On the weakness of global trade

World trade has been disappointing in recent years, falling back from average annual growth rates as high as 6% between 1980 and 2007 to less than 3% since. Much of this contraction can be blamed on the slowdown in global economic growth, of course. However, global trade elasticity – the ratio of world trade growth to global activity growth – has dwindled as well. This raises concerns that the pace of globalisation, and thus of international specialisation, might be faltering, a scenario which would have negative repercussions for economic progress.

Yet at the same time, it is possible to demonstrate that the convergence-driven shifts in global economic growth towards the emerging market economies explain a large chunk of the decline. The trade elasticity of the emerging market economies, which are gradually climbing through the ranks of the global economy, is far lower than that of the advanced economies. What is more, the swing towards the emerging market economies has been particularly strong for the trade-intensive components of economic activity, with the increase seen since 2008 in global investment and industrial output being generated solely by these up-and-coming economies.

So why exactly is the trade elasticity of economic growth so low in major emerging market economies? In the long term, imports and exports need to move broadly in tandem if imbalances are to be kept in check. Moreover, the slower rate of export market growth in the advanced economies is stifling foreign trade in the emerging market economies. Chinese exports, in particular, appear to be reaching their limits. China's swift ascent in the global hierarchy has seen it evolve from a "small" economy to a "large" one for which international trade in goods plays second fiddle – being the world's second-largest economy, China simply cannot run a predominantly export-led growth model over the long run.

All things considered, the disheartening path which international trade has taken in recent years probably very much reflects the growth profile of the global economy. There is precious little evidence that global trade is inherently weak or that trade policy measures are having a major influence. Given that the emerging market economies are likely to continue outpacing the advanced economies, the trade intensity of global economic growth looks set to remain fairly low.

Symptoms and diagnoses

Growth in global trade subdued at best in recent years

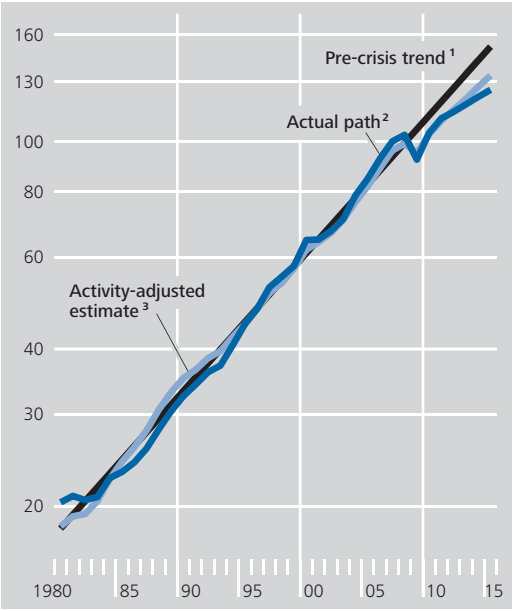
The pace of global trade growth has fallen well short of expectations over the past few years. According to data from the International Monetary Fund (IMF), trade volume growth has shrunk from a mean annual rate of as high as 6% between 1980 and 2007 to no more than just under 3% since. If a log-linear trend is computed for the years 1979 to 2007 and then extrapolated, it can be shown that the trade volume in 2015 was down on this path by just over 17%. Immediately prior to the onset of the global financial and economic crisis, the trade volume was still 7% up on the trend figures.

Much of global trade weakness down to poorer global economic growth

A good chunk of the sluggishness of global trade can be blamed, in mathematical terms, on the moderation of global economic growth, which has seen not only the international exchange of goods but also global economic activity switch to a lower and flatter expansionary path since the financial and economic crisis.

World trade volume

Indices, log scale



Source: Bundesbank calculations based on data from the IMF World Economic Outlook, October 2015; some IMF data for 2015 are estimates. **1** Extrapolated log-linear trend for the 1979-2007 period. **2** World trade volume of goods and services, 2007 = 100. **3** Based on the linear relationship between the log of the levels of the world trade volume and global economic activity (based on market exchange rates) for the 1979-2007 period.

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When real national gross domestic product (GDP) growth rates are aggregated using market exchange rates, global economic activity climbed by 3% on average between 1980 and 2007; since then, however, growth has dropped to no more than 2% *per annum*. It is no surprise, then, that global value added also lagged behind its earlier trend path last year. An estimation of the log-linear relationship with global economic activity explains two-thirds of the deviation of world trade from its pre-crisis path.[1]

But world trade dynamics disappointing relative to economic growth, too

There has, however, also been a shift in the ratio of world trade growth to global output growth. When relative growth rates are investigated using five-year moving averages, world trade elasticity, as it is known, would appear to have diminished distinctly since the global financial and economic crisis (see the technical annex on pages 33 to 35).[2] What this calculation also reveals is that the elasticity had already been fairly volatile beforehand, visibly drifting higher in the late 1980s and early 1990s before contracting around the year 2000. If the average growth rates of the two variables are expressed as a ratio throughout the entire pre-crisis era, there is an elasticity of 2. Hence the assumption by many experts that world trade expanded roughly twice as quickly as global economic activity over longer stretches. This ratio contracted to 1.4 in the post-crisis era, however.[3]

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1 See Deutsche Bundesbank, The empirical relationship between world trade and global economic output, Monthly Report, November 2013, pp 13-17.
2 An analysis of the level of the world trade volume reveals that the deviations from a log-linear relationship with global economic activity (estimated for 1979-2007) started declining in 2008. This is another indication that elasticity may have fallen since 2007.
3 If national GDP rates are instead aggregated using purchasing power parity exchange rates, the elasticity calculated according to this alternative method has declined more strongly still, receding from 1.7 to just 0.9. However, exchange rates based on purchasing power parities are irrelevant for international trade, which means that global economic activity calculated on the basis of purchasing power parities does not constitute a suitable measure in this regard. See Deutsche Bundesbank (2013), The empirical relationship between world trade and global economic output, op cit; and P Ollivaud and C Schwellnus, Does the post-crisis weakness of global trade solely reflect weak demand?, OECD Journal: Economic Studies, Vol 2015/1, pp 269-97.

Possible implications for economic policy

This persistent and uncharacteristic decline in global trade elasticity in recent years needs explaining. Fast-moving globalisation in the pre-crisis era had once been regarded as a major engine propelling the global economy. A genuine lull in international trade could harm the economy at large and necessitate economic policy countermeasures.

Are cyclical or structural factors to blame?

Some believe that cyclical and structural factors might be behind the distinct weakness in world trade. Structural factors bring about deep and lasting change in the relationship linking international trade and economic activity. Examples notably include the pace of specialisation (also in the guise of multinational production chains), the level of protectionism and the role played by funding constraints.

Strong cyclical factors in 1982, 2001 and 2009

The impact of short-lived cyclical factors, meanwhile, can be observed by using the annual quotients, rather than multiyear averages, of world trade volume growth and global economic activity growth. Elasticities calculated according to this method slumped particularly in 1982 and 2001, when international trade contracted or at least stagnated while the pace of global growth fell significantly. The steep rise in elasticity in 2009 also bore the tell-tale signs of cyclical factors. At that time, the decline in world trade outpaced the drop in economic activity by a considerable margin. This drove up the elasticity (in mathematical terms), even though it was actually a manifestation of the pronounced weakness in trade.[4]

Focus of international trade on goods, notably capital goods, …

International trade is highly sensitive to cyclical factors primarily because trade activity focuses more on manufactured products and less on cyclically more stable services, though the latter account for the bulk of economic activity.[5] Note also that the output and trade flows are each used for different purposes. Economic activity (ie value added) is a net measure which can be calculated by deducting intermediates. It is income that is ultimately either consumed or invested. Consumption accounts for three-quarters of worldwide expenditure, investment just one-quarter. Imports and exports, by contrast, are gross measures which include a large share of intermediates. Primary and intermediate products account for more than 60% of international merchandise trade. Furthermore, consumer and capital goods as a share of international goods trade (at roughly 22% and 15%, respectively) are far more balanced than their respective shares of aggregate expenditure.

Growth in world trade volume and global economic activity

Sources: IMF World Economic Outlook, October 2015, and Bundesbank calculations; some IMF data for 2015 are estimates. **1** Goods and services. **2** Aggregation of national real GDP growth rates using market exchange rates.
Deutsche Bundesbank

4 Global economic activity (based on market exchange rates) in 2009 was 2% down on the year, and the world trade volume slumped by just over 10%. This has a dampening effect on elasticity in the ratio of multiyear average rates, however. See also C Freund, The trade response to global downturns, in R Baldwin (ed, 2009), The great trade collapse: causes, consequences and prospects, Center for Economic Policy Research, VoxEU.org Report, London, pp 59-70.

5 Aggregate economic output consists of many goods that are not normally traded internationally, including a large number of services as well as construction. World Bank data indicate that services account for roughly 70% of global output. But services play a less important role for world trade, with a share of just one-fifth. The international exchange of goods is predominantly composed of trade in goods, particularly manufactured products, which make up just one-sixth of global output, but half of the volume of world trade.

… driving strong cyclical volatility

In times of recession, it is primarily spending on non-urgent goods – that is to say, mainly consumer durables and capital goods – which tends to be postponed. This explains why industrial output is far more volatile than value added in the services sector. No less striking is the volatility of international trade, in which capital goods play a comparatively significant role, particularly when the corresponding intermediate goods are taken into account. This is consistent, on the aggregate expenditure side, with the rich import content attributed to investment, especially, but also to exports.[6]

Besides cyclical factors, …

Above all the sharp downturn in international goods flows in the fourth quarter of 2008 and the first quarter of 2009 was seen in the context of the simultaneous emergence of recessionary tendencies across a number of countries, particularly in terms of industrial output and investment.[7] This cyclical interpretation of the then prevailing weakness in world trade was borne out, it seemed, by the fairly robust rebound seen in the years immediately following the crisis. The downswing in global economic growth in 2012 was accompanied by a stronger slowdown in the expansion of international goods trading. Studies continued to highlight the role played by cyclical factors, above all the persistently weak investment in advanced economies,[8] yet a great deal of the slump in international trade still appears to be unexplained, even after making allowances for the compositional shift in global demand.[9] The existence of a residual of this size is often seen as pointing to the influence of structural factors.

… structural distortions are also under discussion

One line of argumentation that has made particular headway posits that the expansion of global value chains – or even globalisation itself – is losing steam. A widely cited study by Constantinescu et al (2015) sees this as the root cause of the shift in the long-term relationship between world trade and economic activity.[10] Previously, China's international role had often been hailed as a model for vertical integration ("extended workbench"), given that the country mainly processed imported intermediate inputs and then re-exported them as final products to the United States. But now, the authors wrote, the sluggish performance of imports, above all in these countries, was showing that the international division of labour was moving forward more slowly. There are also many studies which discuss the role that protectionism might be playing in the sluggishness of world trade.

World trade and economic activity

What is behind the contraction in global trade elasticity since the crisis?

The commonly drawn distinction between the cyclical and structural determinants of the sluggishness of world trade paints an incomplete picture, ignoring, as it does, the other composition effects, besides the expenditure split of economic activity, which can impair global trade elasticity. Furthermore, their influence need not necessarily be temporary in nature.

Geographical composition

Discrepancies between global and regional perspective

The sharp contraction in global trade elasticity stands in contrast to a flatter decline in the elasticities for the group of advanced econ-

6 See M Bussière, G Callegari, F Ghironi, G Sestieri and N Yamano (2013), Estimating trade elasticities: demand composition and the trade collapse of 2008-2009, American Economic Journal: Macroeconomics, Vol 5, No 3, pp 118-151.
7 See Deutsche Bundesbank, Financial market shock and downturn in industrial output in advanced economies, Monthly Report, May 2009, pp 14-15; and R Baldwin, The great trade collapse: what caused it and what does it mean?, in R Baldwin (ed, 2009), The great trade collapse: causes, consequences and prospects, Center for Economic Policy Research, VoxEU.org Report, London, pp 1-14.
8 See also Deutsche Bundesbank, Investment in the euro area, Monthly Report, January 2016, pp 31-49.
9 Boz et al (2014) observe the lag between the import volume and an extrapolated long-term trend for 18 advanced economies in the period from the first quarter of 2012 to the second quarter of 2014. Using the model of Bussière et al (2013), they find that just over half of the lag was explained by cyclical factors. See E Boz, M Bussière and C Marsilli (2014), Recent slowdown in global trade: cyclical or structural, VoxEU.org.
10 See C Constantinescu, A Mattoo and M Ruta (2015), The global trade slowdown: cyclical or structural?, IMF Working Paper, No 15/6.

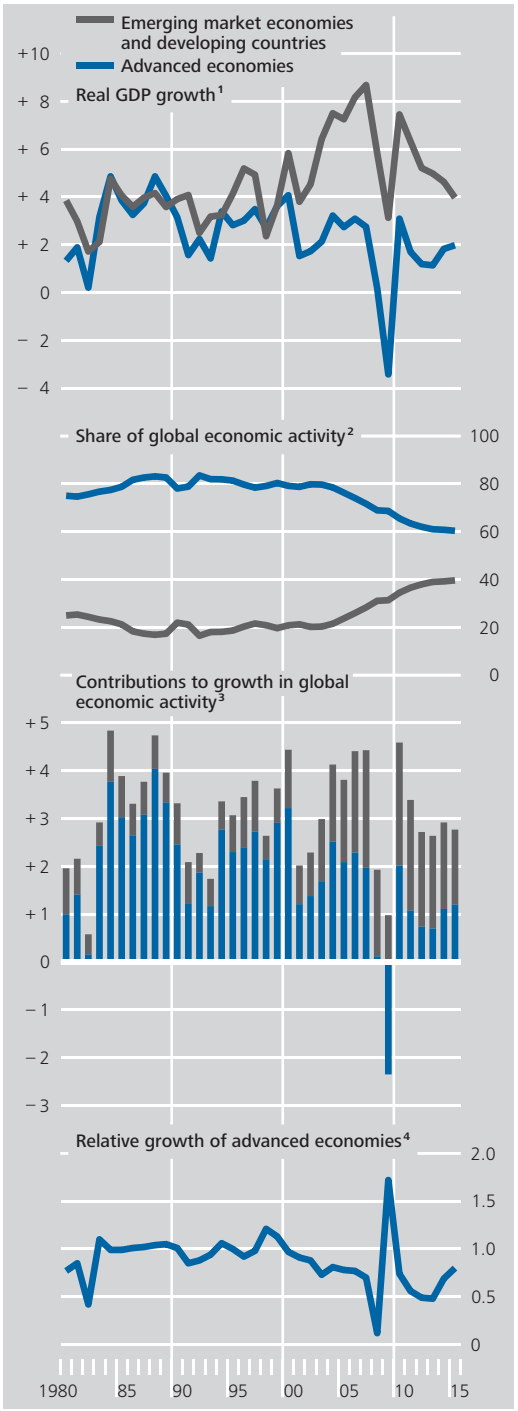
omies and the group of emerging market economies and developing countries. For the latter group, the ratio of average import growth rates[11] to average GDP growth rates has shrunk from a pre-crisis 1.4 to 1.0 since 2008, while that of the industrial countries even dwindled to just 1.9 from 2.1. The discrepancy between the relatively small decline for the individual groups of countries and the perceptible drop in the global ratio suggests that composition effects might be at play. Owing to the lower trade elasticity of the emerging market economies, a mere shift in the focus of growth towards this first group can act as a drag on global elasticity, even if the relationships remain invariant at the deeper level.[12]

Shift in global growth towards emerging market economies

Global economic growth has indeed been supported quite substantially by the emerging market economies in recent years, in a shift away from the situation in the 1980s and 1990s when the advanced economies were still the main engine driving growth. While real GDP growth in the industrial countries eased significantly over time, growth rates even gained traction at times in the up-and-coming economies. Since 2000, the emerging market economies have been outpacing their advanced counterparts by at least 1¾ percentage points *per annum*, and the gap widened to as much as 6½ percentage points when the advanced economies fell into deep recession in 2009. These dynamics doubled the emerging market economies' contribution to global economic activity to just shy of 40% between 1999 and 2015, and their importance for international trade increased on roughly the same scale. This explains why the emerging mar-

Factors indicating the greater importance of emerging market economies and developing countries

% / percentage points



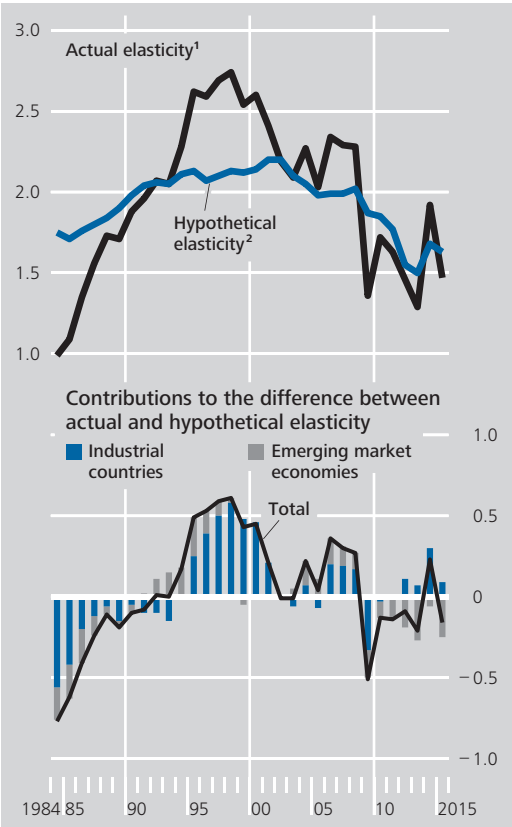
Sources: IMF World Economic Outlook, October 2015, and Bundesbank calculations; some IMF data for 2015 are estimates. IMF country groups. **1** Aggregation based on purchasing power parity exchange rates. **2** Nominal (US$ basis), converted at market exchange rates. **3** Approximation based on weighting the country groups' real GDP growth rates (at purchasing power parity exchange rates) by their shares of nominal GDP (at market exchange rates). **4** Country group's real GDP growth rate (at purchasing power parity exchange rates) relative to growth in global economic activity at market exchange rates.

Deutsche Bundesbank

11 Imports and exports ought to match up at the global level, but that need not be the case for individual countries. It is common to analyse imports when investigating the relationship with economic activity at the country level. That is because imports are widely thought to be sensitive to an economy's aggregate demand, unlike exports, which are characterised more by external demand.

12 See Deutsche Bundesbank, The decline in the elasticity of global trade to global economic activity, Monthly Report, January 2015, pp 27-29. One reason for the relatively low trade intensity of economic growth in the emerging market economies might be that a given external impulse generates a relatively strong increase in income (starting from a lower level) in those countries.

Actual and hypothetical world trade elasticity*



Source: Bundesbank calculations based on data from the World Bank (World Development Indicators) and the IMF (World Economic Outlook, October 2015); some IMF data for 2015 are estimates. * World as an aggregate of 42 countries, country groups based on IMF classification. Elasticity and contribution data: no unit. **1** Quotient of the (moving) average growth rates of real imports (goods and services) and of real GDP over the last five years in each case. **2** Assumption that country-level elasticity is constant throughout the period, specified as the quotient of the average growth rates of real imports and of real GDP over the 1980-2007 period.
Deutsche Bundesbank

ket economies are now such a major driver of global expansion, and also why the slowdown in the advanced economies is no longer affecting the global rate as much as it would have done in the past.

Key share of decline in global elasticity due to shift in global weights, …

A straightforward counterfactual experiment shows how shifts in the make-up of the global economy have affected the trade intensity of global growth. This experiment draws on data for a total of 42 economies, including a number of major emerging market economies, and their import elasticities, expressed as the ratio of the average growth rates of imports to real GDP in the pre-crisis era (1980 to 2007). The idiosyncratic elasticities are then kept constant throughout the entire period up until 2014 and only their weights, ie the national import shares and relative growth rates, are varied in line with actual data.[13] The experiment reveals that the computed hypothetical global trade elasticity in the last few years has veered deeply to the downside of the pre-crisis average of 2, dropping to 1½ in 2012 and 2013. All in all, this analysis can explain roughly half of the contraction in global elasticity.[14]

… but import intensity of emerging market economies' growth also down

By splitting global trade elasticity into its constituent components, it is possible to quantify the notional contributions of individual countries or groups of countries. The gap between actual contributions and their hypothetical counterparts allows a conclusion to be drawn on the extent to which changes in the national elasticities have become significant at the global level. As a case in point, only a small part of the increase in the world trade elasticity actually observed during the 1980s and 1990s is reflected in the hypothetical contributions. This is mainly because economic growth became more trade-intensive in nature, particularly in the industrial countries. Much of the subsequent decline in global elasticity, on the other hand, is also reflected in the above experiment. In other words, that share of the decline originates from the shift in global growth towards the emerging market economies. It can be concluded that it was above all the weakness in the euro-area economy in the wake of the financial and economic crisis, and later on after the sovereign debt crisis, which deteriorated world trade. In the case of the United States, however, the actual contribution to global

13 Owing to the fairly strong fluctuations in the annual data, for illustrative purposes weights are calculated on the basis of moving averages for the past five years in each case.
14 The decline in the hypothetical global elasticity is stronger still if the experiment is expanded by additionally fixing the national shares at their pre-crisis mean averages, ie only the relative growth is varied. When viewed in isolation, the shift in trade shares impacts positively on global elasticity because at the end of the day, it is the economies that are enjoying relatively strong trade growth which increase their shares over time.

trade elasticity has sometimes fallen noticeably short of the hypothetical measure in recent years, which suggests that the slowdown in GDP growth was compounded by idiosyncratic import weakness. The bulk of the gap that began to emerge between the actual global elasticity and its hypothetical counterpart in 2010, however, can be attributed to the emerging market economies, first and foremost the Chinese economy. The import intensity of economic growth in China appears to have contracted perceptibly in recent years.

Shift in global weights probably largely persistent

Against this backdrop, global trade elasticity in the years ahead looks set to run at noticeably lower levels than in the pre-crisis era, judging by how persistently the balance has shifted in the global economy. The inroads which the emerging market economies have made into international trade will probably be permanent, and the relative growth rates also appear to have shifted for good. While economic growth in the industrial countries has rebounded a little, now that the euro-area recession sparked by the sovereign debt crisis has been overcome, and the growth outlook for the emerging market economies has dimmed in recent years,[15] it is nonetheless highly likely that the up-and-coming economies will continue to far outpace their advanced counterparts in the near future.

Results similar when analysing trade volumes …

The key results of this analysis are robust to various modifications, particularly one in which the individual countries' trade volumes (defined as the weighted sum of real imports and exports) are investigated instead of imports. It is noteworthy, though, that the United States is no longer quite as prominent in this modification. Idiosyncratic developments are probably to blame for the subdued upward path of US imports (see the box on page 20).

… or alternative elasticity measures

The significance of the geographical composition of global economic growth is also confirmed when alternative measures of trade elasticity are used. A paper by Stratford (2015) goes as far as to demonstrate that this effect can explain almost all of the weakness in global trade, as long as the reference points used are hypothetical import growth rates derived from adjusting national GDP rates such that they have the same mean and variance as the changes in imports.[16] Historically, world trade has not only grown twice as quickly as economic activity on average – the variance of trade growth dynamics measured with the aid of the standard deviation was in fact more than three times the size. According to that paper, it is not unusual for a general lull in economic activity to be accompanied by an even stronger decline in trade growth. While adjusting the global rates to allow for this does not help to

Growth in global import volume and adjusted GDP growth rates

Year-on-year percentage change

Source: Bundesbank calculations based on data from the World Bank (World Development Indicators) and the IMF (World Economic Outlook, October 2015); some IMF data for 2015 are estimates. **1** Aggregated volume of imports of goods and services for 42 countries. **2** Suitably standardised real GDP growth rates adjusted such that they have the same mean and standard deviation as real import growth rates in the 1990-2007 period, in line with Stratford (2015). **3** National rates aggregated using shares of the global import value.
Deutsche Bundesbank

15 See Deutsche Bundesbank, Slowdown in growth in the emerging market economies, Monthly Report, July 2015, pp 15-31.
16 The first step here is to standardise GDP growth using its own mean and standard deviation. See K Stratford (2015), Why has world trade been so weak in recent years?, Bank of England, http://bankunderground.co.uk/2015/10/28/why-has-world-trade-been-so-weak-in-recent-years/

External trade in the United States

Some see the relatively weak growth of US imports in recent years as a sign that globalisation trends are on the wane. Yet at the same time, exports have been following a far more upbeat path. While real US imports of goods and services grew at an annual rate of just 1½% between 2008 and 2015, exports expanded twice as quickly (3%). This pace is also impressive when compared with aggregate economic growth – real gross domestic product (GDP) rose by an average of 1¼% per year over the same period. These contrasting patterns in US external trade probably owe a great deal to adjustments made in connection with the United States' external imbalance, which was fairly pronounced right up to the onset of the financial and economic crisis. Due consideration should also be given to the tangible impact of what has been termed the fracking boom, which has seen a sharp expansion of unconventional oil extraction methods in the United States push down imports of crude oil and petroleum-based products by 4% annually since 2008. Excluding crude oil thus drives the average growth rate of imports of goods and services sharply higher to 2½%, which is only narrowly short of the pace set by exports. Added to this, the past two years in particular have seen imports regain greater momentum. Upbeat domestic demand relative to the USA's major trading partners could have been a factor here, as could the recent appreciation of the US dollar. All things considered, then, it seems questionable whether US import data can deliver any insights into what might be propelling world trade at a deeper level.

explain the sluggish rate of import growth since 2012, given that the global economy did not expand at such an uncharacteristically weak pace during those years, the global perspective does, however, mask more substantial deviations at the country level which come to bear when national GDP rates are adjusted and then aggregated.[17] This approach highlights the role which the geographical composition of economic growth can potentially play in conjunction with the stronger variance of international goods flows. Since the composition effect does not fully explain the weakness of world trade in more conventional analytical approaches, it might prove worthwhile to take a closer look at the variant components of economic activity.

Demand-side breakdown

On the demand side, it is investment which fluctuates to a similarly strong degree as foreign trade flows and is relatively closely connected to them owing to the high import content. Moreover, prolonged investment slumps are quite conceivable, which means that an explanation can also be given for fairly persistent deviations from historical norms. One can hardly speak of weak global investment since the financial and economic crisis, however. Real gross investment in the group of 42 countries considered here even rose marginally more strongly than price-adjusted consumption expenditure on an average for the years 2008 to 2014. Yet this masks highly divergent develop-

Large international discrepancies in investment activity

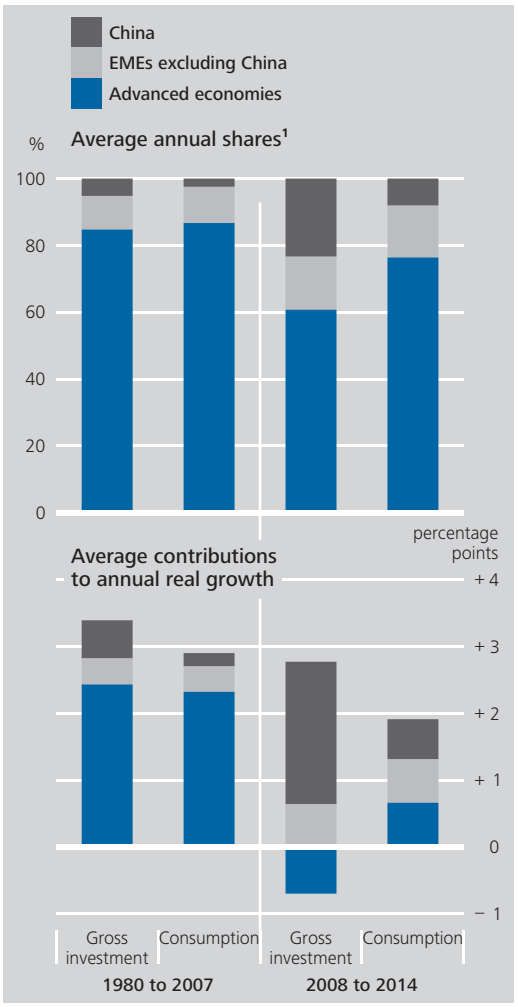
17 Some of the particular characteristics of this approach are worth highlighting. First, it is a regression of import growth to GDP growth and a constant in the event of perfect correlation. No such parallel movement has been observed in the past, however. Second, the constant mean implies that the apparent trade elasticity varies with the level of economic growth. Third, the robustness of the assumption of a constant mean import growth is doubtful, given the persistent downside deviations observed in recent years. Finally, the results produced by the approach do not appear to be insensitive to the choice of reference period.

ments in the individual economies. Ultimately, growth in gross investment is solely attributable to the emerging market economies, notably China, where real investment expenditure climbed to twice its pre-crisis level by 2014. In the other emerging market economies, real investment expenditure rose by just under one-third, whereas investment activity in the industrial countries was even 5% down on the level measured in 2007. The global expansion of private and public consumption proved to be more balanced. In the meantime, these growth differentials have led to a conspicuous mismatch between China's shares in the expenditure components. In 2014, China's households and general government together accounted for just over 10% of all consumption expenditure, but almost 30% of investment expenditure, in the group of countries analysed in this article.

Adjustments to investment in different economic areas curbing global import growth

As well as special developments in investment and consumption activity, consideration also needs to be given to country and demand-specific propensities to import. It is remarkable that, particularly in China, import growth and investment growth appear to be closely correlated.[18] This indicates that the reorientation of the Chinese economy, now underway, towards greater consumerism is unlikely to benefit imports, especially in the next few years. By contrast, it was probably primarily the constraints on euro-area investment that curbed global imports during the sovereign debt crisis.[19] More recently, adjustments in the commodity-exporting economies may have had a distinct dampening effect (see the box on pages 23 and 24).

Regional breakdown of global demand*



Source: Bundesbank calculations based on World Bank data (World Development Indicators). * Aggregate for 42 countries; country groups according to IMF classification. Aggregation using market exchange rates. **1** Nominal, US$ basis.
Deutsche Bundesbank

Breakdown by sector

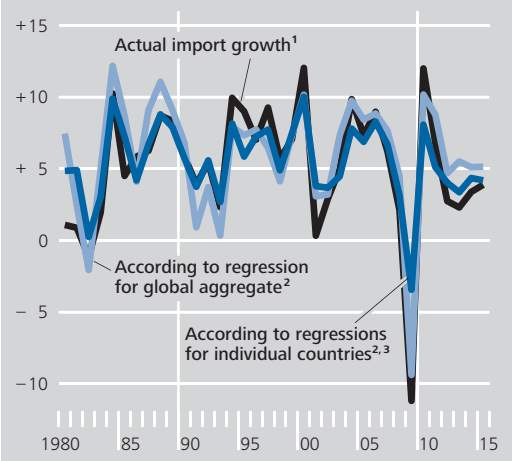
Expansion of global industrial output driven quite substantially by Asian EMEs, …

Mirroring the importance of individual demand variables, a breakdown by sector of the supply side in connection with the regional distribution also grants some insight into the weakness in world trade. There are no comprehensive international datasets which provide a long history of the breakdown of value added by sector. However, data from the Dutch Centraal Planbureau in the *World Trade Monitor* make it possible to place industrial output and the import of goods into context for the world as a

18 This is shown by different regressions containing price-adjusted consumption expenditure, gross investment and relative prices as explanatory variables for real imports. This is consistent with the low share of consumer goods in Chinese imports.
19 In 2012, euro-area real GDP fell by just less than 1% on the year, and by ¼% in 2013. On the other hand, real gross investment contracted by 7½% and 1¾% respectively.

Global import growth and correlation with growth in consumption and gross investment

Year-on-year percentage change



Source: Bundesbank calculations based on data from the World Bank (World Development Indicators) and the IMF (World Economic Outlook, October 2015); some figures for 2015 are estimates based on IMF data. Rates of change according to differences in logarithmic levels. **1** Global volume of imports of goods and services; aggregate for 42 countries. **2** Regression of the logarithmic level of real imports on the logarithmic level of real consumption expenditure, gross investment and relative import prices as well as a constant for the 1979-2007 period. **3** Aggregation of the estimated national rates of change of imports using the shares of the global import value.

Deutsche Bundesbank

whole and for individual economic areas.[20] The development in the case of industry is found to be unbalanced in much the same way as that for investment. For example, the 16½% increase in global industrial output since 2008 is attributable solely to the emerging market economies.[21] Whereas output in those countries exceeded the pre-crisis level by 47% last year, it fell short of that mark by just over 4% in the advanced economies. The source of the growth can be narrowed down even more closely still, namely to an increase in output by almost 86% in the Asian emerging market economies that was mainly driven by China. On the other hand, non-Asian emerging market economies saw their output rise by a comparatively modest 6%.

… whose growth is generating only minor stimuli to world trade

Additionally, the trade intensity of output growth differs quite significantly between the economic areas. Asian emerging market economies' imports of goods rose at merely the same pace as their industrial output on an average for the years 1992 to 2007. Trade elasticity in the advanced economies was almost three times as high. It is therefore not surprising that the growth rates in global output achieved in Asia have not generated any disproportionate increases in imports in recent years either. Yet at the current end, imports by Asian emerging market economies have even fallen short of what might be expected when viewed in a historical context. Nevertheless, the rise in the advanced economies' imports of goods – coinciding with a drop in industrial output – rules out globally effective, trade-specific factors as an explanation for the sluggishness of global imports. There is no indication of production which had previously been outsourced to the emerging market economies being reshored to the industrial countries.

Further explanatory factors and reservations

No clear evidence of structural dislocations with regard to trade in intermediate goods …

Whereas composition effects probably go a long way towards explaining the decline in elasticity, evidence that points to other factors is less clear-cut. Analysis of developments in the international division of labour is rendered difficult by the fact that foreign trade statistics only cover gross flows.[22] For this reason, intermediate goods as a share of total trade or of trade in certain product groups is often used as a simple measure of the degree of vertical integration. This share has maintained its rather high level in recent years, meaning that it does not give any indication of sharp reductions in

20 This makes it possible to exclude the services sector, which accounts for only a minor part of world trade. By contrast, Constantinescu et al (2015) examined the elasticity of the different categories of goods in world trade (goods and services) in relation to aggregate economic output. This approach, of course, overlooks possible changes in the importance of the categories of goods to income growth. See C Constantinescu, A Mattoo and M Ruta (2015), The global trade slowdown: cyclical or structural?, op cit.

21 It should be noted that the Centraal Planbureau's definition of the groups of countries is not entirely consistent with the IMF's definition.

22 See Deutsche Bundesbank, The German economy in the international division of labour: a look at value added flows, Monthly Report, October 2014, pp 27-42.

Recent trends in world trade in goods

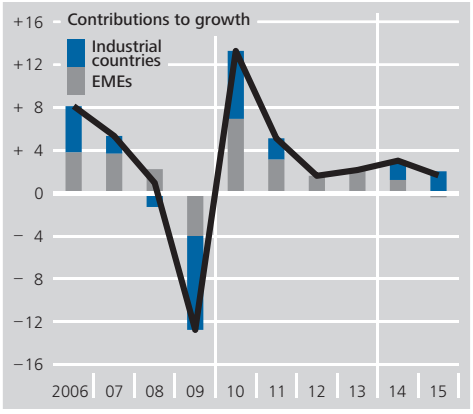
International trade has remained listless in recent times, too. Based on data from the Dutch Centraal Planbureau (CPB), the volume of international trade in goods grew by just 2½% last year. In terms of value, cross-border trade even shrunk significantly on a US dollar basis. However, the main factors behind this were probably the purely nominal effect of the US currency's major appreciation and the at times huge decreases in the prices of commodities, which make up an important part of world trade. In any case, the shifts in relative prices could have exacerbated latent problems in the price adjustment of nominal trade figures, thus necessitating caution when interpreting real goods flows, too, which are relevant from a macroeconomic perspective.[1]

Looking at world trade from the imports side, last year's sluggishness was attributable chiefly to the group of emerging market economies (EMEs), where the import volume even declined slightly, according to CPB's calculations. By contrast, the industrial countries' imports saw fairly robust growth,[2] as confirmed by national accounts data. In particular, the USA's real goods and services imports rose sharply last year (+5%), possibly bolstered by gains in purchasing power owing to exchange rate changes. But the imports of the United Kingdom and the euro area also picked up with equal momentum (+6¼% and +5¾% respectively).[3] The virtual stagnation in deliveries to Japan should be viewed in the context of the very high increases in previous years and weak growth in gross domestic product (GDP).

Given this import growth in the advanced economies, the more likely explanation for the current weakness of world trade is specific influences on EMEs, rather than factors with a global impact. China is the first case in point. Probably for the first time in a long while, China's imports recorded a slight decrease last year.[4] This is surprising because although the Chinese economy is no longer quite as dynamic as before, it still saw major growth by international standards. However, the engines of the domestic economy seem to have shifted from investment to consumption. According to official estimates, two-thirds of last year's economic growth was generated by consumption and just one-third by investment. In addition, real exports apparently declined slightly. Since China's consumption comprises a smaller import share than investment and especially exports, the observed demand-side shift in economic growth is likely to have dampened imports when viewed in isolation.[5] Moreover, that same economic

Growth in global goods imports

Volume, year-on-year percentage change



Sources: Centraal Planbureau and Bundesbank calculations.
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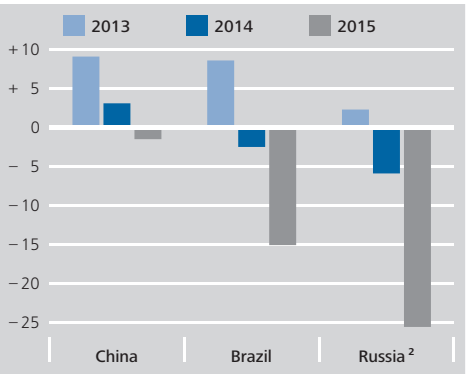
1 The discrepancy between the real rates of change in global exports and imports of goods calculated by CPB points to certain statistical problems at the current juncture. With an increase of 3¼%, the reported rate of growth for international exports is almost twice as high as that for global imports (1¾%).
2 The industrial countries' exports of goods (+2%) did not rise to the same degree as their imports (+3½%). In relation to the meagre growth in their industrial output (+¾%), however, the increase in exports was still noteworthy.
3 In the national accounts, euro-area imports also include the individual member states' imports from other euro-area countries.
4 China publishes data on price-adjusted foreign trade flows based on unit values only. In this approach, imports of goods decreased by 2% in 2015.
5 According to the OECD's Trade in Value Added database, the import content of China's consumption was only around 10%, compared with 18% for investment and 30% for exports (based on 2011 in each case; more recent data is not available).

Growth in goods imports in major EMEs

Year-on-year percentage change, price-adjusted [1]



Sources: National statistics and Bundesbank calculations. **1** For China and Brazil, prices adjusted using unit values. **2** Based on national accounts (incl services).

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growth – and hence also the growth in demand components – was potentially somewhat lower last year than officially stated.[6]

Aside from China, the main contributors to the decline in EME imports last year were Brazil and Russia. In both economies, the loss of income brought about by the drop in commodity prices choked domestic demand. In the case of Brazil, the commodity-related strains were compounded by a serious political crisis as well as the limited abilities of monetary and fiscal policy. Although final domestic demand subsided to a comparable extent in both countries, the slump in imports was still significantly stronger in Russia. The relatively sharp depreciation of the rouble was one likely factor. Another potentially pertinent factor was that, as part of a new development strategy, the Russian government has opted to push ahead with domestic production in place of imports.[7]

6 The procedure used by the Chinese statistical office to deflate nominal value added is likely to overstate the real GDP growth rate at present. See Deutsche Bundesbank, Global and European setting, Monthly Report, November 2015, pp 14-15.
7 The ban on imports of food from the west, which the country imposed in response to international sanctions, can also be considered in this connection.

production chains. However, it has ceased to rise at the pace seen in pre-crisis years. This may have contributed to the decline in global trade elasticity.[23] But this may also be interpreted as a cyclical phenomenon rather than a structural dislocation, since trade in intermediate goods is subject to sharper cyclical swings.[24]

… or to trade in value added

Trade in value added, which is estimated by linking national input-output accounts, presents a similarly ambivalent picture.[25] On the one hand, foreign value added as a share of exports fell significantly in the course of the financial and economic crisis in 2009. On the other hand, it recovered somewhat during the following two years. Veenendaal et al (2015) point out that in 2011, the year up to which the data run, particularly foreign value added as a share of exports of European and east Asian countries moved towards new all-time highs.[26] Nagengast and Stehrer (2015) show that a restriction of the division of labour played a considerable part in the decline of value added trade in 2009, and that by 2011 the degree of specialisation had not yet regained its pre-crisis level. Moreover, the results of their study point to a cyclical pattern in specialisation, indicating that a reduction of the division of labour is not unusual in an economic downturn, and that in a downturn phase, a change in the degree of

23 See B Gangnes, A C Ma and A Van Assche, Global value chains and the trade-income relationship: Implications for the recent trade slowdown, in B Hoekman (ed, 2015), The Global Trade Slowdown: A new normal?, Centre for Economic Policy Research, VoxEU.org eBook, pp 111-126.
24 The main reason for this may be that trade in intermediate goods is more closely related to the manufacturing of capital goods than to that of consumer goods. See K Stratford (2015), Why has world trade been so weak in recent years?, op cit.
25 Information of this kind becomes available with a considerable delay. For instance, the World Input-Output Database currently only runs up to 2011. See, for example, R C Johnson (2014), Five facts about value-added exports and implications for macroeconomics and trade research, Journal of Economic Perspectives, Vol 28, pp 119-142.
26 See P Veenendaal, H Rojas-Romagosa, A Lejour and H Kox, A value-added trade perspective on recent patterns in world trade, in B Hoekman (ed, 2015), The Global Trade Slowdown: A New Normal?, Centre for Economic Policy Research, VoxEU.org eBook, pp 161-178.

specialisation could even be more significant than in a phase of expansion.[27] Thus, the evidence does not provide compelling proof that the structural link between trade growth and economic growth was impaired.

Effect of protectionist measures probably fairly minor

Trade policy appears to do little to explain the decline in elasticity. According to World Trade Organisation (WTO) data, more trade-restricting measures are introduced year for year than are abolished. However, the speed at which they are introduced has varied little in recent years. What is more, only a small fraction of global trade in goods is subject to the new restrictions that have been implemented since 2008.[28] Overall, the part that protectionism played in the collapse of world trade during the financial and economic crisis is considered to be marginal.[29] Of course, it is sometimes difficult to gauge the impact of such measures. Very little headway has been made since 2005 in the dismantling of tariffs, which is clearly quantifiable by comparison, after good progress had previously been made.[30]

Another trend that has virtually come to a halt in recent years is the political fragmentation of the world. The drawing of new borders creates international trade without a rise in income, as hitherto domestic flows of goods are subsequently counted towards foreign trade.[31] According to a study by Lavallée and Vicard (2013), around 17% of world trade was attributable to such a statistical artefact in 2007 compared with 1948.[32] The number of sovereign states rose significantly in the 1990s in particular following the collapse of the Soviet Union.

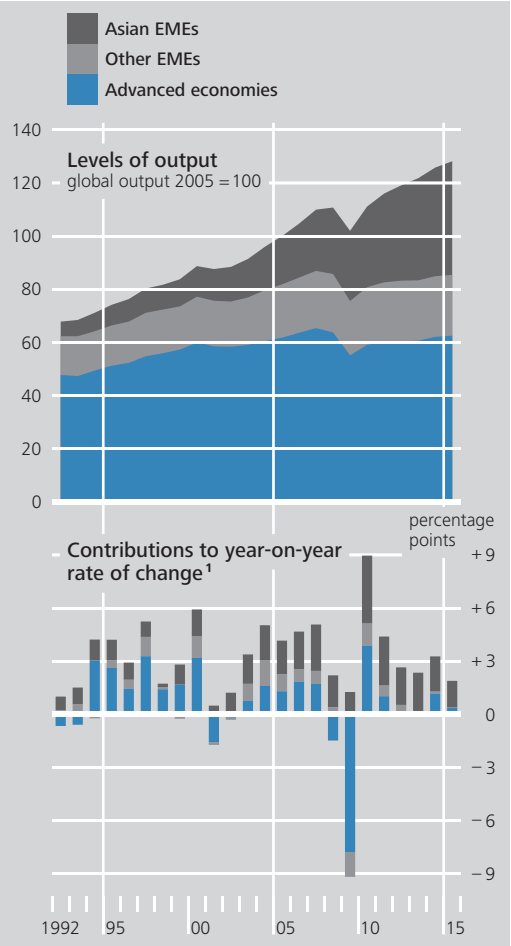
Process of political fragmentation slowed down, too

Over and above any additional explanatory variables, factors should be emphasised that generally impair the meaningfulness of studies on world trade. Ultimately, it is the develop-

Price adjustment of foreign trade flows problematic

Regional breakdown of global industrial output

Price-adjusted (base year 2005)



Source: Bundesbank calculations based on Centraal Planbureau data (CPB, World Trade Monitor); country groups according to CPB classification. **1** Owing to inaccuracies, contributions do not add up exactly to the rate of change of the world production index published by CPB.

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27 See A J Nagengast and R Stehrer, The great collapse in value added trade, Deutsche Bundesbank Discussion Paper, No 47/2015.

28 According to the WTO, 4½% of global imports and 6% of imports by the G20 economies are subject to trade restrictions that the G20 countries have introduced since 2008. Moreover, many new trade-facilitating measures have been counted of late. See WTO, Report on G-20 Trade Measures, 30 October 2015; WTO, Overview of Developments in the International Trading Environment, Annual Report by the Director-General, 17 November 2015; and European Commission, Understanding the Weakness in Global Trade, European Economic Forecast, Winter 2015, pp 46-49.

29 Kee et al (2013) put it at US$43 billion or 2% of the decline. See H L Kee, C Neagu and A Nicita (2013), Is protectionism on the rise? Assessing national trade policies during the crisis of 2008, Review of Economics and Statistics, Vol 95, pp 342-346.

30 See UNCTAD (2015), The Trade Slowdown, Key Statistics and Trends in International Trade.

31 A further point is that the trade of some countries was not recorded at all in international statistics before they gained independence.

32 See E Lavallée and V Vicard (2013), National borders matter … Where one draws the lines too, Canadian Journal of Economics, Vol 46, pp 135-153.

Growth of global import of goods and correlation with growth in industrial output

Year-on-year percentage change

Source: Bundesbank calculations based on data from Centraal Planbureau (CPB, World Trade Monitor). Growth rates according to differences in logarithmic levels. **1** Aggregate volume of imports of goods by the economic areas USA, Japan, euro area, other advanced economies, Asian EMEs, central and eastern Europe, Latin America as well as Africa and Middle East (country groups according to CPB classification). **2** Regression of the logarithmic level of real imports of goods on the logarithmic level of industrial output as well as a constant for the 1991-2007 period. **3** Aggregation of the estimated rates of change for the respective economic areas.

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ment of real variables that is relevant for economic analysis. However, the necessary price adjustment of flows in terms of value entails considerable problems. Besides nominal imports and exports, unit values are also recorded in foreign trade statistics; but often these do not adequately take differences in quality into account.[33] On the other hand, the price indices constructed for this purpose may be slow to capture trade in new products. Moreover, the quality of the measurement is not assured to the same extent as with consumer prices. These measurement difficulties not only impair the estimates of real trade flows: they may also make it more difficult to identify the effect of relative price shifts, which should – alongside increases in income – be given a major role in determining changes to imports and exports.

Robustness of data for emerging market economies questionable

The robustness of data for emerging market economies in particular is not assured. China's statistics office does not publish any price-adjusted import or export series in its national accounts.[34] Questions also arise regarding the data on macroeconomic growth, notably in connection with deflating.[35] Since India revised its official statistics, the country's economy has presented a markedly more favourable picture of the last few years[36] which is not necessarily in keeping with key economic indicators. In view of this, it would be wrong to draw too sweeping conclusions from the finding that import volumes saw a weaker development in major emerging market economies in particular than would have been expected from the historical correlations to real GDP growth.

Conclusion and further considerations

Speed and composition of global economic growth of relevance to world trade weakness

To a great extent, the weakness of international trade in recent years has been directly attributable to the slowdown in global economic growth. Beyond that, however, it raises the fundamental question as to whether the process of globalisation and therefore of international specialisation has slowed down. This would have to be reflected by a broad-based reduction in country-specific trade elasticities. Apart from several exceptions, there are no clear signs of this. Rather, it may be seen that the shift of economic growth towards countries with low trade elasticities has reduced global elasticity. In contrast to the pre-crisis years, global economic growth in the past few years has for the most part been driven by the emerging market economies, whose growth shows a relatively low import intensity. Viewed in isolation, this effect goes some way towards solving the riddle surrounding world trade. The explanatory contribution becomes greater when shifts in the supply and demand-side composition of economic activity are likewise

33 See M Silver (2010), The Wrongs and rights of unit value indices, Review of Income and Wealth, Vol 56, pp 206-223.
34 The data used here are estimates by the World Bank.
35 See Deutsche Bundesbank, Global and European setting, Monthly Report, November 2015, p 15.
36 See Deutsche Bundesbank, Global and European setting, Monthly Report, February 2015, p 15.

The catching-up process of major emerging market economies and its implications for global trade – an analysis using the gravity model

Prior to the global financial and economic crisis, the rapid growth of key emerging market economies (EMEs) was accompanied by a massive increase in their foreign trade activities. In the case of China, in particular, the build-up of a high-performing manufacturing industry was seen as an engine of the catching-up process. China's industrial sector specialised in turning imported inputs into finished products for export to many regions in the world, particularly the advanced economies. Although the EMEs' economic upturn has tailed off in recent years,[1] they have maintained their lead in growth over the advanced economies. However, foreign trade flows have seen even more pronounced deceleration. This box will discuss some of the implications of the persistent gap in growth between the industrialised nations and the EMEs for the ratio between the growth rates of international trade flows and global GDP, ie the global trade elasticity. It will devote particular attention to the role played by China.

The analysis will begin with a simple gravity equation which, in modified form, is the basis for many empirical studies of foreign trade.[2] According to Newton's Universal Law of Gravitation, the attraction (F) between two masses (M_i and M_j) increases in proportion to the product of these variables and falls as the distance between them (D_{ij}) increases, while g is a constant:

$$(1)\ F_{ij} = \frac{gM_iM_j}{D_{ij}^2}.$$

By analogy, trade (T_{ij}) between two countries (i and j) can be modelled as the output of their economic masses (measured in terms of real GDP Y), the distance between them and a constant (k):

$$(2)\ T_{ij} = \frac{kY_iY_j}{D_{ij}^2}.$$

Approaches of this type are compatible with a variety of stylised facts. Neighbouring countries tend to share closer trade links than countries further apart; small economies are relatively open (ie trade is important relative to income), whereas large countries are relatively closed.

According to the gravity equation, the economic power of both partners is relevant to the intensity of their exchange of goods; at a given overall income, the ratio between the two economies' sizes plays a role. If distance does not matter, bilateral trade is maximised if the two economies are the same size; similarity permits intensive economic relationships. In such a world without distances, the rate of change in bilateral goods trade is determined by the sum of national gross domestic product (GDP) growth rates. If these differ, the fast-growing economy will have a low elasticity owing to the consistent increase in bilateral trade, while the slow-growing economy will have a high elasticity.

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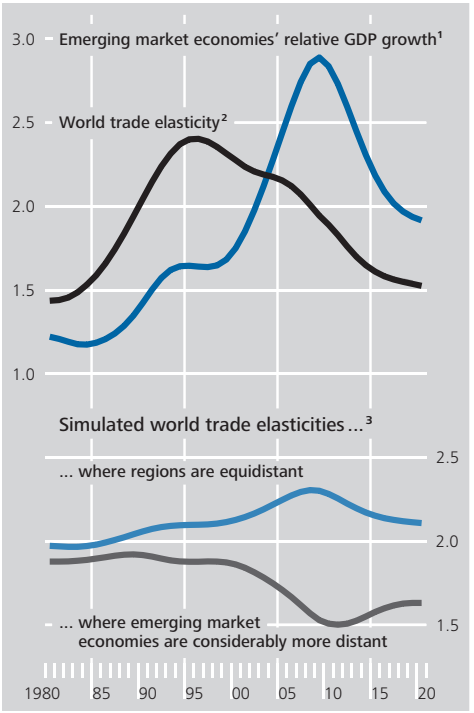
1 See Deutsche Bundesbank, Slowdown in growth in the emerging market economies, Monthly Report, July 2015, pp 15-31.

2 For more information on the following, see P Krugman (1995), Growing world trade: causes and consequences, Brookings Papers on Economic Activity, Vol 1, pp 327-362, as well as, and in particular, P Hong (1999), Import elasticities revisited, United Nations Department of Economic and Social Affairs Discussion Paper No 10.

World trade elasticity and income convergence



Source: Bundesbank calculations based on data provided by the World Bank (World Development Indicators) and the IMF (World Economic Outlook, October 2015); IMF data for 2015 are partly estimated, and data as of 2016 are IMF projections. Global aggregates refer to a group of 42 countries. Real variables aggregated using nominal weights for the year 2005. Trend extracted using the Hodrick-Prescott filter (smoothing parameter of 100). Relative growth and elasticities are non-unit. **1** Ratio of trend growth rates of EMEs' real GDP to the global aggregate. **2** Ratio of trend growth rates of the global trade volume to GDP. **3** Based on gravity equations for three regions and assuming the level and growth of trend real GDP for the euro area, the other advanced economies and the EMEs.

Deutsche Bundesbank

If the bilateral flows (for the countries $i = 1, \ldots, q$) are aggregated, one obtains for global trade, disregarding distances,

$$(3)\ T_w = kY_w^2\left(1 - \sum_{i=1}^{q} s_i^2\right),$$

where s_i denotes a country's share of global economic output. Consequently, the last term represents the impact of the size differential between the economies. If they are identical, this maximises global trade. The equation also implies a global trade elasticity of 2, provided the weights do not shift during the growth process.[3] If the size differentials shrink, ie, for instance, the EMEs gain ground against the advanced economies, this results in a higher elasticity.

Against this background, the flow and ebb of the EMEs' catching-up process has been cited as an explanation for the observed evolution of global trade elasticity.[4] If trade is simulated for three regions (euro area, other advanced economies and EMEs) according to equation (2) with the respective trend components of real GDP growth, global trade elasticity goes up in the years prior to the financial and economic crisis; it subsequently falls to again approach the value of 2.[5] This is predicated, however, on disregarding the distance between the regions. In actual fact, however, global trade elasticity in the past few years did not return to its long-run level but even dropped well below it. Above all, however, the slump had already started prior to the crisis, just as the convergence process was beginning to pick up considerable steam.

Such a trend can be retraced using equation (2) if the economically relevant distance

3 It must be emphasised here that this elasticity value is the outcome of an analogy to a purely physical model. By contrast, linking the gravity equation to economic approaches generally leads to an elasticity value of 1. This is because, in a world with no distortions and identical preferences, each country's share of expenditure on goods must be the same everywhere, consequently representing its share of global GDP. In place of a constant, the inverse of global GDP is then entered into equation (3). See P Hong (1999), Import elasticities revisited, loc cit; J E Anderson (1979), A theoretical foundation for the gravity equation, American Economic Review, Vol 69, pp 106-116; and J E Anderson (2010), The gravity model, National Bureau of Economic Research, Working Paper 16576.

4 See H Escaith and S Miroudot, World trade and income remain exposed to gravity, in B Hoekman (ed, 2015), The global trade slowdown: a new normal?, Centre for Economic Policy Research, VoxEU.org eBook, pp 127-160.

5 The GDP data refer to a group of 42 economies (see technical annex on p 33). For the constant and the distances in equation 2, values were entered in order to roughly model the dimensions of the actual trade volume. Note that this experiment only simulates trade flows between regions, not those between economies within a region, which are likewise contained in the actual trade data.

between the EMEs and advanced regions is sufficiently larger than the relevant distance between the developed economies.[6] A recovery process in the periphery will do only relatively little to stimulate international trade.[7] Here, the EMEs' greater distance is to be understood not only in a geographical sense. It could also be interpreted as the subordinated importance of final demand in the EMEs. Given that the international division of labour is primarily geared towards production to meet final demand in the advanced economies, it comes as no surprise that faster-growing demand in the EMEs does relatively little to boost global trade.

The gravity equation illustrates the fact that the trade flows of an economy are influenced by the level and growth of real GDP in its partner countries. It is particularly some Asian EMEs which, in the past, made good progress by building up an efficient export sector. According to the Penn World Tables, South Korea, for instance, increased its per capita GDP based on purchasing power parities (PPPs) from 7% of the US level in 1960 to 65% in 2010. Over the same period, the ratio of goods exports to GDP rose from 1% to 42%. China followed a similar, though lagged, path, and in 2010 achieved one-fifth of US per capita income with a ratio of goods exports to GDP of around 20%; this is more or less where South Korea stood in 1980. Against this background, one might get the impression that China's export-driven recovery process could still have quite a future ahead of it. However, whereas South Korea is a small country which can relatively easily create a niche in the system of the international division of labour, China's sheer size alone tends to set limits to the Chinese economy's export growth.

Degree of openness, income convergence and economic size

%

Sources: Penn World Tables 8.1, World Bank (World Development Indicators), national statistics and Bundesbank calculations. **1** Based on purchasing power parities. **2** Goods and services. **3** Based on market exchange rates.

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Thus, in Japan, which should likewise be regarded as a relatively large economy, the export sector never achieved the dimensions that can currently be seen in South Korea. According to data from the World Bank, which are based on conversions using market exchange rates, China accounted in

6 Some gravity models take into account relative trade costs ("multilateral resistance"). See J Anderson and E van Wincoop (2003), Gravity with gravitas: a solution to the border puzzle, American Economic Review, Vol 93, pp 170-192.

7 Admittedly, the sharp rise in global trade elasticity in the 1990s cannot be simulated in this fashion. From an accountig point of view it is attributable mainly to the advanced economies.

2014 for just over 13% of global (nominal) GDP.[8] Japan had such a weight in 1986 – yet its exports (of goods and services) to GDP ratio, at 11%, was a paltry half the level last seen in China. Measured in terms of the global importance of the Chinese economy, its export sector is thus already strikingly massive. Indeed, in 2014 China was tied with the United States of America as the number one leading exporter, accounting for 10% of the value of global exports.[9]

Given that there still exists a pronounced income dispersion, China's real GDP is likely to grow considerably more rapidly than that of the rest of the world in the years to come as well. On the other hand, in the long run China's exports will not be able to grow more strongly than the partner countries' imports.[10] Chinese exporters appear recently to have been having a more difficult time expanding their market share further.[11] Consequently, for China, like other countries, export growth will be increasingly constrained by the growth of sales markets. Owing to the very rapid pace of income growth, some years ago China already reached the point as of which export growth lagged behind its own GDP growth rate. Thus, the exports-to-GDP ratio fell from its high of nearly 36% in 2006 to a mere 22½% in 2014. In order to maintain its openness to some degree, China would have had to enhance its global market share perceptibly more strongly in the past few years.

Should the Chinese economy continue to grow considerably faster than the rest of the world in the future, too, its exports-to-GDP ratio is likely to drop further – and its trade elasticity to be correspondingly low. This is ultimately a mirror image of developments in the United States or Japan, the economies of which are similarly large but are growing more slowly. Those countries' degree of openness is increasing, whereas their relative importance for global GDP is declining.[12] On the whole, it is no big surprise that China, as part of its transition to a large economy, is becoming more and more a closed economy.[13] Admittedly, the high GDP growth projected by many for China in the coming years is by no means a done deal. Given that foreign trade is not expected to provide much of a boost, and that investment is already playing an outsized role, Chinese consumption is going to have to become the driver of the Chinese upswing.

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8 Whereas incomes should be converted based on PPPs in order to compare standards of living, it is advisable to use market exchange rates in order to reflect the actual size of economies.

9 According to these figures, Germany's share amounted to 7½%.

10 See also M D Chinn, China's trade flows: some conjectures, in B Hoekman (ed, 2015), The global trade slowdown: a new normal?, Centre for Economic Policy Research, VoxEU.org eBook, pp 229-252.

11 In the past few years, the Chinese share of total industrial goods imports to the European Union and the United States has already even begun to stagnate. See Deutsche Bundesbank, The development of labour costs in China and their impact on consumer prices in the industrial countries, Monthly Report, May 2013, pp 13-15.

12 The German economy's openness is also rising in inverse proportion to its weight in the world. It is already a relatively highly open economy owing to its interlinkages within Europe.

13 This is consistent with a model of intra-industry trade in which the consumers' basket of goods reflects global output shares. An economy becomes more closed as its size increases since consumption reflects the growing global significance of domestic production. The economies' relative sizes then represent a key determinant of global trade. As the size and per capita income of an economy grow, intra-industry trade gains in empirical importance. The increasingly important role of intra-industry trade for China is also verified. See E Helpman (1987), Imperfect competition and international trade: evidence from fourteen industrial countries, Journal of the Japanese and International Economies, Vol 1, pp 62-81, B Balassa (1986), Intra-industry specialization – a cross-country analysis, European Economic Review, Vol 30, pp 27-42, and G M Caporale, A Sova and R Sova (2015), Trade flows and trade specialisation: the case of China, China Economic Review, Vol 34, pp 261-273.

taken into consideration. This is because only emerging market economies have generated the increase in worldwide investment activity and in industrial output, which have proved to be especially trade-intensive, since the economic and financial crisis.

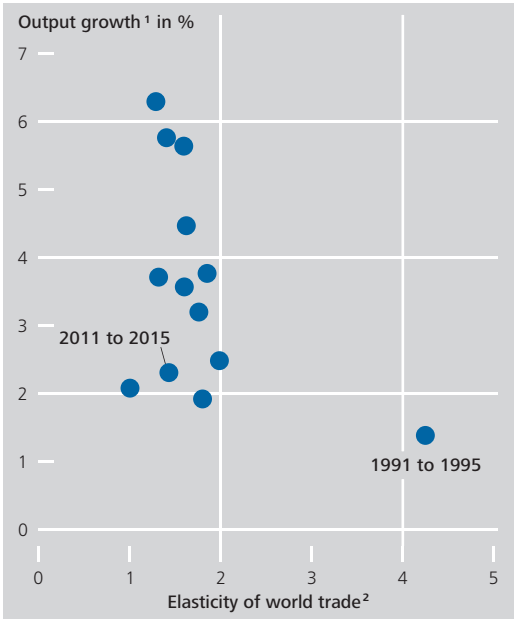
Possible endogeneity of national elasticities

However, it is questionable to what extent elasticities are actually structural in nature at the national level. It is striking that particularly countries with high economic growth have low trade elasticity. This means that the different degrees of elasticity could reflect relative growth.[37] This is seen in a simple, structureless gravity model in which the trade flows of an economy are also determined by the partner countries' income and distance (see the box on pages 27 to 30). Under such an approach, global elasticity is also dampened by growth ratios when global economic growth is generated mainly in countries far removed from the centres of world trade. Given that emerging market economies focus more strongly on supplying primary and intermediate products and exporting final consumer goods to the industrial countries, it is not surprising that the growth of their final domestic demand – and notably in consumption – possibly creates relatively little stimulus to world trade.

Implications of surging economic growth in China

With regard to the Chinese economy, the high growth rate of real GDP implies a substantial rise in the degree of openness, even with a trade elasticity of only slightly more than 1. Moreover, the international growth differential is resulting in a rapid increase in the Chinese share in world trade. For a while, Chinese exports did profit from massive market share gains abroad. But in the long run, China's exports cannot grow much more strongly than the imports of its partner countries.[38] Chinese imports, on the other hand, ultimately have to keep in step with exports if a growing external imbalance is to be avoided. Thus it follows that a persistent gap in growth between China and the rest of the world causes a drop in the elasticity of Chinese imports such as is also estimated in the IMF staff projections.[39] In view of its rapidly growing global importance, China may appear to be "closed" in much the same way as other large economies. Alternatively, Chinese GDP growth could decline more strongly than expected, or the real exchange rate could undergo a correspondingly marked adjustment.

Global output growth and elasticity of world trade between 1951 and 2015



Source: Bundesbank calculations based on WTO data (International Trade Statistics 2015); for 2015, based on Centraal Planbureau data (World Trade Monitor). **1** Average growth in global output of goods in five-year periods in each case. **2** Quotient of the average growth rates of global export volumes (goods) and of output of goods in five-year periods in each case.
Deutsche Bundesbank

37 As early as 1989, Krugman pointed to a link between relative trade elasticities and relative growth rates, and proposed supply-side effects as an explanation. Wu (2008) developed an intertemporal model in this regard. See P Krugman (1989), Differences in income elasticities and trends in real exchange rates, European Economic Review, Vol 33, pp 1031-1047; and Y Wu (2008), Growth, expansion of markets, and income elasticities in world trade, Review of International Economics, Vol 16, pp 654-671.
38 In a number of industrial countries in particular, the persistence of rather large external trade balances is sometimes also noticeable. However, this is a reflection of differences in import and export levels and not of lasting discrepancies in dynamics.
39 In the World Economic Outlook (WEO) of October 2015 for 2020, China's imports were projected to rise by just 4% compared with an increase in GDP of 6¼% over the same period.

Balance of payments constraints in emerging economies

Generally speaking, the advanced economies' imports restrict the emerging market economies' imports if the latter have to be paid for using foreign currency revenues from current export revenues.[40] A slowdown in economic growth in the industrial countries would then impair the income elasticity of imports in other countries. The adjustment pressure on important commodity-exporting emerging market economies is likely to be increased even more by, at times, sharp deteriorations in the terms of trade. This is consistent, for instance, with the fact that the Russian current account continues to record a surplus despite the plunging oil prices – not least because the country has imposed dramatic restrictions on imports.

Benchmark of elasticity possibly too high

It is not unusual for the elasticity of global trade to fluctuate. Particularly striking is the increase of this elasticity in the 1990s. Very long time series are needed to put this period into context and examine its suitability as a reference measure. The WTO provides annual data on global output and real exports of goods starting from 1950. When average global output growth and the trade elasticities are calculated for five-year periods in each case, the elasticities fluctuate between 1 and 2 almost without exception. The years 2011 to 2015 are also to be found within this band, with a value of 1.4.[41] The elasticity of 2 calculated for the period 1980 to 2007 is due, above all, to an unusually high figure in the first half of the 1990s.[42] Running counter to the usual cyclical pattern, trade in goods picked up substantially between 1991 and 1993, whereas output contracted slightly. However, this period is likely to represent an anomaly because of major steps taken towards integration in Europe such as the creation of the single European market, the opening up of the former transition countries and the emergence of numerous new countries. But given the inclusion of large emerging market economies like China and India in the global economy, this could – to an extent – be true of later years as well. This would mean, however, that an elasticity level of 2 may be an excessively high yardstick.

Implications for economic policy

All in all, there is much evidence to suggest that global trade is not inherently weak. At the end of the day, international trade in goods cannot build up much momentum as long as the industrial countries generate only comparatively weak economic growth. Given that the emerging market economies are likely to retain their growth lead, we can expect global trade to continue posting subdued growth in the years ahead. No economic policy action needs to be taken on this basis alone. Nevertheless, additional efforts to liberalise the markets could provide global trade with a key boost.

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40 According to "Thirlwall's Law", the long-run growth rate of an economy depends on the relative trade elasticities and the pace of growth in the rest of the world. See A P Thirlwall (1979), The balance of payments constraint as an explanation of international growth rate differences, Banca Nazionale del Lavoro Quarterly Review, Vol 128, pp 46-53.

41 Centraal Planbureau data on global industrial output and on the global export of goods serve as the basis for 2015.

42 See Deutsche Bundesbank (2013), The empirical relationship between world trade and global economic output, op cit; and D A Irwin, World trade and production: A long-run view, in B Hoekman (ed, 2015), The Global Trade Slowdown: A New Normal?, Centre for Economic Policy Research, VoxEU.org eBook, pp 21-30.

Technical annex

Sample of 42 countries representative of world economy

The empirical analysis drew on nominal and real annual data for imports (goods and services), GDP, consumption and gross investment for 42 countries in the period from 1979 to 2015. The main source used was the World Bank's World Development Indicators (WDI); the most recent data were added from the IMF's *World Economic Outlook* (WEO) of October 2015.[43] In line with the IMF's framework, the country group was subdivided into 24 advanced economies and 18 emerging market economies (EMEs).[44] A number of EMEs for which there are no sufficiently long time series were dropped from the dataset. This particularly relates to EMEs in central and eastern Europe and in the Middle East. However, the sample contains major EMEs, including China, India, Indonesia and Brazil. In total, the sample represented approximately 84% of global economic activity and 76% of global imports in 2014. As in the IMF's approach, the national growth rates of the real variables were aggregated using nominal shares (always based on market exchange rates). The rates of change constructed in this way for the country group in question largely match the IMF's data for the world as a whole. In particular, the significant decline in aggregate trade elasticity since the period prior to the global financial and economic crisis is traced, which means that the dataset is suitable for examining the relevant composition effects.

Elasticity of imports as ratio of growth rates

In economic theory, elasticity expresses the percentage by which a variable changes depending on the percentage change of another variable. Trade elasticity is understood here as the responsiveness of the trade volume (goods and services) to real GDP. We use price-adjusted imports owing to the closer relationship to domestic economic activity. A simple measure of elasticity is the ratio of the (average) growth rates for imports (M) and for GDP (Y) in real terms over a given period:

$$\text{(1a)}\ \eta = \frac{\Delta M}{M} / \frac{\Delta Y}{Y}.$$

Components of global elasticity

The rate of change in global imports is defined as the weighted sum of the corresponding growth rates for the individual countries $(i = 1, \ldots, q)$; the shares in nominal imports (M^n) serve as weights. This means that elasticity at the global level can be expressed as

$$\text{(1b)}\ \eta_w = \left(\sum\nolimits_{i=1}^{q} \frac{\Delta M_i}{M_i} \frac{M_i^n}{M_w^n}\right) / \frac{\Delta Y_w}{Y_w}$$

Extending the numerator and denominator to each include the national rates of change in (real) GDP gives global trade elasticity as a weighted sum of national elasticities, with the weight of a given country determined by the product of its import share and its GDP growth in relation to the expansion of global economic activity:

$$\text{(1c)}\ \eta_w = \sum\nolimits_{i=1}^{q} \eta_i \frac{M_i^n}{M_w^n} \frac{\Delta Y_i}{Y_i} / \frac{\Delta Y_w}{Y_w}.$$ [45]

The national elasticities weighted in this way can be interpreted as contributions to global elasticity.

Disadvantages of a simple growth ratio as elasticity

Since the ratio of rates of change in imports to GDP does not take into account the influence of other variables, especially relative prices, its usefulness is potentially limited. It is often simply referred to as apparent elasticity. In a scatter plot depicting the log of the levels of imports and economic activity, it corresponds to the incline of a straight line drawn through the start and end point of the observation period. Because the other observations ultimately do not play a role, a longer period should be selected for a representative ratio.

Regression of log of levels

To fit a straight line to all observation points, use can be made (due to the cointegration of the variables) of a regression of the log of the levels (with a constant α and ϵ as residual):

$$\text{(2a)}\ lnM_t = \alpha + \beta \cdot lnY_t + \epsilon_t\,.$$

The coefficient β can then be interpreted directly as a measure of the incline, or elasticity. However, the long pre-crisis period selected here ensures that the

43 Since the IMF does not publish any time series on real gross investment, the nominal rates of change calculated from the available investment ratios were used for 2015, under the assumption that there were no relative price shifts. These data for 2015, in particular, should thus be treated with caution.
44 Specifically, the advanced economies are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Singapore, South Korea, Spain, Sweden, the United Kingdom and the United States. The EMEs, on the other hand, are Argentina, Brazil, Chile, China, Columbia, Egypt, India, Indonesia, Malaysia, Mexico, Morocco, Pakistan, Peru, the Philippines, South Africa, Thailand, Uruguay and Venezuela.
45 See C Constantinescu, A Mattoo and M Ruta (2015), The global trade slowdown: cyclical or structural?, op cit.

Pre-crisis trade elasticities[1]

Model	Period	Measure of elasticity			
			World[2]		
				Industrial countries[3]	EMEs[4]
Ratio of average growth rates of real imports[5] and real GDP (1a)	1980-2007	η	2.0	2.1	1.6
Regression of real imports[5] on real GDP (2a)	1979-2007	β	2.1 (0.04)	2.2 (0.04)	1.7 (0.05)
Regression of real imports[5] additionally including relative import prices (2b)	1979-2007	β	2.4 (0.14)	2.6 (0.12)	1.5 (0.04)
Regression of real goods imports on industrial output (3a)	1991-2007	β	2.2 (0.06)	2.9 (0.08)	1.7 (0.03)
Regression of real imports[5] on real consumption expenditure and gross investment as well as relative import prices (3b)	1979-2007	β	1.8 (0.41)	2.1 (0.29)	0.4 (0.24)
		y	0.6 (0.30)	0.5 (0.24)	1.0 (0.18)
Adjustment[6] of standardised growth rates for real GDP (4b)	1990-2007	σ_m/σ_y	4.1	4.4	2.8

Source: Bundesbank calculations based on annual data from the World Bank, the IMF and Centraal Planbureau (CPB); some IMF data for 2015 are estimates. **1** Aggregations generally based on market exchange rates. Regressions of logarithmic levels taking into account a constant; standard error of the estimated coefficients in brackets. **2** Aggregate for 42 countries (country groups according to the IMF classification) or CPB country group (3a). **3** Aggregate for 24 advanced economies or CPB country group (3a). **4** Aggregate for 18 EMEs or CPB country group (3a). **5** Goods and services. **6** Adjustment to mean and standard deviation of growth rates for real imports (goods and services).

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simple ratio of growth rates generally does not differ significantly from β.

Influence of relative prices

The regression method can also take into account the influence of additional variables.[46] Income elasticity and price elasticity of imports have traditionally been determined simultaneously using a regression of the log of the levels:

(2b) $lnM_t = \alpha + \beta \cdot lnY_t + \gamma \cdot lnP_t + \epsilon_t.$

Here, P is taken as a measure of relative import prices, the selection of which is not trivial, however.[47] If, as in Bussière et al (2013), the ratio of the deflators for imports and GDP is calculated, only limited price effects are revealed in the dataset used in this article. However, the discrepancies between the income elasticities estimated in equations (2a) and (2b) are also small.

Alternative regression methods

The differences in the log of the levels or the rates of change in the variables can be analysed in place of the levels. Equation (2a) implies that import growth is explained solely by changes in income (and random forces). A regression of rates of change only can pose problems, however, as the adjusted straight line has to pass through the origin. If a constant is

46 See Deutsche Bundesbank, The impact of alternative indicators of price competitiveness on real exports of goods and services, Monthly Report, January 2016, pp 13-29.

47 A fundamental work on the income elasticity of various countries' trade flows is the study authored by Houthakker and Magee (1969), which is based on estimates in the form of equation (2b). The price measure they selected was the ratio of the import price index to the wholesale price index; the latter was used due to the unavailability of a price index for goods that compete with imports. The authors deliberately discarded the option of using the GDP deflator as a reference measure, citing the influence of non-traded goods. Other studies have opted to use the readily available GDP deflators. In their export equations, Houthakker and Magee calculated the ratio of a country's export prices to those of other exporting countries. From a global perspective, however, the price ratio between tradable and non-tradable goods is likely to be of particular importance. Kohli (1982) demonstrated the implications of different formulations for the price elasticities of import demand and stressed that such price and volume effects are always derived under certain ceteris paribus assumptions and should be interpreted accordingly. See H S Houthakker and S P Magee (1969), Income and price elasticities in world trade, Review of Economics and Statistics, Vol 51, pp 111-125; and U R Kohli (1982), Relative price effects and the demand for imports, Canadian Journal of Economics, Vol 15, pp 205-219.

taken into account, however, the influence of trend growth will probably also be ascribed to this term. The regression coefficient for the rate of change of GDP then mainly reflects short-term, cyclical influences and is therefore comparatively high.

Error correction models combine this kind of formulation of the short-term relationship with a long-term relationship of the levels. However, Ollivaud and Schwellnus (2015) point out that the long-term elasticity derived in this way is severely instable for short observation periods, as they argue the model cannot differentiate between short-term growth and the long-term relationship.[48] Alternatively, short-term and long-term elasticities can be determined using a regression of the levels, which additionally takes account of lags in the variables and has favourable properties on the whole, according to Irwin (2002).[49] In this way, the current slackness of world trade is explained to a certain extent by the preceding weakness.

Elasticities in respect to industrial production or investment

To depict the comparatively strong fluctuations in trade flows, variables behind the cyclical fluctuations in GDP could also be analysed. To do so, the first step was to determine the elasticity of goods imports, in particular, in respect to industrial production *(IP)*based on CPB data with the aid of regressions in the same way as equation (2a):[50]

(3a) $lnM_t = \alpha + \beta \cdot lnIP_t + \epsilon_t\,.$

Second, regressions were estimated according to equation (2b), which, instead of real GDP, used (price-adjusted) consumption *(C)* and gross investment *(I)* as explanatory variables:

(3b) $lnM_t = \alpha + \beta \cdot lnC_t + \gamma \cdot lnI_t + \delta \cdot lnP_t + \epsilon_t.$

However, the added explanatory contribution of this model is only revealed at the current end.[51]

Adjustment of standardised GDP growth rates

In all of these approaches, import growth ultimately cannot be wholly explained by changes in domestic activity variables. The method used by Stratford (2015) assumes perfect correlation, however. Specifically, the rates of change in real GDP *(y)* are first standardised, which is to say they are adjusted for their mean $(\bar{y})$ and their standard deviation (σ_y):

(4a) $y_t^{ST} = \frac{y_t - \bar{y}}{\sigma_y}.$

The standardised GDP rates are then extrapolated using the mean $(\bar{m})$ and the standard deviation (σ_m) of the import rates to arrive at the adjusted rates as a reference measure for import growth:

(4b) $y_t^{AD} = \sigma_m \cdot y_t^{ST} + \bar{m}\,.$

The short-term elasticity of imports is thus influenced by the (high) ratio of the standard deviations. It should be emphasised that this approach postulates constant trend growth in imports. A downward deviation from this trend is always interpreted as a temporary phenomenon within the range of normal volatility, even if it actually represents a trend slowdown in growth. Against this backdrop, it is questionable whether this approach is truly suited to explaining the persistent weakness of world trade.

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48 See P Ollivaud and C Schwellnus (2015), Does the post-crisis weakness of global trade solely reflect weak demand?, op cit.

49 See D A Irwin (2002), Long-run trends in world trade and income, World Trade Review, Vol 1, pp 89-100.

50 Data on the deflators relevant to industrial production and that could be used to construct relative prices were not available.

51 One problem here could be posed by the changing importance of components of gross investment, which differ considerably in terms of their import content. Construction investment, in particular, is likely to be relatively unimportant to international trade. Furthermore, many countries now also count spending on intellectual property rights as investment. This expenditure has grown in importance in the advanced economies over the past few years.