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Crises and the Collapse of World trade: The shift to Lower Quality

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**CRISES AND THE COLLAPSE OF WORLD TRADE:
THE SHIFT TO LOWER QUALITY****NON-TECHNICAL SUMMARY**

Much attention has been paid to the collapse of world trade during the last quarter of 2008 and the first quarter of 2009. Between July 2008 and January 2009, the volume of world exports decreased by 24%, while trade prices decreased by 14%. Similar disconnection between values and volumes of World trade was also observed during the crisis in 2001.

This paper shows that contractions of income affect more the imports of high quality varieties, which are sold at higher prices, leading to a decrease in import price indices. Import price indices may indeed decrease because (i) the individual price of each variety is decreasing, (ii) the product mix that is imported is changing, and (iii) importers change the composition of varieties of each product they import. In our analysis, a variety is defined as a product category differentiated by its country of origin. Hence, several countries can export a product category; but, since the goods exported differ in their characteristics, they are usually considered as different varieties of a single product.

We use detailed product level data for European Union 15 (EU15) imports provided by Eurostat on a monthly basis, and confirm that the import price index of the EU15 decreased sharply during the crisis in 2008-2009. 24% of the collapse of the trade price index can be explained by a larger decrease of the demand addressed to high-quality varieties that are sold at a higher price on the European market.

The econometric analysis is performed on historical data for about 200 countries in the World and 5000 product categories over the period 1995-2007. Estimation results confirm that imports of high quality varieties react more to GDP variations than low quality varieties. The larger income elasticity for high-quality varieties contributes to explain the sharp reduction of trade price indices during crises.

ABSTRACT

One of the most striking features of the crisis that started during the fall of 2008 has been the sharp decrease in the world volume of trade in goods. The collapse of trade values has been even larger, leading to a decrease of import price indices. We argue that the decrease of import price indices can be explained by a decrease of the demand addressed to the most expansive varieties. Descriptive statistics for the EU15 confirm that the decrease in the import price index is mainly due to a loss in market shares by high price varieties. The estimation of import demand equations confirm that higher price varieties report a larger elasticity with respect to GDP variations, as compared to low price varieties. Countries specialized over high quality varieties are expected to lose more trade in periods of global turmoil, and experience a faster recovery.

JEL Classification: E31, F14, F41

Key Words: Global crisis, income elasticity, quality ladders

CRISES ET EFFONDREMENT DU COMMERCE : UN AJUSTEMENT EN GAMME ?**RESUME NON TECHNIQUE**

Une attention particulière a été portée à l'effondrement du commerce mondial, au cours du dernier trimestre 2008 et du premier trimestre 2009. Entre juillet 2008 et janvier 2009, le volume du commerce mondial s'est contracté de 24% et les prix du commerce mondial ont diminué de l'ordre de 14%. Les données de commerce international permettent aussi d'observer que le ralentissement marqué de l'activité en 2001 avait eu un effet plus important sur la valeur des importations que sur leur volume.

Cet article met en évidence que les contractions du revenu affectent davantage les importations de variétés haut de gamme, vendues à un prix plus élevé sur chaque marché, ce qui engendre mécaniquement une baisse des indices de prix à l'importation. La diminution des indices de prix à l'importation peut en effet potentiellement être expliquée (i) par une diminution des prix individuels pour chaque variété, (ii) par un changement dans la composition des produits importés, et (iii) par un changement dans la composition des variétés importées pour un même produit. Dans notre analyse, une variété correspond à une catégorie de produit différenciée par son pays d'origine.

Nous utilisons dans un premier temps des données d'importation de l'Union Européenne (UE15), à un niveau très fin de désagrégation. L'analyse confirme que l'indice de prix à l'importation de l'UE15 a très fortement diminué au cours de la crise en 2008 et 2009. 24% de la baisse de cet indice de prix peuvent être expliqués par une diminution plus prononcée de la demande adressée aux variétés les plus chères, pour chaque catégorie de produit.

L'analyse économétrique est réalisée sur des données historiques pour environ 200 pays et 5000 catégories de produits, pour la période 1995-2007. Les estimations confirment qu'en moyenne, les importations de variétés haut de gamme réagissent davantage aux variations du PIB du pays importateur. Cette plus grande réactivité du haut de gamme permet d'expliquer en partie la baisse des indices de prix du commerce au moment des crises.

RESUME COURT

La crise qui a débuté à l'automne 2008 s'est accompagnée d'un effondrement du volume du commerce mondial et des indices de prix à l'importation. Cet article étudie dans quelle mesure la diminution des indices de prix peut s'expliquer par un changement de la composition de la demande d'importations. Les statistiques détaillées du commerce pour l'Union Européenne (UE15) indiquent ainsi que la baisse des indices de prix à l'importation

est partiellement expliquée par une diminution plus marquée de la demande adressée aux variétés vendues à un prix plus élevé. L'analyse économétrique effectuée à partir de données de commerce pour plus de 200 pays et sur la période 1995-2007 montre que l'élasticité revenu est plus forte pour les variétés haut de gamme, ce qui rend leur volume importé plus sensible aux variations de revenu.

Classification JEL : E31, F14, F41

Mots-clefs : Crise mondiale, élasticités-revenu et gammes du commerce.

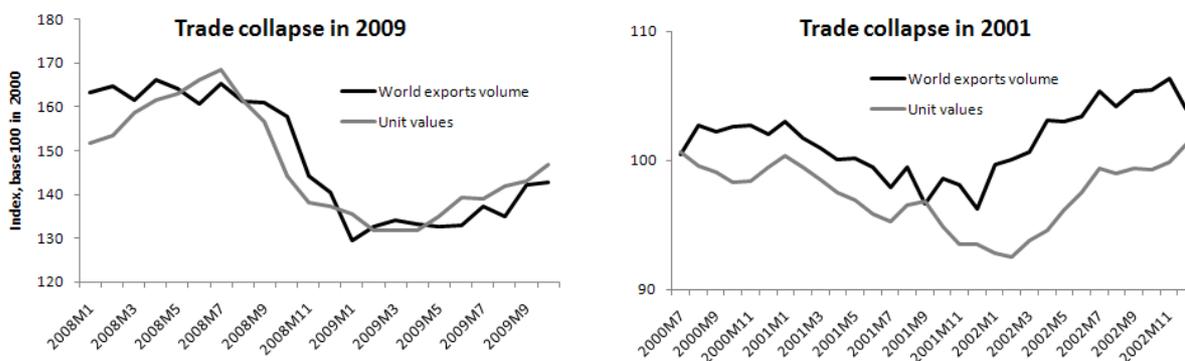
CRISES AND THE COLLAPSE OF WORLD TRADE: THE SHIFT TO LOWER QUALITY

Antoine Berthou & Charlotte Emlinger*

1. INTRODUCTION

Much attention has been paid to the collapse of world trade during the last quarter of 2008 and the first quarter of 2009. Global crisis episodes are characterized by a large collapse of world trade values, and a smaller contraction of world GDP (Freund, 2009). The collapse was much steeper this time than during the Great Depression of the 1930s (Eichengreen and O'Rourke, 2009) and much synchronized across major players in the global economy. Figure 1 below shows that the volume of trade, and also trade prices, contribute to the disconnection between World GDP and the value of World trade during crises events. Between July 2008 and January 2009, the volume of world exports decreased by 24%, while trade prices decreased by 14%.¹ A similar pattern is observed during the trade collapse in 2001.

Figure 1: Indexes of World exports volume and unit values



Source: CPB Netherlands Bureau for Economic Policy Analysis.

This paper argues that crises are associated with a higher decrease of imports for high-quality varieties, leading to a decrease of import price indices. We find strong empirical support for this mechanism in the data.

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¹ IMF World Economic Outlook 2009

A large number of recent papers have provided explanations to the decrease in the *volume* of world trade during the crisis that started in 2007. First, the availability of trade finance instruments such as letters of credit may be a source of trade collapse. Indeed, exporting and importing firms typically make use of such instruments to insure against the risk of payment, with the assistance of issuing (for the importer) and advising (for the exporter) banks. In a context of global financial crisis, the incapacity of banks to provide such instruments may be a source of disruption in trade relationships. However, data on trade credit are very scarce, which makes it difficult to disentangle “pure” finance from “trade” finance mechanism. Beyond trade credit issues, the lack of credit available to firms may have contributed to the collapse of trade volume through the collapse of investment. Using firm-level exports data, Bricongne et al. (2009) show that firms operating in sectors that are more dependent from external finance have suffered more from the crisis in terms of exports. Second, the decrease of trade was much larger than the world GDP recession. This can be explained by a composition effect: the automobile industry, industrial supplies and capital goods have been more affected and their contribution to world trade is larger than their contribution to GDP (Francois and Woerz, 2009; Levchenko et al., 2009). An alternative explanation is the decline in inventories that tends to amplify the adjustment through international trade in goods (Alessandria et al., 2010). In a simulation of the MIRAGE Computable General Equilibrium models, Benassy et al. (2009) show that this pattern cannot be explained by the international fragmentation of the production chain. The fragmentation of the world production process however, through the increasing use of outsourcing in manufacturing industries, can explain however the very high synchronization of the crisis across countries (Bems and Johnson, 2010). As soon as demand for the final good decreases, this affects all the steps of production worldwide. Finally, in times of recession, nations have the possibility to raise their protection on imports of goods by making use of measures allowed by the WTO rules. Those measures comprise subsidies, anti-dumping measures, bailout packages, licensing requirements and standards.² There is however little evidence that protection increased during the crisis.

The tightening of financing conditions, the decline of inventories, or the international fragmentation of the production chains are good candidates to explain the contraction of the *volume* of trade. They cannot however, explain the huge decrease of trade prices. This is an important issue since a large part of the collapse of the *value of world trade* during the crisis is related to a *trade price* effect. Francois and Woerz (2009) show that part of the decrease of import prices can be explained by the reduction of world commodity prices. The decrease of commodity prices can also affect the value of raw materials, and therefore the price of manufactured goods. Alternatively, the decrease in trade prices may be explained by a contraction of markups affecting individual prices, and also by the composition of varieties that are imported.

This paper explores the contribution of this last source of decrease in trade prices. We make use of detailed product-level data of international trade, and investigate whether the selection of vertically differentiated varieties, within product categories, can explain the decrease in

² See the CEPR book edited by S. Evenett and R. Baldwin for details on protection instruments allowed by the WTO.

import price indices in 2009. The recession may have affected differently the demand for goods differentiated by their quality. Higher quality goods are usually assumed to be sold at higher prices to consumers. If shocks on income affect differently imports of different quality, this would result in composition effects in import price indices. In this paper, we ask whether variations of the aggregate income affect differently the import quantity of high and low price varieties. This is an important policy question for countries specialized on higher quality ladders.

We investigate this issue by making use of highly disaggregated data at the product level. Countries indeed import goods with unit values that can differ a lot according to the origin, within product categories, suggesting that varieties are vertically differentiated. Following the existing literature, we assume that for a very detailed product category, price differences are a proxy for quality differences.³ First, based on detailed product level data on European Union 15 (EU15) imports provided by Eurostat on a monthly basis, we confirm that the import price index of the EU15 decreased sharply during the 2008-2009 crisis. We show that 24% of the collapse of the trade price index can be explained by a selection of varieties differentiated by their origin, within each detailed product category.

Second, we use the distribution of unit values for each destination market and product category to classify import flows as low or high quality. This classification is performed using a novel database that allows exploiting the most detailed product nomenclature on each market. The “Tariff Line” data are provided by the United Nations Statistics Division for the year 2005 only, and correspond to the bilateral exports and imports declarations by individual countries, at the most refined level of product disaggregation. These data allow us to compare unit values across exporters to each destination, using the most detailed information. Not surprisingly, advanced economies are found to export at higher prices on each market than developing and emerging economies, in 2005. Using the classification of varieties across low and high quality ladders and Eurostat Comext imports for the European Union, we find that the decrease of imports by the EU15, during the crisis in 2008-2009, was more pronounced for high quality varieties.

Third, we turn to the estimation of import demand elasticity for a large set of importers, exporters and product categories, using the classification of varieties from the Tariff Line data for the year 2005, and the BACI database for the period 1995-2007. Results strongly support the idea that imports of high quality varieties are more sensible to GDP variations than imports of low quality varieties. This contributes to explain the sharp reduction of trade price indices during crises, and the disconnection between import values and GDP variations.

Section 2 provides evidence of composition effects in trade price indices during the crisis in 2009. Section 3 proposes a classification of varieties into high and low quality segment, and details the evolution of European imports during the 2009 crisis by level of quality. Section 4 computes income elasticity by level of quality. Section 5 uses empirical estimations of

³ See for example Fontagné et al. (2008) and Schott (2008) who use unit value to proxy quality.

revenue elasticity, to derive some predictions about the evolution of trade for a sample of countries in 2009. The last section concludes.

2. IMPORT PRICE INDEXES AND THE COMPOSITION OF VARIETIES

We use import unit values at the detailed product level to compute an aggregate price index for total imports of the European Union 15 (EU 15), using the following formula:

$$P_t = \prod_{k=1}^K \prod_{i=1}^I \left(\frac{p_{ikt,t}}{p_{ik,r}} \right)^{\omega_{ikt}} \quad \text{With } \omega_{ikt} = \frac{X_{ikt}}{X_t} \quad (1)$$

P_t is the aggregate price index for EU15 imports, at time t . We use a weighted geometric average of individual price indices at the product level. p_{ikt} is the unit value for imports by the EU from country i , in product category k , at time t . To compute the individual aggregate price index, we use the reference price $p_{ik,r}$, where r is the reference period. X_{ikt} is the quantity of imports by the EU15 from country i for product k . X_t is the total quantity of imports by the EU15 in t . Accordingly, ω_{ikt} is the share of individual trade flow of dimension ikt in the total imports of the EU at time t . With these data, we can identify two sources of composition bias: the composition of products, and the composition of exporters. With detailed product-level data, we do not identify however the composition of firms within each product category. Our aggregate import price level in Equation (1), P_t , can therefore be influenced by the following observables: (i) the evolution of individual prices at the level of detailed product categories, (ii) the composition of products, and (iii) the composition of exporting countries. In times of recession, the composition of product categories exported, and the composition of exporters, can have a large impact on the aggregate import price.

It is possible to identify the contribution of the selection of countries, within product categories, in the variation of import prices over the years 2008 and 2009. For this we use alternative assumptions regarding the weights that are used to compute the price index. First, we use the weights ω_{ikt} where the structure of EU15 imports is allowed to vary both in terms of products and in terms of country of origin. Second, we keep the share EU15 imports from country i , within each product category k , to their levels in 2007 ($\bar{\omega}_{ik}^{2007} = \frac{X_{ik}^{2007}}{X_k^{2007}}$), but the EU15 demand for different product categories k is allowed to vary over time. Accordingly, the share of imports of product k in total imports is defined as follows: $\omega_{kt} = \frac{X_{kt}}{X_t}$. The price index with a fixed composition of varieties within product categories is therefore:

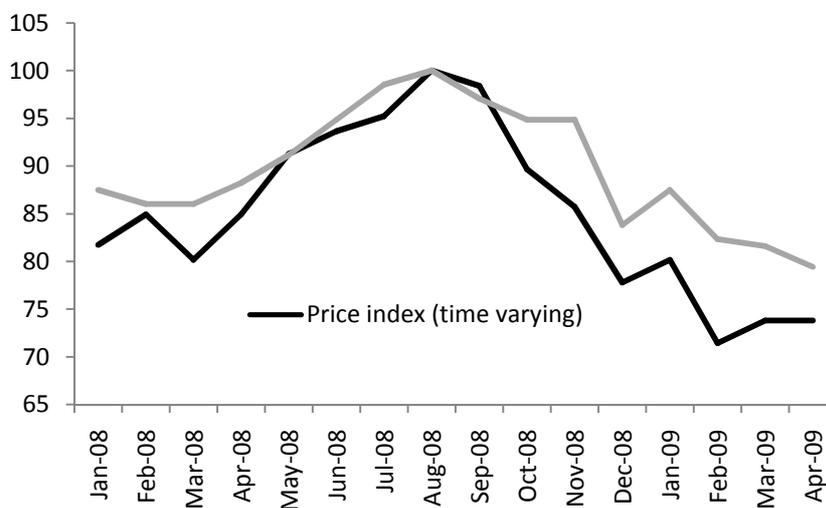
$$\bar{\omega}_{ikt} = \bar{\omega}_{ik}^{2007} \times \omega_{kt} \quad (2)$$

The difference between the first and the second weighting enables to identify the contribution of the variation of demand addressed to different varieties of the same product category (identified by their country of origin) to the overall variation of prices during the period of the crisis in 2008-2009.

We use detailed product-level trade data, provided by Eurostat at a monthly frequency, to compute unit values from bilateral trade values and quantities. The data we use cover trade flows from the major exporters to the EU15.⁴ These data are used to compute the evolution of the aggregate import price index of the EU15. Figure 2 compared the aggregate price index computed using different assumptions regarding weights, as discussed above. August 2008 is used as the reference period, so that we can identify the variation of prices that is specific to the period of the crisis. First, all components of the structure of EU15 imports are allowed to vary over time, and the weight ω_{ikt} applies. This first price index corresponds to the dark curve in the graph. Second, the composition of countries within HS6 products is fixed to 2007 levels, and the weight $\bar{\omega}_{ikt}$ applies. This second price index corresponds to the light grey curve.

Both curves report a collapse of EU15 import prices that started in August 2008 and stabilized in February 2009. The composition of exporters within product categories contributed, to a large extent, to this pattern. If the composition of countries had remained stable over time, within HS6 Product categories, the collapse of prices would have been more limited as evidenced by the light line. Hence, a large part of the decrease in the aggregate import price can be explained by the fact that more expensive varieties have lost market shares. Precisely, the selection of varieties differentiated by origin, within HS6, explains 24% of the collapse of prices between August 2008 and April 2009.

Figure 2: Evolution of EU15 aggregate import price (base 100= August 2008)



Source: Eurostat COMEXT and authors' calculations

⁴ The sample is composed of the individual countries that are members of the EU27, the United States, Canada, Japan, Australia, Switzerland, Israel, Korea, Mexico, Chile, Argentina, Brazil, Russia, Turkey, India, Singapore, Indonesia, China, Thailand, Egypt, Morocco, Senegal and Ivory Coast.

We now proceed to a classification of varieties imported across low-quality and high-quality varieties, and analyze the evolution of export quantity for each category.

3. QUALITY IN INTERNATIONAL TRADE

The objective of this Section is to classify the varieties of a single product category into low and high quality segment. This classification will be ultimately used to provide a description of the evolution of low and high quality imports during the 2009 crisis.

Measuring the quality of a nation's exports is challenging. Previous works have extracted information on quality from prices or unit values (Fontagné et al. 2008; Schott, 2008). Goods within a detailed product category are indeed imported at different prices on each market. This suggests that varieties are vertically differentiated according to their origin. We follow this approach and classify varieties, within detailed product categories, in high or low quality groups, according to their unit values on the import market.

Our classification of varieties in low or high quality categories relies on the tariff-lines international trade data, provided by the UN statistical division. This database is initially available for the year 2005, and reports the value and the quantity of individual trade flows for most countries in the world. More specifically, values and quantities are reported by the exporter and the importer at the most granular level of disaggregation. This level of disaggregation varies according to the declaring country. For instance, the United States records individual imports and exports at the 10-digit level of disaggregation, whereas the European Union records at the 8-digit level. Using the most refined level of disaggregation can make a difference. For example, string musical instruments like acoustic guitars and harps are classified in the same HS 6-digit code "920290". The 8-digit disaggregation for the European Union allows separate harps from acoustic guitars, which are clearly different products. The 10-digit disaggregation disentangles acoustic guitars with a price below 100 US dollars, and the guitars with a price above 100 dollars. With an HS 6-digit disaggregation, we would compare the price of different types of instruments within a single product category, which may result in a biased classification of individual trade flows by type of quality.

Using declarations by importers at the most granular level of disaggregation (the "tariff-line" level) we compare, on each market, the unit value of each individual trade flow to the average import price of the product category. We end up with a relative price of imports, RP_{ijk} , for each product k , with origin i , imported by country j :

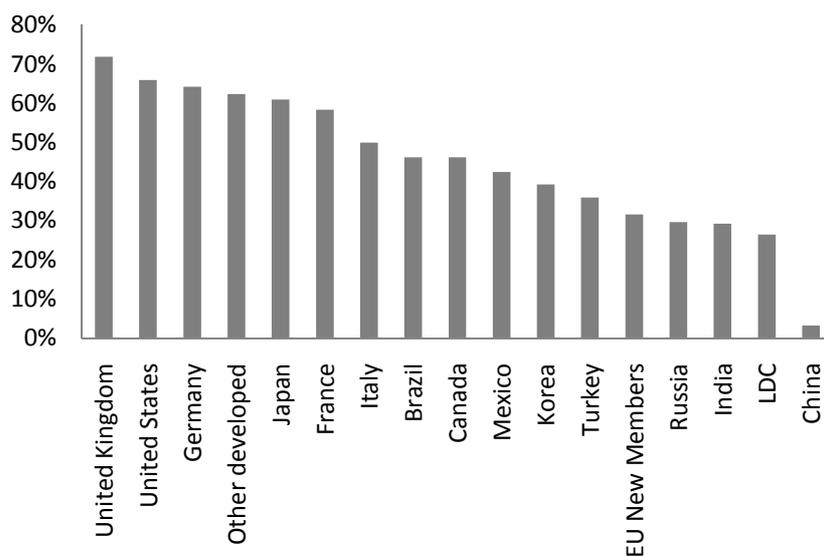
$$RP_{ijk} = \frac{p_{ijk}}{P_{jk}} \quad (3)$$

Where p_{ijk} is the unit value. P_{jk} is the weighted geometric mean of all unit values p_{ijk} . This relative price is computed on the whole sample of exporters of product k to destination j . We use this relative price index to infer the quality of each variety. We simply assume that the most expensive varieties ($RP_{ijk} > 1$) are associated with a higher quality. Cheaper varieties ($RP_{ijk} < 1$) are associated with a lower quality. Importantly, each relative price index has three

dimensions (exporter, importer and product), so that one exporter can sell both high and low quality varieties, across products and markets. Moreover, as the classification in low or high quality is specific to the destination, a variety exported to two different destinations can be classified in different quality segment. For example, a given product imported by Bangladesh and the United States from Korea at the same price can be considered as a high quality in one market, and low quality in the other one. The ranking of varieties across low or high quality is therefore specific to the importing market.

Figure 3 reports the share of high quality exports for a selection of countries ($RP_{ijk}>1$) in 2005. The bar chart shows that a majority of rich countries export high quality varieties, while China only reports 3.3% exports with high quality in 2005. This emphasizes that in a majority of cases where China is exporting, the unit value of Chinese varieties is below the average import price observed on the import market. On average, our data indicate that unit values of OECD countries are twice the unit values of China, over all import markets.

Figure 3: Share of exporting countries' value of exports with high quality ($RP_{ijk}>1$), in 2005



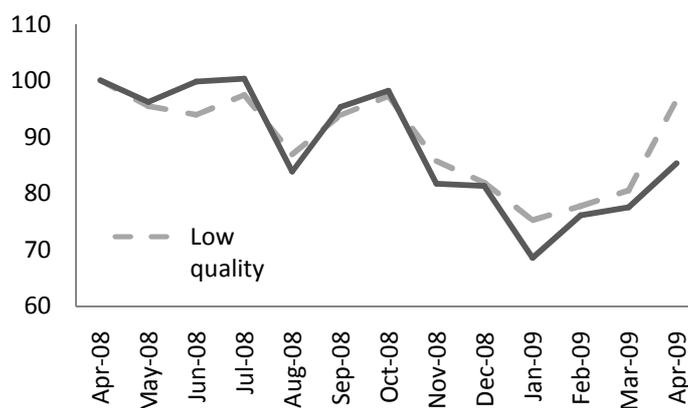
Source: authors calculations from the tariff-line trade data, United Nations Statistical Division.

In a second step, we aggregate the relative price index at the HS-6 digit level by computing a geometrical average weighted by trade volumes.⁵ This enables to merge the indicator of the quality of exports, computed from the tariff line data in 2005, with the trade data provided by the Eurostat Comext database. The Eurostat data have the advantage of providing bilateral exports for the period covering the trade collapse in 2008 and 2009, at monthly frequency.

⁵ So, the ranking of countries exports between low and high qualities are now defined at the 6-digit level.

We extract data for a sample composed of major exporters to the EU15.⁶ Figure 4a reports the evolution of import quantity, for high and low quality varieties. Data show that the decrease of import quantity was more pronounced for high quality imports, especially during the fourth quarter of 2008. Between April 2008 and April 2009, high quality imports decreased by 15%, against 3% for low quality imports.

Figure 4a: Evolution of low quality and high quality import quantity by the EU15 (base 100=April 2008)



Source: Eurostat COMEXT and authors' calculations

Figure 4b reports the evolution of high and low quality imports, by the EU15, from selected countries. The data show that for each exporter, high quality export quantity has decreased more than low quality export quantity, especially during the last quarter of 2008 and the first quarter of 2009. Notice that, even though high quality exports represent a small proportion of Chinese exports to the EU15, those exports also report a higher volatility, with a huge drop during the last two quarters.

These stylized facts do not however provide definitive evidence of a substitution from high to low quality import during the crisis. We turn to econometric estimations in the next section to identify the effect of quality on income elasticity in import demand equations.

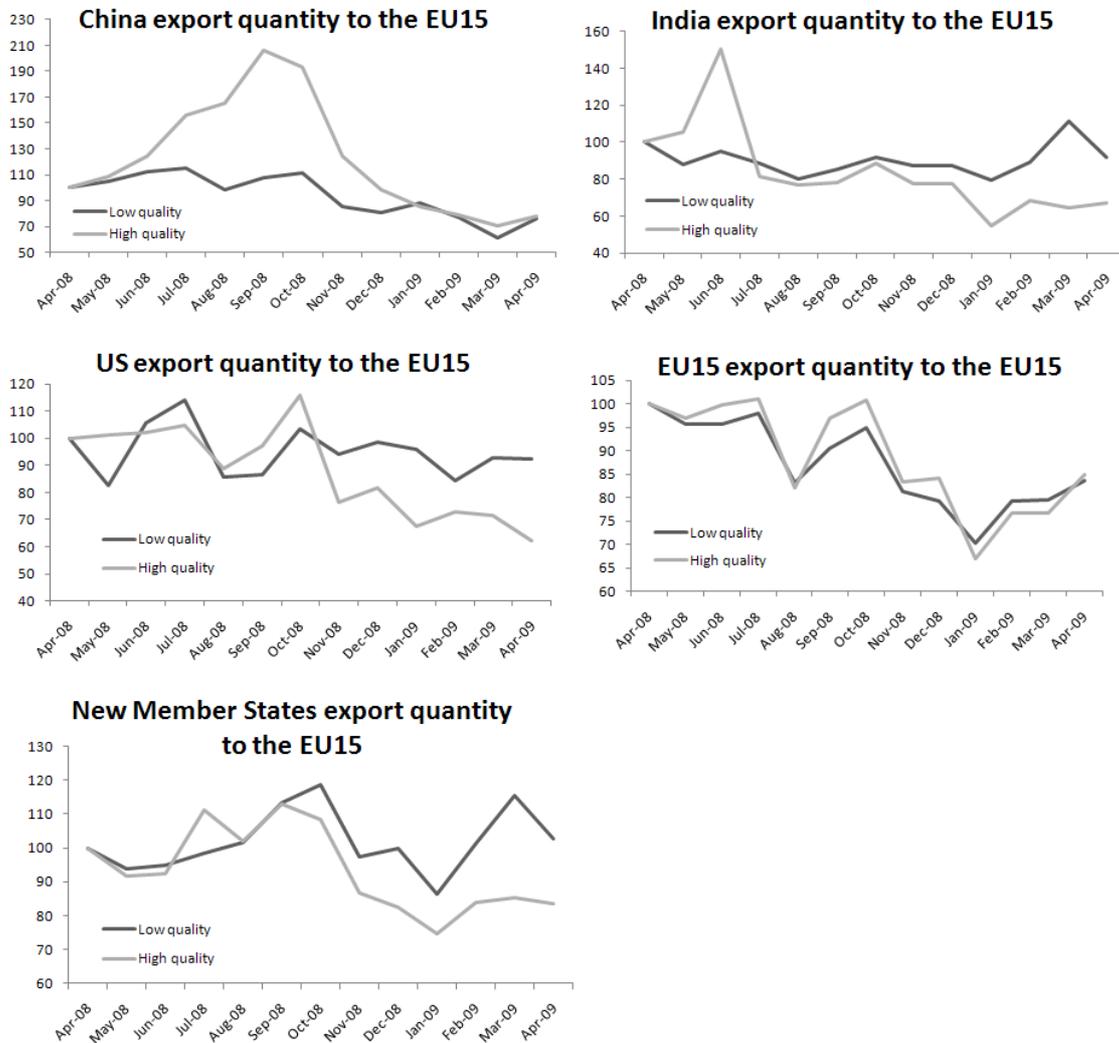
4. INCOME ELASTICITY

Why should income elasticity of imports differ across quality levels? Textbooks in microeconomics detail how income variations can possibly channel through consumption. In the case where the consumer's choice is focused on quantity, an increase in income leads to an increase in the consumption of each variety by the same amount. This is the traditional

⁶ This sample of countries is composed of the individual countries members of the EU27, the United States, Canada, Japan, Australia, Switzerland, Israel, Korea, Mexico, Chile, Argentina, Brazil, Russia, Turkey, India, Singapore, Indonesia, China, Thailand, Egypt, Morocco, Senegal and Ivory Coast, representing 88% of EU 27 imports.

“Engel curve”. Textbooks though discuss the possibility that substitution may occur between luxury goods and necessity/normal goods.

Figure 4b: Evolution of low quality and high quality import quantity by the EU15, from selected origins



Bils and Klenow (2001) have developed a model where the consumer’s choice focuses on quality rather than quantity of consumption for each good. An increase in income is associated with relatively more consumption of higher-quality goods. This relation can be labeled a “quality Engel Curve”. Empirical tests based on a consumer survey for durable goods in the United States confirm that higher income is associated with more consumption of higher quality goods. Fajgelbaum et al. (2009) also develop a model where consumers have different incomes and different tastes. The model predicts that the fraction of consumers that buy high quality varieties rises with income.

These predictions are in line with the descriptive statistics discussed above. The recession in 2008 and 2009 was associated with a decrease in the market share of high-quality varieties in EU15 imports. This suggests that the income elasticity is larger for high-quality varieties than for low quality varieties. We test this prediction by estimating the following import demand equation using annual bilateral trade data at product level, where GDP is interacted with a high quality dummy variable:

$$\Delta \log(M_{ijkt}) = \beta_1 \Delta \log(\hat{P}_{ijkt}) + \beta_2 \Delta \log(GDP_{jt}) + \beta_3 \Delta \log(GDP_{jt}) \times HQ_{ijk} + \gamma_i + \gamma_j + \gamma_k + \gamma_t + \varepsilon_{ijkt} \quad (4)$$

The model is estimated in first difference. M_{ijkt} is the quantity of imports of product category k from country i to destination j for year t . GDP_{jt} is the Gross Domestic Product of the importer. GDP_{jt} is interacted with a High Quality dummy variable HQ_{ijk} , which takes a value of 1 if the product is sold above the average import price (i.e. if $RP_{ijk} > 1$), and zero otherwise (i.e. if $RP_{ijk} \leq 1$). Consequently, we have two quality segment as in the previous Section: High quality and Low Quality. γ_i , γ_j , γ_k , and γ_t are respectively exporter, importer, product and year fixed effects. ε_{ijk} is the error term. \hat{P}_{ijkt} is the FOB unit value, that we instrument with the nominal exchange rate using the following specification in a first step estimation:

$$\Delta \log(P_{ijkt}) = \alpha_1 \Delta \log(E_{ijt}) + \gamma_i + \gamma_j + \gamma_k + \gamma_t + \xi_{ijkt} \quad (5)$$

With E_{ijt} the exchange rate and ξ_{ijkt} the error term of the first step estimates.

Product disaggregation is defined at the HS 6-digit level. We estimate Equations (4) and (5) separately for each HS 4-digit level of product disaggregation. This allows us to keep as much heterogeneity as possible between product categories. We therefore estimate a single elasticity for each HS 4-digit product category. Country and year fixed effects are included in the specification to control for individual heterogeneity in the panel and for the business cycle. Estimations also include fixed effects for each HS 6-digit product categories.

FOB unit values P_{ijkt} are from the BACI database provided by the CEPII⁷. These unit values are used to control for the variation of prices over time. Imports quantity data are also from the BACI database. GDP and nominal exchange rates are from the World Development Indicators (World Bank). We use import quantity, unit values, exchange rates and GDP for the period 1995-2007, which leaves us with 12 years for the estimation. The High Quality dummy is computed from the relative price index discussed in Section for the year 2005.

We are interested in coefficients β_2 and β_3 from the estimation of Equation (4) above. β_2 corresponds to the elasticity of low quality import quantity with respect to GDP. $\beta_2 + \beta_3$ correspond to the elasticity of high quality import quantity with respect to GDP in the destination country. Since we have as many coefficients as HS4 product categories, we report the mean and median of β_2 and β_3 coefficients in Table 1 below. These statistics are reported by considering all coefficients first, or alternatively coefficients that are significant at the 10%

⁷ <http://www.cepii.fr/anglaisgraph/bdd/baci.htm>

level. Estimation results are reported for the whole sample of destinations (world). We then consider separately OECD and emerging countries.

Table 1: Estimation of revenue elasticity by quality (period 1995-2007)

Destinations	Dependent variable	World		OECD		Emerging	
		Import volume ($M_{ijk,t}$)		Import volume ($M_{ijk,t}$)		Import volume ($M_{ijk,t}$)	
		<i>Median</i>	<i>Mean</i>	<i>Median</i>	<i>Mean</i>	<i>Median</i>	<i>Mean</i>
<i>All coefficients</i>	GDP _j	1.26	0.41	2.25	1.26	1.04	1.98
	GDP _j *HQ _{ijk}	0.73	1.20	0.67	1.21	0.52	0.74
	% of positive coef. on interaction variable	69%		64%		62%	
<i>Only coefficients significant at 10%</i>	GDP _j	2.29	0.05	3.56	1.84	2.08	1.74
	GDP _j *HQ _{ijk}	1.31	2.75	1.69	2.77	1.42	1.97
	% of positive coef. on interaction variable	79%		73%		71%	
Number of observations		25,652,174	25,652,174	13,502,097	13,502,097	10,051,180	10,051,180

First of all, estimation results show that β_2 coefficient is positive in all cases, as expected: an increase in GDP at home increases the quantity of goods imported. However, this elasticity differs across low and high qualities. β_3 has a positive sign, which indicates that imports of high quality/high price varieties are more sensitive to GDP variations. This result confirms predictions by Bils and Klenow (2001) that variations in income are associated with some change in the composition of the goods that are imported, with respect to quality. We find similar results for all destinations, OECD destinations and emerging economies destinations.

Secondly, we find that the median elasticity of import quantity with respect to GDP is always above unity. This is the case for both high quality/high price varieties, and low quality/low price varieties. This implies that variations of import quantity are always larger than variations of GDP. This result is in line with the statistics regarding trade and GDP in 2008-2009, with a larger collapse in trade volume (-11.9%) as compared to the decrease of world production (-1.1%).⁸ If we apply this decrease of world production to our results, we find that the predicted contraction of world GDP in 2009 should lead to a 1.6% decrease of the import quantity for low quality varieties, and a 2.6% decrease of import quantity for high quality varieties. Our estimation results therefore predict a larger adjustment of trade quantity, as compared to variations of GDP. The difference between our prediction and the actual data however suggest that other factors, such as the rationing of credit, the rise in protection or the collapse of some sectors have also contributed to the decrease of world import volumes.

Finally, Table 1 reports that the income elasticity is larger for OECD destinations, as compared to emerging destinations. In Table A.1 in appendix, we can see also that recession has been worse for advanced economies. These figures, taken together, contribute to explain

⁸ IMF World Economic Outlook April 2009, chapter 1 "Global prospects and policies".

the collapse of world trade in 2008-2009: countries for which import demand is more elastic to GDP variations also had the largest recession in 2009.

We next turn to a more detailed simulation exercise to quantify the effect of GDP variations on export quantity, for selected countries.

5. SIMULATIONS

We now proceed to some trade simulations for a sample of exporting countries, by using GDP forecasts for 2009 provided by the IMF.⁹ Importantly, these predictions are only related to GDP. Of course, other factors such as exchange rate variations contribute to explain the evolution of export quantity. Our objective is however to quantify the effect of variations of income, for a sample of exporters.

First, we compute the impact of the GDP decline on that of selected exports to individual destinations, for the year 2009. This contribution is obtained by using the following formula:

$$\Delta exports_{ij,2009} = \sum_Q \omega_{ijQ} * elasticity_Q * \Delta GDP_j \text{ with } Q=H,L \quad (6)$$

ω_{ijQ} corresponds to the share of low or high quality exports from country i to destination j . We use the median estimates from our estimations of import income elasticity in Table 1, with the low quality elasticity equal to 1.26, and the high quality elasticity equal to 1.99 (1.26+0.73). For OECD and emerging economies, we use the specific income elasticities that are reported in Table 1.

Second, we compute the variation of selected countries' export quantity to the world using the following formula.

$$\Delta exports_{i,2009} = \sum_Q \sum_j \mu_{ij,Q} * elasticity_Q * \Delta GDP_j \quad (7)$$

μ_{ijQ} corresponds to the share of low or high quality exports from country i to destination j , in country i 's exports to all destinations. μ_{ijQ} and ω_{ijQ} have been calculated using international trade data from the BACI database (CEPII) and the classification in high/low price variety described above. We report simulation using equations (5) and (6) in Table 2 below. Considering Japan in the sample of destinations, we can see that imports from different origins range from -14.7% (China) to -17.05% for Italy. Differences in the simulation for various exporters arise due to their heterogeneous vertical market positioning on the Japanese market. Our quantification suggests that different reactions of export quantity, across exporters, are sizeable with up to more than 2 percentage points of difference in their reaction.

⁹ IMF World Economic Outlook April 2009, chapter 1 "Global prospects and policies".

Overall, our simulation show that the heterogeneous reaction of import demand to GDP variations is quantitatively important, when we consider a single destination. Where GDP is decreasing, the import demand for Chinese goods is also less decreasing, as compared to the import demand addressed to advanced economies. This difference between China and advanced economies, regarding the variation of exports to individual destinations, can reach two percentage points. This difference is explained by vertical differentiation.

For countries where GDP is increasing, as China and India, import demand for high quality products is more increasing. For example, on the Indian market, the variation of imports from Germany and France (+6.2) is higher than the variation of imports from China (+5%) due to vertical differentiation. The variation of Chinese imports from India (+9.2%) though is comparable to the variation of imports from Germany (+9.1). In our exercise, this implies that the share of high quality imports by China from India and Germany is almost the same.

Simulations computed using all destinations in the world are not always in line with destination specific simulations. This is due to the geographical composition of exports. China exports to destinations characterized by large recessions in 2009. On the contrary, Japan benefits from its geographical positioning of exports towards other Asian economies, such as China, that report a lower recession. Hence, on each individual destination, exporters of high quality suffer more from recession. The difference in the predicted variation of export, between high quality exporters and low quality exporters, is indeed quantitatively important. But the evolution of total exports of a country is conditioned to the geographical composition of its exports.

Table 2: Simulation for export quantity variations in 2009 (selected exporting countries)

	Importer								
	Brazil	China	France	Germany	India	Japan	United Kingdom	USA	All destinations (world)
Exporter									
Brazil	.	9.29	-7.22	-14.18	6.33	-15.71	-10.14	-7.11	-5
China	-1.48	.	-7.02	-13.09	4.95	-14.69	-9.47	-6.45	-7.53
France	-1.73	9.03		-14.60	6.23	-16.99	-10.37	-7.46	-7.71
Germany	-1.73	9.06	-7.99	.	6.15	-16.85	-11.00	-7.65	-7.16
India	-1.61	9.18	-7.27	-13.68	.	-16.01	-9.84	-7.14	-3.96
Japan	-1.76	8.30	-8.05	-14.78	6.15	.	-10.59	-7.59	-4.58
United Kingdom	-1.81	8.84	-7.83	-14.87	6.42	-16.71	.	-7.76	-7.21
USA	-1.71	8.54	-8.12	-14.47	6.08	-16.65	-10.84	.	-7.17
GDP prediction	-1.3	6.5	-3	-5.6	4.5	-6.2	-4.1	-2.8	

Importantly, it should be emphasized that the elasticities that are used for the simulation exercise are not individual destination specific (but we use specific elasticities for OECD and emerging destinations). For each groups of countries, we have two elasticities, one for the high quality varieties and one for the low quality varieties that are applied for each country

according to their trade structure. For instance, we can see in Table 2 that the predicted variation of quantity is large and positive for Chinese imports, which is the consequence of the positive variation of GDP for China in 2009 (+6.5%). However, the actual variation of Chinese imports quantity for the year 2009 may be lower in reality. For instance, large entry barriers would dampen the reaction of imports to GDP variations. This type of distortion is not taken into account in our forecasts exercise. Overall, this illustrates that simulation in Table 2 should be taken only as contribution in the evolution of exports and imports quantity in 2009. As discussed above, several other factors that we do not take into account for the simulation, such as the evolution of protection, the rationing of credit, or variations of the exchange rate, may have an impact on the evolution of exports. Nevertheless, our predictions suggest that on each market, differences in the reaction of demand addressed to high and low quality varieties are quantitatively important. These differences contribute to explain the decrease of import price indices in 2008-2009.

6. CONCLUSION

World trade collapsed during the crisis in 2008-2009, both through price and volume effects. This paper argues that part of the decrease in trade price indices can be explained by a larger decrease of the demand addressed to high quality varieties.

Stylized facts report that the decrease of import prices during the 2008-2009 trade collapse is to some extent related to the selection of varieties within the same product category. In times of crises, the demand addressed to varieties with a higher price tends to decrease more, thus depreciating the import price index.

Empirical estimations of import demand equations for a large sample of product categories and countries confirm that the income elasticity is larger for high quality varieties. This suggests that variations of income do affect the quality composition of goods that are imported, which translates into changes in import-price index. The decrease in import price indices, due to this composition effect, contributes to explain the larger decrease in trade values, as compared to the quantity of goods that are exchanged.

The effect is quantitatively important regarding countries' exports. In a simulation exercise, we show that the demand addressed to countries specialized on high quality segments is expected to be more affected by a contraction of income. The difference in the trade collapse between countries specialized on low and high quality segments can reach two percentage points on a specific market. Our results also simulate a quicker recovery for countries specialized on high quality.

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APPENDIX A

Table A.1: GDP growth predictions for 2009

Countries	Predictions for GDP growth (2009)	Countries	Predictions for GDP growth (2009)
United states	-2.8	Latvia	-12.0
Germany	-5.6	Lithuania	-10.0
France	-3.0	Hungary	-3.3
Italy	-4.4	Poland	-0.7
Spain	-3.0	Bulgaria	-2.0
Netherlands	-4.8	Croatia	-3.5
Belgium	-3.8	Romania	-4.1
Greece	-0.2	Russia	-6.0
Austria	-3.0	Ukraine	-8.0
Portugal	-4.1	Kazakhstan	-2.0
Finland	-5.2	Belarus	-4.3
Ireland	-8.0	Turkmenistan	6.9
Slovak Republic	-2.1	Azerbaijan	2.5
Slovenia	-2.7	Armenia	-5.0
Luxembourg	-4.8	Georgia	1
Cyprus	0.3	Kyrgyz Republic	0.9
Malta	-1.5	Moldova	-3.4
Japan	-6.2	Tajikistan	2
United Kingdom	-4.1	Uzbekistan	7
Canada	-2.5	Argentina	-1.5
Korea	-4.0	Brazil	-1.3
Australia	-1.4	Chile	0.1
Taiwan	-7.5	Colombia	0
Sweden	-4.3	Ecuador	-2.0
Switzerland	-3.0	Mexico	-3.7
Hong Kong	-4.5	Peru	3.5
Czech Republic	-3.5	Uruguay	1.3
Norway	-1.7	Venezuela	-2.2
Singapore	-10.0	Algeria	2.1
Denmark	-4.0	Morocco	4.4
Israel	-1.7	Tunisia	3.3
New Zealand	-2.0	Ethiopia	6.5
Iceland	-10.6	Sudan	4
China	6.5	Congo, Rep Dem of	2.7
India	4.5	Kenya	3
Pakistan	2.5	Tanzania	5

Countries	Predictions for growth (2009)	GDP	Countries	Predictions for growth (2009)	GDP
Bangladesh	5		Uganda	6.2	
Indonesia	2.5		Angola	-3.6	
Thailand	-3.0		Ghana	4.5	
Philippines	0		Nigeria	2.9	
Malaysia	-3.5		Cameroon	2.4	
Vietnam	3.3		Côte d'Ivoire	3.7	
Turkey	-5.1		South Africa	-0.3	
Estonia	-10.0				

Source: OECD World Economic Outlook April 2009, chapter1 "Global prospects and policies".

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