CEPS POLICY BRIEF
Thinking ahead for Europe

Is there a need for additional monetary stimulus? Insights from the original Taylor Rule

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Key Messages for Policy-Makers

Central banks in the developed world are being misled into fighting the perceived dangers of a 'deflationary spiral' because they are looking at only one indicator: consumer prices.

While consumer prices are flat, broader price indices do not show any sign of impending deflation: the GDP deflator is increasing in the US, Japan and the euro area by about 1.2-1.5%. The real economy is not sending deflationary signals either: Unemployment is at record lows in the US and Japan, and is declining in the euro area while GDP growth is at, or above potential. Thus, the overall macroeconomic situation does not give any indication of an imminent deflationary spiral.

In today's high-debt environment, central banks should be looking at the GDP deflator and the growth of nominal GDP, instead of CPI inflation. Nominal GDP growth, as forecasted by the major official institutions, remains robust and is in excess of nominal interest rates.

If the ECB were to set the interest rate according to the standard rules of thumb for monetary policy, which take into account both the real economy and price developments of broader price indicators, it would start normalising its policy now, instead of pondering over additional measures to fight a deflation, which does not exist. Economic conditions are slowly normalising; so should monetary policy.

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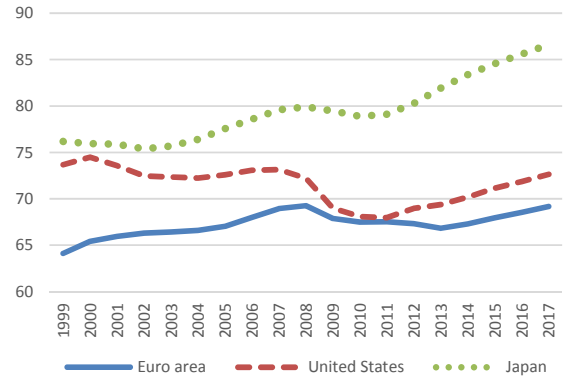
The latest data on inflation (and inflation expectations) in the euro area (EA) and Japan have reignited concerns about a possible deflationary spiral. This has led to a large debate about what additional monetary policy tools could, and should, be used to prevent this from happening. Even "helicopter money", i.e. the overt monetary financing of government deficits,[1] is now being mentioned.

This concern about low inflation, however, is difficult to square with the data on the real economy. Growth remains steadily positive[2] in advanced economies and employment is nearing historical heights even in the euro area (see Figure 1).

Figure 1. Employment rates in the US, Japan and the euro area (1999-2015 and projections 2016-17)



Data source: Ameco.

This raises the question what monetary policy should do when inflation and the real economy send different signals. A simple and practical solution for this quandary is provided by the so-called Taylor rule (Taylor, 1993), which gives a 'rule of thumb' to guide monetary policy-setting based on inflation and output.

1. The Taylor rule

In macroeconomic theory, a standard policy guideline for setting interest rates by central banks is given by the Taylor rule. In its original formulation, the rule implies that the central bank policy rate should respond to the equilibrium nominal interest rate, deviations of inflation from the target rate and the output gap:

$$i_t^i = r^* + \pi_t \ + 0.5(\pi_t - \pi_t^*) + 0.5\bar{y}_t^i$$

Where r^* denotes the long-term real equilibrium rate, π_t is current inflation, π^* is the target and $\bar{y}_t^i$ is the output gap. A key feature of the Taylor rule is that although the weights of inflation and the output gap are identical, the central bak should react with a factor of 1.5 to actual inflation. A more than 1:1 reaction to changes in actual inflation is a key characteristic of most monetary policy rules. This assumption, based on the idea that the key mandate of a central bank is the stabilisation of price developments, has important implications in the judgment of today's policy stance.

In Taylor's original contribution, the equilibrium real interest rate was set at 2% (close to the estimated potential GDP growth rate), the target level of inflation was also set at 2% and the current rate inflation was measured over the previous four quarters, de facto being a lagged rate.

Subsequent theoretical literature has shown that the rule incorporates features of optimal monetary policy,[3] and it has been widely used in general equilibrium models to proxy the behaviour of the central bank. In particular, the rule is consistent with the framework of a central bank following a 'flexible' inflation targeting,[4] i.e.

[1] See www.voxeu.org/article/helicopter-money-policy-option, among others.

[2] This is true regardless of the source of the forecasts.

[3] Woodford (2001) proves that the Taylor rule is optimal from the standpoint of at least one class of optimising models. He also emphasises that the rule as originally formulated suffers from several defects, and modifications such as time dependency should be introduced.

[4] Inflation targeting is a "framework for monetary policy characterised by the public announcement of official quantitative targets (or target ranges) for the inflation rate over one or more time horizons, and by explicit acknowledgement that low, stable inflation is monetary policy's primary long-run goal." (Bernanke et al., 1999, p. 4). Inflation targeting is usually modelled by a simple policy rule that anchors inflation expectations and delivers a good inflation outcome.

with a mandate on both inflation and output stability, as has been the case for several central banks since the 1990s. In reality, none of the world's major central banks, i.e. the Federal Reserve, the ECB or the Bank of Japan, is formally engaged in inflation-targeting; the Bank of England is the only exception. Yet, this simple equation, in many slightly different variants, has been useful in capturing actual policy-making.[5] Today it is still useful to assess whether the monetary policy stance is roughly right given the key economic variables, i.e. inflation and output.

2. Which measure of inflation?

After John Taylor's seminal work, a large academic and policy literature flourished around alternative specifications of rules for interest-rate setting. These include modifications of the weights applied to output and inflation deviations, the use of real-time data instead of ex-post values to account for informational limits at the time of the policy decision,[6] alternative measures of macroeconomic conditions and inflation. In particular for the latter, the literature has focused on current and expected (with different time horizons) inflation and alternative indicators of price developments, e.g. the GDP deflator, CPI (consumer price index) and core[7] inflation.

In the original Taylor specification, it was implicitly assumed that the proper measure of inflation is the broadest possible price index, namely the GDP deflator. This measures the difference between nominal and real GDP and, unlike the CPI, captures changes in prices related to production and income developments. Crucially, the GDP deflator is not affected by taxes and input price developments. As we show below, the latter aspect has become important in a context of volatile commodity prices.

However, when central banks adopted inflation targets, whether formally or informally, the reference measure of inflation turned out to be the CPI, or some variant of it. This index covers households' spending and captures changes in the purchasing power that can affect aggregate demand, and consumption in particular. For this reason, it is the key variable in the public's perceptions of price developments and why, for example, the ECB adopted a reference value for the 2% target in terms of the HICP (harmonised index of consumer prices). It is more easily understood by the wider public than the more abstract concept of the GDP deflator. For this reason, there exists a variety of measures of expected inflation-based consumer prices, both in the form of surveys and derived from inflation-protected bonds (based on measures of the CPI, rather than the GDP deflator).[8]

These two different measures of inflation (CPI and the GDP deflator) have a different economic meaning and their relevance can change over time. Measures of inflation based on consumer prices are more relevant in a context where developments in demand and in particular households' inclination to spend and to repay debt are the concern of the central bank. This was the case during the 'Great Moderation' when public and corporate debt did not seem to be relevant. But this has changed. Today a key problem is the high levels of government and corporate debt (see Figure 2).

In today's context of high debt, the GDP deflator provides a better guideline for policy-making. Debt sustainability for governments and corporates depends more on the growth of their revenues, i.e. nominal GDP, than on consumers' purchasing power measured by the CPI.

As shown in Figure 3, the usual (public) debt sustainability condition as measured by the difference between nominal GDP growth and nominal interest rate is now satisfied in each of the regions considered and the situation of debtors is now better than any time over the last

[5] Bernanke (2015) shows how a modified Taylor rule fits, almost perfectly, the Fed's stance between 1996 and 2007.

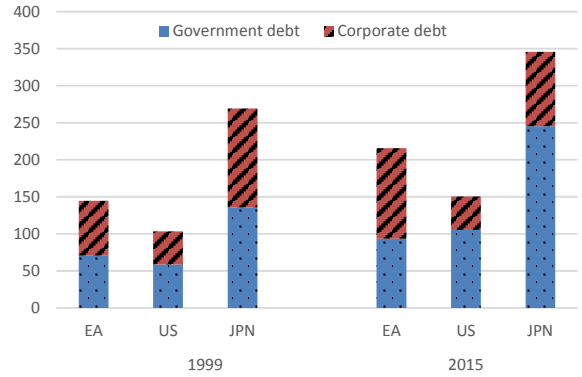
[6] See Orphanides (2001).

[7] For instance, the Federal Reserve usually refers to the PCE (personal consumption expenditures) in its communications about inflation developments, but in practice, core PCE is the relevant indicator for monetary policy-setting.

[8] In practice, one can calculate at least some measure of expected inflation based on the GDP deflator from the official forecasts for real and nominal GDP from major institutions, e.g. the IMF and the European Commission.

20 years. In the euro area current conditions are exactly the same as in 2006.

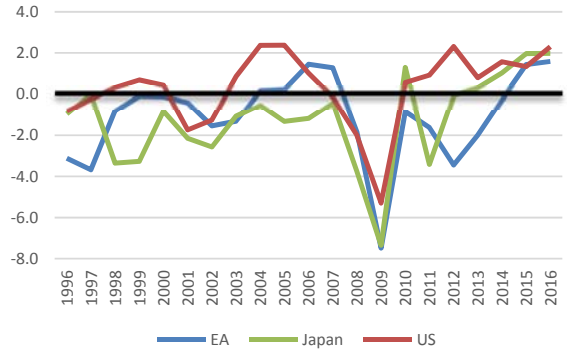
Figure 2. Government and corporate debt as percent of GDP in US, Japan and the euro area (1999 and 2015)



Data sources: Board of Governors of the Federal Reserve System, Bank of Japan, ECB and Ameco.

As shown in Figure 3, the usual (public) debt sustainability condition as measured by the difference between nominal GDP growth and nominal interest rates is now positive in each of the regions considered and better than any time over the last 20 years. In the euro area, current conditions are exactly the same as in 2006.

Figure 3. The (negative) snowball effect



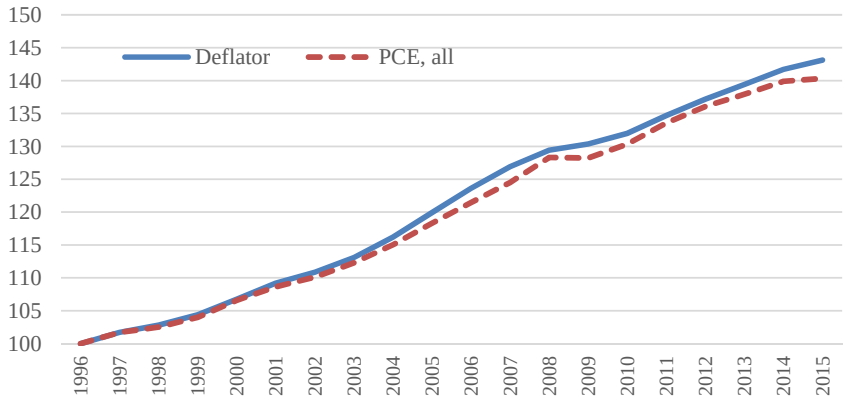
Note: Long-term interest rates on sovereign bonds as a measure of interest rates.

Data sources: Ameco, ECB, Board of Governors of the Federal Reserve System and IMF.

The choice between these two price indices seemed 'academic' for a long time, as the two indices usually display a high degree of co-movement. This has indeed been the case in the US, as shown in Figure 4, which plots the US GDP deflator and the preferred measure of inflation of the Federal Reserve, namely the PCE.

However, the two indices have had a very divergent development in other advanced economies.

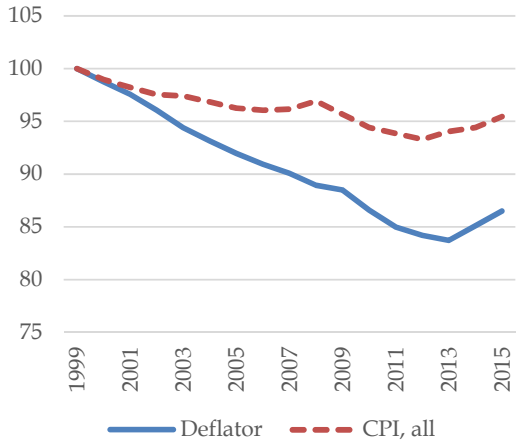
Figure 4. US: GDP deflator vs. PCE (1996=100)



Note: PCE is produced by the US Department of Commerce, and the Fed often refers to the indicator to measure price inflation.

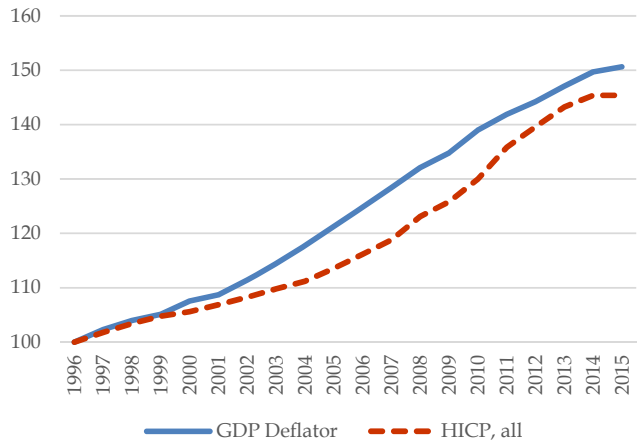
Data sources: Federal Reserve Economic Data (FRED), Federal Reserve of Saint Louis and IMF.

Figure 5. Japan: Deflator vs. CPI (1999=100)



Data sources: Bank of Japan and IMF.

Figure 6. The UK: Deflator vs. CPI (1996=100)

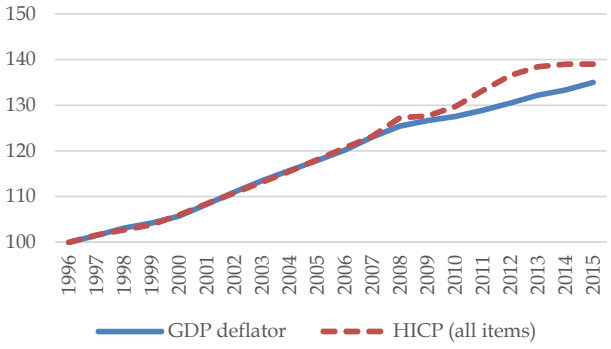


Data source: Ameco.

Figure 5 shows that in Japan the two variables exhibited very different trends over more than 15 years. Both the CPI and the GDP deflator have been falling trend-wise until 2012, at least, but the GDP deflator has fallen by about 10% points more, about 0.6% more per annum. This more inflationary (or rather less deflationary) trend of the CPI has thus masked, partially, the urgency to fight deflation in a country that has the highest public debt ratio within the OECD.

In the UK, the trend in the two variables has been quite similar, but until 2007, the GDP deflator grew faster than the CPI, creating a gap between the two variables of almost 10 points in 2007, after which it slowly reduced with the CPI growing more than the deflator. Over the last two years, CPI inflation slowed down to zero while the GDP deflator continued to grow (see Figure 6). Figure 7 shows that in the euro area until 2007 the HICP has been moving in tandem with the GDP deflator. Thus, until the crisis started, it did not make any difference whether the ECB concentrated on the HICP instead of the GDP deflator.[9] But after 2008, a large and variable gap has opened between the two. The reason for this is most probably the large swings in the prices of commodities (in particular oil).

Figure 7. HICP vs GDP deflator in the euro area (1996=100)



Data sources: Eurostat and Ameco.

[9] See Gros (2015).

As result, until about 2013, the HICP increased by more than the GDP deflator, but then the opposite happened. In 2015, the difference between inflation measured by the HICP and the GDP deflator for the eurozone was above 1 percentage point, 0 inflation based on the HICP and 1.2 on the GDP deflator. If the ECB were looking at the GDP deflator, it would not quite have hit its target, but it certainly would not have to agonise over how to escape 'deflation'.

3. Implementing the original rule

An instructive way to illustrate the importance of the choice of the price index for central bank policy-setting today is to assume that the original Taylor rule remains appropriate.

A key aspect here is that the factor weight accorded to actual inflation is at 1.5 much higher than for output, 0.5.

In 2015, the difference between the HICP and the GDP deflator, 1.2%, p.a., as mentioned above, implies that, if the ECB were to follow a Taylor rule based on the inflation measured by GDP deflator, the policy rate would be 1.8 percentage points higher than if using the HICP. Using the appropriate price index can thus be crucial. In the case of the output gap, given that it enters only with a fraction in the Taylor rule, a mis-measurement problem would lead to a smaller difference in the policy rate.

Table 1 shows the policy rates for the major central banks, derived from the original Taylor rule, assuming that the equilibrium real rate is zero in each year and in each country.[10] This strong assumption implies that our estimates are likely to be too low for a proper Taylor rule. Indeed in the long run the equilibrium real rate should be close to potential output growth, which should be at least positive. Even for the euro area, potential output growth is around 1% per annum, implying that this estimate of the Taylor rule is about 1 full percentage point too low.

Table 1. Taylor rule-based policy rate over time assuming real equilibrium interest rate = 0

	2013	2014	2015	2016	2017
EA	-0.5	-0.9	0.0	0.2	1.0
US	0.0	0.4	-0.3	0.3	1.4
Japan	-2.5	0.6	1.1	-1.3	-0.2
UK	1.1	1.5	0.0	0.9	2.3

Source: Own elaboration based on AMECO and IMF.

For the euro area the key message emerging from the table is that monetary policy might have been too tight until 2014. The original Taylor rule would have recommended negative policy rates until then. But the ECB was looking at HICP inflation, which was driven partially by oil prices, and even the core HICP (often advocated as a benchmark) did not strip out fully the impact of commodity prices. This explains why the ECB did not try more unconventional measures (like negative rates) during that period.

For 2016 and for 2017, however, the rule suggests that rates should return positive. This is in stark in contrast with the current debate about what more can be done to ensure looser monetary conditions. The large swings in commodity prices thus induced the 'inflation-obsessed' ECB into making the wrong call twice: it should have been more expansionary until 2014 and, it is now flailing about in search of additional measures, when it should actually be tightening.

For the US and the UK, the picture is not as stark also because for the US the difference between (the change in) PCE and GDP deflator is smaller, as shown above. But even here, it would now be time to tighten considerably. In Japan the time to move away from the zero lower bound seemed to have arrived as well when the Bank of Japan was in its early days for implementing very aggressive bond purchases.

Table 1 is based on ex-post data, as available today. However, the last years were a period of considerable uncertainty, not only about commodity prices, but also the output gap. To be fair to central banks, one should use only the

[10] This assumption reflects the "secular stagnation" hypothesis evoked by Larry Summers (2013) in his speech at the IMF and in Summers (2014). A critical point of this assumption is that negative real interest rates are a necessary condition for full employment.

information available at the time decisions were made.

Table 2 thus shows the same Taylor rule exercise with real time output gap and inflation expectations, measured by the forecasts of the GDP deflator.[11]

Table 2. Taylor-rule with an equilibrium rate of 0%, inflation expectations and real-time data

	2013	2014	2015	2016	2017
EA	-0.2	-0.6	-0.7	0.2	1.1
US	-0.7	-0.3	1.2	0.3	1.4
Japan	-2.6	0.6	0.1	-1.3	-0.2
UK	0.3	1.2	1.2	0.9	2.4

Note: Inflation expectations for current year.

Source: Own elaboration based on AMECO and IMF.

The predicted rates are now sometimes lower than in Table 1, but overall, with the exception of Japan, the rule recommends positive rates everywhere.

Table 3, which compares the policy rates recommended by the rule with the actual policy rate for the current year, suggests an excess of expansionary monetary zeal in most developed countries. If one uses the GDP deflator to measure inflation, policy rates should be higher almost everywhere, even taking into account the fact that in two areas (Japan and the EA) the output gap is still negative.

Table 3. Taylor rule versus actual policy rate, 2016

	Taylor rule-recommended policy rate	Actual policy rate	Output gap (change from 2015)
EA	r* plus 0.2	0.0	-1.1 (+07)
US	r* plus 0.3	0.5	0.4 (+0.3)
Japan	r* plus -1.3	0.1	-0.9 (+0.6)
UK	r* plus 0.9	0.0	0.3 (+0.3)

Note: Using the Taylor rule from Table 1.

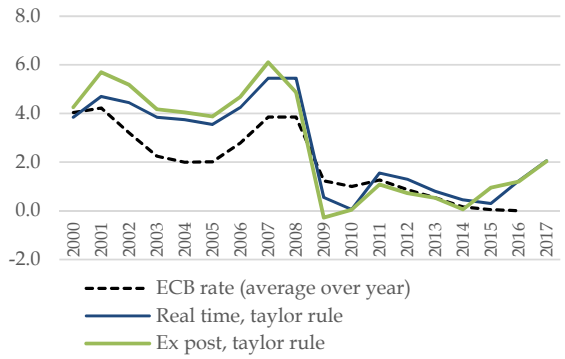
Source: Own elaboration based on data from European Commission, IMF and national central banks.

[11] We use the forecasts published in spring for the same year.

4. Monetary policy and the rule in the euro area

Figure 8 focuses on the euro area and compares the actual policy rate with the policy rate predicted by the Taylor rule, using real-time data and ex-post data, under the assumption that the equilibrium real interest rate is positive and close to the potential GDP. (See the Figures A1 and A2 in the Annex to assess the ECB performance under different assumptions about the equilibrium real interest rate). Leaving aside the difference between ex-post and real time, the rule suggests that monetary policy was too loose until 2008 and then too tight in 2009 and in 2010. Between 2011 and 2014, the fit is quite good for the real-time and perfect for the ex-post estimates. It is since 2015 that the difference between the recommendation of the rule and the actual rate becomes evident. According to the rule, the ECB should have gradually started to tighten, instead of searching for additional unconventional policy tools to ease policy further.

Figure 8. Original Taylor rule, ex-post and real time and ECB policy rate, positive equilibrium real interest rate



Note: Real equilibrium interest rate chosen as 2% until 2008, thereafter at 1%.

Data sources: ECB, European Commission's statistical annex and Ameco.

It is somewhat inconsistent that the ECB publicly continues to bemoan low actual and expected HICP inflation, but does not explicitly mention how the economy is expected to develop and in

particular that the GDP deflator will increase at a rate that is much closer to the 2% target than the CPI. The fact that the output gap is improving suggests that current concerns about a deflation spiral are overblown.

This is reflected in the recent IMF forecasts on GDP and the deflator, which predict a nominal average growth rate of above 4% over the next 5 years for the UK and the US (see Table 4). The euro area is forecasted to achieve an average deflator of 1.3%, leading to nominal growth of just below 3%. None of these forecasts suggests a deflationary spiral, even for Japan.

Table 4. IMF forecasts for average real GDP growth and average inflation rate, 2016-20

	Average real growth rate	Average GDP deflator	Annual nominal growth rate
EA	1.6	1.3	2.9
US	2.5	1.9	4.4
Japan	0.7	0.4	1.2
UK	2.2	2.1	4.3

Source: IMF.

5. Concluding remarks

Central banks in advanced economies consider deflation the biggest risk they are facing. The ECB and the Bank of Japan are considering new tools to provide additional stimuli and even the Federal Reserve has indicated that it is delaying its path of 'normalisation' of interest rates.

The fear of deflation, however, is based solely on one indicator, the weak growth in consumer prices. Broader price indices, like the GDP deflator, do not signal impending deflation. On the contrary, the GDP deflator is increasing almost everywhere by about 1.2-1.5% and growth is almost everywhere at or above potential. Unemployment is at record lows in the US and Japan, and it is declining in the euro area. The overall macroeconomic situation thus does not give any indication of an imminent deflationary spiral.

Central banks are misled by the signal coming from consumer prices. Consumer prices are more easily understood and communicated to the public at large, and for this reason were chosen as the reference point in the formulation of the target inflation. Nevertheless, they are influenced by swings in commodity prices and in certain circumstances do not provide a useful indicator of longer-term price pressures. Even core CPI inflation measures, which strip out the direct, but not the indirect impact of commodity prices, are of limited help.

In the monetary policy setting, the proper choice of the price index becomes more important than it appears at first sight, because the usual rules of thumb imply that the central bank should react by more than 1:1 to any excess inflation or deflation.

More importantly, the main brake on the ongoing recovery is widely presumed to be the debt overhang from the credit boom of the early 2000s. The proper price index to measure the degree to which monetary policy can facilitate deleveraging is the GDP deflator. Growth in nominal GDP is a much better indicator of the growth in revenues that highly indebted governments and corporations can expect. This is another reason to prefer the GDP deflator as an indicator for the monetary policy stance in today's high-debt environment.

Forecasts[12] of the nominal GDP growth rates across advanced economies remain also far away from deflationary levels. For the EU, nominal GDP is forecast to grow by 3% per annum until 2020. This forecast is not compatible with the perceived need for additional monetary stimulus and does not seem to be compatible with negative interest rates for a 5-year horizon.

It is time for a normalisation of global monetary policy.

[12] From any institution, from the IMF to the European Commission.

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Annex

Figure A1. EA: Taylor rule with real time data

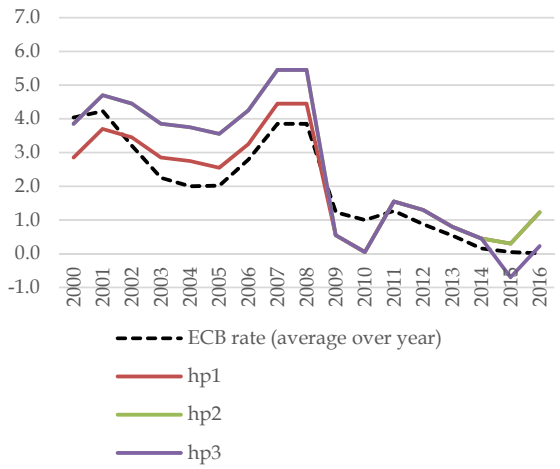
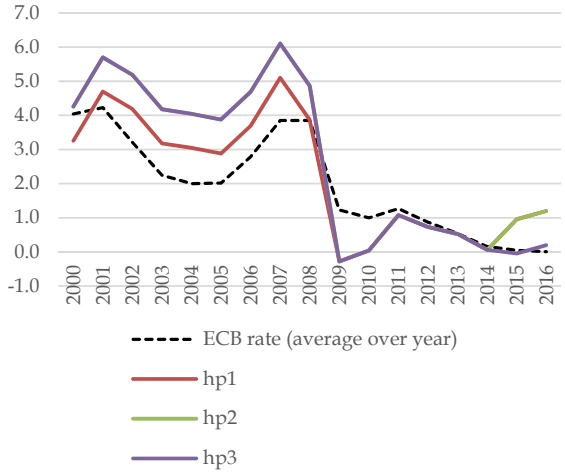


Figure A2. EA: Taylor rule with ex-post data



Notes:

Hp1: equilibrium real rate= 1 over the entire period.

Hp2: equilibrium real rate=2 between 2000 and 2008 and thereafter=1.

Hp3: equilibrium real rate=2 between 2000 and 2008, 1 between 2009 and 2014 and 0 in 2015 and 2016.

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