Estimating Trade Elasticities: Demand Composition and the Trade Collapse of 2008-09*

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Abstract

This paper provides a new methodology for the estimation of trade elasticities based on an import intensity-adjusted measure of aggregate demand. It does so by analyzing the collapse of world trade that took place in the wake of the 2008-09 global financial crisis. By its magnitude and synchronicity across countries, this contraction was unprecedented since 1945. Regrettably, however, standard empirical trade models—which typically use aggregate measures of demand—fail to account for these developments and severely underestimate the magnitude of the trade collapse. This led observers to search for alternative explanations, including the drying up of trade finance. In this paper, we argue that the composition of demand during the crisis played a key role in the collapse of trade, and we highlight two main effects. First, the significant fall in import-intensive categories of expenditure (especially investment, but also private consumption) in key trading nations had a large downward impact on the quantity of imports from the rest of the world. Second, the fragmentation of production across countries implies high import content of exports and, in turn, the propagation of shocks across borders. We provide evidence in favor of these factors, based on the analysis of the new OECD input-output tables and on econometric estimates for a group of OECD countries. Specifically, we show that a new intensity-weighted measure of demand outperforms alternative measures, during the crisis but also in normal times and the long run. Our measure thus provides a solution to the long-standing Houthakker-Magee (1969) elasticity puzzle.

JEL Codes: F10, F15, F17.

Keywords: Estimation of trade elasticities; Financial crisis; Global trade; Houthakker-Magee puzzle; Input-output tables.

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1 Introduction

The estimation of trade elasticities is a central question in international economics at least since Houthakker and Magee's (1969) seminal work. The question has received renewed attention, and the debate on the determinants of trade flows has re-heated, as scholars debated the adjustment of the global trade imbalances that emerged in the 2000s and struggled to understand the dynamics of world trade in the aftermath of the global financial crisis of 2008-09. One of the key features of the global recession triggered by this crisis was a sharp contraction in world trade that reached its peak between the end of 2008 and the first quarter of 2009. In 2009, global trade fell by 11% in real terms on a year-on-year basis—an unprecedented development since 1945. The recovery of global trade started in the second quarter of 2009 in most advanced and emerging economies and gained strength in 2010, when global trade is anticipated to rise by over 11% according to international organizations. A distinct feature of the recent world trade collapse is that such fall has been much more pronounced than the fall in world output (real world GDP dropped by 0.6% in 2009). This fact suggested the possibility of a break in the relation between world trade and world output: Data indicate that the change in global trade was higher than that of global output by a factor of 19 in 2009, against an average of 1.9 in the 1990-2008 period (Figure 1). The fall in international trade affected a large number of countries in all main economic regions, albeit to a different extent (Figure 2). The fall in imports between the fourth quarter of 2008 and the first quarter of 2009 was particularly strong in emerging countries, such as China, Taiwan and Mexico, but also in some large industrialized countries such as Japan.

These stylized facts raise the question of what could have triggered such sharp contraction in world trade. The downturn in trade is not surprising per se, given the fall in demand that results from financial crises (through wealth effects and lower consumer access to credit). However, the magnitude of the fall and its synchronicity across the world constitute a puzzle: Indeed, standard empirical trade models, which relate trade flows to demand and relative prices, tend to under-estimate the size of the contraction, as we will review below.

The fact that trade flows contracted by a larger extent than expected based on standard elasticities led observers to consider alternative explanations. In particular, the drying up of trade finance received much attention.[1] World Bank President Robert Zoellick mentioned that this factor could account for 10-15% of the total fall in world trade. This led several international organizations to disburse credit in an effort to stimulate trade finance. These efforts culminated in the G20 leaders decision to allocate 250 billions of U.S. dollars to support trade finance in their April 2009 meeting in London. Understanding the contraction in world trade thus has important policy implications. Other explanations for the trade collapse included inventory adjustment (Alessandria, Kaboski, and Midrigan, 2010) and the role of imported intermediates and compositional effects (Eaton, Kortum,

[1] Among others, see Amiti and Weinstein (2009) and Chor and Manova (2010).

Neiman, and Romalis, 2011, and Levchenko, Lewis, and Tesar, 2010).

In this paper, we provide a new methodology for the estimation of trade elasticities. We do so by exploring the role played by the composition of aggregate demand during the crisis using a novel, import intensity-adjusted measure of aggregate demand that we construct from the new input-output tables produced by the Organisation for Economic Cooperation and Development (OECD).[2] Our approach is motivated by the fact that different components of aggregate demand have very different import contents, as shown by the analysis of input-output tables. In particular, the import content of investment is higher than that of private consumption, which in turn is higher than that of government consumption (government spending typically goes to non-tradable or domestically-produced, tradable goods). Simple cross-correlations show a similar pattern, i.e., imports are highly correlated with investment, the correlation of imports and government consumption is low, while the correlation of imports and private consumption is somewhere in between.

The analysis of input-output tables allows us to explore another, related factor that plays an important role: the import content of exports. Specifically, two effects may take place. First, the increasing integration of production chains in the world mechanically raises the share of exports that corresponds to the transformation of imported inputs. Thus, a fall in demand in the United States or other large industrialised countries may affect a broad range of countries directly, by reducing the volume of traded final goods, and indirectly, by reducing the volume of intermediate goods. The fact that Asian countries recorded such large falls in trade is also consistent with this argument, given the close integration of Asian countries with each other and the extent of production sharing across them. Second, even without vertical integration, several key countries' exports generally tend to have a strong import content because many inputs necessary to the production of tradables are imported (for instance, raw materials or energy products).[3]

The fact that standard econometric models ignore these different import contents and consider only aggregate demand may explain why they fail to account for the magnitude of the fall in world trade during the 2008-09 financial crisis. In the last quarter of 2008 and the first quarter of 2009, investment fell by a larger extent than aggregate output (in the United States, investment fell by 23.8% and 36.6%, respectively, whereas output—partly supported by government spending—contracted by "only" 7% and 5%). The breakdown of traded goods confirms the potential relevance of the import content channel (the volumes of capital and intermediate goods have fallen by a larger extent than consumer goods). To address this problem, we build a new intensity-weighted measure of demand based on the OECD input-output tables. We then use this new measure in our econometric exercise

[2] The use of the OECD's new input-output tables for multiple countries is a key distinguishing feature of our exercise relative to Levchenko, Lewis, and Tesar (2010).

[3] A recent literature explores the role of imported intermediates and production chains in propagating shocks and increasing business cycle synchronization across countries (see, among others, Bergin Feenstra, and Hanson, 2009, Burstein, Kurz, and Tesar, 2008, and Zlate, 2010).

and show that it outperforms alternative measures, during the crisis but also in the long run.[4]

In particular, we run standard trade regressions for a panel of 18 OECD countries[5] where real import flows are modeled as function of our new intensity-weighted measure of demand and relative import prices. This model, estimated for the period 1985Q1-2010Q2, proves to be superior to models using standard measures of demand in terms of both goodness of fit and stability of parameter estimates. The model performs well during recession times compared to standard models (e.g., it is able to capture on average 78% and 69% of the fall in imports in 2008Q4 and 2009Q1, respectively, while a model using GDP as explanatory variable captures only 48% and 32%) since, in these periods, highly import-intensive demand components tend to fall on average more than relatively less import-intensive components. Moreover, our empirical model outperforms standard models also in the long run; in particular, the estimated short-term and long-term elasticities of imports to our new measure of demand are remarkably stable over the entire sample period for the majority of countries, suggesting that no structural break occurred in the trade-demand relationship during the 2008-09 financial crisis. This a first important result that adds to the recent literature aimed at explaining the trade collapse.[6] According to our model, there is no major "puzzle" in the magnitude of the fall in world trade observed during the crisis: Trade fell mostly because demand crashed globally and did so particularly in its most import-intensive component—investment.[7] Moreover, the strong relationship between exports and imports in each country (in 2005, the average import content of exports was 27% for our sample of countries, and 23% for the G7), linked to the increased internationalization of production and the strong dependence of the tradable sector on imported inputs, certainly contributed to the simultaneity of the trade collapse and likely amplified its magnitude. A second important implication of our analysis is that, although demand can be identified as the principal cause of the fall in global trade during the recent crisis, using standard measures of aggregate demand, such as GDP or domestic demand, in trade equations may be misleading, especially during periods, such as the 2008-09 crisis, in which the more import-intensive GDP components (i.e., investment and exports) shrank much more than the others. Our paper has the advantage of

[4] Eaton, Kortum, Neiman, and Romalis (2011) also use input-output tables in their analysis of the trade collapse to specify the trade structure between the U.S., Germany, Japan, and China in a model built on Eaton and Kortum (2002). They use the model to decompose the collapse into four different components (demand composition, trade frictions, productivity, and overall trade deficit) and analyze their quantitative importance using counterfactual exercises. Our work differs and complements theirs in several ways: First, we use a more agnostic approach based on empirical tests without reference to a specific theoretical model; Second, by focusing on demand components rather than the nature of goods (manufacturing versus non-manufacturing or durables versus nondurables), we choose to look at how changes in the use of goods (rather than their nature) can help explain the trade collapse; Finally, our work complements theirs by providing a rationale for the fall in manufacturing demand, as long as we connect it to the contraction in investment and export demand.

[5] The choice of countries reflects data availability.

[6] In addition to the contributions mentioned above, see also Baldwin (2009), Bems, Johnson, and Yi (2010), and International Monetary Fund (2010).

[7] Our results thus suggest a key, "indirect" role of finance in the trade collapse: By inducing a paralysis of traditionally credit-dependent investment, the seizure of financial markets brought about the collapse of the most trade-intensive component of aggregate demand. In general equilibrium, this demand-side effect of finance and the supply-side, direct, trade finance channel highlighted by Amiti and Weinstein (2010) and Chor and Manova (2010) can complement each other in a complete explanation of the collapse.

introducing a single statistics, our new intensity-weighted measure of demand, which is superior to standard ones in terms of fit and stability of the elasticity estimates. From a policy perspective, our analysis has implications for the recovery of world trade after the crisis, by suggesting that an investment-led recovery would likely stimulate world trade by a larger amount than a government consumption-led recovery.

Importantly, our results have broader implications than explaining the outcome of the 2008-09 financial crisis—the application of our methodology on which we focused. As we noted above, the appropriate estimation of (exchange rate and demand) trade elasticities is indeed one of the longest standing questions in international economics. Houthakker and Magee (1969) estimated demand elasticities for U.S. exports and imports such that, in the long run, the U.S. should run a trade deficit, and imports should reach 100% of GDP. Much subsequent literature has reached similarly puzzling results, lending robustness to the Houthakker-Magee elasticity puzzle. In more recent academic and policy debates, the estimation of trade elasticities plays a role, in particular, in the context of global trade imbalances and the fluctuations of the dollar that may accompany an adjustment in the trade balance of the U.S. and its trading partners (Obstfeld and Rogoff, 2005, 2006, Blanchard, Giavazzi, and Sá, 2005). Trade elasticities also represent a key parameter in the propagation of shocks across borders. Our results contribute to these debates by providing a better specification of empirical trade equations and a more accurate estimation of trade elasticities. Using our panel of countries, we compute short-term and long-term demand elasticities (comparing them with a model including GDP as demand variable). Our results are optimistic compared to the existing literature, as we find lower short-run and long-run income elasticities of trade, such that the Houthakker-Magee puzzle is substantially reduced.

The rest of the paper is organized as follows. Section 2 reviews the existing literature, paying particular attention to the ability of standard empirical models to account for the fall in world trade. Section 3 provides stylized facts on the import content of investment, exports, private and government consumption and presents our new intensity-weighted measure of demand based on the OECD input-output tables. Section 4 turns to econometric evidence for a panel of OECD countries: We present an alternative specification that uses our new measure of demand and improves the fit of the model. Section 5 presents the implications of our methodology for the broad question of estimating trade elasticities in the short and in the long run. Section 6 concludes.

2 Can Standard Models Explain the Fall in World Trade?

The appropriate estimation of (exchange rate and demand) trade elasticities has a very long tradition in international economics. Accordingly, a large number of papers have estimated trade equations (see Bussière, Chudik, and Sestieri, 2009, for a recent review of the literature). Most of these papers relate imports to domestic demand and relative import prices; similarly, they relate exports to foreign

demand and relative export prices, see e.g. the ECB's Area Wide Model (Fagan, Henry, and Mestre, 2001), the Fed's FRB Global and USIT models (Bertaut, Kamin, and Thomas, 2008), the OECD (Pain, Mourougane, Sédillot, and Le Fouler, 2005), as well as the survey in Goldstein and Kahn (1985).[8]

Specifically, typical trade equations relate real exports X to foreign demand FD and relative export prices RXP on the export side, and real imports M to domestic demand DD and relative import prices RMP on the import side:[9]

$$X = X(FD, RXP) \tag{1}$$

$$M = M(DD, RMP) \tag{2}$$

As the estimated demand elasticities are usually very high (in the ballpark of 1 on the export side and 2 on the import side[10]), a fall in demand in a given country is likely to be associated with falling real imports. In the context of the 2008-09 crisis, the fall in demand can in turn be related to the real effects of the financial crisis. First, real disposable income has been significantly reduced in many countries; this effect has been reinforced by wealth effects due to falling asset prices (both stock and house prices). Second, access to credit has been more limited, therefore weakening investment and consumption (e.g., firms being refused finance for investment projects, and households being refused loans to purchase consumer durables). In addition, trade itself was an important channel in the transmission of the crisis across borders, with varying importance across countries, depending on their openness, robustness of domestic demand, and integration in world trade. It is for this dual nature of world trade (consequence and propagation mechanism of the crisis) that the fall in world trade figures prominently in policy discussions.

Importantly, the fall in world trade during 2008 and 2009 exceeds the magnitude that could be expected based on standard relations like (1) and (2). In particular, data indicate that the change in global trade was higher than that of global output by a factor of 19 in 2009, against an average of 1.9 in the 1990-2008 period. This led many commentators to suggest that other factors may have been at play, such as the drying out of trade finance or protectionism. In this paper, we argue that a collapse of demand is the major culprit of the collapse in global trade, but that a more nuanced analysis of demand than standard aggregate measures is needed to show this—in particular, that it

[8] A few definitions: Relative import prices refer to the ratio of import prices to domestic prices (expressed in the same unit); Relative export prices refer to the ratio of export prices to a weighted average of foreign prices (expressed in the same unit). Other proxies for competitiveness can be found in the literature. Foreign demand is a weighted average of demand in foreign countries (the weights are usually given by the shares of partner countries in total exports).

[9] The specifications are generally expressed in error correction form and often include additional variables and/or (possibly non-linear) time trends. The equations are written here in a very general form for illustrative purposes.

[10] This result is very robust in the empirical literature; it is a puzzle because it implies that, in the long run, countries would run a trade deficit (based on output growth convergence) and that countries' imports reach 100% of GDP. This is referred to as the Houthakker-Magee (1969) elasticity puzzle.

is necessary to disentangle the effects of demand composition and import intensity.

In fact, some attempts have been made to account for the composition effects of demand on trade in earlier literature. In particular, Erceg, Guerrieri, and Gust (2006) use a dynamic, stochastic, general equilibrium model (the SIGMA model recently developed at the Board of Governors of the Federal Reserve System) to show that the composition of demand in the U.S. matters for the response of trade to a variety of shocks (they explore in particular the effect of an investment shock). The main difference between our paper and Erceg, Guerrieri, and Gust (2006)—besides the fact that ours is a purely empirical paper—is that they are primarily concerned with the impact of various shocks on investment in the context of global imbalances and their adjustment. In this paper, by contrast, our main objective is to present a test for the composition effect and a quantification of its importance across countries, focusing primarily on the downturn in world trade that took place in 2008-09. In addition, Erceg, Guerrieri, and Gust (2006) focus on the composition of domestic demand only, ignoring the role of the import content of exports.

More recently, a chapter of the World Economic Outlook (IMF, 2010—WEO below) studied trade dynamics following past banking and debt crises for a panel of 154 advanced, emerging, and developing economies over the 1970-2009 period. The main findings are that imports are strongly affected during crisis episodes, falling by 16% on average in the first two years and remaining below normal over the medium term. Adverse output dynamics explain 50 to 60% of import losses over the medium term. The authors also control for factors other than output, such as credit conditions, exchange rate changes, exchange rate volatility, and protectionism, and they show that, even taking these factors into account, 20 to 35% of import losses remain unexplained over the medium term. Finally, the authors investigate the role that "composition effects" may have on trade dynamics following a crisis. This analysis of composition effects is motivated by the evidence that, during crises, the fall in demand for particular categories of goods, such as durables, is more pronounced than for others, and those goods account for a larger share of imports than output. The authors, however, focus on the composition of trade rather than that of demand, the main reason for this being the unavailability of import contents of different demand components. By means of simple calculations, they show that this channel may account on average for a significant but small part of import reductions during the 5 years after the start of a crisis. Our paper is somehow similar to the WEO analysis but focuses on the composition of demand. We show that, using an alternative and more appropriate measure of demand that takes into account the different import content of different demand components and the import content of exports, the "trade collapse puzzle" of 2008-09 basically disappears. We do not argue that other factors have not played a role in driving down global trade during the crisis, but our results suggest that no structural break has occurred in the import-demand relationship across countries once we consider a better measure of demand than standard ones. Moreover, the aim of this work is to go beyond the explanation of the trade collapse

of 2008-09, by proposing a new demand measure that outperforms standard measures during all times.[11]

3 A New Import Intensity-Adjusted Measure of Demand

Empirical trade models typically use aggregate foreign and domestic demand; they ignore the fact that different components of domestic expenditure have different import contents and different correlation coefficients with imports. Table 1 shows the evolution of import contents of main GDP components over time for a large set of countries.[12] The methodology explaining the derivation of the input-output tables used in this paper to compute the import contents of the different demand components can be found in Yamano and Ahmad (2006), De Backer and Yamano (2007), and Gou, Webb, and Yamano (2009). The 2005 values of the import components of private and government consumption, investment, and exports for our panel of 18 OECD countries (with the exception of Korea) are shown in Figure 3, together with the average across all countries and the G7.[13] Figure 4 shows the contemporaneous correlation between quarterly changes in real imports and changes in the main components of GDP for the same group of countries.

As Figure 3 shows, the import content of government consumption is low (government spending mostly includes non-tradables, such as services, and a high share of domestically produced goods, e.g. for the defense industry) across all countries.[14] Turning to the other two main components of aggregate expenditure, investment has a higher import content than private consumption across countries. Finally, exports are also very import-intensive as shown by the purple bars in Figure 3: On average the import content of exports is 30% with peaks of about 40% for small open economies such as Belgium and Portugal and for some emerging countries (see Table 1 for a comparison across a larger set of countries). Consistently with these findings, imports tend to be strongly correlated on average with exports and investment and, to a lesser extent, with private consumption, while they appear to be uncorrelated with government consumption, as shown in Figure 4.

In this paper, we focus on imports, and we propose a new measure of demand that reflects the import intensity of the different components of expenditure and the import content of exports.[15] We call this import intensity-adjusted measure of demand IAD, for "import-adjusted demand", and

[11] With respect to explaining the 2008-09 trade collapse, the closest paper to ours is perhaps Levchenko, Lewis, and Tesar (2010). However, their analysis focuses on the U.S., while we use the new OECD input-output tables to study a panel of countries.

[12] The input-output tables allow us to compute import contents for the different demand components. We report the values for the 1995-2005 period in Table 1. For some countries, values back to 1985 exist and are available upon request.

[13] The countries we focus on are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the UK, and the U.S.

[14] Government spending may be more affected than private consumption by protectionist pressures, such as the Buy American Act of 1933 and the more recent Buy American provision of the American Recovery and Reinvestment Act of 2009 in the U.S., which contribute to explain the low import content of government consumption.

[15] We could also try to model exports, but this would be slighlty more tedious as we would need to construct a series of aggregate demand by category, summing up investment, private and public consumption across trading partners.

construct it, country by country, as follows:

$$IAD_t = PC_t^{\omega_t^{pc}} * GC_t^{\omega_t^{gc}} * INV_t^{\omega_t^{inv}} * EX_t^{\omega_t^{ex}},$$

where PC stands for private consumption, GC for government consumption, INV for total investment, and EX for exports, included to take into account the import content of export demand. In logarithms:

$$\ln IAD_t = \omega_t^{pc} \ln PC_t + \omega_t^{gc} \ln GC_t + \omega_t^{inv} \ln INV_t + \omega_t^{ex} \ln EX_t.$$

The weights, ω_t, come from the input-output tables, are time varying and normalized in each period such that their sum is equal to one.[16] IAD represents a better measure of demand than aggregate demand or GDP to explain import fluctuations since it weights each GDP component according to its import content. Having neglected that investment and exports tend to have larger import content than private consumption and government consumption may explain why the impact of the fall in GDP on trade during the 2008-09 crisis was larger than suggested by commonly estimated elasticities. Two facts are also worth noticing: First, the relative import contents of the main components of GDP are substantially different from their shares in GDP (on average, private consumption represents 60% of GDP in our panel of countries, against 20% of government consumption and investment[17]). Second, different components of aggregate demand showed very different behaviors during the crisis. Indeed, investment and exports fell much more than private and government consumption in most countries. In the U.S., for instance, total investment fell by 24% and 37% at annual rates in the last quarter of 2008 and first quarter of 2009, whereas private consumption fell only by 3.3% and 0.5%, respectively. Likewise, in the euro area, the fall in real GDP that took place in 2009 (4%) was mostly due to the fall in investment over this period (11.3%), whereas private consumption fell moderately (by 1.1%).[18] The fact that investment falls more sharply than other categories of expenditure during recessions is a robust stylized fact.[19] Figure 5 shows the typical path of demand components and trade variables during the two years after the start of a recession (defined as two consecutive quarters of negative real GDP growth) for our panel of 18 OECD countries and the G7.[20] Panels A and C show the average loss of each variable during all the recessions that occurred between

[16] Since the input-output tables provide import contents for the different demand components only every five years, we linearly interpolate the available points to construct quarterly weights. For the period after 2005, we assume the same weight as in 2005. For some countries, the input-output tables do not provide data before 1995. In these cases, we use the same weight as in 1995 for the period before.

[17] Exports and imports also represent on average 20% of GDP in our panel of countries.

[18] Net trade also contributed negatively to real GDP growth by –0.8 percentage points in 2009.

[19] It is consistent with the standard property of the business cycle for many countries that investment is more volatile than GDP, while consumption is smoother.

[20] To obtain the lines in Figure 5, we performed panel regressions for each of the variables, where the regressors are an indicator of recession start (equal to 1 in the first quarter of a recession), the lags of such indicator, and country-specific dummy variables. The methodology is similar to that of IMF (2010). The resulting line for each variable can be interpreted as its unconditional average cumulative loss during recession periods.

1985 and 2007, whereas panels B and D refer to the 2008-09 recession only. The figures also include the behavior of real GDP and our new measure of demand, IAD. As panel A shows, investment is the demand component that exhibits the largest fall during recession periods, dropping by 14% on average two years after the start of a recession. Trade variables also fall substantially in the first year and then gradually recover. Government consumption does not generally fall during recessions (possibly because it is used for counter-cyclical policy), while private consumption falls less than GDP on average. Our adjusted measure of demand falls by 2% more than GDP on average. Focusing on the 2008-09 recession, the first major difference is on the scale of the vertical axis, which is almost doubled: Investment on average fell by more than 20% and did not exhibit any sign of recovery after two years. The second major difference is the size of the average fall of trade variables, which in the case of imports is thrice the size observed during previous recessions and in the case of exports is increased sixfold. This last fact illustrates clearly the global nature of the 2008-09 recession: Exports on average fell modestly during previous recessions, partly because external demand was sustained by trading partners in a different phase of the cycle. In contrast, during 2008-09, 16 out of our 18 countries experienced a recession, driving down external demand for each of the country in our sample. This global effect, together with the propagation/synchronization mechanism implied by increased vertical integration, could help explain why the fall in trade in 2008-09 was exceptionally high and synchronized. Finally, panel B shows that our measure of demand exhibits a drop of about 18% two years after the start of the crisis, reflecting significant export and investment losses, against a realized drop in GDP of "only" 8%. The story is rather similar in terms of behavior of different components of demand and differences in magnitude between past recessions and the 2008-09 one when looking at the G7 countries.

4 Econometric Analysis

The objective of this section is to quantify the importance of the composition effect described above on import flows by means of a simple econometric exercise. There are two main motivations for turning to econometric models. First, one needs to know whether the fall in world trade is still largely unexplained once composition effects and import intensity are taken into account (which would call for investigating the role of other factors as primary explanation of the trade collapse). Second, econometric estimations should be able to distinguish between static and dynamic effects. Indeed, the input-output tables show the immediate effect of a rise in the main categories of expenditure on imports, but they do not show the long-run dynamics of imports, which can only be assessed with an econometric model.

Results build on a dataset of the 18 advanced OECD countries (with the exception of Korea) mentioned in the previous section and repeated here for the reader's convenience: Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, Netherlands, Norway, New Zealand, Por-

tugal, Spain, Sweden, Switzerland, the UK, and the U.S. The data on imports and exports of goods and services, GDP, private and government consumption, total investment, all in volume, and the series of import prices come from the OECD Economic Outlook database; the time series are at quarterly frequency, and the estimation is performed over the period 1985Q1-2010Q2. Relative import prices have been constructed by dividing the series of import prices of goods and services for each country by the respective GDP deflators.

4.1 Panel Results

We start by estimating a simple, standard model for imports similar to that used in IMF (2010). In the regression, the quarterly growth of real imports for each country, $\Delta \ln M_{it}$, is a function of contemporaneous values of the quarterly growth of demand, $\Delta \ln D_{it}$, and the quarterly growth of relative import prices, $\Delta \ln RMP_{it}$, as well as country dummies δ_i:

$$\Delta \ln M_{it} = \delta_i + \beta_1 \Delta \ln D_{it} + \beta_2 \Delta \ln RMP_{it} + \varepsilon_{it} \tag{3}$$

In the analysis that follows, we compare three models: Two are standard models where either GDP or domestic demand, DD (computed as the sum of private and government consumption and total investment), are used as measures of domestic aggregate demand, and one is a model using our new import intensity-adjusted measure of demand, IAD. For robustness, we also consider an alternative specification for each model, where import growth is also function of its own lags and lags of the explanatory variables to allow for a richer dynamics:[21]

$$\Delta \ln M_{it} = \delta_i + \sum_{j=0}^{J} \beta_{1j} \Delta \ln D_{it-j} + \sum_{j=0}^{J} \beta_{2j} \Delta \ln RMP_{it-j} + \sum_{j=1}^{J} \beta_{3j} \Delta \ln M_{it-j} + \varepsilon_{it} \tag{4}$$

We estimate panel regressions of the type (3) and (4) using country-specific fixed effects and robust variance-covariance matrix estimates. Table 2 presents the in-sample results of the 6 specifications just described for the full set of 18 countries and the G7 (the U.S., the UK, Japan, Germany, France, Italy, and Canada) for the period 1985Q1-2010Q2. Estimation results show that the model using IAD is noticeably superior in terms of fit to the other two, and this applies both to the full set of countries and the sub-set of G7 countries. Including lags of the dependent and independent variables improves the fit of the models only marginally and does not reveal substantial changes in the elasticity point estimates, especially for the model using IAD as demand variable. The ranking of the three models also remains unchanged.

Figure 6 shows the actual and fitted values of real import growth for a subsample of countries (the U.S., the UK, Japan, Germany, France, and Italy[22]), where the fitted values are obtained by estimating the panel regression (3) for the full set of countries using respectively IAD, GDP, and

[21] We considered $J = 2$ in the estimation.

[22] We do not report the results for the other countries to save space, but they are available upon request.

DD as demand variables. As the figure illustrates, the IAD model delivers better estimates of import growth than the other two models, while the model using domestic demand is inferior to the other two. For this reason, from now onward, we will compare the IAD specification only with the GDP specification. When looking at the panels in Figure 6, it is also evident that the IAD model performs better than the GDP model especially in periods of large falls in imports, such as the global recession of 2008-09. Figures 7 and 8 illustrate exactly how much of the fall in imports observed during 2008Q4 and 2009Q1 the two models are able to account for: The last blue bar in each figure, called total, shows the actual fall in aggregate imports in our 18 countries[23] together with the predicted aggregate fall using IAD and GDP, respectively. In particular, the weighted average of real imports in our sample of countries fell by 5.6% in 2008Q4 and 9.3% in 2009Q1, on a quarterly basis. The model using IAD as explanatory variable captures 78% and 69% of the fall in aggregate imports in 2008Q4 and 2009Q1, respectively, while only 48% and 32% is explained by the GDP model specification.

Since the model using IAD performs well in explaining the 2008-09 trade collapse, it is important to understand whether the superiority of this model against standard specifications, as shown in Table 2, comes from a better fit only during recession periods, when highly import-intensive demand components tend to fall on average more than the components that are relatively less import-intensive (as shown in Figure 5), or survives also in "normal" times. This is an important question, since only in the second case we would be able to conclude that our new measure of demand is in fact superior to standard measures and should be preferred in empirical work aimed at estimating trade elasticities. Table 3 shows the result of the model (3) estimated separately for "normal" and recession periods for the full set of countries and the G7.[24] Several results are worth noticing. First, both models do better at estimating real import growth during recession times, i.e., in periods when the fall in demand is particularly crucial to explain the behavior of trade variables. Second, the model using IAD outperforms the one using GDP during all times in terms of goodness of fit, hence suggesting that the results in Table 2 are not driven only by recession periods, but they apply over the entire estimation period. Third, the short-term demand elasticity of imports generally varies between recession and non-recession periods, being higher in recessions. However, while the elasticity of demand estimated from the GDP specification is four times bigger in recession times, both for the entire set of countries and the G7, the increase in elasticity from the IAD specification is much lower, one and a half times higher for the full set of countries, and only 20% higher for the G7. This is an important result that corroborates our idea that using GDP as demand measure in trade equations may be misleading as it may deliver highly volatile estimates of demand elasticities that may suggest the presence of structural breaks even when this is not the case. Our new measure of demand, instead, by taking into account the different import content of demand components, delivers elasticities that are lower

[23] To construct the aggregate values of import growth, we used the average of the import weights for the countries between 2000 and 2009.

[24] As in the previous section, recessions are defined as two consecutive quarters of negative real GDP growth.

in magnitude and more stable over time.[25] Finally, the IAD specification also provides higher and more significant estimates for import price elasticities, which is a promising result given that few papers find a large and significant role for relative prices in trade equations.

5 Estimating Trade Elasticities: A Solution to the Houthakker-Magee Puzzle

A large body of literature in international economics focuses on the estimation of trade elasticities, given its relevance in trade-related policy debates. The estimation of price and income elasticities is indeed crucial to assess, for instance, which factors would play a decisive role in the process of global trade rebalancing, as well as to gauge the effects of exchange rate and relative demand movements on trade flows. The study of income trade elasticities is linked to the so-called "elasticity puzzle," or Houthakker-Magee (1969) puzzle, i.e., the well-known empirical result for the U.S. (but also for other countries) that finds that the demand elasticity is significantly higher on the import side (where it is commonly estimated to be above one) than on the export side (where it is generally equal to one).[26]

In this paper, we focus on the estimation of import demand elasticities; in particular, we compare the results obtained estimating models using, respectively, IAD or GDP as demand measures. A comparison of our results with other empirical work on trade elasticities is difficult; existing papers model differently import equations, featuring different measures for domestic demand and relative prices. In practice, for what concerns short-run import elasticities of demand, we compare the estimates of the demand coefficient β_1 in panel equation (3) (as already shown in Table 2 for the full set of countries and the G7), and we estimate the same equation also for the G7 countries individually. Long-term import elasticities of demand are obtained by estimating equation (3) with the variables in levels instead of first differences, which can be interpreted as the first stage of the two-step cointegration procedure of Engle and Granger (1987). We also use a second methodology to compute long-term import elasticities of demand for individual G7 countries, which consists of estimating a vector error correction model (VECM) featuring real imports, a measure of real demand, and real import prices for each country, and taking the cointegration coefficient of demand as a measure of long-run income elasticity. Although we will base our discussion on the first methodology, we report results from this second approach for two reasons: First, because it represents a robustness check on the results obtained with the first methodology, and second, because many papers use cointegration coefficients as measures of long-run elasticities, hence making the comparison with previous work on this subject easier.

Table 4 shows the estimated values of short-term and long-term import demand elasticities for the

[25] See below for further analysis of the stability of demand elasticities from the two models.

[26] This represents a puzzle because it implies that, to prevent the trade balance from permanently moving into deficit, the exchange rate should permanently depreciate (this is also under the condition that foreign and domestic output grow at similar rates). Another puzzling implication of having a demand elasticity above one is that output should be completely imported in the long run, barring a permanent depreciating trend.

full set of countries, the G7, and individual G7 countries over the entire sample period. Results from the panel regressions show a substantial reduction in estimated demand elasticities, both short-term and long-term, when IAD is used. In particular, short-run elasticity estimates are close to unity (1.01 for the entire set of countries and 1.05 for the G7), implying an almost proportional relation between demand and imports at high frequency. Estimates of long-term elasticities are slightly bigger (1.2 for the entire panel and 1.39 for the G7) but still much lower than the demand elasticities of imports to GDP (1.88 and 2.34, respectively). Similar results hold for individual G7 countries, i.e., both short-run and long-run elasticity estimates are substantially reduced when our new import intensity-adjusted measure of demand is used instead of GDP. Our results for the U.S. and other G7 countries from the model using GDP are comparable with existing literature, i.e., we find large values of long-term demand elasticities, in the ballpark of 2 for most countries, under both estimation methodologies.[27] The results from the model using IAD are encouraging: Long-term import demand elasticities are much lower for all countries, and of the same order of magnitude as export income elasticities found in the literature (see, for instance, Hooper, Johnson, and Marquez, 2000, and Crane, Crowley, and Quayyum, 2007), such that the asymmetry at the heart of the Houthakker-Magee puzzle basically disappears. Although a direct comparison with other models is not possible, our results using IAD as demand variable go in the same direction of other papers that found lower long-term income elasticities of imports once import equations are corrected for other factors, such as vertical integration or aggregation bias. Cardarelli and Rebucci (IMF, 2007), for instance, find that once exports of intermediate products are added in the U.S. import equation to account for vertical integration, the resulting income elasticity drops significantly and becomes lower than one. A similar result holds in Bussière, Chudik, and Sestieri (2009) in the context of a global VAR where exports enter in the import cointegration relation. Our approach is in principle more complete, as we do not correct only for vertical integration, but also for the import content of different demand components that is not taken into account when using aggregate demand. Moreover, this approach has the advantage of using a single statistic, our import intensity-adjusted measure of demand, delivering a single demand coefficient of easier interpretation.

As a final point, we study the stability of elasticity estimates across countries and over time. This is important since previous studies have found very different estimates for trade income elasticities, depending on the sample period and the countries analyzed. A first result worth noticing in Table 4 is that not only the point estimate values of short-run and long-run elasticity estimates are reduced by using our new measure of demand, but the dispersion of these values across countries is also substantially lower (the standard deviation of G7 short-term elasticities is 0.22 against 0.47 in the

[27] Cardarelli and Rebucci (IMF, 2007), for instance, estimate an OLS import equation in levels for the U.S. and obtain a value of long-term demand elasticity of 1.86 using annual data from 1986 to 2006 and 2.03 for the period 1973-2006. Crane, Crowley, and Quayyum (2007) perform VECM estimation for imports for the G7 and find estimates of the cointegration coefficients of demand similar to ours for most countries. For the U.S., they find a value of the long-term import demand elasticity of 1.93 over the period 1960-2006.

GDP model, and that of G7 long-term elasticities is 0.07 against 0.58 in the GDP case).

We analyze the behavior of demand elasticities over time by estimating equation (3) with a five-year rolling window to study the dynamics of short-run elasticities, and by estimating the level version of (3) with a ten-year rolling window to study the dynamics of long-run elasticities. Results for short-term elasticities are reported in Figure 9 for a selection of countries[28]: The red lines refer to the IAD specification, and the blue lines to the GDP one. The improvement of our model in generating stable estimates over time stands out clearly when looking at the figure; in particular, the improvement is very large for some countries, such as Germany, Japan, Italy, and Spain, but also for countries where this is less striking, such as the U.S. and France, the reduction in the dispersion of these values over time is substantial (in the U.S. case, for instance, the standard deviation of the estimated rolling elasticities is 0.38 in the IAD case against 0.66 in the GDP model). Moreover, rolling short-term elasticities fluctuate tightly around values very close to one for most countries, confirming the result from the full sample estimation that there exists an almost proportional relation between demand and imports at high frequency. Finally, if we look at the end of the rolling sample, corresponding to the trade collapse of 2008-09, the difference between the two models becomes even clearer: Rolling elasticities with respect to GDP show a jump in most of the countries around the crisis time, especially in the U.S., Japan, the UK, Canada, Spain, and Sweden, which may suggest that a structural break occurred in the demand-import relationship during that time. In contrast, rolling elasticities with respect to IAD do not present a discontinuous behavior at all or register a jump that is much smaller in size, such as in the U.S. case, suggesting a rejection of the structural break hypothesis.[29]

Figure 10 repeats the exercise of Figure 9 for rolling long-term demand elasticities. Again, the elasticities with respect to IAD are much more stable over time than those with respect to GDP. Moreover, the values of the elasticities to IAD are very homogeneous across countries, whereas the values of the same elasticities with respect to GDP are much more dispersed across countries.

These results about the stability over time and across countries of import demand elasticities estimated using our new measure of demand have important policy implications. Stability across countries implies, among other things, that symmetric shocks in different countries should have very similar effects on trade flows both in the short run and the long run. Stability over time permits to make more precise forecasts of trade flows conditioning on different policy scenarios. Overall, using our import intensity-adjusted measure of demand instead of standard measures of aggregate demand would allow policy makers to construct more stable scenarios and calibrate them with higher precision.

[28] We do not report the results for other countries to save space, but they are available upon request.

[29] Formally testing for the presence of a structural break during the crisis, for instance using a Chow test, is difficult since this episode coincides with the end of our estimation sample.

6 Conclusion

This paper proposed a new methodology for the estimation of trade elasticities, based on an import intensity-adjusted measure of aggregate demand. It did so by analyzing the trade collapse that took place in the wake of the 2008-09 financial crisis and focusing on the composition of demand during the crisis. Whereas standard models typically use an aggregate measure of demand such as GDP, we argue that there is value added in giving different weights to the components of GDP, which typically have very different import intensities. In particular, the analysis of the new OECD input-output tables shows that investment is significantly more import intensive than private consumption, which in turn is more import intensive than government spending. In addition, we also find that exports are very import intensive, which contributes to explaining the synchronicity of the trade collapse across countries.

Carefully disentangling the effects of investment, private and government consumption, and exports turns out to be especially important in the context of the 2008-09 crisis, during which these different components of aggregate demand evolved very differently. In particular, investment decreased significantly over this period, whereas government spending remained robust, supported largely by the fiscal packages put in place by governments in response to the crisis. To the extent that investment (and, to a lesser extent, private consumption) is more import intensive than government spending, this may explain why standard models typically underestimate the fall in trade that took place in 2008-09. We reported key stylized facts on these developments, put also in historical perspective, and provided formal econometric evidence in favor of our novel measure of demand.

Importantly, using the import intensity-weighted measure of demand proposed in this paper can significantly enhance the performance of empirical trade models, helping resolve long standing questions in international economics. The results presented here also have substantial policy implications, related to the likely path of the recovery and the appropriate policy response to the collapse in world trade. For instance, an investment-led recovery could be expected to lift world trade more significantly than a government spending-led recovery due to the much higher import content of investment.

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Figure 1: Recent developments and projections in world trade and output (volumes)

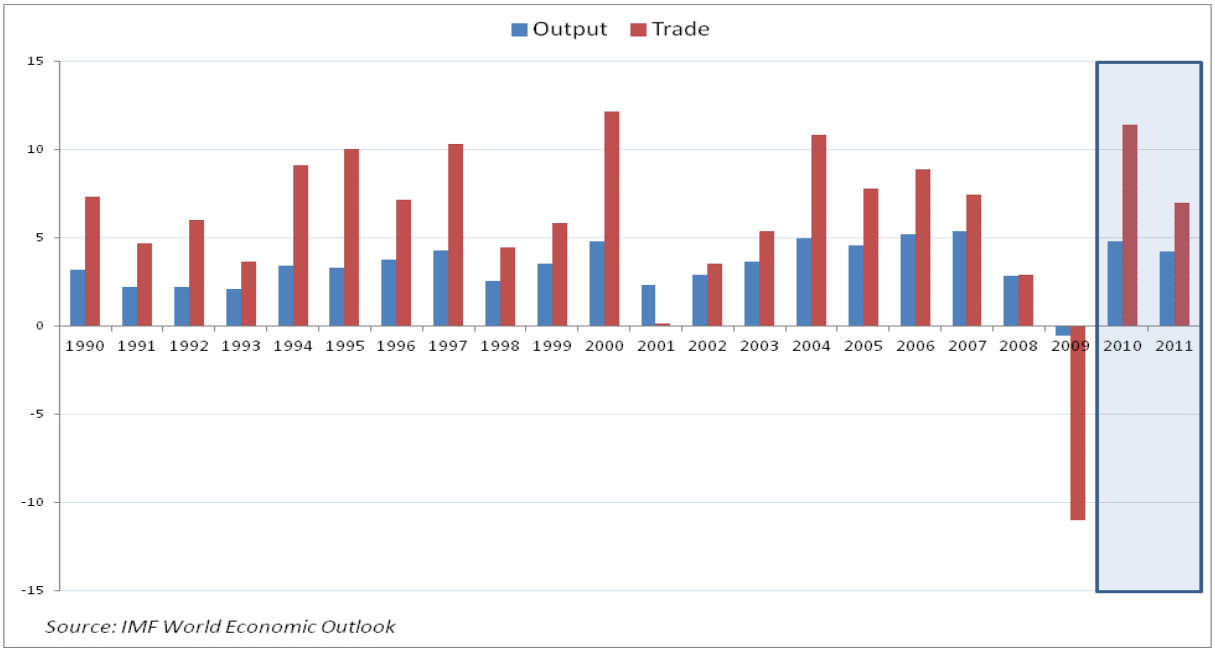


Figure 2: Growth rate of real imports in 2008Q4 and 2009Q1, q-o-q growth rates

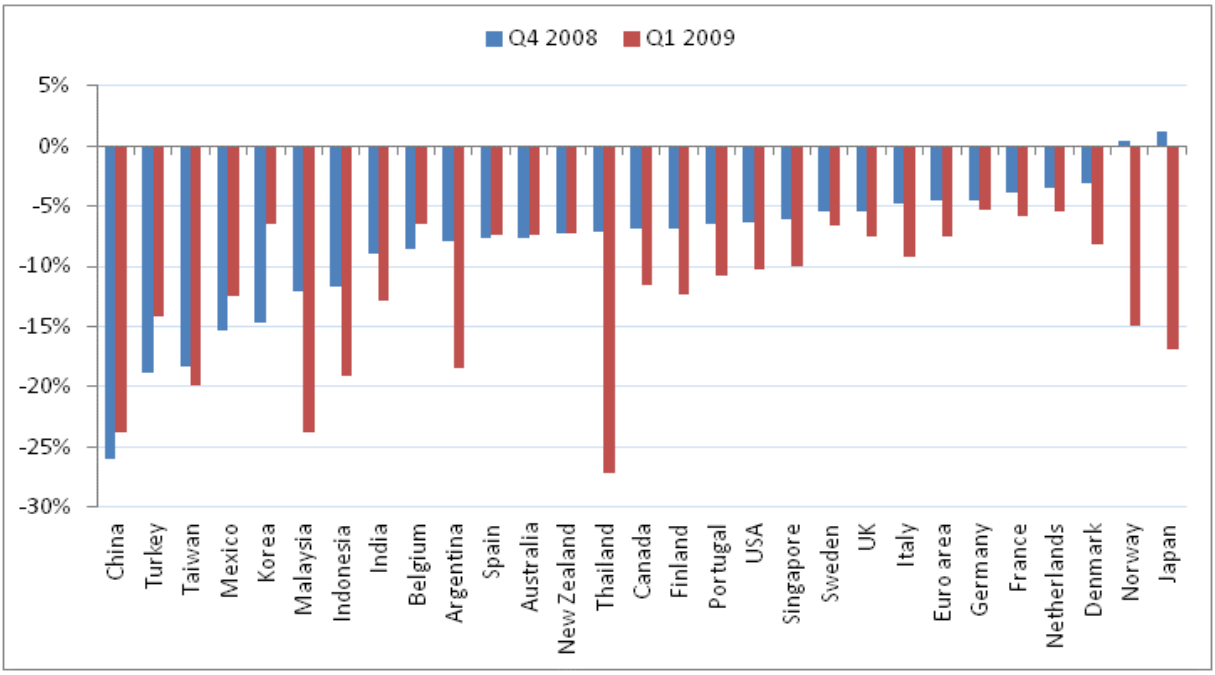


Figure 3: Import content of main GDP components

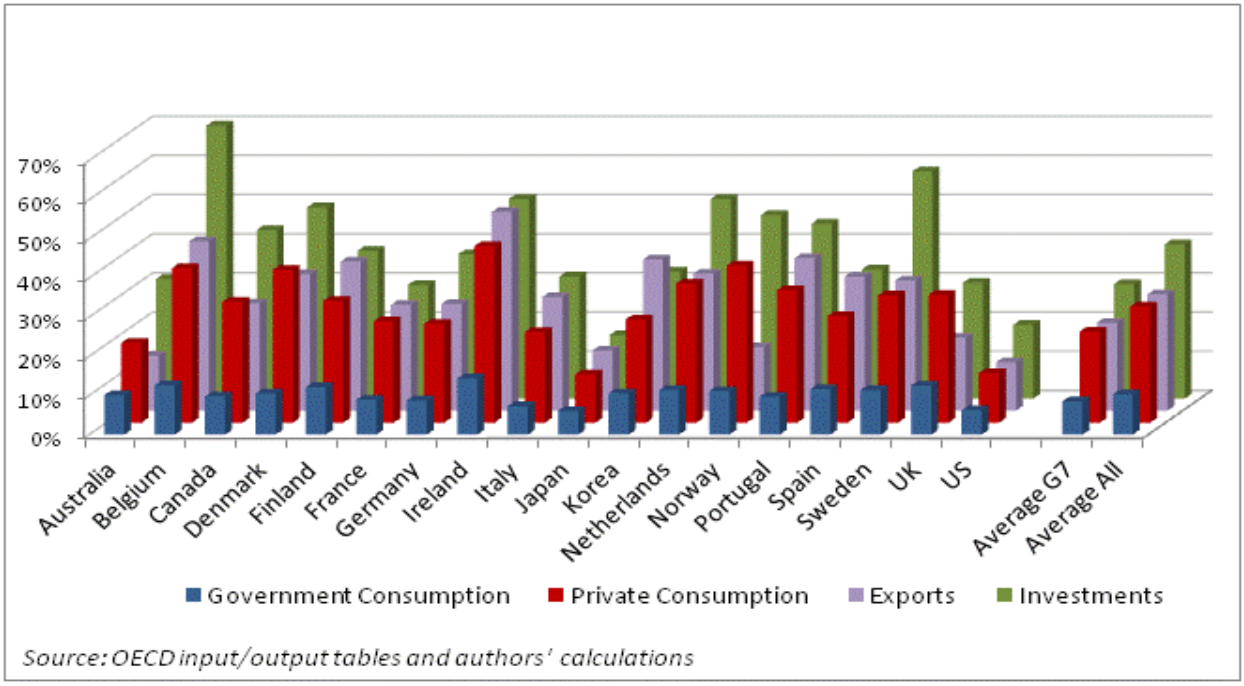


Figure 4: Short-term correlations between imports and main GDP components

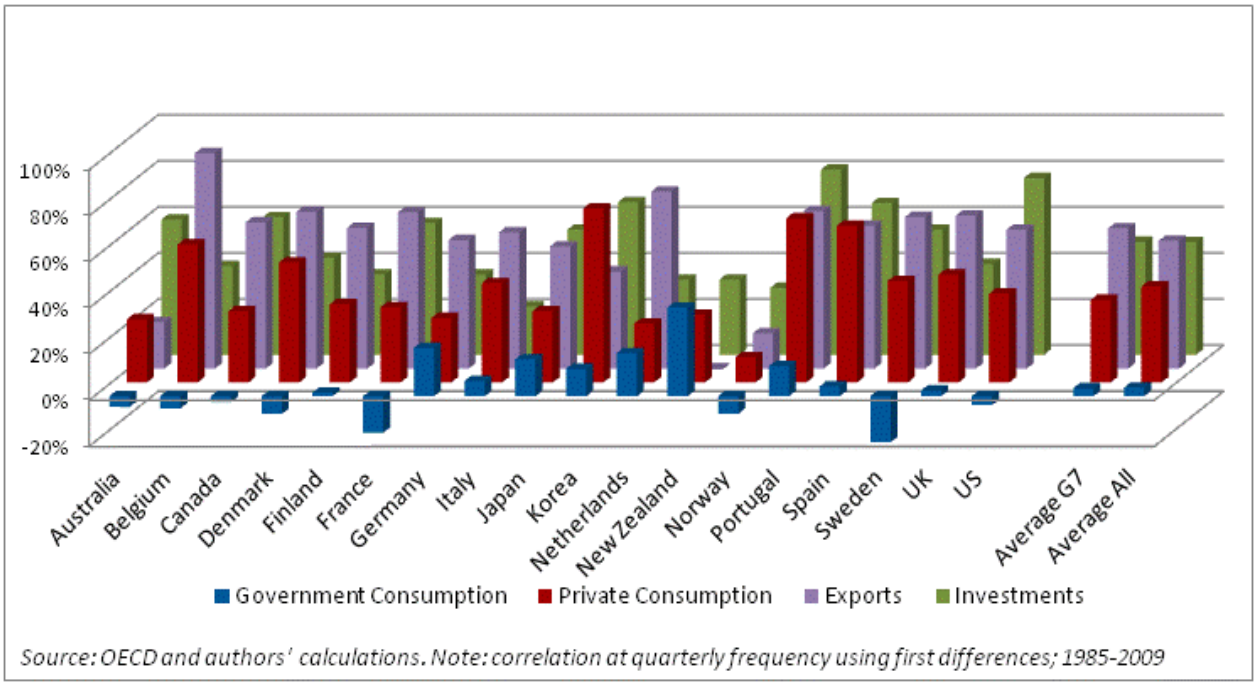
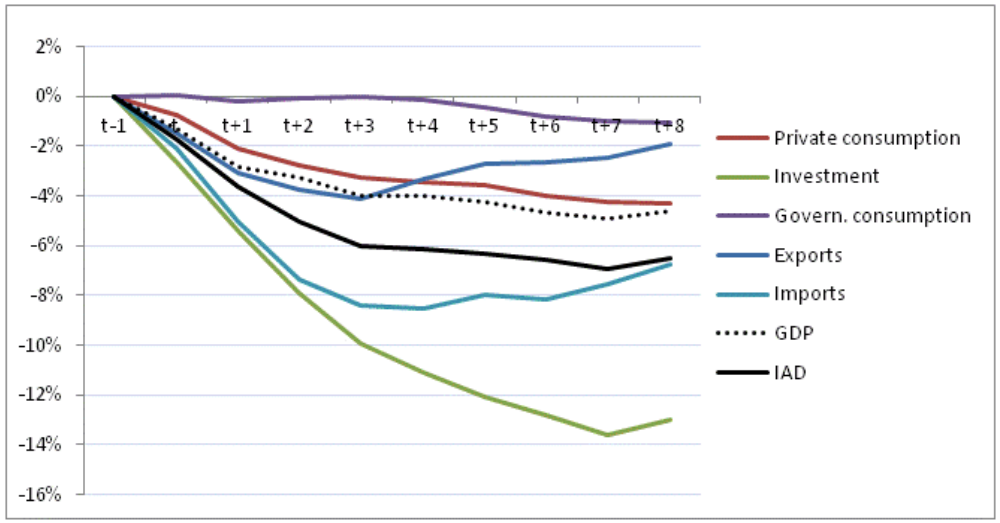
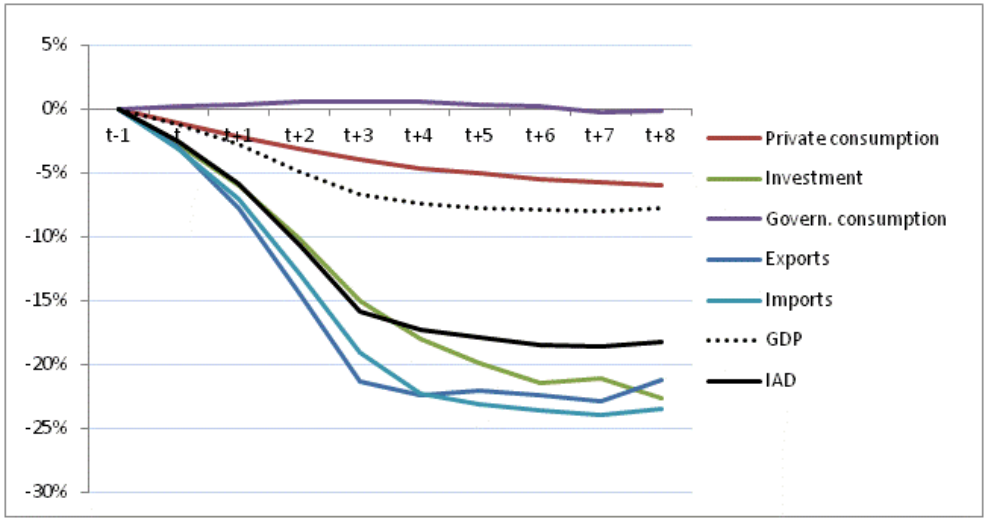


Figure 5: Behaviour of GDP components during recessions (real variables, cumulated fall)

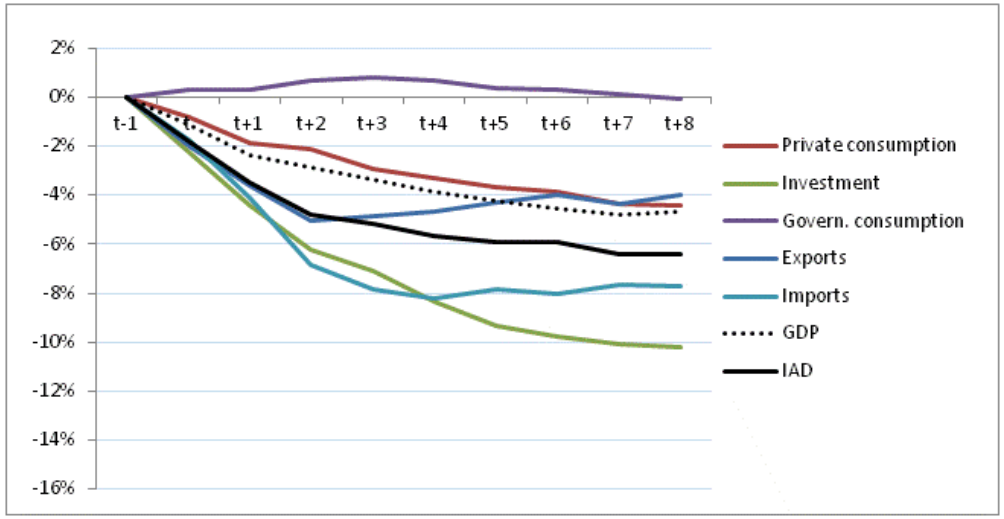
Panel A: All countries - 1985-2007 recessions



Panel B: All countries - 2008-2009 recessions



Panel C: G7 - 1985-2007 recessions



Panel D: G7 - 2008-2009 recessions

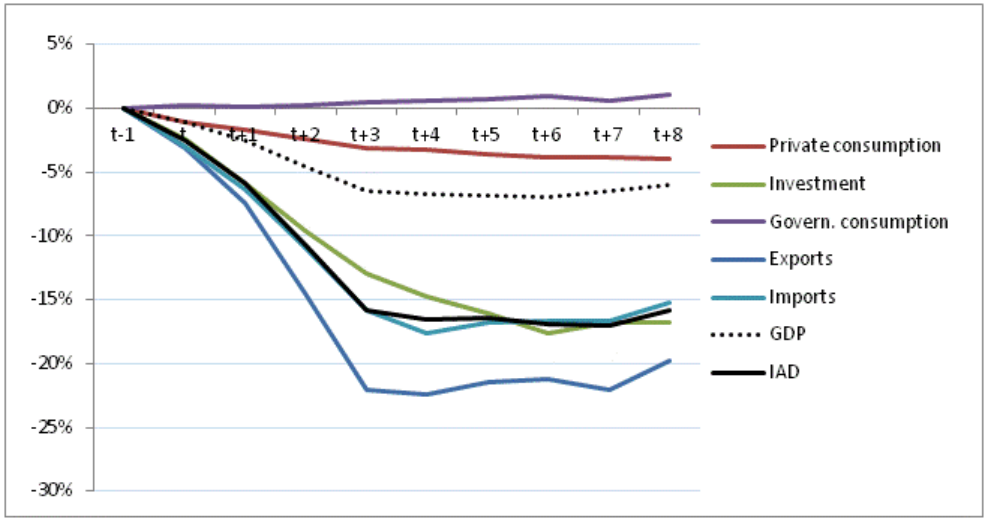


Figure 6: Actual vs. fitted values of real import growth - Selected economies

The charts below show the actual vs. fitted values of real import growth for a subsample of countries. The green line shows fitted values from the model using IAD as a measure of demand, the red line from the GDP specification and the yellow line from the domestic demand specification, DD.

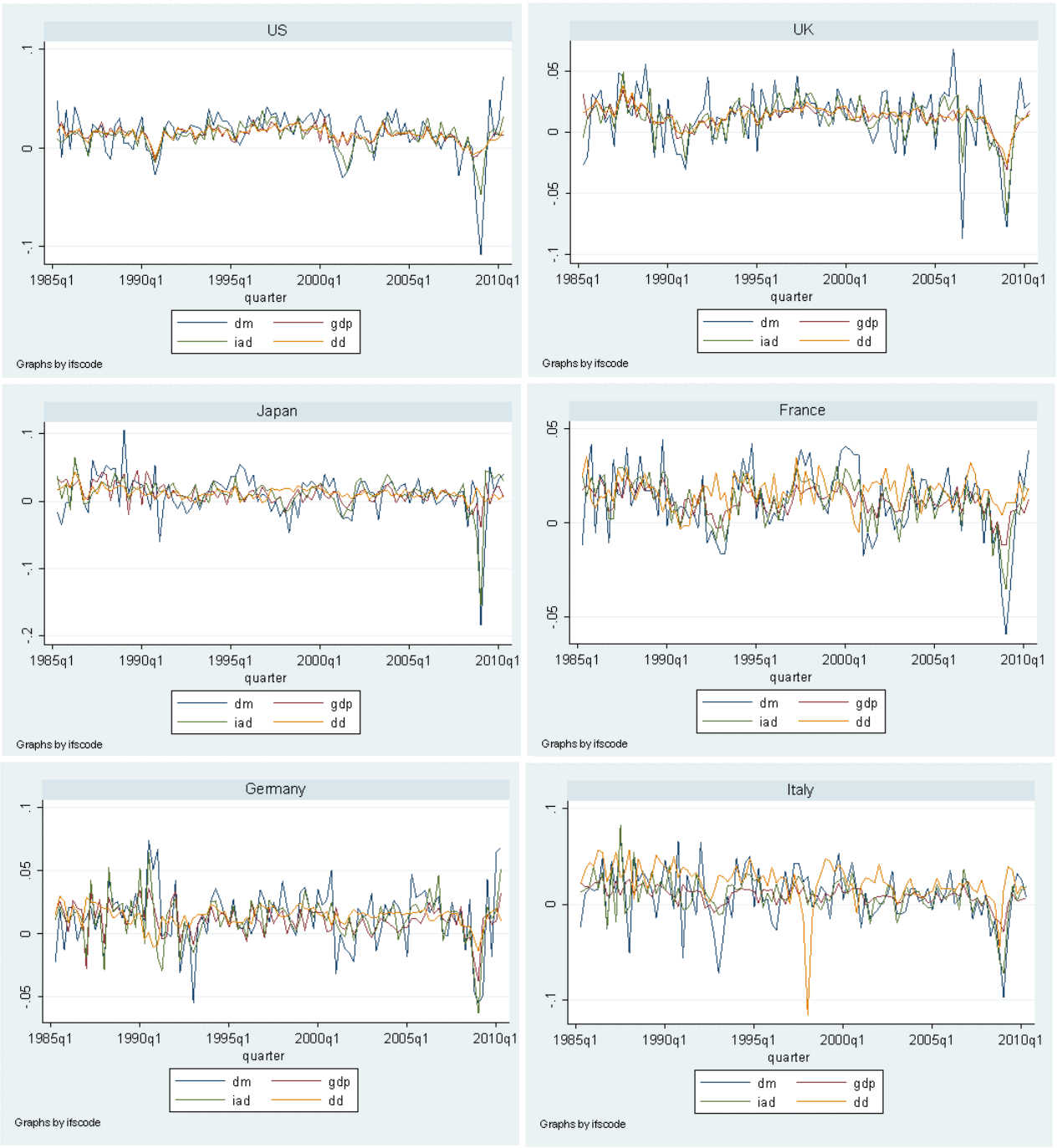


Figure 7: Actual vs. fitted values of real import growth in 2008Q4

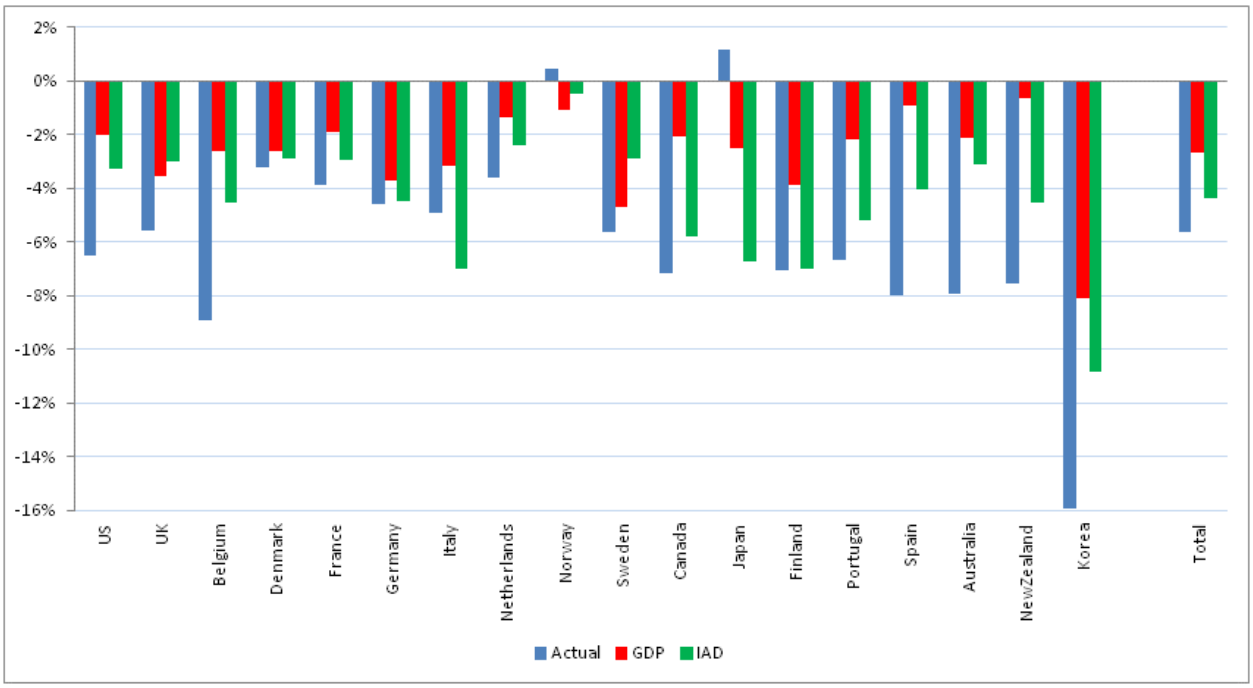


Figure 8: Actual vs. fitted values of real import growth in 2009Q1

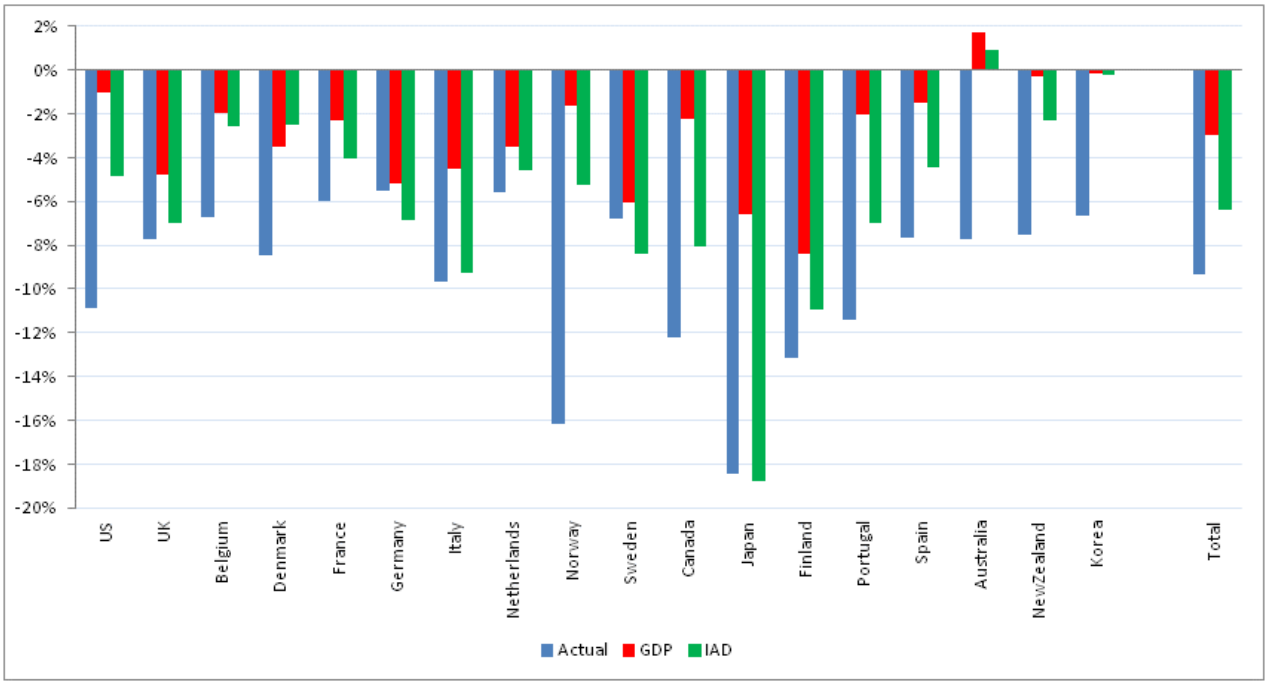


Figure 9: Short-term elasticities - Selected economies

The figures show estimated short-term demand elasticities of imports, β_1, for a subset of countries obtained from two alternative models using GDP and IAD as demand measures, respectively. Rolling regressions of the form $\Delta \ln M_{it} = \delta_i + \beta_1 \Delta \ln D_{it} + \beta_2 \Delta \ln RMP_{it} + \varepsilon_{it}$ are performed on our set of 18 OECD countries, with rolling windows of 5 years. The analysis uses quarterly data from March 1985 to June 2010. The dates on the x-axes refer to the ending quarter of each rolling window.

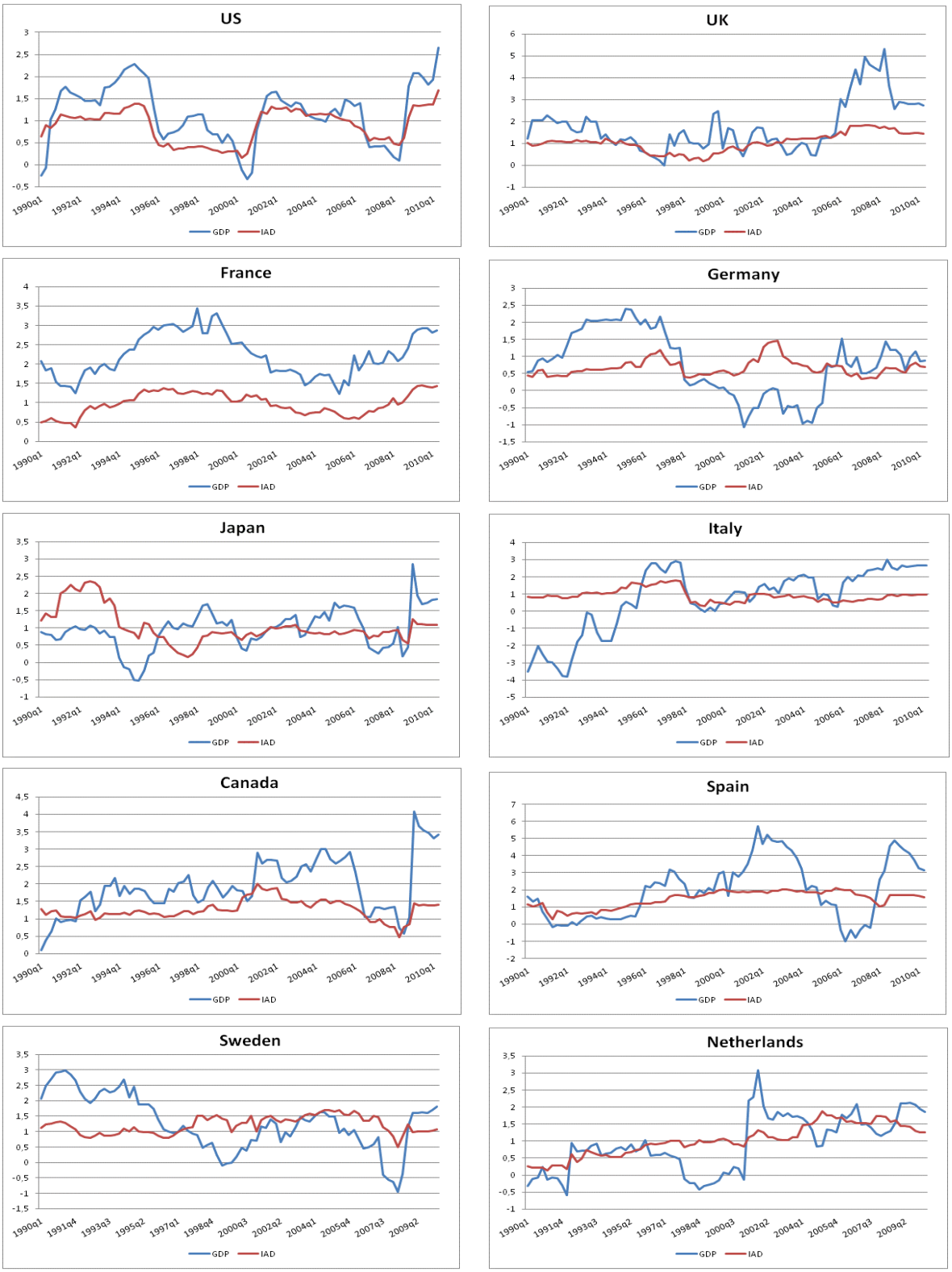


Figure 10: Long-term elasticities - Selected economies

The figures show estimated short-term demand elasticities of imports, $\widetilde{\beta}_1$, for a subset of countries obtained from two alternative models using GDP and IAD as demand measures, respectively. Rolling regressions of the form $\ln M_{it} = \delta_i + \widetilde{\beta}_1 \ln D_{it} + \widetilde{\beta}_2 \ln RMP_{it} + \varepsilon_{it}$ are performed on our set of 18 OECD countries, with rolling windows of 10 years. The analysis uses quarterly data from March 1985 to June 2010. The dates on the x-axes refer to the ending quarter of each rolling window.

Table 1: Import-content of main GDP components

	Import content of private consumption			Import content of government consumption			Import content of total investment			Import content of exports .		
	1995	2000	2005	1995	2000	2005	1995	2000	2005	1995	2000	2005
Australia	18,4%	20,5%	20,4%	9,0%	10,1%	10,0%	31,4%	31,5%	30,5%	14,0%	14,1%	14,0%
Austria	27,9%	33,4%	33,7%	9,4%	11,3%	11,8%	46,2%	56,0%	56,7%	30,0%	34,6%	34,7%
Belgium	37,9%	44,0%	39,4%	7,8%	10,7%	12,6%	55,9%	68,0%	69,7%	40,9%	45,9%	43,2%
Canada	30,3%	27,3%	30,8%	10,3%	10,0%	9,8%	50,5%	57,5%	43,1%	30,5%	30,9%	27,4%
Czech Republic	40,0%	48,8%	47,1%	19,7%	20,8%	21,0%	47,8%	67,3%	75,7%	29,1%	45,6%	48,3%
Denmark	24,2%	37,2%	39,0%	7,2%	9,0%	10,5%	42,3%	48,5%	48,9%	27,1%	32,3%	34,9%
Finland	22,8%	25,5%	31,1%	8,0%	10,9%	12,1%	60,6%	36,7%	37,7%	28,8%	33,4%	38,0%
France	21,6%	24,7%	25,9%	8,4%	8,1%	8,8%	28,3%	29,8%	29,0%	19,8%	26,5%	27,0%
Germany	20,2%	24,6%	25,2%	6,4%	8,1%	8,7%	25,6%	32,3%	36,9%	20,4%	25,8%	27,2%
Greece	23,9%	28,1%	28,1%	11,7%	19,7%	9,9%	42,7%	49,6%	45,4%	15,8%	26,9%	25,9%
Hungary	60,0%	40,0%	42,9%	32,3%	17,0%	16,1%	96,3%	84,6%	68,6%	47,4%	58,6%	55,8%
Iceland	36,6%	18,3%	15,9%	18,1%	6,2%	5,5%	58,3%	41,4%	30,0%	26,7%	26,9%	27,1%
Ireland	66,1%	56,7%	45,1%	17,0%	13,8%	14,4%	72,1%	68,9%	51,0%	48,7%	53,3%	50,7%
Italy	19,4%	22,3%	23,2%	5,7%	6,8%	7,3%	28,9%	32,8%	31,2%	23,4%	27,1%	29,0%
Japan	9,5%	10,2%	12,3%	3,0%	2,8%	6,0%	8,5%	10,2%	16,3%	8,4%	9,6%	15,4%
Korea	23,0%	25,7%	26,3%	11,4%	10,2%	10,5%	36,4%	39,8%	32,5%	29,9%	38,1%	38,6%
Luxembourg	65,0%	77,3%	70,0%	16,1%	18,5%	18,7%	72,0%	76,4%	69,6%	41,3%	57,7%	60,4%
Mexico	36,3%	20,0%	18,3%	8,3%	5,1%	4,7%	50,6%	50,6%	35,8%	42,5%	39,3%	33,2%
Netherlands	29,8%	33,2%	35,5%	10,5%	11,3%	11,4%	53,2%	54,5%	51,0%	33,3%	36,9%	34,9%
New Zealand	23,3%	26,7%	23,9%	10,2%	11,7%	9,9%	49,6%	53,7%	53,1%	18,1%	19,2%	17,5%
Norway	34,5%	39,3%	40,1%	11,2%	11,1%	11,1%	57,7%	59,0%	46,9%	21,6%	16,9%	16,2%
Poland	21,3%	29,9%	27,7%	8,0%	6,4%	9,6%	35,3%	63,8%	70,5%	16,8%	24,7%	30,6%
Portugal	31,6%	39,2%	33,9%	8,7%	11,2%	9,7%	43,7%	47,8%	44,7%	35,8%	30,8%	38,9%
Slovak Republic	47,4%	55,6%	61,5%	17,7%	16,3%	23,7%	82,3%	72,1%	94,1%	35,4%	50,3%	48,6%
Spain	19,5%	25,8%	27,2%	7,4%	10,0%	11,6%	30,2%	38,2%	33,0%	26,6%	33,9%	34,2%
Sweden	26,0%	30,2%	32,5%	10,6%	11,5%	11,4%	60,6%	68,6%	58,0%	28,9%	32,3%	33,2%
Switzerland	17,7%	25,4%	27,5%	5,8%	9,2%	9,3%	31,5%	31,5%	40,1%	14,2%	23,1%	25,3%
Turkey	19,8%	16,5%	25,1%	6,0%	10,6%	15,2%	49,5%	40,9%	52,5%	13,9%	13,6%	30,7%
United Kingdom	23,3%	29,1%	32,6%	11,2%	12,7%	12,5%	50,0%	46,8%	29,6%	22,2%	20,3%	18,6%
United States	9,1%	11,2%	12,6%	3,7%	6,1%	6,2%	20,6%	21,6%	18,8%	9,5%	11,0%	12,3%
Argentina	8,5%	8,1%	13,2%	2,2%	1,8%	2,8%	26,7%	26,7%	32,0%	10,3%	10,9%	16,8%
Brazil	9,9%	12,9%	10,7%	3,3%	4,8%	3,7%	14,1%	13,8%	23,2%	10,8%	12,0%	14,4%
China	11,6%	13,8%	20,1%	10,0%	10,8%	13,8%	30,7%	19,2%	31,4%	15,5%	19,6%	27,4%
Chinese Taipei	27,5%	25,7%	29,5%	13,6%	9,3%	8,7%	54,6%	70,5%	72,0%	35,2%	37,3%	48,3%
India	7,7%	10,8%	14,4%	6,0%	8,4%	8,3%	23,8%	25,0%	31,5%	10,4%	12,4%	18,5%
Indonesia	18,3%	26,5%	25,0%	12,7%	14,3%	14,2%	34,9%	36,6%	34,1%	15,1%	19,5%	18,1%
Israel	22,6%	35,7%	34,7%	6,2%	14,9%	15,5%	23,8%	36,0%	48,8%	16,6%	34,1%	37,9%
Russian Fed.	26,5%	29,2%	27,0%	10,7%	12,2%	12,2%	22,1%	26,2%	29,7%	10,6%	10,9%	9,1%
Singapore	64,1%	56,9%	63,4%	27,6%	35,0%	35,4%	93,4%	88,5%	104,3%	57,2%	58,4%	56,6%
South Africa	15,3%	20,0%	22,7%	5,5%	7,1%	8,7%	36,6%	44,1%	42,3%	9,7%	15,2%	14,6%
Hong Kong	12,6%	9,9%	7,2%	8,4%	9,7%	6,3%	15,0%	13,4%	6,2%	13,9%	14,1%	12,6%
Chile	26,1%	31,6%	37,0%	8,5%	8,2%	9,8%	54,3%	46,1%	48,7%	19,0%	19,0%	23,2%
Estonia	67,6%	50,3%	53,4%	27,5%	19,5%	19,0%	138,7%	97,9%	85,3%	47,5%	55,1%	50,8%
Slovenia	51,4%	46,3%	49,4%	20,3%	17,0%	16,4%	84,1%	86,1%	73,3%	36,9%	43,6%	45,6%
Malaysia	63,1%	52,2%	52,3%	27,5%	24,9%	26,0%	87,1%	104,6%	108,0%	38,8%	53,0%	50,4%
Philippines	28,0%	32,9%	38,5%	12,0%	11,8%	8,3%	54,2%	77,5%	82,4%	32,4%	46,0%	41,6%
Thailand	33,4%	37,1%	28,3%	8,4%	9,7%	10,6%	54,5%	73,4%	97,3%	33,5%	40,6%	38,1%
Romania	24,9%	26,4%	29,8%	19,1%	20,8%	17,8%	43,4%	70,3%	83,1%	26,0%	27,9%	29,0%
Viet Nam	17,0%	37,7%	42,5%	12,2%	26,3%	28,8%	46,5%	46,5%	62,3%	15,0%	27,5%	30,6%
Saudi Arabia	20,1%	39,8%	47,4%	13,5%	20,1%	15,3%	23,7%	65,7%	88,7%	1,3%	5,9%	2,0%

Source: OECD Economic Outlook and authors' calculations.

Table 2: Panel Regressions

The table reports the in-sample estimates of panel regressions of the form $\Delta \ln M_{it} = \delta_i + \beta_1 \Delta \ln D_{it} + \beta_2 \Delta \ln RMP_{it} + \varepsilon_{it}$ performed on our set of 18 OECD countries and on the G7 countries, respectively. The dependent variable is the quarterly growth rate of real imports of goods and services. 3 models are compared in the table, according to the demand measure D used in each regression, where IAD stands for our new import intensity adjusted measure of demand, GDP for real GDP, and DD for real domestic demand. RMP are real import prices. To save space we do not report here the point estimates of the lagged values of the dependent variable and of the lagged values of RMP. R^2 is the in-sample coefficient of determination. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The analysis uses quarterly data from March 1985 to June 2010.

All countries						
	IAD model		GDP model		DD model	
	0 *lags*	2 *lags*	0 *lags*	2 *lags*	0 *lags*	2 *lags*
$\Delta \ln(D)_t$	1.01***	1.00***	1.36***	1.28***	1.15***	1.00***
	(0.0608)	(0.0528)	(0.2904)	(0.2331)	(0.2584)	(0.2768)
$\Delta \ln(D)_{t-1}$		0.42***		0.85***		0.38***
		(0.0557)		(0.1318)		(0.1154)
$\Delta \ln(D)_{t-2}$		0.16**		0.35**		0.10
		(0.0754)		(0.1511)		(0.1387)
$\Delta \ln(RMP)_t$	-0.20**	-0.22***	-0.12**	-0.13**	-0.11**	-0.13
	(0.0467)	(0.0464)	(0.0611)	(0.0574)	(0.0892)	-0.13
R-sq	0.41	0.47	0.19	0.26	0.14	0.18
#Observations	1818	1818	1818	1818	1818	1818
G7						
	IAD model		GDP model		DD model	
	0 *lags*	2 *lags*	0 *lags*	2 *lags*	0 *lags*	2 *lags*
$\Delta \ln(D)_t$	1.05***	0.97***	1.64***	1.25***	0.69	0.40
	(0.0789)	(0.0848)	(0.1914)	(0.1314)	(0.3644)	(0.3305)
$\Delta \ln(D)_{t-1}$		0.30***		0.89***		0.52***
		(0.0674)		(0.2047)		(0.0685)
$\Delta \ln(D)_{t-2}$		0.01		0.28		-0.04
		(0.0750)		(0.1897)		(0.1119)
$\Delta \ln(RMP)_t$	-0.18**	-0.19***	-0.01	-0.04	0.07	0.00
	(0.0321)	(0.0278)	(0.0498)	(0.0345)	(0.0475)	(0.0345)
R-sq	0.49	0.52	0.23	0.32	0.07	0.18
#Observations	707	707	707	707	707	707

Table 3: Recessions vs. non-recession periods

The table reports the estimates of panel regressions of the form $\Delta \ln M_{it} = \delta_i + \beta_1 \Delta \ln D_{it} + \beta_2 \Delta \ln RMP_{it} + \rho_{it} + \varepsilon_{it}$ performed on our set of 18 OECD countries and on the G7 countries, respectively. D is the demand measure used in each regression, where IAD stands for our new import intensity adjusted measure of demand and GDP for real GDP. ρ_{it} is a dummy variable equal to 1 if country i is in recession and equal to zero otherwise. R^2 is the in-sample coefficient of determination. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The analysis uses quarterly data from March 1985 to June 2010.

	All countries			
	IAD model		GDP model	
	recession	*normal*	*recession*	*normal*
$\Delta \ln(D)_t$	1.33***	0.85***	2.83***	0.73**
	(0.1289)	(0.0623)	(0.3112)	(0.2819)
$\Delta \ln(RMP)_t$	-0.37***	-0.15***	-0.19**	-0.11**
	(0.1277)	(0.04305)	(0.0789)	(0.0498)
R-sq	0.63	0.26	0.41	0.05
#Observations	190	1628	190	1628
	G7			
	recession	*normal*	*recession*	*normal*
$\Delta \ln(D)_t$	1.16***	0.93***	3.20***	0.80**
	(0.0817)	(0.0830)	(0.4780)	(0.2608)
$\Delta \ln(RMP)_t$	-0.30**	-0.13***	-0.14	-0.02
	(0.0888)	(0.0328)	(0.0994)	(0.0420)
R-sq	0.69	0.29	0.45	0.05
#Observations	76	631	76	631

Table 4: Short-term and long-term demand elasticities

The table reports estimated values of short-term and long-term import demand elasticities for our panel of 18 countries, for the G7 countries on aggregate, as well for individual G7 economies. Results for short-term elasticities, β_1, comes from panel regressions of the form $\Delta \ln M_{it} = \delta_i + \beta_1 \Delta \ln D_{it} + \beta_2 \Delta \ln RMP_{it} + \varepsilon_{it}$ and from the same regression performed on individual G7 countries, where D is the demand measure (IAD or GDP) used in the regressions. Results for long-term elasticities come from two different models: OLS results, β_1^*, come from panel regressions of the form $\ln M_{it} = \delta_i + \beta_1^* \ln D_{it} + \beta_2^* \ln RMP_{it} + \varepsilon_{it}$ and from the same regression estimated on individual G7 countries. Johansen results, instead, are the demand coefficients, $\widetilde{\beta}_1$, of cointegrating vectors estimated from single-country Vector Error Correction Models of the form $\ln M_t = \alpha(\ln M - \widetilde{\beta}_1 \ln D - \widetilde{\beta}_2 \ln RMP)_{t-1} + ... + \varepsilon_t$,where 4 lags of the endogenous variables are included in the short-term dynamics. All coefficient are statistically significant at 1% level. Sample period: March 1985 - June 2010.

	IAD model			GDP model		
	$Short-term$	$Long-term$		$Short-term$	$Long-term$	
		OLS	$Johansen$		OLS	$Johansen$
$Panel-all\ countries$	1.01	1.2		1.36	1.88	
$Panel-G7$	1.05	1.39		1.64	2.34	
$United\ States$	1.36	1.44	0.83	1.98	2.09	1.89
$United\ Kingdom$	1.23	1.38	1.29	1.96	1.98	1.94
$Japan$	0.92	1.32	1.02	1.19	2.65	3.95
$France$	1.12	1.49	1.24	2.52	2.7	2.65
$Germany$	0.75	1.44	1.38	1.18	3.57	4.69
$Italy$	1.01	1.28	0.88	1.85	2.72	2.94
$Canada$	1.29	1.39	1.69	1.8	1.95	2.44