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## The Global Trade Slowdown: Cyclical or Structural?

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**The Global Trade Slowdown: Cyclical or Structural?****Prepared by Cristina Constantinescu\*, Aaditya Mattoo^, Michele Ruta\***

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**Abstract**

This paper focuses on the sluggish growth of world trade relative to income growth in recent years. The analysis uses an empirical strategy based on an error correction model to assess whether the global trade slowdown is structural or cyclical. An estimate of the relationship between trade and income in the past four decades reveals that the long-term trade elasticity rose sharply in the 1990s, but declined significantly in the 2000s even before the global financial crisis. These results suggest that trade is growing slowly not only because of slow growth of Gross Domestic Product (GDP), but also because of a structural change in the trade-GDP relationship in recent years. The available evidence suggests that the explanation may lie in the slowing pace of international vertical specialization rather than increasing protection or the changing composition of trade and GDP.

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| Contents                                                                                 | Page |
|------------------------------------------------------------------------------------------|------|
| I. Introduction .....                                                                    | 4    |
| II. The Global Trade Slowdown: Some Stylized Facts.....                                  | 7    |
| III. An Analysis of the Trade-Income Relationship.....                                   | 8    |
| A. Trade and Income in 1970-2013: Annual Data.....                                       | 10   |
| B. Trade and Income Before and After the Great Recession: Quarterly Data.....            | 11   |
| IV. The Global Trade Slowdown in Retrospect and Prospect .....                           | 13   |
| A. Cyclical versus Structural Factors.....                                               | 13   |
| B. Trade Projections.....                                                                | 16   |
| V. Factors Explaining the Decline in Trade Elasticity .....                              | 17   |
| A. A Regional Decomposition of the Long-run Trade Elasticity .....                       | 18   |
| B. Changes in the Composition of World Trade.....                                        | 20   |
| C. Changes in Vertical Specialization .....                                              | 21   |
| D. Changes in the Composition of Aggregate Demand.....                                   | 24   |
| E. Changes in Protectionism .....                                                        | 25   |
| VI. Conclusion .....                                                                     | 26   |
| References.....                                                                          | 28   |
| Tables                                                                                   |      |
| 1. Results of Estimations Using Yearly Data.....                                         | 40   |
| 2. Results of Estimations Using Quarterly Data .....                                     | 40   |
| 3. Decomposition of Trade Growth .....                                                   | 41   |
| 4. Trade Predictions .....                                                               | 41   |
| 5. Long Run Elasticity of Imports to GDP, by Country and Region .....                    | 42   |
| 6. Long Run Elasticity of Imports to GDP, by Type of Imports .....                       | 42   |
| 7. Assessing the Impact of Protectionism on Long Run Elasticity of Imports to GDP .....  | 43   |
| Figures                                                                                  |      |
| 1. Total World Trade, Volumes and Growth Rates .....                                     | 33   |
| 2. Total Import Volumes .....                                                            | 33   |
| 3. Total Export Volumes.....                                                             | 34   |
| 4. Share of Import Volumes in Real GDP .....                                             | 34   |
| 5. Average Growth Rates Across Selected Periods .....                                    | 35   |
| 6. Decomposition of Trade Growth .....                                                   | 35   |
| 7. Trade Predictions .....                                                               | 36   |
| 8. China's Share of Imports of Parts and Components in Total Exports of Merchandise..... | 36   |
| 9. Manufacturing Imports .....                                                           | 37   |
| 10. Ratio of Foreign Value Added to Domestic Value Added in World Gross Exports.....     | 37   |
| 11. Long Run Elasticities, 7-year periods.....                                           | 38   |
| 12. Share of Real Investment and Consumption in World Real GDP .....                     | 38   |

13. Trade Covered by Import-Restrictive Measures of All WTO Members and Observers ...39

Appendixes

1 - Decomposition of the World Trade Elasticity .....31

## I. INTRODUCTION<sup>1</sup>

After bouncing back from the historic low of the Great Recession in 2010, world trade grew by less than 3.0 percent in 2012 and 2013, compared to the pre-crisis average of 7.1 percent (1987-2007). This slowdown has received much attention (from, among others, Davies, 2013, and Krugman, 2013), but not been subject to rigorous analysis. One question is whether the slower growth in trade simply reflects the sluggishness of GDP or whether there is a deeper structural shift in the relationship between trade and GDP. Furthermore, if there is indeed a structural shift, is it a post-crisis phenomenon or does it reflect longer-term factors? And what might these factors be?

We use a simple empirical strategy based on an error correction model to address these questions. We first estimate the relationship between trade and income for the period 1970-2013. While the global trade slowdown is a recent phenomenon, the analysis of a long time period can shed light on structural changes that may have occurred in the trade-income relationship and that may help to explain more recent events. We find that the long-term elasticity of trade with respect to income was 1.3 between 1970 and 1985, rose to 2.2 in the period 1986-2000, but reverted back to 1.3 in the 2000s. Formal tests confirm the existence of significant structural breaks in the trade-income relationship in the 1990s relative to the preceding and subsequent periods.

A focus on the 2000s shows that the decline in the long-run trade elasticity, from the high levels of the 1990s, set in before the global financial crisis and was accentuated in the post-

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crisis world. We divide the period in two parts, before and after the Great Recession, and estimate the long-run trade elasticity for the two sub-periods. We find that a 1 percent increase in income was associated to a 1.5 and a 0.7 increase in trade in the period 2001-2007 and 2008-2013, respectively. These results indicate that the change in the trade-income relationship cannot be entirely attributed to the financial crisis and suggest that global trade is growing slowly not only because GDP growth is sluggish, but also because the trade-GDP relationship changed. An implication is that even if GDP growth picks up, we may not see the dramatic rates of trade growth witnessed in the 1990s.

We formally investigate these ideas using the results of our empirical model to decompose the cyclical and structural components of trade growth and to predict trade growth in coming years. First, we find that while cyclical effects dominate during periods of crisis such as the trade collapse of 2008 and 2009, the current global trade slowdown is in significant part explained by a decline in the long-term component of trade growth. Specifically, focusing on the 2000s, our model indicates that close to half of the slow trade performance in 2013 results from the lower long-run component of trade growth while the rest is explained by cyclical factors. Second, we use the model estimates to predict trade growth in 2014-2019. We show that the extent of the global trade slowdown in coming years will depend on whether the estimates for the 2008-2013 period are “transitional” or properly capture changes in the long-term association between trade and income.

The factors behind the decline in the elasticity of trade could range from protectionism to the changing structure of trade and aggregate demand. The preliminary evidence considered here suggests that the explanation lies primarily in changes in international vertical specialization, most notably in the United States and China.<sup>2</sup> The long-run trade elasticity increased during the 1990s as production fragmented internationally into global supply chains and decreased in the 2000s as this process decelerated. Other factors may have contributed to the lower

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<sup>2</sup> For example, as we show below, Chinese exporters are now using more domestically produced inputs than imported inputs; the share of Chinese imports of parts and components in total exports has decreased from 60 percent in the mid-1990s to 35 percent today.

responsiveness of trade to income, but the evidence suggests that their role was less prominent.

Our work relates to two branches of economic literature. A first set of papers analyzed the changes in the long-run relationship between trade and income. Irwin (2002) documents the variation of the world trade elasticity between 1870 and 2000 providing valuable insights into the underlying factors. Freund (2009) calculates the elasticity of trade to GDP in tranquil and crisis times, and shows that the latter tends to be higher. Escaith et al. (2010) provide evidence of the increase in the world trade elasticity in the 1990s and relate this to the process of vertical specialization. Differently from these studies, our main interest is in understanding the extent to which changes in the long-run trade and income relationship can explain the global trade slowdown. We also attempt to analyze in a more systematic way some of the factors that may underpin the changing relationship between trade and GDP.

Our work also relates to the wide literature on the trade collapse of 2008-2009 (among others, Bems et al., 2010, Levchenko et al., 2010, Bussiere et al., 2013, Abiad et al., 2014).<sup>3</sup> This literature studies the causes of the sudden, severe and synchronized collapse of world trade that followed the global financial crisis in 2008-2009. The emerging consensus is that the driving factor of the collapse was the sharp contraction in aggregate demand, concentrated on trade-intensive components, and amplified by other factors, such as inventory effects and trade credit constraints (Bems et al., 2013). Our study complements this work by taking a longer-term view and investigating the structural versus cyclical determinants of the current trade slowdown. Interestingly, we document that while cyclical factors dominated the trade collapse, structural determinants are key to understanding the current slowdown.

The rest of the paper is organized as follows. In Section II, we present some stylized facts about the trade slowdown. In Section III, we estimate the elasticity of trade with respect to

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<sup>3</sup> Early contributions to this literature were collected in Baldwin (2009). Bems et al. (2013) have a recent survey.

GDP for the period 1970-2013 and take a closer look at the 2000s, pre and post-Great Recession. In Section IV, we decompose the trade slowdown into its short and long-run components and use model estimates to obtain trade projections. Section V presents an analysis of the factors that may explain the decline in long-term elasticity. Section VI concludes.

## II. THE GLOBAL TRADE SLOWDOWN: SOME STYLIZED FACTS

Trade recovered after the global financial crisis, but trade growth has been sluggish since then. After a solid post-recession rebound in 2010, when the volume of global trade rose 13 percent, trade volumes grew by 6.2 percent in 2011, 2.8 percent in 2012 and 3.0 percent in 2013 (Figure 1). This is well below the pre-crisis average trade growth of 7.1 percent (1987-2007) and is slightly below the growth rate of world GDP in real terms, which has hovered around 3 percent in recent years. These recent developments in international trade growth are now commonly referred to as the “global trade slowdown” (see, for instance, Donnan, 2014).

Proximate explanations of the global trade slowdown link it to changes in world GDP and, hence, to the Euro crisis and other cyclical factors. Trade growth in 2012 and 2013 was weak in advanced economies, particularly in the Euro Area, and moderate in emerging markets and developing economies. Imports in the Euro Area declined by 1.1 percent in 2012 and increased by 0.3 percent in 2013, with improvements towards the later quarters of 2013 reflecting positive developments in the sovereign debt crisis in Europe. Imports of emerging economies increased by 5.6 percent in 2013, with higher growth concentrated in Asia and Africa (Figure 2). Export growth rates have been more different across regions, but the pattern of stronger growth in emerging and developing economies relative to advanced economies remains (Figure 3).

As Figures 2 and 3 show, the crisis in the Euro Area can help explain the cyclical component of the trade slowdown in 2012 and 2013. The European Union roughly amounts to one-third of total world trade volumes as, by convention, trade between EU countries is counted in

world trade totals. The crisis depressed import demand in Europe, thus contributing to depress global trade. From this point of view, if European economies recover, world trade growth should pick up again.

Alongside these cyclical factors, however, there may be other (structural) components of the global trade slowdown. Figure 4 shows that, while after the crisis most countries/regions have a stable import to GDP ratio, this “flatness” appears to pre-date the crisis for China and the US where import volumes as a share in real GDP have been roughly constant for nearly a decade. This fact may point to a structural change in the relationship between trade and income, at least for the two largest economies.

Visual inspection of the data of world trade (import volume) and world income (real GDP) indicates that the relationship between trade and income changed in the last decades (Figure 5). Specifically, the period 1986-2000, which we call the “long 1990s”, were different from the preceding and the subsequent period.<sup>4</sup> For the entire sample (1970-2013), trade and income experienced an expansion and trade grew more rapidly than income. However, the trade-income ratio remained stable over much of the period 1970-1985, then increased rapidly over the long 1990s, but has not grown much since 2001. This behavior creates a presumption of greater trade responsiveness over the period 1986-2000.

In the rest of the paper, we first test if this observation is supported by a formal statistical analysis. Then, we analyze the extent to which the changing trade-income relationship can explain the current global trade slowdown and the implications for its future prospects. Finally, we investigate the underlying reasons for any changes in the long-run trade-income relationship.

### **III. AN ANALYSIS OF THE TRADE-INCOME RELATIONSHIP**

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<sup>4</sup> This terminology borrows from Eric Hobsbawm’s characterization of the “long 19th century” as the period between the years 1789 and 1914.

To examine the relationship between trade and income in greater detail, we follow the literature and use an Error Correction Model (ECM), which makes it possible to account for the serial correlation of residuals. In particular, we are interested in estimating the long-run income elasticity of trade (in short, the trade elasticity), which measures the long-run relationship between trade and income. Further, we estimate the short-term determinants of trade: the short-run trade elasticity, which measures the relationship between trade and income in the short-run, and the speed of adjustment to the long-run equilibrium. Specifically, we use a regression of the form

$$\Delta \ln m_t = \alpha + \beta \Delta \ln y_t + \gamma \ln m_{t-1} + \delta \ln y_{t-1} + \varepsilon_t, \quad (1)$$

where  $\Delta$  denotes first differences,  $m_t$  is the import volume and  $y_t$  is real GDP at time  $t$ ,  $\alpha$  is a constant, and  $\varepsilon_t$  is the error term. In this framework, the short-run trade elasticity is  $\beta$ , while the speed of adjustment to the long-run equilibrium is  $-\gamma$ . The long-run trade elasticity is given by  $-\delta/\gamma$ .

As discussed in the introduction, these types of import demand equations have been widely used in the empirical trade literature (including, more recently, in Irwin (2002), Freund (2009), Escaith et al. (2010), Bussiere et al. (2013)). The theoretical underpinning is the standard constant elasticity of substitution (CES) demand system, under which import demand, an aggregate of individual imports (e.g. services and goods), is a function of aggregate demand, an aggregate of individual components of demand (e.g. consumption and investment). While in this section we follow the standard approach and regress (aggregate) import volumes on GDP, in Section V we study the relationship between the individual components of imports and GDP.

A well-known limitation of this empirical approach is that it presumes that world income is an exogenous variable that has contributed to the increasing levels of world trade, when in fact both are endogenous variables that are co-determined. These regressions should, therefore, be seen only as useful reduced-form specifications that illustrate the changing correlation between trade and income, which is the main focus of this paper. They do not,

however, capture the complex and structural relationship between these two variables and its deeper determinants.

### **A. Trade and Income in 1970-2013: Annual Data**

In this subsection, we begin looking at the trade-income relationship using annual data for the period 1970-2013. While the global trade slowdown is seen as a recent phenomenon, investigating a sufficiently long time period is essential to detect structural changes that may have occurred in the relationship between trade and income. The results for this period are presented in Table 1. The next subsection will take a closer look at the dynamics of the trade and income data before and after the Great Recession.

For the entire sample, the long-run elasticity ( $-\delta/\gamma$ ) is 1.7, but the response of trade with respect to income differs considerably across the three periods. In the period 1986-2000, a 1 percent increase in world real GDP is associated with a 2.2 percent increase in the volume of world trade. This elasticity is substantially higher than in the preceding period (1970-1985) and in the subsequent period (2000-2013), for both of which the trade elasticity was 1.3. Using a non-linear Wald test to assess the presence of structural changes in the sample, we find that there is a significant structural break in the long-run trade-income relationship in the long 1990s relative to the preceding and subsequent periods.<sup>5</sup> The null hypothesis that the long-run trade elasticity differs across the first and the latter periods is, however, rejected.

The short-run dynamics of the data also present interesting variations during the three periods. The estimates of the short-run elasticity  $\beta$  increased over time: from 2.1 for the period 1970-1985 to 2.8 for the period 1986-2000 and 3.4 for the period 2000-2013. These estimates suggest that over time, changes in world income had an increasing short-term impact on world trade. The speed of adjustment  $\gamma$  also varied over the three periods but not

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<sup>5</sup> Recursive estimation tests (not presented in the paper for brevity) confirm these results.

monotonically. The speed was greatest in the long 1990s: if the volume of trade in the previous period was 1 percent higher than the level predicted by the long-run relationship, then trade in the current period would be reduced by 0.58 percent to restore the long-run equilibrium relationship between trade and income. The estimate of the speed of adjustment was 0.31 for the 2000s and even lower, but not statistically significant, for the period 1970-1985.<sup>6</sup>

While the question of the structural versus the cyclical components of the global trade slowdown will be addressed more precisely below, these regression results already reveal some patterns. Specifically, world trade has become more responsive on impact to changes in world income in the 2000s compared to the long 1990s (higher short-run trade elasticity), but at the same time it has also showed a tendency to grow more slowly than world income (lower long-run trade elasticity). This finding suggests that, in addition to cyclical factors, structural elements contributed to the global trade slowdown in 2012 and 2013. World trade is growing more slowly in recent years, not only because GDP has been sluggish, but also because the long-run link between trade and income has changed in recent years. In some sense, the long 1990s appear as an exceptional period and the reasons for this exceptional behavior of trade will be further investigated in Section V.

## **B. Trade and Income Before and After the Great Recession: Quarterly Data**

In this section, we use (seasonally adjusted) quarterly data to study the changing trade-income relationship within the 2000s.<sup>7</sup> We divide the period in roughly half: pre-Great Recession (2001q1-2007q4) and post-Great Recession (2008q1-2013q4). The results are

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<sup>6</sup> Note that residuals are always found to be stationary. Moreover, the Breusch-Godfrey LM test generally accepts the null hypothesis that there is no serial correlation in the residuals of the linear regression. These results further justify the use of the ECM specification. While we always perform these tests and report them in key tables, we do not discuss them in the text as findings are broadly supportive of the model specification used.

<sup>7</sup> We do not have quarterly data for 1970-1990. The regression analysis using quarterly data provides results for the period 1991-2000 that are in line with the findings for the period 1986-2000. The results from the quarterly and the yearly analysis of the 2000s are substantially the same, as expected.

presented in Table 2, which also reports for comparison the estimates of the coefficients in equation (1) using quarterly data for the period 1991-2000.

Consider first the long-run trade elasticity ( $-\delta/\gamma$ ). For both the pre- and the post-Great Recession periods, trade is less responsive to changes in income compared to the 1990s, as on average the long-run trade elasticity fell by half, from 2.4 to 1.2. This finding simply confirms with quarterly data the analysis of the previous subsection. More interestingly, the decline in the long-run responsiveness of trade to income first takes place in the early 2000s, even if it appears to be much stronger in the post-Great Recession world. Specifically, the long-run trade elasticity is 1.5 in the period (2001q1-2007q4) and 0.7 in the second period (2008q1-2013q4). This suggests that the change in the trade-income relationship predated the Great Recession and, hence, cannot be entirely attributed to this event.

The short-run elasticity ( $\beta$ ) is higher in the 2000s compared to the 1990s, respectively 2.6 and 1.5. More importantly, the impact elasticity of trade to income is higher for both the pre- and post-Great Recession periods relative to the 1990s, as its estimates are 4.0 for the period 2001q1-2007q4 and 2.2 for 2008q1-2013q4. The speed of adjustment has a less clear-cut behavior, being lower (respectively, higher) in the pre-Great Recession (post-Great Recession) period relative to the 1990s.

The pre- and the post-Great Recession periods display some distinctive common features, most notably the lower long-run elasticity compared to the 1990s and the higher short-run responsiveness of trade to income shocks.<sup>8</sup> In this respect, these findings confirm the insights of the previous subsection: The global trade slowdown has deep roots, and the change in the income-trade relationship is not a byproduct of the financial crisis.

But the pre- and post-Great Recession periods also present some remarkable differences. In particular, the long-run link between trade and income appears much more attenuated after

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<sup>8</sup> Formal tests confirm that there is a significant structural break between the 1990s and the 2000s (both, pre and post-Great Recession).

the financial crisis. A legitimate question is whether this lower long-run trade elasticity truly reflects a structural shift. Performing a non-linear Wald test indicates that there is a significant structural break between the period preceding and the one following the crisis. However, it is difficult to rule out that the long-run post-crisis trade elasticity is affected by the long cycle that appears to characterize the Great Recession, particularly in the context of advanced economies.<sup>9</sup> In this context, a period of five years may be too short to capture long-run trends and the current estimate may capture a “transitional” rather than a long-run elasticity.

#### **IV. THE GLOBAL TRADE SLOWDOWN IN RETROSPECT AND PROSPECT**

In the previous section, we analyzed the dynamics of trade and income data and estimated the long-run and short-run elasticities of trade with respect to income as well as the speed of adjustment of trade to its long-run equilibrium. The key finding is that the relationship between world trade and world income has undergone a structural change. While the short-run impact of changes in income on trade has increased over time, the long-run link between these variables has attenuated.

Section V will investigate the potential causes of the changing long-run relationship between trade and income. In this section, we use the results from the empirical model to decompose the cyclical and structural factors of the 2012-2013 global trade slowdown and to obtain model-consistent trade projections for 2014-2019.

##### **A. Cyclical versus Structural Factors**

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<sup>9</sup> Several factors could in principle disproportionately affect trade. For instance, deleveraging in advanced economies impacts durable goods (that are more trade intensive) to a larger extent than non-durable goods. Confidence about future prospects may have a similar effect on trade, as it also disproportionately affects demand of durables.

The evidence in Section III creates a presumption that, in addition to cyclical factors, there is a structural component to the current slow growth of world trade. Here we investigate the relative importance of these factors, by decomposing the growth rate of imports into its structural and cyclical components.

The import growth decomposition requires a few steps. We first obtain the import growth predicted by our model ( $\widehat{m}_t$ ), by applying the estimated coefficients of equation (1) to the actual data. The predicted import growth is given by the following condition:

$$\widehat{m}_t = \widehat{\alpha} + \widehat{\beta} \Delta \ln y_t + \widehat{\gamma} \ln m_{t-1} + \widehat{\delta} \ln y_{t-1}, \quad (2)$$

where  $\dot{m}_t = \Delta \ln m_t$  is the growth rate of imports at time  $t$  and  $\widehat{\alpha}$ ,  $\widehat{\beta}$ ,  $\widehat{\gamma}$ , and  $\widehat{\delta}$  are the estimates of coefficients in equation (1).

Note that equation (1) can be rewritten as:

$$\Delta \ln m_t = \alpha_1 + \beta \Delta \ln y_t - \gamma [-\ln m_{t-1} - (\alpha_2/\gamma) - (\delta/\gamma) \ln y_{t-1}] + \varepsilon_t, \quad (3)$$

where  $\alpha_1 + \alpha_2 = \alpha$ . The term in square brackets is the residual of the cointegration equation, which gives the long run relationship between imports and GDP. We can use this relationship to calculate the long-run import growth predicted by the model. Specifically, from the residual of the cointegration equation we have that:

$$\ln \widehat{m}_t^{LR} = -(\widehat{\alpha}_2/\widehat{\gamma}) - (\widehat{\delta}/\widehat{\gamma}) \ln y_t \quad (5)$$

$$\ln \widehat{m}_{t-1}^{LR} = -(\widehat{\alpha}_2/\widehat{\gamma}) - (\widehat{\delta}/\widehat{\gamma}) \ln y_{t-1}, \quad (6)$$

where  $\ln \widehat{m}_t^{LR}$  is the predicted log long-run level of imports at time  $t$ . Hence, taking the difference of equations (6) and (7), we obtain

$$\widehat{m}_t^{LR} = \ln \widehat{m}_t^{LR} - \ln \widehat{m}_{t-1}^{LR} = -(\widehat{\delta}/\widehat{\gamma}) (\ln y_t - \ln y_{t-1}). \quad (7)$$

Since we already know the estimated long-run elasticity ( $-\widehat{\delta}/\widehat{\gamma}$ ), we can use equation (7) to calculate the long-run import growth predicted by the model ( $\widehat{m}_t^{LR}$ ).

The last step is to obtain the part of the import growth predicted by the ECM framework and associated with the short-run factors (the impact elasticity and the speed of adjustment to the long-run equilibrium of trade). We can obtain the short-term component of import growth ( $\widehat{m}_t^{SR}$ ) by subtracting equation (7) -the predicted long-run growth of imports- from equation (2) -the import growth predicted by the model:

$$\widehat{m}_t^{SR} = \widehat{m}_t - \widehat{m}_t^{LR}. \quad (8)$$

Figure 6 reports the decomposition of the growth of world imports for the period 1970-2013. The blue bars capture the long-term import growth predicted by the model ( $\widehat{m}_t^{LR}$ ), while the red bars represent the predicted short-run component of import growth ( $\widehat{m}_t^{SR}$ ). The figure also reports the ECM import growth ( $\widehat{m}_t$ ) and the actual growth of world imports.

Figure 6 provides some useful insights. First, a comparison between actual import growth and ECM import growth shows that the model performs reasonably well in predicting trade growth over the past 43 years. Second, the long-run portion of import growth tends to explain most of the total growth for most of the sample. Third, the remaining portion, capturing cyclical effects, dominates during periods of crisis and post-crisis recovery such as the trade collapse in 2008 and 2009 and the trade rebound in 2010. The rationale for these findings is that even if the short-run trade elasticity is large and has increased over time, trade tends to quickly adjust to its long-run equilibrium which offsets the impact of income shocks.<sup>10</sup>

Does the current global trade slowdown reflect cyclical or structural factors? Both are clearly involved. The cyclical component of world import growth (the impact growth and the adjustment term) has been negative in 2012 and 2013. As reported in Table 3, the short-term component of import growth ( $\widehat{m}_t^{SR}$ ) is equal to -0.9 percent for both years. This negative cyclical factor has contributed to the sluggish performance of imports. The long-run import growth ( $\widehat{m}_t^{LR}$ ), however, has also been strongly subdued. Specifically, long-term components of import growth are respectively 4.2 and 3.9 percent, much lower than the average in the pre-Great Recession period (5.8 percent) and the long 1990s (7.3 percent).

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<sup>10</sup> The cyclical effects can be further decomposed into the two offsetting factors: the impact growth and the speed of adjustment. The first term is given by  $\widehat{\beta} (\ln y_t - \ln y_{t-1})$ , where  $\widehat{\beta}$  is the estimated short-run elasticity, while the adjustment component can be calculated by subtracting this term from the short-run predicted growth of imports  $\widehat{m}_t^{SR}$ .

A focus on the year 2013 may help provide some insights on the relative importance of cyclical and structural factors in the current trade slowdown. In 2013, ECM import growth was 1.9 percentage points lower than the average ECM growth in the 2000s. According to the model, approximately 48 percent of this decline is imputed to lower long-run growth (which was 3.9 percent in 2013 and 4.8 percent in the 2000s) and the remaining 52 percent is the result of cyclical factors (which was -0.9 percent in 2013 and 0.1 percent in the 2000s). The percentages of structural versus cyclical factors are different when we compare 2013 with the averages for the long 1990s. The decline in long-run growth explains about 81 percent of the lower import growth, while the cyclical component explains the remaining 19 percent. Intuitively, the long-run trade elasticity had already started declining in the 2000s relative to the exceptional period of the long 1990s, which implies that in relative terms cyclical factors tend to explain a larger share of the trade decline when we use the 2000s as a benchmark. As the latter period can be considered as the “new normal”, we think of this as the most appropriate benchmark.

## **B. Trade Projections**

Is the current sluggishness going to persist in the next few years? And what growth rate of trade can be reasonably expected? In the last two years, most international institutions have consistently had to revise downwards their trade forecasts but the projections may still be too high.

The explanation provided in this paper is that the lower long-run elasticity of trade with respect to GDP has contributed to the lower than expected performance of world trade in recent years. Specifically, the analysis of the previous subsection indicates that approximately half of the slowdown in 2013 is structural and is due to the lower elasticity of trade to income that prevailed in the 2000s. Since in the coming years we are likely to continue to live in a world where trade is not as responsive to income as it used to be in the long 1990s or in the pre-crisis period of the 2000s, the growth of world trade is going to be moderate, even in the event that cyclical factors improve.

Going forward, the performance of world trade will depend on how far the post-crisis scenario is structural. The World Economic Outlook (WEO) of April 2014 projects world trade volumes to grow at an average annual rate of 5.2 percent in the period 2014-2019. We compare these estimates with the predictions that we would obtain using the estimates obtained in Section III from our regression analysis for the periods 2000-2013 and 2008-2013 (Figure 7 and Table 4). WEO projections are lower than our predictions of trade growth using the implied trade elasticity for the longer period and are higher when we use the estimates for 2008-2013. If the latter estimates capture a further structural (and, hence, more permanent) change in the trade-income relationship rather than a transitional phenomenon, current trade projections could be overly optimistic.

Which scenario is more likely? As discussed in Section III.b, reaching a firm conclusion on the extent of the trade slowdown may be difficult at this stage. Formal tests indicate that there is a structural break in the pre- and post-Great Recession trade-income relationship, lending support to the more pessimistic scenario. However, the estimates for 2008-2013 are based on a period that may be too short to rule out cyclical factors (albeit a long cycle) and to properly capture changes in the long-term association between trade and income.

## **V. FACTORS EXPLAINING THE DECLINE IN TRADE ELASTICITY**

The previous sections have established that the trade-income relationship has changed over time and that the lower long-term trade elasticity helps explain the global trade slowdown in recent years and is likely to affect trade growth in the near future.

In this section, we take a first look at the causes of the changing association between trade and GDP. We first analyze the dynamics of trade and income data at a disaggregated level to identify key countries and regions where a structural break has taken place. Second, we investigate possible explanations for the lower long-run response of trade to income: (i) Changes in the composition of world trade, particularly the relative importance of goods and

services trade; (ii) Changes in the structure of trade, particularly those associated with the international fragmentation of production; (iii) Changes in the composition of GDP, particularly the share of investment in aggregate demand; (iv) Changes in the trade regime, particularly the presumed rise in protectionism. While we cannot directly test the relative importance of these factors, we provide some circumstantial evidence on how far each might have contributed to the observed trade slowdown.

Needless to say, these explanations are neither exclusive nor exhaustive. They are not exclusive as changes in the composition of international trade, for example, are associated both with changes in vertical specialization and in the composition of GDP. These explanations are not exhaustive because the diminished responsiveness of trade may be related to other factors. For instance, rising wages in certain developing countries or the shale gas revolution in the United States may also have had an influence on the trade-income relationship. However, the explanations listed above are the ones that are commonly discussed in the literature (see, in particular, Irwin (2002)) and are the logical starting point of any analysis of the structural causes of the global trade slowdown.

### **A. A Regional Decomposition of the Long-run Trade Elasticity**

We begin the analysis by focusing on the regional dimensions of the diminished responsiveness of trade to income in the 2000s. The technical appendix shows the details of how to decompose the long-run global trade elasticity into a weighted average of individual regions' (or, equivalently, countries') trade elasticity to their own income, where weights depend on a region's relative import and growth shares. The upshot of the decomposition is that a decline of the world trade elasticity can be explained by a combination of three factors: an increase in the import share of a region with lower trade elasticity; an increase in the relative growth of a region with lower trade elasticity; and a decrease in the elasticity of a region's imports to its own income.

We estimate equation (1) separately for advanced and emerging/low income economies, using both yearly and (when available) quarterly data. Then we repeat the exercise for

selected countries. For brevity, Table 5 reports only the estimates for the long-run trade elasticity, including for the world for comparison, along with the trade and GDP growth weights. A few results stand out.

First, the responsiveness of trade to income in the 2000s is lower relative to the 1990s for both advanced economies and developing countries. Furthermore, formal tests show that there is a structural break in the trade-income relationship for both groups of countries. However, a breakdown by country uncovers interesting differences. The change in the world long-run trade elasticity is driven by a few countries that have a large share in world trade and/or are growing faster relative to the rest of the world. China and the United States turn out to be particularly important as they account for 13 and 20 percent, respectively, of the change in the world trade elasticity in the long 1990s, and for 32 and 8 percent, respectively, in the 2000s.<sup>11</sup> In both cases, the elasticity of imports to their own GDP is significantly lower in the 2000s compared to the long 1990s. Using yearly data, the trade elasticity for the United States declined from 3.7 to 1.8, while for China the drop was from 1.5 to 1.1 (quarterly data provide slightly different figures, but confirm the substantial decline in their elasticities in the 2000s).<sup>12</sup> Finally there is also some evidence of a structural break in the trade-income relationship for both countries between the two periods. Interestingly, the Euro Area, which accounts for a sizeable share of the world trade elasticity due to its significant import share, displayed an increasing elasticity of imports to its own income over the 2000s. Other geographical areas with decreasing trade elasticity, most notably Latin America and the Caribbean, have little weight in explaining the changing responsiveness of world trade with respect to GDP.

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<sup>11</sup> These numbers are the product of their share in world imports and their growth relative to world growth (see Appendix 1).

<sup>12</sup> We ran country regressions both including and excluding the real effective exchange rate (REER) and results do not change much. In the tables, we report coefficients for the regressions without the REER.

In the rest of this section, we therefore investigate each of the candidate explanations for the lower world trade elasticity, paying special attention to developments in China and the United States.

## **B. Changes in the Composition of World Trade**

A first explanation is that the composition of world trade may have changed in later years towards a trade category with lower income elasticity of demand. The technical appendix shows that the trade elasticity can be decomposed into a weighted average of the elasticity of different components of trade with respect to income, where the weights are given by the share of the specific category in world trade. Hence, the decline in the world trade elasticity could be driven by a fall in the elasticity of its components and/or by an increasing share of the component with lower elasticity (i.e. by a changing composition of world trade).

To test this hypothesis, we decompose the world trade elasticity into its various components and estimate separately the elasticity of services trade and of goods trade with respect to income for the world. Results presented in Table 6 show that the main force in the decline of the world trade elasticity has been the fall of the goods trade elasticity in the 2000s, which was driven by manufacturing trade, not by the changing composition of world trade. At the world level, the long-run manufacturing-trade elasticity was 2.6 in the long 1990s and fell to 0.8 in the 2000s. When we replicate the analysis for the United States and for China, we find that a similar pattern exists for both countries. Specifically, in the United States the manufacturing trade elasticity fell from 2.8 in the 1990s to 1.1 in the 2000s, while in China the manufacturing elasticity fell from 1.2 in the first period to 0.7 in the second. These results raise the question of the determinants of the manufacturing trade elasticity, an issue that we take up in the next subsection.

The services trade elasticity and the commodity trade elasticity actually increased in the more recent period relative to the long 1990s, possibly in response to the digitization of the economy and to the process of rapid and continuing industrialization in emerging economies.

Specifically, the long-run elasticity of world services trade increased from 1.8 to 2.2, while the elasticity of world commodity trade rose from 1.7 to 2.3.<sup>13</sup> More importantly, the share of services trade in total trade has been remarkably stable at about one-fifth in the past two decades, suggesting that changes in the composition of world trade cannot explain the lower elasticity of trade with respect to GDP in recent years.

### C. Changes in Vertical Specialization

A second explanation for the changing long-run trade elasticity is the varying pace of international vertical specialization. The information and communication technology shock of the 1990s led to a rapid expansion of global supply chains, with an increasing number of parts and components being imported, especially by emerging economies for processing and re-export (Baldwin, 2011). The resulting increases in back-and-forth trade in components led to measured trade racing ahead of national income. The transition to a world where production is increasingly internationally fragmented in the long 1990s is compatible with the higher long-run trade elasticity for that period (Escaith et al., 2010). Conversely, the decline in the long-term responsiveness of trade with respect to income in the 2000s may well be a symptom that the technology shock of the 1990s has been absorbed and that the process of international production fragmentation has slowed down.<sup>14</sup>

The changing long-term relationship between manufacturing trade and income that was documented in the previous subsection may be a symptom of changing international

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<sup>13</sup> Calculating these elasticities for China and the United States gives similar results, with the one exception that the elasticity of service trade in China is lower in the 2000s than in the long 1990s.

<sup>14</sup> While the focus here is on the long-run trade elasticity, one should also expect a discrepancy between the short and the long-run dynamics of trade and income data. The persistently high short-run elasticity for the 2000s documented in Section III may reflect the fact that the impact of a GDP shock is larger in a world where global supply chains are more developed. The literature on the trade collapse discussed several mechanisms through which vertical specialization may increase the short-term responsiveness of trade to GDP -e.g. if expenditure declines more in vertically specialized sectors (Bems et al., 2011), if there are inventory –also called bullwhip- effects (Altomonte et al., 2012), or if there is re-nationalization of production chains (Buono and Vergara-Caffarelli, 2013).

production relations.<sup>15</sup> In this respect, China and the United States are paradigmatic of two different situations. Because of data limitations, we can only present some circumstantial evidence. Note that the manufacturing supply chain between China and the United States, took to a large extent the form of parts and components being imported by the former and then being assembled into final goods which were exported to the latter. The diminishing importance of such trade is reflected in the falling share of imports of parts and components in China's merchandise exports, from the peak in the mid-1990s of 60 percent to the current share of approximately 35 percent (Figure 8).<sup>16</sup> This decline is even more pronounced as a share of manufacturing exports, which is not surprising given the growing importance of Chinese manufacturing exports in total merchandise exports over the period. The falling share of imports of parts and components reflects the substitution of domestic inputs for foreign inputs by Chinese firms, a finding that is corroborated by evidence of increasing domestic value added in Chinese firms (Kee and Tang, 2014).<sup>17</sup>

The reduced responsiveness of manufacturing trade with respect to income for the United States mirrors in some ways developments in China. In the 1990s, as US firms increasingly

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<sup>15</sup> Similarly, we find evidence that the elasticity of durables trade has decreased from 2.7 in the long 1990s to 0.8 in the 2000s. This is consistent with the changing structure of global supply chains, which are more concentrated in complex goods such as durables relative to non-durable sectors (Ferrantino and Taglioni, 2014). For brevity, these regression results are not reported.

<sup>16</sup> WTO (2014 a and b) also investigates the evolution of China's position in global value chains. They find that foreign inputs contained in China's exports increased by 13.8 percent between 2000 and 2009 ("Evolution of GVC participation and its components, selected Asian economies," in WTO 2014b) and that between 1995 and 2008 China's position becoming more downstream (Figure C.7 in WTO 2014a). The apparent difference from our conclusions arises first of all because the WTO figures include imports not just of parts and components but also of fuel and raw materials. Since the prices of commodity inputs increased significantly in the 2000s, lumping together components and raw materials may create the impression that China's exports became more import dependent even though it was reducing its reliance on imported parts and components. Despite this difference, the data on which the WTO charts are based, and to which we were given access, show that in fact China became more upstream since 2005 and that foreign inputs contained in exports actually declined by 3 percent after 2005.

<sup>17</sup> These changes do not mean that China is turning its back on globalization. As discussed in Kee and Tang (2014), the enhanced availability of inputs domestically is in part linked to growing foreign direct investment in these industries. Moreover, there may be a geographical dimension to these changes, with China's coastal regions beginning to source relatively more from the Chinese interior, because transport and communication costs have declined more sharply with the interior than with the rest of the world. Trade integration may now be taking the form of greater internal trade than international trade, which is captured by official statistics.

relocated production stages outside national borders, trade tended to respond more to changes in income as variations in domestic demand were increasingly met by imports. In recent years, the international fragmentation process seems to have leveled off. Figure 9 provides preliminary evidence. While merchandise imports grew consistently in the United States since the 1980s, the share of manufacturing imports in merchandise imports (and in national GDP) declined since the early 2000s. In fact, US manufacturing imports as a share of GDP have been stable at around 8 percent since the turn of the century, after nearly doubling in the preceding decade-and-a-half. Interestingly, Chinese manufacturing imports as a share of GDP rose from 10 percent at the beginning of the long 1990s to almost 30 percent in the early 2000s and have sharply declined since then.

In order to analyze the impact of global supply chains more systematically, we estimate the long-run elasticities of value added trade with respect to income and contrast these estimates with our results for the (gross) trade elasticities.<sup>18</sup> The varying gap between the two provides information on the extent to which the changing pace of supply chain expansion is behind the lower trade responsiveness. Note first that the ratio of foreign value added to domestic value added in world gross exports increased by 8.4 percentage points between 1995 and 2005, but by only 2.5 percentage points between 2005 and 2012 (Figure 10). This indicates that global supply chains are expanding at a slower pace. Second, we estimate the long-run trade elasticities in value-added terms on a seven-year rolling basis and compare them with the gross trade elasticities calculated in the same way. Intuitively, if the slower pace of global supply chains' expansion is a contributing factor of the trade slowdown, we would expect the gap between the gross and value added trade elasticities to close over time, with the first converging to the value of the latter. Figure 11 indeed shows that the world long-run elasticities of gross trade to GDP decreased over time approaching the lower and more stable estimates of the trade elasticities in value added terms.

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<sup>18</sup> Data on world domestic value added and foreign value added in gross exports from the OECD-WTO dataset are only available starting from 1995 and for selected years. Here we use a time series that was created by Duval et al. (2014) by interpolating the OECD-WTO data. Further details can be found in the technical appendix of Duval et al. (2014).

### **D. Changes in the Composition of Aggregate Demand**

Another plausible explanation for the lower long-run trade elasticity concerns the changing composition of GDP. Different components of aggregate demand have different trade intensities, investment having a larger import content than private consumption and, especially, government spending. For this reason, the changing composition of GDP in the aftermath of the crisis, with its sharp decline in investment and surge in government spending, has been shown to play an important role in explaining the relationship between trade and macroeconomic dynamics during the trade collapse (Bussiere et al., 2013).

It is possible that a prolonged reduction in the components of GDP that have the highest import content may also lead to a decline in the long-run trade elasticity. Figure 12 shows how the composition of world GDP has changed throughout the 2000s. The share of investment in world aggregate demand grew substantially faster than private and public consumption in the period before the Great Recession and then declined, government spending as a share of GDP was virtually the mirror image of investment, while the share of private consumption was flat up to 2009 and then moderately increased. Can this change in the composition of aggregate demand explain the decline in the long-run trade elasticity?

Weak investment may help explain the low trade elasticity for the post-Great Recession period that we documented in Section III.<sup>19</sup> However, the changing composition of demand cannot on its own explain the decline in the long-run world trade elasticities throughout the 2000s. If this channel were driving the changing long-run relationship between trade flows and GDP, the world trade elasticity in the pre-Great Recession period should have been increasing, as the share of investment in aggregate demand was rising, the share of public

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<sup>19</sup> Boz et al. (2014) provide evidence consistent with this hypothesis. They use the model estimates of Bussiere et al. (2013) that are based on an “import-intensity adjusted” demand, which gives higher weight to components of demand with higher import content such as investment. They show that the model predictions are close to actual trade growth for a set of advanced economies during the global trade slowdown.

consumption was falling and private consumption remained stable. As discussed in Section III, this is not what we find in the data.

### **E. Changes in Protectionism**

Finally, a change in protection seems to be a natural candidate for the lower responsiveness of world trade to income, as an increase in trade barriers in the 2000s could have contributed to lower growth of world trade (and particularly so in the aftermath of the Great Recession). However, the recorded increase in protectionism since the outset of the crisis has not been substantial. The WTO trade restrictiveness indicators –capturing border measures such as tariff increases, import licenses, or new customs controls- show a modest increase in the share of world trade covered by new import restricting measures since the Great Recession (Figure 13). For 2013, this share was at 1.3 percent for all WTO member and observer countries. World Bank data on Temporary Trade Barriers (TTBs), such as antidumping and countervailing duties, provide a similar picture.

One simple way to test the role of changing protection on the dynamics of trade and income relationship is to augment equation (1) to include a variable capturing the level of trade barriers. As a measure of protectionism, we use the World Bank’s TTBs dataset that offers a longer time series though for a more limited set of policy instruments. The results from this augmented specification for the world, the United States and China are presented in Table 7, which shows only the coefficients of interest. Once the ECM is augmented to include TTBs, the estimate of the long-run elasticity of world trade with respect to income is essentially unaltered and continues to be significant, while the variable capturing protection at the world level is not significant. The same result holds true when we use the augmented framework to estimate the responsiveness of imports to GDP for China. The US results appear to tell a slightly different story, as the magnitude of the estimated coefficient for the long-run trade elasticity in the 2000s is marginally larger. This suggests that an increase in contingent protection may have had a role, even if minor, in the decline of the responsiveness of imports in the United States.

These findings suggest that protectionist trade policies are playing a negligible (if any) role in explaining the reduction in the world trade elasticity and, hence, in the current trade slowdown. However, a word of caution may be warranted. First, changes in still-opaque non-tariff measures are not captured by standard measures of protection and they may be playing a role that our analysis cannot account for.<sup>20</sup> Second, it is still well possible that the slower pace of trade liberalization in the 2000s relative to the long 1990s, rather than a surge in protection, may contribute to explain the declining responsiveness of world trade to GDP.

## VI. CONCLUSION

To assess whether the global trade slowdown of recent years is cyclical or structural, we analyzed the relationship between trade and income in the past four decades. We demonstrated the rise of the long-run world trade elasticity in the long 1990s and its decline in the 2000s, which set in before the Great Recession. Furthermore, we used the estimates of an error correction model to decompose import growth and show that both long-term and short-term components contribute to explain the global trade slowdown, but that structural factors play a large role in explaining the recent low rates of world trade growth. These findings have implications for trade projections.

We then studied the underlying determinants of the decline in the trade elasticity in the 2000s. We investigated four candidate explanations: changes in the composition of trade, changes in vertical specialization, changes in the composition of GDP, and the rise in protectionism. We find evidence that a slower pace of expansion of global supply chains is an important determinant of the trade slowdown. We argued that the high trade elasticity of the long 1990s reflected the increasing production fragmentation driven primarily by the

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<sup>20</sup> The Global Trade Alert initiative considers a broader range of policy instruments relative to the WTO and has documented a larger number of protectionist measures since the crisis (Evenett, 2014). This count, however, includes both trade restrictive and trade promoting measures, particularly export subsidies and various forms of fiscal incentives to exporting firms, with potentially contrasting effects on the volume of trade.

United States and China; that particular engine appears to have exhausted its propulsive energy in the 2000s. We do not find evidence that the change in composition of trade and the rise in protectionism are relevant determinants of the lower trade elasticity of the 2000s.<sup>21</sup> Finally, the changing composition of GDP, particularly the smaller share of investment in aggregate demand after the crisis, can explain the lower trade elasticity in the post-Great Recession period but not its historical decline since the early 2000s.

An interesting question is whether the decline in trade elasticity has implications for global growth. Paul Krugman, commenting on the global trade slowdown, recently noted that “The flattening out of flattening [*sic*] is neither good nor bad, it’s just what happens when a particular trend reaches its limits” (Krugman, 2014). While our findings support the view that the slowdown is the result of a specific trend in international trade that may be leveling off, the flattening may nevertheless have real consequences. Specifically, the changing long-term relationship between trade and income that underpins the trade slowdown is, in part, a symptom of changing international production relations. To the extent that a finer international division of labor is isomorphic to factor-augmenting technical change (Grossman and Rossi-Hansberg, 2008), a slower pace of its expansion could indicate that world trade is contributing less to global growth today than it did in the long 1990s. This issue merits further investigation. Looking ahead, there is still considerable scope to enhance the international division of labor by drawing in regions that have been at the margin of global supply chains, such as South Asia, Africa and South America. But how and when these untapped opportunities will be seized, is an open question.

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<sup>21</sup> As discussed in the paper, however, a slower pace of trade liberalization in the 2000s relative to the long 1990s may contribute to explain the elasticity in the latter period.

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### Appendix 1 - Decomposition of the World Trade Elasticity

Define the long-run world income elasticity of trade,  $\sigma_w$ , as the percentage change in total world imports (or exports) in volume terms ( $m_w$ ) over the percentage change in real world income ( $y_w$ ), where  $m_w$  and  $y_w$  can be interpreted as the equilibrium levels of imports and income, respectively.<sup>22</sup> That is,

$$\sigma_w = \frac{\Delta m_w / m_w}{\Delta y_w / y_w}$$

We first show that the world trade elasticity can be decomposed as a weighted average of the elasticities of different trade categories (e.g. goods and services). To keep things simple, define  $z = z_1 + z_2$  and  $\Delta z = \Delta z_1 + \Delta z_2$ , where  $z = m_w, y_w$  and 1 and 2 are the two trade categories (the extension to  $n$  trade categories is straightforward and is omitted).

We can write

$$\sigma_w = \frac{(\Delta m_1 + \Delta m_2) / (m_1 + m_2)}{\Delta y_w / y_w} = \frac{\frac{\Delta m_1}{m_1} \frac{m_1}{m_w} + \frac{\Delta m_2}{m_2} \frac{m_2}{m_w}}{\Delta y_w / y_w} = \sigma_w^1 \frac{m_1}{m_w} + \sigma_w^2 \frac{m_2}{m_w},$$

Where  $\sigma_w^j$  is the elasticity of goods/services imports to global income and  $m_j / m_w$  (with  $j = 1, 2$ ) is the share of goods/services imports in world imports.

This decomposition indicates that the world trade elasticity can decline for two reasons. First, for given trade weights, the elasticity is lower if the responsiveness to GDP of goods trade and/or services trade decline. Second, for given goods and services trade elasticities, the

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<sup>22</sup> Differently from the main text, we use subscripts to differentiate aggregate variables from their components.

world trade responsiveness to GDP is lower if the share of world imports of the trade category with lower elasticity increases over time.

We next obtain the world trade elasticity as a weighted average of the elasticity of regions' (or, equivalently, countries') imports to their own income. Again, for simplicity, we focus on two regions, denominated as region 1 and 2.

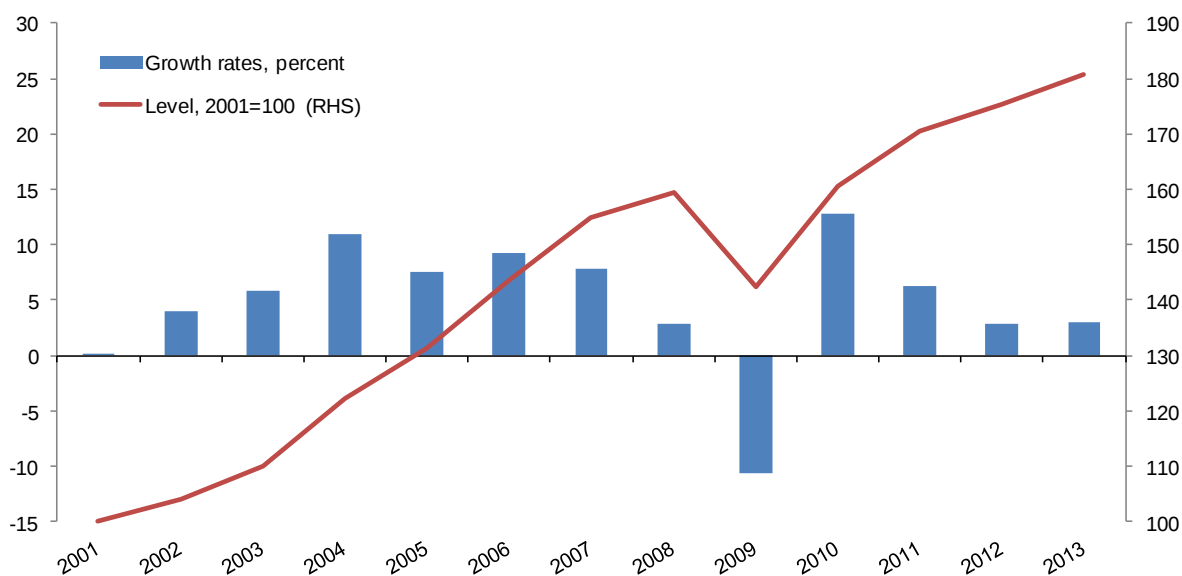
$$\begin{aligned}\sigma_W &= \frac{\frac{\Delta m_1}{m_1} \frac{m_1}{m_W} + \frac{\Delta m_2}{m_2} \frac{m_2}{m_W}}{\frac{\Delta y_1}{y_1} \frac{y_1}{y_W} + \frac{\Delta y_2}{y_2} \frac{y_2}{y_W}} = \frac{\frac{\Delta m_1}{m_1} \frac{m_1}{m_W} \frac{\Delta y_1}{y_1} \frac{y_1}{y_W}}{\frac{\Delta y_1}{y_1} \frac{y_1}{y_W} \frac{\Delta y_W}{y_W}} + \frac{\frac{\Delta m_2}{m_2} \frac{m_2}{m_W} \frac{\Delta y_2}{y_2} \frac{y_2}{y_W}}{\frac{\Delta y_2}{y_2} \frac{y_2}{y_W} \frac{\Delta y_W}{y_W}} = \\ &= \sigma^1 \frac{m_1}{m_W} \frac{\frac{\Delta y_1}{y_1}}{\frac{\Delta y_W}{y_W}} + \sigma^2 \frac{m_2}{m_W} \frac{\frac{\Delta y_2}{y_2}}{\frac{\Delta y_W}{y_W}},\end{aligned}$$

where  $\sigma^i$  is the elasticity of region  $i$ 's imports to its own income. This elasticity is weighted by region  $i$ 's share in world imports and by the elasticity of region  $i$ 's income to world income (i.e. the growth rate of region  $i$  relative to world growth).

This decomposition indicates that a decline of the world trade elasticity can be explained by three factors. A first element can be a decline in the elasticity of a region's imports to its own income. A second factor can be the increasing import share of a region with lower trade elasticity. Finally, a third element is the increasing relative growth of a region with lower trade elasticity.

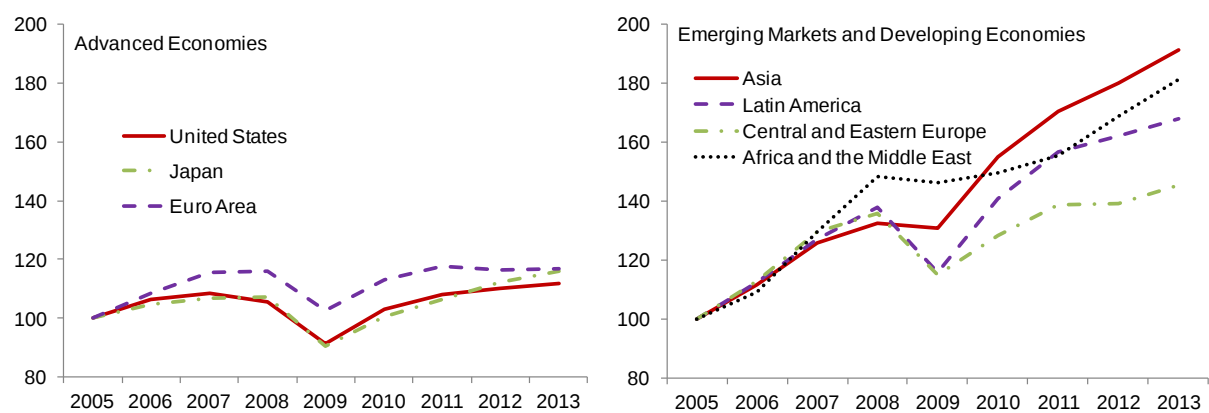
## TABLES AND CHARTS

Figure 1. Total World Trade, Volumes and Growth Rates



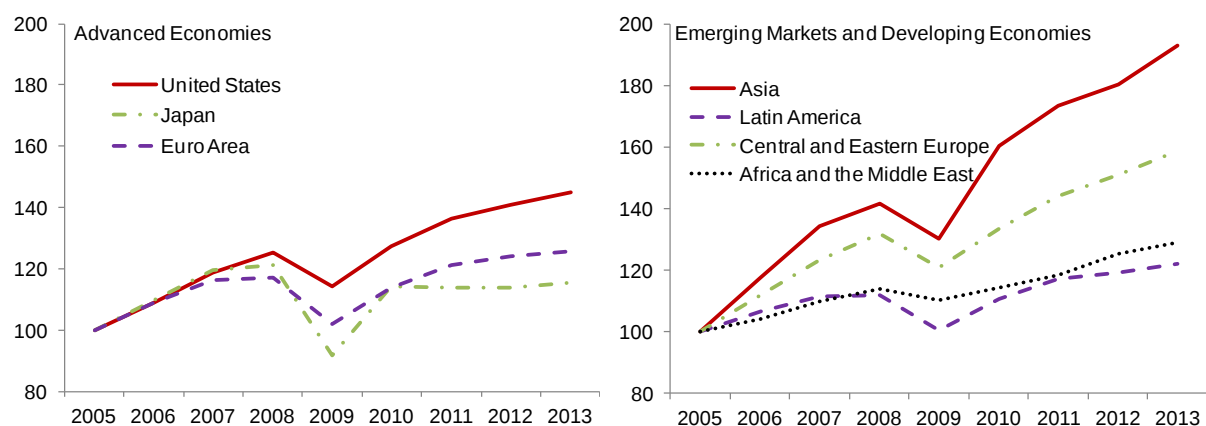
Source: IMF World Economic Outlook

Figure 2. Total Import Volumes (Levels, 2005=100)



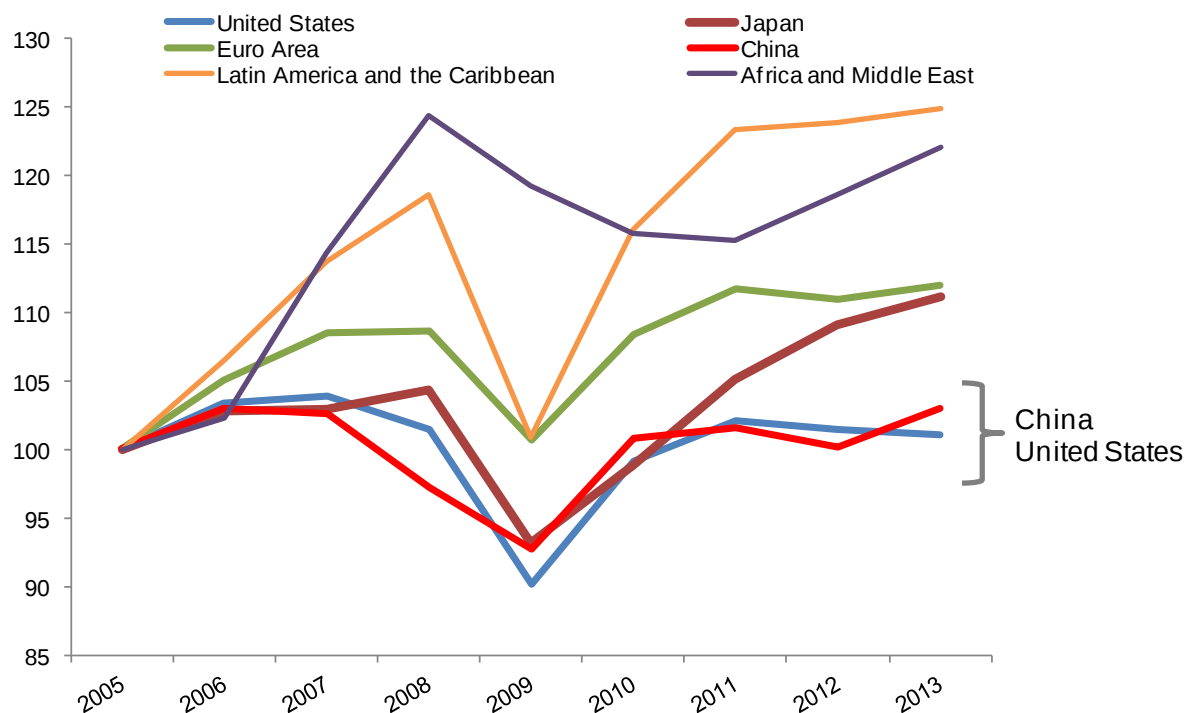
Source: IMF World Economic Outlook

Figure 3. Total Export Volumes (Levels, 2005=100)



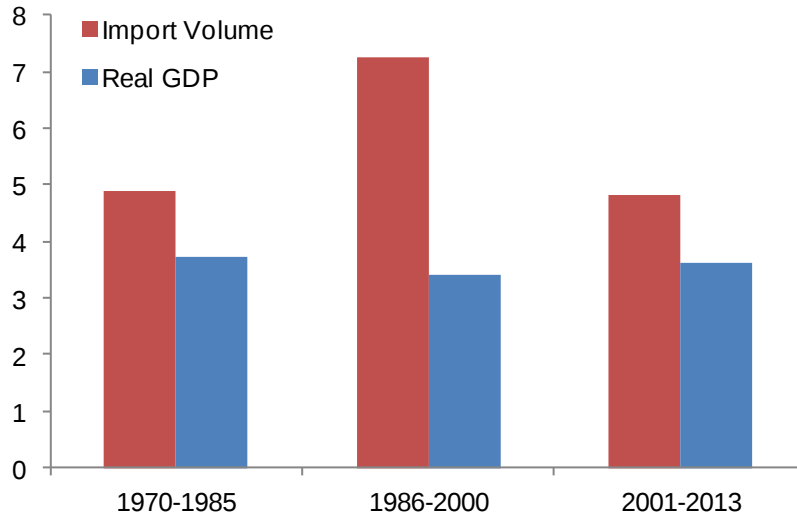
Source: IMF World Economic Outlook

Figure 4. Share of Import Volumes in Real GDP (Levels, 2005=100)



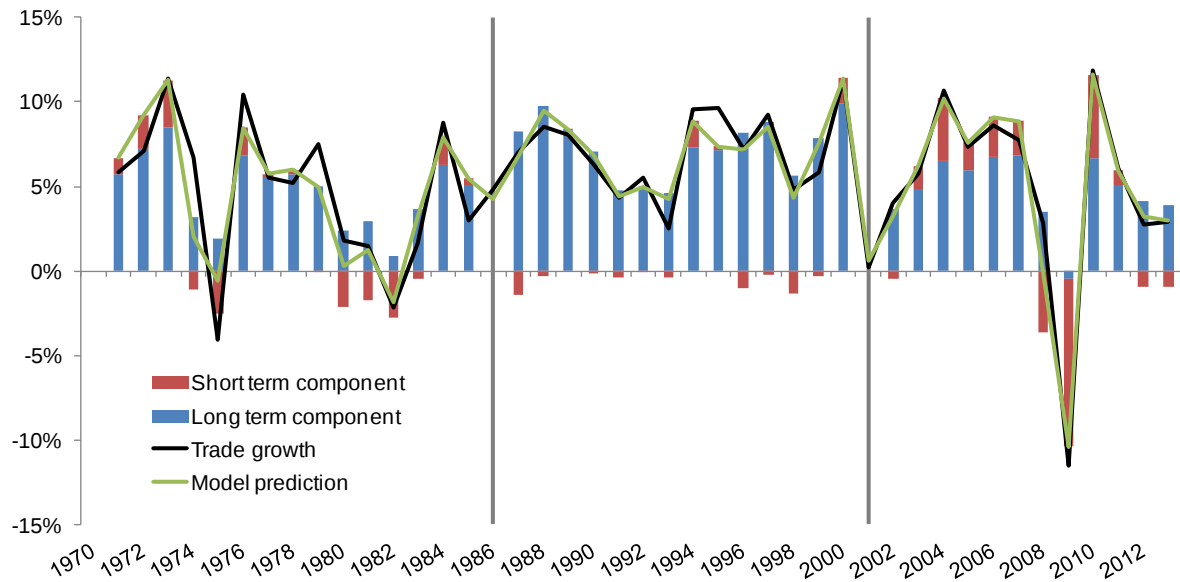
Source: IMF World Economic Outlook

Figure 5. Average Growth Rates Across Selected Periods (percent)



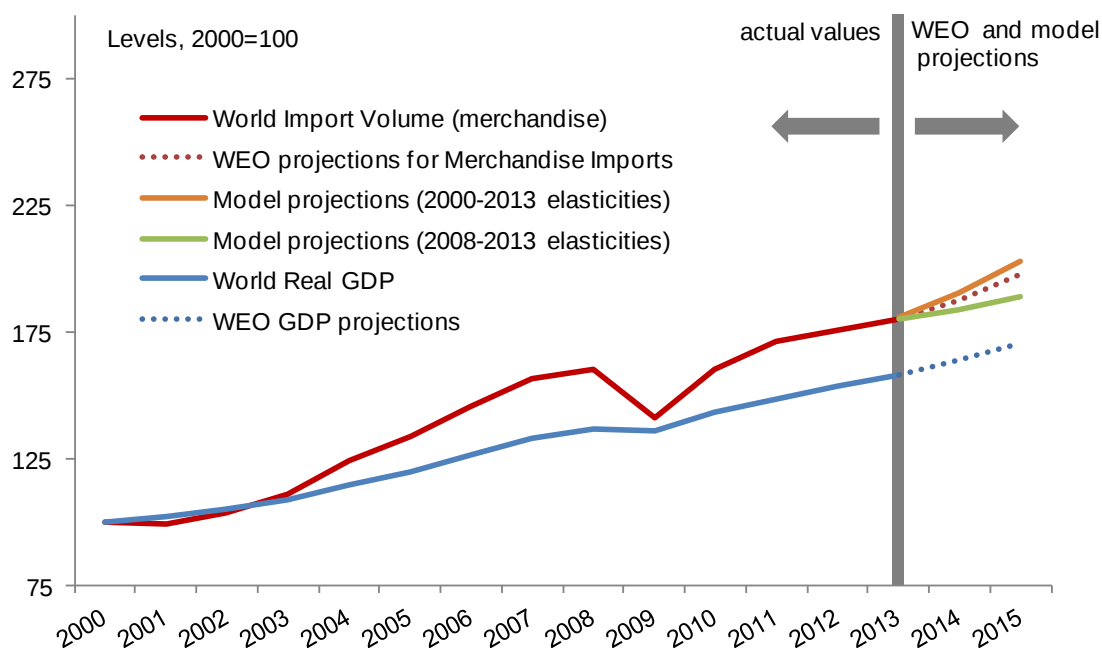
Source: IMF World Economic Outlook

Figure 6. Decomposition of Trade Growth



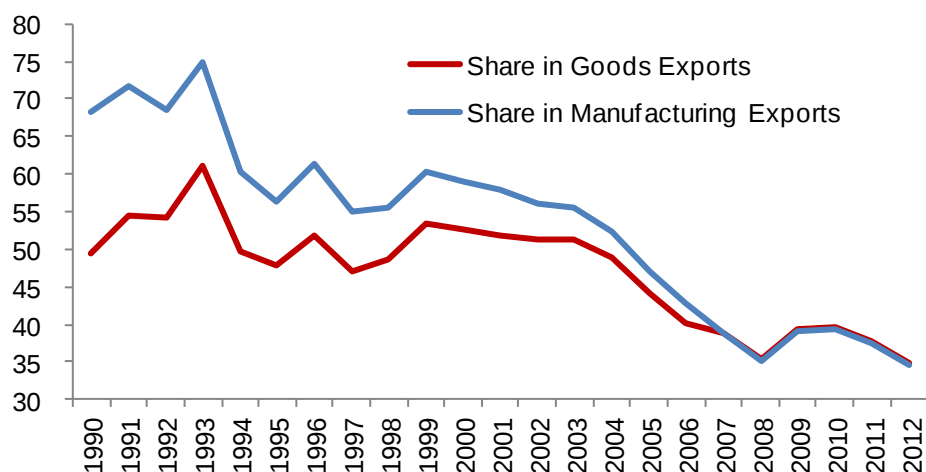
Source: IMF World Economic Outlook and authors' calculations

Figure 7. Trade Predictions



Source: IMF WEO, IMF IFS and authors' calculations

Figure 8. China's Share of Imports of Parts and Components in Exports of Merchandise and Manufacturing (percent)



Source: UN Comtrade

Note: Classification of parts and components is based on UN Comtrade's BEC\*

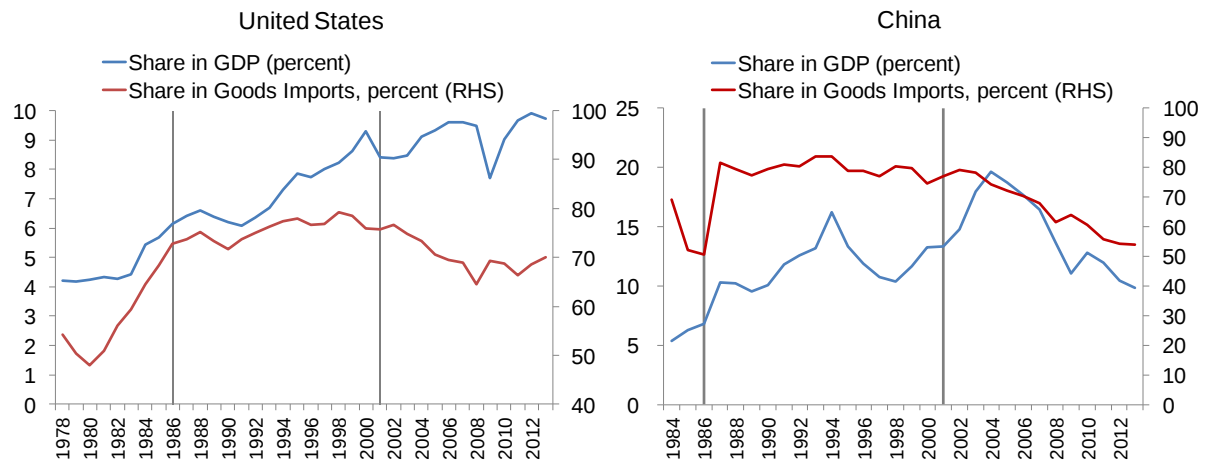
\*sum of three UN Comtrade's Broad Economic Categories:

42 - parts and accessories of capital goods (except transport equipment);

53 - parts and accessories of transport equipment;

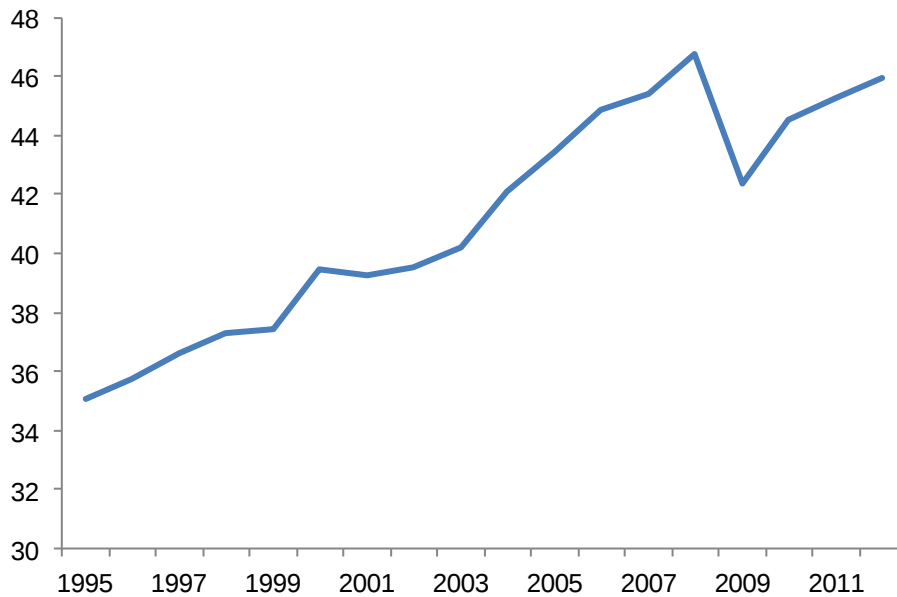
22 - processed industrial supplies not elsewhere specified.

Figure 9. Manufacturing Imports



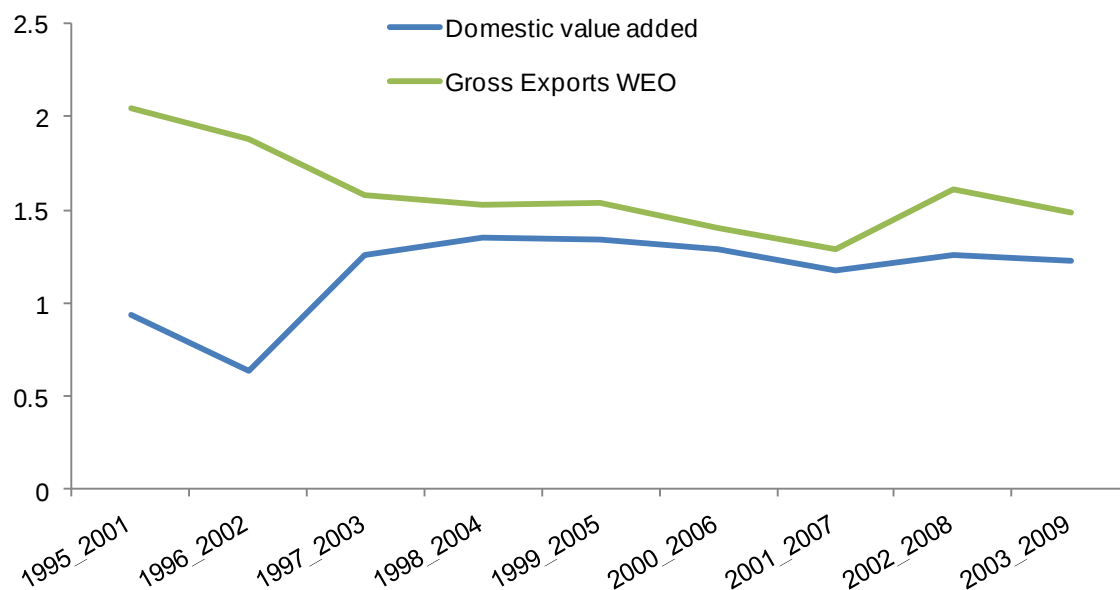
Source: UN Comtrade, IMF WEO

Figure 10. Ratio of Foreign Value Added to Domestic Value Added in World Gross Exports (percent)



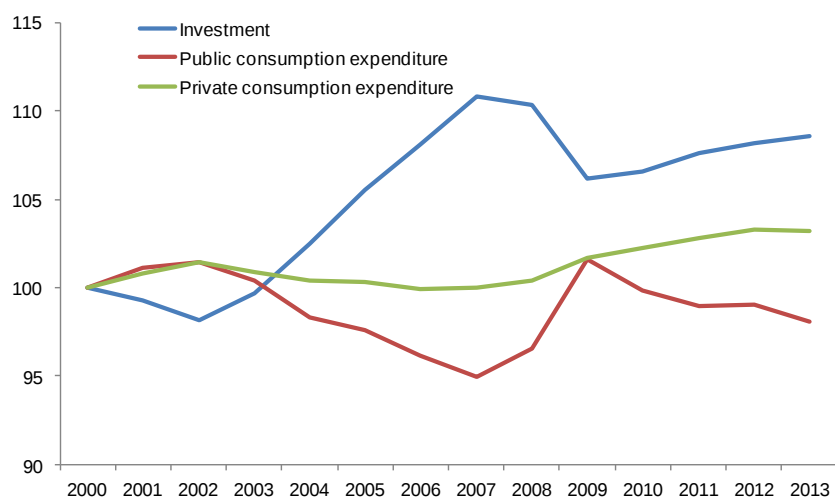
Source: Duval et al. (2014) and OECD-WTO TiVA Database

Figure 11. Long Run Elasticities, 7-year periods



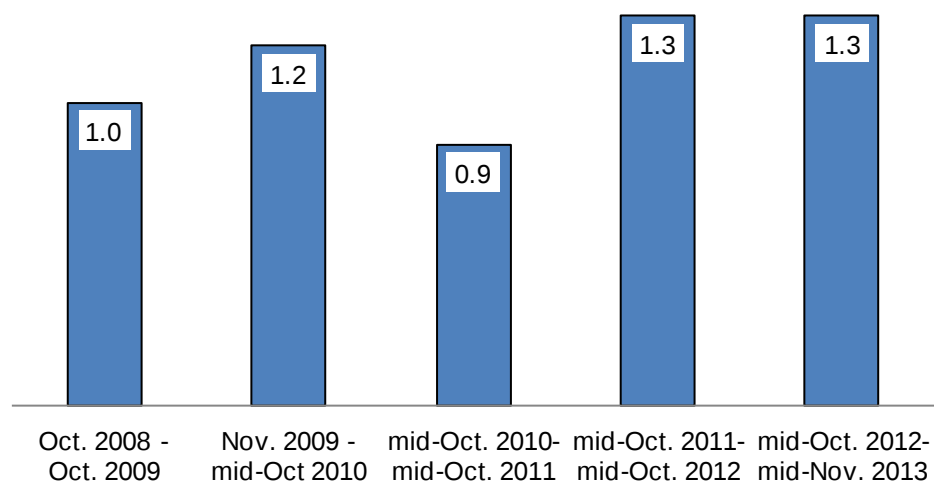
Source: IMF WEO, Duval et al. (2014) and OECD-WTO TiVA Database

Figure 12. Share of Real Investment and Consumption in World Real GDP (index, 2000=100)



Source: IMF WEO

Figure 13. Trade Covered by Import-Restrictive Measures of All WTO Members and Observers (percent of world merchandise imports)



Source: WTO

**Table 1 Results of Estimations Using Yearly Data**

|                                                                   | Pooled w/o dummy variables <sup>1</sup> | Pooled w/ dummy variables for separate periods <sup>2</sup> |                    |                         |
|-------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------|--------------------|-------------------------|
|                                                                   | 1970-2013<br>(1)                        | 1970-1985<br>(2)                                            | 1986-2000<br>(3)   | 2001-2013<br>(4)        |
| $\alpha$                                                          | -0.43**<br>(0.17)                       | -0.35<br>(0.53)                                             | -3.17***<br>(0.64) | -0.52**<br>(0.19)       |
| Short-run elasticity ( $\beta$ )                                  | 2.82***<br>(0.36)                       | 2.13***<br>(0.60)                                           | 2.77***<br>(0.35)  | 3.43***<br>(0.21)       |
| Speed of adjustment ( $-\gamma$ )                                 | 0.12**<br>(0.05)                        | 0.18<br>(0.31)                                              | 0.58***<br>(0.13)  | 0.31**<br>(0.13)        |
| $\delta$                                                          | 0.20**<br>(0.09)                        | 0.23<br>(0.39)                                              | 1.26***<br>(0.26)  | 0.40**<br>(0.17)        |
| Long-run elasticity <sup>3</sup> ( $-\delta/\gamma$ )             | 1.70***                                 | 1.31***                                                     | 2.18***            | 1.31***                 |
| Breusch-Godfrey LM test for serial correlation <sup>4</sup>       | 9.67**                                  | 10.52**                                                     | 9.19*              | 7.43                    |
| Stationarity of the residual                                      | yes                                     | yes                                                         | yes                | yes                     |
| Test that long-run elasticity differs across periods <sup>3</sup> |                                         | (2) vs (3)<br>8.68***                                       | (2) vs (4)<br>0.00 | (3) vs (4)<br>291.21*** |
| Rsquared                                                          | 0.740                                   | 0.957                                                       | 0.957              | 0.957                   |
| N                                                                 | 43                                      | 43                                                          | 43                 | 43                      |

Source: IMF WEO

Note: Standard errors in paranthesis; \*\*\* indicates a significance level of 1%, \*\* of 5%, and \* of 10%.

<sup>1</sup>  $\ln(\text{total imports})_t = \alpha + \beta \ln(\text{gdp})_t + \gamma \ln(\text{total imports})_{t-1} + \delta \ln(\text{gdp})_{t-1} + \varepsilon_t$ , where total imports includes imports of goods and services<sup>2</sup>  $\ln(\text{total imports})_t = \alpha_1 + \beta_1 \ln(\text{gdp})_t + \gamma_1 \ln(\text{total imports})_{t-1} + \delta_1 \ln(\text{gdp})_{t-1} + \alpha_2 + \beta_2 \ln(\text{gdp})_t + \gamma_2 \ln(\text{total imports})_{t-1} + \delta_2 \ln(\text{gdp})_{t-1} + \alpha_3 + \beta_3 \ln(\text{gdp})_t + \gamma_3 \ln(\text{total imports})_{t-1} + \delta_3 \ln(\text{gdp})_{t-1} + \varepsilon_t$ , where total imports includes imports of goods and services<sup>3</sup> Significance established using non linear Wald test<sup>4</sup> Null hypothesis states that there is no serial correlation in the residuals of the linear regression.**Table 2 Results of Estimations Using Quarterly Data**

|                                                                   | Pooled w/ dummy variables for separate periods <sup>1</sup> |                         |                        |                        |
|-------------------------------------------------------------------|-------------------------------------------------------------|-------------------------|------------------------|------------------------|
|                                                                   | 1991q2-2000q4<br>(1)                                        | 2001q1-2007q4<br>(2)    | 2008q1-2013q4<br>(3)   | 2001q1-2013q4<br>(4)   |
| $\alpha$                                                          | -3.09***<br>(0.80)                                          | -0.54<br>(0.46)         | 1.01**<br>(0.43)       | -0.07<br>(0.11)        |
| Short-run elasticity ( $\beta$ )                                  | 1.50**<br>(0.67)                                            | 4.05***<br>(1.01)       | 2.25***<br>(0.42)      | 2.62***<br>(0.23)      |
| Speed of adjustment ( $-\gamma$ )                                 | 0.49***<br>(0.13)                                           | 0.23*<br>(0.11)         | 0.64**<br>(0.26)       | 0.06<br>(0.04)         |
| $\delta$                                                          | 1.18***<br>(0.30)                                           | 0.34<br>(0.21)          | 0.43**<br>(0.20)       | 0.07<br>(0.06)         |
| Long-run elasticity <sup>2</sup> ( $-\delta/\gamma$ )             | 2.40***                                                     | 1.49***                 | 0.68***                | 1.21***                |
| Breusch-Godfrey LM test for serial correlation <sup>3</sup>       | 1.40                                                        | 1.50                    | 0.52                   | 0.59                   |
| Stationarity of the residual                                      | yes                                                         | yes                     | yes                    | yes                    |
| Test that long-run elasticity differs across periods <sup>2</sup> | (1) vs (2)<br>15.24***                                      | (1) vs (3)<br>365.76*** | (2) vs (3)<br>11.19*** | (1) vs (4)<br>16.25*** |
| Rsquared                                                          | 0.838                                                       | 0.838                   | 0.838                  | 0.812                  |
| N                                                                 | 90                                                          | 90                      | 90                     | 90                     |

Source: IMF WEO, IMF IFS

Note: Standard errors in paranthesis; \*\*\* indicates a significance level of 1%, \*\* of 5%, and \* of 10%.

<sup>1</sup>  $\ln(\text{imports})_t = \alpha_1 + \beta_1 \ln(\text{gdp})_t + \gamma_1 \ln(\text{imports})_{t-1} + \delta_1 \ln(\text{gdp})_{t-1} + \alpha_2 + \beta_2 \ln(\text{gdp})_t + \gamma_2 \ln(\text{imports})_{t-1} + \delta_2 \ln(\text{gdp})_{t-1} + \alpha_3 + \beta_3 \ln(\text{gdp})_t + \gamma_3 \ln(\text{imports})_{t-1} + \delta_3 \ln(\text{gdp})_{t-1} + \varepsilon_t$ , where imports are represented by imports of<sup>2</sup> Significance established using non linear Wald test<sup>3</sup> Null hypothesis states that there is no serial correlation in the residuals of the linear regression.

**Table 3. Decomposition of Trade Growth**

| Period    | Trade growth<br>(model<br>prediction) | Long term<br>component | Short term<br>component |
|-----------|---------------------------------------|------------------------|-------------------------|
| 1970-1985 | 4.7%                                  | 4.7%                   | -0.1%                   |
| 1986-2000 | 7.2%                                  | 7.3%                   | -0.2%                   |
| 2001-2013 | 4.9%                                  | 4.8%                   | 0.1%                    |
| 2001-2010 | 5.2%                                  | 4.9%                   | 0.2%                    |
| 2001-2007 | 7.5%                                  | 5.8%                   | 1.8%                    |
| 2011-2013 | 4.1%                                  | 4.4%                   | -0.3%                   |
| 2011      | 5.9%                                  | 5.1%                   | 0.9%                    |
| 2012      | 3.3%                                  | 4.2%                   | -0.9%                   |
| 2013      | 3.0%                                  | 3.9%                   | -0.9%                   |

Source: IMF World Economic Outlook and authors' calculations

**Table 4. Trade Predictions**

| Country/region                            | WEO<br>projections<br>2014 - 2015<br>(percent) | Model predictions 2014-2015 (percent) |                              |
|-------------------------------------------|------------------------------------------------|---------------------------------------|------------------------------|
|                                           |                                                | using 2000-2013<br>estimates          | using 2008-2013<br>estimates |
| World                                     | 4.6                                            | 5.8                                   | 2.3                          |
| Advanced Economies                        | 3.8                                            | 6.0                                   | 2.1                          |
| Emerging Markets and Developing Economies | 5.8                                            | 6.5                                   | 4.0                          |

Source: IMF WEO, IMF IFS and authors' calculations

Note: data refers to merchandise trade only.

**Table 5. Long Run Elasticity of Imports to GDP, by Country and Region**

| Country/group                              | Share in world imports<br>(percent) |               |               | Growth in GDP relative<br>to growth in world GDP |               |               | Long run elasticities   |               |               |                   |                   |
|--------------------------------------------|-------------------------------------|---------------|---------------|--------------------------------------------------|---------------|---------------|-------------------------|---------------|---------------|-------------------|-------------------|
|                                            | 1970-<br>1985                       | 1986-<br>2000 | 2001-<br>2013 | 1970-<br>1985                                    | 1986-<br>2000 | 2001-<br>2013 | from yearly estimations |               |               | from quarterly    |                   |
|                                            |                                     |               |               |                                                  |               |               | 1970-<br>1985           | 1986-<br>2000 | 2001-<br>2013 | 1991q2-<br>2000q4 | 2001q1-<br>2013q4 |
| World                                      |                                     |               |               |                                                  |               |               | 1.31**                  | 2.18***       | 1.31***       | 2.40***           | 1.21***           |
| <u>Advanced Economies</u>                  | 75                                  | 78            | 71            | 0.8                                              | 0.9           | 0.4           | 1.33**                  | 2.39***       | 2.31***       | 2.63***           | 2.11***           |
| United States                              | 18                                  | 20            | 19            | 0.8                                              | 1.0           | 0.4           | 1.62**                  | 3.68          | 1.77***       | 2.85***           | 1.40***           |
| Euro Area                                  | 30                                  | 29            | 25            | 0.7                                              | 0.7           | 0.2           | 1.77**                  | 2.94***       | 3.01***       | 3.11***           | 1.83***           |
| <u>Emerging Markets and Dev. Economies</u> | 25                                  | 22            | 28            | 1.4                                              | 1.2           | 2.0           | 0.00                    | 2.23***       | 1.34***       | 1.69***           | 1.27***           |
| Emerging and Developing Asia               | 5                                   | 7             | 12            | 1.7                                              | 2.8           | 3.0           | 1.52**                  | 1.48***       | 1.14***       | 2.35**            | 1.16***           |
| China                                      | 1                                   | 3             | 8             | 2.8                                              | 4.4           | 4.0           | 1.71**                  | 1.54***       | 1.10***       |                   |                   |
| Emerging and Developing Europe             |                                     | 2             | 3             |                                                  | 0.5           | 1.1           |                         | 2.22          | 1.72***       |                   |                   |
| Latin America and the Caribbean            |                                     | 5             | 5             |                                                  | 0.8           | 1.0           |                         | 3.38***       | 1.65***       |                   |                   |
| Sub-saharan Africa, MENA                   |                                     | 6             | 6             |                                                  | 1.0           | 1.6           | 1.46                    | 1.05***       | 1.60***       |                   |                   |

Source: IMF WEO and authors' calculations

Note: \*\*\* indicates a significance level of 1%, \*\* of 5% and \* of 10%.

**Table 6. Long Run Elasticity of Imports to GDP, by Type of Imports**

| Country/Region | Period    | Total imports | Services | Goods   |               |             |
|----------------|-----------|---------------|----------|---------|---------------|-------------|
|                |           |               |          | Total   | Manufacturing | Commodities |
| World          | 1986-2000 | 2.18***       | 1.80***  | 2.31*** | 2.61***       | 1.66***     |
|                | 2001-2013 | 1.31***       | 2.18     | 1.31*** | 0.79***       | 2.35***     |
| United States  | 1986-2000 | 3.68          | 1.68***  | 3.49*** | 2.75***       | 2.41**      |
|                | 2001-2013 | 1.77***       | 1.95***  | 1.73*** | 1.14***       | 3.77**      |
| China          | 1986-2000 | 1.54***       | 2.24***  | 1.44*** | 1.20***       | 1.26***     |
|                | 2001-2013 | 1.10***       | 1.22***  | 1.10*** | 0.73***       | 1.84***     |

Source: IMF WEO and authors' calculations

Note: \*\*\* indicates a significance level of 1%, \*\* of 5% and \* of 10%.

**Table 7. Assessing the Impact of Protectionism on Long Run Elasticity of Imports to GDP**

| Country/Region | Period    | Total imports | Accounting for protectionism |
|----------------|-----------|---------------|------------------------------|
| World          | 1986-2000 | 2.18***       | 2.04***                      |
|                | 2001-2013 | 1.31***       | 1.3***                       |
| United States  | 1986-2000 | 3.68          | 2.62***                      |
|                | 2001-2013 | 1.77***       | 1.86***                      |
| China          | 1986-2000 | 1.54***       | -                            |
|                | 2001-2013 | 1.10***       | 1.07***                      |

Source: IMF WEO and authors' calculations

Note: \*\*\* indicates a significance level of 1%, \*\* of 5% and \* of 10%.