

# The Permanent Effects of Fiscal Consolidations

Antonio Fatás\* and Lawrence H. Summers\*\*

Abstract: The global financial crisis has permanently lowered the path of GDP in all advanced economies. At the same time, and in response to rising government debt levels, many of these countries have been engaging in fiscal consolidations that have had a negative impact on growth rates. We empirically explore the connections between these two facts by extending to longer horizons the methodology of Blanchard and Leigh (2013) regarding fiscal policy multipliers. Our results provide support for the presence of strong hysteresis effects of fiscal policy. The large size of the effects points in the direction of self-defeating fiscal consolidations as suggested by DeLong and Summers (2012). Attempts to reduce debt via fiscal consolidations have very likely resulted in a higher debt to GDP ratio through their long-term negative impact on output.

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\*INSEAD, CEPR and ABFER \*\* Harvard University and NBER. We would like to thank the editor, two anonymous referees, Alan Auerbach, Ethan Ilzetki, Jeffrey Frankel, as well as participants in the 2017 NBER International Seminar on Macroeconomics conference for their helpful comments and suggestions.

## 1. Introduction.

After more than nine years since the global financial crisis started, most advanced economies are still suffering from its aftermath and GDP remains far from its pre-crisis trend. Relative to previous business cycles, the current cycle can be characterized by a much more protracted and persistent recession with limited reversion towards its previous trend.

While this persistence is now recognized by policy makers, it was not obvious in the early years of the crisis. When the crisis started, the original GDP forecasts suggested at least a partial return towards previous trends. But that return never happened, and GDP forecasts were continuously revised downwards as the crisis unfolded leading to a succession of positively correlated forecast errors. And as time passed, pessimism grew about the potential or long-term level of GDP.<sup>1</sup>

While this phenomenon is true for most advanced economies, including the US, the pattern has been the most dramatic for European economies, where the crisis has been felt the most.

In Figure 1 we show the evolution of US GDP as predicted by the IMF World Economic Outlook (WEO) in three different dates: April 2007 (before the crisis), April 2008 (after the first wave of the crisis) and April 2010 after most of the effects of the crisis were settled (at least for the US). We can see how the downward revisions of GDP that took place in 2008 were followed by additional revisions in 2010 as the crisis was much more persistent than expected.<sup>2</sup>

We can also see from the forecasts that in 2010 the deviations from previous trends were expected to be persistent. And this pessimism was not unfounded as the 2010 forecast for GDP in 2015 ended up being very much in line with the actual data for that year. Today, there is very little hope of returning anywhere close to the pre-crisis GDP trend.

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<sup>1</sup> See Ball (2014).

<sup>2</sup> All our data was provided to us by the IMF research department and it is part of the 5 year projections of the IMF World Economic Outlook (WEO). Each WEO provides forecasts for the next five years. We have extended these forecasts by extrapolating average growth rates from 2000 until the last year in which a forecast is included. For example, for the WEO 2010 we have forecasts up to 2015. We extend them to 2021 by using the average growth rate between 2000 and 2015.

Figure 1. Revisions to US GDP

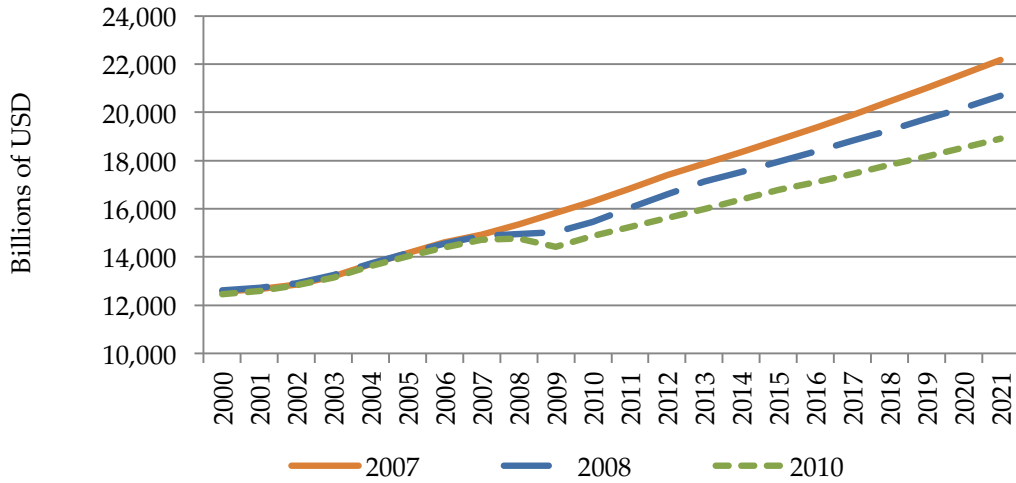
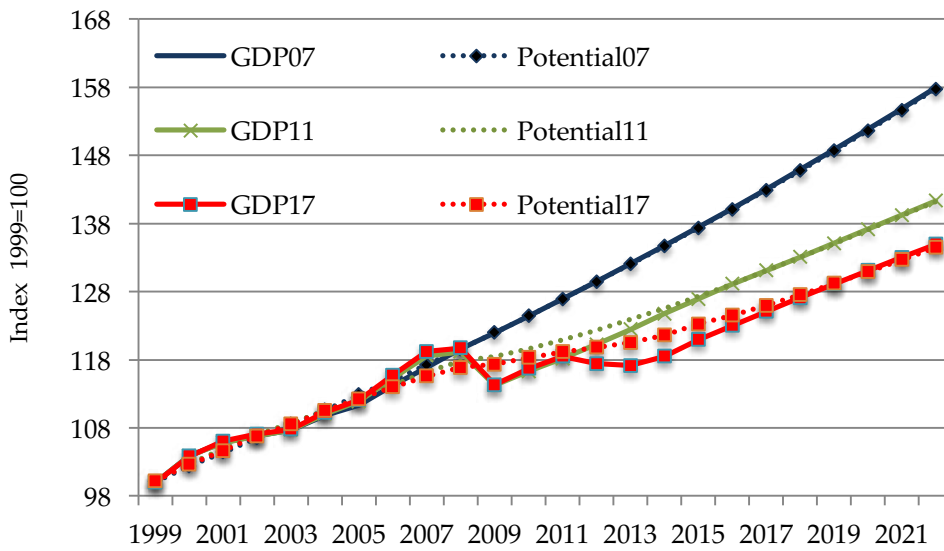


Figure 2. Revisions to Euro actual and potential GDP



In the case of Europe, the same phenomenon looks even more dramatic. Not only the revisions were large in the first years but they continued even after 2010 as the Euro zone entered its second recession. And when forecasts were being revised downwards, they also did so for long horizons. In Figure 2 we show the projections for both GDP and potential output for the Euro area in three different

dates: April 2007 (before the crisis), April 2011 (after the first wave of the crisis) and April 2017, the latest available data.<sup>3</sup>

What is clear from this chart is that the persistent effects of the current crisis are very large. Relative to the trend that the Euro area was following since the Euro was launched in 1999, GDP today is still far below that level (about 13% below). And as a signal that this reduction is seen as permanent, potential GDP has been revised downwards by a similar amount. The IMF expects today that by 2022 the Euro area will be about 15% below the level implied by its pre-crisis trend.<sup>4</sup>

In some ways, the persistence of GDP during the crisis does not entirely come as a surprise. The fact that recessions are persistent and can even leave permanent effects on GDP trend is well known in the academic literature since the presence of unit roots in GDP became accepted. However, the deviation from pre-crisis trend is much larger this time than in previous recessions and, as a result, is receiving more attention.

Where there is less consensus is on the origin of this persistence and how it should have influenced economic policy. Some see it as a reflection of slower trends in fundamentals (e.g. demographics, productivity) or the consequence of excesses in the past and conclude that the right policy response is structural reforms. Others see it as the outcome of hysteresis where the permanent effects are the result of cyclical phenomena. In this second case, the policy advice focuses on the need for more aggressive fiscal and monetary policies.

The debate is particularly relevant for the current crisis where contractionary fiscal policies were adopted two years after the crisis. Many advanced economies had seen exploding deficits and debt and concluded that a process of fiscal consolidation was needed. As fiscal consolidation took place, we witnessed its negative effects on output growth. As shown in Figure 2, the adjustment to potential GDP meant that policy makers believed that some of the causes of the

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<sup>3</sup> The April 2007 WEO does not contain forecast beyond 2008 for GDP or Potential. In that case, we are we are extrapolating both series using the average growth rate since 1999. The April 2011 WEO contains forecasts up to 2016. We are extrapolating both series for the next six years using the average growth rate since 1999. The April 2017 WEO contains forecasts up to 2022 for both variables. GDP data prior to 2007 is not identical in all three vintages because of data revisions. Potential was also revised backwards for several of these years.

<sup>4</sup> These numbers underestimate the actual changes in potential because the IMF has revised backwards its estimates for potential for earlier years. In our empirical analysis we will correct for these effects and we explain our methodology in an appendix at the end of the paper.

crisis were structural. This leads to a negative loop in which low GDP growth is seen as structural and makes policy makers believe that further fiscal policy adjustments are needed. And if hysteresis effects are large, potential output will indeed be reduced, validating the pessimistic expectations of policy makers. This is the focus of our paper. By extending the methodology of Blanchard and Leigh (2013) to longer horizons as well as applying it to potential output we analyze how fiscal consolidations during the 2009-2011 period led to changes in our long-term views on GDP and how this potentially created negative permanent effects on GDP.

By using IMF forecasts of both actual and potential GDP we show that fiscal consolidations in 2010-11 had a negative impact on output that extended over a long horizon, as the long-term performance of GDP as well as the estimates of potential output were both negatively affected.

The size of the effect is very large. In fact, our estimates provides evidence supporting the argument of DeLong and Summers (2012) who bring up the possibility of self-defeating fiscal consolidations, i.e. reductions in deficits that end up delivering higher debt-to-GDP ratios because of their negative effects on potential GDP. This has strong implications for the assessment of economic policies during the crisis. The cost of austerity extends beyond a short-run impact on GDP; it permanently affects the expected path of GDP and its effects on sustainability are exactly the opposite than its original goals.

The paper is organized as follows. Section 2 presents an analysis of the persistence of GDP during the crisis and compares this persistence to the behavior of potential output. Section 3 discusses alternative theoretical explanations for this behavior. Section 4 uses the fiscal consolidation of 2009-2011 as a way to identify the causes of persistence. Section 5 compares our estimates to the parameters of DeLong and Summers (2012) and Section 6 concludes.

## 2. The persistence of the Global Financial Crisis.

### 2.1 Forecast errors and persistence.

Starting in early 2007 GDP growth in advanced economies slowed down. By the end of 2007 the decrease in growth rates was evident and it materialized in a

recession that started in 2008 and deepened in 2009.<sup>5</sup> The crisis came as a surprise to forecasters, both private and official.

To understand how far forecasts were from the actual values of GDP we make use in our analysis of the forecasts made by the World Economic Outlook (WEO). The WEO is produced every 6 months, in April and October. The IMF makes its forecasts available through an online database that includes forecasts for at least two years. But there is also an unpublished complete set of 5-year forecasts to which we had access and that we use in our empirical analysis.

We start with the April 2007 issue of the WEO that, to a large extent, precedes the crisis. We take the 2006 data as factual and ignore the fact that later issues of the WEO will revise the data. We make use of the available forecasts going all the way to the year 2012.

We use the following notation for the forecast made in year  $t$  of a variable  $Y$  for the year  $t + i$ .

$$Y_{t+i}^{F,t}$$

So for GDP in 2009, the forecast made in 2007 will be expressed as

$$GDP_{2009}^{F,2007}$$

We compare these forecasts with the actual data for GDP. The data comes from the April 2016 edition of the WEO. We can for example calculate the forecast error for the year 2009 as:

$$FE_{GDP,2009}^{2007} = \frac{GDP_{2009} - GDP_{2009}^{F,2007}}{GDP_{2009}^{F,2007}}$$

Because of data revisions, changes in base year and also changes in national accounting rules, the level of GDP might not be comparable across different vintages of the IMF WEO.<sup>6</sup> We will use the following notation: the value of a

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<sup>5</sup> The NBER declared December 2007 as the starting month for the US recession. The CEPR concluded that the Euro had entered a recession in the first quarter of 2008.

<sup>6</sup> Since October 2014 the WEO has started using updated data using ESA2010 criteria.

variable  $Y$  in year  $t$  according to the IMF WEO vintage of year  $t + i$  is represented by:

$$Y_t^{t+i}$$

So, for example, GDP in 2009 according to the IMF WEO of 2016 will be expressed as

$$GDP_{2009}^{2016}$$

One way to avoid data revisions of GDP levels is to rewrite the expression for forecast errors in terms of GDP *growth*.<sup>7</sup> The forecast error for 2009 using the forecast made in 2007 then simply becomes the difference between actual and forecasted growth rates between 2006 and 2009:

$$FE_{GDP,2009}^{2007} = \frac{GDP_{2009}^{2016}}{GDP_{2006}^{2016}} - \frac{GDP_{2009}^{F,2007}}{GDP_{2006}^{2007}}$$

We first plot the data for 34 advanced economies (Figure 3).<sup>8</sup> The forecast of real GDP for the year 2009 was clearly too optimistic compared to the actual data. And for some countries such as Estonia, Latvia or Ireland the forecast error is as large as 30%.

We can think of these figures as the cyclical shock that hit advanced economies in the years 2007-2009, where by cyclical shock we have in mind the unexpected change in GDP during those two years.

The next question is how persistent this shock was. As we move our horizon forward and as time passes did we see a return of as output towards its previous trend?

We continue using the April 2007 WEO and look at the forecast made for 2012. We also extend the forecast horizon to 2015 by extrapolating GDP growth rates in the 2000-2012 period.<sup>9</sup>

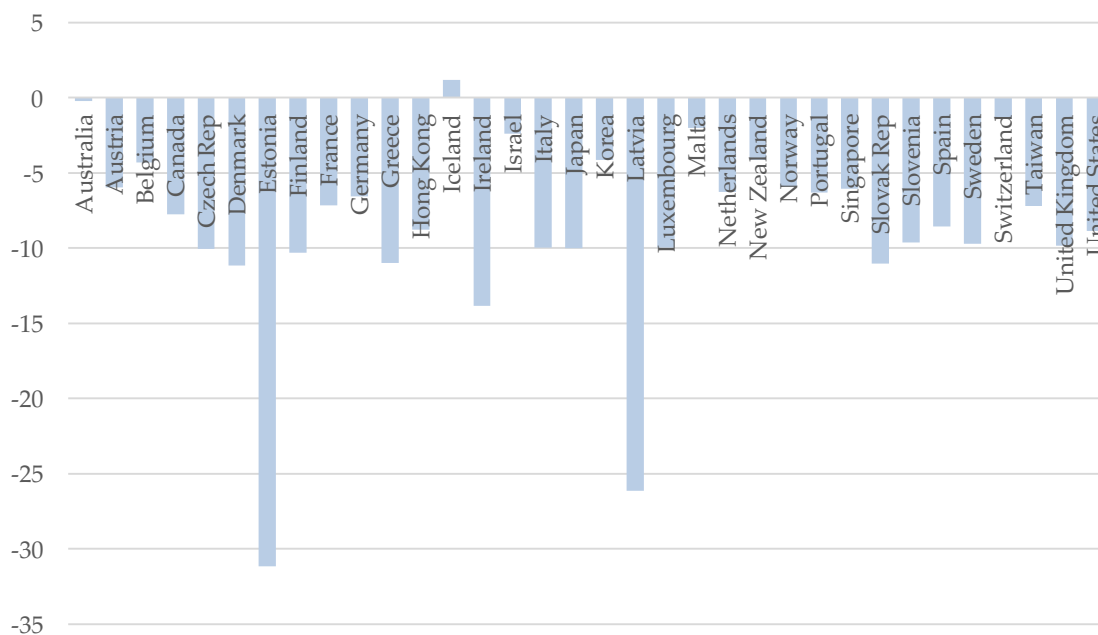
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<sup>7</sup> This is the same approach followed by Blanchard and Leigh (2013). An appendix at the end of the paper describes in detail the calculation of forecast errors for actual and potential GDP.

<sup>8</sup> An appendix at the end of the paper includes the list of all countries used in our analysis.

<sup>9</sup> When we extend the IMF forecasts beyond their 5 year horizons we always include the data since 2000 as well as the 5 years of forecast ahead to produce and average growth rate that is then applied to the years beyond those five. This could be considered as a pessimistic scenario as we

Figure 3. Forecast Error Real GDP 2009



When we compare the three forecast errors for all advanced economies we see a very large amount of persistence. Figure 4 shows the data for a representative sample of countries. The deviations of real GDP from forecasts in 2012 is almost always larger than those in 2009. The 2015 forecast error is also typically larger than the 2012 one, in particular in the European countries. This suggests that we see very little (or none) trend reversion and that the first shock continued its propagation during the 2009-2015 years and, in a sense, it seems to become permanent. We therefore confirm in this figure the results of Ball (2014): there is strong evidence that the 2008 crisis left permanent effects on GDP judged by the state of these economies in 2015.

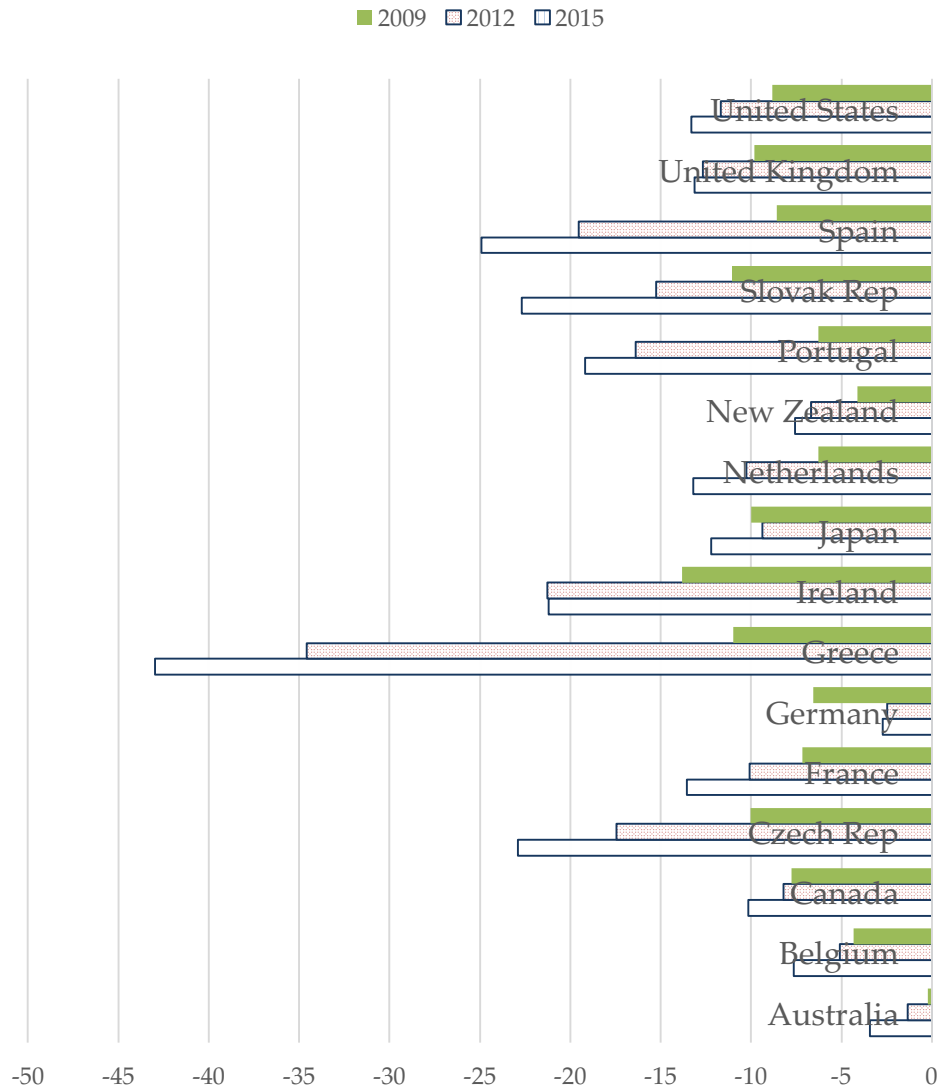
The fact that shocks to GDP are persistent is well known in the academic literature since the discussions on the existence of a unit root in. For example, Campbell and Mankiw (1989) were the first ones to look at GDP persistence in an international sample. Using simple univariate regressions, they analyzed by how much an unexpected 1% change in GDP changes future values of GDP. Their conclusion was that the initial change in GDP gets propagated over very long

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are including the crisis years to calculate a future trend. We have reproduced all our results using only the available years (without using the forecasts) as well as just the years before the crisis (2008). Qualitatively the results are identical but forecast errors become larger if trends are calculated excluding the crisis years.

horizons. By comparing forecast errors at different horizons we are performing a similar exercise but for a single event over an eight-year window.

Figure 4. Forecast Error Real GDP 2009, 2012 and 2015.



What we can see in Figure 4 is not just that GDP was lower than what we expected in 2012 or 2015, it is also that, across countries, the deviation of GDP from its forecast in those years is very much correlated with the size of the initial shock. The countries where the initial shock was large are the same countries where the forecast error several years ahead is the largest. This is an important fact because it suggests that there is a positive correlation in forecast errors across countries so the changes in GDP over long horizons are related to the size of the

initial shock. This would not be the case if we were looking at random independent shocks taking place in different years.

To make this pattern of persistence explicit we run a regression of the forecast error for these later years against the forecast error for 2009. For this analysis we extend our horizon by calculating the forecast error for 2021.<sup>10</sup>

In Table 1, for advanced economies, we can see that the coefficient is greater than one, signaling that the outlook for 2012, 2015 and 2021 has worsened relative to the unexpected change in GDP in 2009. We confirm that countries that suffered larger crisis have seen a much larger downward revision of our long-term GDP estimates, the crisis is seen as long lived.

Table 1. Persistence of Forecast Errors Real GDP. Advanced Economies.

	2012	$FE_{GDP,t}^{2007}$ 2015	2021
$FE_{GDP,2009}^{2007}$	1.086*** (0.123)	1.429*** (0.151)	1.848*** (0.206)
Constant	-2.120 (1.340)	-2.202 (1.748)	-2.799 (2.581)
Observations	34	34	34
R-squared	0.592	0.611	0.605

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Interestingly, a similar pattern is visible among a group of emerging markets (Table 2). Using the same methodology as above we replicate the analysis for a sample of 31 emerging markets and we get similar result with an even larger coefficient.<sup>11</sup>

<sup>10</sup> We use 2021 because it is the latest year for which the April 2016 WEO produces a forecast. Although we refer to this figure as a forecast error, what we are really capturing is the change in forecast for the year 2021 between our extended forecast using the IMF data of the April 2007 WEO and the one produced by the IMF for the WEO in April 2016.

<sup>11</sup> The fact that persistence is larger for emerging markets with higher growth rates is consistent with the findings of Fatás (2000).

Table 2. Persistence of Forecast Errors Real GDP. Emerging.

	$FE_{GDP,t}^{2007}$		
	2012	2015	2021
$FE_{GDP,2009}^{2007}$	1.588*** (0.229)	2.180*** (0.391)	2.180*** (0.391)
Constant	1.971 (1.381)	-0.415 (2.682)	-0.415 (2.682)
Observations	31	31	31
R-squared	0.734	0.691	0.691

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Why is output so persistent? Is the labor market relevant to explain the persistence of GDP shocks? We replicate in Table 3 the specification of Table 1 but with the addition of the forecast error of both the unemployment rate and employment over the same years to understand if changes in the labor market can help explain the persistence of GDP forecast errors in 2015 and 2021.

While these results have to be taken with great care given the unstructured nature of our specification, labor market variables do not seem to have much explanatory power beyond the changes in GDP. With the exception of employment at the 2015 horizon, none of the other variables are significant. This does not mean that the labor market does not matter, as it is behind the initial change in GDP, but it shows that differences in labor market performance among two countries with similar GDP changes in the earlier years does not significantly improve our understanding the long-term persistence of GDP. And the fact that the significance is only present at a shorter horizon is consistent with the logic that labor market outcomes might be persistent over several years but they tend to return to normal over a longer horizon. The very long-term persistence of GDP needs to be explained by other factors such as physical capital or productivity.

Table 3. Persistence of Forecast Errors Real GDP. Advanced Economies.

	$FE_{GDP,t}^{2007}$			
	2015	2021	2015	2021
$FE_{GDP,2009}^{2007}$	1.198*** (0.181)	1.658*** (0.249)	1.377*** (0.287)	1.811*** (0.355)
$FE_{Employment,2009}^{2007}$	0.483** (0.215)	0.397 (0.322)		
$FE_{Unemployment,2009}^{2007}$			-0.171 (0.684)	-0.120 (0.818)
Constant	-3.538** (1.596)	-3.897 (2.423)	-2.292 (1.774)	-2.862 (2.625)
Observations	34	34	34	34
R-squared	0.641	0.617	0.612	0.605

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

## 2.2. Persistence or permanent effects?

We have seen that unexpected changes in GDP in 2008 became very persistent and, across countries, the forecast error in 2016 or even 2021 is correlated with the initial shock. Will these persistent effects ever die out? Or are the observed changes in GDP likely to be a good estimate of the permanent effects?

One way to address this question is to make use of measures of potential output. Potential output can be seen as a long-term forecast for GDP and the distance between potential and actual GDP (the output gap) is an indication of the possibility that GDP will return to its previous trend. If cyclical events are seen as transitory, a fall in GDP should lead to a smaller change or no change in potential output. In that sense, the estimates of potential output offer us a view on how the persistent effects of this crisis are perceived to become permanent. The drawback of using potential output is that it is a constructed measure that might contain noisy and limited information on the long-term evolution of GDP. If this is true, the only way to truly assess the long-term effects of a crisis on GDP

is to wait a few more decades and see where actual GDP is relative to what was predicted before the crisis.

Our view is that, despite all the issues associated to its measurement, potential output still provides two valuable insights. First, for some countries in our sample there is still a significant output gap at the end of the sample and measures of potential output are a valuable predictor of long-term GDP. Second, potential output as forecasted by the IMF or national governments, is a key variable used in the analysis of fiscal policy sustainability and, as such, it informs policy makers of the correct fiscal stance at a given point in time. By looking at potential output during the crisis we can see how the policy makers' views on the long-term value of GDP were evolving. As we argued before, it is possible that a pessimistic view of long-term GDP leads to an excessive fiscal consolidation that makes that pessimistic forecast a self-fulfilling prediction through the permanent effects of fiscal policy. We want to understand these dynamics.

We now replicate our previous regressions but using as dependent variable the forecast error of potential GDP for the same three years (2012, 2015 and 2021).<sup>12</sup> We once again use the unexpected change in GDP during 2006-09 as our measure of the initial shock and we ask how potential output changed relative to what we had earlier anticipated (Table 4). The estimates suggest that the revisions to potential output were very large as well.

In fact, the size of the coefficients in Table 4 are very similar to what we found in Table 2, suggesting that the large revisions to GDP are, over time, perceived as permanent. As an example, the unexpected decrease in GDP until 2009 can help explain a decrease in about 1.8 percentage points of potential output in 2021, not very different from the 2.1 percentage points we found for GDP. Another way to understand these magnitudes is to look at current estimates of output gap. While they signal some expected recovery in the years ahead for some countries, this recovery is much smaller than the output that has been lost so far. The losses have become, to a large extent, permanent.

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<sup>12</sup> Calculating forecast errors for potential output is more complicated than for GDP. Potential output is not observed but estimated. In addition, revisions to current level of potential output tend to lead to revisions of *past* levels of potential output. In our calculations we ignore these historical revisions. What we are comparing is how our view of future potential output changes as time passes. This means that we cannot simply compare forecast errors in growth rates as we did with GDP. We explain in detail the methodology we use to deal with ex-post revisions to potential output estimates in an appendix at the end of the paper.

Table 4. Persistence of Forecast Errors Potential GDP. Advanced Economies.

	$FE_{Potential\ GDP,t}^{2007}$		
	2012	2015	2021
$FE_{GDP,2009}^{2007}$	1.174*** (0.295)	1.537*** (0.365)	1.843*** (0.421)
Constant	-0.188 (2.041)	-1.186 (2.360)	-4.642* (2.566)
Observations	29	29	29
R-squared	0.448	0.440	0.399

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

While these effects seem to be present across all 29 advanced economies, they are stronger in some countries. Table 5 repeats the same exercise for the sample of European countries and Euro members. Overall the coefficients are the largest among the Euro members.

Table 5. Persistence of Forecast Errors Potential GDP in the Euro Area.

	Europe			Euro		
	$FE_{Potential\ GDP,t}^{2007}$			$FE_{Potential\ GDP,t}^{2007}$		
	2012	2015	2021	2012	2015	2021
$FE_{GDP,2009}^{2007}$	1.136*** (0.380)	1.482*** (0.466)	1.851*** (0.556)	1.802*** (0.575)	2.207** (0.838)	2.760** (1.017)
Constant	-1.471 (2.894)	-2.646 (3.368)	-4.603 (3.890)	3.446 (4.069)	2.120 (6.089)	0.759 (7.650)
Observations	19	19	19	13	13	13
R-squared	0.390	0.361	0.336	0.480	0.400	0.388

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 3. Is the persistence of GDP surprising? Literature review.

#### 3.1. Output shocks tend to be persistent.

So far we have shown that the shock that hit advanced economies after 2007 has been very persistent. More than eight years after the crisis started the current level of output as well as the estimates of potential GDP are much lower than expected. It is by now well accepted that these countries will not regain their pre-trend crisis levels.

In many ways this should not be a surprise, since we know from the pioneering work of Nelson and Plosser (1982) that fluctuations are persistent and that US GDP displays a unit root in GDP. And Campbell and Mankiw (1989), among others, later confirmed that this persistence is also present for G7 countries: a 1% fall in output lowers its long-term projection by more than 1%, consistent with our findings.

The fact that persistence is large during this crisis is also supported by an empirical literature that has studied the long-term permanent effects of major crises. The focus of this literature is typically only on negative shocks (“crises”) that are large and clearly identifiable in the data.

Many of the papers have studied either emerging markets (where crises tend to be larger) or financial crises that tend to be characterized by deep and protracted recessions. The evidence shows that output fails to catch up with its previous trend after any of these large events.

Cerra and Saxena (2008) produce evidence that after financial and political crises output losses are very persistent even after taking into account the possibility of endogeneity. Using a much longer time horizon Reinhart and Rogoff (2014) also show that recovery from financial crisis is slower than from regular crisis (similar results in International Monetary Fund (2009), Jordà, Schularick, and Taylor (2011) or Claessens, Kose, and Terrones (2011)).<sup>13</sup>

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<sup>13</sup> Although others have expressed partial disagreement with this assessment. Howard, Martin, and Wilson (2011) show that recoveries are in fact very quick after deep financial crisis although they agree that they are very slow after *long* financial crisis. And Bordo and Haubrich (2012) or Romer and Romer (2014) present an even more dissenting view about why financial crisis are special using data for US or advanced economies.

Some of these papers assess directly the effect that financial crises have on potential output. Furceri and Mourougane (2012) show that financial crises have a significant effect on potential output for OECD economies.

The strong persistence of recessions applies to more than just large financial crisis. Blanchard, Cerutti, and Summers (2015), Martin and Wilson (2013) and Haltmaier (2013) show that across all recessions in advanced economies over the last 40 years GDP is very persistent. More interestingly, they also show that potential output is consistently revised downwards during crisis years. This is very much consistent with the evidence we have presented in the previous section.

A related, although separate, literature emphasizes the persistent or permanent effects of recessions on the labor market. The literature started with the observation that European unemployment failed to return to its pre-crisis level during the 1970s (Blanchard and Summers (1986)). The literature has recently regained some interest because of the persistent behavior of unemployment and, in particular, long-term unemployment, during the Great Recession mainly in Europe but also in the US.

The severity of the Great Recession has generated a good number of papers that have looked at its persistence. Ball (2014) shows that potential output has been reduced significantly among OECD countries during the years following the beginning of the crisis. Rawdanowicz et al. (2014) also show how losses to GDP have become permanent in most advanced economies. Reifschneider, Wascher, and Wilcox (2015) make the same point just for the US economy.

### 3.2. Interpreting the persistence of shocks (and large crises).

The early evidence on the persistence of GDP shocks, both positive and negative, represented a challenge to the standard view of business cycles. Traditionally, the trend had been seen as driven by a standard growth model (e.g. Solow) and models of the business cycles, even those based on Keynesian views of fluctuations, assumed that booms and recessions represented deviations from this trend.

The fact that Nelson and Plosser (1982) showed that the trend itself was stochastic and its variance could account for a large amount of the GDP variation was seen as evidence that technology shocks were a significant driving force of

fluctuations. This interpretation led to the generalized use of real business cycle models in the analysis of economic fluctuations. In fact, the persistence of shocks was used as a way to separate demand (temporary) from supply (permanent) sources of shocks as in Blanchard and Quah (1989).

But there is also a very different interpretation of the persistence of GDP, if we are willing to deviate from the tradition of separating long-term dynamics and business cycles. It is possible that cyclical conditions leave permanent scars on output, what is typically referred to as hysteresis. It was originally applied to models of the labor market as in Blanchard and Summers (1986) where cyclical unemployment turned into structural one. But the logic extends even more naturally when we start thinking of long-term growth as endogenous and we allow for the possibility that economic cycles interrupt temporarily these long-term dynamics. Stadler (1990) showed how in endogenous growth models any type of shock has permanent effects on GDP because it temporarily affects the underlying growth dynamics. During recessions, investment is lower, R&D expenditures are lower and trend growth happens at a lower pace than during normal years. Fatás (2000) presents a similar model as well as evidence supporting this logic.<sup>14</sup>

The difficulty of separating these two hypotheses (technology shocks versus hysteresis) is dealing with endogeneity and identification of shocks. The literature has followed several approaches to produce evidence that supports the existence of hysteresis. First, by showing that variables that drive trend growth are indeed affected by cyclical conditions (e.g. investment and R&D expenditures are procyclical). Second, by studying the existing positive correlation between long-term growth rates and the persistence of fluctuations, which is consistent with models with hysteresis effects (Fatás (2000)). Finally, by identifying specific shocks that are cyclical in nature (such as monetary or fiscal policy shocks) and then analyzing the persistence of GDP in response to these shocks to show the presence of hysteresis. For example, Blanchard, Cerutti, and Summers (2015) show that recessions that are caused by demand shocks tend to be very persistent. International Monetary Fund (2009) presents evidence that during the Asian crisis, countries with stronger countercyclical policies had less persistent

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<sup>14</sup> There is a third interpretation of persistence which argues that the pre-crisis evolution of GDP was unsustainable. Some of those activities (e.g. financial sector activity) turned out to be unproductive and once they evaporated, GDP follows a lower trajectory than what was observed prior to the crisis. While in some ways this can be interpreted as a negative “technology” shock, strictly speaking it is not a shock but more the end of the dynamics that drive the business cycle.

fluctuations. We follow this last strand of the literature by studying the cyclical movements in output that resulted from the widespread 2009-11 fiscal consolidations to understand how much they can explain the observed persistence in GDP.<sup>15</sup>

#### 4. Cyclical or structural? A test using the 2009-11 fiscal consolidation.

##### 4.1. Identifying fiscal policy shocks.

We have documented in Section 2 that the crisis that started in 2007 has turned to be very persistent across all countries. From our discussion in Section 3 we understand that there are two potential explanations. First, it could be that the depth of the crisis is simply driven by changes in potential output. For this to be true, it would have to be that during the years 2008-15 these countries have suffered structural changes that have made forecasters revise downwards the estimates of potential output. These changes must have had a country-specific component that explains the cross-country variation. And the changes must have been unanticipated; i.e. aging and demographic changes could be relevant to understand dynamics of potential output but they were anticipated before the crisis.

The second explanation for persistence is that country-specific factors (such as economic policies or labor market characteristics or pre-crisis dynamics) have generated variation in the depth and length of the crisis that has translated into a fall in potential output via hysteresis effects.

Separating these two effects from an empirical point of view is challenging. Ideally one needs to identify exogenous movements in macroeconomic variables that can be used to identify the direction in which causality runs. This issue is no different from the endogeneity problems of the literature on fiscal policy multipliers and the debate about the effects of austerity: we know that fiscal policy austerity seems to be correlated with decreases in output but in which direction does causality run?

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<sup>15</sup> House, Tesar, and Pröbsting (2017) also analyze the persistent effects of fiscal policy changes in European countries. Gechert et al. (2017) replicate some of our results and produce some additional robustness checks. Engler, Tervala, and others (2016) provides a model where fiscal policy shocks become persistent through learning by doing.

In the context of the fiscal policy multiplier debate, Blanchard and Leigh (2013) introduced a simple methodology to deal with endogeneity in order to measure the impact of the 2009-2010 fiscal consolidations in European economies. Their methodology is in many ways similar to the identification assumptions of more complex econometric specification (such as a VAR) but in a much simpler framework. Their methodology relies on the fact that GDP forecast errors should be uncorrelated with fiscal policy if the model used to generate the forecasts has the right assumptions about fiscal policy multipliers. If we find that the correlation is negative and significant it means that the model is underestimating fiscal policy multipliers.

We make use of their methodology to identify fiscal policy shocks and then explore how these fiscal consolidations are responsible for changes in both GDP over a longer horizon and potential output.

We start by replicating the results of Blanchard and Leigh (2013). We use the same years, 2010 and 2011, where fiscal consolidations were planned and executed among many economies. We also focus on the same set of countries: European countries among the advanced economies. We collect data from the April 2010 WEO and measure the planned fiscal consolidation over the next two years (2010 and 2011) as the change in the forecast of the change in the structural balance as a percentage of potential GDP ( $\Delta SB_{i,2010-2011}^{F,2010}$ ). This is identical to the specification of Blanchard and Leigh (2013) and this magnitude can be thought of as the size of the planned fiscal consolidation. We then measure the forecast error for real GDP in the level of output for different years ( $t$ ).

The forecast error for year  $t$  and country  $i$  is computed using the data available from the IMF World Economic Outlook of April 2016 against the forecast made in April 2010. We then regress this GDP forecast error on the planned fiscal consolidation in the cross section of countries.

$$FE_{GDP,i,t}^{2010} = \alpha + \beta \Delta SB_{i,2010-2011}^{F,2010} + \varepsilon_i$$

Under the assumption that the forecast had been made using the right fiscal policy multipliers, the coefficient  $\beta$  should be equal to zero. Blanchard and Leigh (2013) found that the coefficient was negative, large and significant, a sign that fiscal policy multipliers had been underestimated by the IMF model.

Table 6. Blanchard and Leigh Replication.

	$FE_{GDP,t}^{2010}$	
	Europe	Euro
	2011	2011
$\Delta SB_{2010-2011}^{F,2010}$	-1.341** (0.530)	-1.534** (0.578)
Constant	1.150*** (0.402)	1.340*** (0.393)
Observations	22	14
R-squared	0.500	0.609

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

When we replicate their results for 2011 (Table 6), we find almost identical results (there are small differences because of slightly different sample and because the data has been revised since their analysis). We find a coefficient of about 1.3 for Europe as a whole, similar to their results, and slightly larger if we restrict the sample to Euro countries. Remember that the forecast made by the IMF in April 2010 for the next two years already assumed that fiscal consolidation would affect GDP with a multiplier of 0.5. In that sense, the coefficient  $\beta$  here represents the effects of fiscal consolidation in addition to that assumed multiplier (0.5). Given the coefficient of 1.3 the estimated multiplier is around 1.8 for Europe and closer to 2 for the Euro members.

#### 4.2. The persistent effects of fiscal policy shocks.

Using the methodology of Blanchard and Leigh (2013) we have identified movements in GDP that are associated to the fiscal consolidations during the years 2009-2011. We now want to assess how persistent these changes in GDP were and whether they were also reflected in changes in potential output.

In order to capture these effects, we run a two-stage procedure: we first regress changes in output during the earlier years of the crisis (2010-11) on the planned fiscal consolidation during those years (this is identical to the Blanchard and Leigh (2013) specification of Table 6):

$$FE_{GDP,i,2011}^{2010} = \alpha + \beta \Delta SB_{i,2010-2011}^{F,2010} + \varepsilon_i$$

We now use the fitted values from this regression  $\widehat{FE}_{GDP,2011}^{2010}$  as the explanatory variable to understand unexpected changes in GDP over longer horizons.

$$FE_{GDP,i,t}^{2010} = \alpha + \beta \widehat{FE}_{GDP,i,2011}^{2010} + \varepsilon_i$$

The interpretation of this second regression is that we are measuring the effects on long-term GDP of changes that took place during 2010-11 *that were caused by the fiscal consolidation during those two years*. In other words, we are isolating changes in GDP that are caused by identifiable changes in demand (via fiscal policy) and assessing whether they become persistent over time.

The estimates of Table 7 show that the fiscal-policy-induced changes in GDP in the years 2009-2011 were very persistent. A 1% change in GDP led to changes in more than 1% by 2015 and around 2% by the year 2021.

Table 7. Long-Term Effects of Fiscal Consolidation. 2SLS Estimation.

	$FE_{GDP,t}^{2010}$			
	Europe		Euro	
	2015	2021	2015	2021
$\widehat{FE}_{GDP,2011}^{2010}$	1.176** (0.462)	2.061*** (0.501)	1.299** (0.439)	2.099*** (0.559)
Constant	-4.980*** (0.997)	-4.700*** (1.481)	-5.441*** (1.315)	-5.239** (2.086)
Observations	22	22	14	14
R-squared	0.575	0.540	0.657	0.607

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Our 2SLS estimation can be interpreted as an IV estimation of the long-term effects of cyclical changes in GDP using fiscal policy as an instrument. When we perform a Durbin-Wu-Hausman test we see that the hypothesis of exogeneity in the OLS estimates cannot be rejected. This means that the persistent effects identified by IV estimation are not different from the effects of any other cyclical

movements in GDP (those unrelated to fiscal policy). This is not a surprise, and it simply confirms that the persistence of fiscal policy shocks is similar to that of any of the other cyclical events that were taking place during these years.

The fact that the coefficient is similar across the two samples does not mean that the overall effects are the same. We are not measuring a fiscal policy multiplier in this table, we are capturing the extent to which short-term changes in GDP became persistent. In Table 6 we have shown that the short-term multiplier was larger for the Euro members. Given that now we can see that the persistence is similar for both samples, it means that the initial larger multiplier is also translated into larger permanent effects for the Euro countries.

We can now test whether a similar pattern is observed when looking at potential output. We estimate these effects using the same 2SLS procedure. The first-stage regression is the same as before and for the second-stage regression we now use forecast errors of potential GDP on the left-hand side of our regression:

$$FE_{PGDP,i,t}^{2010} = \alpha + \beta \widehat{FE}_{GDP,i,2011}^{2010} + \varepsilon_i$$

Table 8. Permanent Effects of Fiscal Consolidation. 2SLS Estimation.

	$FE_{Potential\ GDP,t}^{2010}$			
	Europe		Euro	
	2015	2021	2015	2021
$\widehat{FE}_{GDP,2011}^{2010}$	1.005** (0.402)	1.401** (0.559)	1.065** (0.387)	1.468** (0.600)
Constant	-3.521*** (0.869)	-5.060*** (1.464)	-3.548*** (1.114)	-5.671** (2.064)
Observations	22	22	14	14
R-squared	0.560	0.433	0.654	0.499

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The results of Table 8 confirm that the effects of fiscal policy are seen as permanent, having an effect on our current estimates of potential output that are as large or larger than the cyclical effect on GDP. The estimated coefficient is very large. It suggests that not only the temporary effects of fiscal consolidation do not die out over time but that the long-term effects are likely to be larger than

the initial ones. Every 1% fiscal-policy-induced decline in GDP during the years 2010-11 translated into a 1% decline in potential output by 2015 and even more for 2021.

The results are significant for both samples with similar coefficients for the Europe and Euro samples. And looking at the R-squared, the short-term fiscal-policy-induced movements in GDP can explain a large percentage of the variation in potential output across countries, as much as 65%.

### 4.3 Interpreting our results. Are there alternative explanations?

*How can the results be so large?*

We have exploited the strong cross-country correlation between the fiscal consolidations in 2010-11 period and the subsequent changes to GDP and potential output to claim that fiscal policy has had large and permanent effects on GDP. As argued before, persistence of fiscal policy shocks should not be a surprise to the academic literature. However, the size of the effects seems to be larger than in previous crises. But we need to keep in mind that our estimates take place during the worst recession since the Great Depression at a time when monetary policy was constrained by the zero-lower bound in many countries.<sup>16</sup> In addition, for the countries inside the Euro area monetary and exchange rate policies were unavailable at the country level and they all coordinated to large fiscal consolidations.<sup>17</sup>

As an illustration of why this was a special crisis, Blanchard and Leigh (2013) show that applying their methodology to other periods of time where these conditions do not apply produce much smaller fiscal policy multipliers. We would expect our results to be also weaker for those periods.

*Are these long-term fiscal policy multipliers?*

When it comes to interpreting the size of our coefficients one needs to be careful. While our specification is based on the analysis of fiscal policy multipliers of Blanchard and Leigh (2013), we are looking at a longer horizon which makes the interpretation of our estimates as multipliers less straightforward. In their

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<sup>16</sup> Recent analysis of fiscal policy multipliers confirms that they tend to be substantially larger in a depressed economy. See, for example, Auerbach and Gorodnichenko (2011).

<sup>17</sup> In addition, the fact that European economies are very integrated is likely to make fiscal policy multipliers large through spillovers effects. See Auerbach and Gorodnichenko (2013).

analysis by matching the timing of the fiscal consolidation to the change in the forecast error for GDP one could argue that the variation in changes in GDP is directly related to fiscal policy changes (which constitutes the standard definition of multipliers).<sup>18</sup>

In our case we extend the horizon by an additional four to eight years beyond the years where the fiscal policy changes are taking place. In that sense, it is possible that we are capturing some additional effects. In particular, the initial fiscal policy shock could be correlated (across countries) with shocks or reactions in the following years that also have an impact on GDP or potential. While this makes more difficult the interpretation of our estimates as multipliers, we see this possibility as strengthening the story we want to tell from our analysis.<sup>19</sup>

Countries that implemented large fiscal consolidations in 2010-11 might have found themselves in 2012 with a depressed economy that might have required even larger adjustments in fiscal policy that further depressed future growth. If this is true, as we move the timing of GDP to 2015 and 2021 we are likely to capture in our estimates also the effects of potential second-round policy tightening. But in some ways these second-round effects can be seen as the outcomes of the first policy decisions. In that sense, the fact that the final effects on GDP are correlated with the initial fiscal policy shock suggests that our estimates are capturing the full consequences of the policy decisions taken earlier even if do not quite fit the typical definition of a fiscal policy multiplier.<sup>20</sup>

*Are our fiscal consolidation shocks exogenous?*

Our measure of fiscal consolidation is based on the planned changes to structural budgets according to the IMF. Are these shocks truly exogenous? The biggest potential concern with the interpretation of our results is that the persistence we

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<sup>18</sup> Of course, there could be longer-term effects on GDP that are not captured in their analysis but as long as we believe that the majority of the effects of fiscal policy shocks are felt contemporaneously, the estimate of multipliers will be close enough.

<sup>19</sup> The fact that in many of our results the short-term effects are amplified as time passes suggests that either there are other shocks that follow and are correlated with the initial one or the presence of "superhysteresis". It might be that not only the level of GDP is affected by the crisis but also its growth rate, in a persistent manner. Studying these interesting issues is beyond the scope of this paper and probably requires additional data to test each of these hypotheses.

<sup>20</sup> This is a general issue with any estimate of the dynamic effects of economic policy shocks. It is just more relevant for our paper because of the longer horizons over which we are estimating the effects.

observe is not the response to these fiscal consolidations but it is simply an outcome of the initial shock that takes place in the early years (2008-09). That shock leads to a deterioration of budgets and the need for fiscal consolidation in the years that follow. Countries that are more affected by the initial shock have to implement stronger consolidations.

For this concern to be relevant it would have to be that the forecasts made by the IMF in 2010 somehow ignored the persistent effects of the changes in GDP during 2008-09. In that case, their forecast errors in the later years would be correlated with the size of the fiscal consolidation but this would simply reflect the mechanical correlation with the early shock, and not causality.

This criticism applies to our work as much as the work of Blanchard and Leigh (2013). In their analysis Blanchard and Leigh (2013) already provide evidence that addresses this concerns. In particular, they control for macroeconomic variables that could be related to the size of the initial shock, such as financial stress, initial level of current account imbalances and household debt. The estimate of multipliers is robust to the introduction of all these controls.

Table 9. Permanent Effects of Fiscal Consolidation. 2SLS Estimation.  
Robustness Test: Introducing Size of Initial Shock

	$FE_{Potential\ GDP,t}^{2010}$			
	Europe		Euro	
	2015	2021	2015	2021
$\widehat{FE}_{GDP,2011}^{2010}$	0.984* (0.475)	1.832*** (0.526)	0.994** (0.424)	1.305** (0.569)
$FE_{GDP,2009}^{2007}$	0.448 (0.289)	0.532 (0.460)	0.557 (0.824)	1.449 (1.191)
Constant	-1.622 (2.027)	-0.709 (3.599)	-0.899 (6.412)	6.577 (9.304)
Observations	22	22	14	14
R-squared	0.594	0.563	0.617	0.618

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

To complement their robustness analysis, we produce an additional regression (Table 9) where we replicate the specification of Table 8 but adding as a control the size of the initial shock to GDP measured as the forecast error of the first two years of the crisis (2008 and 2009), from the perspective of April 2007 ( $FE_{GDP,2009}^{2007}$ ).

The results show that the introduction of this control does not change the conclusions of our analysis. The coefficient on our variable of interest remains significant and of similar size. In other words, the persistence that we are measuring is not simply an outcome of the persistence of the initial shocks. It is still the case that the changes in GDP induced by fiscal consolidations help are persistent and explain the long-term forecast of GDP.

Other recent papers in the literature have also provided additional robustness tests supporting our interpretation. Addressing the concern that the IMF forecasts might not be capturing all the information available at the time they were made, Gechert et al. (2017) have replicated our analysis using two alternative measures of fiscal consolidations: forecast errors by the European Commission and a narrative measure of fiscal consolidation that relies on the Discretionary Fiscal Effort collected by the European Commission in the AMECO database. These measures are very different from the one we are using in this paper but the estimate of hysteresis is confirmed in their empirical estimates.

In summary, while there is no doubt that the issue of endogeneity is challenging when identifying policy shocks in a small cross section of countries, we find that our estimates combined with those of the other papers in the literature strongly support our interpretation of the results.<sup>21</sup>

#### *Persistent or permanent?*

Our results show that the effects of the fiscal consolidations of 2010-11 were very persistent. We have shown this using two different measures of the long-term effects on GDP. We first have looked at GDP levels seven years after the policy was planned (2016) as well as changes in forecasts for an even longer horizon (2021). In addition, in Table 8, we have made use of estimates of potential output that could contain additional information on future GDP and our results were confirmed.

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<sup>21</sup> Gechert et al. (2017) also provide additional robustness tests of our results including different time periods and a panel specification.

Despite the consistency of our results, is it possible that neither of these measures provide a good forecast of GDP in the very long term? Maybe when we look at the years ahead we will witness a period of fast economic growth that brings GDP closer to its pre-fiscal consolidation years? While this is possible, we believe it is very unlikely. The fact that the value of actual GDP in 2016 or its current forecast for 2021 are correlated with the fiscal changes in 2010-11 is already a good indication that these effects are extending over a very long horizon. We are not aware of any current forecasts of GDP from any national government or international organization that suggests that an increase in growth is about to happen and that this increase will be correlated with the GDP losses of the previous years. Using one of the most dramatic countries as an example, it is difficult to imagine Greece to deliver extremely fast growth rates over the coming years not only to recover the 25% lost GDP but in addition to catch up with the previous pre-crisis trend. In summary, all information currently available points in the direction that the GDP losses are indeed very persistent or permanent.<sup>22</sup>

## 5. Was the fiscal consolidation self-defeating?

Our estimates suggest that the fiscal contraction in European economies reduced output not only in the short term but also in the medium term and possibly on a permanent basis. This reduction in output makes achieving the goal of the fiscal consolidation harder as it raises the ratio of debt to GDP.

This argument was forcefully made by DeLong and Summers (2012) who show that in a depressed economy a fiscal consolidation can be self-defeating, it can lead to an increase in debt. We now follow closely their analysis and use our results to see whether the European experience during this crisis can be seen as supportive of their conclusion.

Let  $D_t$  be the level of government debt,  $G_t$  spending,  $T_t$  taxes and  $Y_t$  the level of GDP in year  $t$ . Imagine a government that introduces a fiscal consolidation plan that involves a decrease in spending.

$$\Delta G_t = G_{t+1} - G_t$$

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<sup>22</sup> Strictly speaking, we can reinterpret permanent effects as very persistent effects. We can then calculate the “permanent equivalent” loss in GDP as in DeLong and Summers (2012).

where  $G_{t+1}$  refers to the level of government spending planned for next year which we assume matches its execution. But the change in spending is likely to affect negatively GDP next year. The change in GDP will depend on the fiscal policy multiplier ( $\mu$ ).

$$\Delta Y_t = \mu \Delta G_t$$

The level of debt will be reduced by

$$\Delta D_t = \Delta G_t - \Delta T_t = \Delta G_t - \mu\tau\Delta G_t = (1 - \mu\tau) \Delta G_t$$

This reduction in the level of debt imposes a burden on future government balances equal to

$$(r - g) \Delta D_t = (r - g) (1 - \mu\tau) \Delta G_t$$

Where  $r$  is the government borrowing rate and  $g$  is the long-run growth rate of GDP.

We assume that some of the effects of the recession become permanent. In particular potential output is likely to change by an amount ( $\Delta Y_t^p$ ) that is related to the cyclical change in output ( $\Delta Y_t^c$ ).

$$\Delta Y_t^p = \eta \Delta Y_t^c = \eta \mu \Delta G_t$$

Where the parameter  $\eta$  is the hysteresis parameter. Because of this change in output there will be a permanent loss of revenues equal to

$$\tau \Delta Y_t^p = \tau \eta \mu \Delta G_t$$

A fiscal contraction is self-defeating as long as

$$\tau \eta \mu \geq (r - g) (1 - \mu\tau)$$

or, alternatively, we can express it as an upper bound for the interest rate faced by governments as a function of all the other parameters:

$$r \leq g + \frac{\tau \eta \mu}{(1 - \mu\tau)}$$

DeLong and Summers (2012) calibrate the above equation for the US economy. They take the real growth of GDP to be around 2.5% using CBO forecasts of long-term growth. Since their work was published, the CBO forecast has reduced this estimate to 1.9% (see Congressional Budget Office (2017)). The marginal tax-and-transfer rate ( $\tau$ ) was calibrated to be equal to 0.333. Given these parameters we can now calculate values for the government debt interest rate below which the condition holds given certain values of the hysteresis parameter ( $\eta$ ) and the fiscal policy multiplier ( $\mu$ ). These critical values are included in Table 10, where we use the same range as DeLong and Summers (2012) for the hysteresis parameter and a narrower one for the multiplier.<sup>23</sup>

Table 10. Critical Values for the Government Real Interest Rate (US)  
( $g=1.9\%$ ,  $\tau=0.333$ )

	Fiscal Policy Multiplier				
	$\mu = 0.5$	$\mu = 1.0$	$\mu = 1.5$	$\mu = 2.0$	$\mu = 2.5$
Hysteresis Parameter					
$\eta = 0$	1.90%	1.90%	1.90%	1.90%	1.90%
$\eta = 0.025$	2.40%	3.15%	4.40%	6.89%	14.33%
$\eta = 0.050$	2.90%	4.40%	6.89%	11.87%	26.75%
$\eta = 0.1$	3.90%	6.89%	11.88%	21.84%	51.60%
$\eta = 0.2$	5.90%	11.89%	21.86%	41.78%	101.30%

These values are consistent with the calculations in Table 2 of DeLong and Summers (2012) and the small existing differences are due to our use of a lower growth rate for GDP.

Let us focus on the middle column where the fiscal policy multiplier parameter is assumed to be 1.5, which is likely to be underestimating fiscal policy multipliers during a large downturn. In the absence of a hysteresis effect, the critical value for the interest rate is equal to the growth rate of real GDP, as expected. Very small hysteresis effects, for example around 0.025, already raise the critical value of the real interest rate to 4.40%. Given historical values for the average real interest rate on US treasuries, DeLong and Summers (2012) conclude that under

<sup>23</sup> Notice that, following DeLong and Summers (2012), we are simply looking at parameter values for which the tax revenues lost by decreased GDP more than compensate the reduced burden associated to the fiscal consolidation. For that reason, we think of the interest rate as the one faced by the government (which for some countries can be thought of as a riskless rate). We are ignoring potential welfare implications associated to risk and the potential timing of government spending and taxation.

these parameter values fiscal consolidations are very likely to be self-defeating. In fact, if we use current values of real interest rates, which are even possibly below real GDP growth rates, the conclusion becomes even more obvious. And even if we are not willing to believe a multiplier of 1.5, for much smaller estimates of the multiplier, the critical values of interest rates remain above historical levels and therefore the conclusion is likely to hold.

What if we use our results and calibrate the same exercise for the European economies? For simplicity, we will think about the aggregate of the European Union or the Euro area. The two parameters that we need to calibrate are growth and the marginal tax-and-transfer rate. For growth, we rely on recent estimates of potential real GDP growth used by the European Commission or the European Central Bank. The estimates are lower than those for the US economy both because of demographics and productivity dynamics. The current estimates are typically in the range 1%-1.5%. We will use the pessimistic scenario of 1% for our calculations.

Regarding the marginal tax-and-transfer rate, we will use a higher number than for the US given the larger size of governments and significantly larger marginal tax rates (at least on income). We will use 35% instead of the 33.3% used for the US.<sup>24</sup>

If we focus on the middle column again, with a fiscal policy multiplier of 1.5, the critical values of interest rates are very similar to those in the US case. For the case of low hysteresis, the critical values are lower (because of the low growth rate), but as the hysteresis parameter increases, the critical values become higher than in Table 10 because of the larger marginal tax and transfer rate.

For example, if we use the higher level of fiscal policy multipliers of 2, which is closer to our own estimates for the 2009-11 episode, even with the smallest possible amount of hysteresis (0.025), as long as real interest rates are below 6.83%, a fiscal policy contraction will be self-defeating.

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<sup>24</sup> We are, again, being conservative and using a value that is likely to underestimate the differences in marginal tax rates between Europe and the US. One of the reasons for not using a higher number is that as if this parameter approaches 40%, and for high values of the multiplier the denominator of the expression tends to zero. The combination of large multipliers and a large impact of output on taxes means that any fiscal expansion pays for itself even for the smallest possible values of hysteresis.

Table 11. Critical Values for the Government Real Interest Rate (Europe)  
( $g=1.0\%$ ,  $\tau=0.35$ )

	Fiscal Policy Multiplier				
	$\mu = 0.5$	$\mu = 1.0$	$\mu = 1.5$	$\mu = 2.0$	$\mu = 2.5$
Hysteresis Parameter					
$\eta = 0$	1.00%	1.00%	1.00%	1.00%	1.00%
$\eta = 0.025$	1.53%	2.35%	3.76%	6.83%	18.50%
$\eta = 0.050$	2.06%	3.69%	6.53%	12.67%	36.00%
$\eta = 0.1$	3.12%	6.38%	12.05%	24.33%	71.00%
$\eta = 0.2$	5.24%	11.77%	23.11%	47.67%	141.00%

What is the likelihood that real interest rates on government debt in European countries are below that number in the future? Looking at history, there have been very few instances when real interest rates have reached that level and they all have corresponded to very short periods associated to the possibility of sovereign debt crisis in some particular countries. Today, real interest rates remain very low (lower than in the case of the US for most European economies). As an illustration, the forecasts used by the IMF Fiscal Affairs department for their calculation of debt sustainability assume for the majority of the European countries that interest rates will remain so low that they will be below GDP growth rates for the next 5 years. Only in the case of Italy the difference will be positive and equal to 0.9%.<sup>25</sup> But even in this case, this is a very small number and the real interest rate in Italy remains far below any of the critical values implied by Table 11.

What about the hysteresis parameter? Are the values included in Table 10 and Table 11 reasonable? The hysteresis parameter can be thought of as the amount of cyclical output losses that are translated into permanent losses of GDP. Measuring such a ratio is not easy because cyclical output is itself measured as a difference between actual and potential which means that we need very precise annual estimates of potential output.

DeLong and Summers (2012) provide some bottom-up as well as top-down evidence for the US from labor markets as well as investment rates during recessions that support the view that the hysteresis effect is likely to be much larger than any of the numbers considered in those tables (so it is likely above 0.2).

<sup>25</sup> See International Monetary Fund (2017).

For other countries the evidence is even stronger. Rawdanowicz et al. (2014) produce an estimate by calculating the ratio of the change in potential output to the cumulative output gaps for OECD economies during the 2009-14 period. The estimates are in the range 0.1-1.2. For some of the European countries, in particular the Southern European countries, the estimate is around 0.5, once again much higher than the 0-0.2 range we have considered.

What about our own estimates of the permanent effects of fiscal consolidations? Can we translate those into an estimate for the hysteresis parameter? If we take our results at face value, the hysteresis effect is much larger than any of the previous estimates. For example, if we look at the regression of Table 8 we see permanent effects that are similar to changes in GDP during the years 2010-11. If we identify those years as the cyclical changes in output associated to the fiscal contraction we would then be calibrating the parameter  $\eta$  to be at or above 1, much higher than any of the values considered above. If we consider that some of the years after 2011 are also part of the cyclical dynamics caused by the initial fiscal policy shock then the hysteresis parameter would be lower. However, at the same time, this would imply that the overall fiscal policy multiplier effect is larger than what we had estimated earlier when we had only considered its effects over the first two years.<sup>26</sup>

In summary, using the calibration of DeLong and Summers (2012) adapted to European countries and supplemented with our estimates of the permanent effects of the 2009-11 fiscal episode we find very strong support for the conclusion that the fiscal consolidations during those years were self-defeating.<sup>27</sup> The combination of parameter values that would be required to refute this conclusion does not seem to be supported by any of the evidence presented in our paper or the other recent papers in this literature.

The idea that a government trying to restore debt sustainability should opt for spending more can be seen as implausible, or as some might call a “free lunch” (Rogoff (2015)). Our results do not suggest in any way that this is standard policy advice for all governments at all times. We are looking at a particular episode

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<sup>26</sup> As we have argued later, we do not need the effects to be truly permanent. We can then think about the accumulated effects in terms of a “permanent equivalent” concept (see DeLong and Summers (2012)).

<sup>27</sup> Auerbach and Gorodnichenko (2017) also reach the same conclusion in their analysis of fiscal consolidations in OECD economies since the 1980s. And House, Tesar, and Pröbsting (2017) calibrate a DSGE model to the recent episode of fiscal policy contractions and also conclude that for some European economies, the contraction had a negative effect on the debt-to-GDP ratio.

where several special circumstances are coming together. First, for many of these countries monetary policy was constrained either by the zero-lower bound or because of the institutional arrangements of the Euro area. This is likely to generate larger short-term fiscal policy multipliers (Eggertsson (2011) and Eggertsson and Krugman (2012)). Second, this was a very deep crisis with growth rates reaching negative numbers that had not been seen since the Great Depression. In addition, the nature of the crisis made the recession long and the recovery slow. These persistent short-run dynamics are likely to leave much larger permanent effects on output through hysteresis effects (see Blanchard, Cerutti, and Summers (2015)). In the case of the Great Recession, these hysteresis effects are the outcome not only of very persistent labor market dynamics but of a depressed behavior of investment that results in a much lower capital stock (see evidence in International Monetary Fund (2015)).

Hysteresis is crucial for the possibility of self-defeating fiscal consolidations. A lower permanent level of output increases the debt-to-GDP ratio and it also reduces the level of tax revenues. Because output is likely to trend upwards, so are fiscal variables. While the recipe for a government with high debt is likely to be a lower spending to GDP ratio, reducing spending and, as a result, GDP, not only does not achieve its objective but it leads to a higher debt-to-GDP ratio. The fact that some or all of the change in output is permanent, makes austerity the wrong fiscal policy.

Our conclusion that countercyclical fiscal policy has to be aggressive in a depressed economy, given the nature and persistence of the crisis, also applies to monetary policy. As suggested in Blanchard, Cerutti, and Summers (2015), the fact that cyclical shocks are likely to have permanent effects on output calls for a much stronger stabilization policy when policy makers seek to offset negative shocks to aggregate demand.

A final caveat regarding our reading of the empirical results. We are talking about the potential benefits of a more expansionary fiscal policy. It is possible that for some countries there was no alternative because financial markets had completely cut access to additional funds. For capital markets to deny funding a less contractionary fiscal policy it must be that our logic was not shared or properly understood by capital markets at that point. Because if our results are correct and both governments and markets agreed with our logic, capital should continue to flow to support a fiscal policy that might be expansionary but promoted a reduction in the debt-to-GDP ratio. In addition, even if markets do not accept the logic of our conclusions, it would be up to international

organizations (IMF or other governments not constrained in their funding) to decide on additional funding to support the right type of fiscal policy in the constrained economies, one that truly produces a more sustainable budgetary position.

## 6. Conclusions

The global financial crisis has permanently lowered the path of GDP in all advanced economies. In none of these countries is GDP expected to return to its pre-crisis trend. At the same time, many of these countries have been engaging in fiscal consolidations in response to rising government debt levels that had a negative impact on growth rates. In this paper we use the methodology of Blanchard and Leigh (2013) to show that fiscal consolidations had long-term effects on GDP, at a horizon much longer than the traditional analysis of fiscal policy multipliers. Our results strongly suggest that the negative effects on GDP are indeed permanent.

We have first documented the persistence of the effects of the global financial crisis. They are visible both in the current level of GDP and in the IMF forecasts for 2021. In addition, we show that potential output has been revised downwards by a similar amount, a sign that the reduction in GDP is mostly seen as permanent, i.e. there is strong evidence of hysteresis.

While permanent changes in GDP could be associated to structural changes in economic conditions (e.g. productivity shocks or changes in demographics), we exploit the cross-country variation in persistence to show that a significant part of the changes in actual and potential GDP are the direct result of the fiscal consolidation implemented during the period 2009-2011.

The combination of strong cyclical effects of fiscal policy and hysteresis provides support to the hypothesis of self-defeating fiscal consolidations of DeLong and Summers (2012). If the negative effects of fiscal consolidation are long lasting, countries can enter a negative loop where attempts to reduce government debt are not effective because of the reductions in GDP. As GDP falls permanently, attempts to reduce debt via reductions in spending or increases in taxes lead to a higher debt to GDP ratio. Using our empirical results we produce a quick calibration of the model of DeLong and Summers (2012) and show that the calibrated parameter values support the notion of self-defeating fiscal

consolidations for the group of advanced economies, more so for the Euro countries.

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## Appendix A. Calculating forecast errors for potential and actual GDP.

When it comes to GDP forecast errors our methodology is straightforward. Let the forecast made in year  $t$  of a variable  $Y$  for the year  $t + i$ .

$$Y_{t+i}^{F,t}$$

So for GDP in 2009, the forecast made in 2007 will be expressed as

$$GDP_{2009}^{F,2007}$$

We can compare these forecasts with the actual data for GDP at a later date to compute the forecast error. In some cases when we are talking about a future date from the perspective of both years we are calculating the change in forecast between the two years.

As an example, we can calculate the forecast error for the year 2009 made in 2007 by comparing to the actual data from the 2016 vintage of the WEO as:

$$FE_{GDP,2009}^{2007} = \frac{GDP_{2009} - GDP_{2009}^{F,2007}}{GDP_{2009}^{F,2007}}$$

The only issue we face when comparing these two GDP levels is that because of data revisions, changes in base year and also changes in national accounting rules, the forecast and the actual data might not be comparable as they might not be in the same units or follow the same national accounting criteria.

Because we are interested in revisions to growth rates, we make the two numbers comparable by rebasing the original WEO 2007 real GDP series and its forecasts so that the 2006 data matches the data for that year of the WEO April 2016. In other words, given that the 2006 data now coincides in both the April 2007 and the April 2016 databases, the expression above can simply be calculated as the forecast error of accumulated GDP growth from 2006 to 2009:

$$FE_{GDP,2009}^{2007} = \frac{GDP_{2009}^{2016} - GDP_{2006}^{2016}}{GDP_{2006}^{2016}} - \frac{GDP_{2009}^{F,2007} - GDP_{2006}^{2007}}{GDP_{2006}^{2007}} =$$

$$= \frac{GDP_{2009}^{2016}}{GDP_{2006}^{2016}} - \frac{GDP_{2009}^{F,2007}}{GDP_{2006}^{2007}}$$

Where

$$GDP_t^{t+i}$$

refers to the data of GDP for year  $t$  as reported in the vintage for year  $t + i$ .

When it comes to potential output we face a more challenging task. In April 2007 when the IMF produces a number for potential output for 2006, this is not observed, it is an estimation of what they believed at that point potential was. Future values of potential output are also dependent on their views at that point in time.

Later when the crisis is in full force the IMF revises its views of potential output but it also changes its views on the level of potential output in the past. These revisions are very large and they completely change the perception of potential output levels in previous years. This means that a calculation of forecast errors of the level of potential GDP based on the accumulation of forecast errors of potential growth rates, as calculated above, would be misleading. Because the IMF has dramatically changed their views on potential output for both the current and future years by rewriting history, it would seem as if the previous path of potential output (measured in growth rates) has not changed that much. But the level has and we need to incorporate that in our estimates.

The way we do it is by ignoring these revisions and focusing on the level of potential GDP and not on its growth rates. The simplest way to express this calculation is to use the expression above for the forecast errors of GDP and modify it in the following way:

$$FE_{POT,2009}^{2007} = \left( \frac{POT_{2009}^{2016}}{GDP_{2006}^{2016}} - \frac{POT_{2009}^{F,2007}}{GDP_{2006}^{2007}} \right) \frac{GDP_{2009}^{F,2007}}{POT_{2006}^{2007}}$$

Where the first two terms have a similar interpretation but using potential in the numerator. And the last term simply adjusts the denominator so that it is expressed in units of potential base year rather than actual GDP.

The expression above is equivalent to thinking in levels instead of growth rates. Levels of potential GDP are rebased to avoid the revisions done in newer vintages of the WEO by using the following factor:

$$\frac{GDP_{2006}^{2016}}{GDP_{2006}^{2007}}$$

We use 2006 as the year where the GDP data is known in April 2007 and look at the ratio of GDP in 2006 as calculated in the April 2007 and April 2016 vintages to make the potential output series comparable across the two databases.

Once this correction is applied we can calculate the forecast error as:

$$FE_{GDP,2009}^{2007} = \frac{POT_{2009}^{2016} - POT_{2009}^{*F,2007}}{POT_{2009}^{*F,2007}}$$

Where

$$POT_{2009}^{*F,2007}$$

is the rebased series of the forecast of potential GDP from the April 2007 vintage using the adjustment factor. This leads the same expression as above.

## Appendix B. Sample of Countries.

Advanced	Emerging
Australia	Algeria
Austria	Angola
Belgium	Argentina
Canada	Bangladesh
Czech Republic*	Brazil
Denmark	Chile
Estonia*,**	China
Finland	Colombia
France	Egypt
Germany	Ethiopia
Greece	Ghana
Hong Kong	India
Iceland	Indonesia
Ireland	Iran
Israel	Kazakhstan
Italy	Kenya
Japan	Malaysia
Korea	Mexico
Latvia*,**	Morocco
Luxembourg**	Nigeria
Malta*	Pakistan
Netherlands	Philippines
New Zealand	Poland
Norway	Russia
Portugal	Saudi Arabia
Singapore	South Africa
Slovak Republic*	Sudan
Slovenia	Thailand
Spain	Turkey
Sweden	Ukraine
Switzerland	Venezuela
Taiwan	
United Kingdom	
United States	

\* Advanced economies with missing data on potential GDP in the April 2007 WEO.

\*\* Advanced economies with missing data on either potential GDP or Structural Budget Balances in the April 2010 WEO.