OECD FORECASTS DURING AND AFTER THE FINANCIAL CRISIS: A POST MORTEM

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BETTER POLICIES FOR BETTER LIVES

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Main Findings

- GDP growth was overestimated on average across 2007-12, reflecting not only errors at the height of the financial crisis but also errors in the subsequent recovery.

- Forecast errors were larger in countries that are more open to external developments and hence exposed to shocks from other economies.

- Larger forecast errors over 2007-12 have occurred in countries with more stringent pre-crisis labour and product market regulations.

- Growth in the recovery has been weaker relative to predictions in countries in which banks had low capital ratios pre-crisis.

- Stronger projected fiscal consolidation has been associated with weaker-than-projected growth, but this conclusion holds only in some years, and only when Greece is included. The repeated assumption that the euro crisis would dissipate over time, and that sovereign bond yield differentials would narrow, has been a more important source of error.

- The forecasting experience in the wake of the crisis has led to a number of changes in forecasting procedures and communication – in the OECD as well as in other forecasting institutions.

Forecasting during the crisis

1. This note discusses OECD forecast performance over the period 2007-12. It focuses on the lessons that can be learned from cross-country differences in growth forecast errors and the changes to forecasting models and procedures that have been prompted by the experience of the crisis. A more detailed statistical evaluation of OECD forecast performance, and information on growth and inflation projection errors in different economies, is provided in the accompanying working paper (Pain et al., 2014).

The pattern of forecast errors since the crisis began

2. On average across countries, calendar year GDP growth was overestimated across 2007-12 (Table 1). Forecasts were revised down consistently and very rapidly when the financial crisis erupted, but growth outturns nonetheless still proved substantially weaker than had been projected. The onset of the euro area crisis in 2010, with the re-pricing of sovereign debt and banking sector risks, subsequently contributed to a further period of growth disappointments relative to forecasts.

3. As would be expected, errors in projections of current year growth are smaller than in projections of GDP growth for the following year. On average, growth was overestimated in both the OECD and BRIICS economies, though the errors in the latter were slightly smaller than in the OECD economies (Figure 1). The largest errors were made in the vulnerable euro area economies.

Table 1.   Average errors of calendar year GDP growth projections for OECD countries
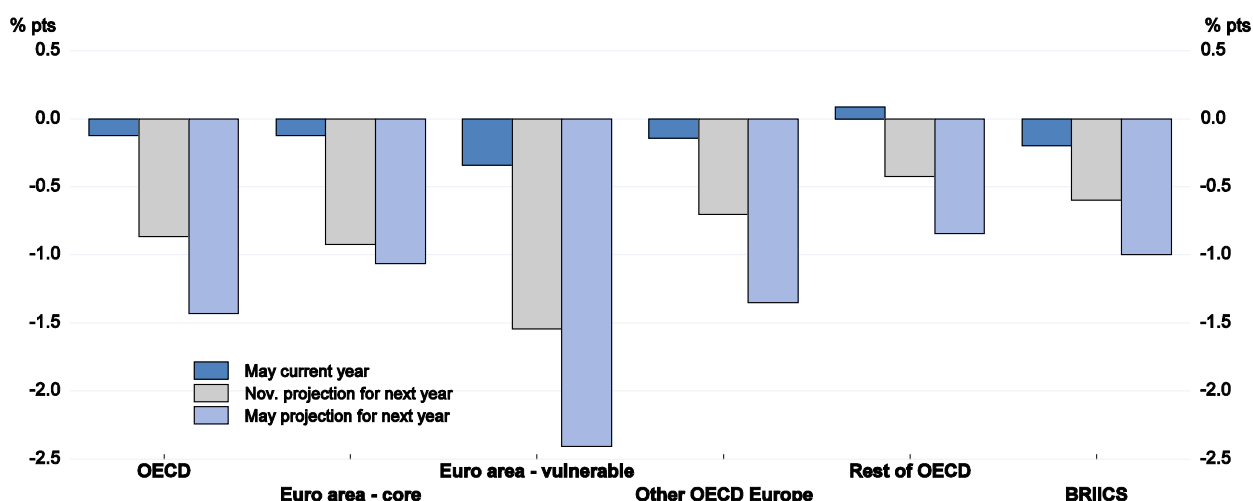
2007-12, percentage points

	May projection for current year	November projection for next year	May projection for next year
Full period: 2007-12	-0.1	-0.9	-1.4
Sub-periods			
2007-09	-0.2	-1.8	-2.6
2010-12	-0.1	0.1	-0.3

Note: Errors are calculated as actual growth less forecast growth at each forecast horizon, where actual growth is the published outturn as at May the following year. A negative (positive) average error indicates over(under)-prediction. There is only partial coverage for Chile, Estonia, Israel and Slovenia, who acceded to the OECD during the period.

Source: OECD Economic Outlook databases; and OECD calculations.

Figure 1. Average forecast errors of calendar year GDP growth differ by country group and date of forecast

2007-12, percentage points

Note: Errors are calculated as actual growth less forecast growth at each forecast horizon, where actual growth is the published outturn as at May the following year. A negative (positive) average error indicates over(under)-prediction. There is only partial coverage for Chile, Estonia, Indonesia, Israel, Slovenia and South Africa. Countries included in the 'euro area - vulnerable' group are: Greece, Ireland, Italy, Portugal and Spain.

Source: OECD Economic Outlook databases; and OECD calculations.

Factors correlated with the forecast errors

4.   The growth forecast errors appear to be related to a number of economic features, institutional factors and economic policy developments in the countries concerned. Pair-wise correlations between the country forecast errors, three broad sets of pre-crisis factors and four indicators of contemporaneous economic developments are set out in Table 2. Key findings include:

- Growth was comparatively weaker than expected and forecast errors higher in countries that are more open to external developments and exposed to shocks from other economies. Factors such

as openness to international trade and the share of total national banking assets held by foreign-owned banks are negatively correlated with forecast errors over the period as a whole and particularly so during the downturn (Figure 2). This suggests that the projections failed to fully reflect the increasing globalisation of real and financial activity prior to the crisis, which had raised the potential for cross-border and cross-market transmission of economic and financial shocks. For instance, at the start of the crisis, foreign-owned banks, an increasingly important pre-crisis presence in domestic banking markets, often cut credit extensions or reduced new lending in their host economies in order to meet lower risk targets imposed by their parent banks (Cetorelli and Goldberg, 2011).[1]

Table 2. Growth projection errors reflect a number of economic features

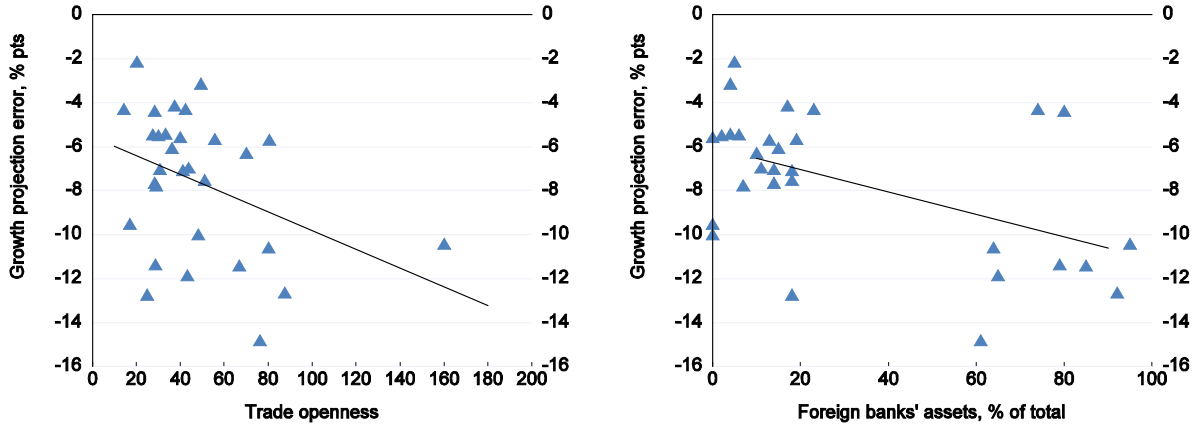|	Full period: 2007-12		Sub-periods Cumulative error over two years shown (at publication date indicated)		
	Average error	RMSE	2008-09	2010-11	2011-12
	From projections at May for the next year		(May-08 EO)	(May-10 EO)	(May-11 EO)
Openness					
Trade openness	-	++	- -		
Financial openness^			+		
Foreign banks' assets	-	+++	- - -		
Economy-wide regulations					
Product market regulation		+			
Employment protection legislation		+	-		
Financial structure					
Stock market capitalisation			+		
Regulatory capital		++	-	+++	
Financial services^				-	
Contemporaneous developments					
Equity price growth				+++	+++
Change in non-performing loans	- - -	+		- - -	- - -
Change in business confidence (manufacturing)				+	
Change in consumer confidence	+			+++	++

Note: RMSE denotes the root-mean squared error of the growth projections. ^ denotes variables with extreme values that have been omitted because they change the nature of the relationship (see Pain et al. (2014) for details). The nature of each pairwise correlation is shown by a positive or negative sign; the strength is shown by one, two or three signs indicating statistical significance at the 10%, 5%, or 1% level respectively, with statistically insignificant relationships omitted. See Table 3 in Pain et al. (2014) for full results. Contemporaneous developments are the change over the relevant period being considered.

Source: Datastream, IMF Financial Soundness Indicators, OECD Economic Outlook databases; OECD Going for Growth (2012); OECD Main Economic Indicators database; OECD Structural Analysis database; World Bank Global Financial Development database; and OECD calculations.

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1. The evidence points to the enhanced exposure of host economies to source economy shocks during the downturn outweighing the potential for foreign-owned banks, with access to internal capital resources, to help shield host economies from domestic shocks, which would limit negative growth surprises.

Figure 2. Growth projection errors for 2008-09 were larger in countries with more international openness

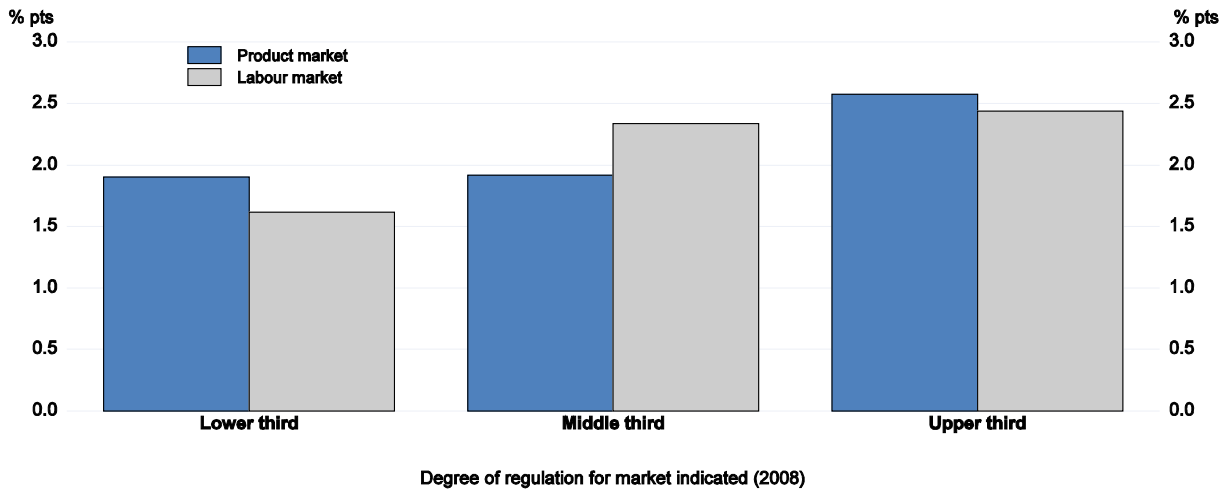Cumulative errors for 2008-09 calendar year projections made at May 2008

Note: Errors are calculated as actual growth less forecast growth at each forecast horizon, where actual growth is the published outturn as at May the following year. A negative (positive) error indicates over(under)-prediction. Countries with partial coverage for the period (Chile, Estonia, Israel and Slovenia) are excluded.

Source: OECD Economic Outlook databases; World Global Financial Development database; and OECD calculations.

Figure 3. Forecast errors were larger in more regulated economies

Average RMSE of annual growth projections for 2007 to 2012 made in November a year earlier

Note: RMSE denotes the root-mean squared error of the growth projections. Countries with partial coverage for the period (Chile, Estonia, Israel and Slovenia) are excluded.

Source: OECD Going for Growth (2012); OECD Economic Outlook databases; and OECD calculations.

- Larger forecast errors over 2007-12 have occurred in countries with more stringent pre-crisis labour and product market regulations (Figure 3). In part this may reflect the weight given at the time to pre-crisis evidence that tight regulations could help to cushion economic shocks (Duval

et al., 2007), together with insufficient attention being paid to the extent to which tighter regulations could delay necessary reallocations across sectors in the recovery phase. A third possibility is that it reflects a correlation between restrictive regulations and the pre-crisis build-up of imbalances that was not fully captured in forecasts.[2]

- Growth has been weaker than expected in the recovery in countries where banks had a low ratio of regulatory capital to risk-weighted assets in 2007 (Figure 4, left panel). This may suggest that insufficient account was taken of the impact of the rapid pre-crisis expansion of financial leverage in a low interest rate environment and the greater need for weakly capitalised banks to deleverage subsequently.

- There are strong correlations between forecast errors and changes in equity prices, private sector confidence and non-performing loans in the banking sector (Figure 4, right panel) during the post-crisis recovery period. This suggests that the impacts of impaired banking systems and weak confidence may have been underestimated in the projections.[3] There is evidence that these variables were also correlated with forecast errors in the pre-crisis period (Pain et al., 2014).

5.   Perhaps surprisingly, indicators of pre-crisis vulnerabilities such as house price increases and private credit growth appear not to be generally associated with negative growth surprises since the crisis began. A possible explanation might be that these vulnerabilities were generally well understood and incorporated successfully into forecast judgements. Not all pre-crisis imbalances were equally well integrated in the projections, however, with higher downside surprises on average in countries that had a pre-crisis current account deficit.

Fiscal consolidation, bond spreads and growth disappointments in 2010-11 and 2011-12
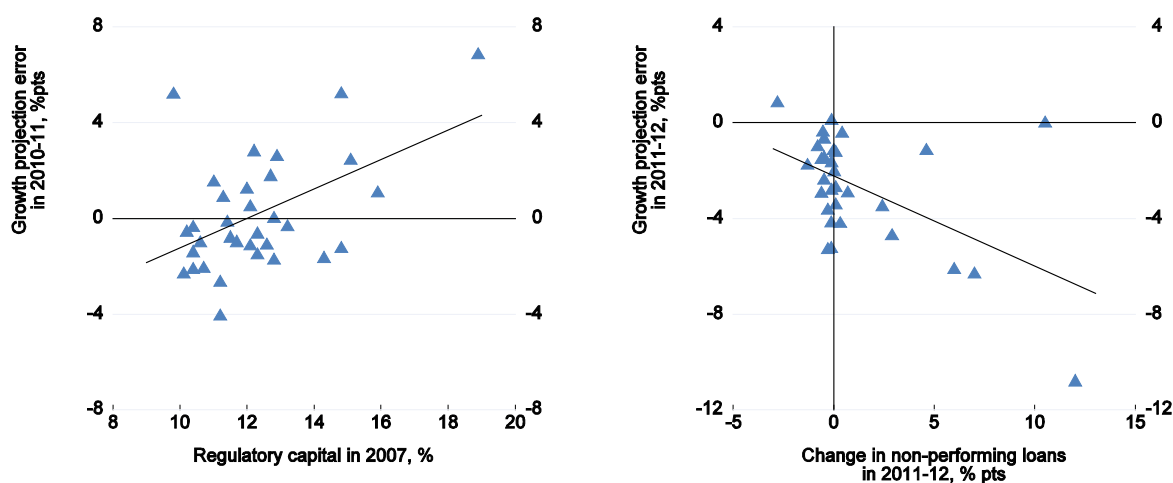
6.   In 2010-12, a repeatedly projected acceleration in the pace of the global recovery ultimately failed to materialise. As mentioned above, an underestimate of the impact of impaired banking systems and bank deleveraging may be one factor behind this (Figure 4). These years also saw the deepening of the euro area crisis and the onset of widespread fiscal consolidation. Indeed, IMF studies point to a negative relationship between the errors in its Spring 2010 *World Economic Outlook* projections for GDP growth over 2010-11 and projected fiscal consolidation during this period (IMF, 2012; Blanchard and Leigh, 2013). An implication drawn from this is that fiscal multipliers were underestimated considerably.

7.   A more nuanced picture appears from the OECD projections published in the *Economic Outlook* in May 2010 and May 2011 for cumulative GDP growth during 2010-11 and 2011-12 respectively. Projected fiscal consolidation is negatively correlated with the growth forecast errors in 2010-11 (Figure 5, upper left panel), but not in 2011-12 (Figure 5, lower left panel). Under the hypothesis that the former reflects an initial underestimation of the fiscal multiplier, the latter would then suggest that OECD forecasters became better at judging the impact of consolidation in an environment with limited monetary policy space. However, the finding for 2010-11 is not statistically significant without the inclusion of Greece. And, among non-European countries, there is no clear association at all between projected consolidation and forecast errors, raising doubts about the hypothesis of a generalised underestimation of fiscal multipliers.

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2.   Related measures of business and labour market regulation produced by the World Bank and the Fraser Institute are found to have similar relationships (not shown here).

3.   However, the correlations could also reflect a reverse causal link, with weaker growth outcomes leading to more impaired loans and deteriorating confidence.

Figure 4. Growth projections were particularly over-optimistic where banks had weak capital and suffered large losses

Note: Errors are calculated as actual growth less forecast growth at each forecast horizon, where actual growth is the published outturn as at May the following year. A negative (positive) error indicates over(under)-prediction.

Source: IMF Financial Soundness Indicators; OECD Economic Outlook databases; World Bank Global Financial Development database; and OECD calculations.

8. A further possibility is that the correlation between fiscal consolidation and growth forecast errors could rise from an underestimate of the amount of fiscal consolidation, rather than from an underestimate of the fiscal multiplier. On average, in the European economies, cumulative fiscal consolidation in 2010-11 was 0.8 per cent of GDP greater than projected in the May 2010 *Economic Outlook*.[4] The actual level of fiscal consolidation is also negatively correlated with the growth forecast errors in 2010-11 (see Pain, et al., 2014), but this relationship is again found to be dependent on the inclusion of Greece in the sample considered.
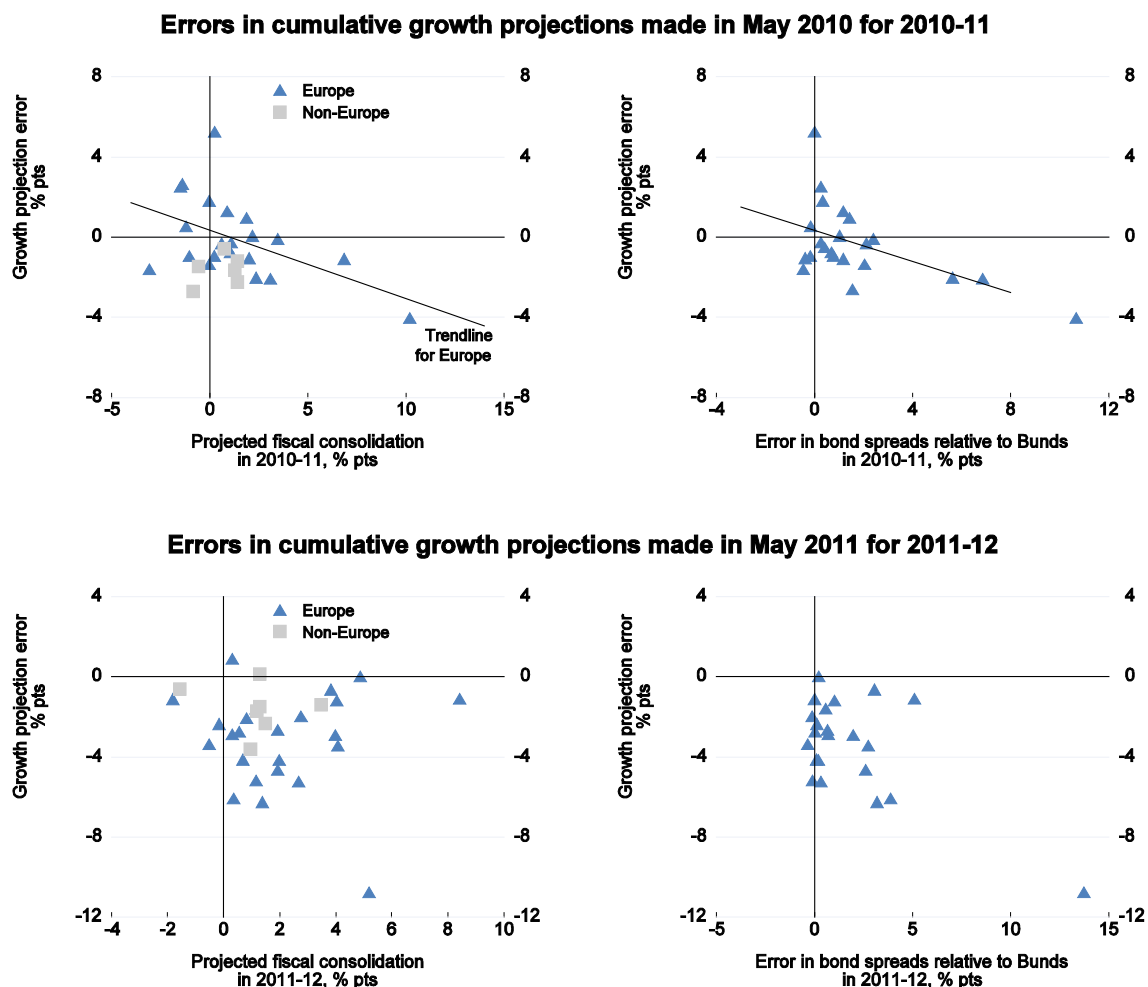
9. The OECD projections in these years relied on a "muddling-through" assumption, with the euro area crisis assumed to be diminishing slowly and government bond spreads between other European countries and Germany narrowing over the projection period. In fact, spreads widened in many countries over the projection period. There is a clear correlation between the errors in the assumptions about spreads and the growth forecast errors in 2010-11 (Figure 5, upper right panel), with growth weaker than projected in European countries whose bond spreads relative to Germany were higher than had been assumed. Although bond spreads are clearly endogenous to growth outcomes, this finding raises questions about the appropriateness of the forecast assumptions made, particularly the prevailing assumption that the euro area crisis would ease over the projection period.

10. Empirically, the errors in the bond spread assumptions appear to be a more important explanation for forecast errors than either the possible underestimation of fiscal multipliers or the underestimation of the amount of fiscal consolidation undertaken. Considered together, the errors in bond spreads remain

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4. Actual fiscal consolidation was however strongly positively correlated with projected fiscal consolidation.

negatively and in most cases significantly related to the forecast errors for 2010-11 but there is no longer any relationship between the forecast errors and either projected or actual fiscal consolidation (Pain et al., 2014). Repeating the exercise for 2011-12 reinforces the finding that fiscal consolidation is not significantly negatively related to the forecast errors. The European Commission (2012) also report a similar result.

Figure 5. Fiscal consolidation, bond spreads and errors in growth projections

Errors in cumulative growth projections made in May 2010 for 2010-11

Errors in cumulative growth projections made in May 2011 for 2011-12

Note: Errors are calculated as actual growth less forecast growth at each forecast horizon, where actual growth is the published outturn as at May the following year. A negative (positive) error indicates over(under)-prediction. The trendline for the error in bond spreads to Bunds excludes Greece. Trendlines are not shown where the relationship is not statistically significant at the 10 per cent level.

Source: OECD Economic Outlook databases; and OECD calculations.

The nature of the OECD projections

11.   The OECD forecasts are conditional projections rather than pure forecasts. They rest on a specific set of assumptions about policies and underlying economic and financial conditions, including

fiscal policy changes and the development of the euro area crisis, and are consistent with the advice given about monetary policy settings. This raises some difficult issues:

- The projections, and especially the accompanying commentary, sometimes point to unsustainable developments and the need for policy changes. If these are built into the projections, but the advice is not followed (or vice versa), an error in the projections will likely occur. It is not clear how or whether this type of error can be controlled for in the projection process.

- As emphasised above, the projections made during the euro area crisis placed a lot of weight on the assumption that the euro area crisis would be contained and subsequently ease, with accompanying declines in sovereign bond spreads and improvements in confidence. This may have contributed to forecast errors, but it is not clear what else could have been assumed in projections for a period of over two years made public by an inter-governmental organisation. One possible answer – and the route chosen – is to make extensive use of scenario analyses to quantify possible adverse outcomes if key assumptions did not hold.

Ongoing changes in forecasting techniques and procedures

12.   Forecasting the timing, depth and ramifications of the financial crisis proved exceptionally difficult. Particular challenges included the identification of imbalances and other unsustainabilities entering the crisis, the timing of their unwinding and the likely impact on real activity. These challenges were compounded by the unusually high speed and depth of cross-country interconnections between real and financial developments, the increased variability of economic growth compared with the pre-crisis period, the lack of timely data on many important financial factors and the limited understanding of macro-financial linkages. All these came on top of the normal difficulties experienced when forecasting around major turning points in activity. The challenges encountered in forecasting in recent years have led to changes in forecasting techniques and procedures, some of them still in progress. Key developments are outlined below, drawing on OECD experience and consultations with experts from other international organisations.[5]

13.   Reflecting the common errors made in all country projections in recent years, and the extent to which these have been associated with stronger-than-expected global financial, trade and sentiment interconnections, the centralisation or "top-down" component of the forecast process has been increased.

- Early identification is now made of key global developments and risks and their quantitative implications for global activity and global trade. This ensures a consistent view amongst country specialists of the main forces shaping the forecast and the outlook for the major economies.

- Early guidance in the form of top-down centralised projections is now provided, at the OECD and elsewhere, to help ensure that projections for individual countries are based on a common general world view. Such guidance draws together the key points from a range of stand-alone inputs, including model-based analyses and assessments of financial market developments.

14.   Monitoring of near-term activity developments has been enhanced. Although it took time for the full effects of the sub-prime crisis and Lehman Brothers collapse and their interactions with underlying weaknesses to appear in published activity data, they were swiftly reflected in high-frequency tendency

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5.   As part of the consultation it was agreed that individual comments and remarks would not be attributable to any individual institution.

surveys. Similarly, the generalised collapse of confidence during the Great Recession and, more recently, during the intensification of the euro area crisis, highlights the potential usefulness of early survey-based signals. Ongoing developments include:

- Increasing use of "nowcasting" models, exploiting high-frequency information to gain an early picture of activity developments. Examples at the OECD include the suite of indicator models of GDP growth introduced a decade ago and, more recently, a suite of indicator models for global trade and an indicator model of GDP growth in China. The indicator models are used as guidance for current and one-quarter ahead GDP growth projections for the G7 economies in the *Economic Outlook,* and provided useful real-time signals as the financial crisis deepened (Pain et al., 2014). Elsewhere, indicator models are being developed for expenditure components, including work on the link between confidence and household consumption and investment (OECD, 2011), and possible non-linearities in the relationship between indicator variables and growth outcomes at times of extreme stress are being explored.

- The OECD composite leading indicators (CLIs), first introduced in the 1970s and intended to provide early signals of turning points in economic activity, were updated in 2012 in order to use GDP instead of industrial production as the CLI reference business cycle series. Based on the cross-country correlations between the recent (real time) changes in the CLIs at the time of the OECD projections and the subsequent projection errors, there is some evidence that the CLIs contained useful information that was not fully heeded during the recovery phase (2010-12). However, there is little evidence that they could have helped to reduce projection errors during the downturn (Pain, et al., 2014), even though changes in the CLIs did signal that growth was weakening in 2008, pointing to a moderate slowdown at the time of the May *Economic Outlook* and a strong slowdown at the time of the November *Economic Outlook*.

- Greater use is now made of anecdotal information gathered from outside business contacts. At times of fast-moving financial developments, these may provide an early signal of changes in factors such as credit conditions, and thus near-term activity developments.

- Increasing attempts are being made, though not yet in the OECD, to utilise high-frequency information on real-time activity developments provided by internet-based indicators ("big data"). Internet-based search measures have already been used to identify early signals about specific housing and labour market developments, as well as policy uncertainty. Real-time financial transactions data (such as the volume of SWIFT banking transactions, or data on credit card transactions) may also prove to be an early indicator of activity developments.

15. Increasing attention is now paid by all forecasting institutions to financial market developments.

- The OECD now makes use of financial condition indices (FCIs) for the United States, Japan, the euro area and the United Kingdom that weight together a wide range of financial variables that have a well-established link with GDP growth 12 to 18 months later. The FCIs have been used extensively in the forecasting rounds since 2008-09 and as a guide to possible GDP effects in scenario analyses.

- Internal discussions with financial market specialists about financial market developments and macro-financial linkages have been strengthened in the OECD and elsewhere.

- Work has begun on the difficult task of augmenting existing macroeconomic models with more detailed relationships of banking sector behaviour, and to take better account of global financial

interconnectedness. The macroeconomic models available at the time of the crisis typically ignored the banking system and failed to allow for the possibility that bank capital shortages and credit rationing might impact on macroeconomic developments.

16.   There is an enhanced focus on risk assessments and global spillovers, reflecting the greater uncertainties surrounding the basic assumptions underlying the projections.

- Greater information is being provided about the distribution of risks around the central projections. At the OECD, the risk profile for the *Economic Outlook* projections is now typically characterised verbally as being, for example, balanced or skewed or bimodal and the projections themselves characterised as being a modal rather than average projection. Other international forecasting organisations highlight risks via the use of fan charts or via forecast ranges for key variables.

- Quantitative scenario analyses are being used to illustrate alternative outcomes. One notable example in the OECD was the scenario showing a severe downside outcome arising from adverse euro area developments published in the November 2011 *Economic Outlook*.

- More broadly, greater use is now made of horizon scanning to help plan ahead for unlikely, but potentially costly, events that might trigger a future crisis that could be very different in nature from the recent financial crisis.

SUGGESTED FURTHER READING

The main paper summarising this project is:

Pain, N., C. Lewis, T-T. Dang, Y. Jin and P. Richardson (2014), "OECD Forecasts During and After the Financial Crisis: A Post Mortem", *OECD Economics Department Working Papers,* forthcoming.

Other relevant studies cited:

Blanchard, O. and D. Leigh (2013), "Growth Forecast Errors and Fiscal Multipliers**,** *International Monetary Fund Working Papers,* No. 13/1, Washington, DC.

Cecchetti, S.G., M.R. King and J. Yetman (2011), "Weathering the Financial Crisis: Good Policy or Good Luck?", *BIS Working Papers,* No. 351, Basel.

Cetorelli, N. and L. Goldberg (2011), "Global Banks and International Shock Transmission: Evidence from the Crisis", IMF *Economic Review*, Vol. 59/1.

Duval, R., J. Elmeskov and L. Vogel, "Structural Policies and Economic Resilience to Shocks", *OECD Economics Department Working Papers,* No. 567, OECD Publishing, Paris.

European Commission (2012), *European Economic Forecast - Autumn 2012*, *European Economy,* No. 7/2012, Brussels.

IMF (2012), "Box 1.1: Are We Underestimating Short-term Fiscal Multipliers?", IMF *World Economic Outlook*, October 2011, Washington DC.

OECD (2011), "Box 1.1: Risk Awareness, Uncertainty and Confidence", *OECD Economic Outlook*, November 2011, OECD Publishing, Paris.

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