includes international production carried out under arms-length contracts by foreign third companies. These data are complemented by balance sheet data drawn from the database Amadeus managed by Bureau van Dyck. The number of firms that answered the EFIGE questionnaire is reported in Table 1: the sample includes around 3,000 firms for France, Italy and Spain, more than 2,200 for UK and Germany, and 500 for Austria and Hungary. It is restricted to firms with more than ten employees. The questionnaire is mainly focused on the year 2008, with some questions on firms' activity in 2009 and in previous years.

Table 1 Number of sampled firms by country

Country	Number of firms
Austria	492
France	2,973
Germany	2,202
Hungary	488
Italy	3,019
Spain	2,832
United Kingdom	2,156
Total	14,162

Source: Barba Navaretti et al. (2010).

The EFIGE dataset therefore allows us to relate aggregate country export patterns to the characteristics of firms and of the overall industrial structure in these economies. In the spirit of Das, Roberts and Tybout (2008), we will now discuss potential trade responses, but we will compare countries instead of industries. Since the EFIGE survey data are static and refer to the 2008-09 period, we are unable to measure trade elasticities, but we can use structural information on past trade performance to gauge potential future responses of a country's exports.

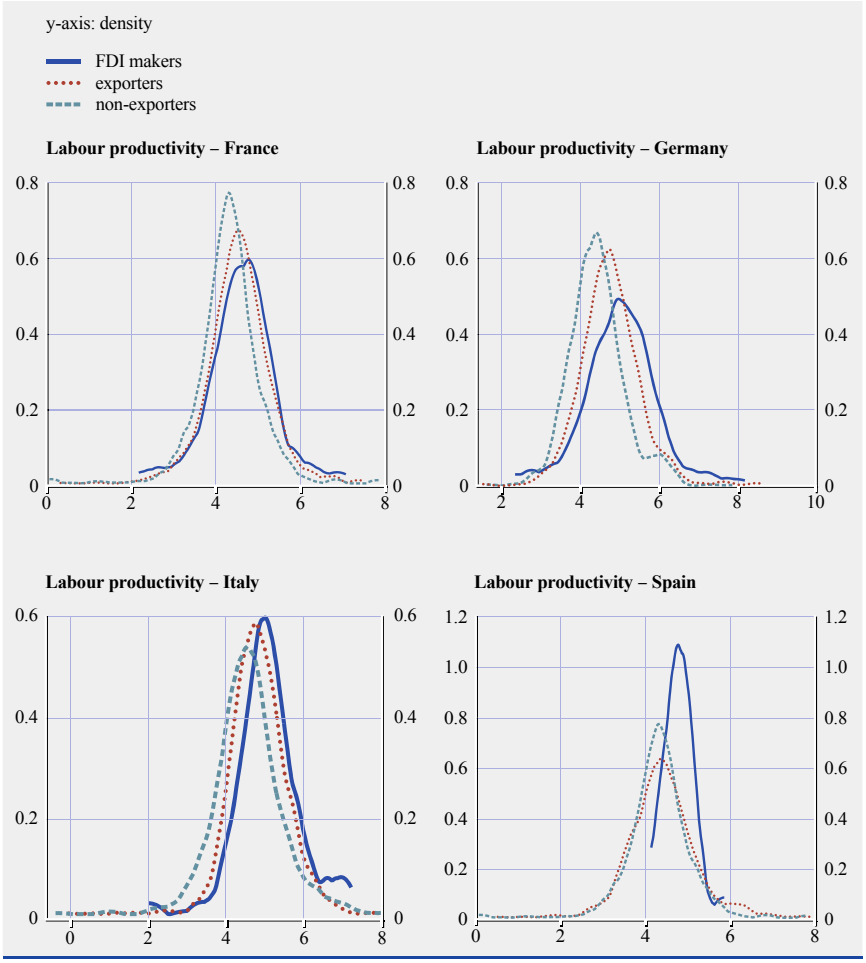
We will proceed in two steps. First, we will review some of the key findings of the second EFIGE policy report "The Global Operations of European Firms", which was prepared by Barba Navaretti et al. (2010) within the EFIGE project. We will then discuss what information regarding future export responses can be inferred from these findings.

2 THE GLOBAL OPERATIONS OF EUROPEAN FIRMS

The report shows that the EFIGE data are largely consistent with the findings of the cited empirical works on heterogeneous firms in international trade: in all seven sampled countries exporting firms are larger, more productive, have a lower share of blue-collar workers and a higher share of college graduates, are more likely to belong to a group or to a foreign owner, are more innovative, and invest more in R&D. When we plot kernel densities of labour productivity for non-exporters, exporters with no foreign direct investment and firms with some production abroad, we find that in the productivity distribution of exporters from Germany, France, Italy and Spain is to the right of that of non-exporters, and that of firms engaging in Foreign Direct Investments ("FDI makers" in the chart) is to the right of that of exporters (Chart 1). That only more productive firms invest in more complex internationalisation strategies is already clear from the literature (see, for example, Antras and Helpman (2004) and Helpman, Melitz and Yeaple (2004)).

The descriptive evidence confirms the well-known fact that exporting firms are "better" than non-exporting ones. However, there are noticeable differences in firms' characteristics across countries, even within the exporting group. For example, Spanish and, to a greater extent, Italian exporters are substantially

Chart 1 Kernel density of productivity for non-exporters, exporters and FDI makers



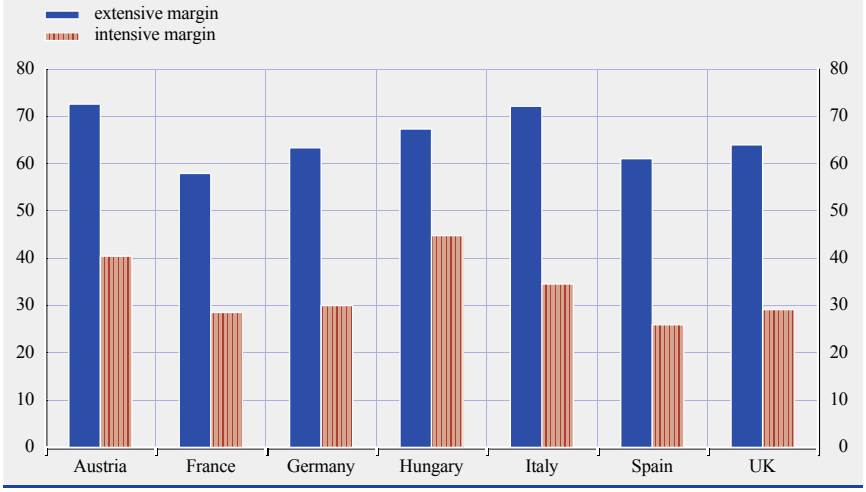
Source: Barba Navaretti et al. (2010).

smaller than those located in the other countries. This, therefore, suggests that both firms' characteristics and country specificities play a role in determining the internationalisation strategies of European firms.

By using firm-level data it is possible to decompose a country's total exports into two margins: the percentage of firms that export a strictly positive fraction of their sales (extensive margin) and, only for exporters, the export value share of total turnover (intensive margin) (Chart 2). Both margins vary substantially across countries and, as expected, are larger in the small open economies of Austria and Hungary, and smaller in the large economies of France, Germany and the United Kingdom. An interesting and significant exception is Italy, which displays one of the highest percentages of exporting firms (72%) and a relatively high intensive margin (35%). These numbers indicate that most of the firms with more than ten employees in Europe engage in some form of exporting

Chart 2 Extensive and intensive margin of exports by country

(percentages)



Source: Barba Navaretti et al. (2010).

activity, suggesting limited scope for an increase in exports along the extensive margin, i.e. new firms starting to export. We will return to this important point later on.

In terms of their relation to firms' characteristics, these two margins are very interesting. For all countries, the share of exporters increases significantly with firm size: the difference in export propensity between firms with 10-19 employees and firms with at least 250 employees is always above 25 percentage points, and is about 40 percentage points for France and Germany (Table 2). Country differences within the same size class are smaller. A similar result holds for the intensive margin, even if differences across size classes are less pronounced (Table 3).

Since size is not the only firm characteristic relevant to internationalisation, Barba Navaretti et al. (2010) follow a more general and systematic approach: they perform a regression analysis of the extensive and intensive margins

Table 2 Extensive margin

(percentages)

Size class	AT	FR	DE	HU	IT	ES	UK
10-19	69.8	44.7	45.7	58.0	65.4	51.2	54.9
20-49	63.8	59.1	65.4	64.7	73.3	63.5	62.8
50-249	88.6	75.4	78.2	79.3	86.6	76.2	76.8
More than 249	90.8	87.6	84.0	97.4	92.6	88.0	80.7
Total	72.6	57.9	63.4	67.3	72.2	61.1	64.0

Source: Barba Navaretti et al.

Table 3 Intensive margin of exports, by country and the firm size class

(percentages)

Size class	AT	FR	DE	HU	IT	ES	UK
10-19	26.2	23.0	25.9	30.2	30.4	21.4	26.2
20-49	33.3	27.0	28.1	43.6	34.2	24.5	27.8
50-249	55.9	33.0	33.9	53.2	42.2	33.3	33.2
More than 249	64.7	41.2	37.8	66.6	52.6	40.6	34.2
Total	40.4	28.5	30.0	44.8	34.6	25.9	29.1

Source: Barba Navaretti et al.

of trade according to country, sector and firms' characteristics. In this way, they can assess the relative importance of the different factors and to what extent they are linked to exports.

The findings can be summarised as follows. First of all, the international performance of European firms, both along the extensive and intensive margin, is largely influenced by firm-specific characteristics, more than by country features or the sectoral composition. Second, a firm's characteristics affect the probability of it engaging in exporting, as well as the share of turnover that it exports: larger, more productive, more innovative firms are more likely to export and tend to export a larger share of their production. Finally, exports are related to firms' characteristics in a remarkably similar way across countries.

Export propensity and the share of turnover exported provide just part of the overall picture as regards the internationalisation of firms. The global operations undertaken by European firms are very heterogeneous and give rise to very complex and different internationalisation patterns.

A clear trend in the current recovery is that demand is rising much faster in emerging economies. The ability of European firms to enter and sell in these countries will be a key factor for future trade developments. It is therefore important to understand if and how firms' characteristics matter in terms of the geography of exports, particularly as regards entry into and expansion in large, dynamic markets such as China and India.

The EFIGE data show that country heterogeneity in exports varies significantly across destination markets (Table 4). Distant destinations are more costly to reach and often involve higher risks and more barriers than closer EU markets. Unvaryingly, all European exporters tap EU markets first. However, upon expansion to more distant destinations, greater differences between countries emerge. For example, in India and China, two markets most exporters have yet to enter, German firms have gained a competitive advantage: the share of German firms exporting there is 5 percentage points higher than that of French firms, 10 points higher than that of Italian firms, and almost 20 points higher than that of Spanish firms. As is to be expected, Spanish firms are more likely to export to central and south America.

Table 4 The geographical distribution of exporters

(percentages)

Country	EU15	Other EU	Other Europe	China India	Other Asia	US Canada	Central South America	Others
AT	94.2	49.9	46.8	16.4	17.7	22.5	7.08	12.4
FR	92.5	36.8	41.8	22.0	27.0	31.6	14.7	30.6
DE	93.1	47.9	52.7	27.9	25.9	36.8	16.4	16.6
HU	82.0	50.1	24.1	1.6	5.2	6.9	0.7	4.3
IT	89.6	41.0	49.7	17.7	23.6	30.5	19.3	24.2
ES	92.6	27.6	26.6	10.8	14.3	18.4	29.6	24.0
UK	92.3	33.7	33.7	25.9	31.6	44.5	15.0	35.1

Source: Barba Navaretti et al. (2010).

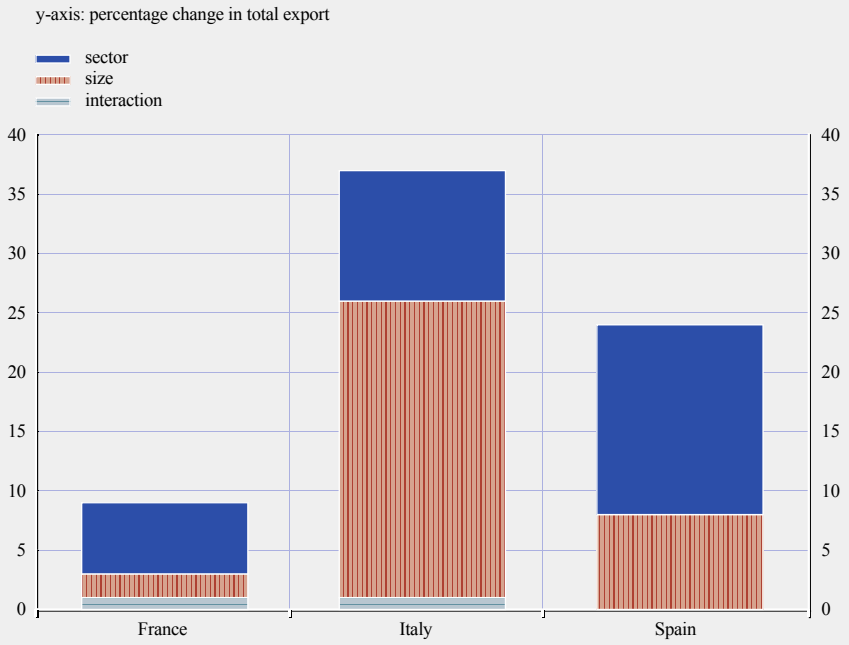
Notes: Each figure represents the share of exporting firms that sell in the destination market indicated in the heading of each column. For each country, the numbers do not add up to 100 because a firm can export in more than one market.

So the question again arises: is Germany's competitive advantage in China and India due to firms' characteristics or to some country-specific effect? Comparing exporters to China and India to all exporters in a regression framework, Barba Navaretti et al. (2010) again find that firms' characteristics have a larger effect than country and sector features. As for firms' characteristics, it is a case of the usual suspects: the probability of exporting to China and India is positively correlated with firm size, productivity, innovation and human capital. Older firms and those belonging to a group are also more capable of reaching the farthest, largest and most dynamic markets in Asia.

How can the finding that internationalisation patterns are predominantly driven by firms' characteristics and that their impact is similar across countries be reconciled with the evidence that, overall, countries perform very differently in terms of their exports and global production strategies? This apparent inconsistency can be easily reconciled if we consider that the overall industrial structures of the countries analysed are very different. If we focus on size and sectoral compositions, we immediately see that firms' characteristics are indeed distributed very differently within each country.

Our claim is therefore that different export patterns and performances across European countries reflect these differences in industrial structure. To support this point, Barba Navaretti et al. (2010) ask: how would a different industrial structure affect a country's export performance, if its firms' export propensity were kept constant? For example, we have seen that Italian firms have a high export propensity, controlling for size, but at the same time the small average size of Italian firms limits the overall export performance. It is natural to ask how Italian exports would change if Italy had a firm size distribution similar to that of France or Germany. A similar reasoning can be applied to any country. For this counterfactual experiment a common industrial structure must be chosen, to be applied to all countries. In theory we could choose, as a benchmark, an industrial structure from any of the European countries in our dataset, or the average

Chart 3 Percentage change in the value of exports using the German size-sector employment distribution, with constant total employment



structure. In practice, since we want to highlight the role of firm size, it is more convenient to use the industrial structure of Germany, which is populated by a higher share of medium and large sized firms.

The results are reported in Chart 3. We find that total exports would increase by 24% for Spain and 37% for Italy. For France, the increase would be a more modest 9%, in line with the fact that its industrial structure is more similar to the German one. For Italy and Spain, therefore, changing their industrial structure to replicate the German one (keeping the number of employees fixed) would substantially increase exports. A decomposition exercise shows that most of the change would be attributable to the size of the structure and not to the sectoral component.

3 LESSONS FOR FUTURE TRADE RESPONSES

What to expect, on the basis of this evidence, for the recovery phase of exports? How will trade elasticities, related both to the exchange rate and to foreign demand, affect European countries' export performance?

As for the overall extensive margin, we argued above that we should not expect it to exert much influence. In fact, all the European countries are characterised by a very large share of exporters to start with, and half of the trade is within

the euro area, where the exchange rate is fixed[3]. However, this conclusion changes if we consider that the sunk costs of exporting also have a destination-specific component. We have seen that in all the European countries featured in the EFIGE dataset, the share of firms exporting to more distant destinations, particularly China and India, is lower than that of those exporting to the rest of Europe, including within the restricted set of firms that already sell a fraction of their products abroad. Given the rapid rise in emerging market demand for foreign goods, will we observe increasing entry into these markets? Extensive margins of these markets will certainly increase, as a larger market size implicitly reduces entry barriers. Yet the response will be heterogeneous across European countries. In the short to medium term, industrial structures will play a role, and the relatively larger German (and French) firms that still do not export to those markets will have a better chance of entering than smaller Spanish and Italian firms.

As pointed out by Das, Roberts and Tybout (2008), firm size also matters in terms of the intensive margin and might therefore also affect heterogeneous responses across Europe in this respect. If the elasticity of exports to demand is greater for larger firms, we should expect incumbent medium to large German firms to benefit to a greater extent from the expected relatively larger increases in income and demand in emerging economies.

So far, these predictions have been confirmed by the fact that the German recovery is much stronger than that of the other European countries. Owing to a production structure that is more favourable to internationalisation activities, the German economy is better positioned to take advantage of the recovery of world trade that will hopefully occur over the next few years, and to rapidly consolidate its lead.

4 CONCLUSION

This chapter has focused on the microeconomic firm-level factors that might explain the large heterogeneity in trade performance observed among European countries, in particular in terms of sensitivity to exchange rate and foreign demand developments. Understanding the micro determinants of macro imbalances will be essential to the functioning of the prospective competitiveness pact among euro area countries.

3 Naturally, we cannot observe here the dynamics of the extensive margins, and therefore how much turnover there is among new, marginal entrants into the export markets. Eaton, Eslava, Kugler and Tybout (2008), using data on Colombia, show that every year a large number of firms start exporting; most of them do it to a very limited extent and stop exporting the following year. But those few that stay rapidly grow into being larger exporters and begin to tap increasing numbers of markets. If observed for long time periods, such as a decade, these exporters end up accounting for a large share of Colombia's exports. Although this type of evidence is not available for Europe at the moment, it is not likely that new entry into the export market will constitute a sizeable component of export response in the near future.

In terms of general policy, our conclusion is that governments should try to remove barriers to firms' growth, and through horizontal measures promote investments in intangible assets, which are instrumental to fostering global competitiveness.

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CHAPTER 16

AN ANALYSIS OF THE DYNAMICS OF FRENCH FIRMS' EXPORTS FROM 2000 TO 2009: LESSONS FOR THE RECOVERY

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This chapter draws on yearly data for the period 2000-09 relating to individual French exporters to analyse the changes in France's overall export value in response to demand shocks and to shed light on the debate surrounding trade elasticities. Over the medium term, two-thirds of the increase in overall exports witnessed during the observation period was accounted for by an expansion in existing trade flows, thereby leaving scope for new flows. Over the very short term, by contrast, trade flows adjust mainly at the intensive margin to large swings in demand. All this underlines the potential role of sunk costs, which introduce irreversibility into export decisions.

1 INTRODUCTION

Capturing the actual magnitude of income trade elasticities is a major difficulty faced in many modelling exercises. For instance, computable general equilibrium models prove unsuccessful in accurately replicating the observed growth in international trade over the 1990s and 2000s. Similarly, these models also fail to replicate the downturn in international trade witnessed in the fourth quarter of 2008 and the first quarter of 2009 (Bénassy-Quéré et al., 2009): both industrial production and trade fell faster in 2008-09 than during the Great Depression (Eichengreen and O'Rourke, 2009; Baldwin and Evenett, 2009). The explanation for such a shortcoming is multifaceted. First, short-term elasticities differ from their long-term equilibrium counterparts. Second, it is difficult to model the creation or destruction of flows in an applied general equilibrium framework. Third, certain mechanisms contributing to the observed growth in international trade – such as the prevalence of global value chains – are not fully embedded in large-scale trade models. Lastly, certain channels potentially driving the contraction in trade – such as credit constraints or, more simply, the sectoral composition of the demand drop – are not well represented in macroeconomic models. Another well-known puzzle is the difference in export and import US income elasticities, elegantly explained by Krugman (1989).

Using a more disaggregated approach to the measurement of trade elasticities at the country and product level helps to shed light on some of these issues, particularly the response of trade margins to changes in income (Hummels and Klenow, 2005). However, as long as it is based on trade flows at the country level, such an approach is unable to disentangle the contribution to the change in overall exports stemming from a change in the number of exporters from that stemming from a change in the values sold by each exporter, i.e. the changes at the "extensive" and "intensive" margins respectively. Were fewer firms exporting to fewer markets during the trade collapse (extensive margin)? Or was the same number of firms exporting lower values to the same number of markets (intensive margin)? Following the adverse shock of the recent financial crisis was it the case, as intuition might suggest, that the smallest and most fragile exporters were pushed out of the market, while larger and more diversified firms were able to take advantage of their size and market power to adjust, perhaps passing on part of the burden to suppliers and wholesalers? How can we tell whether a reduction in the number of exporters was the result of an increased number of exits, fewer entries or a combination of the two? Finally, to what extent did financial constraints play a role? Shedding light on these issues is of utmost importance when it comes to understanding the rapid rebound of international trade in 2010; a contraction of exports at the intensive margin is more easily reversible than a contraction associated with a decline in the number of exporters.

In a companion paper (Bricongne et al., 2010), we use *monthly* microeconomic data to examine the respective contributions of the demand and credit channels to the 2008-09 collapse observed in French exports. The aim was to map export data to firm-level credit constraints. We show that most of the trade collapse is accounted for by the unprecedented demand shock and product characteristics. While the effects of the crisis were felt by all exporters, whether large or small, the impact for large firms was mainly at the intensive margin; while large firms were able to adapt at the extensive margin by reducing the portfolio of products offered in each destination served with relative ease, it was the reduction in existing flows that resonated the most deeply. Smaller exporters, on the other hand, were forced to adjust by reducing the number of markets served or halting exports altogether. Credit constraints, for their part, emerged from the study as an aggravating factor for firms active in sectors of high financial dependence.

In this chapter we seek to build upon the findings of the 2010 paper, altering our approach slightly. First, we extend our period of observation back to 2000. This longer-term perspective aims to identify the medium-term mechanisms at the microeconomic level underlying the fluctuations in the value of trade. Second, we shift to *yearly* data, cumulating the value of exports for each statistical unit, aggregated according to their combined nomenclature, over each calendar year.

This medium-term, microeconomic approach sheds new light on the responses of exporters to changes in demand. We see that as world demand grew in the early to mid-2000s, French firms adjusted at both the extensive and intensive margins over the medium term, adding new lines to their portfolio of products exported to existing customers overseas, as well as increasing the value of their existing trade flows. This is consistent with previous theoretical findings as regards the

behaviour of multi-product exporters (Eckel and Neary, 2010; Bernard, Redding and Schott, 2009). With the onset of the financial crisis and the ensuing sizeable, adverse demand shock, much of the short to medium-term adjustment occurred at the intensive margin, with the greatest contribution to the overall decline in trade values stemming from a decline in the existing flows of the largest firms.

These results shed light on the debate on trade elasticities. Over two-thirds of the growth in exports recorded for the period observed was found to stem from an increase in the value of existing trade flows. This left room for new flows to be created. However, of greater importance for trade elasticities is the creation or destruction of new flows via the entry or exit of products exported by incumbent exporters, rather than the entry or exit of exporters. Demand, of course, plays a significant role in determining any adjustments made at the extensive margin by the smallest firms; but these exporters are too small to really influence overall export figures. Over the very short term, trade flows adjust mainly at the intensive margin when faced with large swings in demand. Sectoral composition effects play a significant role, as do firm composition effects: the importance of adjustments made at the intensive margin by the largest firms becomes particularly evident in times of crisis, as it is this contribution which is the most important factor in determining any swings in export values. All this stresses that observed trade elasticities may be very much conditional on the magnitude of sunk costs, which introduce some irreversibility into the export decisions of individual exporters.

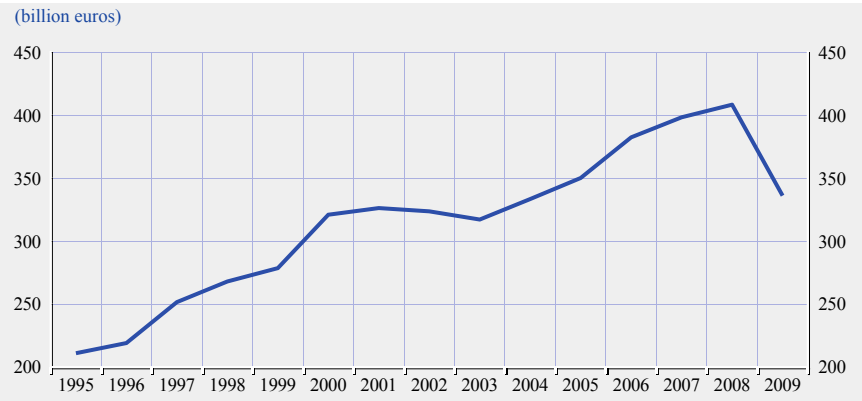
The rest of this chapter is organised as follows. First, we evaluate the individual contributions of the various trade margins to the developments in French trade during the 2000s, before analysing more precisely the sectoral and geographical dimensions of the collapse of 2009. Second, we discuss the issue of trade elasticities, assessing the link between external demand and trade margins, controlling for the ownership status of the exporter.

2 CONTRIBUTIONS OF THE VARIOUS TRADE MARGINS TO THE COLLAPSE IN FRENCH TRADE IN 2009

The 2008-09 trade collapse put an end to the previously observed steady growth in the value of French exports. During the 2000s French exporters took advantage of the expansion in the world market to increase trading activity, although they did so to a lesser extent than most exporting countries. Despite suffering a loss in global market share, just before the crisis the total value of French exports was roughly twice its 1995 value. A fall of 17.7% in 2009 marked a reversal of this moderate upward trajectory, forcing French exports back down to their 2004 level (see Chart 1).

To explore the response of trade margins to demand shocks, we make use of a dataset pertaining to individual exporters located in France (for the sake of simplicity, these statistical units shall henceforth be referred to as “firms”). These exporters can be independent or owned by another statistical unit, i.e. controlled from the headquarters of a given (French or foreign) group. As our

Chart 1 French annual exports, value



Source: French customs. Our calculations are based on individual firm exports.

approach requires us to count the number of firms and the number of entries or exits at any given point in time, we must cover the whole spectrum of exporting firms. We therefore draw on data for all the firms registered with French customs authorities, subject to a recording threshold. The price to be paid for such an approach is that we then cannot control for the individual characteristics of each of the firms, with the exception of the value of their exports. Accordingly, we characterise firms on the basis of their relative size in terms of their export volume (firms are ranked according to their share of France's export market). By observing the identifier of each exporter for each year, we can assess whether a given firm was active within a specific sector of exports and in exporting to a given market over the course of two subsequent years. This leads us to define three extensive margins for our – potentially multi-product – exporters (Mayer and Ottaviano, 2007; Berthou and Fontagné, 2009): (i) number of exporters (firm extensive margin), (ii) average number of products by firm and market (product extensive margin) and (iii) average number of markets (geographical extensive margin).

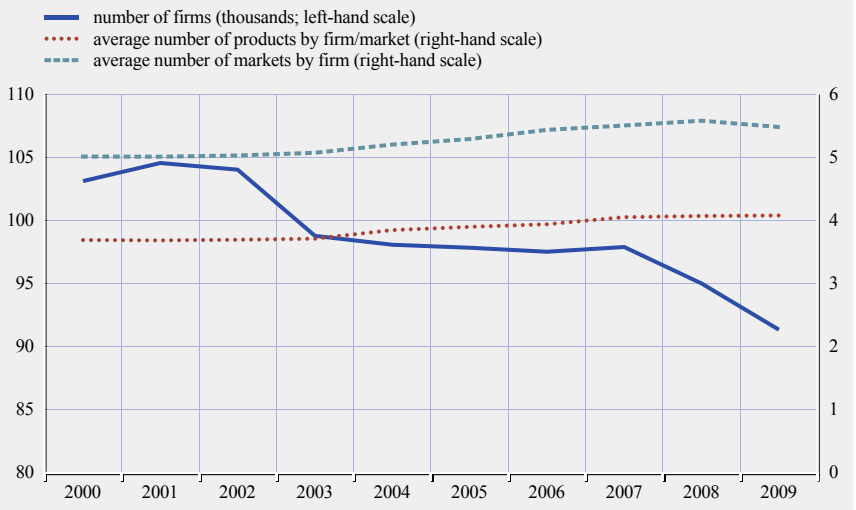
The *annual* value of French exports X can be broken down as follows:

$$X = n_f \bar{n}_c^f \bar{n}_p^{fc} \bar{x}^{fcp},$$

where n_f stands for the number of exporters, $\bar{n}_c^f$ represents the average number of markets served per exporter, $\bar{n}_p^{fc}$ the average number of products by firm and market and $\bar{x}^{fcp}$ the average value of exports by firm, product and market. This will allow us to calculate the various aforementioned trade margins.

Applying this decomposition, Chart 2 shows that the generally steady rise in the value of French exports during the 2000s occurred in parallel with a decline in the number of operators, namely a negative firm extensive margin. Indeed, the 2008-09 crisis caused this downward trend in the number of French exporters to accelerate (with the number of operators declining by 3.0% in 2008 and 2.9% in 2009, although the decline was, in fact, even steeper in 2003, at 5.0%).

Chart 2 The three extensive margins of French annual exports, (2000-2009)



Source: French customs and own calculations.

The other two extensive margins exhibit a medium-term evolution in line with expectations, with the steady increase in the number of markets served and products exported only marginally impaired by the crisis.

One should bear in mind the fact that the export market is very heterogeneous and that while a large number of firms account for only a limited value of exports, a small number of the very largest exporters account for a considerable market share. In view of this, the general increase in trade at the intensive margin could simply be partly reflective of a composition effect, suggesting that it was mainly smaller players that were exiting the export market. An inverse composition effect may have played a role as regards the portfolio of exported products: as marginal products are expected to be those for which the firms are less advantaged, exporting beyond the core products should lead to a decrease in the average value exported by product.

The next step in our analysis is to calculate the contributions made by the individual margins to the change in the total value of annual French exports. In order to take account of the creation and destruction of flows, a specific measure of rates of growth – the mid-point growth rate – is necessary.

The mid-point growth rate for each elementary export flow is defined as:

$$g_{icpt} = \frac{x_{icpt} - x_{icpt-1}}{\frac{1}{2}(x_{icpt} + x_{icpt-1})},$$

where i corresponds to the firm, c to the market and p to the product.

By applying this formula, we can calculate the weighted growth rate of exports, where the weight attributed to each elementary trade flow is dependent on its

contribution to the overall value of exports in *t* and *t-1*. We can also calculate the contributions of the various trade margins by flagging the elementary trade flows (new flow, disappearing flow, etc.) and aggregating the rates of growth in the individual sectors.

On the basis of this decomposition, it would appear as though the overall increase in the value of French exports during the 2000s was driven mainly by the intensive margin (which accounted for 68.3% of this increase); in other words, the general increase was, for the most part, attributable to a rise in the value of existing elementary flows. The importance of the contribution of existing flows to overall trade values became even more evident during the crisis, when a reduction in the value of existing trade flows accounted for 92.5% of the collapse in trade.

To test the validity of the analysis in trade values, these have been deflated by using unit values (i.e. values divided by quantities). Results are broadly resilient to such changes, which justifies proceeding with trade values only (see the detailed results in Bellas et al., 2011; forthcoming).

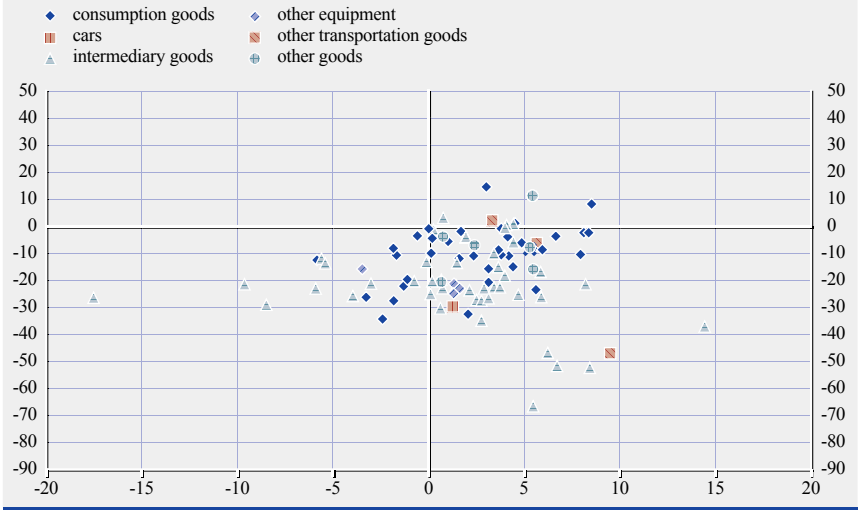
3 THE SECTORAL AND GEOGRAPHICAL DIMENSIONS OF THE COLLAPSE

The crisis had dramatic implications for a number of sectors, such as the car industry, machinery and the intermediate goods industry. By contrast, consumption goods other than cars proved to be far more resilient to the downturn. In terms of markets, many emerging economies better withstood the turmoil than their more advanced counterparts. Lastly, small and large firms may differ strongly in terms of their sectoral and geographic specialisation, and the observed growth rates must consequently be corrected accordingly. To do so, we draw on a shift-share methodology, based on econometrics. This methodology was initially proposed by Jayet (1993) in the context of spatial economics (weighted variance analysis of growth rates), but was then adapted for application to international trade by Cheptea et al. (2005), Bricongne et al. (2010), and Cheptea et al. (2010).

We aggregate export data for individual firms according to sector (as determined by the classification of the traded goods involved, in line with the Harmonised Commodity Description and Coding System (HS)), while maintaining the full market dimension. Each firm is also classified according to its size and allocated to one of four groups, comprising firms that are, respectively, up to the 80th percentile, between the 80th and the 95th percentiles, between the 95th and the 99th percentiles and in the last percentile. The associated annual mid-point growth rates are regressed on three time-invariant fixed effects (sector, market and size of the firm) to "cleanse" the observed growth rates of the corresponding effects. These corrected growth rates by sector can then be compared for two periods: the pre-crisis period (2001-07) and the period of the crisis (2009). (The year 2008 is not considered here, given that crisis conditions were only observed for part of the year.) First, we find the sectoral composition of the changes in exports for the two observation periods to be entirely without correlation. Second, while our findings confirm the widely recognised general trends (intermediate goods

Chart 3 Corrected sectoral mid-point growth rates of annual French exports

(percentages)



Sources : DGDDI, authors' own calculations.

severely impacted; consumption goods more resilient), they reveal that the detailed sectoral dimension of the crisis was far more complex, with the decline in the value of exports in the intermediate goods sector in 2009 ranging from +/- 0% in certain HS sectors to more than 50% in others (see Chart 3).

4 TRADE ELASTICITIES

We can now apply these tools in an attempt to tentatively shed light on the issue of trade elasticities. We can calculate *corrected* mid-point growth rates and identify the individual contributions made by the various margins of exports. Accordingly, our assessment is corrected for most composition effects and allows light to be shed on the role of the extensive margin(s). A further dimension can be introduced, as the ownership of a firm may be of significance as regards trade elasticities. We therefore add one more fixed effect to our previous list, namely the ownership status of the exporter: whether it is independent, controlled by a French group, or controlled by a foreign group or from a headquarters.

There is a price to be paid to such a level of decomposition: the time dimension of the exercise is short and the frequency of data is low. With annual variations available from the mid-1990s only, the best we can do is to rely on correlations. Accordingly, our results must be considered a stepping stone towards a more ambitious research agenda, rather than a definitive answer to the issue at stake.

Here we measure external demand in line with the recommendations of the European System of Central Banks, i.e. we calculate the geometric mean

of import volumes for the destination markets of French exports, weighted according to the three-year moving average of the share in French exports of these markets. We correlate total French exports, as well as its components, with this demand variable. We consider two separate observation periods excluding and including the sizeable shock of 2009 (for more details, see Bellas et al., 2011; forthcoming).

We do not observe any significant correlation between the firm extensive margin and external demand: indeed, the decision to enter the export market requires sunk investments, which are made well in advance of the actual entry onto the export market, thereby dampening the correlation between the firm extensive margin and external demand. Furthermore, given the vast heterogeneity in the size of exporters, entrants are too small in size to make a significant contribution to the value of exports. By contrast, the other extensive margins do indeed play a significant role: the product extensive margin is positively correlated with external demand for the two periods considered, while the geographical extensive margin is significantly correlated with demand only when the crisis is taken into account. Accordingly, when the analysis is extended to cover 2009, the correlation of those two margins with external demand is similar in magnitude. However, the strongest correlation is with the intensive margin, with the correlation approaching one when the crisis is taken into account.

Looking at the role of firm size and considering only the extended period, we would expect demand to play a large role at the firm extensive margin among the group of the smallest players (group one). Indeed, this is where the strongest positive correlation is observed. The correlation is weaker for the second group and insignificant for the two remaining groups. A similar pattern is observed for the geographical extensive margin, except in this case the only group for which the correlation is not found to be significant is the fourth (comprising the largest 1% of exporters). As regards the product extensive margin, the correlation increases with the size of the firm, up to the last percentile, at which point it decreases again. Lastly, the intensive margin is positively and significantly correlated with demand for all classes of size and only slightly weaker for the smallest firms (as is consistent with the increased role played by the firm extensive margin for this grouping). The significance of the intensive margin for the largest firms becomes particularly evident in times of crisis, as shown by the comparison of the correlations measured during the two periods (i.e. including and excluding 2009). As regards ownership, sales of French affiliates of foreign groups are more responsive to changes in external demand, while affiliates of French groups respond more to the French cycle.

5 CONCLUSION

To explain in greater detail the developments in exports during the 2000s at the different margins (intensive and extensive), including the period of the great trade collapse in 2008-09, this chapter takes into account the size of exporters, their positions within groups, and controls for their sectoral and geographical compositions.

The greatest contribution to the downturn in French trade in 2008-09 stemmed from adjustments made at the intensive margin by the largest exporters in response to changes in demand. Small exporters were more affected at the extensive margin. Furthermore, there seems to be no correlation between sectoral and geographical developments before and during the crisis.

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CHAPTER 17

PRICING TO MARKET BY EUROPEAN AUTOMOBILE EXPORTERS

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The chapter uses highly disaggregated bilateral automobile export data to study pricing to market behavior and export price elasticities for five European countries. To account for the dynamic aspects characterizing these economic issues, panel co-integration techniques are employed. The chapter finds systematic variation in the degree of pricing to market both across sectors and source countries and little evidence of price discrimination across destinations. As for export elasticities, there is also evidence of heterogeneity both across countries and sectors. Nevertheless, there appears to be no regular relationship between the estimates of price elasticities and the extent of pricing to market. This suggests that a country export performance is not necessarily linked one to one to changes in price competitiveness measures and to exchange rate fluctuations.

1 THE EUROPEAN AUTOMOBILE SECTOR

The collapse in international trade that followed the recent financial crisis has been highly heterogeneous across sectors. Durable goods industries were severely hit by the crisis, and the automobile sector has displayed the sharpest percentage drop in trade volumes of all. In the major European economies (see Table 1), this sector represents an important share of economic activity, especially in terms of employment, and exports account for more than half of the final production. These facts justify our interest in studying the pricing behaviour of European exporters in this sector as a key determinant of the overall export performance and competitiveness.

Our dataset is based on the Comext database produced by Eurostat. The Comext database contains intra and extra-EU27 trade statistics for the Member States and their trading partners since 1958. The automotive sector in the Comext database comprises 240 eight-digit sub-sectors, covering vehicles other than trains and trams as well as their parts. Of all the country pairs available in the dataset, we consider only those for which shipments take place regularly enough to build a quarterly time series. As a result we restrict our analysis to five countries,

Table 1 Aggregate indicators for the motor vehicle sector

(aggregate ISIC Rev.3 2-digit level)

	France		Germany		Italy		Spain		UK	
	2001	2007	2001	2007	2001	2007	2001	2007	2001	2007[1)]
Value added shares relative to tot. economy	1.2	0.8	3.1	3.5	0.7	0.7	1.5	1.2	0.9	0.7
Value added shares relative to manufacturing	7.5	6.1	13.5	15.0	3.7	3.6	8.4	8.1	5.5	5.5
Employment shares in total economy	0.9	0.8	2.3	2.1	0.8	0.7	1.3	1.1	..	..
Employment shares in manufacturing	6.2	6.2	10.9	11.2	3.6	3.4	7.5	7.1	..	..
Gross output share in manufacturing	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Export share in manufacturing	14.7	14.0	20.5	20.3	7.9	8.6	25.9	23.9	9.6	13.6
Export share of production	51.0	53.6	51.5	55.9	50.3	58.4	63.8	64.7	47.2	56.0

Source: OECD STAN Database.

1) One most recent available.

Table 2 Average number of items exported

(average over five-year periods; thousands of units)

	Small cars	Medium cars	Large cars	Small diesel	Medium diesel	Large diesel	Caravan diesel	Total	Δ% of total
1993-1997									
France	93.2	496.7	1.4	21.2	352.2	1.5	1.2	967.3	
Germany	17.9	1,448.5	152.8	6.5	561.5	21.6	2.7	2,211.6	
Italy	60.3	233.5	4.3	5.0	97.5	1.4	11.6	413.7	
Spain	122.2	251.4	2.0	40.8	292.9	36.0	0.2	745.4	
UK	77.4	325.9	69.5	9.9	133.5	8.8	0.2	625.2	
Other Europe	41.7	1,088.8	36.7	8.8	334.9	14.3	0.8	1,526.0	
1998-2002									**I-II period**
France	137.9	777.2	1.9	37.5	646.3	4.8	1.9	1,607.4	66.2
Germany	44.3	1,806.7	275.2	25.3	1,035.1	61.0	4.7	3,252.4	47.1
Italy	15.4	234.9	7.0	4.2	128.1	11.7	7.0	408.4	-1.3
Spain	162.2	541.5	2.2	36.9	563.1	31.6	0.2	1,337.9	79.5
UK	61.3	476.9	110.0	6.0	205.2	3.6	0.2	863.2	38.1
Other Europe	94.7	1,496.4	83.5	24.2	751.9	68.8	2.6	2,522.0	65.3
2003-2007									**II-III period**
France	169.6	772.7	2.7	246.2	737.0	12.0	3.9	1,944.1	21
Germany	37.0	1,540.9	490.0	118.2	1,364.2	187.2	7.8	3,745.3	15
Italy	14.7	97.7	16.1	51.1	119.2	14.2	11.2	324.2	-21
Spain	41.6	541.9	8.7	250.9	460.0	16.4	0.8	1,320.3	-1
UK	18.3	509.0	93.8	83.5	235.4	30.2	0.3	970.4	12
Other Europe	265.4	1,492.3	222.2	337.0	1,153.5	143.9	6.7	3,620.8	44

Sources: Eurostat and authors' calculations.

Notes: Small=cc<1,000/1,500; medium=1,500<cc<3,000; large cc>3,000.

i.e. France, Germany, Italy, Spain and the United Kingdom. The sample starts in the first quarter of 1993 and ends in the fourth quarter of 2009 for most goods but, in order to shelter the analysis from the high level of data volatility experienced over the recent crisis period, and to be able to identify instead data regularities, we restrict our analysis to the period 1993-2007. To enhance the comparability across countries and also with previous studies, we concentrate on vehicles for passenger transportation, distinguished by the size of the engine (<1000cc; 1000cc to 2500cc; >2500cc) and engine type (gasoline or diesel).We exclude used cars, thus cutting down the data set to seven sub-sectors.

A glance at some descriptive statistics relating to our data reveals a high degree of variation in the export performance of European countries for the different types of cars. For the seven sub-sectors considered, we look at the five-year averages of the median unit values and of the total number of items exported over the period 1993-2007. As concerns export quantities, Table 2 shows that in recent decades most of the action was taking place in the sector of small gasoline-fuelled cars (column 1), with Italian and Spanish exports dropping, to the advantage of France and "Other Europe" (mostly eastern European countries). The export of small diesel cars, by contrast, increased for all countries in our sample. France and Germany increased their total exports in all sectors. In the case of Germany, there was a striking increase in medium and large sized

Table 3 Median unit values by country

(average over five-year periods; percentage)

	Small cars	Medium cars	Large cars	Small diesel	Medium diesel	Large diesel	Caravan diesel	Country average	Δ % Country average
1993-1997									
France	7.0	9.6	22.4	9.7	9.6	13.5	10.6	11.8	
Germany	8.7	15.1	27.8	7.8	13.1	18.6	11.7	14.7	
Italy	5.5	9.2	45.5	7.3	7.9	10.7	8.9	13.6	
Spain	6.8	7.9	14.3	7.4	7.4	7.6	9.3	8.7	
UK	6.9	9.7	14.6	8.1	9.4	11.5	8.0	9.7	
Average	7.0	10.3	24.9	8.1	9.5	12.4	9.7	11.7	
1998-2002									**I-II period**
France	9.2	8.8	26.2	11.4	8.7	12.9	10.2	12.5	6.1
Germany	8.8	13.8	28.4	9.7	11.4	18.8	11.4	14.6	-0.4
Italy	6.8	9.9	50.7	10.7	9.0	7.8	10.0	15.0	10.6
Spain	7.0	8.1	21.9	9.0	8.0	8.8	9.7	10.4	19.8
UK	8.1	10.5	18.3	11.8	10.7	13.1	10.3	11.8	21.5
Average	8.0	10.2	29.1	10.5	9.6	12.3	10.3	12.9	10.1
2003-2007									**II-III period**
France	10.7	9.0	26.3	8.8	9.6	15.6	11.6	13.1	4.9
Germany	10.3	13.7	26.7	8.1	12.0	19.5	12.8	14.7	0.8
Italy	10.6	10.9	49.3	9.1	10.5	9.2	11.2	15.8	5.6
Spain	8.1	7.5	13.5	8.1	8.9	11.0	11.7	9.8	-5.1
UK	10.0	11.0	21.1	9.0	10.0	13.0	12.2	12.3	4.2
Average	9.9	10.4	27.4	8.6	10.2	13.7	11.9	13.2	2.4

Source: Eurostat Comext and authors' calculations.

diesel cars, which represent the broadest segment of the market. Only for Italy did total exports fall in absolute terms. In relative terms the best performing countries have been Germany, France and "Other Europe". As for the unit values (Table 3), while Germany managed to keep its prices almost unchanged during the period, possibly through outsourcing part of the production, unit export prices increased for all the other countries, particularly between the first and second period. France was the second most successful country in terms of keeping its prices stable.

2 PRICING TO MARKET

Our aim is to study the pricing behaviour of European exporters in response to exchange rate changes, referred to in the literature as "pricing to market'' (PTM). There are two extreme cases. When exporters reduce mark-ups in order to fully compensate for an appreciation of the relevant exchange rate and stabilise their price in the buyer's currency, they are fully pricing to market, i.e. they are practising what is called local-currency pricing (LCP). If exporters instead aim to stabilise their mark-ups despite the exchange rate changes, they are practicing domestic-currency pricing (DCP). The degree of PTM can be different across exporters, across goods and across destination countries, depending on differences either in demand elasticities or in the producers' ability to adjust profit margins. To gain additional insight into whether one or the other factor is predominant, it is useful to complement the study of PTM behaviour with an analysis of import demand elasticities.

Previous studies have found significant evidence of heterogeneity in PTM behaviour across types of goods and across exporters. There is also some evidence of price discrimination with respect to destination countries, although there is no consensus on whether heterogeneity is more systematic across industries or across countries. For instance, Knetter (1993) studied the degree of PTM using US, UK, German and Japanese industry-level data. He found evidence of more price discrimination across destinations for the United Kingdom, Germany and Japan than for the United States. However, when controlling for industries that match across source countries, he found that behaviour was very similar across source countries, implying that sectoral differences play a larger role than country differences in pricing behaviour. In a later study that focused on the automobile sector, Gagnon and Knetter (1995) found that the degree of LCP varied both by country (with Japanese exporters pricing to market more than German ones and US exporters practising domestic currency pricing), and by product (with German exporters adjusting the mark-up for smaller autos but not for larger autos). More recently, Gil Pareja (2001) used the same source as we did for his data, and studied a similar sub-set of products in the automotive sector. He found that pricing behaviour depends more on the class of product than on the country of origin and destination.

3 EMPIRICAL ANALYSIS AND RESULTS

The analysis of PTM is based on the basic theoretical argument that the price of exports to a given country depends on the producer's marginal cost and on an additional factor – the mark-up – which varies with the destination. The mark-up depends on import demand elasticity, which is a function of the relative price expressed in foreign currency, and of a constant idiosyncratic characteristic of the importing country. The effect of the exchange rate on the equilibrium price is thus indicated by the effect on elasticity of foreign import demand. Given that for each source country-sector pair we have data for several years and destinations, we can control for the exporter's characteristics that vary over time, for the marginal cost, and for any importer's characteristic that is constant over time. Using the data available in our dataset, together with data on exchange rates and on the consumer price index of the destination countries, we can estimate PTM, i.e. the response of the exporting price, expressed in the domestic currency, to movements in exchange rates. We are able to identify both the short-run and the long-run relationships between the variables.

We find variation in the degree of PTM both across source countries and across sectors, with France generally exhibiting a higher level of PTM, meaning that in most sectors French car exporters adjust the export price in euro to a greater extent than German or Italian expo rters (see Table 4 for a comparison between France and Germany). By contrast, no single sector seems to exhibit a systematically higher degree of PTM. We find little evidence of price discrimination across destinations for each given source country. Our results also show that short-run adjustments are not important determinants of the relationship between the export price and the exchange rate, suggesting the existence of high costs associated with price changes. Finally, we take advantage of the time period covered by our dataset to check if the introduction of the euro somehow affected the way European exporters adjust their price according to exchange rate movements. We find no clear evidence of a systematic change, with the long-run PTM estimate increasing significantly for some countries and sectors (e.g. large cars from Germany, average diesel cars from Spain) and decreasing for others (diesel caravans in France, average cars in Germany, large cars in Italy).

The heterogeneity we found in the PTM behaviour can be explained either by differences across countries and sectors in the import demand elasticity, or by differences in the ability of exporters to actually adjust their profit margins in the way predicted by the theory. To gain additional insight into whether one or the other factor is preponderant, we also estimate export equations, linking the number of vehicles sold in each category to the respective average export price, as well as to other control variables. If countries with high PTM also face highly elastic demand, then elasticity is indeed the main determinant of price adjustment according to exchange rate movements.

As for PTM, export elasticities are also heterogeneous across countries and sectors. Across countries, German exports appear to be the most elastic to unit price changes, especially in comparison with France (see Table 4). In conjunction with the results for the PTM analysis, this means that the high export price

Table 4 Estimates of long-run PTM and price elasticity

(selected countries)

		France		Germany	
		PTM	Elasticity	PTM	Elasticity
Cars cc<1,000	Long-run coefficient	**-0.13**	**-0.40**	**-0.61**	**-4.49**
	Standard error	0.07	0.77	0.22	-0.55
	Number of observations	663	660	280	275
Cars 1,500<cc<3,000	Long-run coefficient	**-0.49**	**-1.18**	**-0.21**	**-2.13**
	Standard error	0.04	0.26	0.04	0.40
	Number of observations	1,691	1,604	1,601	1,525
Cars cc>3,000	Long-run coefficient	-0.29	-0.41	**-0.34**	**-1.58**
	Standard error	0.33	0.28	0.04	0.29
	Number of observations	345	337	1,095	1,076
Diesel cc<1,500	Long-run coefficient	**-0.60**	0.30	-0.11	0.06
	Standard error	0.29	0.56	0.13	0.53
	Number of observations	319	313	279	274
Diesel 1,500<cc<3,000	Long-run coefficient	**-0.47**	**-1.66**	**-0.28**	**-2.50**
	Standard error	0.07	0.49	0.07	0.63
	Number of observations	971	896	971	838
Diesel cc>3,000	Long-run coefficient	**-0.36**	-0.15	**-0.21**	**-2.41**
	Standard error	0.20	0.43	0.05	1.24
	Number of observations	344	338	1,081	1,004
Diesel Caravans	Long-run coefficient	-0.06	-0.17	-0.06	-0.59
	Standard error	0.17	0.75	0.04	0.76
	Number of observations	338	332	690	678

Note: Bold coefficients are significant at a 10% level or lower.

elasticity of French exporters to exchange rate movements cannot be justified solely by the rather limited impact that changes in export prices have on export quantities. Looking across sectors, exports of large cars turn out to be relatively more price-sensitive for all exporters. This result is somehow surprising, since we expected the demand for big cars to be less elastic to price and more sensitive to other factors, such as quality. When comparing the pre-euro and post-euro periods, only Italy exhibits a systematic fall in import demand elasticity to prices.

4 CONCLUSION

The collapse in trade that followed the recent global crisis has been particularly sharp for the automobile industry. Given the high export orientation of this sector and its relevance for many European economies, its prospects in terms of a trade recovery are a central issue in the ongoing policy debate. The debate should focus on the determinants of international competitiveness, deriving important lessons from the patterns displayed by exports in this sector even before recent events. Against this background, we have looked at the export performance of some major European economies in seven automobile sub-sectors, and we have studied the heterogeneity in pricing behaviour across countries and goods, as well as in the responsiveness of export quantities to prices. Our analysis

shows that exporters located in different EU countries tend to react differently to exchange rate movements, in terms of adjustments to their export prices. For instance, France generally exhibits a higher level of PTM with respect to its main European competitors. On the other hand, for a given exporter and sector, PTM appears not to vary according to the destination market. Turning to export volume dynamics, our analysis suggests rather strong differences in price elasticities across exporting countries: German exports appear to be the most elastic to unit price changes, especially in comparison with France. The absence of a clear relationship between the sensitivity of export prices to exchange rate movements and the sensitivity of export quantities to prices suggests two important conclusions: i) factors other than demand elasticity are the key determinants of pricing behaviour; and ii) exchange rate movements should not necessarily be perceived as a key determinant of competitiveness, at least for some European car exporters.

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