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THE "REVEALED" COMPETITIVENESS OF U.S. EXPORTS

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The “Revealed” Competitiveness of U.S. Exports *

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Abstract

We investigate the factors behind the recent decline in the U.S. share of world merchandise exports in an attempt to determine how big a role the changing productivity of U.S. firms has played. We do so against the backdrop of a measure of cost competitiveness which, insofar it is inferred from actual trade ows, we refer to as 'revealed marginal costs' (RMC). Although, in line with our purpose, we derive such measure as an implication of a trade model with (intra-industry) firm heterogeneity, computation does not require firm level data but only aggregate bilateral trade ows, domestic trade included. Brought to the data for the manufacturing sector, such measure reveals that, notwithstanding significant heterogeneity across industries, most U.S. sectors are indeed losing momentum relative to their main competitors, as we find U.S.'s RMC to grow by an average 14%, relative to the other G20 countries. The RMC structure identifies in market size, trade freeness and imports its "revealing-observable" components: while market size is found to be the main responsible of such decline on average, cost competitiveness seems to have benefited from a good combination of increasing trade freeness and decreasing imports, relative to the other G20 countries. The best performing countries in terms of RMC (China and India among others) characterize, however, for an increase in trade freeness higher than in the U.S. At the sectoral level, the "Machinery" industry is the most critical, followed by the "Chemicals" and "Equipment" industries.

Keywords: Productivity, competitiveness, export shares, marginal costs, firm heterogeneity, firm selection, gravity equation, trade costs.
JEL Classification: F12, R13.

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* The views in this paper are solely the responsibility of the authors and should not be interpreted as reecting the views of the Board of Governors of the Federal Reserve System, any other person associated with the Federal Reserve System, or the European Central Bank.

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1 Introduction

The U.S. market share of world merchandise exports has declined sharply over the past decade. Throughout the 1980s and 1990s, approximately 12 percent of the value of goods shipped globally originated in the United States; by 2010, the share had dropped to only 8.5 percent.

This paper investigates the factors driving such decline and, to the extent possible, attempts to determine how big a role the productivity of U.S. firms relative to their competitors has played.

This purpose presents however several complications. First, in many instances, and particularly for international comparisons, both aggregate and firm-level sectoral productivities are difficult to measure directly.[1] Second, export shares may additionally reflect the idiosyncratic composition of the U.S. export bundle or uneven reductions in trade costs and barriers around the world, which may have little to do with the ability of U.S. exporters.

We thus take a structural approach aimed at identifying the relative cost competitiveness of countries by modeling the micro-foundations of market shares explicitly. We do so by modifying the multi-country multi-sector version of Melitz and Ottaviano (2008) used in Corcos *et al.*(2012)[2] in order to derive a measure of country-sector (relative) real marginal costs which, insofar it is inferred from actual trade flows, we refer to as *revealed marginal costs* (henceforth RMC). This (inverse) measure of competitiveness is endogenous to the model, being the outcome of a process of firm selection driven by degree of 'accessibility' (i.e. trade costs) and market size, as well as other structural and technological factors, such as entry costs.

Our main theoretical departure from the Corcos *et al.* (2012) model consists of removing the numeraire good. This allows for an income effect which is essential to our purposes but absent in Melitz and Ottaviano (2008). Such an extension is not considered elsewhere, to the best of our knowledge. Additionally, we employ the approach described in Novy (2011) to compute trade freeness indicators which are comparable through time. This allows us to overcome one of the main limits of trade costs indicators estimated through standard gravity equations.

Such RMC measure features at least four important characteristics. First, it is derived as an implication of a heterogenous firms model. This is a *conditio sine qua non*, given our research question: does the U.S. loss in market share hide a progressive reduction in U.S. firms' productivity? Second, although based on a model with heterogenous firms, it only requires aggregate bilateral trade flows to be brought to the data. Third, computation is straightforward, as it does not (necessarily) require econometrics. Fourth, it provides us with a model-based decomposition of country-sector real marginal costs which, insofar we trust the model, represents a fairly good description of the main determinants of international competitiveness. Such decomposition identifies in bilateral trade freeness, market size and imports the "revealing" (and "observable") components of country-sector RMC.

[1] Measures of aggregate *total factor productivity*, comparable across countries, are in fact usually obtained indirectly, as the residual component of GDP growth that cannot be explained by the growth of production inputs. One of the drawbacks of this growth accounting approach is that the role of the sectoral composition of output is ruled out by assumption. By assuming that GDP is produced by a single sector, one cannot disentangle total factor productivity differences (across countries) due to sectoral specialization from total factor productivity differences due to other factors such as within-sector differences or cross-country differences in the sectoral composition of the economy.

[2] The model was first brought to the data by Del Gatto *et al.* (2006) and further developed by Ottaviano *et al.* (2009).

The economic intuition behind this finding rests on the selection mechanisms featured by trade model with intra-industry heterogeneity. When the size of the domestic market and/or the degree of international trade freeness grow in a given country, competition in factor and/or product markets gets fiercer. This reduces the marginal cost-cutoff above which the firms located in the country are no longer able to target their consumers and pushes down aggregate (average) marginal costs (i.e. RMC) in the country. Moreover, for given market size, imports might grow more than proportionally to the increase in trade freeness. Such a circumstance "reveals" that home firms are losing competitiveness respect to their foreign competitors.

It is also worth noting how, as marginal costs are a composition of total factor productivity (henceforth tfp), input costs and input shares, the idea of competitiveness associated with RMC fits very well, much better than conventional measures of tfp, in globalized contexts, where the link between *tfp* and international competitiveness is blurred by offshoring and international outsourcing. In these cases, it is more realistic to think of countries' export performance as driven by cost competitiveness (i.e. marginal costs), rather than by *tfp* only. In this respect, our contribution is related to other attempts to link the export market performance to the idea of "cost-competitiveness" (e.g. Carlin *et al.*, 2001).

The chance to 'infer' a measure of productivity, and thus of competitiveness, starting from observable trade flows is not peculiar to our framework. The basic idea is that, although mediated by other factors, such as market size and trade costs, international trade flows are mainly driven by cross-country differences in sectoral productivity. To the extent that the relationship between productivity and trade flows can be purged of the effect of the other factors, bilateral trade flows, which are observable, can be used to 'infer' the otherwise unobservable structure of country-sectoral differences in relative productivity. Recent papers have built on this intuition. In particular, Costinot *et al.* (2012) and Finicelli *et al.* (2009) use a probabilistic Ricardian framework à la Eaton and Kortum (2002); Waugh (2009) adopts a variant of the latter including traded intermediate goods and non-traded final goods; Fadinger and Fleiss (2011) rely on a monopolistic competition framework with CES preferences. Other contributions include Hsieh and Ossa (2011), Levchenko and Zhang (2011), Shikher (2011), Chor (2010). Our work adds on this literature in two respects. First, while, with the only exception of Levchenko and Zhang (2011), the above studies take a cross-sectional perspective, our focus is on the evolution of (country-sector) competitiveness. Second, unlike existing literature, which mainly relies on the representative firm hypothesis, our reference framework encompasses firm heterogeneity in productivity. Arkolakis *et al.* (2012) show that, under certain conditions, the aggregate implications of a Ricardian framework with homogenous firms are common to many new trade models with firm heterogeneity. That would be the case for "trade-revealed" productivity measures. However, we show that the theoretical interpretation of such measures can differ substantially, even within the same class of models. For example, we show that different consumer preferences yield a different expression for the discrepancy between "exogenous" and "endogenous" productivity, that is between the productivity levels respectively "before" and "after" the process of firm-selection, even among otherwise similar models with intra-industry heterogeneity. As this discrepancy is key in a "trade-revealing" context, we claim that a clear-cut specification of the reference theoretical framework is always propaedeutical to such type of analysis. In this respect, our paper is much related with Fadinger and

Fleiss (2011), who, differently from us, use a cross-section of countries and a homogenous world to estimate a trade-revealed productivity which, by being theoretically grounded, is fairly comparable to ours. While our focus is on endogenous competitiveness, their estimated productivity are meant to capture, when extended to the case of heterogenous firms, what we define "exogenous" productivity. Our contribution also complements with Costinot *et al.* (2012), who adopt a "trade-revealing" approach to estimate the (not sector-specific) impact of observed ("endogenous", in our terminology) comparative productivity advantages on the pattern of trade across countries and industries but do not use the model to retrieve an estimable expression for the endogenous productivity.

When we bring our measure to the data, and look at the evolution across two non-consecutive decades (1981-1991 and 1997-2006), we obtain, as expected, that U.S. marginal costs have generally kept decreasing, in absolute terms. However, notwithstanding significant heterogeneity across sectors, U.S. manufacturing industries are found to suffer from problems of competitiveness, as the computed RMC growth rate amounts to 14% on average, when evaluated with respect to the other G20 countries. In terms of decomposition, market size is the main responsible for such variation on average, but while it is found to be active in all industries, its relative importance, respect to trade freeness and dependence from abroad in terms imports, varies substantially across sectors.

At the sectoral level, the "Machinery" and "Non-ferrous metals" industries are the most critical, followed by "Industrial chemicals" and "Professional and scientific equipments". On the other hand, sectors like "Footwear", "Furniture", "Printing and publishing", and "Plastic Products, among others, report significantly increasing cost competitiveness.

Overall, our analysis suggests that the dismal performance of the U.S. market share is not a sufficient statistic for competitiveness, as witnessed by the very low correlation between our RMC measure and the export shares.

The exposition proceeds as follows. To motivate the analysis, section 2 presents some descriptive and econometric evidence suggesting that changes in market share may be conflating competitiveness effects with commodity effects, income dynamics and other factors which a "non-structural" analysis is not able to identify. In section 3 we describe the theoretical framework. In section 4 we derive the RMC expression. Our main results for the U.S. economy are then discussed in section 6, after a section (section 5) in which we describe our data and specify the RMC decomposition. Several robustness checks, both theoretical and empirical, are reported in section 7. Section 8 concludes.

Finally, in the Appendix we also report detailed results for the G20 countries, as well as Honk Kong and Singapore, when relevant statistical information is available.[3] Clear winners and losers emerge from this international comparison, with China, India and, interestingly enough, Spain reporting in order the highest decreases. The U.S. lies in the middle of the pack. European countries report moderate changes.

[3]While calculations always takes advantage of the full set of available bilateral trade flows, we limit the exposition to G20 countries.

2 Background analysis: market shares dynamics

From 1984 to 2010, the U.S. share of global exports of goods fell by almost one-third. Through 1999, it was fairly stable at a level of roughly 12 percent, then dropped 3.5 percentage points between 2000 and 2010 (Figure 1). For a subset of countries that report data on the export of certain services, we are able to construct an analogous measure of the U.S. services market share for the 2000-08 period (also shown in Figure 1). Clearly, the decline in U.S. share in the 2000s was not particular to merchandise exports: the services measure fell precipitously from its initial value of about 25 percent before stabilizing in the later years at just above 5 percent. While the data's incomplete coverage of countries and services makes it difficult to ascribe too much precision to the services share levels, the dynamics of the services market share, remarkably similar to those of the goods market share, rules out the argument that a U.S. industry shift from manufactured goods exports to services exports explains the drop in the U.S. share of merchandise exports.[4]

Commodity effects. Using T_s^{lh} to refer to country l's exports to country h in sector s, a useful way of decomposing the above 3.5% fall in the U.S. goods export share is to express it as the sum of changes across product categories as a ratio of the change in world exports - i.e. $\frac{\Delta T^{US}}{\Delta T^{WORLD}} = \sum_s \frac{\Delta T_s^{US}}{\Delta T_s^{WORLD}}$ with $T_s^{US} = \sum_h T_s^{US,h}$ and $T_s^{WORLD} = \sum_l \sum_h T_s^{lh}$ - and use constant market share analysis to separate, for each sector, the change in aggregate market share into a commodity (or extensive) effect and a competitiveness (or intensive) effect, defined as follows:[5]

$$\underbrace{\frac{\Delta T_s^{US}}{\Delta T_s^{WORLD}}}_{\textit{Overall Effect}} = \underbrace{\frac{T_s^{US}}{T_s^{WORLD}}\left(\Delta \frac{T_s^{WORLD}}{T^{WORLD}}\right)}_{\textit{Commodity Effect}} + \underbrace{\left(\Delta \frac{T_s^{US}}{T_s^{WORLD}}\right)\frac{T_s^{WORLD}}{T^{WORLD}}}_{\textit{Competitiveness Effect}} \qquad (1)$$

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

Using bilateral industry-level trade flows from National Bureau of Economic ResearchUnited Nations [NBER-UN] Trade Data, as compiled by Feenstra et al. (2005), Figure 2 depicts the contributions to the change in aggregate export share for each 1 digit SITC code over the period from 1984 to 2008.[6]

In terms of the *Overall Effect*, we observe that virtually every sector registered a decrease in market share over the period from 1984 through 2008. The sector that contributed the most to the overall decline in share was machinery and transportation equipment, which alone accounted for half of the decrease in the U.S. export share

[4]Limited data availability on the services trade forces us to focus exclusively on merchandise trade.

[5]Constant market share analysis is beset by a number of well documented theoretical problems (see Richardson (1971) for an overview and ECB, 2005 for a detailed description). However, the approach remains illustrative and simple to implement even if interpretation is complicated by relative price changes and other issues. It is worth noting that the constant market share approach often includes an additional "market effect" related to the geographical pattern of trade. For ease of exposition we have focused only on the commodity effect, in a sense wrapping the market effect into our measurement of the competitiveness effect. With declining trade costs it is likely that the market effect has become a less pronounced determinate of aggregate share in any case.

[6]Robert Feenstra kindly furnished a preliminary version of an updated data set running through 2008.

over that period. This large contribution in part reflects the fact that machinery and transportation-related products represent almost half of U.S. exports. Within the machinery sector, the declines in the U.S. share of office machine and computer exports are particularly striking, dropping from about a third of total world sales to just under one-tenth. The vast majority of the remaining share losses were recorded in commodities categories which account for approximately a quarter of U.S. export sales over the twenty-five years examined. For instance, the contributions of crude materials (a category that includes, among other things, metals and minerals with low levels of processing) and food and live animals added up to about 1.5 percentage points, accounting for 43 percent of the overall change in the U.S. share. Another third of a percentage point is accounted for by miscellaneous manufactured products, which primarily includes footwear, clothing, apparel, furniture, and certain scientific or photographic apparatus, and manufactured goods classified by material, which includes material-intensive products such as textiles, metal and mineral manufactures, pulp, paper, and rubber.

The importance of commodities for the decline in the U.S. share offers our first reason to resist interpreting aggregate export share statistics as direct evidence of declining competitiveness. Commodity prices fell over most of the period under consideration and, since the exports of the United States are relatively commodity-intensive, it follows that U.S. revenue from commodity sales (and hence the U.S. share of world exports) would fall as well. This point is reinforced by price trends for those individual products within the commodities categories that contributed the most to the share decline. For instance, the prices of corn and soybeans fell in the late 1990s and then remained at this lower level until 2006, when they began to rise. This pattern of prices corresponds closely to the rapid decline in the U.S. export share at the beginning of the past decade and its leveling off in the middle of the decade. Thus, it appears likely that movements in the U.S. export share partly reflect commodity price fluctuations (as opposed to being driven entirely by changes in U.S. competitiveness).

Commodity price effects aside, disentangling between *Commodity Effects* and *Competitiveness Effects* reveals (see Figure 2) how the negative overall contributions of machinery and transportation, miscellaneous manufactured products, and chemicals can be completely attributed to a decline in U.S. competitiveness, because these sectors increased their weight in world exports over the time frame under consideration. In contrast, the food and live animals sector and the crude materials sector have large negative extensive margin effects. Thus, the large negative contributions of the two sectors for the most part reflect the declining importance of these goods in world merchandise exports, although U.S. exports also suffered a negative intensive effect in each case.

In sum, compositional effects make it difficult to attribute all of the observed decline in the U.S. export share to the nation's faltering competitiveness. However, the declining export share in key sectors like machinery, transportation products and chemicals, as well as miscellaneous manufactures, no doubt reflect ground lost to competitors within those sectors. In these cases, the evidence of a fall in U.S. competitiveness is more compelling.

Output shares. One possible explanation for the decline in U.S. export share is simply that the U.S. now accounts for a smaller share of global output. As China and other emerging economies expand rapidly and become more integrated into the global economy, it is natural that the U.S. share of world exports would fall without necessarily indicating any decline in the productivity of U.S. exporters. As shown in Figure 3, the US

GDP share, like its export share, was fairly steady leading up to the year 2000. Subsequently, the fall in the U.S. share of global exports of about 3.5 percentage points through 2008 corresponded to a decrease in the U.S. share of global GDP of about 4.5 percentage points.

The relatively tight correlation between export share and GDP share holds true for many other countries: the United Kingdom and Italy, but also the export-intensive Asian economies. An exception is Germany, which has more or less maintained export share even as its share of world output has declined. Figure 3 strongly suggests that changes in market share may be conflating competitiveness effects with income dynamics.

As a first attempt to investigate this dimension, let us start with a standard gravity equation $T_s^{lh} = D^l D^h r_s^l r_s^h \rho_s^{lh} \phi$, in which country l's exports to country h in sector s are a function of country size (D), latent country-specific multilateral resistance (r), geographic characteristics (ρ) and global shocks (ϕ). Let us now consider a derivative of this equation, in which the latter is 'folded' by dividing through by total exports to country h - industry s: $R_s^{lh} = \frac{T_s^{lh}}{\sum_l T_s^{lh}} = \frac{D^l r_s^l \rho_s^{lh}}{\sum_l D^l r_s^l \rho_s^{lh}}$ In this way, importer-specific terms cancel out[7] and the equation converts neatly into an expression for the market share of country l in country h - sector s, as a function of relative exporter size, relative geographic characteristics and relative multilateral resistance.[8] Denoting the geometric mean of a given variable by $\overline{X} = \prod_{l=1}^{M} \left(X^l\right)^{\frac{1}{M}}$, taking logs, and allowing for a mean-zero perturbation (ε), we can rewrite the above expression as:[9]

$$\ln R_s^{lh} \equiv \ln \frac{T_s^{lh}}{\sum_l T_s^{lh}} = \ln \frac{1}{M_s} + \ln \frac{D^l}{\overline{D}} + \ln \frac{\rho_s^{lh}}{\overline{\rho}_s^h} + \ln \frac{r_s^l}{\overline{r}_s} + \varepsilon_s^{lh} \tag{2}$$

As reported in Table (1), estimation of (2)[10] reveals that the relative size of the exporting countries (as measured by their GDP share) is positively related to the export share, with a 1 percent decrease in relative income decreasing export share by roughly 0.3 percent.

The residuals of equation (2), which anticipates the "trade-revealing" spirit of our main analysis, embody information on the exporter's country-sector underlying productivity, which, though mixed with other unmeasured components, is net of the effect of the exporting country's size. An index of market share changes for the U.S., along with an index of model predicted values, is thus reported in Figure 4.[11] Although the model prediction tracks the flat periods in the market share series (that is, 1994-2000, 2005-2008), it misses the decline

[7] Other examples of canceling out the importer fixed effects in a gravity framework include: Head and Mayer (2000), Martin *et al.*(2008) and Head *et al.*(2010).

[8] Previous studies such as Baier and Bergstrand (2001), and more recently Whalley and Xin (2009) and Novy (2011), use gravity to decompose the levels of bilateral trade flows into contributions from income, trade costs or otherwise. Each finds that exporter and importer income plays a substantial, even dominant, role in explaining trade.

[9] Expression (2) imposes separability across right-hand side ratios with the assumption that $\ln \sum T = \sum \ln T$. In practice, this may have the effect of overestimating the share of each exporter (i.e., since the shares as decomposed on the right-hand side will add up to more than 1), but little impact on the relative size of the shares.

[10] As well as nominal GDP from the Penn World Table (converted into international dollars at PPP exchange rates), equation (1) is estimated using bilateral industry-level trade flows from National Bureau of Economic Research - United Nations [NBER-UN] Trade Data (as compiled by Feenstra *et al.* 2005), of which Robert Feenstra kindly provided us with a preliminary version running through 2008. The estimation of (2) is isomorphic to that of a standard gravity model, though specified in relative terms. As well as country-pairs (a static measure of trade costs which wipes out variation in border, distance, language and other unchanging barriers to trade) and year fixed effects (which soak up secular trends in n), dummies for post-NAFTA and post-EURO years are included, for the appropriate countries, to control for large policy changes which cannot be viewed as endogenous to competitiveness. A dummy for China's WTO membership is also used. However, cognizant of the fact the this might tend to attribute all of China's recent performance to its WTO accession, we report results with such control in a separate column - i.e. specification (ii).

[11] The index in each year is a geometric mean of share changes across U.S. destination countries and products, where each change in share is weighted by the SITC-importer value in the year 2000.

in U.S. share in the early 2000s. In particular, the residual, a broad measure of competitiveness, declines sharply in the beginning of the 2000s. This would mean that relative productivity fell at that time, before stabilizing in the middle of the decade. It is however difficult, without an underlying model, to know whether, and to what extent, gravity residuals reflect the actual evolution in the productivity of exporters rather than other factors, such as evolving trade costs, factor costs, relative prices.

In the following section we thus take a structural approach aimed at identifying the cross-country differences in terms of cost competitiveness by modeling the micro-foundations of trade shares explicitly.

3 Theoretical framework

Consider S industries (indexed $s = 1, \ldots, S$) active in M countries, indexed $l = 1, \ldots, M$. Each country-industry is endowed with given amounts of labor L_s^l and capital K_s^l and the output of each industry is horizontally differentiated in a large (continuum) set of varieties indexed by $i \in \Theta_s$.

Firms compete in a monopolistic market and each variety is supplied by one and only one firm. Firms in a given sector share the same (Cobb-Douglas) technology but are heterogeneous in terms of Unit Input Requirement (UIR) c, defined as inverse 'total factor productivity' (tfp) (i.e. $c = \frac{1}{tfp}$). c is used to identify the firm. Accordingly, the marginal cost faced by a generic firm c active in country l and sector s is:

$$m_s^l(c) = \omega_s^l \; c \tag{3}$$

where $\omega_s^l = B \prod_{x \in X} \left(w_{x,s}^l / \beta_{x,s}\right)^{\beta_{x,s}}$ denotes the Unit Input Cost (UIC), with $w_{x,s}^l$ and $\beta_{x,s}$ referring to input x's cost and share (in country l - sector s) respectively and $\sum_{x \in X} \beta_{x,s} = 1$. B is the bundle of parameters associated with the Cobb-Douglas.[12]

National markets are segmented but firms can export and, as production faces constant returns to scale, they independently maximize the profits earned in different destination countries. Exporting firms incur a per-unit trade cost, encompassing not only carriage in a strict sense, but all those "impediments to trade" whose amount is related to the quantity exported. For each delivered unit from country l to country h, $\tau_s^{lh} > 1$ units have to be shipped. Moreover, we also allow for costly trade within a country with $\tau_s^{lh} > \tau_s^{ll} \geq 1$.

Firm heterogeneity enters the model as follows. In order to start producing, each firm has to make an irreversible investment in terms of labor and capital. This "sunk cost of entry" amounts to $F_s^l \equiv \omega_s^l f_s^l$. At this stage, firms are only partially aware of their marginal costs. While the (exogenous) country-sector specific UIC ω_s^l is in fact known ex ante, c is revealed only once the sunk costs has been payed. This phase is modeled as a firm level draw from a known Pareto distribution $G_s^l(m) = \left[\frac{m_s^l(c)}{\max(m)_s^l}\right]^{\gamma_s} = \left[\frac{c}{\max(c)_s^l}\right]^{\gamma_s}$, with the support $[0, max\,(m)_s^l]$ varying across sectors and countries.

Consumers maximize a 'two-tiered' utility function. In the first step, they allocate a constant fraction σ_s^l of

[12] Equation (3) expresses the marginal cost associated with a standard Cobb-Douglas production function $Q(c)_s^l = c^{-1} \prod_{x \in X} (M_x)^{\beta_{x,s}}$, where M_x denotes the amount of input x.

their income $Y(i)^l$ to goods produced in each sector according to

$$U(i)^l_s = \prod_{s=0}^{S} \left[u(i)^l_s\right]^{\sigma^l_s} \qquad \text{with} \qquad \sum_s \sigma^l_s = 1. \tag{4}$$

In the second step, they allocate $\sigma^l_s Y(i)^l$ among the different varieties in sector s by maximizing (Ottaviano *et al.*, 2002) the following quasi-linear utility function with quadratic sub-utility

$$u(i)^l_s = \alpha_s \int_{i\in\Theta_s} d^l_s(i)di - \frac{1}{2}\upsilon_s \int_{i\in\Theta_s} \left[d^l_s(i)\right]^2 di - \frac{1}{2}\eta_s \left(\int_{i\in\Theta_s} d^l_s(i)di\right)^2 \tag{5}$$

subject to

$$\int_{i\in\Theta_s} p^l_s(i)\ q^l_s(i)di = \sigma^l_s Y(i)^l \tag{6}$$

where $d^l_s(i)$ represents the individual consumption level of variety i of good s. The demand parameters α_s, η_s, and γ_s are all positive. For each differentiated good s, increases in α_s and decreases in η_s both shift out the demand for the differentiated varieties. The parameter γ_s indexes the degree of product differentiation between the varieties of good s. In the limit, when $\gamma_s = 0$, consumers only care about their total consumption over all varieties of that good, $D^l_s = \int_{i\in\Theta_s} d^l_s(i)di$. Such varieties are then perfect substitutes. The degree of product differentiation increases with γ_s as consumers give increasing weight to the distribution of consumption levels across varieties.

With this type of preferences, marginal utilities are bounded, and utility maximization yields the following expression for the individual demand of a generic variety i

$$d^l_s(i) = \frac{\lambda^l_s[\max(p)^l_s - p^l_s(i)]}{\upsilon_s} \tag{7}$$

where

$$\lambda^l_s = \upsilon_s\ \frac{\sigma^l_s\ Y(i)^l}{N^l_s\left[\max(p)^l_s\ \bar{p}^l_{1,s} - \bar{p}^l_{2,s}\right]} \tag{8}$$

in which λ^l_s is the Lagrange multiplier, $\max(p)^l_s = \alpha_s - \upsilon_s D^l_s$ denotes the price level above which the demand of a generic variety in a given country-sector is positive, $\bar{p}^l_{1,s}$ and $\bar{p}^l_{2,s}$ represent the first and the second moment of the price distribution of the N^l_s varieties available in the country. In this setting, each firm is negligible to the market and does not compete directly with the other firms. However, given the demand structure, firms interact indirectly through an aggregate demand effect, as the total output of the industry has an influence on firms' profit.

Only those firms whose cost draw is good enough to enable them to sell to market h at a price below $\max(p)^h_s$ earn non-negative profits and can afford to serve that market. Let m^{hh}_s denote the marginal cost inclusive of trade frictions faced by a producer in country h-industry s that is just indifferent between serving its local market or not. Then, the zero profit condition $m^{hh}_s = \max(p)^h_s$ holds true. As a consequence, a firm, wherever located, can serve market h only provided that its delivered cost does not exceed m^{hh}_s. In other words: firm c

producing in country l is able to target market h when $\tau_s^{lh} m_s^l < m_s^{hh}$, it is not able to target market h when $\tau_s^{lh} m_s^l(c) > m_s^{hh}$, it is indifferent between serving or not market h when $\tau_s^{lh} m_s^l(c) = m_s^{hh}$. Thus, m_s^{hh} measures the (domestic) 'cutoff cost' in country h-industry s, with the export cutoff amounting to $m_s^{lh} = m_s^{hh}/\tau_s^{lh}$.

From profit maximization, aggregate demand and aggregate price for the variety sold in country h by firm c, producing in country l, are respectively given by

$$q_s^{lh}(c) = \frac{\lambda_s^h \ L^h}{2\upsilon_s}[m_s^{hh} - m_s^{lh}(c)] \tag{9}$$

and

$$p_s^{lh}(c) = \frac{1}{2}[m_s^{hh} + m_s^{lh}(c)] \tag{10}$$

where $m_s^{lh}(c) = \tau_s^{lh} m_s^l(c)$ and L^h is the population level in the destination country.

Using (8), aggregate exports from country l to country h, in sector s, can be expressed as:

$$\begin{aligned} T_s^{lh} &= N_{E,s}^l \int_0^{m_s^{lh}=m_s^{hh}/\tau_s^{lh}} p_s^{lh}(c) \ q_s^{lh}(c) \ d\left(m_s^l(c)/\max(m)_s^l\right)^{\gamma_s} = \\ &= \Upsilon_{1,s} \ N_{E,s}^l \ [\max(m)_s^l]^{-\gamma_s} \ \rho_s^{lh} \ \left[m_s^{hh}\right]^{\gamma_s+2} (P_s^h)^{-(\gamma_s+2)} \ Y_s^h \end{aligned} \tag{11}$$

where

$$P_s^h \equiv \left[N_s^h \left(\max(p)_s^h \ \bar{p}_{1,s}^h - \bar{p}_{2,s}^h\right)\right]^{\frac{1}{\gamma_s+2}} \qquad \text{and} \qquad Y_s^h \equiv \sigma_s^h \ L^h \ Y(i)^h; \tag{12}$$

$\Upsilon_{1,s} \equiv \frac{1}{2(\gamma_s+2)}$ is a bundling sectoral parameter playing no role in subsequent analysis; $N_{E,s}^l$ denotes the number of entrants in country l - sector s; $\rho_s^{lh} \equiv (\tau_s^{lh})^{-\gamma_s} \in (0,1]$ is a measure of trade freeness between country l and country h in sector s; P_s^h refers to the exact price index in country h; Y_s^h is the amount of national income $Y^h \equiv L^h \ Y(i)^h$ that residents in country h devote to sector s.

From a gravity point of view, equation (11) suggests using different measures to account for origin and destination country size, namely $N_{E,s}^l$ for the country of origin and Y_s^h for the destination country. Such specification provides us with the following interpretation (see also note 20) of the residuals in equation (2): $ln\left[\frac{max(m)_s^l}{max(m)_s}\right]^{-\gamma_s} = \ln R_s^{lh} - \ln(N_{E,s}^l/\bar{N}_{E,s}) - \ln(\rho_s^{lh}/\bar{\rho}_s^h) - \ln(1/M_s)$. A first consideration is that, taking the model seriously, proper estimation of (2) would require detailed country-sectoral information on the number of entering firms. Since standard gravity estimation (and our regression results in Table 1 are no exception) use national GDP shares to account for country size, gravity residuals (including those plotted in Figure 4) in general conflate country and country-sector size effects. A second consideration is that cross-country differences in the residuals of equation (2) would be revealing of structural differences in terms of "exogenous" comparative advantages which, though probabilistic in nature, can be intended in a classical-ricardian sense (cfr. Costinot et al., 2012).[13] However, it is worth noting the different role played by $\max(m)_s^l$ (i.e. exogenous marginal costs cutoff) and m_s^{hh} (i.e. endogenous marginal costs cutoff) as determinants of the export flows of country l in

[13]It is worth noting how underlying (probabilistic) comparative advantages, expressed in terms of marginal costs, could be easily obtained as $\frac{max(m)_s^l/max(m)_s^f}{max(m)_j^l/max(m)_j^f}$.

(11): on the one hand, a high $\max(m)_s^l$ (i.e. high input costs and low *tfp*) reduces the export performance by weakening its comparative advantages, as in traditional trade models; on the other hand, a relatively high m_s^{hh} in the destination country increase the export capacity of country l. While the first effect is *exogenous*, the latter is *endogenously* determined by a selection process fostered by the degree of international competition. Thus, as we also discuss in Appendix A, the latter is the measure which better accounts for firms' ability to target international consumers of good s. As endogenous to the model, such measure also has a dynamic nature in the long run, which our analysis aims at extrapolating from the data.

Moreover, under the hypothesis that the UIC distribution is Pareto, cross country differences in endogenous marginal cost cutoffs (m_s^{hh}) translate one to one into cross country differences in average marginal costs ($\overline{m}_s^h$) - i.e. $\overline{m}_s^h = \frac{\gamma_s}{\gamma_s+1} m_s^{hh}$. Thus, for each sector, *the vector of the M_s endogenous cutoffs m_s^{ll} provides us with a country ranking in terms of the effective ability to sell good s at relatively low prices to the international market.*[14]

It is thus possible to exploit equation (11) to derive an analytical expression linking our object of interest - i.e. country-sectoral market shares - to *endogenous* marginal costs. This provides us with the chance to infer the latter directly from observed market shares.

4 Revealed Marginal Costs (RMC)

We start by noting that only T_s^{lh} and Y_s^h are observable, with the latter equal to the sum of country h's imports over all possible countries of origin, country h included - i.e. $Y_s^h = \sum_l T_s^{lh}$. Thus, we first of all need to purge (11) of unobservable terms. However, consider that the terms in (11) are specific to both the origin and the destination country [i.e. ρ_s^{lh}], or either to the former (i.e. $[\max(m)_s^l]^{-\gamma_s} \ N_{E,s}^l$) or the latter (i.e. $\left[m_s^{hh}\right]^{\gamma_s+2} (P_s^h)^{-\gamma_s+2} \ Y_s^h$) only. To isolate the cost cutoff, we can therefore use country l's exports to a reference country f to transform equation (11) into a prediction of relative export shares

$$\frac{R_s^{lh}}{R_s^{lf}} = \frac{\rho_s^{lh}}{\rho_s^{lf}} \left[\frac{m_s^{hh}/P_s^h}{m_s^{ff}/P_s^f}\right]^{\gamma_s+2} \tag{13}$$

in which $R_s^{lh} \equiv T_s^{lh}/Y_s^h$ and $R_s^{lf} \equiv T_s^{lf}/Y_s^f$ denote the export share of country l in country h and country f respectively, evaluated with respect to the total imports in the destination country. Expression (13), in which measurable terms are grouped on the left hand side, expresses (measurable) export shares as a function of trade freeness and marginal costs cutoff, both relative to the benchmark country f. Notice how, as well as the unmeasurable exogenous marginal costs component, also the variable (i.e. number of entering firms) accounting for the size of the exporting country, which is endogenous to the model, canceled out at this stage. Using a tilde to indicate that a variable is expressed in relative terms ($\tilde{\rho}_s^{lh} = \rho_s^{lh}/\rho_s^{lf}$; $\tilde{R}_s^{lh} = R_s^{lh}/R_s^{lf}$; $\tilde{m}_s^{hh} = m_s^{hh}/m_s^{ff}$),

[14] The result that $\overline{m}_s^h = \frac{\gamma_s}{\gamma_s+1} m_s^{hh}$ follows from the fact that the average cost of firms selling to country h from any country l is the same whatever the country of origin: $\overline{m}_s^h \equiv \left[1/G_s^l(m_s^{lh})\right] \int_0^{m_s^{lh}} \tau_s^{lh} m_s^l(c) dG_s^l(m)$ for any l (h included).

average real marginal costs in a given country-sector can thus be written as

$$\frac{\tilde{\overline{m}}_s^{hh}}{\tilde{P}_s^h} \equiv \left(\frac{\tilde{R}_s^{lh}}{\tilde{\rho}_s^{lh}}\right)^{\frac{1}{\gamma_s+2}} \tag{14}$$

where we also used the fact that, under the Pareto assumption, $\overline{m}_s^h = \frac{\gamma_s}{\gamma_s+1} m_s^{hh}$ and, thus, $\tilde{\overline{m}}_s^{hh} \equiv \tilde{m}_s^{hh}$.

The level of bilateral trade costs - or more precisely the degree of trade freeness $\tilde{\rho}_s^{lh}$ - is however unknown. To deal with this issue, we derive - in the spirit of Novy (2011) - a very simple expression for bilateral trade freeness, which exploits the structure of the reference model without the need to estimate a gravity equation. From (13), bilateral trade freeness between country l and country h can be in fact expressed as

$$\tilde{\Omega}_s^{lh} \equiv \frac{\tilde{T}_s^{lh}}{\tilde{T}_s^{ll}} \frac{\tilde{T}_s^{hl}}{\tilde{T}_s^{hh}} = \frac{\tilde{\rho}_s^{lh}}{\tilde{\rho}_s^{ll}} \frac{\tilde{\rho}_s^{hl}}{\tilde{\rho}_s^{hh}}. \tag{15}$$

where $\tilde{T}_s^{ll} = T_s^{ll}/T_s^{lf}$ and $\tilde{T}_s^{hh} = T_s^{hh}/T_s^{hf}$.

The intuition behind (15) is (Novy, 2011) straightforward. If bilateral trade flows between two countries increase relative to domestic trade flows, it must have become relatively easier for the two countries to trade with each other. This is captured by an increase in $\widetilde{\Omega}_s^{lh}$.

Under the implicit assumption that $\tilde{\rho}_s^{lh} = \tilde{\rho}_s^{lh}$, equation (15) can be plugged into (14) in order to obtain the following measure of RMC - Revealed Marginal Costs[15]:

$$RMC_s^h \equiv \frac{\tilde{\overline{m}}_s^{hh}}{\tilde{P}_s^h} = \frac{\tilde{R}_s^{lh}}{\tilde{\Omega}_s^{lh}}. \tag{16}$$

Equation (16) represents the basis of our analysis. Mindful that $R_s^{lh} \equiv T_s^{lh}/Y_s^h$, the economic intuition behind it is that, for given market size $\tilde{Y}_s^h$ and price differentials $\tilde{P}_s^h$ respect to the benchmark country, an increase in country h's imports from country l (i.e. $\tilde{T}_s^{lh}$) is 'revealing' of decreasing competitiveness in country h if it is associated with a less than proportional increase in the degree of trade freeness ($\widetilde{\Omega}_s^{lh}$). On the other hand, when the size of the domestic market ($\tilde{Y}_s^h$) and/or the degree of trade freeness ($\widetilde{\Omega}_s^{lh}$) between h and l grow, fiercer product market competition reduces the marginal cost-cutoff above which firms, wherever located, are no longer able to target consumers in country h. This put into motion a process of firm selection according to which less efficient firms are forced to leave the market and their shares are reallocated in favour of more productive firms. This in turn pushes down aggregate (and average) marginal costs (i.e. RMC) in country h, thereby increasing cost competitiveness.

The formulation of equation (16) presents three main advantages over equations (10) in Costinot *et al.* (2012) and (14) in Fadinger and Fleiss (2011), which it closely resembles, as well as over traditional gravity estimates in general.

First, it *does not require econometrics* to be brought to the data.

Second, it can be computed on the basis of *external and internal trade flows only*; no other data being

[15] The exponent $\frac{1}{\gamma_s+2}$ will be omitted hereinafter, as it plays no role in terms of within-sector country rankings.

required.

Third, differently from traditional gravity estimates (see Novy, 2011), it makes *overtime comparisons* possible.

It is also worth noting that, as well as nominal marginal costs, the measure of RMC in (16) also encompasses country-sector specific price indexes. Given marginal costs, a relatively high revealed competitiveness might be the consequence of a relatively high price index in a particular sector. However, due to the poor statistical information available on sector-specific time-varying international price differentials, there is no way to properly control for the presence of $\tilde{P}_s^h$ empirically. We speculate on this point in section 6 (see also note 18).

Finally, the idea of competitiveness associated with (16) is more general than more conventional measures of tfp. To see this, consider equation (3), in which firms' "marginal costs" are shown to consist of a composition of "inverse tfp" (c) and input costs ($w^l_{x,s}$), as well as input shares ($\beta^l_{x,s}$). A high tfp (i.e. low c) might not be enough for a country-sector to be competitive on the international market if input costs are relatively too high. Moreover, firms' offshoring activities can increase a country's market share through marginal costs reduction, even without any change in firms' tfp. tfp is in fact by definition meant to measure the output differences which are not explained by different input choices and occurs, instead, through marginal product increases. Due to this *physical* nature, firms' (and thus aggregate) tfp is invariant to different choices concerning whether to outsource phases of the production process and whether to buy intermediates domestically or abroad.

5 Data and specification

Following equation (16), which derives country h's RMC from its bilateral trade flows with a given country l, we compute, for each country h (and industry s), as many RMC_s^h as the number of countries for which export flows to country h are available. For each country-sector, a final value is then obtained as simple average over all countries of origin.[16] With this specification, zeros and missings in bilateral trade do not translate one-to-one into zeros in RMC_s^h, with the latter occurring only in the event of complete unavailability of a country's imports or, more likely, of missing internal trade flows. The number of country-sector combinations with non-zero RMC is reported in Table 2.

We focus on RMC changes across two non-consecutive decades (1981-1990 and 1997-2006)[17] and consider the following decomposition, derived by taking logs and first differences of (16):

$$\Delta \ln(RMC_s^h) = \underbrace{\Delta \ln(\tilde{T}_s^{l,h}) - \Delta \ln(\tilde{Y}_s^h)}_{\Delta \tilde{R}_s^{lh}} - \Delta \ln(\tilde{\Omega}_s^{l,h}) \tag{17}$$

where $\Delta \ln(X) \equiv \ln(\bar{X}_{97 \text{ to } 06}) - ln(\bar{X}_{81 \text{ to } 90})$ refers to the growth rate of the mean of the generic variable X from the early (1981-1990) to the late (1997-2006) period. According to (17), country h's RMC growth rate can

[16] We also experimented with weighted averages finding that country rankings are only slightly affected. We thus preferred to report unweighted averages, as the resulting country rankings are more comparable to those that can be obtained through an econometric procedure (see section 7.2) or to those resulting from (38), where RMC is derived "from the export side".

[17] The break in 1990 is chosen in such a way to have homogenous trade flows for USSR and Germany in both periods.

be traced back to that part of the variation in imports from country l which is not explained by the observed variation in bilateral trade costs and market size. The intuition is as follows. Assume e.g. an increase in trade freeness between Mexico and the U.S. For given U.S. market size ($\Delta \ln(\tilde{Y}_s^{US}) = 0$), whether or not higher trade freeness results in lower RMC in the U.S. depends on the effect on U.S. imports from Mexico. An increase in the latter, such that $\Delta \ln(\tilde{T}_s^{Mex,US}) > \Delta \ln(\tilde{\Omega}_s^{Mex,US})$, is interpreted by (17) as evidence of a decreasing competitiveness (increasing marginal costs) in the U.S., vis-à-vis Mexico.

Data on bilateral flows are obtained from the CEPII *TradeProd* database. Differently from other datasets (e.g. NBER-UN), *TradeProd* reports detailed information on internal trade flows, which is essential to our analysis. Such information is available from 1980 to 2006, that is just before the trade collapse associated to the 2007 economic crisis. Trade flows are provided in nominal dollars at the 3-digits level of the ISIC Rev.2 classification. We truncate the data at \$10,000 per annual bilateral flow. This has no remarkable effects on the results, but avoids potential distortions from errors of units in the data and implausibly small trade values.

For Y_s^h, we use country h's total imports in sector s, inclusive of internal trade (T_s^{hh}).

We set United Kingdom as the reference country, as it presents the higher number of observations as importer-exporter.

Results are presented for the U.S. in the next section, while detailed country rankings and growth rates are reported in Appendix D for G20 countries plus Hong Kong and Singapore, where available.

6 Results

Our main results are shown in Table 3, where the values of the decomposition in (17) are reported for each (2-digits ISIC Rev.2) industry of the U.S. economy.

To ease the interpretation, we report, as well as numbers as such, standardized values within the G20 country-group (see however Appendix D for G20 extended results). The latter refer to the distance between the raw RMC in country h - sector s and the G20 sectoral mean, expressed in units of G20 sectoral standard deviation - i.e. $std\ RMC_s^h = (RMC_s^h - \overline{RMC}_s^{G20})/\sigma_s^{G20}$, with σ_s^{G20} denoting within G20 standard deviation.

The results in the Table are sorted on $std\ RMC$.

While, as expected, non-standardized RMC declined in almost all industries (except for FU - PE - TB), standardized values reveal that the U.S. economy lost momentum with respect to its G20 competitors, its $std\ RMC$ increase amounting to 14%.

In some cases (NF, MA, EM, IC, PS), the competitiveness loss is substantial. In particular, for NF and MA, $std\ RMC$ increased by more than 100% on average, respect to the average G20 performance. In those cases, the relatively high decrease in market size has not been compensated by an analogous reduction in imports and/or increase in trade freeness. Of particular interest is the case of the "Electric Machinery" industry, registering the highest decrease in trade freeness: -65.8%.

On average, Table 3 traces back most of the decline in U.S. cost competitiveness to the conspicuous reduction in market size (-53.1%). The variation in T_s^{lh} and Ω_s^{lh} has in fact the "desired" sign. The economic intuition for this market size effect in our reference model is that, when consumers devote a lesser share of their income to a given sector, they induce a reduction in competition which weakens the effectiveness of the selection process in equilibrium by allowing less productive firms to survive. However, while such market size effect is found to be active in all industries, the relative importance of the three components of (17) varies substantially across sectors. Thus, a "main responsible" for the RMC decline cannot be unequivocally identified. In this respect, it is worth noting that, while the correlation among T_s^{lh}, Y_{sh} and Ω_s^{lh} is quite low, their correlation with RMC amounts respectively to 0.73, -0.3617 and -0.5642. Thus, they all played an important role.

It is finally worth noting that, according to (16), our measure of RMC is expressed in real terms. As above said, this entails that low RMCs also mirror high relative prices. In principle, one might be interested in RMC expressed in PPP. However, country-sectoral PPPs for all the years (or at least some of them) would be needed for deflation, and such information is not available for a sufficiently large number of countries and sectors.[18] While we speculate on such issue in Section 7.4, it is here worth noting that we tried to apply a country-specific correction using PPPs drawn from the CHELEM database. The rather obvious (unreported) result is that those countries which experienced relatively higher inflation rates tend to gain the most from such correction. However, as the correction takes only advantage of country-specific consumer prices, it is likely to introduce undesirable noise due to both i) the presence of neglected sectoral price-variability, and ii) the fact that proper deflation would need producer prices, and not consumer prices, according to the model (see Section 7.4 on this issue). We thus prefer to keep focusing on a measure of real marginal costs, which is definitively what matters for competitiveness.

7 Robustness

7.1 RMC with Exogenous Markups

In this section we show that a similar expression to (16) can be derived in a framework with constant exogenous markups. To this aim, we derive again the trade equation (11) in a model which is identical in everything to ours except for: i) the way in which consumers allocate their income across varieties (i.e. the second stage of the utility maximization process), which is now based on a CES utility function, and ii) the presence of a fixed cost of exporting. The resulting model is a multi-country multi-sector version of Melitz (2003), in the spirit of Chaney (2008), which is basically an extension of the Fadinger and Fleiss (2011) representative firm set up to the case of heterogenous firms.

While the first step of utility maximization is still described by (4), let us assume, for the second stage, that

[18] Constructing sectoral based PPP measures is not an easy task. Basically, economic literature developed two approaches: i) the *industry of origin* approach, based on unit value ratios, carried on by the Groningen Growth and Development Centre (see e.g. Timmer *et al.*, 2007); ii) the *expenditure* approach, based on consumer prices using expenditure shares, within the International Comparison Program (ICP) involving World Bank, OECD, and Eurostat. Van Biesebroeck (2009) tests whether sectoral PPPs work better than aggregate PPPs in capturing differential changes in relative prices between countries, showing that they work well for agriculture and the majority of industrial sectors, but not for most service sectors and for manufacturing sectors that produce differentiated products. In both databases, however, available information does not match our time, country and sectoral degree of analysis.

consumers maximize subutility

$$u(i)^l_s = \left(\int_{i \in \Theta^l_s} d^l_s(i)^{\frac{1}{\upsilon_s}} \right)^{\upsilon_s} \tag{18}$$

subject to

$$\int_{i \in \Theta_s} p^l_s(i)\ q^l_s(i) di = \sigma^l_s Y(i)^l \tag{19}$$

where Θ^l_s is the set of available varieties in sector s-country l and $\upsilon_s = \frac{\epsilon_s}{\epsilon_s - 1}$, with ϵ_s denoting the elasticity of substitution among different varieties in sector s. The associated demand function can be written as

$$d^l_s(i) = [p^l_s(i)]^{-\epsilon_s} [P^l_s]^{1-\epsilon_s} \sigma^h_s\ Y(i)^h \qquad \text{with} \quad P^l_s = \left(\int_{i \in \Theta^l_s} [p^l_s(i)]^{1-\epsilon_s} di \right)^{\frac{1}{1-\epsilon_s}} \tag{20}$$

From profit maximization, we know that

$$p^{hl}_s(c) = \frac{m^{hl}_s(c)\ \tau^{hl}_s}{\upsilon_s}. \tag{21}$$

Differently from above, let we assume that firms in country h bear a fixed cost $F^{hl}_s \equiv \omega^l_s f^{hl}_s$ to target consumers in country l. The following condition of zero operating profits has to be satisfied

$$\pi^{hl}_s(c) = \frac{1-\upsilon_s}{(\upsilon_s)^{1-\epsilon_s}} \left(\frac{m^{hl}_s(c)\ \tau^{hl}_s}{P^l_s} \right)^{1-\epsilon_s} \sigma^l_s Y^l - \omega^l_s f^{hl}_s = 0 \tag{22}$$

where $Y^h = Y(i)^l L^l$ is country l's national income.

From condition (22), together with its analogous for domestic sales in country l (i.e. $\pi^{ll}_{i,s}$), it is possible to derive a relationship between the export cutoff in the exporting country (m^{hl}_s) and the domestic cutoff in the importing country (m^{ll}_s):

$$m^{hl}_s = \left(\frac{f^{hl}_s}{f^{ll}_s} \right)^{\frac{1}{1-\epsilon_s}} m^{ll}_s\ \tau^{hl}_s \tag{23}$$

By calculating $N^l_{P,s} \int_0^{m^{lh}_s} p^{lh}_s(c)\ q^{lh}_s(c)\ d\left(\frac{m^l_s(c)}{\max(m)^l_s} \right)^{\gamma_s}$ (that is aggregating $p^{lh}_s(c)\ q^{lh}_s(c)$ over all country l's firms with marginal costs below the export cutoff m^{lh}_s), where $N^l_{P,s}$ denotes the number of firms producing in country l - sector s, and using (23), country l's export share in country h can be expressed as

$$R^{lh}_s = \frac{T^{lh}_s}{\sum_l T^{lh}_s} = \Upsilon_{2,s}\ N^l_{P,s}\ [\max(m)^l_s]^{-\gamma_s}\ \rho^{lh}_s\ [f^{lh}_s]^{\gamma_s-\epsilon_s+1}\ [f^{hh}_s]^{-(\gamma_s-\epsilon_s+1)}\ [m^{hh}_s]^{\gamma_s-\epsilon_s+1}\ [P^h_s]^{\epsilon_s-1} \tag{24}$$

with $\Upsilon_{2,s} \equiv \frac{\gamma_s\ \upsilon_s^{\epsilon_s-1}}{\gamma_s-\epsilon_s+1}$. Equation (24) can be used to derive an RMC expression which is estimationally equivalent to (16). To isolate the cost cutoff of the importing country, use, as above, country l's exports to a reference country f, to yield the following measure of RMC:

$$RMC^h_s \equiv \left(\frac{\tilde{\tilde{m}}^{hh}_s}{\tilde{f}^{hh}_s} \right)^{1+\gamma_s-\epsilon_s} \left(\tilde{P}^h_s \right)^{\epsilon_s-1} = \frac{\tilde{R}^{lh}_s}{\tilde{\Omega}^{lh}_s} \tag{25}$$

Thus, RMC formulation (16) still holds true, with the understanding that i) the measure of RMC is now gross of the fixed cost f_s^{hh}, as well as the price index, and ii) the interpretation of $\tilde{\Omega}_s^{lh}$ is now slightly different, since

$$\tilde{\Omega}_s^{lh} \equiv \frac{\tilde{T}_s^{lh} \; \tilde{T}_s^{hl}}{\tilde{T}_s^{ll} \; \tilde{T}_s^{hh}} = \frac{(\tilde{\rho}_s^{lh} \tilde{f}_s^{lh}) \; (\tilde{\rho}_s^{hl} \tilde{f}_s^{hl})}{(\tilde{\rho}_s^{ll} \tilde{f}_s^{ll}) \; (\tilde{\rho}_s^{hh} \tilde{f}_s^{hh})}. \tag{26}$$

7.2 Gravity Estimation of equation (16)

Although computability is one of the main feature of (16), in this section we wonder to what extent our RMC (levels and growth rates) country rankings are correlated with the rankings obtained using a standard gravity approach to estimate (instead of calculate) equation (16).

To this aim, we use standard gravity tools in two different specifications. The former originates directly from (13) which, when written in logarithmic terms, takes the form

$$\ln \tilde{R}_s^{lh} = \ln \left(\frac{\tilde{\tilde{m}}_s^{hh}}{\tilde{P}_s^h} \right)^{\gamma_s + 2} + \ln \left(\tilde{\tau}_s^{lh} \right)^{\gamma_s} + \varepsilon_s^{lh}. \tag{27}$$

(27) is a gravity equation in which RMC, embodying importing country's multilateral resistance, can be isolated as

$$RMC_s^h(1) = \frac{\tilde{\tilde{m}}_s^{hh}}{\tilde{P}_s^h} = \overline{dest}_s = exp \left[\ln \bar{\tilde{R}}_s^{lh} - \hat{\beta}_s \ln \bar{\tilde{X}}_s^{lh} - \bar{\tilde{\varepsilon}}_s^{lh} \right] \tag{28}$$

where vector $\tilde{X}_s^{lh}$ includes bilateral distances, as well as a number of dummies controlling for the presence of border effects (contiguity, language indicators, etc.), $dest_s$ is a (destination) country-sector dummy capturing RMC, and bars refer to the mean across all exporting countries.

Equation (28) is isomorphic to the benchmark specification in Fadinger and Fleiss (2011), with the difference that they have dummies for exporting, rather than importing, countries. The problem with such approach is that the dynamics of the obtained competitiveness cannot be trusted without the additional assumption of time invariant trade costs.[19]

The second specification we adopt is induced by the fact that in back of the envelop calculations we replaced UK with other reference countries (e.g. U.S.) and verified that our results are, though only slightly, affected by the different number of zero trade flows with the reference country f. An alternative consists of dividing (11) by $\sum_f T_s^{lf}$ in order to work with country h's (import) share in country l's total exports as a dependent variable. In this way, relativized trade flows do not suffer from the presence of zero/missing observation in the reference country. Denoting, as in section 2, the geometric mean of a given variable by $\overline{X} = \prod_{l=1}^{N} \left(X^l \right)^{\frac{1}{N}}$, taking logs, and allowing for a mean-zero perturbation (ε), this strategy leads to the following estimating equation:

$$\ln \frac{T_s^{lh}}{\sum_f T_s^{lf}} - \ln \frac{Y_s^h}{\overline{Y}_s} = \ln \frac{1}{N_s} + \ln \left(\frac{m_s^{hh}/P_s^{hh}}{\overline{m}_s/\overline{P}_s} \right)^{\gamma_s + 2} + \ln \left(\frac{\tau_s^{lh}}{\overline{\tau}_s^l} \right)^{-\gamma_s} + \varepsilon_s^{lh}. \tag{29}$$

[19]It is well known (Novy, 2011), that trade costs obtained through gravity estimations are in fact not comparable over time. A way to get round this problem might be that to work under the assumption that trade frictions are reciprocal and replace the term $\ln \bar{\tilde{X}}_s^{lh}$ with (26). However, this would make the estimation problematic, due to evident endogeneity issues.

Using double bars to refer to the mean across all exporting countries, equation (29) can be rearranged as

$$\begin{aligned} RMC_s^h(2) &= \frac{m_s^{hh}/P_s^{hh}}{\overline{m}_s/\overline{P}_s} = \overline{\overline{dest_s}} = \\ &= exp\left[\ln\overline{\overline{\left(\frac{T_s^{lh}/\sum_f T_s^{lf}}{Y_s^h/\overline{Y}_s}\right)}} - \hat{\beta}_s \ln\overline{\overline{\left(\frac{X_s^{lh}}{\overline{X}_s^l}\right)}} - \ln\frac{1}{M_s} - \overline{\overline{\hat{\varepsilon}}}_s^{lh}\right]. \end{aligned} \tag{30}$$

We estimate (28) and (30) including fixed effects for the destination country but without year effects. However, as said, RMC growth rates can in this case be trusted only under the assumption that τ_s and N_s do not vary over time, which is hardly the case.[20]

The correlation between our benchmark RMC and the two gravity-based measure described in this section can be red in the first column of Table 4. The estimations, performed without year dummies, follows (28) and (30) and includes controls for contiguity, common language, NAFTA, EMU and EU-15. Bilateral distance and other needed data are drawn from the "geo_cepii" database. Although not very high, the correlation is significative and of the right sign in levels but not in terms of growth rates, but this is expected, as gravity estimations are not conceived for comparison overtime. However, the discrepancy can be in large part attributed to the fact that all the variability on trade costs not accounted for by geographical and non-geographical barriers to trade flows into the residual, in the standard gravity formulation, making (28) and (30) spurious measures of RMC.

7.3 "Unpacking" the price index in equation (16)

The price index in the above export shares can be seen as an endogenous term of "multilateral resistance". In this section we exploit the Pareto assumption to "unfold" the price index in equation (11) and show how the expression for RMC is affected. We do so in both the variable and constant markups cases (respectively VM and CM).

With Variable Markups (VM). Denoting by $N_{E,s}^l$ and $N_{P,s}^l$ respectively number of entrants and number of firms producing in country l - sector s, under the Pareto hypothesis it has to hold that $N_{E,s}^l = N_{P,s}^l \left[\frac{m_s^{ll}/\tau_s^{ll}}{max(m)_s^l}\right]^{-\gamma_s}$. Using this expression, the price index expression (12) can be written as

$$P_s^h = \left(\frac{1}{\Upsilon_{1,s}}\,[m_s^{hh}]^{\gamma_s+2}\,\sum_j N_{P,s}^j\,\left(\frac{\rho_s^{jh}}{\rho_s^{jj}}\right)\,[m_s^{jj}]^{-\gamma_s}\right)^{\frac{1}{\gamma_s+2}}. \tag{31}$$

[20] Equation (30) closely resembles (2), whose interpretation in our framework would be in fact:

$$max(m)_s^l/\overline{max(m)_s^l} = \overline{\overline{orig_s}} = exp\left[\ln\overline{\overline{\left(\frac{T_s^{lh}/\sum_f T_s^{fh}}{N_{E,s}^l/\overline{N}_{E,s}}\right)}} - \hat{\beta}_s \ln\overline{\overline{\left(\frac{X_s^{lh}}{\overline{X}_s^h}\right)}} - \ln\frac{1}{M_s} - \overline{\overline{\hat{\varepsilon}}}_s^{lh}\right].$$

Thus, the residuals of (2) would contain information on countries' exogenous competitiveness that can be extrapolated by purging them of the effect of trade costs.

Substituting for P_s^h in equation (11), the aggregate export share of country l in country h - sector s can be rewritten as:

$$R_s^{lh} \equiv \frac{T_s^{lh}}{\sum_l T_s^{lh}} = N_{P,s}^l \; [m_s^{ll}]^{-\gamma_s} \; \frac{\rho_s^{lh}}{\rho_s^{ll}} \; \frac{1}{\Lambda_s^h} \tag{32}$$

with

$$\Lambda_s^h = \sum_j N_{P,s}^j \; \left(\frac{\rho_s^{jh}}{\rho_s^{jj}}\right) \; [m_s^{jj}]^{-\gamma_s}. \tag{33}$$

With Constant Markups (CM). With constant markups, the price index equals (under the Pareto hypothesis)

$$P_s^h \;=\; \left[\sum_{j=1}^{N} N_{P,s}^j \int_0^{m_s^{jh}} [p_s^{jh}(c)]^{1-\epsilon_s} d\left(\frac{m_s^j}{max(m)_s^j}\right)^{\gamma_s}\right]^{\frac{1}{1-\epsilon_s}} = \tag{34}$$

$$= \left(\Upsilon_{2,s} \; [f_s^{hh}]^{-\frac{\gamma_s-\epsilon_s+1}{1-\epsilon_s}} \; [m_s^{hh}]^{\gamma_s-\epsilon_s+1} \; \Lambda_s^h\right)^{\frac{1}{1-\epsilon_s}} \tag{35}$$

with

$$\Lambda_s^h = \sum_j N_{P,s}^j \; [\tau_s^{jh}]^{\gamma_s+2(1-\epsilon_s)} \; [f_s^{jh}]^{-\frac{\gamma_s-\epsilon_s+1}{1-\epsilon_s}} \; [max(m)_s^j]^{-\gamma_s}, \tag{36}$$

Accordingly, aggregate export share of country l in country h - sector s can be expressed as

$$R_s^{lh} \equiv \frac{T_s^{lh}}{\sum_l T_s^{lh}} = N_{P,s}^l \; [\max(m)_s^l]^{-\gamma_s} \; \rho_s^{lh} \; [f_s^{lh}]^{\gamma_s-\epsilon_s+1} \; [f_s^{hh}]^{\epsilon_s-1} \; \Lambda_s^h. \tag{37}$$

A measure of RMC can be derived from equations (32) and (37). As presently shown, however, the two cases (VM and CM) yield different interpretations for the same expression. To this aim, it is worth using country h's import from a reference country f (instead of country l's exports to a reference country f) to relativize the market share of country l in country h. In this way, a measure of revealed marginal costs of the form

$$RMC_s^l(3) = \frac{\tilde{N}_{P,s}^l \; (\Omega_s^{lh}/\Omega_s^{fh})}{T_s^{lh}/T_s^{fh}} \tag{38}$$

can be obtained from both (32) and (37).

However, the two models yield a different interpretation for such expression. In the VM case, since

$$RMC_s^l(3) = \tilde{\tilde{m}}_s^{ll} \; \tilde{\rho}_s^{ll}, \tag{39}$$

equation (38) provides us with an alternative RMC in country l, calculated from the "export side" which, compared with (16), is net of the term P_s^l but gross of internal trade frictions ρ_s^{ll}. By contrast, in the CM case (38) amounts to

$$RMC_s^l(3) = \widetilde{\max(m)}_s^l \tag{40}$$

where Ω_s^{lh} has to be interpreted as explained in (26). Thus, in the CM case, (38) is a measure of revealed *exogenous*, rather than endogenous, cost cutoff.

It is worth noting how (39) and (40) compares with the analysis in Fadinger and Fleiss (2011), whose reference model features constant markups and representative firms. In that case, as the selection effect is ruled out by the representative firm assumption, competitiveness is only exogenous. To obtain a measure of "revealed aggregate *tfp*", Fadinger and Fleiss (2011) estimate, as benchmark analysis, a gravity equation similar to (28) but with an exporter fixed effect and with national income as the size variable. However, when they address the issue of how their apparatus is affected by turning to a theoretical structure with endogenous markups (section 1.3 of their Supplementary Appendix), they show their productivity estimation procedure to remain valid as long as aggregate production is replaced by the number of firms in the exporting country. Equation (39) shows that this is no longer the case in a heterogeneous firms framework: if the focus is on *exogenous* competitiveness (as in their case), the required variable to switch from a context of constant markups to one of variable markups is the *number of entrants*[21]. According to (39), using the number of active firms leads in fact to a measure of endogenous, and not exogenous, productivity. Within their constant markups hypothesis, the number of firms located in the exporting country (i.e. $N_{P,s}^l$) is instead the variable needed to switch from a model of homogenous firms to one with firm heterogeneity, as shown by equation (40).

Table 4 reports the calculated correlation between our benchmark RMC and RMC(3). Information on the number of firms, needed for the latter, is drawn from CEPII. The correlation is positive and significative in terms of both growth rates and levels. It is indeed particularly high in levels.

7.4 Unit Labour Costs, Labour Productivity, Producer Prices

Producer Prices. Ricardian frameworks with intra-industry heterogeneity feature a close relationship between productivity and producer prices. Under the Pareto distributional assumption, our model implies in fact that average prices in country h are a very simple function of the marginal cost cutoff: $\bar{p}_s^h = \frac{2\gamma_s+1}{2(\gamma_s+1)} m_s^{hh}$.[22] Such property reveals useful when average endogenous marginal costs (or productivities) levels are propaedeutical to another analysis. Corcos et al. (2012) and Costinot et al. (2012) exploit this relationship relying on country-sectoral producer price indexes drawn from the GGDC - EU KLEMS database. To the extent that one is willing to trust our computations, the correlation between our RMC measure and Relative Producer Prices should be positive, though not high, being the former expressed in real terms.[23] Spearman's rank correlation is reported in Table 5, where, since the producer price index is available only for 1997 in the GGDC - EU KLEMS database, we compare it with the 1996-1998 average of our RMC. Interestingly enough, the correlation is positive, rather low (0.1083), and significative.

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[21]By equation (11), and mindful that $N_{E,s}^l = N_{P,s}^l \left[\frac{m_s^{ll}/\tau_s^{ll}}{max(m)_s^l} \right]^{-\gamma_s}$, we have in fact that $\frac{\tilde{T}_s^{lh}}{\tilde{N}_{E,s}^l \; \tilde{\Omega}_s^{lh}} = \frac{1}{\widetilde{\max(m)}_s^l}$ under variable markups.

[22]This follows from the fact that $\bar{p}_s^h \equiv \left[1/G_s^l(m_s^{lh})\right] \int_0^{m_s^{lh}} p_s^{lh}(m) dG_s^l(m)$.

[23]It is worth noting that the fact that measure is expressed in real terms is a desirable property when one is interested in pure productivity (i.e. *tfp*) differentials, as e.g. in Corcos et al. (2012) and Costinot et al. (2012).

Unit Labour Costs, Labour Productivity. To give a sense of the relationship between our country-sector rankings and those which one could obtain with more conventional measures of cost competitiveness, in this Section we look at how RMC correlate with Labour Productivity and a basic measure of Unit Labour Costs (ULC), obtained by applying country-sectoral wages to Labour Productivity. Being derived under the hypothesis that marginal costs are well described by (3), our computed RMC should be to some extent negatively correlated with both of them. This is indeed the result we obtain in Table 5, where we also consider real measures of ULC and Labour Productivity deflated on the basis of the above country-sectoral (GGDC - EU KLEMS) Producer Price Index.

8 Conclusions

We tried to investigate the factors behind the idea that the recent decline in the U.S. share of world merchandise exports hides a deteriorating productivity of U.S. firms.

After a preliminary analysis showing that market shares are not a sufficient statistic for competitiveness, because of their obvious correlation with the evolution of underlying factors such as specialization and relative size of countries and degree of international trade freeness, we built on a model of trade with intra-industry heterogeneity to derive a measure of country-sector (relative) cost competitiveness which is endogenous to the model, being the outcome of a process of firm selection driven by degree of 'accessibility' (i.e. trade costs) and market size, as well as other structural and technological factors, such as entry costs. Insofar such measure is inferred from actual data, it has been referred to as *revealed marginal costs* (henceforth RMC). One of the main advantages of such measure is that only statistical information on bilateral trade flows is needed to bring it to the data.

Benchmarks results looking at RMC changes across two non-consecutive decades (1981-1991 and 1997-2006) revealed that, notwithstanding significant heterogeneity, most U.S. industries are indeed losing momentum relative to their main competitors, as we find U.S. RMC to grow by 14% on average, relative to the other G20 countries.

At the sectoral level, the "Machinery" and "Non-ferrous metals" industries are the most critical, followed by "Industrial chemicals" and "Professional and scientific equipments". On the other hand, sectors like "Footwear", "Furniture", "Printing and publishing", and "Plastic Products", among others, report significantly increasing cost competitiveness.

The model-based decomposition of RMC identifies in market size, trade freeness and imports its "revealing", and "observable", components. While we find the former to be the main responsible on average, the industry dimension reveals that, while the market size effect is found to be active in all industries, its relative importance respect to the other determinants varies substantially across sectors. In this respect, it is worth noting that the best performing countries in terms of RMC (China and India in particular) characterize for an average increase in trade freeness higher than in the U.S. In the spirit of the model, increasing trade freeness would increase U.S. cost competitiveness in the aggregate, by stimulating the degree of competition and fostering the selection process.

International comparison at the level of G20 (plus Hong Kong and Singapore, when available), clear winners and losers emerge, with China, India and Spain reporting, in order, the highest decreases. The U.S. lies in the middle of the pack. European countries report moderate changes. By contrast, other Asian competitors like Japan and Korea report the lower performance in terms of RMC percentage change.

References

[1] Arkolakis C., A. Costinot and A. Rodríguez-Clare (2012), "New Trade Models, Same Old Gains?", *American Economic Review*, 102, 94130.

[2] Baier, S.L. and J.H. Bergstrand (2001), "The growth of world trade: tariffs, transport costs and income similarity", *Journal of International Economics*, 53, 1-27.

[3] Carlin W., A. Glyn and J. Van Reenen (2001), "Export market performance of OECD countries: an empirical examination of the role of cost competitivness", *The Economic Journal*, 111, 128162.

[4] Caliendo L. and F. Parro (2009), "Estimates of the Trade and Welfare Effects of NAFTA", mimeo.

[5] Chor D. (2010), "Unpacking sources of comparative advantage: A quantitative approach", *Journal of International Economics*, 82(2), 152-167.

[6] Corcos G., Del Gatto M., G. Mion and G.I.P. Ottaviano (2012), "Productivity and Firm-Selection: Quantifying the "New" Gains from Trade", *The Economic Journal*, 122(561), 754798.

[7] Costinot A., D. Donaldson and I. Komunjer (2012), "What Goods Do Countries Trade? A Quantitative Exploration of Ricardos Ideas", *Review of Economic Studies*, 79, 581608.

[8] Del Gatto M., G. Mion and G.I.P. Ottaviano (2006), "Trade Integration, Firm Selection and the Costs of Non-Europe", *CEPR Discussion Paper*, 5730.

[9] Fadinger H. and Fleiss P. (2011) "Trade and Sectoral Productivity". *The Economic Journal*, 121(555), pp. 958-989.

[10] Feenstra R.C., Lipsey R.E., Deng H., Ma A.C. and Mo H., "World Trade Flows: 1962-2000" (2005), *NBER Working Paper Series*, 11040.

[11] Finicelli A., Pagano P. and Sbracia M. (2009) "Trade-revealed TFP". *Banca d'Italia wp*, 729.

[12] Head, K. and T. Mayer (2000), "Non-Europe: the Magnitude and Causes of the Market Fragmentation in the EU", *Weltwirtschaftliches Archiv*, 136(2), 285-314.

[13] Head, K., T. Mayer and J. Reis (2010), "The erosion of colonial trade linkages after indepenence", *Journal of International Economics*, 81, 1-14.

[14] Hsieh C. and R. Ossa (2011), "A global view of productivity growth in China", *NBER Working Paper Series*, 16778.

[15] Levchenko A. and J. Zhang (2011), "The Evolution of Comparative Advantage: Measurement and Welfare Implications", *NBER Working Paper Series*, 16806.

[16] Martin, P., T. Mayer and M. Thoenig (2008), "Make trade not war?" *Review of Economic Studies*, 75(3), 865-900.

[17] Melitz, M. (2003). 'The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity', *Econometrica*, vol. 71, pp. 1695-1725.

[18] Melitz M. and Ottaviano G. (2008), "Market Size, Trade, and Productivity", *Review of Economic Studies*, 75, 295-316.

[19] Novy D. (2011) "Gravity Redux: Measuring International Trade Costs with Panel Data". *Economic Inquiry*, forthcoming.

[20] Ottaviano, G.I.P., Tabuchi, T. and Thisse, J.F. (2002), Agglomeration and Trade Revisited", *International Economic Review*, vol. 43, pp. 409-436.

[21] Ottaviano G.I.P., Taglioni D. and di Mauro F. (2009). "The euro and the competitiveness of European firms". *Economic Policy*, 24(01).

[22] Shikher S. (2011), "Capital, technology, and specialization in the neoclassical model", *Journal of International Economics*, 83(2), 229-242.

[23] Waugh M.E. (2009) "International trade and income differences". *Federal Reserve Bank of Minneapolis, Staff Report*, 435.

[24] Whalley, J. and X. Xin (2009), "Regionalization, changes in home bias, and the growth of world trade", *Journal of Policy Modeling*, forthcoming.

[25] Timmer, M., O'Mahony, M. and van Ark, B. (2007), "The EU KLEMS Growth and Productivity Accounts: An Overview", *International Productivity Monitor*, 14.

A Exogenous versus endogenous competitiveness

Given the model, one might wonder why to focus on endogenous, rather than exogenous, competitiveness. In fact, by using reference trade flows T_s^{fh} to divide by in (13), a measure of "Revealed Competitiveness", analogous to (14), can be in principle derived also for the exogenous competitiveness. This would take the following form:

$$\widetilde{max(m)}_s^l = \left(\frac{\tilde{N}_{E,s}^l \ (\rho_s^{lh}/\rho_s^{fh})}{(T_s^{lh}/T_s^{fh})} \right)^{\frac{1}{\gamma_s}} . \tag{41}$$

However, such measure presents several drawbacks.

First, computing (41) requires country-sector specific information on the number of entrants to be available, and this is hardly the case. On the other hand, relying on the number of active firms as a proxy is not a good idea. Equation (39) shows in fact that this would produce again a measure of endogenous competitiveness, gross of internal trade freeness (instead of the price index). Moreover, as shown by (40), the interpretation radically change if one has in mind a world with CES preferences.

Second, for given ability to produce low cost firms (which is how we interpret exogenous competitiveness), the cost cutoff to stay in the market (i.e. endogenous competitiveness) might differ substantially across countries, due to the action of international competition. Equation (41) has indeed very little to say about firms' actual ability to serve international consumers at relatively low prices, which is what matters to explain market shares' dynamics.

Third, as a further proof of how poor is the informative content of (41), assume, as in Chaney (2008), an underlying UIR distribution $G(c) = c^{\gamma_s}$, with support $[0, \max(c)_s = 1]$, varying across sectors but not across countries. This implies a marginal costs distribution $G_s^l(m) = \left[\frac{m_s^l}{\max(m)_s^l}\right]^{\gamma_s} = \left[\frac{c_s^l}{\max(c)_s^l}\right]^{\gamma_s}$ with support $[0, max\,(c)_s^l = \omega_s^l]$. In this case, the term $max(m)_s^l$ in (16) boils down to ω_s^l, making (41) a measure of relative input costs which has very little to say about "productivity".

B Relationship between Endogenous Competitiveness and Global Market Shares.

To show the role of endogenous competitiveness and exogenous competitiveness in the export share, let us focus on country h and express its total export in sector s respect to world sectoral trade:

$$MktSh_s^h \equiv \frac{\sum_l T_s^{hl}}{\sum_l Y_s^l} = \frac{[m_s^{hh}]^{-\gamma_s} \ (\rho_s^{hh})^{-1} \ N_{P,s}^h \ \sum_l \ \rho_s^{hl} \ [m_s^{ll}]^{\gamma_s+2} \ Y_s^l}{\sum_f \sum_l [m_s^{ff}]^{-\gamma_s} \ (\rho_s^{ff})^{-1} \ N_{P,s}^f \rho_s^{fl} \ [m_s^{ll}]^{\gamma_s+2} \ Y_s^l} \tag{42}$$

Such expression (42) reveals that country h's global market share depends, negatively and positively respectively, on the domestic cost (m_s^{hh}) cutoff and number of firms ($N_{P,s}^h$), as well as positively on a measure of market potential encompassing, as well as size and bilateral trade freeness, the endogenous cost cutoff in all potential destination countries. The more competitive, the smaller and the more remote the destination countries, the lower is country h's market potential, and the lower is its market share.

Note that, as a function of the endogenous cutoff in all the countries, country h's market potential is itself endogenous. Thus, relying on market share dynamics to infer competitiveness effects can be highly misleading, as a decrease in e.g. the U.S. export share might be driven by increasing endogenous cost competitiveness in third countries (i.e. decreasing market potential in the U.S.), even in the presence of decreasing absolute marginal costs in the U.S. .[24]

As a proof of this, note that the overall correlation between RMC and export share amounts to -0.2171 and 0.0165 when computed with respect to, respectively, levels and growth rates.

C 1992-1999 vs 2000-2007 (UNIDO data)

In this section we replicate the analysis using the UNIDO-IDSB (Industrial Demand-Supply Balance Database) data. UNIDO-IDSB contains information on production and total exports from 1991 to 2007. It is worth noting that, respect to the *TradeProd* database: i) the number of countries drops to 86 as a maximum; ii) the sectoral classification is less detailed: 23 ISIC Rev.3 sectors; iii) available information on domestic trade drops much more, due to bad production/export - country/industry combinations of missing values; iv) information on domestic trade flows can be recovered as the difference between production and total exports, but such difference is negative in about six per cent of the available country-sector combinations.

With these limits in mind, we replicate the analysis considering two consecutive periods (1992-1999 and 2000-2007). Table 6 the values of (17) and the % variation in the export share for the U.S. economy. As in Table 3, we also report standardized (within the G20 group) values.

Although the theoretical content of the results is diminished by the fact that our reference model is long run in spirit, the negative trend characterizing the competitiveness of the U.S. economy is confirmed on average, although stronger in magnitude (24.68%). On average, it is the change in the U.S. dependence from aborad in terms of average import flows (23.4%) which seems to be decisive for the stronger fall in revealed competitiveness, as it comes with a less than proportional increase in trade freeness (19%)

D G20 and other countries

In this section we provide an extensive description of our results for the G20 group[25].

In Table 7 we report, for each country, the average values for the decomposition in (17), while country-sectoral percentage changes from the early to the late period are shown in Table 8. Finally, Table 9 reports, for

[24] Corcos *et al.* (2012) - cfr eq. (11) -, show that an increasing endogenous competitiveness can result from: i) increasing foreign market size; ii) positive technological-structural shocks reducing other countries' exogenous competitiveness; iii) trade costs. As for the latter, in the presence of a process of trade liberalization, the model predicts an increase in the endogenous competitiveness (decrease in m_s^{ll}) in the countries interested by the process and, at the same time, a decrease in the endogenous competitiveness of those countries which do not take part in the process. Said differently, a decline in endogenous competitiveness in the U.S. might be (simply) driven by a reduction in trade costs (either because of dismantling trade barriers or reducing transport costs) among third countries, all the rest equal.

[25] Although both former URSS (in the early period) and CIS countries (in the later period) enter the analysis, Russia is excluded in terms of results, as we break right at 1991.

each sector, the country ranking in the two periods and the growth rate from the early to the late period (with reported growth rates referring to the countries listed in the second column). Differently from Table 3, we only report non standardized values, as the evaluation of results is straightforward .[26]

Although Table 9 reveals that the U.S. economy has in many sectors improved its position in the ranking, it lies in the middle of the pack in terms of RMC average growth (see Table 7). It is worth noting how the increase in trade freeness reported in Table 7 for the U.S. (1.35) is indeed smaller to that of the best performing countries (China, India, Spain). This finding is clearer in Figure (5), where the performance of the U.S. economy is contrasted with that of other leading competitors.

As for the other countries, clear winners and losers emerge in terms of RMC. China, India and, interestingly enough, Spain report the highest increase in cost competitiveness, followed by Turkey, Austria, and Germany. By contrast, other Asian competitors like Japan and Korea report lower performances in terms of RMC growth, presumably owing to the rise of China and large increases in Mexican exports to the United States over the sample period. European countries and Canada have more moderate changes.

[26] Countries for which relevant statistical information was available only for the early period disappear in the second column.

Tables and Figures

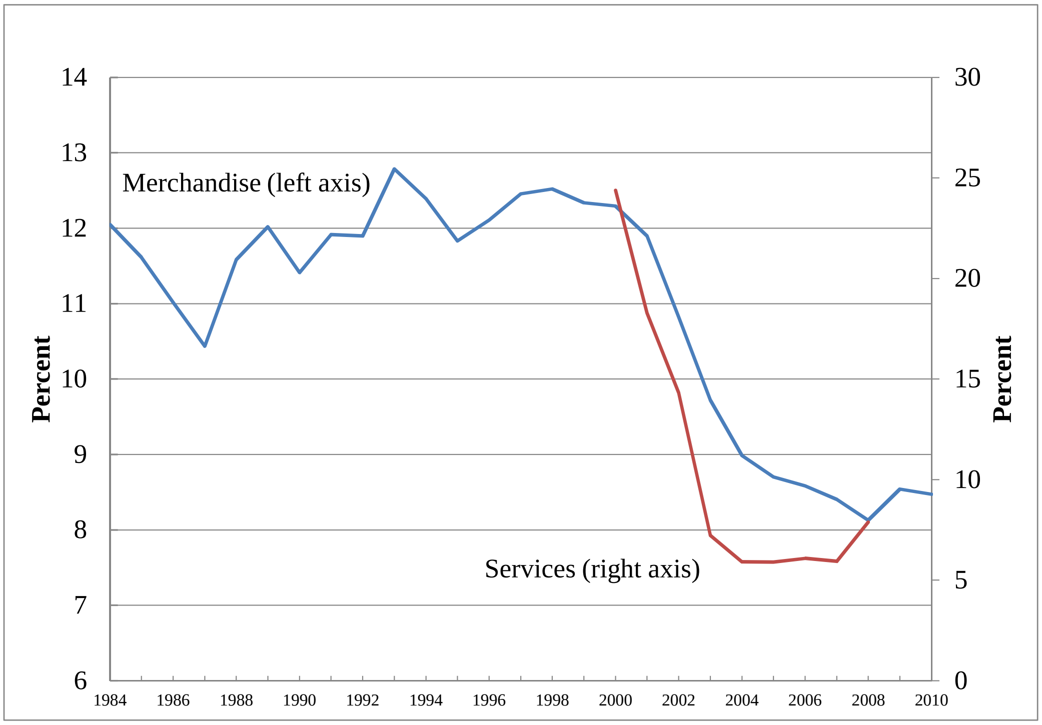

Figure 1: U.S. Share of World Exports

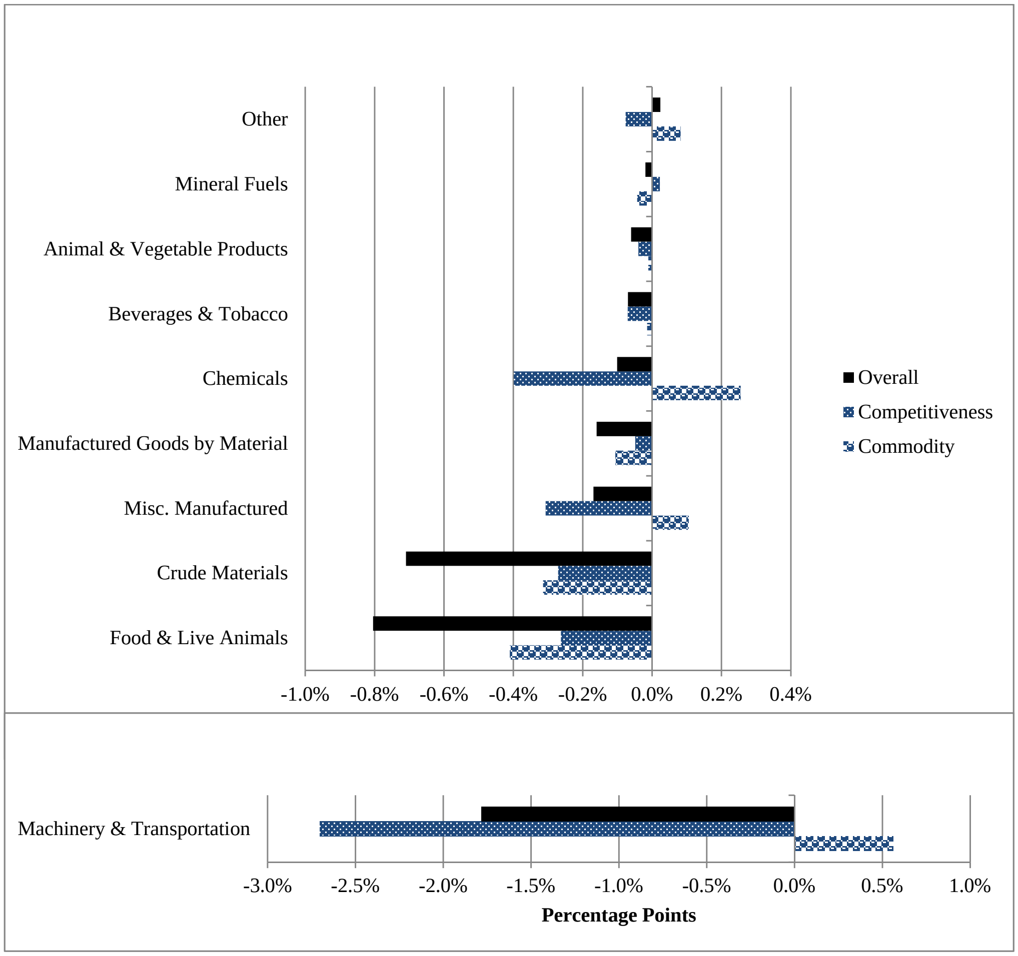

Figure 2: Intensive (Competitiveness) and Extensive (Commodity) Margin Contributions to the Aggregate Share Decline (1984-2008)

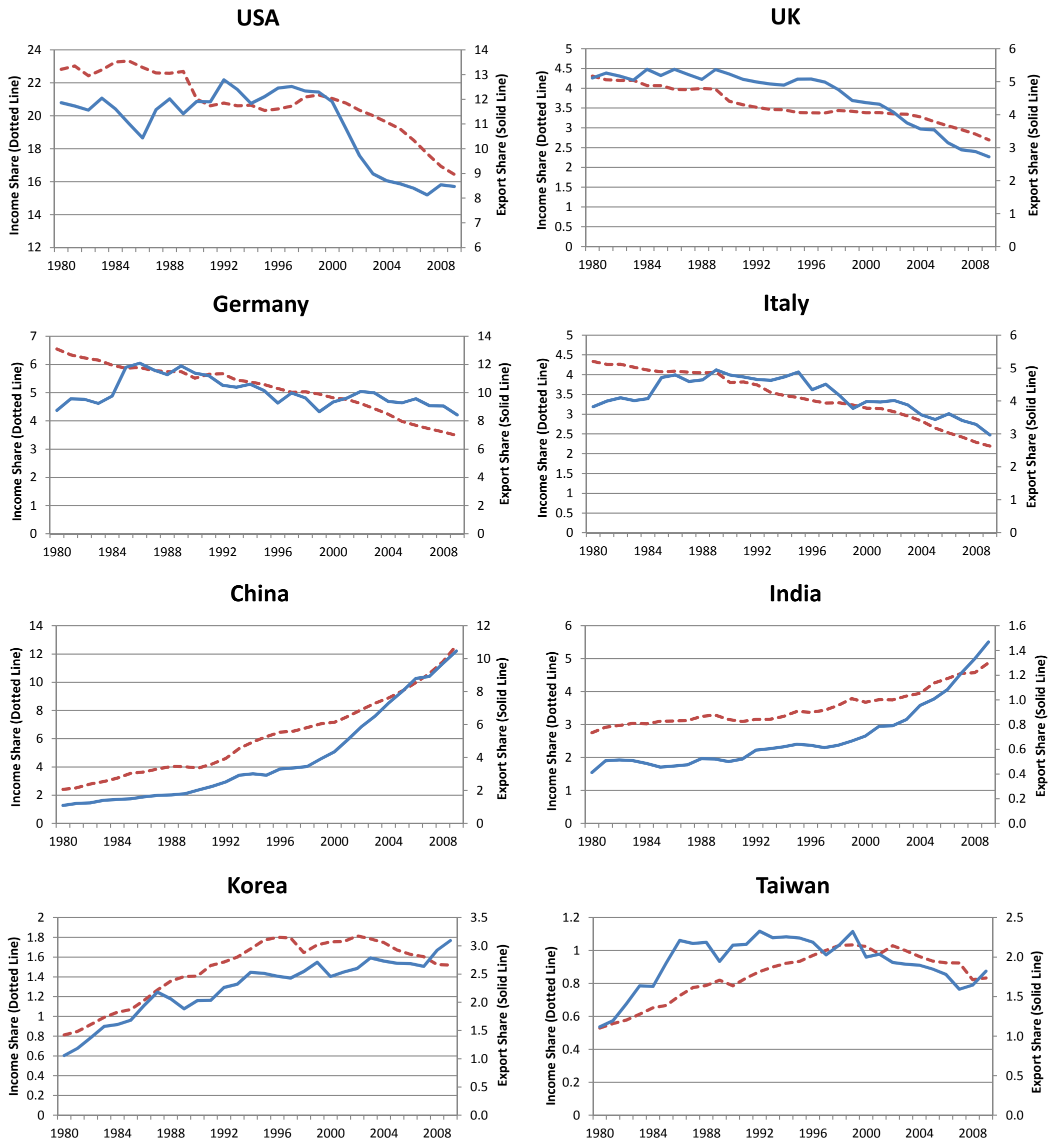

Figure 3: Export and GDP Shares

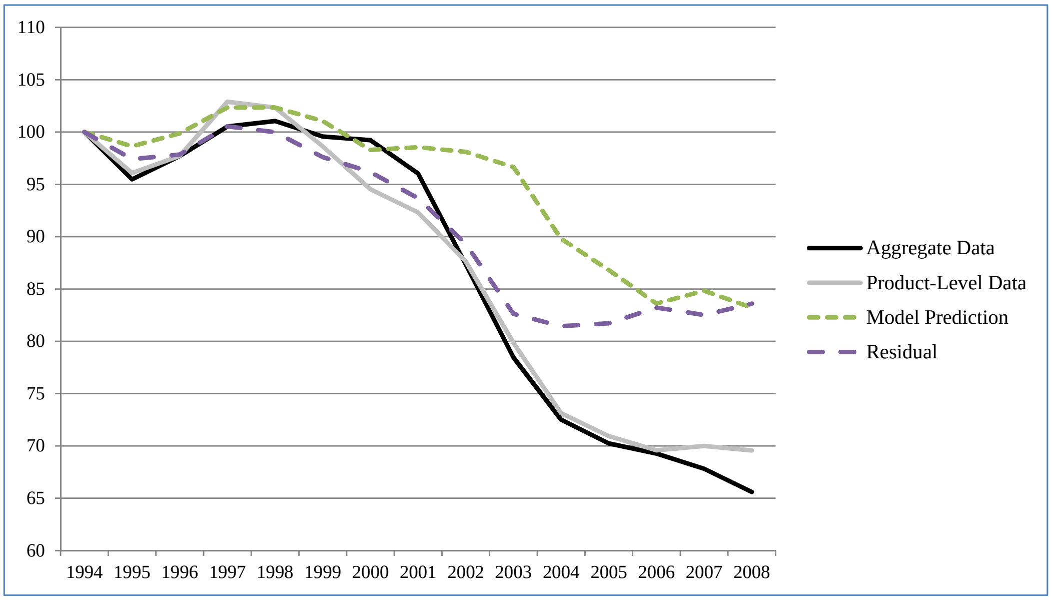

Figure 4: Predicted and Actual Market Share Indices (cfr. specification (i) in Table 1)

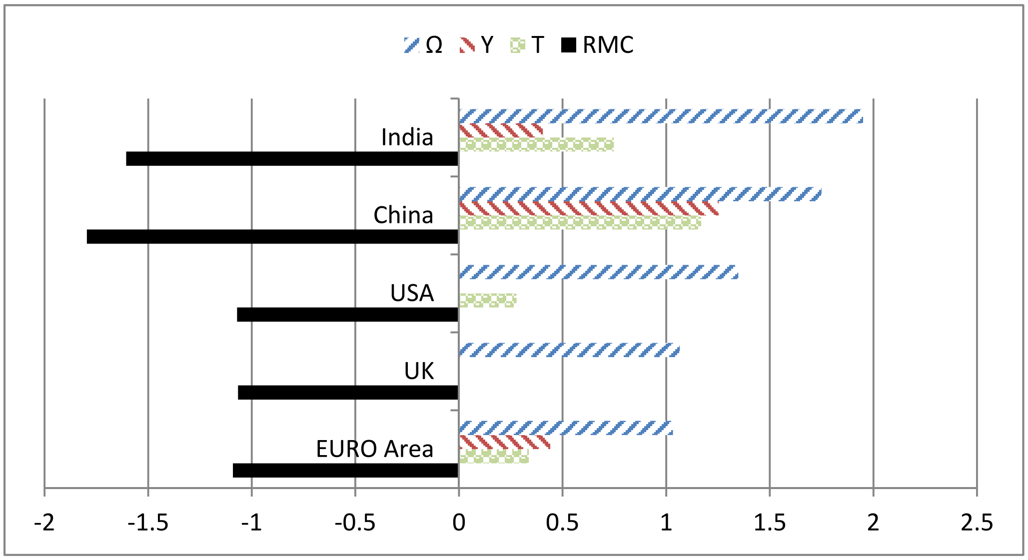

Figure 5: Decomposition of RMC growth rates (cfr. eq. 17) from early (1981-1990) to late (1997-2006) period.

Table 1: Gravity regression - cfr. equation (2).

Dependent Variable	Export Share	Export Share
	(i)	(ii)
ln(Exporter GDP Share)	0.330	0.254
	(0.106)	(0.113)
NAFTA	0.807	0.807
	(0.238)	(0.238)
EMU	0.483	0.484
	(0.091)	(0.091)
China (WTO memb.)	-	0.226
		(0.198)
Constant	-1.223	-1.588
	(0.505)	(0.536)
Year FE	yes	yes
Exporter-Importer FE	yes	yes

OLS regressions with Standard Errors in parenthesis.

Table 2: Number of non-zero country-sector combinations in RMC calculations.

Sector	Sector Sh.	1981-1990	1997-2006
Food products	FD	69	108
Beverages	BV	98	126
Tobacco	TB	144	160
Textiles	TX	74	126
Wearing apparel	AP	98	146
Leather products	LT	106	142
Footwear	FT	113	163
Wood products except furniture	WO	84	127
Furniture except metal	FU	104	132
Paper products	PA	95	126
Printing and publishing	PP	104	123
Industrial chemicals	IC	86	134
Other chemicals	OC	96	128
Petroleum refineries	PE	126	157
Rubber products	RU	107	143
Plastic products	PL	110	129
Pottery china earthenware	PT	117	161
Glass products	GL	127	139
Other non-metal min. prod.	NM	120	137
Iron and steel	ST	110	139
Non-ferrous metals	NF	128	169
Fabricated metal products	MP	84	115
Machinery except electrical	MA	101	143
Electric Machinery	EM	91	133
Transport equipment	TR	97	141
Prof. and scient. equipment	PS	120	159
Total	Total	2709	3606

Table 3: Decomposition of U.S. RMC growth rates* from early (1981-1990) to late (1997-2006) period.

Sector	Sector Sh.	*std* RMC_s^h	RMC_s^h	*std* T_s^{lh}	T_s^{lh}	*std* Y_s^h	Y_s^h	*std* Ω_s^{lh}	Ω_s^{lh}
Footwear	FT	*-140.5*	-2.29	*-123.2*	-0.26	*-63.5*	-0.14	*80.8*	2.17
Furniture except metal	FU	*-117.9*	2.33	*-83.8*	0.06	*-3.4*	0.32	*37.5*	-2.59
Printing and publishing	PP	*-107.5*	-0.78	*-70.5*	0.12	*-62.8*	-0.37	*99.8*	1.26
Plastic products	PL	*-100.1*	-1.37	*-114.5*	0.11	*-27.1*	-0.03	*12.6*	1.51
Beverages	BV	*-96.0*	-1.28	*-55.5*	0.02	*-37.3*	-0.06	*77.8*	1.35
Tobacco	TB	*-81.5*	1.26	*-35.4*	0.09	*31.6*	-0.88	*14.5*	-0.30
Rubber products	RU	*-61.6*	-2.47	*-69.6*	0.10	*-19.4*	0.12	*11.3*	2.44
Wearing apparel	AP	*-61.4*	-2.05	*-33.8*	-0.06	*-61.7*	-0.32	*89.3*	2.31
Iron and steel	ST	*-55.3*	-1.36	*-68.5*	-0.33	*-54.8*	0.38	*41.6*	0.65
Glass products	GL	*-51.3*	-0.53	*-76.8*	0.03	*-73.7*	-0.14	*48.3*	0.70
Wood products except furniture	WO	*-46.4*	-0.20	*-3.7*	0.96	*-10.5*	0.35	*53.2*	0.81
Paper products	PA	*-45.1*	-1.23	*-45.8*	-0.12	*-63.5*	0.12	*62.7*	0.99
Other non-metal min. prod.	NM	*-38.1*	-0.86	*39.0*	0.46	*-14.4*	0.62	*91.5*	0.70
Other chemicals	OC	*-33.9*	-2.31	*-76.9*	-0.05	*-51.5*	0.10	*8.5*	2.16
Fabricated metal products	MP	*-32.9*	-1.37	*-39.5*	-0.08	*-29.4*	-0.11	*22.8*	1.39
Pottery china earthenware	PT	*-22.6*	-1.38	*-29.5*	-0.11	*-2.6*	0.31	*-4.3*	0.96
Leather products	LT	*-0.3*	-0.71	*-43.7*	0.42	*-51.4*	0.18	*8.0*	0.94
Petroleum refineries	PE	*15.9*	1.10	*9.9*	0.60	*-42.5*	-0.30	*36.5*	-0.20
Food products	FD	*25.3*	-0.37	*10.9*	0.31	*-17.9*	0.14	*3.5*	0.55
Transport equipment	TR	*51.3*	-1.89	*-5.4*	0.48	*-81.3*	-0.16	*24.6*	2.54
Textiles	TX	*53.5*	-1.77	*65.1*	0.62	*18.7*	0.08	*-7.1*	2.31
Prof. and scient. equipment	PS	*60.5*	-0.77	*-0.5*	0.65	*-144.2*	-0.78	*83.2*	2.20
Industrial chemicals	IC	*61.6*	-1.15	*59.9*	0.33	*-25.4*	0.55	*23.7*	0.93
Electric Machinery	EM	*80.1*	-2.06	*-61.2*	0.16	*-75.5*	0.15	*-65.8*	2.07
Machinery except electrical	MA	*111.4*	-0.80	*28.7*	0.53	*-83.5*	0.09	*0.7*	1.24
Non-ferrous metals	NF	*128.7*	-1.23	*22.5*	-0.16	*-85.0*	-0.14	*-21.2*	1.21
Average	avg	*14.0*	-1.07	*-17.4*	0.28	*-53.1*	0.00	*21.8*	1.35

*Calculations based on Equation (17).

std stands for "Standardized" (within G20)
Non-standardized values consider each single country with respect to itself.
std values expressed in %.

Table 4: Robustness sections 7.2 and 7.3 - Spearman's rank correlations (G20).

RMC % CHANGE	RMC benchmark	RMC(1)	RMC(2)	RMC(3)
RMC benchmark	1			
# obs.	509			
RMC(1)	0.0683	1		
# obs.	509	509		
RMC(2)	-0.1149*	0.6292*	1	
# obs.	509	509	509	
RMC(3)	0.3821*	-0.1515*	-0.1439*	1
# obs.	509	509	509	509

RMC LEVEL	RMC benchmark	RMC(1)	RMC(2)	RMC(3)
RMC benchmark	1			
# obs.	534			
RMC(1)	0.3139*	1		
# obs.	534	534		
RMC(2)	0.4607*	0.4235*	1	
# obs.	534	534	534	
RMC(3)	0.6522*	0.1039*	-0.5371*	1
# obs.	534	534	534	534

% changes are from the early (1981-1990) to the late (1997-2006) period.
Stars denote 5% significance level.

Table 5: Robustness section 7.4 - Spearman's rank correlations (G20).

	RMC (benchmark)	PP	ULC	ULC (real)	LP	LP (real)
RMC (benchmark)	1					
# obs.	390					
Producer Prices - PP	0.1291*	1				
# obs.	390	390				
Unit Labour Cost - ULC	-0.1027*	0.2741*	1			
# obs.	390	390	390			
Unit Labour Cost - ULC (real)	-0.2008*	-0.0379	0.9104*	1		
# obs.	390	390	390	390		
Labour Productivity - LP	-0.1242*	0.3191*	0.7781*	0.7253*	1	
# obs.	390	390	390	390	390	
Labour Productivity - LP (real)	-0.2112*	-0.1342*	0.6322*	0.7902*	0.8420*	1
# obs.	390	390	390	390	390	390

Reference period is 1996-1998 (average), except for the Producer Price Index, for which is 1997.
Stars denote 5% significance level.

Table 6: Appendix C - Decomposition of U.S. RMC growth rates from early (1991-1999) to late (2000-2007) period. UNIDO data.

Sector	*std* RMC_s^h	RMC_s^h	*std* T_s^{lh}	T_s^{lh}	*std* Y_s^h	Y_s^h	*std* Ω_s^{lh}	Ω_s^{lh}
Other transport equipment	*-87.9*	-0.10	*-10.1*	-0.26	*-49.2*	-0.21	*127.0*	0.05
Basic metals	*-77.7*	-0.55	*-55.6*	0.13	*-37.1*	0.20	*59.2*	0.48
Office, accounting and computing machinery	*-43.9*	-4.13	*-3.2*	0.29	*-31.8*	4.74	*72.6*	-0.32
Fabricated metal products	*-38.9*	0.04	*43.9*	0.21	*-22.8*	-0.08	*105.7*	0.26
Radio,television and communication equipment	*-36.6*	-0.44	*15.9*	0.24	*-24.5*	-0.42	*77.0*	1.10
Printing and publishing	*-19.4*	0.51	*-3.3*	-0.06	*-24.7*	-0.17	*40.7*	-0.40
Leather, leather products and footwear	*-7.0*	0.02	*-27.3*	0.09	*-5.6*	0.07	*-14.7*	0.00
Coke,refined petroleum products,nuclear fuel	*6.2*	-0.67	*116.0*	0.71	*-3.1*	0.79	*112.9*	0.59
Textiles	*10.0*	-0.42	*42.8*	0.28	*-29.7*	0.11	*62.4*	0.60
Rubber and plastics products	*24.6*	0.27	*2.6*	0.24	*-36.2*	-0.04	*14.2*	0.02
Electrical machinery and apparatus	*34.0*	-0.25	*35.8*	0.29	*-33.3*	0.05	*35.2*	0.48
Medical, precision and optical instruments	*34.8*	0.06	*39.6*	0.43	*-19.1*	-0.19	*23.9*	0.55
Furniture; manufacturing n.e.c.	*38.4*	0.06	*34.9*	0.02	*-31.6*	-0.05	*28.0*	0.02
Chemicals and chemical products	*48.6*	0.47	*40.0*	0.24	*-15.9*	-0.29	*7.2*	0.05
Machinery and equipment n.e.c.	*50.6*	0.16	*40.5*	0.21	*-22.1*	-0.02	*12.1*	0.07
Non-metallic mineral products	*52.5*	0.25	*34.8*	0.17	*-39.5*	-0.05	*21.9*	-0.03
Wood products (excl. furniture)	*55.2*	0.48	*83.2*	0.73	*-16.1*	-0.14	*44.1*	0.39
Wearing apparel, fur.	*67.5*	-0.07	*-11.1*	-0.03	*-41.8*	0.22	*-36.8*	-0.17
Tobacco products	*90.9*	2.12	*-45.2*	0.56	*-16.0*	0.08	*-120.1*	-1.64
Food and beverages	*119.8*	0.22	*26.9*	-0.03	*-11.9*	-0.04	*-81.0*	-0.20
Paper and paper products	*120.0*	0.54	*99.2*	0.48	*-14.8*	0.09	*-6.0*	-0.15
Motor vehicles, trailers, semi-trailers	*124.5*	0.80	*42.4*	0.32	*-32.2*	-0.03	*-49.9*	-0.45
Recycling	.	.	*19.2*	0.41	*-58.9*	-0.18	.	.
Average	*24.7*	-0.11	*23.4*	0.20	*-20.3*	0.16	*19.0*	0.15

*Calculations based on Equation (17).

std stands for "Standardized" (within G20)
Non-standardized values consider each single country with respect to itself.
std values expressed in %.

Table 7: Appendix D - RMC growth rates decomposition from early (1981-1990) to late (1997-2006) period.

country	$\overline{RMC}_s^h$	$\bar{T}_s^{lh}$	$\bar{Y}_s^h$	$\bar{\Omega}_s^{lh}$
China	- 1.796	1.17	1.25	1.75
India	- 1.606	0.75	0.41	1.95
Spain	- 1.482	0.70	0.54	1.65
Turkey	- 1.267	1.00	0.89	1.38
Austria	- 1.242	0.33	0.18	1.37
Germany	- 1.232	0.19	- 0.04	1.46
Canada	- 1.208	0.24	- 0.06	1.50
Finland	- 1.208	0.06	0.24	1.03
Ireland	- 1.184	0.56	1.03	0.97
Mexico	- 1.148	0.61	1.18	0.75
USA	- 1.071	0.28	0.00	1.35
UK	- 1.066	-	-	1.07
Italy	- 1.038	0.21	0.57	0.68
Sweden	- 0.953	0.08	0.12	0.89
Indonesia	- 0.921	0.42	0.61	0.67
Greece	- 0.882	0.35	0.55	0.72
Denmark	- 0.856	0.02	0.26	0.63
France	- 0.817	0.32	0.11	1.03
Argentina	- 0.770	0.20	- 0.14	1.06
Portugal	- 0.733	0.32	0.79	0.38
Korea	- 0.602	0.28	0.92	- 0.05
Australia	- 0.247	0.15	0.20	0.14
Japan	- 0.068	0.06	- 0.09	0.21
South Africa	- 0.002	0.92	- 0.01	0.73

Cross-Sectoral Averages
Belgium, Brazil, Netherland and Saudi Arabia not included because of missing RMC in more than five industries.

Table 8: Appendix D - RMC percentage changes from early (1981-1990) to late (1997-2006) period by country-sector.

COUNTRY	avg	FD	BV	TB	TX	AP	LT	FT	WO	FU	PA	PP	IC	OC
Argentina	-0.77	-0.92	-1.34	-	-0.88	0.37	-0.14	-0.33	-0.15	2.52	0.45	0.17	-1.19	-1.64
Australia	-0.25	-0.03	0.18	-	-1.4	-0.56	-0.19	-0.72	0.48	2.72	0.42	0.02	-0.33	-1.24
Austria	-1.24	-1.21	-2.28	0.08	-2.08	-1.08	0.02	-2.61	-0.92	3.74	-1.47	-0.62	-0.81	-2.85
Belgium	-	-1.22	-1.41	0.79	-2.49	-2.57	-	-	-0.37	3.54	-2.07	-0.1	-1.11	-
Brazil	-	-0.8	-0.76	1.65	0.39	0.2	-	-	-0.95	2.12	0.27	0.77	-0.34	-1.67
Canada	-1.21	-0.27	-0.12	1.39	-1.73	-1.21	-0.87	-1.39	0.35	2.76	-0.09	-0.54	-1.47	-3
China	-1.8	0.03	-0.04	5.18	-1.95	-0.49	-0.89	-	-0.26	2.46	-1.15	-1.33	-1.92	-0.82
Denmark	-0.86	-1.37	-0.36	2.03	-3.75	-3.48	-	-	0.2	5.07	-1.09	0.33	-0.94	-2.49
Finland	-1.21	-0.43	-0.54	-	-1.65	-0.11	-1.42	-0.66	-0.63	4.26	-0.72	-0.57	-1.2	-3.06
France	-0.82	-0.51	-0.08	0.47	-2.18	-2.08	-1.82	-1.5	-0.21	2.77	-1.04	0.02	-0.96	-2.1
Germany	-1.23	-0.7	-0.88	0.21	-3.3	-1.94	-2.28	-1.89	-1.25	3.39	-1.46	-0.23	-1.12	-2.5
Greece	-0.88	-0.64	-0.81	2.72	-2.59	-	-	-0.09	0.23	2.82	-0.82	-0.26	-1.15	-2.51
Hong Kong	-	-0.46	0.74	0.66	-	-	-	-	-	-	-	0.66	-	-
India	-1.61	-1.3	-0.09	2.99	-2.03	-	-1.32	-0.07	1.39	2.22	-1.86	-0.85	-2.51	-3.15
Indonesia	-	-0.54	-0.58	-	-2.91	-	1.85	-0.96	1.55	2.36	-1.61	-0.46	-2.34	-1.34
Ireland	-	-1.21	0.19	4.52	-3.03	-0.76	-	-	0.06	3.58	-0.09	-	-	-3.08
Italy	-1.04	-0.94	-0.58	3.43	-2.7	-2.11	-0.67	-1.33	-0.29	3.5	-1.72	0.23	-1.22	-1.95
Japan	-0.07	0.43	0.13	1.73	-0.57	-0.09	0.69	0.57	0.75	3.77	-0.27	0.66	-1.45	-0.94
Korea	-0.6	0.27	1.31	-	-1.12	1.65	1.36	1.93	1.9	3.87	-1.26	0.93	-2.16	-1.9
Mexico	-1.15	-0.56	-2.29	4.68	-2.91	-2.59	-3.5	-0.39	-0.75	2.75	-0.18	0.14	-1.48	-1.94
Netherlands	-	-0.82	-1.29	1.39	-	-	-	-	-0.28	4.52	-1.91	-0.37	-0.36	-
Portugal	-0.73	-0.24	-0.2	-0.53	-2.65	-	-0.63	0.31	1.28	0.87	-0.37	0.64	-1.42	-2.35
Singapore	-	0.15	-	-	-	-2.45	-	-	-	4.52	-1.25	-0.9	0.91	-1.51
South Africa	0	0.99	-0.22	-	0.47	1.49	0.94	0.57	1.27	4.79	1.31	1.02	-0.46	-0.91
Spain	-1.48	-1.29	-0.66	0.95	-2.62	-2.39	-1.49	-1.11	-0.9	1.96	-1.39	-0.18	-1.89	-2.64
Sweden	-0.95	-0.46	-1.06	1.08	-3.2	-3.67	0.44	-1.82	-0.72	3.86	-0.69	-0.9	-1.8	-2.54
Turkey	-1.27	-0.92	1.09	2.8	-2.63	0.39	-0.35	-0.91	1.02	4.13	-1.65	-0.07	-1.15	-2.76
UK	-1.07	-0.71	-0.74	0.44	-2.3	-1.91	-1.41	-2.95	0.02	2.57	-1.25	-0.34	-1.4	-2.13
USA	-1.07	-0.37	-1.28	1.26	-1.77	-2.05	-0.71	-2.29	-0.2	2.33	-1.23	-0.78	-1.15	-2.31

COUNTRY	avg	PE	RU	PL	PT	GL	NM	ST	NF	MP	MA	EM	TR	PS
Argentina	-0.77	0.99	-1.04	-1.01	-	0.44	0.77	-0.05	-1.15	-1.17	-0.72	-2.55	-2.34	-1.32
Australia	-0.25	0.42	-1.29	0.01	-0.43	0.5	-0.07	-0.13	-	-0.46	-0.99	-2.26	-1.08	-0.66
Austria	-1.24	-0.16	-2.92	-0.69	-3.66	-0.46	-0.04	-0.5	-2.62	-0.47	-1.39	-2.5	-2.22	-
Belgium	-	1	-	-2.28	-2.48	0.16	-0.12	-	-1.41	-1.73	-	-4.02	-	-
Brazil	-	-	-1.23	-0.47	-	-	-	0.31	-	-	-0.96	-2.05	-1.63	-0.62
Canada	-1.21	0.99	-1.52	-1.51	-2.46	-0.86	-0.52	-0.51	-0.87	-1.84	-2.04	-3.03	-2.44	-1.81
China	-1.8	-0.53	-3.12	-0.21	-1.82	-1.68	-2.34	-2.57	-2.59	-1.64	-3.93	-2.83	-3.15	-2.56
Denmark	-0.86	1.18	-2.15	0.01	-1.35	0.03	-0.18	-1.7	-	-1.56	-0.1	-2.92	-2	0.53
Finland	-1.21	0.05	-2.81	-0.96	-1	-0.55	-0.92	-1.48	-2.45	-1.11	-0.7	-2.77	-3.54	-0.3
France	-0.82	0.51	-1.54	-0.59	-	0.35	-0.35	-0.82	-2	-0.79	-1.06	-2.2	-0.76	0.76
Germany	-1.23	0.78	-2.1	-0.97	-2.11	0.03	-0.08	-0.93	-2.19	-1.31	-1.19	-2.46	-1.95	-0.68
Greece	-0.88	0.37	-2.19	-1.33	-0.97	0.02	0.33	-0.59	-3.17	-1.75	-1.53	-3.77	-1.13	-0.38
Hong Kong	-	-	-	-	-	-	-0.56	-	-	-	-	-	-	-
India	-1.61	0.17	-2.66	-1.25	-1.93	-0.41	-2.25	-2.45	-2.33	-1.61	-1.54	-2.61	-1.09	-0.85
Indonesia	-	-	-3.73	-0.27	-1.82	-0.84	0.25	1.25	-	-1.86	-	-3.01	0.16	-
Ireland	-	-	-1.66	-0.85	-0.18	-0.1	1.13	-0.15	-	-0.82	-0.93	-2.66	-2.85	-1.42
Italy	-1.04	1.23	-2.1	-1.19	-1.88	0.02	-0.7	-1.54	-2.37	-1.4	-0.85	-2.65	-1.29	-0.57
Japan	-0.07	0.83	-0.75	-0.08	-0.64	0.5	-0.11	0.26	-1.72	0.15	0.01	0.02	-0.64	0.32
Korea	-0.6	-0.18	-0.95	-0.13	-0.41	0.05	-0.1	-0.59	-1.86	-0.54	-0.72	-0.83	-0.93	-0.2
Mexico	-1.15	2.25	-2.23	-1.96	-	-0.47	-0.48	-1.6	-0.72	-	-1.81	-	-3.45	-
Netherlands	-	0.7	-	-1.37	-1.37	-0.43	-0.69	-	-	-1.2	-	-3.66	-4.76	-
Portugal	-0.73	2.23	-2.81	-0.85	-0.93	0.58	-0.04	-0.57	-1.58	-1.89	-0.82	-3.54	-2.67	-
Singapore	-	-	-	-0.59	-	-	-0.29	-	-	-1.38	-	-	-1.26	-
South Africa	0	-	-1.16	0.98	-	1.6	0.8	-0.06	-	-0.79	-1.44	-2.11	-1.07	-0.06
Spain	-1.48	0.75	-2.28	-1.69	-1.97	-0.09	-1.54	-0.56	-1.95	-1.6	-1.41	-3.19	-2.53	-0.99
Sweden	-0.95	-	-1.91	-0.64	-5.1	0.29	-0.89	-1.13	-2.13	-0.88	0.03	-2.59	-0.85	0.7
Turkey	-1.27	2.22	-2.56	-1.78	-1.93	-0.72	-0.88	-1.85	-2.97	-2.65	-2.89	-3.55	-2.66	-0.2
UK	-1.07	0.63	-2.06	-1.12	-1.83	0.58	-0.21	-1.35	-3.23	-1.26	-1.1	-2.87	-1.48	0.42
USA	-1.07	1.1	-2.47	-1.37	-1.38	-0.53	-0.86	-1.36	-1.23	-1.37	-0.8	-2.06	-1.89	-0.77

Table 9: Appendix D - RMC country rankings and growth rates* from early (1981-1990) to late (1997-2006) period.

	FD			BV			TB			TX			AP			LT		
rank	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth
1	USA	Netherlands	-0.82	France	UK	-0.74	Ireland	Germany	0.21	Hong Kong	Germany	-3.3	Hong Kong	Denmark	-3.48	Denmark	China	-0.89
2	Netherlands	Brazil	-0.8	UK	France	-0.08	Turkey	Hong Kong	0.66	China	China	-1.95	China	Singapore	-2.45	Singapore	Germany	-2.28
3	Brazil	Argentina	-0.92	Brazil	Brazil	-0.76	China	Portugal	-0.53	Taiwan	Belgium	-2.49	Korea	China	-0.49	Indonesia	France	-1.82
4	Singapore	USA	-0.37	Turkey	Netherlands	-1.29	Denmark	UK	0.44	Korea	Denmark	-3.75	Taiwan	Sweden	-3.67	Netherlands	Italy	-0.67
5	Argentina	Denmark	-1.37	China	USA	-1.28	Singapore	USA	1.26	Belgium	Korea	-1.12	Netherlands	Italy	-2.11	Taiwan	India	-1.32
6	Germany	Germany	-0.7	Italy	Belgium	-1.41	USA	Netherlands	1.39	Japan	Italy	-2.7	Turkey	Belgium	-2.57	China	Mexico	-3.5
7	China	Belgium	-1.22	Germany	Germany	-0.88	Greece	France	0.47	Germany	India	-2.03	Singapore	Germany	-1.94	Sweden	UK	-1.41
8	France	France	-0.51	Hong Kong	Argentina	-1.34	Netherlands	Belgium	0.79	Brazil	Sweden	-3.2	Denmark	USA	-2.05	Korea	Finland	-1.42
9	Australia	Singapore	0.15	Ireland	Italy	-0.58	Hong Kong	Denmark	2.03	India	UK	-2.3	Austria	France	-2.08	Italy	Argentina	-0.14
10	Denmark	Italy	-0.94	Korea	Mexico	-2.29	South Africa	Turkey	2.8	USA	Ireland	-3.03	Ireland	UK	-1.91	Argentina	USA	-0.71
11	UK	Ireland	-1.21	Netherlands	Austria	-2.28	India	Ireland	4.52	UK	Turkey	-2.63	Italy	Spain	-2.39	Austria	Austria	0.02
12	Italy	UK	-0.71	Spain	Spain	-0.66	Germany	Austria	0.08	South Africa	USA	-1.77	Germany	Austria	-1.08	Greece	Sweden	0.44
13	Belgium	Spain	-1.29	USA	China	-0.04	Italy	Sweden	1.08	Italy	France	-2.18	Finland	Ireland	-0.76	India	Spain	-1.49
14	South Africa	China	0.03	India	Greece	-0.81	UK	Brazil	1.65	France	Indonesia	-2.91	UK	Turkey	0.39	Germany	Indonesia	1.85
15	Ireland	India	-1.3	Belgium	Sweden	-1.06	Belgium	Greece	2.72	Austria	Mexico	-2.91	USA	Mexico	-2.59	USA	Australia	-0.19
16	Indonesia	Australia	-0.03	Singapore	Ireland	0.19	Mexico	Canada	1.39	Turkey	Austria	-2.08	Belgium	Korea	1.65	France	Portugal	-0.63
17	Canada	Indonesia	-0.54	Argentina	Denmark	-0.36	Brazil	Spain	0.95	Ireland	Spain	-2.62	France	Finland	-0.11	South Africa	Korea	1.36
18	Spain	Canada	-0.27	South Africa	South Africa	-0.22	France	India	2.99	Australia	Portugal	-2.65	Sweden	Japan	-0.09	Australia	Canada	-0.87
19	Hong Kong	Hong Kong	-0.46	Portugal	India	-0.09	Taiwan	Japan	1.73	Sweden	Japan	-0.57	South Africa	Canada	-1.21	UK	Turkey	-0.35
20	Taiwan	Turkey	-0.92	Australia	Portugal	-0.2	Sweden	Italy	3.43	Argentina	Greece	-2.59	Brazil	Brazil	0.2	Finland	South Africa	0.94
21	India	Austria	-1.21	Denmark	Canada	-0.12	Portugal	China	5.18	Spain	Australia	-1.4	Spain	Australia	-0.56	Ireland	Japan	0.69
22	Japan	Greece	-0.64	Canada	Turkey	1.09	Canada	Mexico	4.68	Denmark	Canada	-1.73	Japan	South Africa	1.49	Belgium	.	
23	Turkey	Mexico	-0.56	Greece	Hong Kong	0.74	Japan	.		Indonesia	Brazil	0.39	Argentina	Argentina	0.37	Portugal	.	
24	Korea	Sweden	-0.46	Taiwan	Australia	0.18	Spain	.		Mexico	Finland	-1.65	Mexico	.		Japan	.	
25	Sweden	South Africa	0.99	Sweden	Indonesia	-0.58	Austria	.		Portugal	Argentina	-0.88	Canada	.		Spain	.	
26	Mexico	Finland	-0.43	Finland	Finland	-0.54	.	.		Greece	South Africa	0.47	Australia	.		Turkey	.	
27	Greece	Japan	0.43	Indonesia	Korea	1.31	.	.		Canada	.		.	.		Canada	.	
28	Finland	Korea	0.27	Mexico	Japan	0.13	.	.		Finland	.		.	.		Mexico	.	
29	Portugal	Portugal	-0.24	Austria	.		.	.		.	.		.	.		.	.	
30	Austria	.		Japan	.		.	.		.	.		.	.		.	.	

*Growth rates refer to the countries in the second column.

Table 9: Appendix D - RMC country rankings and growth rates* from early (1981-1990) to late (1997-2006) period.

	WO			FU			PA			PP			IC			OC		
rank	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth
1	Taiwan	Indonesia	-0.96	Indonesia	Brazil	-0.95	Denmark	China	2.46	Finland	Finland	-0.72	Germany	USA	-0.78	Netherlands	Belgium	-1.11
2	Korea	Austria	-2.61	Taiwan	Finland	-0.63	China	Portugal	0.87	Sweden	Belgium	-2.07	UK	UK	-0.34	Belgium	Germany	-1.12
3	Hong Kong	Sweden	-1.82	Portugal	Sweden	-0.72	Italy	Indonesia	2.36	Canada	Sweden	-0.69	Hong Kong	Germany	-0.23	Germany	Netherlands	-0.36
4	Indonesia	USA	-2.29	Hong Kong	Indonesia	1.55	Hong Kong	Italy	3.5	Brazil	Netherlands	-1.91	USA	China	-1.33	Singapore	USA	-1.15
5	Portugal	Italy	-1.33	Canada	Germany	-1.25	Taiwan	Germany	3.39	Germany	Germany	-1.46	France	France	0.02	France	UK	-1.4
6	India	Germany	-1.89	Finland	USA	-0.2	Indonesia	India	2.22	USA	Austria	-1.47	Taiwan	Singapore	-0.9	USA	France	-0.96
7	Singapore	UK	-2.95	USA	Austria	-0.92	Germany	USA	2.33	Austria	USA	-1.23	Italy	Netherlands	-0.37	UK	Japan	-1.45
8	Italy	India	-0.07	Brazil	China	-0.26	Netherlands	France	2.77	South Africa	Canada	-0.09	Japan	Italy	0.23	Italy	China	-1.92
9	Netherlands	France	-1.5	Denmark	Belgium	-0.37	Sweden	Spain	1.96	Netherlands	Italy	-1.72	Netherlands	Hong Kong	0.66	Japan	Spain	-1.89
10	Sweden	Spain	-1.11	China	Canada	0.35	Singapore	UK	2.57	Belgium	France	-1.04	Korea	Sweden	-0.9	Denmark	Italy	-1.22
11	Ireland	Portugal	0.31	Sweden	Denmark	0.2	Finland	Brazil	2.12	Portugal	UK	-1.25	Spain	Spain	-0.18	Austria	Korea	-2.16
12	Belgium	Korea	1.93	Belgium	Italy	-0.29	Austria	Sweden	3.86	France	Brazil	0.27	Denmark	Belgium	-0.1	Finland	Sweden	-1.8
13	Germany	Finland	-0.66	Korea	Spain	-0.9	France	Denmark	5.07	UK	Spain	-1.39	Ireland	Austria	-0.62	Taiwan	Finland	-1.2
14	Denmark	Greece	-0.09	South Africa	Netherlands	-0.28	South Africa	Austria	3.74	Japan	Portugal	-0.37	Singapore	Finland	-0.57	Spain	Denmark	-0.94
15	Spain	Turkey	-0.91	Italy	France	-0.21	USA	Netherlands	4.52	Italy	Denmark	-1.09	Belgium	Japan	0.66	China	Austria	-0.81
16	USA	Canada	-1.39	Austria	Mexico	-0.75	India	Belgium	3.54	Taiwan	Indonesia	-1.61	China	Denmark	0.33	Sweden	Canada	-1.47
17	Austria	Argentina	-0.33	Germany	Ireland	0.06	Belgium	Finland	4.26	Denmark	China	-1.15	Sweden	Canada	-0.54	Brazil	India	-2.51
18	France	Mexico	-0.39	India	Portugal	1.28	Portugal	Singapore	4.52	Spain	Japan	-0.27	Austria	Indonesia	-0.46	Korea	Singapore	0.91
19	Greece	Australia	-0.72	Ireland	UK	0.02	Korea	Argentina	2.52	Argentina	Singapore	-1.25	Finland	India	-0.85	Canada	Mexico	-1.48
20	Finland	Japan	0.57	Netherlands	Argentina	-0.15	UK	Ireland	3.58	Ireland	Korea	-1.26	Portugal	Korea	0.93	South Africa	Indonesia	-2.34
21	UK	South Africa	0.57	France	South Africa	1.27	Japan	Korea	3.87	China	South Africa	1.31	Indonesia	Greece	-0.26	Mexico	Brazil	-0.34
22	Japan	.		Turkey	Australia	0.48	Turkey	Australia	2.72	Singapore	Ireland	-0.09	Canada	Australia	0.02	Australia	Portugal	-1.42
23	Argentina	.		Spain	Greece	0.23	Ireland	Japan	3.77	Australia	Turkey	-1.65	Australia	Mexico	0.14	Turkey	Turkey	-1.15
24	Mexico	.		Australia	India	1.39	Spain	Canada	2.76	Mexico	Mexico	-0.18	Mexico	Portugal	0.64	Portugal	Argentina	-1.19
25	Turkey	.		UK	Turkey	1.02	Brazil	Mexico	2.75	Indonesia	Argentina	0.45	India	Turkey	-0.07	Argentina	South Africa	-0.46
26	Canada	.		Mexico	Korea	1.9	Argentina	Greece	2.82	Hong Kong	Greece	-0.82	Brazil	Argentina	0.17	Greece	Greece	-1.15
27	Australia	.		Japan	Japan	0.75	Australia	South Africa	4.79	Korea	Australia	0.42	Greece	Brazil	0.77	India	Australia	-0.33
28	South Africa	.		Argentina	.		Greece	Turkey	4.13	Greece	India	-1.86	South Africa	South Africa	1.02	Indonesia	.	
29	.	.		Greece	.		Canada	.		Turkey	.		Turkey	.		.	.	
30	.	.		.	.		Mexico	.		India	.		Argentina	.		.	.	

*Growth rates refer to the countries in the second column.

Table 9: Appendix D - RMC country rankings and growth rates* from early (1981-1990) to late (1997-2006) period.

	PC			RU			PL			PT			GL			NM			ST		
rank	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth
1	Germany	Germany	-2.5	Netherlands	Netherlands	0.7	Netherlands	Germany	-2.1	Taiwan	Belgium	-2.28	China	Sweden	-5.1	Germany	Germany	0.03	Germany	Italy	-0.7
2	Netherlands	Denmark	-2.49	USA	USA	1.1	Japan	Japan	-0.75	China	Germany	-0.97	Germany	China	-1.82	Belgium	China	-1.68	Italy	Spain	-1.54
3	Hong Kong	France	-2.1	Italy	France	0.51	Korea	USA	-2.47	Germany	China	-0.21	Taiwan	Germany	-2.11	France	Belgium	0.16	Austria	Germany	-0.08
4	France	UK	-2.13	Ireland	Germany	0.78	Germany	Austria	-2.92	Hong Kong	USA	-1.37	Japan	Austria	-3.66	Hong Kong	France	0.35	Japan	China	-2.34
5	UK	USA	-2.31	Belgium	Belgium	1	France	France	-1.54	Japan	Italy	-1.19	Portugal	Italy	-1.88	Italy	Italy	0.02	France	Austria	-0.04
6	USA	Ireland	-3.08	Germany	UK	0.63	Taiwan	Italy	-2.1	Korea	Netherlands	-1.37	Italy	UK	-1.83	Japan	Austria	-0.46	Spain	USA	-0.86
7	Denmark	Sweden	-2.54	Portugal	Italy	1.23	Italy	Korea	-0.95	France	France	-0.59	Denmark	Denmark	-1.35	Taiwan	USA	-0.53	Belgium	France	-0.35
8	China	Austria	-2.85	France	Greece	0.37	USA	China	-3.12	Denmark	UK	-1.12	UK	Spain	-1.97	UK	Netherlands	-0.43	UK	Japan	-0.11
9	Japan	Italy	-1.95	Turkey	Finland	0.05	UK	Indonesia	-3.73	Italy	Spain	-1.69	USA	USA	-1.38	Austria	Turkey	-0.72	USA	Belgium	-0.12
10	Italy	Spain	-2.64	UK	China	-0.53	Denmark	Spain	-2.28	USA	Korea	-0.13	Korea	Portugal	-0.93	Sweden	Japan	0.5	Taiwan	UK	-0.21
11	Ireland	Finland	-3.06	Mexico	Spain	0.75	Spain	Denmark	-2.15	Netherlands	Japan	-0.08	Brazil	Belgium	-2.48	Netherlands	Finland	-0.55	Denmark	India	-2.25
12	Sweden	Japan	-0.94	Argentina	Argentina	0.99	Austria	UK	-2.06	Sweden	Sweden	-0.64	Spain	Indonesia	-1.82	USA	Indonesia	-0.84	Portugal	Turkey	-0.88
13	Singapore	China	-0.82	Spain	India	0.17	Sweden	Portugal	-2.81	Belgium	Austria	-0.69	Ireland	Japan	-0.64	China	UK	0.58	Greece	Netherlands	-0.69
14	Austria	Singapore	-1.51	Greece	Korea	-0.18	Ireland	Sweden	-1.91	Austria	Denmark	0.01	Indonesia	Turkey	-1.93	Denmark	Spain	-0.09	Korea	Denmark	-0.18
15	Spain	India	-3.15	South Africa	Portugal	2.23	Hong Kong	Turkey	-2.56	UK	Singapore	-0.59	Sweden	Canada	-2.46	Spain	Sweden	0.29	Netherlands	Sweden	-0.89
16	Australia	Canada	-3	Finland	Austria	-0.16	Singapore	Finland	-2.81	Singapore	Finland	-0.96	Austria	Netherlands	-1.37	Korea	Denmark	0.03	South Africa	Korea	-0.1
17	Finland	Korea	-1.9	Sweden	Turkey	2.22	Brazil	Ireland	-1.66	Finland	Ireland	-0.85	Netherlands	Korea	-0.41	Turkey	Korea	0.05	Turkey	Portugal	-0.04
18	Brazil	Portugal	-2.35	India	Australia	0.42	China	Greece	-2.19	Spain	Turkey	-1.78	Finland	India	-1.93	Portugal	Mexico	-0.47	China	Finland	-0.92
19	Korea	Mexico	-1.94	Denmark	Mexico	2.25	Portugal	India	-2.66	Indonesia	Canada	-1.51	Turkey	Finland	-1	Finland	Ireland	-0.1	Sweden	Greece	0.33
20	Taiwan	Greece	-2.51	Canada	Canada	0.99	Greece	Brazil	-1.23	Ireland	Portugal	-0.85	Singapore	Ireland	-0.18	Indonesia	India	-0.41	Argentina	Mexico	-0.48
21	Mexico	Brazil	-1.67	China	Japan	0.83	Turkey	Canada	-1.52	Portugal	India	-1.25	Belgium	Greece	-0.97	Ireland	Portugal	0.58	Ireland	Canada	-0.52
22	Indonesia	Turkey	-2.76	Japan	Denmark	1.18	Canada	Mexico	-2.23	Brazil	Greece	-1.33	Mexico	Australia	-0.43	South Africa	Canada	-0.86	Mexico	South Africa	0.8
23	Portugal	Australia	-1.24	Taiwan	.		Finland	South Africa	-1.16	South Africa	Mexico	-1.96	Argentina	.		Mexico	Greece	0.02	Indonesia	Hong Kong	-0.56
24	South Africa	Argentina	-1.64	Australia	.		Indonesia	Australia	-1.29	India	Indonesia	-0.27	Australia	.		India	Australia	0.5	Finland	Singapore	-0.29
25	Argentina	Indonesia	-1.34	Korea	.		India	Argentina	-1.04	Australia	Brazil	-0.47	Canada	.		Australia	South Africa	1.6	Canada	Indonesia	0.25
26	India	South Africa	-0.91	Austria	.		South Africa	.		Canada	Australia	0.01	South Africa	.		Greece	Argentina	0.44	Singapore	Argentina	0.77
27	Greece	.		.	.		Argentina	.		Greece	Argentina	-1.01	Greece	.		Canada	.		India	Ireland	1.13
28	Canada	.		.	.		Australia	.		Turkey	South Africa	0.98	India	.		Argentina	.		Hong Kong	Australia	-0.07
29	Turkey	.		.	.		Mexico	.		Mexico	.		.	.		.	.		Australia	.	
30	.	.		.	.		.	.		Argentina	.		.	.		.	.		.	.	

*Growth rates refer to the countries in the second column.

Table 9: Appendix D - RMC country rankings and growth rates* from early (1981-1990) to late (1997-2006) period.

	NF			MP			MA			EM			TR			PS			OT		
rank	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth	early	late	growth
1	Japan	Germany	-0.93	Belgium	UK	-3.23	Taiwan	China	-1.64	Netherlands	Germany	-1.19	Japan	Belgium	-4.02	Japan	Netherlands	-4.76	Denmark	Germany	-0.68
2	Germany	Denmark	-1.7	Canada	Belgium	-1.41	Germany	Germany	-1.31	Taiwan	China	-3.93	Taiwan	Germany	-2.46	Germany	Germany	-1.95	Germany	China	-2.56
3	France	France	-0.82	Germany	Germany	-2.19	Japan	Italy	-1.4	Germany	Italy	-0.85	Korea	China	-2.83	France	USA	-1.89	UK	USA	-0.77
4	South Africa	Italy	-1.54	Denmark	Italy	-2.37	China	USA	-1.37	Italy	UK	-1.1	Germany	UK	-2.87	USA	Japan	-0.64	France	Denmark	0.53
5	Brazil	Turkey	-1.85	UK	France	-2	Italy	UK	-1.26	Sweden	USA	-0.8	Hong Kong	Sweden	-2.59	Netherlands	Austria	-2.22	Indonesia	Ireland	-1.42
6	Singapore	Sweden	-1.13	France	Canada	-0.87	France	France	-0.79	Denmark	France	-1.06	France	Netherlands	-3.66	UK	France	-0.76	Taiwan	UK	0.42
7	Sweden	UK	-1.35	Australia	Austria	-2.62	Hong Kong	Belgium	-1.73	USA	Denmark	-0.1	USA	France	-2.2	Italy	UK	-1.48	Japan	Canada	-1.81
8	Denmark	Japan	0.26	South Africa	USA	-1.23	USA	Spain	-1.6	Japan	Austria	-1.39	Sweden	USA	-2.06	Hong Kong	Denmark	-2	USA	Italy	-0.57
9	Italy	USA	-1.36	USA	Greece	-3.17	Austria	Netherlands	-1.2	UK	Sweden	0.03	Singapore	Italy	-2.65	Korea	Finland	-3.54	Sweden	Japan	0.32
10	Spain	South Africa	-0.06	Italy	Sweden	-2.13	UK	Denmark	-1.56	Hong Kong	Japan	0.01	China	Denmark	-2.92	Austria	Spain	-2.53	Singapore	Spain	-0.99
11	Korea	Finland	-1.48	Sweden	Turkey	-2.97	Korea	Sweden	-0.88	Singapore	Canada	-2.04	UK	Korea	-0.83	Sweden	Canada	-2.44	Korea	France	0.76
12	Austria	China	-2.57	Japan	China	-2.59	Sweden	Turkey	-2.65	France	Ireland	-0.93	Italy	Japan	0.02	Denmark	Italy	-1.29	Italy	Korea	-0.2
13	UK	Spain	-0.56	Mexico	Finland	-2.45	Netherlands	Japan	0.15	Belgium	Spain	-1.41	Denmark	Finland	-2.77	Taiwan	Ireland	-2.85	Ireland	Sweden	0.7
14	Netherlands	Korea	-0.59	Austria	Spain	-1.95	Belgium	Austria	-0.47	Korea	Korea	-0.72	Belgium	Portugal	-3.54	Singapore	Korea	-0.93	Spain	Finland	-0.3
15	USA	Austria	-0.5	Spain	Japan	-1.72	Spain	Korea	-0.54	Austria	Mexico	-1.81	Netherlands	Spain	-3.19	Spain	China	-3.15	Finland	Greece	-0.38
16	Turkey	Brazil	0.31	Argentina	Korea	-1.86	Denmark	India	-1.61	Ireland	Finland	-0.7	Finland	Austria	-2.5	Canada	Sweden	-0.85	China	Australia	-0.66
17	Argentina	India	-2.45	Finland	Portugal	-1.58	Finland	Canada	-1.84	Finland	Portugal	-0.82	Austria	Canada	-3.03	Brazil	Portugal	-2.67	Greece	Turkey	-0.2
18	Finland	Mexico	-1.6	Taiwan	Argentina	-1.15	India	Portugal	-1.89	Spain	Turkey	-2.89	Spain	Turkey	-3.55	Ireland	Brazil	-1.63	Hong Kong	Brazil	-0.62
19	Indonesia	Greece	-0.59	China	Mexico	-0.72	Singapore	Singapore	-1.38	Canada	Greece	-1.53	Ireland	Ireland	-2.66	Finland	Singapore	-1.26	Canada	India	-0.85
20	Greece	Argentina	-0.05	Portugal	India	-2.33	Ireland	Finland	-1.11	Portugal	Brazil	-0.96	Canada	Greece	-3.77	Australia	Mexico	-3.45	Australia	South Africa	-0.06
21	Canada	Canada	-0.51	Korea	.		Canada	Indonesia	-1.86	Mexico	Australia	-0.99	Portugal	Indonesia	-3.01	Greece	Turkey	-2.66	Turkey	Argentina	-1.32
22	Hong Kong	Portugal	-0.57	Turkey	.		South Africa	Greece	-1.75	China	South Africa	-1.44	Brazil	India	-2.61	Portugal	Argentina	-2.34	Mexico	.	
23	Taiwan	Australia	-0.13	Greece	.		Turkey	Ireland	-0.82	Brazil	India	-1.54	Mexico	Brazil	-2.05	China	Greece	-1.13	Brazil	.	
24	Australia	Ireland	-0.15	India	.		Portugal	South Africa	-0.79	Australia	Argentina	-0.72	Turkey	Australia	-2.26	Indonesia	Australia	-1.08	South Africa	.	
25	Ireland	Indonesia	1.25	.	.		Australia	Argentina	-1.17	Indonesia	.		Indonesia	South Africa	-2.11	India	India	-1.09	India	.	
26	Portugal	.		.	.		Indonesia	Australia	-0.46	Greece	.		India	Argentina	-2.55	Turkey	South Africa	-1.07	Argentina	.	
27	China	.		.	.		Greece	.		South Africa	.		Australia	.		Mexico	Indonesia	0.16	.	.	
28	Mexico	.		.	.		Argentina	.		India	.		Greece	.		South Africa	.		.	.	
29	India	.		.	.		Mexico	.		Argentina	.		South Africa	.		Argentina	.		.	.	
30	.	.		.	.		.	.		Turkey	.		Argentina	.		.	.		.	.	

*Growth rates refer to the countries in the second column.

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