Eurozone and United States in 2011: growth despite shocks

Dorian Roucher

Division Synthèse conjoncturelle

Matthieu Lequien
Amélie Mauroux

Division Croissances et Politiques macroéconomiques

A number of shocks hit the United States and the Eurozone in 2011: those that were "external" to the two zones, with the rise in oil and commodities prices and the consequences of the March earthquake in Japan; and domestic shocks, with the sovereign debt crisis in the Eurozone, but also the efforts to consolidate government finances.

The prices of oil and commodities rose sharply between mid-2010 and mid-2011. They then came down slightly but still remained high. The United States, Germany and France, all countries that import raw materials, were penalised in 2011 by the rise in oil prices (-0.3 to -0.4 points), and, to a lesser extent, by the high prices of commodities in 2011 (-0.1 points).

The second shock to affect the United States and the Eurozone was the consequence of the earthquake and tsunami which hit Japan in March 2011. Japanese industrial output, consumption and exports immediately plunged. The shock spread to the rest of the world, first via a drop in Japanese demand for foreign products, and then in terms of world supply, with breaks in certain international production chains. With only minor consequences on world trade, the drop in Japanese demand for finished products had little effect on the exports of the major world economies. The effects of the disruption in production chains appear to have been more marked, although they are difficult to measure.

While monetary policies remained very expansionist, fiscal policies became more restrictive in both the United States and the Eurozone in 2011. This held back activity, in the order of 0.6 points in the Eurozone and 0.4 points in the United States.

Lastly, as early as mid-2010 certain countries of Europe were subjected to strong pressure on the interest rate demanded by investors on their government debt, and this pressure intensified in summer 2011. Of the four biggest Eurozone economies, Spain was the first to be affected by a sharp rise in its long rates, in H2 2010, cutting its 2011 growth by 0.8 points. Italy, where rates only saw a sharp increase after the summer of 2011, lost 0.2 points in 2011. France, and above all Germany, benefited from a "flight to quality" effect with a drop in long rates. This helped sustain investment, although this favourable effect was offset by weak exports to Spain and Italy.

All in all, these shocks slashed about 1 point off growth in the United States and the Eurozone, hindering these economies in their bid to make up the ground "lost" during the crisis. The effect of some of these shocks should be reversed (e.g. the tsunami) or negligible (e.g. commodities prices) in 2012. Conversely, and particularly in the Eurozone, activity is likely to be slowed once again by the step-up in fiscal adjustment measures and persisting tensions surrounding rates which are still close to the level of summer 2011. ■

Eurozone and United States in 2011: growth despite shocks

Activity was relatively sluggish in the United States and in the Eurozone in 2011

Fairly sluggish activity both in the United States and in the Eurozone

In 2011, activity progressed at a similar pace in the Eurozone and in the United States, with respective growth rates of 1.5% and 1.7%. Within the Eurozone itself, the trajectories were very different. Germany continued to grow at a far higher rate than the zone's growth potential (+3.1%), while the Spanish and Italian economies only progressed slightly (+0.7% and +0.5% respectively). France registered a similar growth rate to that of the Eurozone as a whole (+1.7%).

Two very intense external shocks: rise in the prices of commodities...

The sharp rise in the prices of oil and commodities which started in 2010 held back the dynamics of economic recovery, both in the emerging countries and the advanced economies. As early as 2010, the production capacities of the emerging countries were showing signs of overheating, and in these conditions the rise in commodities prices provoked a sharp acceleration in inflation in these countries. The central banks of the main emerging countries then tightened their monetary policies and the governments brought down their deficits, causing a sharp slowdown in these economies, particularly in Q3 2011. In the advanced economies the rise in energy and food prices reduced the gains in household purchasing power and the margins of enterprises.

... and consequences of the Japanese earthquake

Following the earthquake in Japan in March 2011, Japanese industrial output, consumption and exports immediately plunged. This shock spread to the rest of the world, on the one hand via the fall in Japanese demand for foreign products and on the other hand in terms of world supply, with breaks in certain international production chains [1].

Aggravation of the sovereign debt crisis in the Eurozone

As early as mid-2010 certain countries of Europe were subjected to strong pressure on the interest rate demanded on their government debt, most notably Spain and Italy. This pressure intensified in the summer of 2011. The aggravation of the foreign debt crisis in the Eurozone took its toll on the financing conditions of private agents and fueled investors's wait-and-see attitude [2].

Monetary policy still accommodating in the United States and Europe

Faced with the shocks affecting the world economy throughout 2011, the central banks had little room for manoeuvre as their base rates were close to historic lows. The European Central Bank (ECB) briefly increased its base rates in 2011 from 1% to 1.5% following an upsurge in inflation, but at the end of the year brought them down again to 1% in response to fast-deteriorating business prospects.

All year long, the central banks implemented "non-conventional" measures. The American Federal Reserve (Fed) stopped purchasing government debt securities in April 2011 but continued its monetary easing policy with "Operation Twist" in order to bring down long rates: the Fed increased its purchases of long-term Treasury bonds in exchange for short-term Treasury bonds. In December 2011, then in February 2012, the ECB also carried out two operations involving a 3-year refinancing of the banking sector.

Globally restrictive fiscal policies

Accommodating in 2009 and 2010, the orientation of fiscal policies became more restrictive in 2011. Tax rises were applied in Spain and in Italy in 2011. In parallel, government expenditure made a negative contribution to activity in all

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(1) At the end of the year, the floods in Thailand have also caused a slowdown in world trade. However, the effect on growth of the United States and Europe is negligible.

(2) We only estimate the effect on the interest rates. For a quantification of the effects of uncertainty shocks, see *Conjoncture in France* (Zakhartchouk A., March 2012).

the countries of Southern Europe and in the United States. The American Congress nonetheless extended the majority of household income support measures so as not to hinder recovery.

A reassessment of 2011

Numerous shocks therefore affected activity in Europe and the United States in 2011 and the NiGEM multicountry model can be used to assess their effects (*see Box 1*). For each type of shock a counterfactual scenario is built, describing a reference trend. Due to the nature of the shocks examined, their impacts may be added together to obtain a correct approximation of the cumulative effect on activity.

Rises in oil and commodities prices in early 2011 held back activity more in the Eurozone than in the United States

Oil and commodities prices rising sharply from end 2010...

After one year of stability, oil prices increased sharply from summer 2010: the price of North Sea Brent rose from 90 dollars in December 2010 to more than 120 dollars in April 2011 (*see Graph 1*). Similarly, agricultural and non-energy industrial commodities also saw a sharp rise in prices from the summer of 2010 (*see Graph 1*).

The momentum of recovery in the emerging economies clearly sustained demand on all the commodities markets. Additionally, major supply tensions emerged in the course of the year. For example, the price of cereals rose from summer 2010 due to harvest perspectives that were not as good as expected, notably in Ukraine and Russia. On the oil market the geopolitical tensions in North Africa and the Middle East in early 2011 contributed to price rises.

... and then remaining high throughout 2011

Despite a slight drop after the peak of Q2 2011, oil prices remained far higher throughout 2011 than in 2010. Non-energy commodities prices slowed more sharply in spring 2011, with a slowdown in the prices of base metals.

European and American prices not following the same trends anymore

Following the discovery and exploitation of large shale gas deposits in the United States, American demand for oil dropped (*see Focus, "Shale gas: a supply shock working in favour of the United States" in the "United States" note*). As there were physical constraints preventing the export of oil from America to Europe, the prices of oil barrels on the American market (WTI) and the European market (Brent) decoupled from the start of 2011. The spread between Brent and WTI prices reached a high of 25 dollars in August 2011.

1 - Oil and commodity prices rose in 2011

$ per barrel, base 100 in 2005

Oil (North Sea Brent) <--
Oil (WTI of Texas) <--
Commodities price index -->
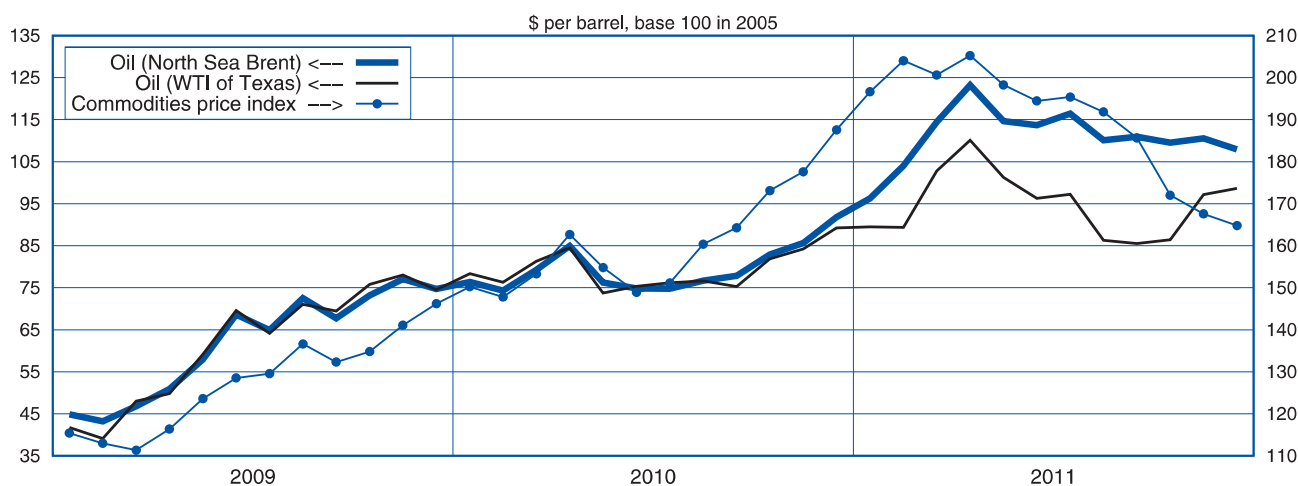
Source: MIF

Eurozone and United States in 2011: growth despite shocks

Box 1 - Model Assumptions

NiGEM is a multinational model in which all the countries mentioned in this paper feature individually. All the economies in the model are linked with each other by trade and financial flows.

In order to estimate the effects of the major events of 2011 on growth in the main advanced economies, a baseline scenario was constructed in which each variable in the model that was affected in reality remained at its level or on its trend prior to the shock in question. The economic data without the shock was then compared with that observed in reality. This comparison can therefore quantify the effects of the events.

Oil

In 2011, the hitherto similar prices per barrel in America and Europe diverged. Although in principle there is only one world oil price in the NiGEM model, the American WTI price was also included to take account of the fact that the rise in oil prices from the end of 2010 onwards was smaller in the United States.

In the no-shock scenario, prices per barrel of oil (WTI and Brent), agricultural and metal commodity prices levelled out at their Q3 2010 values through to Q4 2011. In the course of 2011, monetary policy was also unchanged in relation to Q4 2010 (ECB rate at 1%, Fed rate at 0.25% and Bank of Japan (BoJ) rate at 0.1%).

Based on this counterfactual economy, a rise in oil prices, food prices and the ECB base rate was simulated over the year 2011 in line with the actual observations, while allowing all the other variables to react endogenously. This gave the overall effect of the various shocks on the US and European economies in 2011.

Eurozone debt crisis

From Q2 2010 to Q2 2011, we assume that the flight to quality takes place within the Eurozone only. In the countries outside the Eurozone, notably in the United States, the fall in long-term interest rates stems fully from the effect of the quantitative easing policy conducted at the time. This gives us an implicit estimate of the impact of the latter on the American long-term interest rates. This estimate is consistent with that of the St. Louis Fed (Thornton, 2010). From summer 2011 onwards, the worsening of the Eurozone sovereign debt crisis resulted in a worldwide trade-off and as the American quantitative easing ended in April 201, the American and British long-term interest rates only benefited from the flight to quality. Thus in the baseline scenario, between Q1 2010 and Q2 2011, long-term interest rates are parallel to the average long-term rate in the Eurozone, which is the only country where no massive direct intervention on the sovereign debt market took place. From Q3 2011 onwards, long-term interest rates are parallel to the global rate. In the alternative scenario with the Eurozone crisis, the American and British rates are the same as in the baseline scenario up until Q2 2011. From Q3 2011, they equal their historical standards increased with the effect of the quantitative easing policy, as estimated before. The Eurozone rates equal their actual rates.

The NiGEM model can take account not only of the transmission mechanisms via which the increase in long-term rates affects the national economy (direct internal effect), but also of the effect of long-term rate shocks on the main trading partners (indirect external effect). This evaluation was limited to the effects induced by rate rises and the solvency constraint of each State affected by the rise was deactivated. In the Eurozone, the impact of fiscal consolidation measures applied largely in response to the rise in interest rates on sovereign debt was taken from Conjoncture in France (Kerdrain C. *et Lapegue V.* , INSEE, March 2011).

Fiscal consolidation in the United States

In the baseline scenario, consumption and public investment were stable at Q3 2010 levels through until Q4 2011. In the scenario with fiscal consolidation, consumption and government investment were in line with the values that were actually observed, meaning a 1.4-points fall in the growth rate in public consumption and a fall of 7.9 points for public investment in 2011. Household expectations were adaptive and the solvency constraint was deactivated.

Japanese earthquake

In the baseline scenario without an earthquake, the OECD growth forecasts for Japanese consumption in 2011 were taken *(Economic Outlook n°88, November 2010)*, applied at Q4 2010 values. In the simulation, only private consumption was assumed to be affected, while private investment was not. Capital stock did not show a large fall and the corresponding investment shock, on a scale comparable to that of the shock on consumption, should therefore only penalise the exports of Japan's partners very little. Private investment is equivalent to just one quarter of private consumption. In addition to this, NiGEM does not take account of the fact that investment is more import-intensive than household consumption.

The supply shock was estimated outside the model as NiGEM cannot be used to study shortages in supplies to international production lines, which can be modelled as a negative supply shock on intermediate goods. Only one good was modelled and no distinction was made between exports of intermediate goods and of finished products. Nor was it possible to model any transfers towards other countries of demand that would usually be for Japanese goods. Only those effects induced by the fall in household consumption in H1 2011 (and its upturn in H2) were evaluated. The effects of the quake on the structure of the Japanese economy in the short term (negative shock on productivity, fall in the number of hours worked, electricity shortages, etc.) and in the long term (modification of the energy mix, etc.) were not studied. ■

Eurozone and United States in 2011: growth despite shocks

Importing countries suffer from falling demand from households and enterprises...

For the countries importing oil and food commodities, a price rise constitutes a burden on private agents. On the one hand, the rise in inflation slashed household purchasing power, thereby compressing demand from households. On the other hand, the rise in commodities prices placed a burden on businesses; owing to the rise in the cost of the corresponding intermediate consumption, investment fell generally. For both the Eurozone and the United States, these internal mechanisms were generally reinforced by the increase in exports: the rise in oil and commodities prices negatively affected their main trading partners, who were also net importers of oil and commodities.

... but this negative effect was partly offset by higher demand for imports by oil producers

Conversely, for net exporters of commodities, a price rise brings an increase in revenues. They spend part of these revenues by importing more goods and part of it by purchasing more foreign securities, thus bringing down the long-term interest rates abroad.

For the OECD countries, each extra dollar of oil imports is offset by an average of 0.4 cent of extra exports to oil-producing countries, according to a study by the OECD (2009) covering the period 2002-2008. These favourable effects stemming from the demand from commodities-producing countries are particularly significant in Germany. For the countries importing commodities, these channels only partially offset the direct and indirect effects of the rise in commodities prices via the trading partners importing oil and commodities.

The rise in commodities prices in 2011 penalised activity in the Eurozone and in the United States

The United States and the Eurozone were penalised by the increase in commodities prices *(see Graph 2)*. All in all, the growth rate diminished by 0.4% in the United States, 0.5% in France and 0.6% in Germany. Despite its best export performance, the German economy is indeed more oil-intensive than the French one. The impact of the rise in oil prices was more marked than that of other commodities.

The overall effect was slightly more marked in France and Germany than in the United States. For the United States, the favourable effects of the decoupling of WTI and Brent prices outweighed the unfavourable effects of a greater oil[3] intensity. These results are comparable to those of the OECD (2011): a 25-dollar

(3) When nominal interest rates are exogenous, growth in Spain and Italy is positively affected by the oil shock. This explains why activity is less strongly affected in the Eurozone as a whole (growth is reduced by 0.2 percentage points) than in its two main economies (-0.4 percentage points in France as well as in Germany). Though counterintuitive, this result can be accounted for by the fact that in our simulation, higher oil prices reduce consumption growth less heavily in Spain and in Italy in the short term than it does in France and in Germany, as wages rise more strongly due to higher oil prices in the former than in the latter. Another reason is that private investment increases in Spain and in Italy in our simulation thanks to a sharper drop in real long-term rates in these countries.

2 - Estimated impact of oil and commodity price changes and of ECB monetary policy on growth
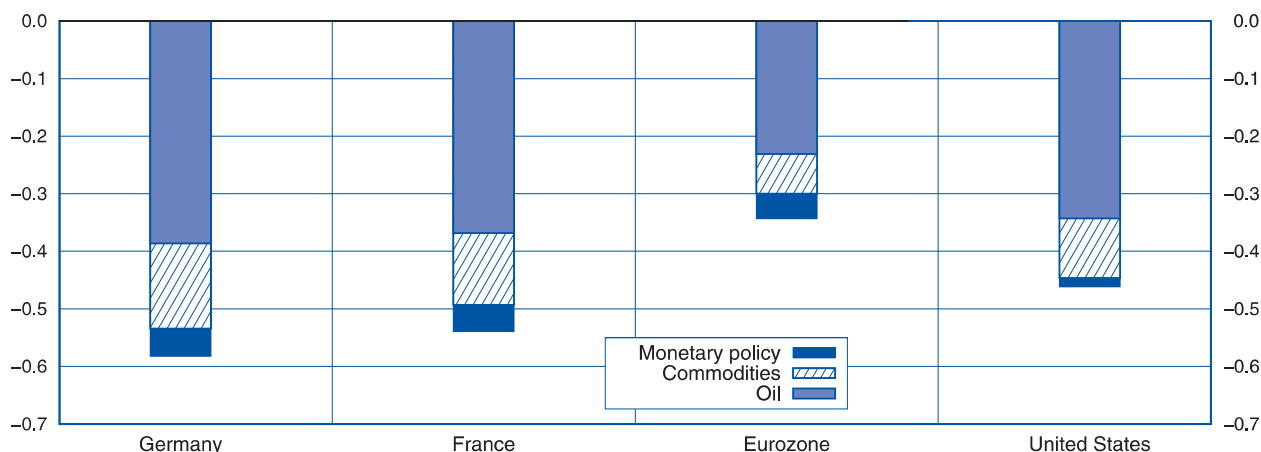
Monetary policy
Commodities
Oil

Sources: NiGEM, calculations by the authors

rise in oil prices would lead to a fall in activity in the OECD countries of 0.5 points after two years. On the other hand, the increase in base rates in the Eurozone in 2011 in order to contain the rise in inflation had a slightly unfavourable effect on growth in the Eurozone countries.

The adverse affects of the sovereign debt crisis on the financing of European economies

The debt crisis in the Eurozone intensified in spring 2010 ...

The sovereign debt crisis within the Eurozone gathered pace during 2010. In May 2010, with the first bailout plan for Greece, the Italian and - above all - Spanish sovereign yields also started to rise (*see Graph 3*). However, at the start of 2011, while the interest rates on the sovereign debt of the most fragile States (Portugal, Greece, Ireland, etc.) were still high, the set-up of the European Financial Stability Mechanism and the fiscal consolidation measures implemented seemed to result in stabilisation for the bigger States: the Italian 10-year spread vs. bund stabilised at around 150 basis points and the spanish ones at 200 basis points.

... and worsened once again in summer 2011

Concerns surrounding the sovereign debt situation in the Eurozone were suddenly heightened in summer 2011, provoking a collapse of the financial markets. The interest rates on Spanish and Italian sovereign debt rose sharply, going over 6%. Conversely, Germany benefited from a flight to quality bringing down the yield on its sovereign bonds, which were considered safer. The spread between sovereign yields then widened dramatically within the Eurozone. In November 2011, the spread between the 10-year Italian and German yields reached a high of 450 basis points.

The tensions surrounding European sovereign debt also spread to the interbank markets, reflecting banks' exposure to Eurozone debt, and the financing conditions of private agents tightened, particularly at the end of 2011.

The increase in long rates forced up the cost of capital and took its toll on investment

The main consequence of an increase in long rates was a rise in the cost of capital. This took its toll on corporate investment and also, although to a lesser extent, on the property investment of households. The rise in the cost of capital also pushed up producer prices, thereby damaging price competitiveness. This weighed down on exports whilst sustaining imports.

This rise in producer prices pushed up consumer prices, thereby slowing household consumption. Lastly, the rise in rates caused a drop in the value of assets, which could have led to a drop in household consumption via the wealth effect.

3 - 10-year sovereign rates on the secondary market

in %
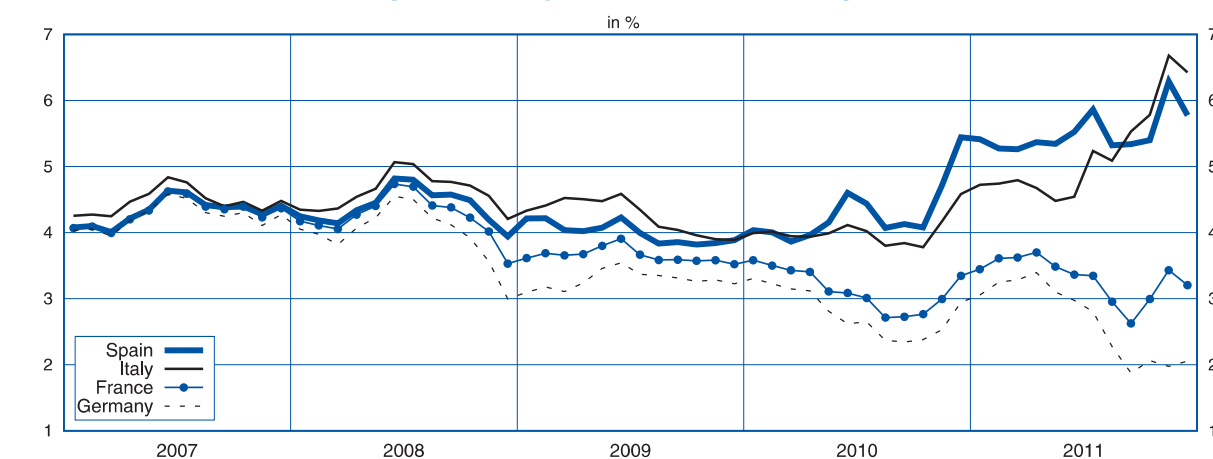
Source: DataInsight

Eurozone and United States in 2011: growth despite shocks

The activity of a country is also affected by the changes in the long rates of its main trading partners via the trade channel. A drop in demand in one of the Eurozone countries has a major effect on the activity of its neighbours due to the strong interdependence between the countries in the zone.

Spain, affected earlier than Italy by the increase in its long rates, was harder-hit in 2011

Spain was hit very hard by the rise in rates as early as H2 2010. All in all, the rise in Spanish long rates in 2010 and 2011 depressed growth in the country by 0.8 points *(see Table 1)*. Italy, where the rates only rose sharply after summer 2011, lost 0.2 percentage points in 2011. In Germany and France the overall effect of the variations in long rates in the Eurozone on activity was nil.

A major impact on Spanish and Italian investment, German and French exports

As private investment reacts strongly to long-term interest rates, this investment fell sharply in Italy and even more so in Spain *(see Table 1)*. The contraction of domestic demand in Spain and Italy took its toll on their trading partners' exports. In Germany and France, the export shock partly cancelled out the positive effect of the drop in long rates on investment.

Reduced growth in the Eurozone

All in all, the sovereign debt crisis had a recessive effect in the Eurozone, with a loss of activity in the order of 0.2 percentage points in 2011. The effect of long-term rates movements is not the same for all the countries within the Eurozone. Indeed, the countries which are adversely affected, notably Spain and Italy, are more sensitive to interest rates shocks than those which are positively affected. Therefore Eurozone internal demand and growth fell along with the observed long-term rates movements. Besides, from summer 2011, the flight to quality outside the Eurozone led to a rise in the average Eurozone rate when compared to the American and British long-term rates that also undermined growth.

Table 1

Effect of variations in long-term rates since 2010 on growth in GDP and its components in 2011

Effect on growth 2011	Germany	Spain	France	Italy	Eurozone
GDP	0.1	-0.9	0.0	-0.3	-0.2
Private consumption	0.1	-0,3	-0.1	-0.2	-0.2
Private investment	2.7	-6.1	1.1	-2.8	-1.0
Exports	-0.6	-0.2	-0.6	-0.4	-0.2
Imports	0.3	-1.9	0.0	-1.3	-0.4

Sources: NiGEM, calculations by the authors

Table 2

Effect of European fiscal consolidation plans on growth in GDP in 2011

	Effect on American growth
Germany	-0.4
Spain	-0.6
France	-0.6
Italy	-0.4
Eurozone	-0.6
United Kingdom	-0.8

Source: Kerdrain C. et Lapègue V. , 2011 INSEE

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Fiscal consolidation, in Europe but also in the United States

A budgetary response to the sovereign debt crisis from the European authorities

To cope with this pressure on their financing conditions, most European governments brought in fiscal consolidation measures in early 2011 *(see Conjoncture in France of March 2011, "Fiscal tightening in Europe: what are the effects?")*. These measures depressed growth in the Eurozone by 0.6 points (*see Table 2*). The measures announced since the summer of 2011, most notably in Italy, France and Spain, in order to cope with rising tensions surrounding sovereign debt, will mainly affect activity in 2012.

Fiscal consolidation also held back the American economy

Fiscal consolidation in the United States mainly came in the form of a reduction in government consumption and investment, starting from Q4 2010 and lasting throughout 2011. Subjected to strict budgetary rules, the local authorities adjusted their expenditure to lacklustre revenues. In parallel, at federal level cuts were made to the national defence budget. This consolidation through public expenditure led to a reduction in the GDP growth rate by 0.4 points in 2011, but spared households somewhat; private consumption was not affected *(see Table 3)*. The effect on GDP in the Eurozone appears to have been insignificant.

The earthquake of 11 March 2011 in Japan disrupted the world economy

The earthquake of 11 March 2011 hit a highly industrialised area...

On 11 March 2011 an earthquake of magnitude 9.0, followed by a tsunami, hit the Tohoku region in Japan. As well as the human losses, the earthquake had the immediate consequence of destroying a large part of the region's production capacity and temporarily suspending activity in numerous sectors, particularly the automobile industry. Close to the Pacific coast and boasting strong transport infrastructures, the Tohoku region had many production units manufacturing intermediate goods (oil, ferronickel, zinc), steel plants specialised in the production of upmarket intermediate goods (Sumitomo iron for car bodies, steel wire for reinforcing tyres, steel for shipyards, etc.), and plants for automobile spares, semi-conductors and electronic components.

... and the consequences spread to the whole Japanese economy

After the earthquake the industrial and transport infrastructures in the Tohoku region were partly destroyed (rail, road, port). Due to a lack of sufficient supplies of parts and components, many of the country's production units were shut down, mainly in the automobile, naval, chemicals, and electronic and computer production sectors. Amplified by the just-in-time management method, meaning that low stock levels were kept in many companies, this shock spread to the country as a whole and took its toll on Japan's ability to rebound.

Table 3

Effect of US fiscal consolidation on growth in American GDP and its main components in 2011

	Effect on growth 2011
GDP	-0.4
Private consumption	0.0
Private Investment	-0.5
Exports	-0.2
Imports	-1.0

Sources: NiGEM, calculations by the authors

The nuclear accident at the Fukushima plant following the earthquake also caused the virtual shut-down of the Japanese reactors which, prior to the earthquake, supplied 30% of national electricity. The shock therefore came hand in hand with a major strain on the electricity supply. In summer, traditionally a period when consumption reaches a peak, Japan experienced electricity shortages and, at the end of 2011, despite the mobilisation of previously unused fossil fuel capacities, electricity output was still 5% below its pre-earthquake level.

A major impact on business in Japan...

The earthquake caused a sudden decline in Japanese activity. In March, industrial output slipped back by 16% and household consumption by 5%. Exports were affected later and the low point was reached in April, with a decline of more than 10% *(see Graph 4)*. Japan went into recession: GDP fell by 2.0% in Q1 2011 and by a further 0.3% in Q2.

... and on world trade

The impact of the earthquake was not only limited to Japan. Production stoppages in the region around Sendai and the rest of the country caused supply difficulties and slowdowns in production wherever Japanese specialisation was

4 - A considerable shock for the Japanese economy
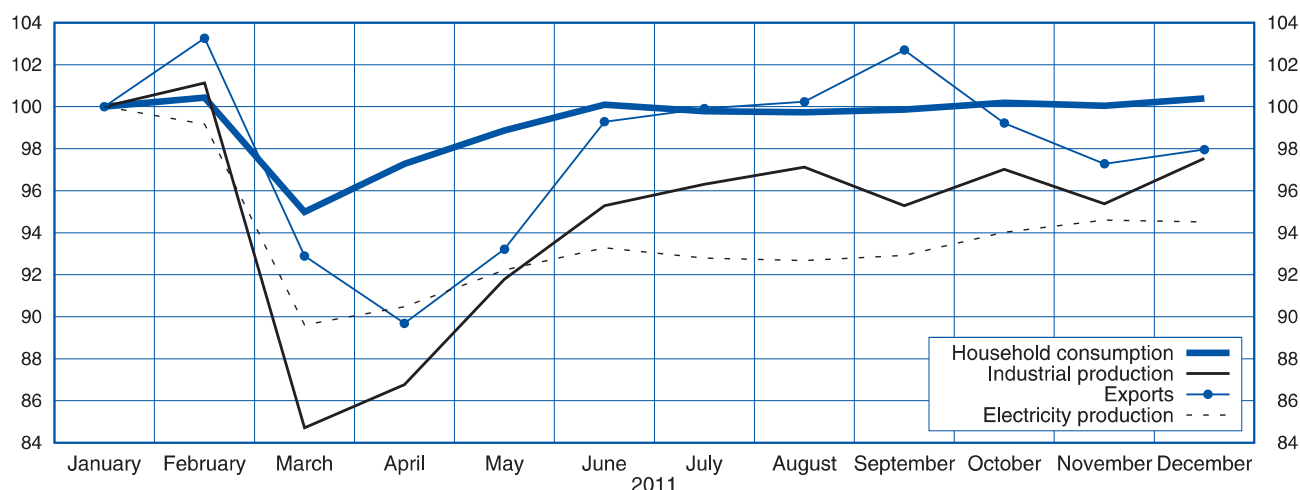
Sources : Cabinet Office, Ministry of Economy, Trade and Industry, Bank of Japan

5 - Quarterly growth of imports (volume in %)
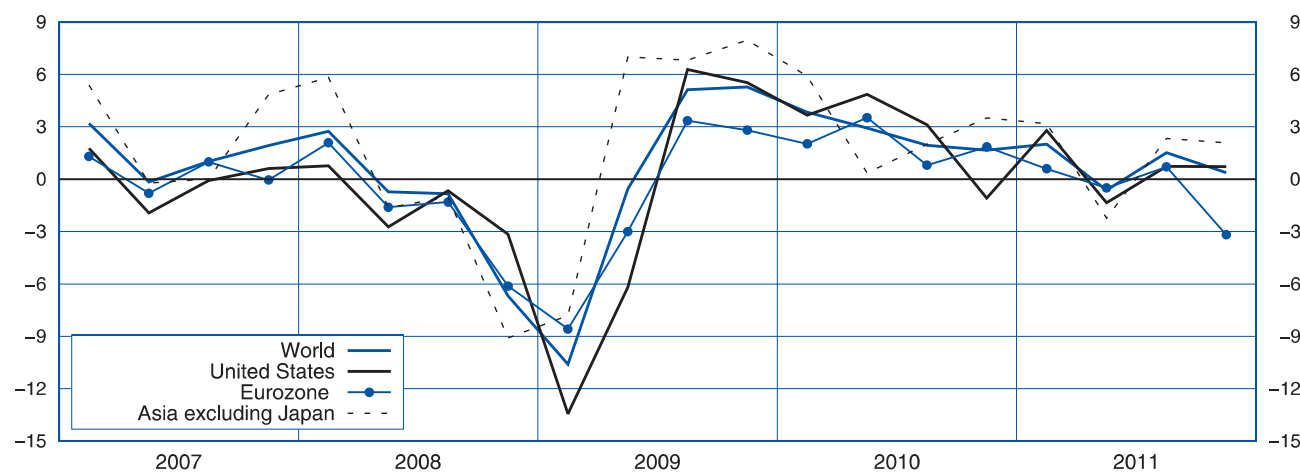
Source : Centraal Plan Bureau

significant and no substitute was available (automobile, electronic components). Additionally, the drop in exports of Japanese finished products held back household consumption, for example automobile purchases in the United States. World trade declined by 0.6% in Q2 2011 (see Graph 5). The drop in imports was particularly pronounced in the United States (-1.4%) and in Asia (-2.2%). Indeed, Japan was the biggest or second-biggest supplier to most countries of South-East Asia, and the leading supplier to the Chinese economy.

Two channels for transmission to the world economy: fairly low in terms of demand ...

This natural disaster can be broken down into two shocks: a demand shock *via* a drop in consumption and investment; and a supply shock with the shut-down of industrial production and a loss of business. These two shocks led respectively to a contraction of exports of finished products to Japan and a break in international supply and production chains.

The contraction of domestic demand in Japan after the earthquake did not have a notable effect on the exports of Japan's main trading partners. The induced drop in exports and activity in Europe, in the United States and even in China was well below 0.1% with the usual balancing of world trade (see Box 1).

... and quite extensive in supply terms, especially regionally

If there was a significant effect on the activity of the main world economies, it seems to have been manifested on the supply side. The effect of this shock is very difficult to quantify. The consequences of the earthquake on GDP via the supply shock were, however, probably limited in the United States and the Eurozone, in the order of 0.1 GDP points (see Box 2). They were probably more significant in China and the emerging Asian countries.

Conclusion

The shocks experienced in the course of 2011 (rise in commodities prices, the Japanese earthquake, tensions surrounding sovereign debt in the Eurozone) significantly cut growth in the United States and in the Eurozone, preventing these economies from starting their bid to make up the ground "lost" during the crisis (see Table 4). Oil and commodities prices and the fiscal consolidation policies were the shocks that weighed most heavily on growth in the United States and in the Eurozone. The debt crisis also had a large recessive effect in the European countries affected by the increase in their long rates. While the rise in commodities prices should no longer come into play in 2012, activity could be slowed once again by the intensification of fiscal adjustment measures and the lasting tensions surrounding sovereign debt, particularly in the Eurozone. With hindsight, the disaster in Japan only had a modest and transitory effect on the United States and the Eurozone activity, one which could be reversed in 2012 with the rebuilding efforts underway.■

Table 4

Effect of the different shocks on GDP growth rates in 2011

	Sources	Germany	France	Eurozone	United States
Oil and commodities	NiGEM,calculations by the authors	-0.6	-0.5	-0.3	-0.4
Eurozone debt crisis	NiGEM,calculations by the authors	0.1	0.0	-0.3	-0.1
US fiscal consolidation	NiGEM,calculations by the authors	0.0	0.0	0.0	-0.4
European fiscal consolidation	INSEE (2011)	-0.4	-0.6	-0.6	-
Japan (demand shock)	NiGEM,calculations by the authors	0.0	0.0	0.0	0.0
Japan (supply shock)	calculations by the authors	-	-	-0.1	-0.1

Sources: NiGEM, calculations by the authors

Box 2 - Assessing the impact of the Japanese earthquake on supply in partner countries

The catastrophe in Japan on 11 March 2011 affected the world economy via the fall in Japanese demand on the one hand and via shortages in certain supply chains on the other. The former channel can be analysed in macro-econometric models like NiGEM but not the latter, because models cannot take account of temporary constraints on supply.

This box therefore proposes a "non-model" evaluation of the effects of shortages of Japanese products on production in the United States, the Eurozone[1] and China. These effects are difficult to quantify and the results that are proposed must be taken with precaution. They are, however, consistent with the estimate proposed by *Sampognaro and Sicsic* (2012) using a similar but not identical method. A shock on imports from Japan has two types of consequences for activity in the country receiving them: on the one hand, a shock transmitted via trade and transport margins on finished product imports; on the other, a shock on domestic output via production line sourcing difficulties.

Modelling the impact of finished product imports

To determine the impact relating to the fall in supplies of finished products by Japan, we worked on the assumption that the stocks of the partner country did not vary to adjust to the fall in imports from Japan. Bilateral trade data from the OECD's STAN database provided the use of Japanese exports in each country and for each product. Once an import deficit had been determined for each type of finished product, the shock on domestic demand in the country in question, meaning the demand that could not be served on account of the shortage of Japanese finished products, was obtained using the product structure of domestic consumption and investment. The shock on activity was then obtained by applying trade and transport margin rates to this domestic demand deficit.

OECD data cannot be used to establish trade and transport margins per product type. For each country, a global rate was therefore applied to each aggregate assessed on the basis of the average margin in the OECD 2005 Input-Output tables.

Modelling the impact of interruptions in supplies of Japanese intermediate goods on production lines

To determine the impact on production in a given country of supply shortages linked to the fall in supply of Japanese products, three assumptions were made: *(i)* there was no substitution of the missing Japanese products by supply of intermediate goods from other countries; *(ii)* stocks in the country in question did not vary to offset the fall in imports from Japan; and *(iii)* exports of intermediate goods from partner countries were not affected: there was no "knock-on" contamination between countries other than Japan.

This is denoted $Y_i = f(C_{ij})$ where Y_i represents production of product j and C_{ij} the i production factors entering into the manufacture of product j.

The matrix of technical coefficient values based on the intermediate input tables [2] is therefore written:

$$\Gamma = \begin{pmatrix} \dfrac{C_{11}}{Y_1} & \dfrac{C_{12}}{Y_2} & \cdots \dfrac{C_{1N}}{Y_N} \\ \dfrac{C_{21}}{Y_1} & & \\ \cdots & & \\ \dfrac{C_{N1}}{Y_1} & & \dfrac{C_{NN}}{Y_N} \end{pmatrix}$$

We also denote $VA_i = \beta_i Y_i \quad 0 \leq \beta_i \leq 1$ where is VA_i the added value of sector j and $\beta = (\beta_1, \beta_2, ..., \beta_N)$

Assuming perfect competition,

$\dfrac{\delta VA_i}{VA_i} = \dfrac{\delta Y_i}{Y_i} = \sum_i \dfrac{C_{ij}}{Y_i} \dfrac{\delta C_{ij}}{C_{ij}}$, which is to say that the shock on added value is proportional to the production shock.

If we therefore write

$$C^*_{ij} = C_{ij}\left(1 - \dfrac{\delta C_{ij}}{C_{ij}}\right),$$

$$\Gamma^* = \begin{pmatrix} \dfrac{C^*_{11}}{Y_1} & \dfrac{C^*_{12}}{Y_2} & \cdots \dfrac{C^*_{1N}}{Y_N} \\ \dfrac{C^*_{21}}{Y_1} & & \\ \cdots & & \\ \dfrac{C^*_{N1}}{Y_1} & & \dfrac{C^*_{NN}}{Y_N} \end{pmatrix},$$

$$\Delta = diag\left(1 - \dfrac{\delta VA_i}{VA_i}\right)$$

and normalise production in each sector without a shock to 1, the loss in production resulting from the interruption in Japanese intermediate good supplies will then be written, by successive iterations:

$$1 - \beta \Delta \left(I - \Gamma^*\right)^{-1}$$

The loss of production and activity in each sector can then be estimated. By weighting the loss in each sector by its weight in each domestic aggregate (GDP, consumption, investment, exports, public expenditure), an estimate can also be made of the effect of the shock on each of these aggregates.

(1) The OECD tables used in this box do not provide data for the Eurozone as such. All the results are estimated on the basis of a recomposed Eurozone formed by its 6 main economies: Germany, France, Italy, Spain, Netherlands and Belgium.

(2) We used the "mid-2000's" input-output matrices supplied by the OECD for all its members. In the interests of consistency, bilateral trade data for the year 2005 was used for the information on the use of imports from Japan for each product and in each country.

Eurozone and United States in 2011: growth despite shocks

A deficit of about 8% in Japanese intermediate product imports, but more in certain sectors

Japanese exports collapsed from March 2011. Over 2011 as a whole, Japanese exports of goods fell back by 0.5% while world demand for Japanese goods increased by 6.7%.

To estimate the deficit of Japanese exports due to the quake, the counterfactual "no quake" scenario was one in which year-on-year change from March 2011 of Japanese exports for the main products [3] was equal to the average for the months September 2010 - February 2011.

The products analysed specifically were chemicals, transport equipment, machine tools, electrical appliances and metals/metallurgy products, which represent over 80% of Japan's exports. For other products, an average shock was taken according to the same rules.

Now that we knew the deficit in Japanese exports, the import deficit then had to be deduced for the three zones studied here (United States, China and the Eurozone). For the three zones, the shock was calibrated per product according to the share in annual imports of products from Japan (see Table 1). The import deficit was thus more pronounced in the transport equipment and machine tool sectors and was more violent for China than for the United States.

A small effect on activity in the United States and Europe, more pronounced in China

The effect of supply constraints due to supply shortages of Japanese products would appear to have been limited, less than 0.1 points, on the 2011 annual growth of the United States and the Eurozone (see Table 2). In both, investment was the item in

demand that was hardest hit, on account of its traditionally high import content, especially in those sectors in which Japan is specialised (automobiles and machine tools).

On the contrary, the effect on Chinese growth appears to have been significant. The Japanese tsunami appears to have cost the Chinese economy 0.4 points of growth in 2011 and almost 1.0 points of growth in investment. The slowdown in Chinese growth in 2011 (9.2% after 10.4%) might therefore be partly explained by interruptions in supplies of Japanese components.

These orders of magnitude are consistent with the estimate made by Sampognaro and Sicsic (2012) according to which the shock would seem to have been much greater on Asian economies than in the other OECD countries.

Transport equipment and machine tool production hardest hit

The shock appears to have had varying effects from one sector to another. It would seem to have been much greater in transport equipment, especially in the automobile sector, which was affected twice as much, on average, than the rest of the economy (see Table 3). Logically, the effect seems to have been greater in industrial activities than in services. However, some service activities seem to have been significantly affected, such as construction or IT activities.■

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(3) We worked on a year-on-year basis to neutralise the very large seasonal effects on the monthly data. The period that was selected excludes the post-crisis catch-up phase in order to provide a credible counterfactual scenario.

Table 1

1 - Calibrating the shock: import deficit per product and per zone, as a spread from the "no quake" scenario

	Chemicals	Metals	Machine tools	Transport	Others products
Eurozone	10%	10%	10%	12%	8%
United States	10%	5%	10%	12%	5%
China	10%	12%	20%	14%	6%

Sources: Bank of Japan and calculations by the authors

Table 2

2 - Estimated effect of Japanese tsunami-related supply constraints on the 2011 annual growth in GDP and its main component

in % / in percentage points

	United States	China	Eurozone
GDP	**-0.1**	**-0.4**	**-0.1**
Household consumption	-0.1	-0.4	-0.1
Public consumption	-0.1	-0.4	0.0
Investment	-0.3	-1.0	-0.2
Exports	-0.1	-0.7	-0.1
Imports	-0.6	-1.6	-0.2

Note: the estimate of the shock in consumption, investment and GDP includes the two effects mentioned above via finished products and via intermediate goods.

Source: Calculations by the authors

Table 3

Estimated effect of Japanese tsunami-related supply constraints on annual production (by sector)

in percentage points / in %

Sectors	United States	China	Eurozone
Chemicals	-0.2	-0.5	-0.1
Transport equipment	-0.4	-0.8	-0.2
Metals, minerals and metallurgy	-0.1	-0.5	-0.1
Machines and equipment	-0.2	-1.1	-0.2
IT activities	-0.1	-0.8	-0.1
National defence	-0.1	-0.2	0.0
Construction	-0.1	-0.5	-0.1

Source: Calculations by the authors

Bibliography

Artus P., 2012, « Croissance et prix du pétrole », *Note Flash Économie* No. 191, 7 mars 2012.

Banque de France, 2011, « Les répercussions du séisme du 11 mars sur l'économie japonaise et l'économie mondiale », *Bulletin de la Banque de France*, No 184, 2e trimestre 2011

Kerdrain C. et **Lapegue V.** , 2011, « Resserrement budgétaire en Europe : quels effets ? », *Note de conjoncture*, mars, Insee.

OCDE, 2011, « Les effets de la hausse des prix du pétrole sur l'activité économique et l'inflation », *Département des affaires économiques de l'OCDE, Notes de politique économique,* No. 4.

Sampognaro R. et **Sicsic M**. , 2012, « Impact du séisme au Japon sur l'économie mondiale », *Trésor Éco,* DG Trésor, No. 100

Thornton D.L., 2010, "Would QE2 Have a Significant Effect on Economic Growth, Employment, or Inflation?", *Economic Synopses,* Réserve Fédérale de St Louis, n°29.

Wurzel E., **Willard L**. et **Ollivaud P.** , 2009, "Recent Oil Price Movements: Forces and Policy Issues", OECD *Economics Department Working Papers*, No. 737, OECD Publishing.

Zakhartchouk A. , 2012, « Les chocs d'incertitude freinent l'activité », *Note de Conjoncture*, mars, Insee. ■