DETERMINANTS AND IMPLICATIONS OF LOW GLOBAL INFLATION RATES

2016

Juan Carlos Berganza, Pedro del Río
and Fructuoso Borrallo

Documentos Ocasionales
N.º 1608

BANCO DE **ESPAÑA**
Eurosistema

DETERMINANTS AND IMPLICATIONS OF LOW GLOBAL INFLATION RATES (*)

Juan Carlos Berganza and Pedro del Río

BANCO DE ESPAÑA

Fructuoso Borrallo

EUROPEAN CENTRAL BANK

(*) Juan Carlos Berganza (jcberganza@bde.es), Fructuoso Borrallo (Fructuoso.Borrallo@ecb.europa.eu), Pedro del Río (pedrodelrio@bde.es). The authors would like to thank Marina Conesa, Roberto Pascual and Patricia Sánchez for their excellent research assistance.

Documentos Ocasionales. N.º 1608

2016

ISSN: 1696-2230 (on line)

Abstract

In this paper we look at global inflation trends over the last decade and try to disentangle factors that could explain the ultra-low levels of inflation during the recovery from the Great Recession. We review the literature on the subject, which points at possible structural shifts in price and wage setting processes in recent decades, such as inflation's reduced cyclical sensitivity to domestic economic slack, a bigger role being played by forward-looking inflation expectations, and the increased importance of global factors. We then test empirically whether changes in the coefficients of the Phillips curve in the wake of the global financial crisis can explain the behaviour of inflation over this period for a large group of advanced economies. Our results show a wide range of variation between countries, and in some cases the findings are insufficiently robust to offer a satisfactory explanation of the recent course of inflation. Nevertheless, the persistence of inflation and the increased importance of backward-looking inflation expectations in some countries may pose risks for inflation-expectation anchoring and central bank credibility. Finally, we review the adverse effects on the real economy of ultra-low inflation over an extended period and analyse the policy options for addressing this problem.

Keywords: inflation, inflation expectations, Phillips curve, monetary policy.

JEL classification: E31, E32, E50.

Resumen

En este documento se ofrece una panorámica de la evolución de la inflación a escala global en la última década y se trata de descubrir qué factores podrían explicar los niveles muy bajos de inflación durante la recuperación de la Gran Recesión. Se hace una revisión de la literatura que apunta a posibles cambios estructurales en el proceso de fijación de precios y salarios en décadas recientes, tales como la menor sensibilidad cíclica de la inflación a la holgura económica interna, la mayor relevancia del componente prospectivo de las expectativas de inflación o la mayor importancia de factores globales. Posteriormente se analiza empíricamente si cambios en los coeficientes de la curva de Phillips tras la crisis financiera global pueden explicar el comportamiento de la inflación en las principales economías avanzadas en este período. Los resultados muestran un amplio grado de heterogeneidad entre países, y en algunos casos no son suficientemente robustos como para ofrecer una explicación satisfactoria. No obstante, en algunos países la persistencia de la inflación y la mayor importancia del componente retrospectivo de las expectativas de inflación puede plantear riesgos para el anclaje de las expectativas de inflación y para la credibilidad de los bancos centrales. Por último, se repasan los efectos adversos de tasas muy bajas de inflación durante un tiempo prolongado para la economía real y se analizan las opciones de política económica para resolver este problema.

Palabras claves: inflación, expectativas de inflación, precios, salarios, curva de Phillips, política monetaria.

Códigos JEL: E31, E32, E50.

ÍNDICE

1 Introduction

Over the past five years the world has witnessed an almost universal trend towards lower inflation rates, with rates often falling short of central bank targets. The decline steepened in mid-2014 with the oil-price slump, when inflation rates in the main advanced economies fell to extremely low – and in some cases negative – levels. This downward trend in inflation, apparently at odds with the context of economic recovery and highly expansionary monetary policies, followed a period in the immediate wake of the global financial crisis in which inflation proved surprisingly downwardly rigid and fell by less than expected, given the depth of the recession (the so-called "missing disinflation" puzzle). These developments have led to a search for the reasons why consumer prices should be behaving in this way.

One possible explanation is that the course of inflation has been closely linked to transitory factors, such as commodity prices, which have made a strongly negative contribution over the past two years. However, the drop in inflation is also apparent in core rates, where these more volatile factors ought to have less of an effect. Other alternative explanations have therefore been put forward that point to changes in the price formation process over the last few decades that are more structural in nature. Indeed, the economic literature has suggested the possibility that, at least in many advanced economies, the cyclical sensitivity of inflation (i.e. its response to the degree of economic slack in the economy) fell in the period up to the early 1990s, while the relative importance of the anchoring of economic agents' inflation expectations to central bank targets rose, thanks to the greater credibility they had achieved. At the same time, global factors became more important, as a result of the integration of world product and factor markets, lower production costs and increased international competition (all of which is reflected in inflation's heightened sensitivity to the degree of slack in the global economy).

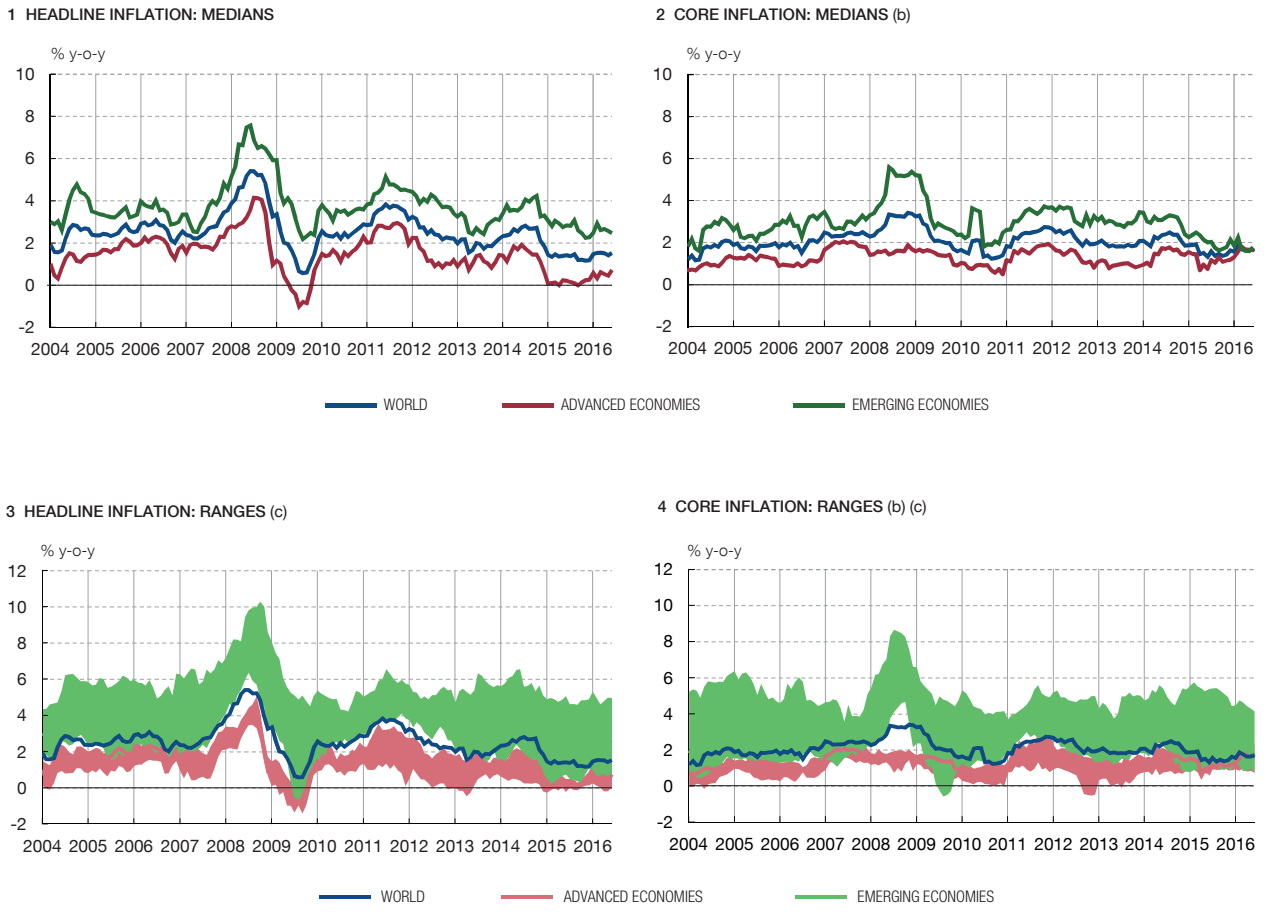
Whatever the reason for unusually low levels of inflation, they can have harmful consequences for economies. For instance, low inflation rates tend to lead to higher real interest rates, and, therefore, tighter monetary conditions. Moreover, low inflation has a negative impact on public and private debt dynamics, making deleveraging harder in the most indebted countries, and making it more difficult for countries in a monetary union to restore competitiveness, thus forcing them to undergo internal devaluation. In the extreme case, there can be a de-anchoring of agents' inflation expectations, with the consequent risk of a deflationary spiral. Sub-target inflation can also have a negative impact on central banks' credibility.

This paper starts with an overview of how inflation has progressed worldwide in recent years, distinguishing its behaviour in different geographical areas. It then examines the possible factors explaining this price behaviour, through a comprehensive review of the extensive literature on the topic and an empirical analysis examining various countries and periods. The possible economic consequences of ultra-low inflation rates are then discussed, along with the associated economic policy implications. The paper ends with some concluding remarks.

2 Global inflation trends

Global inflation has fluctuated widely over the past ten years.[1] After climbing above 5% prior to the global financial crisis, as a consequence, in part, of strong commodity (mainly energy) prices, it declined sharply after the crisis to levels close to 0%. It began to gradually recover in mid-2009, and had reached 4% by mid-2011. Since then, however, global inflation has again been on a downward trend, dropping to approximately 1% at the end of 2015 before slowly increasing to 1.6% in the third quarter of 2016. Global core inflation – which excludes energy and unprocessed food prices, the most erratic components directly influenced by factors such as the weather – decreased from 3.4% to 1.2% during the crisis and, after a partial rebound, has again moderated in recent years, declining from 2.7% in mid-2011 to a minimum of 1.3% in the second half of 2015 and now stands at 2% (Chart 1).

HEADLINE AND CORE WORLD INFLATION (a) CHART 1



SOURCES: National statistics, OECD and own calculations.

a Includes: Canada, Euro area, Japan, Norway, Sweden, Switzerland, United Kingdom, and United States (advanced economies); and Brazil, Chile, China, Czech Republic, Hong kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, Singapur, South Africa, Thailand, and Turkey (emerging economies).
b Core inflation excludes food and energy.
c First and third quartile.

1 The global inflation rate has been constructed from a sample of 27 countries, representing 80% of global GDP.

Over the last five years, headline inflation in advanced economies (which had recorded negative rates during the crisis) dropped from a median rate of 3% to 0.5%, while in emerging market economies, it declined from 4.7% to 2.7%. Core inflation rates also fell in advanced economies in the wake of the crisis, dropping from 2% to 0.6%, although this drop was less than would have been expected given the depth of the recession. Subsequently core inflation rose to 1.9% at the end of 2011, and then declined again, hovering around 1% before gradually picking up, to reach 1.6% in June 2016. In emerging market economies core inflation has also come down from 3.4% in mid-2011 to 1.7% at present, contrary to what might have been expected according to the Balassa-Samuelson hypothesis. Prices of industrial goods have tended to decline over the last two years, linked through the prices of imported goods, while services inflation has tended to remain higher.

Looking at the different countries in the most recent period, inflation rates have been on a downward trend in the main advanced economies over the last five years (Chart 2). Headline inflation in the United States dropped from almost 4% in mid-2011 to close to 0% in the first few months of 2015, remaining close to that level for most of the year and gradually picking up towards 1% by mid-2016. In the euro area, where the economy has been more sluggish, inflation fell from 3% in late 2011 to –0.7% at the beginning of 2015, while for the last twelve months it has hovered around 0%. Even in the United Kingdom, where inflation rates remained relatively high in the wake of the crisis, partly as a result of the depreciation of sterling, inflation dropped from 5% at the end of 2011 to rates close to zero during 2015, rising to around 0.5% in mid-2016. In the case of Japan, price trends have been driven by changes in economic policy in recent years (including the Bank of Japan's new inflation target and quantitative easing, and a consumption-tax increase),[2] such that the inflation rate rose from close to 0% to 2.5% in mid-2014, although it has subsequently dropped back to around 0% since mid-2015, reaching negative values in mid-2016. The trend in core inflation has been fairly similar, at somewhat higher levels but falling short of central bank targets; only in the United States has it recently climbed above the 2% target.

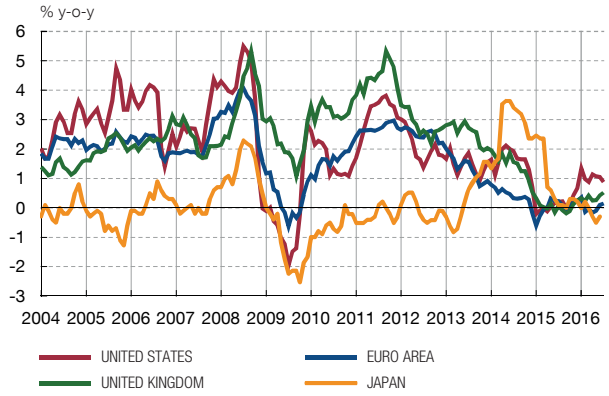
In some smaller advanced economies, such as Denmark, Sweden and Switzerland, inflation rates also moved into negative territory. These are small, open European economies, which have received large capital inflows as a result of spillovers from euro area problems and the ECB's low interest rates. In Denmark and Switzerland this has been exacerbated by their exchange rates' links to the euro. These countries have had to resort to negative policy rates and currency market interventions to stem the upward pressure on their currencies. Other advanced economies, such as Australia, Canada and New Zealand, have also experienced low inflation rates that have fallen short of their central banks' inflation targets. In the case of these commodity exporting countries, lower commodity prices have negatively affected their income levels.

2 Changes in indirect taxes and administered prices have also made a big contribution to changes in inflation in other regions, with an impact on their apparently limited response to cyclical changes in the economy. In a number of euro area countries, for example, fiscal systems were reformed before the crisis to give indirect taxes a more central role, and if the impact of these tax increases is removed then inflation is seen to respond more strongly to the economic slowdown. For an analysis of recent experience in Spain, see the box "Una evaluación preliminar del efecto sobre la inflación de los aumentos en la imposición indirecta y en los precios administrados" in the Banco de España's Boletín Económico (October 2012).

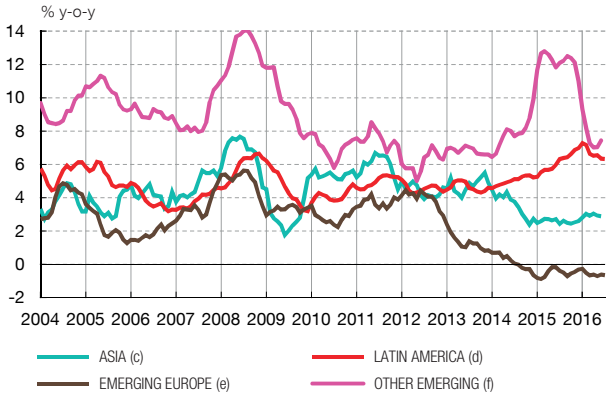
HEADLINE AND CORE INFLATION BY AREA

CHART 2

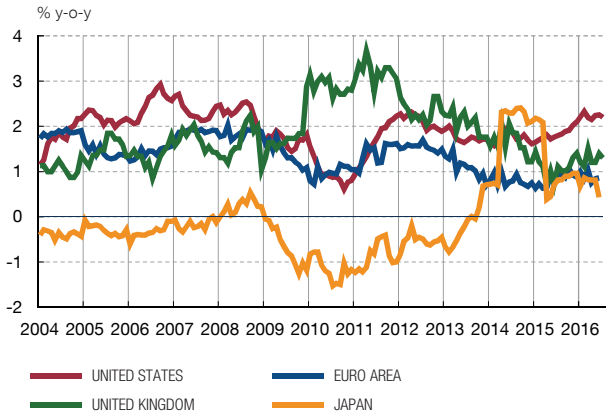
1 HEADLINE INFLATION IN ADVANCED ECONOMIES



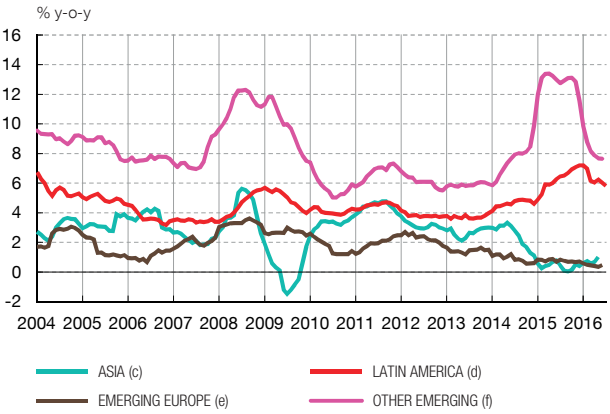
2 HEADLINE INFLATION IN EMERGING ECONOMIES (a)



3 CORE INFLATION IN ADVANCED ECONOMIES (b)



4 CORE INFLATION IN EMERGING ECONOMIES (a) (b)



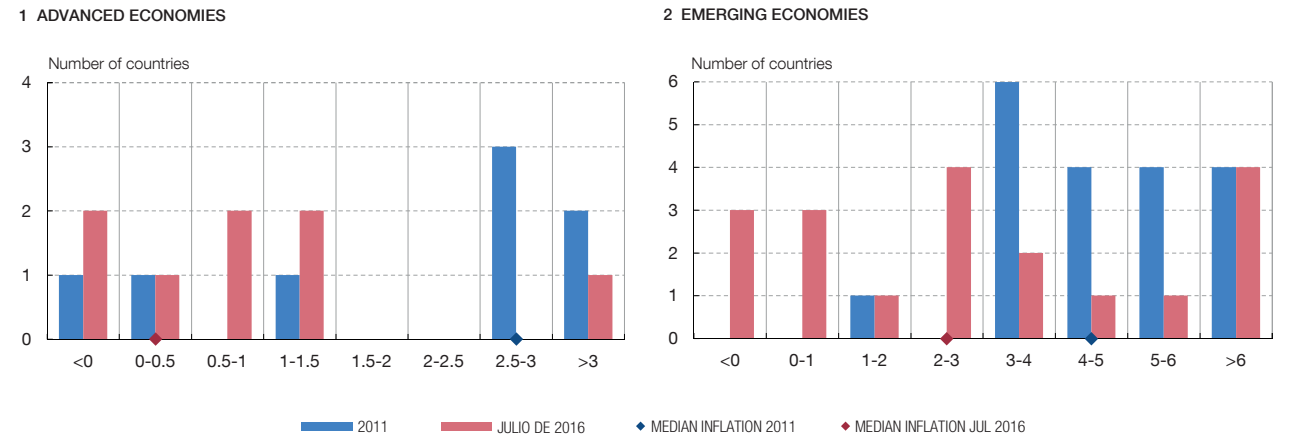
SOURCES: Datastream, national statistics, OECD and own calculations.

a Weighted average of each country in 2005 by GDP in PPP.
b Core inflation excludes food and energy.
c China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapur and Thailand.
d Brazil, Chile, Colombia, Mexico and Peru.
e Czech Republic, Hungary and Poland.
f South Africa, Turkey and Russia.

The trends in headline inflation rates in emerging economies have been more varied. Thus, while in some cases rates have been very low (particularly in the new EU Member States in Eastern Europe, and some emerging Asian economies, such as China and Korea), in some of the main emerging economies, such as Brazil, India, Indonesia, Russia and Turkey, inflation rates have remained high, fuelled by currency depreciation. The same trends are apparent in core inflation, with very low levels in Asia and emerging European economies, and higher rates in Latin America and other emerging economies such as Russia and Turkey. Since 2011 the distribution of inflation rates worldwide has shifted downwards markedly (Chart 3). Out of 26 advanced and emerging economies, only in seven was the inflation rate higher in July 2016 than in June 2011 – basically, emerging economies whose currencies had depreciated. And in many countries inflation rates are below the targets set by their central banks (Chart 4). Similarly, there have been systematic downside errors in analysts' and central banks' inflation forecasts.

DISTRIBUTION OF INFLATION RATES (a)

CHART 3

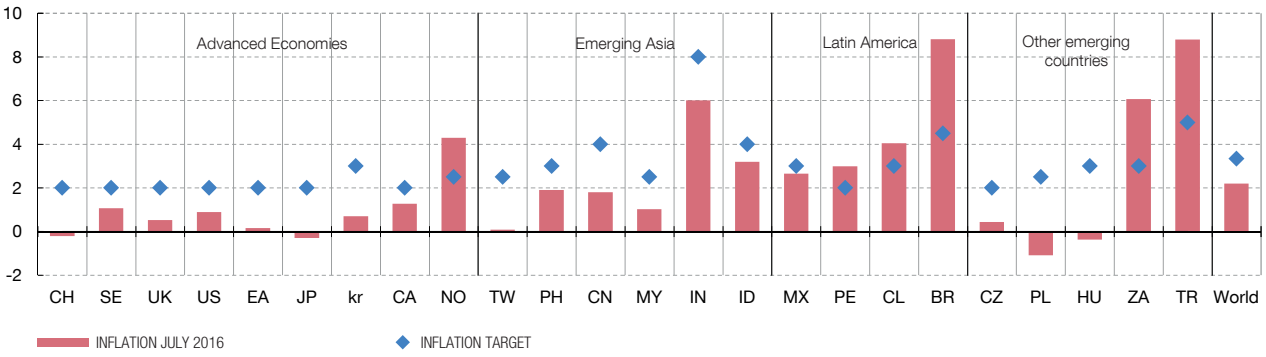


SOURCES: Datastream, national statistics, OECD, own calculation.

a Sample of 27 countries: Canada, the Euro Area, Japan, Norway, Sweden, Switzerland, United Kingdom and United States (advanced) and Brazil, Chile, China, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Russia, the Philippines, Poland, Singapore, South Africa, Thailand and Turkey (emerging). Data is the average of the period.

DEVIATIONS FROM INFLATION TARGETS (a)

CHART 4



SOURCES: Datastream, national statistics, OECD, own calculation.

a The bars show the annual inflation rate for July 2016 and the dots the price stability target of each Central Bank in the medium run (except for Turkey, which shows the target for the end of the year).

3 Determinants of low global inflation

The standard framework for modelling inflation is the Phillips curve, according to which inflation is basically determined by economic agents' inflation expectations, which may comprise both backward- and forward-looking components. It is also affected by the degree of cyclical slack in the economy, so that a negative output gap (i.e. GDP below its potential level) or cyclical unemployment (defined as the extent to which the unemployment rate differs from its structural rate) will be associated with a lower inflation rate. Within this framework, low inflation could basically be explained by greater slack in the economy and/or by agents' lower inflation expectations.[3]

However, the Phillips-curve-based analysis has its limitations and remains controversial among economists [see, for example, ECB (2014), Constâncio (2015) or Yellen (2015)]. To start with, the degree of slack in the economy cannot be directly observed. Instead, various measures are used as proxies and, in exceptional circumstances, such as the global financial crisis, it is surrounded by higher uncertainty. Moreover, the empirical evidence shows that, at least in advanced economies, there were changes in the parameters of the Phillips curve between the 1970s and the early 1990s. First, in that period inflation became less sensitive to the cyclical situation of the economy (in terms of the Phillips curve, the curve flattened), although this sensitivity seems to have remained stable since then, not having diminished further during the crisis. Indeed, some studies have found it to have increased in recent years in some countries.[4] Second, some authors have also asserted that, as a consequence of the process of globalisation, inflation today depends less on each economy's cyclical position and more on the degree of slack in the global economy [a point of view stressed by the BIS; see for example Borio and Filardo (2007), White (2008) and BIS (2014, 2015)]. Finally, other possible changes in the parameters of the Phillips curve have been highlighted, such as the fact that the inflation-expectations coefficient has risen as a result of central banks' greater credibility.

Additionally, the theoretical framework of the Phillips curve has sometimes been supplemented with other factors, which could play a significant role in price determination. These include supply shocks (affecting productivity or commodity prices, for example), labour market institutions, and the effects of exchange rates, indirect tax rates or demographic shifts.[5] This model, commonly known as the triangular model because it captures the effects of

3 Under this framework (see the formula below) inflation (π_t) would be determined by inflation expectations – possibly a combination of forward looking (LT_t) and backward looking elements (π'_t) – and by the degree of cyclical slack in the economy ($slack_t$) :

$$\pi_t = \lambda LT_t + (1 - \lambda)\, \pi'_t + \beta_1\, slack_t + \varepsilon_t$$

4 See, for example, Stella and Stock (2013) for the case of the United States.

5 A number of authors point to the deflationary effect of population ageing, particularly in the case of Japan, due primarily to the negative effect on economic growth and natural interest rates [Shirakawa (2012), Anderson (2014), Carvalho and Ferrero (2014)]. For a more general discussion of the effects of ageing, see, for example, Bean (2004), Bullard et al. (2012), Imam (2013) or Yoon et al. (2014); these authors point to the greater preference of longer-lived generations for low inflation, as their income is mainly fixed, and their lower sensitivity to monetary policy. By contrast, McMillan and Baesel (1990), Lindh and Malmberg (2000) and Juselius and Takáts (2015) find a positive correlation between the ratio of dependent population (young and elderly people) and a high inflation rate.

shifts in demand, supply and expectations, has been used by Gordon (1982, 2011, 2013), in particular. In the remainder of this section we explore how these factors have evolved and we undertake a comprehensive review of the extensive theoretical and empirical literature on the topic. The section concludes with an empirical exercise exploring the influence of each factor on inflation in advanced economies before and after the crisis.

3.1 The effect of commodity prices and exchange rates

The way the main components of inflation have developed reveals that trends in commodity prices, particularly the oil price, have been among the main factors pushing down inflation worldwide (Table 1 and Chart 5). The contribution of the oil price to global inflation has been shrinking since 2011 and has been negative since 2014.[6] Food prices have also fluctuated widely, contributing to the recent drop in inflation rates, particularly in emerging economies, where they account for a larger share of the basket of consumer goods [see Furceri, et al. (2015)]. Core inflation, which excludes the energy and food components, has been somewhat more stable. As mentioned above, within core inflation, goods and services have performed differently. Inflation

CONTRIBUTIONS TO CHANGE IN INFLATION (a)
(Difference between Jun-16 and June-14) **TABLE 1**

pp

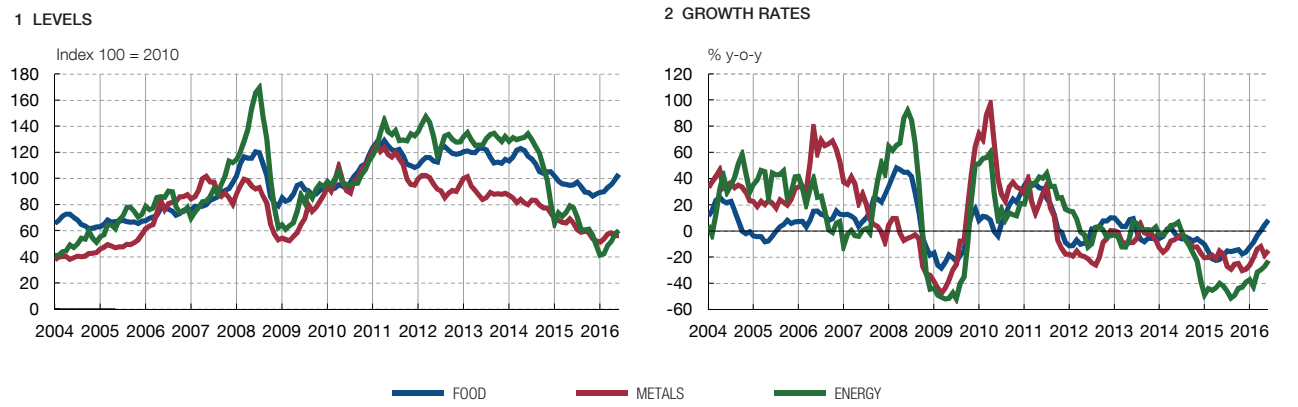
	CPI energy	CPI food	CPI core	CPI general
Advanced Economies				
United States	-1.2	-0.3	0.5	-1.1
Euro Area	-0.7	0.2	0.4	-0.2
Japan (a)	-1.7	-0.3	0.2	-1.8
Norway	1.6	0.0	0.6	2.1
Canada	-1.1	-0.2	0.5	-0.9
Sweden	0.2	0.1	0.7	1.1
Switzerland	-0.4	0.0	0.2	-0.2
United Kingdom	-0.6	-0.3	-0.1	-1.0
Emerging Economies				
Brazil	0.4	1.1	0.8	2.3
China	-0.1	1.2	-1.7	-0.5
India	-0.2	0.0	-1.1	-1.4
Indonesia	-1.3	0.3	-0.2	-1.2
Mexico	-0.9	0.0	-0.5	-1.4
Korea	-1.0	-0.3	0.3	-0.9
Poland	-0.7	0.5	-0.8	-1.0
Czech Republic	0.2	-0.3	0.0	-0.1
South-Africa	-0.4	0.3	-0.2	-0.3
Turkey	-0.3	-1.7	1.7	-0.3

SOURCES: Datastream, national statistics, OECD, Eurostat own calculations.

a For CPI energy, food and core columns, it is the variation of its contribution in the period. Japan data excludes the VAT effect.

6 Bec and De Gaye (2014) find that a large share of inflation forecasting errors in recent years in the United States and France are due to errors predicting the oil price.

COMMODITY PRICES CHART 5



SOURCE: Datastream.

rates for goods, more directly linked to import prices, have tended to be negative over the last two years, whereas rates for services have remained higher. In some cases, such as the United States, the moderation of services inflation is also surprising when compared to previous recoveries, although this could reflect the moderation of health-care prices, after the country's recent health-care legislation.

The direct effects of falling oil prices have varied between countries as a result of differences in oil's weight in the CPI, different levels of taxation on energy (usually in the form of unit tax rates), and changes in energy taxes and subsidies, as well as fluctuations in exchange rates [see IMF (2008)]. For example, oil prices have fallen by more in dollar than in euro terms, and less in other currencies that have depreciated against the dollar over the period. Similarly, the drop in the energy component of the CPI in the EU was smaller than in the United States, as a result of higher tax levels in Europe.[7] In some emerging economies, such as Brazil and Indonesia, subsidy cuts caused an effective rise in fuel prices despite lower oil prices.

Another important point to consider when analysing the impact of falling commodity prices on inflation is whether the decline is being driven by supply- or demand-side factors. This is because the effects of a drop in the oil price caused by supply-side factors would be partially offset by the accompanying stimulus to activity, whereas a price drop driven by weak demand could have a bigger deflationary effect.

Finally, the impact of oil and other commodity prices on inflation, beyond the direct and indirect effects on production costs, will depend on how long the underlying shocks last. Thus, the likelihood of second-round effects on prices and wages will be greater if these shocks are persistent rather than short-lived. In this regard, there is extensive evidence that the degree of pass-through of commodity prices to core inflation has diminished over the past three decades. This is partly because the economy today makes less intensive use of commodities and also

7 However, Álvarez et al. (2011) show that both in Spain and the euro area as a whole the direct impact of the oil price on inflation has increased over the last decade as a consequence of the increased weight of refined petroleum products in the consumption basket.

because the monetary authorities have gained credibility, which enables them to anchor inflation expectations more firmly. An additional factor is that wage indexing is less widespread.[8] In the today's context, unless commodity prices continue to fall over the next few years, something not discounted by markets, the negative impacts on inflation can be expected to dissipate and are not likely to have significant second-round effects. However, the relative importance of demand from the emerging economies [in particular, China) in determining commodity prices has increased over time (see Roache (2012)] and events in large emerging economies (such as a possible slowdown in China while it makes the transition to a less investment- and more consumption-based model) may have a powerful impact on commodity prices over the next few years.

A large share of how inflation has developed in some countries can be explained by shifts in exchange rates. This is easy to confirm in the case of economies where a substantial depreciation in their currency has been linked to a subsequent rise in inflation. This was the case in Japan, following the launch of Abenomics, the United Kingdom, following the depreciation of the pound in the wake of the crisis, and certain emerging economies confronted with the prospect of monetary policy tightening in the United States [see, for example, Vergara (2015)]. By contrast, countries whose currencies have appreciated, such as Switzerland, the United States, China or, more recently, Japan, have experienced deflationary pressures via this route [see, for example, Fischer (2015), Jordan (2015) or Yellen (2015)]. This would explain why inflation has varied so widely around the world, as shown by the negative correlation between inflation rates and changes in nominal effective exchange rates in recent years (Chart 6).

Nevertheless, as in the case of commodity prices, there is evidence that the exchange rate pass-through into inflation has decreased in recent decades. This has been particularly the case in the advanced economies, as well as in some emerging economies[9], as a consequence of several factors, such as the better anchoring of inflation expectations, the development of global production chains that enable better absorption of exchange rate shifts by multinationals firms, the greater depth and liquidity of derivative markets, etc.[10]

In any event, the low levels of inflation recorded in recent years cannot be explained solely by relatively transitory movements of volatile variables, such as exchange rates, commodity prices, or indirect taxes. This raises the question of whether other factors have

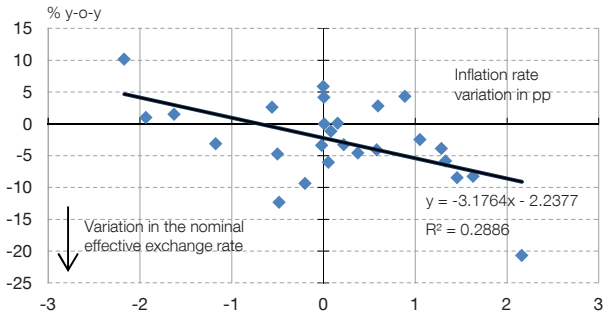
---

8 See, for example, Hooker (2002), de Gregorio et al. (2007), Cecchetti and Moessner (2008), IMF (2008), Blanchard and Galí (2010), Clark and Terry (2010), Álvarez et al. (2011), Evans and Fisher (2011), Davis (2012), BIS (2015), Furceri et al. (2015).

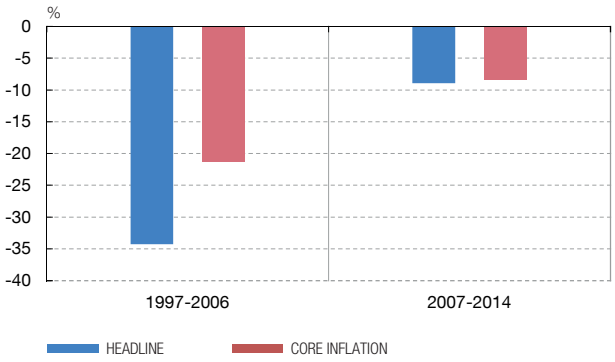
9 See, for example, Campa and Goldberg (2005, 2008), Campa et al. (2007), Bailliu et al. (2010), Kohlscheen (2010), Takhtamanova (2010), Gagnon et al. (2012), BIS (2014). Gopinath (2015) highlights, in the US case, the predominance of dollar-denominated imports as being a key factor in the reduced pass-through of the exchange rate into inflation. Factors such as exporters' pricing to market makes the extent of pass-through of exchange rate movements into import prices incomplete [see, for example, Bank of England (2015)].

10 For a contrasting opinion, see Hara et al. (2015) for the case of Japan since the 2000s. Moreover, Forbes (2015) and Forbes et al. (2015) also find that pass-through in the United Kingdom increased in the wake of the crisis. Furthermore, they highlight that to explain how this pass-through has evolved it is essential to distinguish the origin of the change in the exchange rate (i.e. whether it is due to domestic demand, global demand, domestic monetary policy, global supply shocks, domestic productivity, etc.). The largest degree of pass-through is found if the rise in the exchange rate is due to supply-side shocks, particularly domestic ones, while rising exchange rates linked to global or domestic demand shocks can cause price rises. The ECB's MPC Task Force on Low Inflation Report reached similar conclusions.

1 RECENT RELATIONSHIP BETWEEN INFLATION AND EXCHANGE RATE (a)



2 CHANGE IN THE INFLUENCE OF EXCHANGE RATE ON INFLATION IN RECENT DECADES (b)



SOURCES: Datastream, national statistics, BIS Annual Report (2015).

a Variation between March 2015 and March 2016 in inflation and exchange rates for the following countries: Canada, Euro area, Japan, Norway, Sweden, Switzerland, United Kingdom, United States, Brazil, Chile, China, Czech Republic, Hong Kong, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Singapur, South Africa, Thailand and Turkey.

b Correlation between headline inflation and the second lag of year on year change of nominal effective exchange rate. Simple average between Australia, Brazil, Canada, Chile, Colombia, Czech Republic, Denmark, Euro area, Hungary, India, Indonesia, Japan, Korea, Mexico, New Zealand, Norway, Peru, Philippines, Poland, Singapur, Sweden, Switzerland, Thailand, Turkey, United Kingdom and United States.

played a significant role in the price-formation process. The following sections examine some of these possible factors, from a theoretical viewpoint based on the Phillips curve.

3.2 Cyclical sensitivity of inflation

A high degree of economic slack is typically a driver of low inflation. However, measuring this slack is complicated by the difficulty of estimating potential GDP and the output gap. This measurement problem was exacerbated in the post-financial crisis global economic context. Although it seems clear that the financial crisis has substantially reduced potential GDP (and possibly potential growth as well), the precise extent to which it has done so is less clear. Indeed, potential growth prior to the crisis may have been overestimated as it was achieved by generating macro-financial imbalances that made it unsustainable, particularly in those advanced economies worst hit by the crisis [recent work on this line of research includes that by Alberola, et al. (2014) and Borio et al. (2013, 2014)].[11] There are also uncertainties about the point in the economic cycle reached by emerging economies. Insofar as part of these economies' growth in recent years is explained by strong capital inflows, credit booms and, in some cases, high commodity prices, potential GDP growth is likely to be lower now than previously estimated. Indeed, the main international organisations have cut their long term growth estimates for both the advanced and emerging economies.

An alternative to using the output gap as a measure of the cyclical position of the economy is to use the unemployment rate. However, identifying the cyclical and structural components of the unemployment rate is far from straightforward. The conceptual and practical difficulties in

11 This situation is very different from that in the second half of the 1990s, when there was a tendency to predict higher inflation than actually occurred in the advanced economies. Then, however, the technology revolution boosted productivity and potential growth, allowing greater slack and reducing inflationary pressures [see, for example, Andersen and Wascher (2001), Ihrig and Marquez (2003)].

estimating NAIRU are analogous to those affecting potential GDP estimates [see, for example, Staiger et al. (1997)]. Moreover, changes in other labour market variables can give a different view of the degree of economic slack. For example, in the United States, some of the fundamental labour market variables, such as participation rates, unemployment rates, and long-term unemployment rates, have behaved in recent years in ways not in keeping with historical trends. At the same time, shifts in some statistical relationships that had remained stable over recent decades, such as the Beveridge curve (the relationship between the job-vacancy and unemployment rates) or Okun's law (the relationship between GDP growth and the unemployment rate) have become apparent. These shifts suggest the possible existence of structural changes in the labour market and/or in the relationships between the underlying economic variables. This has increased the uncertainty as to whether the unemployment rate is an accurate measure of the economy's idle capacity, especially when it has been close to what is considered the natural rate of unemployment and no wage pressure has been detected. In particular, it is not clear whether the natural rate of unemployment has changed, and if so, by how much. Moreover, it is unclear whether the unusual drop in the participation rate is partially reversible, and if so, to what extent. There is also uncertainty as to whether long-term unemployment is exhibiting hysteresis, a phenomenon that had been observed previously in other advanced economies, but not in the United States.[12]

All these uncertainties raise some difficult questions. Should economic slack be measured via GDP or unemployment? Should deviations from equilibrium levels or growth rates of the variables [as proposed by Orphanides and Van Norden (2005)] be taken into account? Should financial factors and other macro-financial imbalances be incorporated in the output gap estimates? In any event, existing estimates by international organisations suggest that although output (and unemployment) gaps in the main advanced economies (Chart 7) are still significant, in general the degree of economic slack has decreased over the last few years, despite the moderation of inflation rates. Similarly, the wide output gaps that opened up in the aftermath of the crisis contrast with inflation's downward rigidity in that period [as highlighted, for example, by Ball and Mazumder (2011)],[13] something that could be explained by the countercyclical behaviour of firms' margins, reinforced by financial constraints, as we will discuss below.

In any event, the fact that inflation rates have not responded as expected to economies' cyclical position in recent years is not something new. There is extensive empirical evidence in the literature showing that in advanced economies the Phillips curve flattened between the 1970s and the early 1990s.[14] Chart 8 shows the relationship between consumer price inflation and the

12 For a detailed analysis of recent trends in the US labour market, see Berganza (2014). Some authors have suggested that the long-term unemployed disconnect from the labour market and do not exert the same pressure on wages as the short-term unemployed [Llaudes (2005), Gordon (2013), Krueger et al. (2014), Kumar and Orrenius (2014), Linder et al. (2014), Ball and Mazumder (2015)]. For a contrary view, see Kiley (2014) or Speigner (2014).

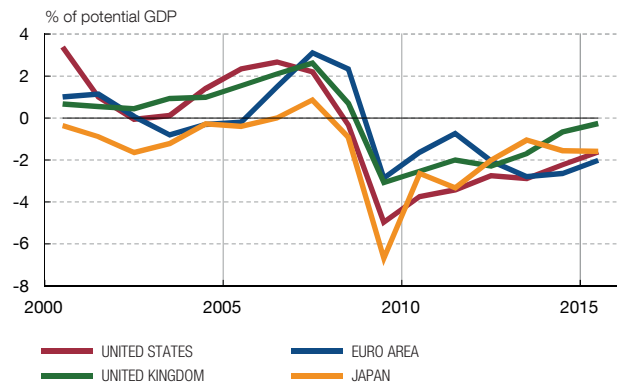
13 Ball and Mazumder (2011) find that according to traditional estimates of the Phillips curve core inflation in the US should have declined well below zero during the crisis (even reaching less than -3%, although it actually just fell to 0.6%). This contrasts with the historical evidence that pronounced and persistent negative output gaps tend to lead to significant deflation in terms of both prices and wages, as Meier (2010) shows.

14 See, for example, Bean (2006, 2007), Iakova (2007), Kuttner and Robinson (2008), Mishkin (2007), Razin and Binyamini (2007), IMF (2013), Matheson and Stavrev (2013), BIS (2014), Murphy (2014), Blanchard et al. (2015). The empirical evidence for emerging economies is limited, although a similar trend seems to have been observed (Baxa et al. (2012) for Eastern Europe). For a contrasting view see, for example, Stella and Stock (2013), who argue that the Phillips curve has become steeper in the United States since 2008.

OUTPUT GAPS AND INFLATION IN ADVANCED ECONOMIES

CHART 7

1 OUTPUT GAPS BY AREAS



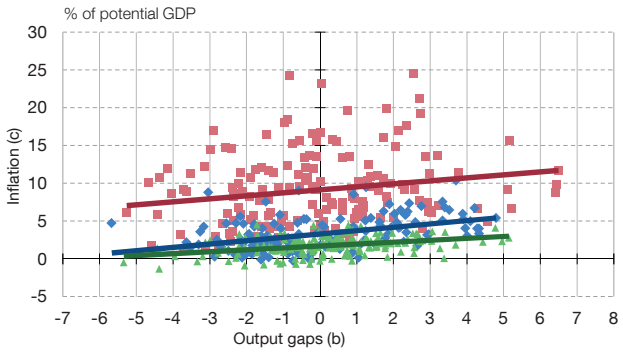
2 OUTPUT GAP AND INFLATION IN OECD COUNTRIES

SOURCES: IMF, World Economic Outlook April 2016, OCDE Economic Outlook.

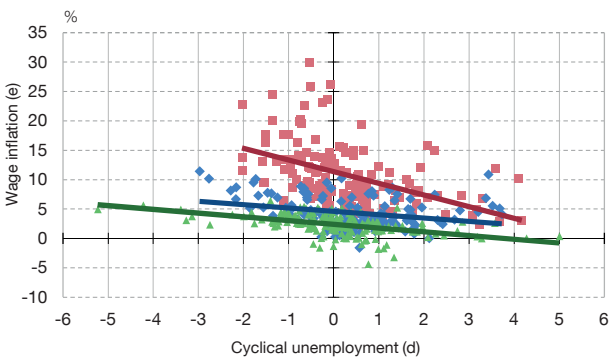
PHILLIPS CURVE IN ADVANCED ECONOMIES

CHART 8

1 INFLATION AND OUTPUT GAPS (a)



2 WAGES AND CYCLICAL UNEMPLOYMENT (a)



SOURCES: BIS Annual Report (2014).

a Annual data, regression lines estimated with panel data unbalanced regressions with individual fix effects, controlling with year on year changes on commodities prices. The countries are Australia, Canada, France, Germany, Italy, Japan, Spain, Sweden, Switzerland, United Kingdom and United States.
b Estimations using a Holdrick-Prescott filter.
c Year on year change on the consumer price index.
d Unemployment rate minus NAIRU.
e Year on year change on wages.

output gap and between wage inflation and the cyclical component of the unemployment rate in different periods.[15] The reduced sensitivity of inflation to the degree of economic slack also means that it is much more difficult to predict inflation precisely.[16]

15 For some authors, the Phillips curve presents non-linearities, being flatter when unemployment rates are higher, due to downward wage rigidities, and steeper when unemployment rates are very low [Mourougane and Ibaragi (2004), de Veirman (2009), Linder et al (2012), Kumar and Orrenius (2014), Speigner (2014)]. Snower (2015) also considers the Phillips curve to be non-linear, with a positive slope segment (higher inflation, higher unemployment) related to the phenomenon of stagflation. For a contrasting view, see Musso et al. (2009). In the case of the Spanish economy, a recent paper by Álvarez et al. (2015) found evidence that inflation responds differently in booms than in recessions, being higher in the contractionary phases of the cycle.

16 As indicated, for example, by Stock and Watson (1999, 2007, 2010), Atkeson and Ohanian (2001), Cecchetti et al. (2007) or Bánbura and Mirza (2013).

Another way of looking at the cyclical sensitivity of inflation is through changes in the coefficient of the Phillips curve that captures the effect of the economy's economic slack over time. A number of recent papers have shown that this parameter decreased in advanced economies between the 1970s and the 1990s, indicating a flattening of the Phillips curve during this period.[17] Nevertheless, there is also considerable evidence that this phenomenon has been reversed in some advanced economies in the wake of the crisis. For example, in some euro area countries, such as Spain, Finland and Italy,[18] this has come about as a result of greater market flexibility following a number of structural reforms.[19]

Turning to developments in labour markets, wage growth in the United States in the last few years has been weaker than in previous recoveries given the declining trend in the unemployment rate, and even bearing in mind the low rates of inflation. There could be various – not necessarily mutually compatible – reasons for this. First, as noted above, this wage behaviour could be a sign that the labour market conditions are actually weaker than the unemployment rate would suggest. However, the literature offers other possible reasons why wages have not risen more in some developed economies. For example, productivity gains in recent years have been low (a phenomenon also observed in other advanced economies). It could also be the case that productivity growth has been slow because wage growth has been slow; that is, faced with only tepid rises in labour costs, firms have had less incentive to invest in labour-saving technologies.

Muted wage growth could also be related to the composition of employment. For example, in the United Kingdom less productive workers earning lower wages bore the brunt of job losses during the crisis and experienced fastest job growth during the recovery, which could explain the slow growth of both productivity and wages (Broadbent, 2015). This change in the composition of employment could be due to demand-side factors (less investment in physical and human capital in the wake of the crisis) or supply-side factors (increased immigration). Another explanation, which became popular following Yellen's speech at Jackson Hole in 2014 [Yellen (2014)], was the concept of pent-up wage deflation developed by Daly and Hobjin (2014). Given workers' reluctance to accept cuts in nominal wages during a recession and the start of a recovery,[20] employees' real wages would remain above equilibrium levels; consequently, unemployment may fall during the recovery, thereby reducing the slack in the labour market, without pushing up nominal wages. This phenomenon would be temporary, so that once real wages reach equilibrium levels (and the pent-up wage deflation is absorbed) nominal wages should start rising again. This process may be abrupt, however.

---

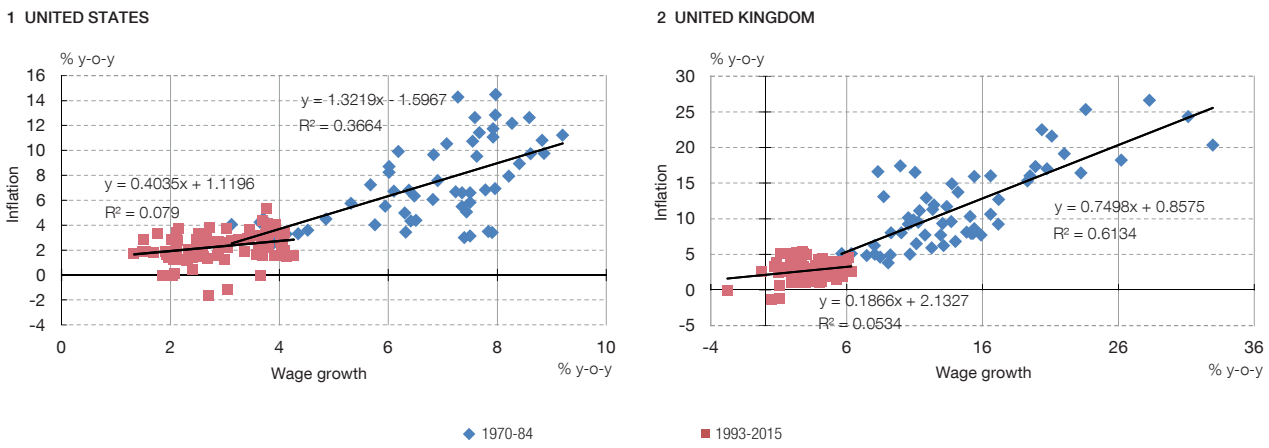
17 See, for example, IMF (2006, 2013), Roberts (2006), Iakova (2007), Andrle et al. (2013), Coibion and Gorodnichenko (2013), Matheson and Stavrev (2013), Stevens (2013), BIS (2014), Broadbent (2014), Ball and Mazumder (2015), Blanchard et al. (2015), Galí (2015), Riggi and Santoro (2015).

18 See, for example, Álvarez and Urtasun (2013), Oinonen et al. (2013), Stella and Stock (2013), Jordan and Vilmi (2014), Larkin (2014), Oinonen and Paloviita (2014), Riggi and Venditti (2014), Álvarez et al. (2015), Banco de España (2015), Blanchard et al. (2015), Carney (2015), Constâncio (2015), Draghi (2015a), Fabiani and Porqueddu (2015), Riggi and Venditti (2015), IMF (2016b).

19 For an analysis applied to the Spanish case, see Izquierdo and Puente (2015).

20 There is extensive evidence of these downward rigidities in nominal wages, even in the US case [see, for example, Benigno and Ricci (2011), Linder et al. (2012), Lopez-Perez (2015)].

WAGE GROWTH AND INFLATION IN THE UNITED STATES AND THE UNITED KINGDOM (a) CHART 9



SOURCE: National statistics.

a Quaterly data.

Another interesting feature of price determination related to the reduced cyclical sensitivity of inflation is that in some advanced economies the close link between wage growth and CPI inflation seems to have dissipated.[21] As Chart 9 shows, in the US and UK economies this relationship was relatively tight in the 1970s and 1980s, whereas inflation seems to have become relatively insensitive to wage fluctuations since the 1990s. As mentioned above, one possible explanation for the looser relationship between wage growth and consumer price increases would be the existence of counter-cyclical mark-ups, such that inflation has become less sensitive to labour-market conditions because mark-ups have offset the effect of wages. If this is the case, increased mark-ups in many economies since the Great Recession would have partially offset the disinflationary effect of declining wages, helping explain inflation's more muted response. This phenomenon would have intensified in the aftermath of the financial crisis, as the financial constraints would reinforce the counter-cyclical trend in margins.[22]

Lastly, other possible explanations for inflation's potentially reduced cyclical sensitivity include the greater importance of global factors in determining prices or the effect of inflation-expectation anchoring. These issues will be addressed in the two following sections.

3.3 Influence of global factors on inflation

Some of the same studies that find inflation to have become less sensitive to domestic cyclical conditions argue that, by contrast, the significance of global factors has increased as a result of globalisation. This argument has been put forward in some BIS papers [see Borio and Filardo (2007) and White (2008)] and in BIS annual reports (2014, 2015). The estimates of the Phillips curve provided by these authors show the effects of variables such as the global output gap or import prices to be significant, while that of the domestic output gap to be small or even

21 See, for example, Mehra (2000), Peneva and Rudd (2015), Yellen (2015).

22 As put forward by Chevalier and Scharfstein (1996), Brayton et al. (1999) and, more recently, Gilchrist and Zakrajšek (2012, 2015), Gilchrist et al. (2015), Kimura (2013) and Montero and Urtasun (2014).

insignificant.[23] A recent IMF study has also highlighted the relevance of global factors (measured by the industrial slack in large exporters such as Japan, the United States, and especially China) in explaining low inflation by putting downward pressure on global prices of tradable goods (IMF, 2016b). This study shows that the decline in goods inflation has been steeper than that in services, particularly in the case of tradable goods.

The process of globalisation has expanded the range of products and services that can be traded internationally. It has also led to tradable goods,[24] particularly manufactured goods – but increasingly services too – becoming cheaper as a result of lower production costs in emerging economies, such as China, in particular.[25] Increased globalisation also influences prices through heightened international competition in both product and factor markets.[26] This competition also constrains workers' bargaining power and business margins.[27] At the same time, global supply and demand conditions determine commodity prices, which have a direct impact on inflation.[28] Strong growth in emerging economies – particularly China – in the years leading up to the crisis drove up prices of commodities, and this process has gone into reverse now these economies are slowing.

In line with the increased importance of global factors, inflation rates and wage growth have tended to be more closely synchronised among advanced economies in recent years and there is considerable evidence that a common factor, obtained empirically by principal component analysis, can explain a significant portion of the variability of inflation in advanced economies.[29] However, although it is accepted that global factors play a bigger role in determining inflation, there is considerable uncertainty as to the real significance of these factors in the recent drop in inflation.[30] And in the medium-to-long term, it is debatable to what extent globalisation will continue to exert a deflationary effect, as differences in labour costs between countries shrink.

---

23 Many studies seem to confirm the increased relevance of global factors in inflation. See, for example, (2006, 2013), Bean (2006, 2007), Razin and Binyamini (2007), Pain et al. (2008), Peacock and Baumann (2008), Ciccarelli and Mojón (2010), Eickmeier and Pijnenburg (2013), Matheson and Stavrev (2013), Stevens (2013), Ferroni and Mojón (2014), Friedrich (2014), Iossifov and Podpiera (2014), Medel et al. (2014), Friedrich and Gosselin (2015).

24 See, for example, Gamber and Hung (2001) or Auer and Sauré (2013).

25 China's deflationary effect on the rest of the world has been highlighted, for example by Morimoto et al. (2003), ECB (2006), Kamin et al. (2006), Freeman (2007), Côté and de Resende (2008), Eickmeier and Kühnlenz (2013), Mandel (2013. For a contrasting view, see Feyzioğlu and Willard (2006).

26 Bentolila et al. (2007) highlight the importance of immigration in flattening the Phillips curve in Spain between 1995 and 2006.

27 These competitive effects have been pointed out by a number of authors, such as Chen et al. (2004), Bean (2006, 2007), Guerrieri et al. (2008), Anderton et al. (2009); Sekine (2009), Auer and Fischer (2010); Benigno and Faia (2010), Auer et al. (2011), Mandel (2013), BIS (2015), Carney (2015), Figura and Ratner (2015), Guilloux-Nefussi (2015), Jordan (2015). For a contrasting view, see Sbordone (2007).

28 See, for example, Pain et al. (2008), Bernanke (2007), Greenslade et al. (2008), Galesi and Lombardi (2009), Draghi (2015b), Medel (2015).

29 The evidence of greater synchronisation between inflation rates in the advanced economies and the importance of common factors can be found in Cecchetti et al. (2007); Hakkio (2009), Monacelli and Sala (2009), Ciccarelli and Mojón (2010), Neely and Rapach (2011), Gerard (2012), BIS (2014), Ferroni and Mojón (2014), Gopinath (2015), Medel (2015). For a contrasting view, see Forster and Tillmann (2014).

30 Many authors, while not denying that global factors have a bigger influence, have questioned the centrality of global effects in explaining the recent episode of low inflation and the one prior to the global financial crisis. They also question the supposed inability of monetary authorities to control inflation for this reason. See, for example, Tootell (1998), Rogoff (2003, 2006), Ball (2006); Gnan and Valderrama (2006), Kohn (2006); Yellen (2006), Bernanke (2007), Mishkin (2008), Pain et al. (2008), Calza (2009), Gaiotti (2010), Galí (2010), Ihrig et al. (2010), Papademos (2010), Woodford (2010), Zaniboni (2011), Martínez-García and Wynne (2012), Bianchi and Civelli (2015), Carney (2015) or Mikolajun and Lodge (2016).

3.4 The role of inflation expectations

The other possible explanation given in the literature for inflation's reduced cyclical sensitivity is the stronger anchoring of agents' inflation expectations on central banks' targets and the increased significance of this factor in price and wage setting.[31] If agents remain confident of central banks' commitment to price stability, they will attach less importance to transient deviations in inflation and cyclical pressures on inflation will be more muted. The greater stability of inflation in recent decades, and its reluctance to drop further during the financial crisis, would be consistent with this hypothesis.[32] Several studies showing how the parameters of the Phillips curve have evolved over time confirm that the coefficient of inflation expectations has risen over the past decades [IMF (2013), Blanchard et al. (2015)].

In this regard, it is particularly important that long-term inflation expectations remain well anchored, given that short-term expectations tend to be more volatile and more responsive to changes in inflation. As Yellen (2015) notes, the medium-term effect on inflation of factors that are, in principle, transient (such as the amount of slack or energy prices) depends on whether long-term expectations are affected or not. In fact, in recent decades long-term expectations have remained much more stable and have barely been affected by changes in past inflation. However, in the most recent recovery the downward trend in inflation may have led to a drop in inflation expectations in some regions, particularly in the euro area, but also in the United States and the United Kingdom.[33] This is not just the case for short-term expectations but for medium- and long-term expectations too[34] (see Chart 10). Indeed, this drop in inflation expectations triggered a reaction of monetary authorities, as they became aware of the risks of inflation expectations becoming unanchored and potentially leading to a deflationary spiral.

In particular, there is some evidence that the correlation between actual inflation and long-term expectations has become closer in advanced economies since the financial crisis (particularly when measures of inflation compensation obtained from financial markets are used);[35] the correlation with oil prices appears to have increased as well[36] (see Chart 11). This is

---

31 See, for example, Williams (2006), Mishkin (2007), Ball and Mazumder (2011), IMF (2013), Matheson and Stavrev (2013), Oinonen et al. (2013), Stevens (2013), BIS (2014), del Negro et al. (2014), Watson (2014), Ball (2015), Yellen (2015).

32 Particular importance is given to inflation-targeting regimes in explaining the greater importance of inflation expectations. See, for example, Levin et al. (2004), Gürkaynak et al. (2010), Davis (2014), Mehrotra and Yetman (2014) or Yetman (2015). For a recent contrasting view, see Kumar et al. (2015).

33 See, for example, ECB (2015), Domit and Jackson (2015), Miccoli and Neri (2015) or Yellen (2015). Ciccarelli and García (2015) find significant spillover effects since August 2014 from long-term inflation in the euro area on expectations in other regions, particularly the United States. This could explain the way market expectations were seen to drop at the same time.

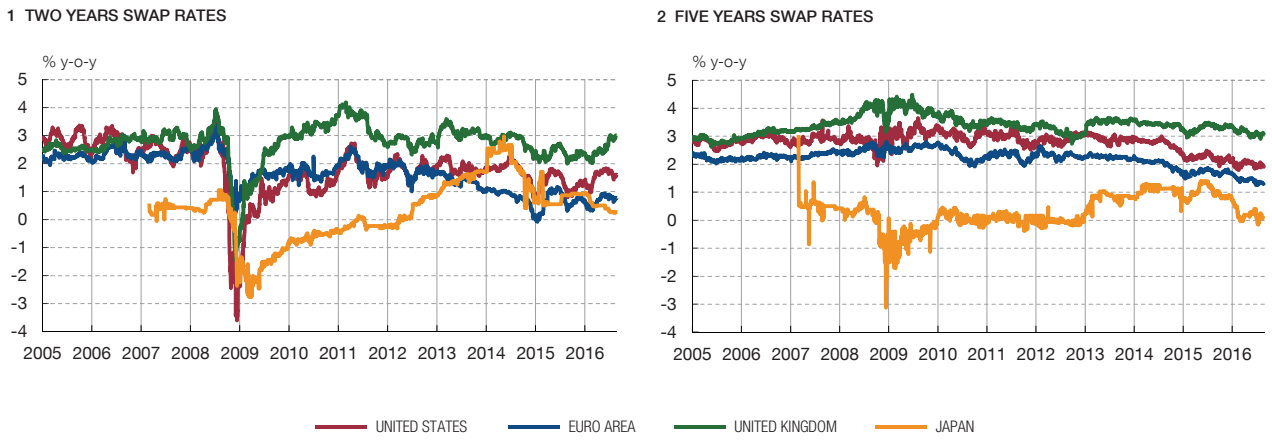
34 See, for example, Antunes (2015), who finds that changes in short-term inflation expectations in the euro area have translated into long-term expectations since mid-2012.

35 See, for example, Galati et al. (2011), BIS (2015), Miccoli and Neri (2015), IMF (2016b). Nevertheless, the limitations of measures of inflation expectations derived from financial instruments (such as the existence of liquidity premiums) must be borne in mind, while, by contrast, expectations reported in surveys have remained much more stable [Hördahl (2009), Bauer and McCarthy (2015), Yellen (2015)]. However, Lyziak and Paloviita (2016) find that in the euro area longer-term inflation expectations of professional forecasters and consumers have become somewhat more sensitive to shorter-term forecasts and to actual HICP inflation in the post-crisis period, which suggests that inflation expectations in the euro area have shown some signs of de-anchoring.

36 See, for example, Coibion and Gorodnishenko (2013), ECB (2015), Badel and McGillicuddy (2015), Elliot et al. (2015), Sussman and Zohar (2015), IMF (2016b). Kumar et al. (2015), for the case of New Zealand, indicate that business's price expectations are somewhat loosely anchored and respond mainly to developments in oil prices.

COMPENSATION BY INFLATION

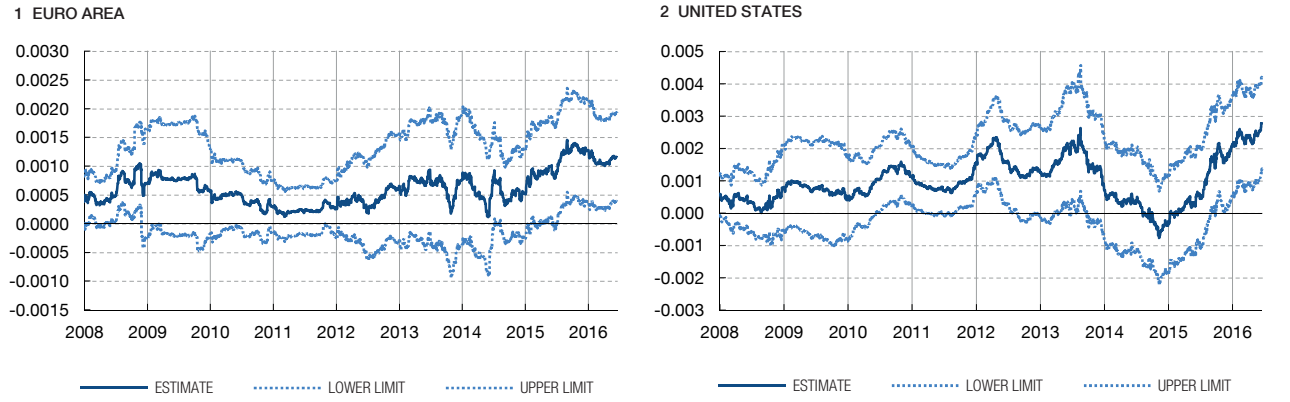
CHART 10



SOURCE: Bloomberg.

OIL PRICES EFFECT ON LONG-TERM INFLATION EXPECTATIONS

CHART 11



SOURCES: Bloomberg, own calculations.
NOTE: Coefficients are estimated by iterative regressions in a 2 year rolling window. The specification is: $D\_Z^{5y/5y} = a + b * D\_oil + c * D\_Z^{1y/1y}$, where $Z^{5y/5y}$ is the 5y/5y inflation expectations, $Z^{1y/1}y$ is the 1y/1y inflation expectations, and oil is the year on year change of oil price in national currency. Confidence intervals are calculated with robust residuals to heteroscedasticity, non-normality outliers using the Huber-White estimator.

particularly the case in economies experiencing slow growth, inflation rates persistently below targets and with policy interest rates close to the zero lower bound, like the US or the euro area, where long-term expectations seemed more firmly anchored than in some other countries such as Japan.[37] All this might indicate looser anchoring of expectations and possible second-round effects, which would be a matter of concern for monetary authorities.

Following the monetary policy decisions adopted in different areas in the last two years, long-term inflation expectations picked up again (ECB, 2015), at least temporarily, but they have remained volatile and below inflation targets, which could indicate that markets are anticipating

37 As highlighted by Clark and Davig (2008), Beechey et al. (2011) and Autrup and Grothe (2014), for instance. The recent "Comprehensive Assessment" of the Quantitative and Qualitative Easing strategy by the Bank of Japan points to the adaptive character of inflation expectations as one of the main determinants of persistently very low inflation in Japan (Bank of Japan, 2016).

low inflation rates for a long time (Yellen, 2015). A recent study by the IMF has found that the coefficient of forward-looking inflation expectations estimated in a hybrid new Keynesian Phillips curve has diminished since the crisis, while the persistence of inflation (the coefficient of lagged inflation capturing the backward-looking component of expectations) has increased (IMF, 2016b), especially for countries at the effective lower bound.

3.5 Empirical analysis of the factors determining inflation

The ultra-low inflation seen during the recent recovery has surprised both economic analysts and central banks, and numerous studies have been published analysing the role of various different factors in explaining why inflation is behaving in this way.[38] Most of these studies find that a large part of the decline in headline inflation can be attributed to transitory factors, such as lower energy prices, economic slack (both at the domestic and global level) and, in some cases, the effect of exchange rate movements. On the other hand, they usually find a wide degree of variation between countries in terms of the role of cyclical sensitivity and the relevance of forward-looking inflation expectations (whereas over recent decades the coefficient of slack has been declining gradually whilst the anchoring of inflation expectations has become more relevant). Nevertheless, overall, these studies are still unable to explain the recent decline in core inflation satisfactorily (not only due to heterogeneity alluded to above, but also to the lack of robust estimates of Phillips curves).

In our empirical exercise, we concentrated on the more recent period to try to discern whether there has been a change in the relative importance of those factors, based on the estimation of core inflation through a standard Phillips curve for 21 advanced economies.[39] In this specification, core CPI inflation (measured at quarterly annualised rates, is determined by inflation expectations – a combination of forward looking and backward looking elements –, the degree of cyclical slack and the role of import prices (the relative inflation of imports over consumer prices):

$$\pi_t = \lambda LT_t + (1 - \lambda)\, \pi'_t + \beta_1\, slack_t + \beta_2\, imp_t + \varepsilon_t$$

As in Ball and Mazumder (2011), the forward looking element of inflation expectations (LT_t) captures long term inflation expectations, measured by the Consensus forecast or proxied by the central bank targets, while the backward looking component (π'_t) is constructed as the average core inflation rate of the last four quarters.[40] The degree of economic slack in each economy ($slack_t$) is proxied by the output gap (the difference between actual and potential GDP divided by potential output) or the unemployment gap (the difference between the unemployment rate and estimated NAIRU). Relative import prices (imp_t) are measured in domestic currency,

38 See, for instance, Banco de España (2015), BIS (2015), Blanchard et al. (2015), Carney (2015), Constâncio (2015), Fischer (2015), Forbes (2015), Jordan (2015), Kiley (2015), Yellen (2015), IMF (2016b).

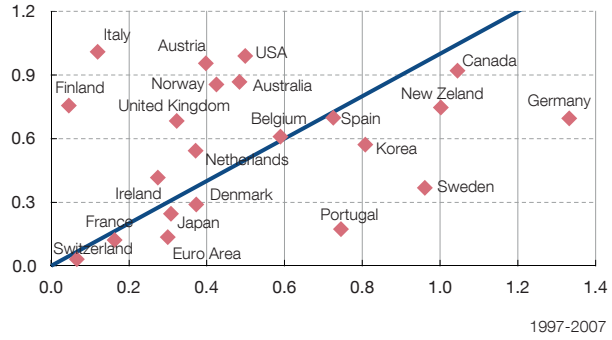
39 Australia, Austria, Belgium, Canada, Denmark, the euro area, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

40 The sum of the coefficients of forward- and backward-looking inflation expectations is restricted to 1 in order to guarantee that the Phillips curve is vertical in the long run.

CHANGES IN THE COEFFICIENTS OF THE PHILLIPS CURVE

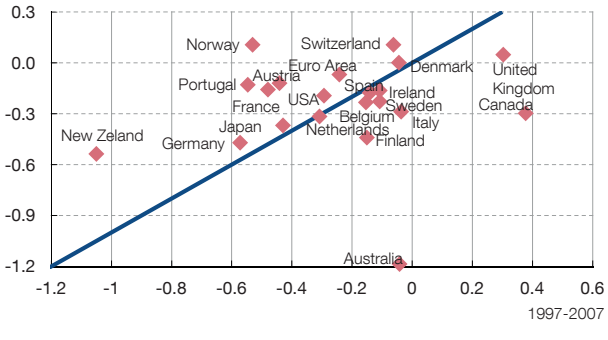
CHART 12

1 COEFFICIENT OF FORWARD-LOOKING INFLATION EXPECTATIONS (λ)



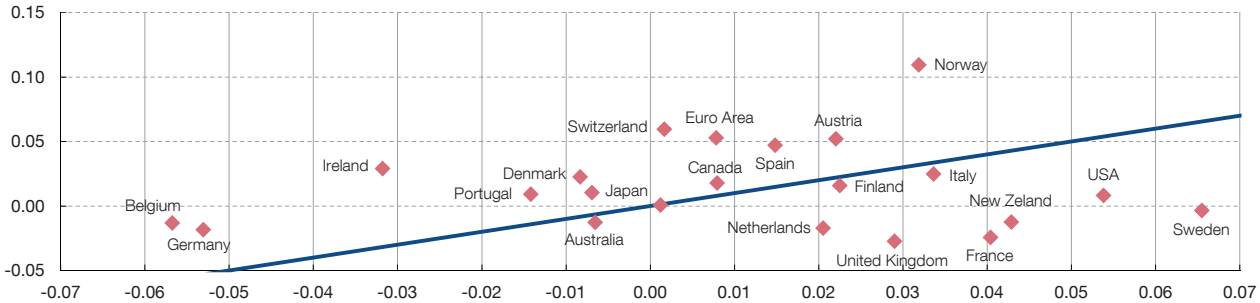
1997-2007

2 COEFFICIENT OF ECONOMIC SLACK - UNEMPLOYMENT GAP (β1)



1997-2007

3 COEFFICIENT OF RELATIVE IMPORT PRICES (β2)



1997-2007

SOURCE: Own elaboration. X-axis before the crisis, Y-axis after the crisis.

to capture trends in prices of imported goods and services, as well as the effect of exchange rates.[41] The variables for slack and relative import prices are included contemporarily or lagged by one period, depending on which specification fits the data better. Finally, we added a dummy variable to account for VAT changes. (Definitions and sources can be found in Appendix A.)

For each country in the sample we estimate the previous relation by OLS[42] for two periods: before the crisis, from 1997[43] to 2007, and after the crisis, from 2008 to 2015. Chart 12 reports the main results, in terms of changes in the coefficients of the Phillips curve between both periods, which, similarly to other studies show a wide degree

41 Another variable typically used in the literature to capture global factors affecting inflation is the global output gap. We tried this variable (the OECD output gap) in our regressions, but it showed a high correlation with domestic output gaps and its coefficient was not significant.

42 Estimation methods vary depending on the empirical approach and the definition of variables. Some authors (e.g., Blanchard et al. 2015) estimate jointly the evolution of inflation and the NAIRU (or potential output) obtaining time varying coefficients by applying the Kalman filter. Other studies, along the new Keynesian spirit, use the inflation rate in period t+1 as the forward-looking component of inflation expectations and estimate by GMM, but this approach is subject to critiques due to the weakness of instruments. In line with studies such as Ball and Mazumder (2011) or Banco de España (2015), we use long-term inflation forecasts from Consensus or the central bank target which allow estimation by OLS for each country. Panel data settings are not considered due to the specific behaviour of inflation in each country.

43 First quarter of 1999 for the euro area.

of variation between countries; for some of them the results are not robust to alternative specifications of the slack – the output gap or the unemployment gap – or the backward-looking inflation expectations – different number of lags, for instance – (see Appendix B).

In the case of inflation expectations, for some countries (Australia, Austria, Finland, the Netherlands, Norway, Ireland, Italy, the United Kingdom, and the United States), we find an increase in the relative role of the forward-looking component of expectations in the most recent period, although only in Italy and Finland is there a statistically significant difference between the coefficient in the two periods. For other countries it appears that the backward-looking component has increased (Canada, Denmark, the euro area, France, Germany, Japan, New Zealand, Portugal, South Korea, Spain, Sweden, and Switzerland), although this change is not statistically significant in a robust way in any of them.

Regarding the cyclical sensitivity of inflation, in line with other studies, there is also a high degree of heterogeneity. For some countries (Australia, Belgium, Canada, Finland, Ireland, Italy, Netherlands, Spain, Sweden and the United Kingdom), we find an increase in the coefficient of slack in the most recent period, while this is not the case in others (Austria, Denmark, the euro area, France, Germany, New Zealand, Norway, Japan, Portugal, Switzerland, and the United States). Again, most of these results are not simultaneously statistically significant and robust (except for Australia, Canada, Italy and Portugal).

Finally, the role of relative import prices on inflation varies also across countries. For some of them (Austria, Belgium, Denmark, the euro area, Germany Ireland, Japan, Norway, Portugal, Spain, South Korea and Switzerland) there is an increase in the coefficient, whereas for others (Australia, France, Finland, Italy, the Netherlands, New Zealand, Sweden, the United Kingdom and the United States) we observe a decrease. These results seem robust and statistically significant for a larger number of countries (Denmark, the euro area, France, New Zealand, Norway, Sweden, the United Kingdom and the United States).

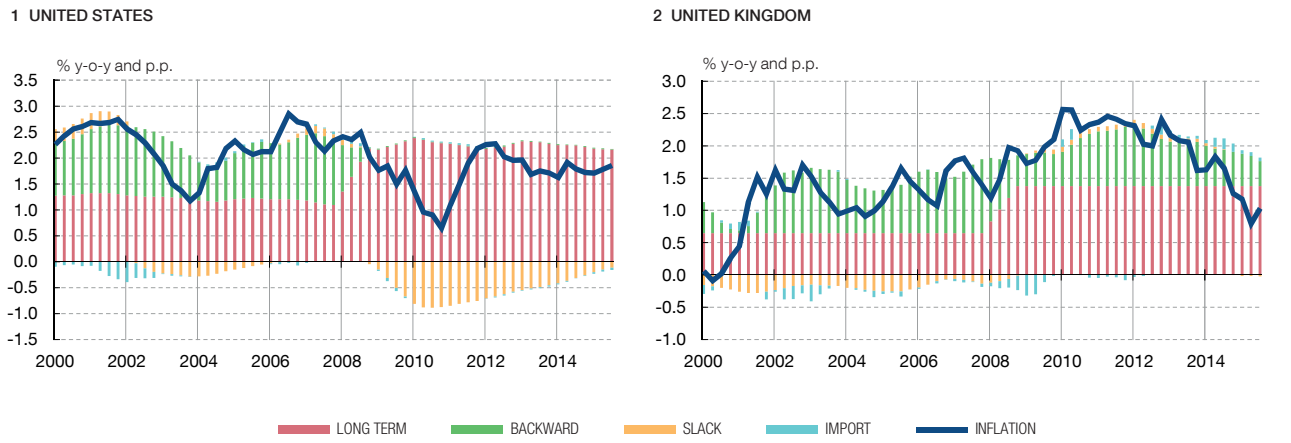
Given the high degree of heterogeneity and lack of robustness of these results, instead of drawing general conclusions, we have tried to infer which factors might explain recent inflation trends in specific countries. In Chart 13 we show the contribution of each factor to the year-on-year core inflation rate for the United States and the United Kingdom (in Appendix C we show the breakdown of inflation for the rest of countries).

In the United States, forward-looking expectations seem to have taken on a more prominent role post-2008, while cyclical slack contributed to the decline in core inflation, although less powerfully since 2011. According to these estimates, if slack continues to diminish and long-term inflation expectations are well anchored, core inflation in the US should converge towards the Federal Reserve's inflation target.

In the United Kingdom, the forward-looking component of inflation expectations also seems to have become more relevant since the crisis, but the coefficient of slack is not

DECOMPOSITION OF CORE INFLATION IN THE US AND THE UK

CHART 13



SOURCE: Own elaboration.

found to be significant (and has the opposite sign), and a large part of the recent decline in inflation remains unexplained. In some countries – and keeping in mind the general lack of robustness of the results – the post-crisis decline in inflation is related to backward-looking inflation expectations taking on a more central role (the euro area, France, Germany, Japan, New Zealand, Portugal, South Korea and Sweden); in other cases, which show forward-looking inflation expectations having a more important role, economic slack is more important in explaining ultra-low core inflation (Australia Finland, Ireland, Italy, the Netherlands and Spain) (see Appendix C). The relevance of import prices is relatively minor, except in the case of some euro area countries.

4 Implications of low inflation

4.1 Adverse economic effects of low inflation

Even if low inflation is the result of positive supply shocks, a context of excessively low inflation poses various risks. First of all, ultra-low inflation rates raise real interest rates, tightening monetary and financial conditions and weakening demand [Akerlof et al. (1996)]. In a recent study looking at the case of Sweden, Svensson (2015) estimates that, even with inflation expectations firmly anchored on the central bank's target, the effect of sub-target inflation has a cost in terms of unemployment.[44] Low inflation also influences inequality: according to a recent study by Adam and Zhu (2015), an unexpected drop in prices increases the inequality in household wealth in the euro area, with younger middle class cohorts losing more, and older, wealthier households benefiting more.

Moreover, in the current context of high public and private debt in many countries, lower inflation makes deleveraging harder, as it reduces economic agents' nominal incomes [Yellen (2015), IMF (2016c)]. The channels through which lower inflation affects debt dynamics are diverse [for the classic treatment of the subject, see Fisher (1933)]. On the one hand, lower inflation reduces nominal GDP growth (to the extent that it is reflected in the GDP deflator), causing an automatic increase in the debt-to-GDP ratio [End et al. (2015)]. The paradigmatic case is that of Japan, where falling prices since the 1990s have accounted for a third of the over 100 pp increase in public debt since then. Moreover, the possible adverse effect of excessively low inflation on GDP growth would also worsen debt dynamics [Neri and Notarpietro (2014)]. Slower growth of prices and wages also has implications for both the public and private sectors' income available to meet debt servicing requirements. Lastly, in an environment of policy rates close to the lower bound, a drop in inflation cannot be accompanied by a proportional lowering of interest rates, which under normal circumstances would compensate for the higher debt ratio.

Similarly, a generalised drop in inflation can hinder macrofinancial adjustment and improvements to competitiveness in those countries belonging to a monetary area. This may force them to undergo a process of internal devaluation, as lower inflation across the area would oblige them to register even smaller – possibly negative – price and wage increases, which are more difficult to achieve in the presence of downward rigidities. This could potentially lead to a sharper adjustment through unemployment [Banco de España (2015), Kuvshinov et al. (2015), Yellen (2015)].

The most harmful consequences of low inflation occur if it turns into deflation, particularly if this is persistent and accompanied by a de-anchoring of inflation expectations, as this can cause a drop in spending and a sharp economic slowdown.[45] Deflationary situations may be due to either supply or demand shocks. However, regardless of the origin, deflationary processes are rarely

44 Svensson estimates that with inflation 0.6 pp below target between 1997 and 2011 the unemployment rate was raised by 0.8 pp

45 See, for example, Ahearne et al. (2002), Bernanke (2002), Buiter (2003), Kumar et al. (2003), Ito and Mishkin (2006), ECB (2012), Ehrmann (2014), Busetti et al. (2014), Bunn et al. (2015), Carney (2015), D'Acunto et al (2015), Nakazono (2016).

benign.[46] They cause a redistribution of income from debtors to creditors, incentives for credit intermediation are undermined by the loss of value of assets used for collateral, and if deflation persists, there is a tendency to fall into a spiral of lower prices, output, profits, and employment.

Finally, an environment of excessively low inflation, or even worse, a deflationary process, may undermine central banks' credibility and limit their ability to implement counter-cyclical monetary policy [Ahearne et al. (2002), Yellen (2015)]. An environment in which interest rates are close to the effective lower bound further complicates matters, and a multiplicity of equilibrium situations may arise [Aruoba and Schorfheide (2015)]. The following section looks at the various challenges low inflation poses for economic policy, and monetary policy in particular, pointing out several policy alternatives that have been put forward in the literature.

4.2 Economic policy implications

Central banks in the developed economies have responded to the environment of moderate economic growth and low inflation in recent years by trying to stimulate aggregate demand. Policy interest rates have remained close to zero in the United States, the United Kingdom, Japan and the euro area for over eight years. Indeed, more recently, official deposit rates have been brought below zero in some cases (Denmark the euro area, Japan, Sweden and Switzerland). Additionally central banks have adopted a series of unconventional monetary policy measures that have added extra stimulus, such as expanding their balance sheets by buying financial assets, or pursuing a policy of forward guidance to steer expectations regarding future monetary policy decisions. According to traditional instruments for measuring the degree of monetary policy easing, such as the Taylor rule, monetary policy has been highly accommodative in most developed economies. Therefore, notwithstanding the lags with which monetary policy operates, these policies should have resulted in higher inflation.

However, assessing the degree of monetary accommodation has become more difficult after the global financial crisis. The natural real interest rate, one of the key parameters of the Taylor rule, has dropped [Laubach and Williams (2015), Pescatori and Turunen (2015)] and there is considerable uncertainty about how it will evolve over the next few years [Hernando et al. (2015), Rachel and Smith (2015)]. As mentioned in previous sections, there are serious doubts about economies' true cyclical slack (measured either via the output gap or unemployment rates), a variable also included in the Taylor rule. Furthermore, certain cyclical and structural characteristics – such as ageing, that increase the share of the population that is less sensitive to changes in interest rates [Imam (2013), IMF (2013)] – may have reduced the effectiveness of monetary policy. Moreover, given the flattening of the Phillips curve, central banks can only achieve their targets with more aggressive policies.[47]

---

46 However, for some authors, mainly those associated with the BIS, the historical evidence shows that not all deflationary episodes are harmful, particularly in the case of those that result from positive supply shocks. See, for example, Atkeson and Kehoe (2004), Bordo and Redish (2004), Borio and Filardo (2004), Bordo and Filardo (2005), BIS (2015), Borio et al. (2015). Arias et al. (2015), for their part, indicate that the harmful effects of low inflation crucially derive from its origin, and the ability of monetary policy to respond. The effects are more positive if deflation is due to positive supply shocks and monetary policy is not limited by the effective lower bound.

47 The same thing could happen when trying to control inflation when it starts to rise.

The inability of central banks to control long-term inflation and provide a nominal anchor to the economy can have consequences for risk premia. Evidence of this can be found in the shifts experienced by medium- and long-term inflation swaps and the inflation expectations deriving from them, which should not have moved with oil prices, as over this time frame their effects should have disappeared.

Moreover, recent experience has heightened central banks' concerns that the effective lower bound on interest rates may become a constraint again [Buiter and Rahbari (2015), Yellen (2016)], so that any shock could put the economy into an unfavourable equilibrium of low growth and inflation, with the space for monetary policy basically limited to unconventional measures [Bullard (2013), Reifschneider (2016)]. Monetary authorities are pondering whether the risks of an early normalisation of monetary policy in this context would not be greater than those of a delayed normalisation [Evans et al. (2015)], as the possibilities of stimulating growth and employment would be limited, while there are a variety of tools to control inflationary pressures. This is all set in an international context in which the risks are still predominantly on the downside for both activity and inflation, and where the experience of other central banks in recent years (Canada, the ECB, Norway and Sweden) has shown that when they have opted to raise policy interest rates, they have had to subsequently cut them again.

In order to obtain more leeway for action and to reduce the probability of reaching the lower bound of policy interest rates in periods of low inflation following adverse shocks, some authors, such as Williams (2009, 2016), Blanchard et al. (2010) and Ball (2014) have suggested that central banks should raise their inflation targets, which would imply a higher average level of interest rates. In this regard, it is worth noting that the 2% target (the predominant target set in the developed economies) is the outcome of weighing up the efficiency costs of positive inflation rates (e.g. distortions in fluctuations in relative prices and increased uncertainty), against the costs associated with zero inflation, such as the downward rigidity of nominal wages and the possibility of reaching the effective lower bound [Bernanke (2002)]. Central banks considered that the probability of reaching the effective lower bound with the 2% inflation target was small.[48] This view may have changed since 2008, partly as a result of falling natural real interest rates [Chung et al. (2012), Canzoneri et al. (2015)]. Some analysts [e.g. Chung et al. (2012)] therefore argue that the inflation target should depend on the natural real interest rate. Opponents of an increase in the inflation target argue that once the nominal anchor has been altered it may prove difficult and costly to anchor it at its new level, and that the change could undermine its credibility.

Other authors have proposed that inflation targeting be replaced by a flexible price level (Hatcher and Minford (2014) and the references therein) or nominal GDP [Woodford (2013); Williams (2016)] targeting. In these frameworks, the central bank targets a steadily growing level of prices or nominal GDP, rather than the rate of inflation, automatically delivering the "lower for longer" policy prescription the situation calls for [Eggertsson and Woodford (2003)].

48 Reifschneider and Williams (2000) found that with a 2% inflation target monetary policy would be constrained by the effective lower bound only 5% of the time and that these episodes would have an average duration of a year.

Other authors have proposed avoiding the effective lower bound on policy interest rates by imposing a negative interest rate on physical cash [Haldane (2015)]. A series of options have been considered along these lines, such as: randomly eliminating banknotes based on their serial number [Mankiw (2009)], abolishing physical currency [Rogoff (2014, 2016)] or setting an explicit exchange rate between physical cash and electronic money [Agarwal and Kimball (2015)]. However, these proposals raise a number of logistic and behavioural issues. Therefore, if we accept that the effective lower bound will re-emerge as a constraint in the future, it will be necessary to deploy unconventional monetary policy measures – forward guidance and asset purchase operations – to stimulate demand and inflation [see, for example, Engel et al. (2015)]. Apart from the fact that asset purchases may be considered quasi-fiscal policy in some ways, they have expanded central banks' balance sheets considerably, but not stimulated private credit growth, which has led to an increase in excess bank reserves. In other words, the monetary base has expanded considerably, but the money supply has not. Bank lending surveys indicate that it is more of a problem on the demand side than the supply side (i.e. the banks' situation is not that unfavourable).

For this reason, some academics and analysts [Bernanke (2003), Turner (2013, 2015)] have suggested the possibility of introducing a fiscal stimulus financed with permanent increases in the amount of money ("overt monetary financing" or "helicopter money"). This stimulates demand by reducing taxes or by raising public spending, without increasing public debt. It is a more direct and effective channel than the previous monetary policy actions as it does not operate by cheapening lending to agents with unutilised borrowing capacity (public sector and businesses, as investment growth has been sluggish). Its proponents argue that the increase in the public deficit is monetised and that there are no Ricardian effects on consumption and investment decisions, as future taxes will not have to rise and the ratio of public debt would decrease as nominal expenditure increases. The big risk of this proposal is that economic agents might come to believe that it will be repeated in the future, generating expectations of more inflation, and thus neutralising its potential positive effect on aggregate demand. It should be recalled that, as Sargent and Wallace (1981) showed, in the long term, monetary policy determines the general price level provided that fiscal policy guarantees the sustainability of public finances. Therefore, monetising the debt ends up translating into a situation of fiscal dominance. Even if the central bank pursues a monetary policy aimed at price stability, a lack of fiscal discipline will drive future inflationary processes.

Going beyond monetary policy, other policies may, in theory, help tackle low inflation. First of all, as mentioned above, fiscal policy might be considered, given governments' low borrowing costs. However, in the light of current high public debt-to-GDP ratios and concerns about long-run fiscal sustainability, some countries have limited scope for borrowing. Another possibility is to lower the exchange rate, but it is not possible for every country to simultaneously bring about inflation by depreciating its currency as this is a zero-sum game [Carney (2016)]. As regards incomes policy, real wages are a relative price that is affected by exogenous factors, such as the labour cost of producing tradable goods in other countries, for example. Inflationary pressures on the wage front will only arise when demand exceeds supply in the labour market

and real wage increases exceed productivity increases. Moreover, given the rise in profits as a share of GDP in recent years, wage increases may be accommodated without giving rise to wage pressure for some time. Structural policies may be a useful way of facilitating the reallocation of resources and raising economic agents' confidence so as to boost demand. At the same time, these policies would increase the natural real interest rate. Macroprudential policy has an important role to play in a long-lasting scenario of low interest rates, given the possibility of vulnerabilities building up that could derail the expansion and deepen the subsequent recession. Lastly, international coordination of policies, as called for by institutions such as the IMF (2016a), Gaspar et al. (2016) and OECD (2016), is crucial.

As discussed above, another much more worrying situation than the persistence of low inflation, and one which has different implications for economic policy, would be deflation, which is defined as a persistent and widespread drop in price levels. In this regard, the lessons learned about deflation are: (i) it can become established very quickly; (ii) it can impose severe economic costs, unless it derives from a permanent positive supply shock (e.g. an increase in productivity); and (iii) vigorous and determined policies can make a rapid and decisive difference. Experience shows that it is essential that the authorities demonstrate they are fully ready to tackle deflation and that they are willing to take all the necessary measures to raise prices in the future as well as today [Eggertsson and Woodford (2003)]. Given the costs involved, it is also essential that deflationary risks be addressed in a forward-looking way, i.e. before they become established.

5 Concluding remarks

In a context of a weak economic recovery accompanied by accommodative monetary policies, falling inflation rates in advanced economies may be due to transient factors – such as the slump in commodity prices or the effects of exchange-rate fluctuations – or to structural shifts in the price and wage setting process – such as shifts in the cyclical sensitivity of inflation to economic slack or in the relevance of forward-looking inflation expectations. These factors could also explain the inflation rate's surprising reluctance to drop in the immediate aftermath of the global financial crisis. Unfortunately, the empirical results in recent studies – including those in this paper – are insufficiently consistent or robust to prove the existence of structural changes in the parameters of the Phillips curve. Although we cannot explain the recent trend in inflation in a completely satisfactory way, in some cases the recent drop in inflation might tentatively be ascribed to backward-looking inflation expectations playing a more important role, which could pose important challenges for central banks.

The lack of definite conclusions stemming from our estimated Phillips curves could simply reflect a misspecification of the model. For instance, there may be global factors depressing inflation rates that are perhaps are not adequately represented by the import prices included in the regressions. It could also be related to the difficulty of measuring the relevant variables (slack in the economy or the labour market). More worryingly, it could constitute a genuine failure of this type of model to explain inflation, something which deserves further investigation. In any case, any of these explanations would have serious implications for policymakers in that inflation may become more difficult to control.

We have also discussed how ultra-low inflation over an extended period can have adverse effects on the real economy, as it raises real interest rates, hampers public and private deleveraging, and hinders competitiveness adjustments in those monetary-union countries that are obliged to resort to internal devaluation. In the most extreme case, in which there is a de-anchoring of inflation expectations, there is the concomitant risk of slipping into a deflationary spiral, the consequences of which would be far worse still. In any event, the credibility of central banks' targets may be undermined if inflation rates fail to meet them for an extended period.

Against this backdrop, having reached the 0% lower bound for policy interest rates, monetary policy sought to become more expansionary by resorting to unconventional measures. And more recently, several central banks in developed economies (including the ECB and the Bank of Japan) crossed this 0% bound by setting negative interest rates on banks' reserves deposited with them, intensifying the debate on the scope for action and the marginal effectiveness and risks of monetary policies. This is an important debate as the lower equilibrium real interest rate suggests that in the future monetary policy may find itself in similar circumstances to today more often and for longer than in the past. In this scenario, support from other types of policies, such as fiscal policy or structural policies, is crucial in order to try to stimulate growth and inflation.

REFERENCES

ADAM, K. and J. ZHU (2014). *Price level changes and the redistribution of nominal wealth across the euro area*, ECB Working Paper No 1853.

AGARWAL, R. and M. KIMBALL (2015). *Breaking Through the Zero Lower Bound*, IMF Working Paper No 15/224.

AHEARNE, A., J. GAGNON, J. HALTMAIER, S. KAMIN, C. ERCEG, J. FAUST, L. GUERRIERI, C. HEMPHILL, L. KOLE, J. ROUSH, J. ROGERS, N. SHEETS and J. WRIGHT (2002). *Preventing deflation: Lessons from Japan's experience in the 1990s*, Board of Governors of the Federal Reserve System, International Finance Discussion Paper No 729.

AKERLOF, G. A., W. T. DICKENS and G. L. PERRY (1996). "The macroeconomics of low inflation", *Brookings Papers on Economic Activity*, 1:1996, pp. 1-76.

ALBEROLA, E., A. ESTRADA and D. SANTABÁRBARA (2013). *Growth beyond imbalances. Sustainable growth rates and output gap reassessment*, Banco de España, Documento de Trabajo No 1313.

— (2014). "Growth and imbalances in Spain: A reassessment of the output gap", *SERIEs*, vol. 5, Issue 2-3, August 2014, pp. 333-356.

ÁLVAREZ, L. J., S. HURTADO, I. SÁNCHEZ and C. THOMAS (2011). "The impact of oil price changes on Spanish and euro area consumer price inflation", *Economic Modelling*, vol. 28, pp. 422–431.

ÁLVAREZ, L. J. and A. URTASUN (2013). "Variation in the cyclical sensitivity of Spanish inflation: an initial approximation", Banco de España, *Economic Bulletin*, July-August, pp. 11-17.

ÁLVAREZ, L. J., A. GÓMEZ and A. URTASUN (2015). "Asymmetries in the relationship between inflation and activity", Banco de España, *Economic Bulletin*, November, pp. 19-25.

ANDERSEN, P. S. and W. L. WASCHER (2001). "Understanding the recent behaviour of inflation: an empirical study of wage and price developments in eight countries", *BIS Papers* No 3, pp. 267-302.

ANDERSON, D., D. BOTMAN and B. HUNT (2014). *Is Japan's population aging deflationary?*, IMF Working Paper No 14/139.

ANDERTON, R., A. GALESI, M. LOMBARDI and F. DI MAURO (2009). *Key elements of global inflation*, The University of Nottingham Research Paper No 2009/22.

ANDRLE, M., J. BRUHA and S. SOLMAZ (2013). *Inflation and output comovement in the euro area: Love at second sight?*, IMF Working Paper No 13/192.

ANTUNES, A. A. (2015). *Co-movement of revisions in short- and long-term inflation expectations*, Banco de Portugal Economic Bulletin and Financial Stability Report Articles.

ARIAS, J., C. ERCEG and M. TRABANDT (2015). *The Macroeconomic risks of undesirably low inflation*, presented at the conference "The Post-Crisis Slump", European Commission, Brussels, 1-2 October.

ARUOBA, S. B. and F. SCHORFHEIDE (2015). *Inflation during and after the zero lower bound*, presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

ATKESON, A. and L. E. OHANIAN (2001). "Are Phillips curves useful for forecasting inflation?", *Federal Reserve Bank of Minneapolis Quarterly Review*, vol. 25, No 1, Winter 2001, pp. 2–11.

ATKESON, A. and P. KEHOE (2004). "Deflation and depression: is there an empirical link?", *American Economic Review*, vol. 94(2), May, pp. 99–103.

AUER, R. A. and A. M. FISCHER (2010). "The effect of low-wage import competition on U.S. inflationary pressure", *Journal of Monetary Economics*, vol. 57, pp. 491–503.

AUER, R. A., K. DEGEN and A. M. FISCHER (2011). *Low-wage import competition, inflationary pressure, and industry dynamics in Europe*, Swiss National Bank Working Paper No 2011/9.

AUER, R. A. and P. SAURÉ (2013). "The globalisation of inflation: a view from the cross section", *BIS Papers* No 70, pp. 113-118.

AUTRUP, S. L. and M. GROTHE (2014). *Economic surprises and inflation expectations. Has anchoring of expectations survived the crisis?,* ECB Working Paper No 1671.

BADEL, A. and J. MCGILLICUDDY (2015). "Oil prices and inflation expectations: Is there a link?", The Federal Reserve Bank of St. Louis, *The Regional Economist*, July, pp. 12-13.

BAILLIU, J., W. DONG and J. MURRAY (2010). "Has exchange rate pass-through really declined? Some recent insights from the literature", *Bank of Canada Review*, Autumn 2010.

BALL, L. M. (2006). *Has globalization changed inflation?*, NBER Working Paper 12687.

— (2014). *The case for a long-run inflation target of four percent*. IMF Working Paper No 14/92.

— (2015). "Comment on 'Inflation and activity' by Olivier Blanchard, Eugenio Cerutti and Lawrence Summers", in ECB, *Inflation and unemployment in Europe*, pp. 47-52.

BALL, L. M. and S. MAZUMDER (2011). "Inflation dynamics and the Great Recession", *Brookings Papers on Economic Activity*, Spring 2011, pp. 337-381.

— (2015). *A Phillips curve with anchored expectations and short-term unemployment*, IMF Working Paper No 15/39.

BÁNBURA, M. and H. MIRZA (2013). *Forecasting euro area inflation with the Phillips curve*, manuscript.

BANCO DE ESPAÑA (2012). "Una evaluación preliminar del efecto sobre la inflación de los aumentos en la imposición indirecta y en los precios administrados", box in the *Boletín Económico*, October, pp. 46-47.

— (2015). "Inflationary dynamics of the Spanish economy in the context of the euro area", Chapter 4 of the *Annual Report 2014*, pp. 99-123.

BANK OF ENGLAND (2015). "The effect of imported price pressures on UK consumer prices", box in the *Inflation Report*, November, pp. 28-29.

BANK OF JAPAN (2016). "Comprehensive Assessment: Developments in Economic Activity and Prices as well as Policy Effects since the Introduction of Quantitative and Qualitative Monetary Easing (QQE)", Background note, September 21, 2016.

BAXA, J., M. PLAŠIL and B. VAŠÍČEK (2012). *Changes in inflation dynamics under inflation targeting? Evidence from Central European countries*, Czech National Bank Working Paper No 4/2012.

BAUER, M. D. and E. McCARTHY (2015). *Can we rely on market-based inflation forecasts?*, The Federal Reserve Bank of San Francisco Economic Letter No 2015-30.

BEAN, C. (2004). "Global demographic change: Some implications for central banks", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

— (2006). "Globalisation and Inflation", Bank of England *Quarterly Bulletin* Q4, pp. 468-475.

— (2007). "Globalisation and Inflation", *World economics*, vol. 8, No 1, pp. 57-73.

BEC, F. and A. DE GAYE (2014). *How do oil price forecast errors impact inflation forecast errors? An empirical analysis from French and U.S. inflation forecasts*, Banque de France Document de Travail No 523.

BEECHEY, M. J., B. K. JOHANNSEN and A. T. LEVIN (2011). "Are Long-Run Inflation Expectations Anchored More Firmly in the Euro Area than in the United States?", *American Economic Journal: Macroeconomics*, vol. 3, pp. 104–129.

BENIGNO, P. and E. FAIA (2010). *Globalization, pass-through and inflation dynamic,* NBER Working Paper No 15842.

BENIGNO, P. and L. A. RICCI (2011). "The inflation-output trade-off with downward wage rigidities", *American Economic Review*, vol. 101 (June), pp. 1436–1466.

BENTOLILA, S., J. J. DOLADO and J. F. JIMENO (2007). *Does immigration affect the Phillips curve? Some evidence for Spain*, IZA Discussion Paper No 3249.

BERGANZA, J. C. (2014). "El comportamiento del mercado de trabajo de Estados Unidos durante y después de la Gran Recesión", Banco de España, *Boletín Económico,* May, pp. 67-79.

BERNANKE, B. S. (2002). "Deflation: Making sure "it" doesn't happen here", speech at the National Economists Club, Washington, 21 November.

— (2003). "Some thoughts on monetary policy in Japan", speech at the Japan Society of Monetary Economics, Tokyo, 31 May.

— (2007). "Globalization and Monetary Policy", speech at the Fourth Economic Summit, Stanford Institute for Economic Policy Research, Stanford, California, 2 March.

BIANCHI, F. and A. CIVELLI (2015). Globalization and Inflation: Evidence from a Time Varying VAR, *Review of Economic Dynamics*, vol. 18(2), pp. 406-433.

BIS (2014). "Growth and inflation: drivers and prospects", Chapter 3, *84th Annual Report*, pp. 41-64.

— (2015). "Another year of monetary policy accommodation", Chapter 4, *85th Annual Report*, pp. 65-82.

BLANCHARD, O. J., G. DELL'ARICCIA and P. MAURO (2010). "Rethinking macro policy", *Journal of Money, Credit and Banking,* vol. 42, Supplement s1, pp. 199–215.

BLANCHARD, O. J., and J. GALÍ (2010). "The macroeconomic effects of oil price shocks: Why are the 2000s so different from the 1970s?", in J. GALÍ and M. J. GERTLER, eds., *International Dimensions of Monetary Policy,* University of Chicago Press, pp. 373-421.

BLANCHARD, O., E. CERUTTI and L. SUMMERS (2015). *Inflation and activity – Two explorations, and their monetary policy implications*, IMF Working Paper No 15/230.

BORDO, M. and A. REDISH (2004). "Is deflation depressing: evidence from the Classical Gold Standard", in R. BURDEKIN and P. SIKLOS, eds., *Deflation: current and historical perspectives*, Cambridge University Press.

BORDO, M. and A. FILARDO (2005). "Deflation and monetary policy in a historical perspective: remembering the past or being condemned to repeat it?", *Economic Policy*, vol. 20, No 44, October, pp. 799–844.

BORIO, C. and A. FILARDO (2004). "Looking back at the international deflation record", *North American Journal of Economics and Finance*, vol 15(3), December, pp 287–311.

— (2007). *Globalisation and inflation: New cross-country evidence on the global determinants of domestic inflation*, BIS Working Papers No 227.

BORIO, C., P. DISYATAT and M. JUSELIUS (2013*). Rethinking potential output: embedding information about the financial cycle*, BIS Working Papers No 404.

BORIO, C., P. DISYATAT and M. JUSELIUS (2014). *A parsimonious approach to incorporating economic information in measures of potential output,* BIS Working Papers No 442.

BORIO, C., M. ERDEM, A. FILARDO and B. HOFMANN (2015). The costs of deflations: a historical perspective, BIS *Quarterly Review*, March, pp. 31-54.

BRAYTON, F., J. M. ROBERTS and J. C. WILLIAMS (1999). *What's happened to the Phillips curve?*, Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series No 99-49.

BROADBENT, B. (2014). "Unemployment and the conduct of monetary policy in the UK", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

— (2015). "Compositional shifts in the labour market", speech at the conference "Understanding the Great Recession: from micro to macro", Bank of England, 23 September.

BUITER, W. H. (2003). *Deflation: Prevention and cure*, NBER Working Paper No 9623.

BUITER, W. H. and E. RAHBARI (2015). "High time to get low: getting rid of the lower bound on nominal interest rates", *Global Economics View, CitiResearch*, 9 April 2015.

BULLARD, J., C. GARRIGA and C. J. WALLER (2012). "Demographics, redistribution, and optimal inflation", *Federal Reserve Bank of St. Louis Review*, November/December 2012, 94(6), pp. 419-39.

BULLARD, J. (2013). "Seven faces of "The Peril", Federal Reserve Bank of St. Louis Review, vol. 95, No 6, pp. 613-28.

BUNN P., L. DRAPPER, A. PUGH and J. ROWE (2015). "How important are households' expectations for spending?", Bank of England, *Bank Underground*, 2 October.

BUSETTI, F., G. FERRERO, A. GERALI and A. LOCARNO (2014). *Deflationary shocks and de-anchoring of inflation expectations*, Bank of Italy, Questioni di Economia e Finanza, No 252.

CALZA, A. (2009). "Globalization, domestic inflation and global output gaps: Evidence from the euro area", *International Finance*, vol. 12:3, pp. 301–320.

CAMPA, J. M. and L. S. GOLDBERG (2005). "Exchange rate pass-through into import prices", *Review of Economics and Statistics*, vol. 87 (4), pp- 679–90.

— (2008). "Pass-through of exchange rates to consumption prices: What has changed and why?", in T. ITO and A. K. ROSE, eds., *International financial issues in the Pacific Rim: Global imbalances, financial liberalization, and exchange rate policy* (NBER-EASE Volume 17), The University of Chicago Press, pp. 139-176.

CAMPA, J. M., L. S. GOLDBERG and J. M. GONZÁLEZ-MINGUEZ (2007). "Exchange rate pass-through into euro-area import prices", in R. ANDERTON and F. DE MAURO. eds., *The external dimension of the euro area*, Cambridge University Press, pp. 63-94.

CANZONERI, M., R. CUMBY and B. DIBA (2015). "Monetary policy and the natural rate of interest", *Journal of Money, Credit and Banking*, vol. 47(2-3), pp. 383-414.

CARNEY, M. (2015). "Inflation in a globalised world", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

— (2016). "Redeeming an unforgiving world", speech at the *8th Annual Institute of International Finance G20 conference*, *Shanghai.*

CARVALHO, C. and A. FERRERO (2014). *What explains Japan's persistent deflation?,* 2013 Meeting Papers, Society for Economic Dynamics.

CECCHETTI, S. G., P. HOOPER, B. C. KASMAN, K. L. SCHOENHOLTZ and M. W. WATSON (2007). "Understanding the evolving inflation process", presented at the U.S. Monetary Policy Forum 2007.

CECCHETTI, S. G. and R. MOESSNER (2008). "Commodity prices and inflation dynamics", *BIS Quarterly Review*, December, pp. 55-66.

CHEN, N., J. IMBS and A. SCOTT (2004). *Competition, globalization, and the decline of inflation*, CEPR Discussion Paper No 4695.

CHEVALIER, J. A. and D. S. SCHARFSTEIN (1996). "Capital-Market Imperfections and Countercyclical Markups: Theory and Evidence", *American Economic Review*, vol. 86(4), pp. 703-25.

CHUNG, H., J. P. LAFORTE, D. REIFSCHNEIDER and J. C. WILLIAMS (2012), "Have we underestimated the likelihood and severity of zero lower bound events?", *Journal of Money, Credit, and Banking*, vol. 44, pp. 47–82.

CICCARELLI, M. and B. MOJON (2010). "Global Inflation", *The Review of Economics and Statistics*, MIT Press, vol. 92(3), pp. 524-535.

CICCARELLI, M. and J. A. GARCÍA (2015). *International spillovers in inflation expectations*, ECB Working Paper no 1857.

CLARK, T. E. and T. DAVIG (2008). *An empirical assessment of the relationships among inflation and short- and long-term expectations,* The Federal Reserve Bank of Kansas City Research Working Paper No 08-05.

CLARK, T. E. and S. J. TERRY (2010). "Time variation in the inflation pass-through of energy prices", *Journal of Money, Credit and Banking*, vol. 42, No 7 (October 2010), pp. 1419-1433.

COIBION, O. and Y. GORODNICHENKO (2013). *Is the Phillips curve alive and well after all? Inflation expectations and the missing disinflation*, NBER Working Paper No 19598.

CONSTÂNCIO, V. (2015). "Understanding inflation dynamics and monetary policy", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

CÔTÉ, D. and C. DE RESENDE (2008). *Globalization and inflation: The role of China*, Bank of Canada Working Paper 2008-35.

D'ACUNTO, F., D. HOANG and M. WEBER (2015). *Inflation expectations and consumption expenditure*, Chicago Booth Global Markets Working Paper Series.

DALY, M. C. and B. HOBIJN (2014). *Downward nominal wage rigidities bend the Phillips curve*, Federal Reserve Bank of San Francisco Working Paper No 2013-08.

DAVIS, J. S. (2012). *The effect of commodity price shocks on underlying inflation: The role of central bank credibility*, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper No 134.

— (2014). *Inflation targeting and the anchoring of inflation expectations: Cross-country evidence from consensus forecasts*, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper No 174.

DE GREGORIO, J., O. LANDERRETCHE and C. NEILSON (2007). "Another pass-through bites the dust? Oil prices and inflation", *Economía*, vol. 7, No 2, Spring 2007, pp. 155-196.

DEL NEGRO, M., M. P. GIANNONI and F. SCHORFHEIDE (2014). *Inflation in the Great Recession and New Keynesian models*, Federal Reserve Bank of New York Staff Report No 618.

DE VEIRMAN, E. (2009), "What makes the output–inflation trade-off change? The Absence of Accelerating Deflation in Japan", *Journal of Money, Credit and Banking*, Vol. 41, No 6, pp. 1117-1140.

DOMIT, S., C. JACKSON and M. ROBERTS-SKLAR (2015). "Do inflation expectations currently pose a risk to inflation?", Bank of England Quarterly Bulletin, vol. 2015 Q2, pp. 165-180.

DRAGHI, M. (2015a). "Structural reforms, inflation and monetary policy", in ECB, *Inflation and unemployment in Europe*, pp. 12-24.

— (2015b). "Global and domestic inflation", speech at the Economic Club of New York, 4 December.

ECB (2006). "Effects of the rising trade integration of low-cost countries on euro area", box in the *Monthly Bulletin*, August, pp. 56-57.

— (2012). "The Phillips curve relationship in the euro area", *Monthly Bulletin*, July, pp. 99-114.

— (2015). "Developments in longer-term inflation expectations in the euro area", box in the *Economic Bulletin*, vol. 3, pp. 25-26.

EGGERTSSON, G. and M. WOODFORD (2003). "The zero bound on interest rates and optimal monetary policy", *Brookings Papers on Economic Activity*, vol. 1:2003, pp. 139-233.

EHRMANN, M. (2014). *Targeting inflation from below—How do inflation expectations behave?*, Bank of Canada Working Paper No 2014-52.

EICKMEIER, S. and M. KÜHNLENZ (2013). *China's role in global inflation dynamics*, Deutsche Bundesbank Discussion Paper No 07/2013.

EICKMEIER, S. and K. PIJNENBURG (2013). "The global dimension of inflation – Evidence from factor-augmented Phillips curves", Oxford Bulletin of Economics and Statistics, vol. 75, No 1, pp. 103-122.

ELLIOTT, D., C. JACKSON, M. RACZKO and M. ROBERTS-SKLAR (2015). "Does oil drive financial market measures of inflation expectations?", Bank of England, *Bank Underground*, 20 October.

END, N., S. J. A. TAPSOBA, G. TERRIER R. DUPLAY (2015). *Deflation and public finances: Evidence from the historical records*, IMF Working Paper No 15/176.

ENGEL, E., T. LAUBACH and D. REIFSCHNEIDER (2015). *The macroeconomic effects of the Federal Reserve's unconventional monetary policies*. Finance and Economics Discussion Series 2015-005 (Washington: Board of Governors of the Federal Reserve System).

EVANS, C. L. and J. D. M. FISHER (2011). *What are the implications of rising commodity prices for inflation and monetary policy?*, Chicago Fed Letter, No 286.

EVANS, C., J. FISHER, F. GOURIO and S. KRANE (2015). *Risk management for monetary policy near the zero lower bound*, Federal Reserve Bank of Chicago, Working Paper No 2015-03.

FABIANI, S. and M. PORQUEDDU (2015), *Changing prices… changing times: evidence for Italy*, Bank of Italy, Questioni di Economia e Finanza, No 275.

FERRONI, F. and B. MOJON (2014). *Domestic and Global Inflation*, mimeo.

FEYZIOĞLU, T. and L. WILLARD (2006). *Does inflation in China affect the United States and Japan?*, IMF Working Paper 06/36.

FIGURA, A. and D. RATNER (2015). *The labor share of income and equilibrium unemployment*, Board of Governors of the Federal Reserve System, FEDS Notes 2015-06-08.

FISCHER, S. (2015). "U.S. inflation developments", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

FISHER, I. (1933). "The debt-deflation theory of great depressions", *Econometrica*, October, pp. 337-57.

FORBES, K. (2015). "Much ado about something important: How do exchange rate movements affect inflation?", speech at the 7th Money, Macro and Finance Research Group Annual Conference, Cardiff, 11 September 2015.

FORBES, K., I. HJORTSOE and T. NENOVA (2015). *The shocks matter: improving our estimates of exchange rate pass-through,* Bank of England External MPC Unit Discussion Paper No 43.

FÖRSTER, M. and P. TILLMANN (2014). "Reconsidering the international comovement of inflation", *Open Economies Review*, vol 25, No 5, pp. 841–863.

FREEMAN, R. (2007). "The great doubling: The challenge of the new global labor market", Chapter 4 in J. EDWARDS, M. CRAIN and A. KALLEBERG, eds., *Ending Poverty In America: How to Restore the American Dream,* NY: The New Press; 2007.

FRIEDRICH, C. (2014). *Global inflation dynamics in the post-crisis period: What explains the twin puzzle?*, Bank of Canada Working Paper No 2014-36.

FRIEDRICH, C. and M. A. GOSSELIN (2015). "Inflation Dynamics in the Post-Crisis Period", Bank of Canada Review, Spring 2015, pp. 1-12.

FURCERI, D., P. LOUNGANI, J. SIMON and S. WACHTER (2015). *Global food prices and domestic inflation: Some cross-country evidence*, IMF Working Paper No 15/133.

GAGNON, E., B. R. MANDEL and R. J. VIGFUSSON (2012). *Missing import price changes and low exchange rate pass-through,* Board of Governors of the Federal Reserve System, International Finance Discussion Papers, No 1040.

GAIOTTI, E. (2010). "Has globalization changed the Phillips curve? Firm-level evidence on the effect of activity on prices", International Journal of Central Banking, vol. 6-1, pp. 51-84.

GALATI, G., S. POELHEKKE and C. ZHOU (2011). "Did the crisis affect inflation expectations?", *International Journal of Central Banking*, vol. 7 No 1, pp. 167-207.

GALESI, A. and M. J. LOMBARDI (2009). *External shocks and international inflation linkages. A global VAR analysis*, ECB Working Paper No 1062.

GALÍ, J. (2010). "Inflation pressures and monetary policy in a global economy", International Journal of Central Banking, vol. 6 No 1, pp. 93-102.

— (2015). "Hysteresis and the European unemployment problem revisited", in ECB, *Inflation and unemployment in Europe*, pp. 53-79.

GAMBER, E. N. and J. H. HUNG (2001). "Has the rise in globalization reduced U.S. inflation in the 1990s?", *Economic Inquiry*, vol. 39, No 1, pp. 58–73.

GASPAR, V., M. OBSTFELD and R. SAHAY (2016). Macroeconomic management when policy space is constrained: a comprehensive, consistent, and coordinated approach to economic policy. IMF Staff Discussion Note 16/09.

GERARD, H. (2012). *Co-movement in inflation*, Reserve Bank of Australia Research Discussion Paper No 2012-01.

GILCHRIST, S., and E. ZAKRAJŠEK (2012). "Credit spreads and business cycle fluctuations", *American Economic Review*, vol. 102(4), pp. 1692–1720.

GILCHRIST, S., and E. ZAKRAJŠEK (2015). "Customer markets and financial frictions: Implications for inflation dynamics", presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

GILCHRIST, S., R. SCHOENLE, J. SIM, and E. ZAKRAJŠEK (2015): "Inflation dynamics during the financial crisis," Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series Paper, No 2015-12.

GOPINATH, G. (2015). "The international price system", presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

GORDON. R. J. (1982). "Inflation, flexible exchange rates, and the natural rate of unemployment", in M. N. Baily, ed., *Workers, jobs, and inflation*, Washington: Brookings, pp. 88-152.

— (2011). "The history of the Phillips curve: Consensus and bifurcation", *Economica*, vol. 78, No 1, pp. 10-50.

— (2013). *The Phillips curve is alive and well: Inflation and the NAIRU during the slow recovery*, NBER Working Paper No 19390.

GNAN, E. and M. T. VALDERRAMA (2006). Globalization, inflation and monetary policy, Oesterreichische Nationalbank *Monetary Policy & the Economy* Q4/06, pp. 37-54.

GREENSLADE, J., S. MILLARD and C. PEACOCK (2008). "How has globalisation affected inflation dynamics in the United Kingdom?", Bank of England Quarterly Bulletin 2008 Q3, pp. 292-298.

GUERRIERI, L., C. GUST and D. LÓPEZ-SALIDO (2008). *International competition and inflation: A new Keynesian perspective*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers No 918.

GUILLOUX-NEFUSSI, S. (2015). *Globalization, market structure and the flattening of the Phillips curve*, Banque de France Document de Travail No 539.

GÜRKAYNAK, R. S., E. SWANSON and A. LEVIN (20). "Does inflation targeting anchor long-run inflation expectations? Evidence from the U.S., UK, and Sweden", *Journal of the European Economic Association*, vol. 8(6), pp. 1208–1242.

HAKKIO, C. (2009). *Global inflation dynamics*, The Federal Reserve Bank of Kansas City, Research Working Paper No 09-01.

HALDANE, A. (2015). "How low can you go?", speech at Portadown Chamber of Commerce, Northern Ireland, 18 September.

HARA, N., K. HIRAKI and Y. ICHISE (2015). *Changing exchange rate pass-through in Japan: Does it indicate changing pricing behavior?*, Bank of Japan Working Paper No 15-E-4.

HATCHER, M. and P. MINFORD (2014). Inflation targeting v. price-level targeting: a new survey of theory and empirics, in voxeu.org.

HERNANDO, I., D. SANTABÁRBARA and J. VALLÉS (2016). "The global real interest rate: past developments and outlook", Banco de España, *Economic Bulletin*, January, pp. 3-12.

HOOKER, M. A. (2002). "Are oil shocks inflationary? Asymmetric and nonlinear specifications versus changes in regime", *Journal of Money, Credit and Banking*, vol. 34, No 2 (May, 2002), pp. 540-561.

HÖRDAHL, P. (2009). "Disentangling the drivers of recent shifts in break-even inflation rates", box in I. FENDER, C. HO and P. HÖRDAHL, "Overview: investors ponder depth and duration of global downturn", *BIS Quarterly Review*, March, pp. 10-11.

IAKOVA, D. (2007). *Flattening of the Phillips curve: Implications for monetary policy*, IMF Working Paper No 07/76.

IHRIG, J. and J. MARQUEZ (2003). *An empirical analysis of inflation in OECD countries*, Board of Governors of the Federal Reserve System International Finance Discussion Papers No 765.

IHRIG, J., S. B. KAMIN, D. LINDNER and J. MARQUEZ (2010). "Some simple tests of the globalization and inflation hypothesis", *International Finance,* vol. 13:3, pp. 343–375.

IMAM, P. (2013). *Shock from graying: Is the demographic shift weakening monetary policy effectiveness*, IMF Working Paper No 13/191.

IMF (2006). "How has globalization affected inflation?", Chapter 3, World Economic Outlook, April, pp. 97-134.

— (2008). "Is inflation back? Commodity prices and inflation", Chapter 3, World Economic Outlook, October, pp. 83-128.

— (2013). "The dog that didn't bark: has inflation been muzzled or was it just sleeping?", Chapter 3, World Economic Outlook, April, pp. 79-96.

— (2016a). *Global prospects and policy changes*, *Group of Twenty*.

— (2016b). "Global disinflation in an era of constrained monetary policy", Chapter 3, World Economic Outlook, October, pp. 121-170.

— (2016c). Fiscal Monitor, October.

IOSSIFOV, P. and J. PODPIERA (2014). *Are non-euro area EU countries importing low inflation from the euro area?*, IMF Working Paper No 14/191.

ITO, T. and F. S. MISHKIN (2006). "Two decades of Japanese monetary policy and the deflation problem", in T. ITO and A. K. ROSE, eds., *Monetary policy under very low inflation in the Pacific Rim*, NBER-EASE, vol. 15, University of Chicago Press, pp. 131-202.

IZQUIERDO, M. and S. PUENTE (2015). "Wage response to changes in the cyclical situation: an estimate based on MCVL social security administrative labour records", Banco de España, *Economic Bulletin*, June, pp. 21-25.

JORDAN C. and L. VILMI (2014). "Analysing euro-area inflation using the Phillips curve", Quarterly Report on the Euro Area, vol. 13, No 2, pp. 21-26.

JORDAN, T. J. (2015). "The impact of international spillovers on inflation dynamics and independent monetary policy: the Swiss experience", presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

JUSELIUS, M. and E. TAKÁTS (2015). *Can demography affect inflation and monetary policy?,* BIS Working Papers No 485.

KAMIN, S. B., M. MARAZZI and J. W. SCHINDLER (2006). "The impact of Chinese exports on global import prices", *Review of International Economics*, vol. 14(2), pp. 179–201.

KILEY, M. T. (2014). *An evaluation of the inflationary pressure associated with short and long-term unemployment*, Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series, No 2014-28.

KILEY, M. (2015). *Low inflation in the United States: A summary of recent research*, Board of Governors of the Federal Reserve System FEDS Notes, 23 November.

KIMURA, T. (2013). "Why do prices remain stable in the bubble and bust period?", *International Economic Journal*, vol. 27:2, pp. 157-177.

KOHLSCHEEN, E. (2010). *Emerging floaters: pass-throughs and (some) new commodity currencies*, Banco Central do Brasil Working Papers No 224.

KOHN, D. L. (2006). "The effects of globalization on inflation and their implications for monetary policy", speech at Federal Reserve Bank of Boston's 51st Economic Conference, Chatham, Massachusetts, 16 June.

KRUEGER, A. B., J. CRAMER and D. CHO (2014). "Are the long-term unemployed on the margins of the labor market?", *Brookings Papers on Economic Activity*, Spring 2014, pp. 229-298.

KUMAR, M. S., T. BAIG, J. DECRESSIN, C. FAULKNER-MACDONAGH and T. FEYZIOGÙLU (2003). *Deflation: Determinants, risks, and policy options*, IMF Occasional Paper No 221.

KUMAR, A. and P. ORRENIUS (2014). *A closer look at the Phillips curve using state-level data*, Federal Reserve Bank of Dallas Research Department Working Paper No1409.

KUMAR, S., AFROUZI, H., O. COIBION and Y. GORODNICHENKO (2015). *Inflation targeting does not anchor inflation expectations: Evidence from firms in New Zealand*, Brookings Paper on Economic Activity, Fall 2015 Conference.

KUTTNER, K. and T. ROBINSON (2008). *Understanding the flattening Phillips curve*, Reserve Bank of Australia, Research Discussion Paper No 2008-05.

KUVSHINOV, D., G. J. MÜLLER and M. WOLF (2015). *Deleveraging, deflation and depreciation in the euro area*, CEPR Discussion Papers No 11015.

LARKIN, J. (2014). "Examining the sensitivity of inflation to the output gap across euro area Member States", box in Bank of Ireland Quarterly Bulletin 02/April 14, pp. 50-51.

LAUBACH, T. and J. C. WILLIAMS (2015). *Measuring the natural rate of interest redux*, Federal Reserve Bank of San Francisco, Working Paper No 2015-16.

LEVIN, A. T., F. M. NATALUCCI and J. M. PIGER (2004). *Explicit inflation objectives and macroeconomic outcomes*, ECB Working Paper No 383.

LINDER, M. H., R. PEACH and R. RICH (2012). "Compensation growth and slack in the current economic environment", *Liberty Street Economics*, Federal Reserve Bank of New York, 19 November.

— (2014). "The long and short of it: The impact of unemployment duration on compensation growth", *Liberty Street Economics*, Federal Reserve Bank of New York, 12 February.

LINDH, T. and B. MALMBERG (2000). "Can age structure forecast inflation trends?", *Journal of Economics and Business,* vol. 52, pp. 31–49.

LLAUDES, R. (2005). *The Phillips curve and long-term unemployment*, ECB Working Paper No 441.

LÓPEZ-PÉREZ, V. (2015). *Do professional forecasters behave as if they believed in the new Keynesian Phillips curve for the euro area?*, ECB Working Paper No 1763.

LYZIAK, T. and M. PALOVIITA (2016). *Anchoring of inflation expectations in the euro area: recent evidence based on survey data*, ECB Working paper no. 1945.

MANDEL, B. R. (2013). *Chinese exports and U.S. import prices*, Federal Reserve Bank of New York Staff Reports, No 591.

MANKIW, N. G. (2009). "It may be time for the Fed to go negative", in the New York Times, 18 April.

MARTÍNEZ-GARCÍA, E. and M. A. WYNNE (2012). *Global slack as a determinant of US inflation*, Globalization and Monetary Policy Institute Federal Reserve Bank of Dallas Working Paper No 123.

MATHESON, T. and E. STAVREV (2013), *The Great Recession and the inflation puzzle,* IMF Working Paper No 13/124.

McMILLAN, H. and J. BAESEL (1990). "The macroeconomic impact of the baby boom generation", *Journal of Macroeconomics*, vol. 12, No 2, pp. 167–95.

MEDEL, C., M. PEDERSEN and P. PINCHEIRA (2014). *The elusive predictive ability of global Inflation*, Banco Central de Chile Working Paper No 725.

— (2015). Fuelling future prices: *Oil price and global inflation*, Banco Central de Chile Working Paper No 770.

MEHRA, Y. (2000). "Wage-price dynamics: Are they consistent with cost push?", Federal Reserve Bank of Richmond *Economic Quarterly,* vol. 86/3, pp. 27-43.

MEHROTRA, A. and J. YETMAN (2014). *Decaying expectations: what inflation forecasts tell us about the anchoring of inflation expectations*, BIS Working Papers No 464.

MEIER, A. (2010). *Still minding the gap—Inflation dynamics during episodes of persistent large output gaps*, IMF Working Paper No 10/189.

MICCOLI, M. and S. NERI (2015). *Inflation surprises and inflation expectations in the euro area,* Bank of Italy, Questioni di Economia e Finanza, No 265.

MIKOLAJUN, I. and D. LODGE (2016). *Advanced economy inflation: the role of global factors*, ECB Working Paper No 1948.

MISHKIN, F. S. (2007). *Inflation dynamics*, NBER Working Paper No 13147.

— (2008). *Globalization, macroeconomic performance, and monetary policy*, NBER Working Paper 13948.

MONACELLI, T. and L. SALA (2009). "The international dimension of inflation: evidence from disaggregated consumer price data", *Journal of Money, Credit and Banking*, Supplement to vol. 41, no 1, pp.101-120.

MONTERO, J. M. and A. URTASUN (2014). *Price-cost mark-ups in the Spanish economy: a microeconomic perspective*, Banco de España, Documentos de Trabajo, No 1407.

MORIMOTO, Y., W. HIRATA and R. KATO (2003). *Global disinflation*, Bank of Japan Research Papers, No 2003/06/13.

MOUROUGANE, A. and H. IBARAGI (2004). *Is there a change in the trade-off between output and inflation at low or stable inflation rates?: Some evidence in the case of Japan*, OECD Economics Department Working Papers, No 379.

MURPHY, R. G. (2014). "Explaining inflation in the aftermath of the Great Recession", *Journal of Macroeconomics,* vol 40, pp. 228–244.

MUSSO, A., L. STRACCA and D. VAN DIJK (2009). "Instability and nonlinearity in the euro-area Phillips curve", *International Journal of Central Banking*, vol. 5, No 2, pp. 181-212.

NAKAZONO, Y. (2016). *Inflation expectations and monetary policy under disagreements*, Bank of Japan, Working Paper No 16-E-1.

NEELY, C. J. and D. E. RAPACH (2011). *International comovements in inflation rates and country characteristics*, Federal Reserve Bank of St. Louis Working Paper No 2008-025F.

NERI, S. and A. NOTARPIETRO (2014). *Inflation, debt and the zero lower bound*, Bank of Italy, Questioni di Economia e Finanza, No 242.

OECD (2016). *Interim Economic Outlook*. September 2016.

OINONEN, S., M. PALOVIITA and L. VILMI (2013). *How have inflation dynamics changed over time? Evidence from the euro area and USA*, Bank of Finland Research Discussion Papers 6-2013.

OINONEN, S., M. PALOVIITA (2014). *Updating the euro area Phillips curve: the slope has increased*, Bank of Finland Research Discussion Papers 31-2014.

ORPHANIDES, A. and S. VAN NORDEN (2005). "The reliability of inflation forecasts based on output gap estimates in real time", *Journal of Money, Credit, and Banking*, vol. 37, No 3, pp. 583-601.

PAIN, N., I. KOSKE and M. SOLLIE (2008). *Globalisation and OECD consumer price inflation*, OECD Economic Studies, No 44, 2008/1.

PAPADEMOS, L. (2010). "The effects of globalization on inflation, liquidity and monetary policy", in J. GALÍ and M. J. GERTLER, eds., *International Dimensions of Monetary Policy,* University of Chicago Press, pp. 593-608.

PEACOCK, C. and U. BAUMANN (2008). *Globalisation, import prices and inflation dynamics*, Bank of England Working Paper No 359.

PENEVA, E. V. and J. B. RUDD (2015). *The pass-through of labor costs to price inflation,* Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series, No 2015-042.

PESCATORI, A. and J. TURUNEN (2015). *Lower for longer: Neutral rates in the United States*, IMF Working Paper No 15/135.

RACHEL, L. and T. D. SMITH (2015). *Secular drivers of the global real interest rate*, Bank of England Staff Working Paper No 571.

RAZIN. A. and A. BINYAMINI (2007). *Flattened inflation-output tradeoff and enhanced anti-inflation policy: Outcome of globalization?*, NBER Working Paper No 13280.

REIFSCHNEIDER, D. (2016). *Gauging the ability of the FOMC to respond to future recessions*, Finance and Economics, Discussion Series 2016-068 (Washington: Board of Governors of the Federal Reserve System).

REIFSCHNEIDER, D. and J. C. WILLIAMS (2000). "Three lessons for monetary policy in a low inflation era", *Journal of Money, Credit and Banking*, vol. 32, No 4, pp. 936–66.

RIGGI, M. and S. SANTORO (2015). "On the slope and the persistence of the Italian Phillips curve", *International Journal of Central Banking*, vol. 11, No 2, pp. 157-197.

RIGGI, M. and F. VENDITTI (2014). *Surprise! Euro area inflation has fallen*, Bank of Italy, Questioni di Economia e Finanza, No 237.

— (2015). "Failing to forecast low inflation and Phillips curve instability: A euro-area perspective". International Finance, 18(1):47-68.

ROACHE, S. K. (2012). *China's impact on world commodity markets*, IMF Working Paper No 12/115.

ROBERTS, J. M. (2006). *Monetary policy and inflation dynamics*, MPRA Paper No 812.

ROGOFF, K. (2003). "Globalization and global disinflation", presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

— (2006). "Impact of globalization on monetary policy", presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

— (2014). "Costs and benefits to phasing out paper currency", *NBER Macroeconomics Annual*, vol. 29, pp. 445 – 456.

— (2016). *The curse of cash*. Princeton University Press.

SARGENT, T. J. and N. WALLACE (1981). "Some unpleasant monetarist arithmetic", Federal Reserve Bank of Minneapolis *Quarterly Review*, Fall, pp. 1-17.

SBORDONE, A. M. (2007). *Globalization and inflation dynamics: The impact of increased competition*, NBER Working Paper No 13556.

SEKINE, T. (2009). *Another look at global disinflation*, BIS Working Papers No 283.

SHIRAKAWA, M. (2012). "Demographic changes and macroeconomic performance – Japanese experiences", speech at the conference BOJ-IMES, Institute for Monetary and Economic Studies, Bank of Japan, Tokyo, 30 May 2012.

SNOWER, D. (2015). "A fresh look at the inflation-unemployment trade-off", in ECB, *Inflation and unemployment in Europe*, pp. 104-111.

SPEIGNER, B. (2014). *Long-term unemployment and convexity in the Phillips curve,* Bank of England Working Paper No 519.

STAIGER, D. O., J. H. STOCK and M. W. WATSON (1997). "How precise are estimates of the natural rate of unemployment?", in C. D. ROMER and D. H. ROMER, eds., *Reducing Inflation: Motivation and Strategy,* University of Chicago Press, pp. 195-246.

STELLA A. and J. H. STOCK (2013). *A state-dependent model for inflation forecasting*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers No 1062.

STEVENS, A. (2013). "What inflation developments reveal about the Phillips curve: implications for monetary policy", *National Bank of Belgium Economic Review*, December, pp. 67-76.

STOCK, J. H. and M. W. WATSON (1999). "Forecasting Inflation", *Journal of Monetary Economics*, No 44, pp. 293–335.

— (2007). "Why has U.S. inflation become harder to forecast?", *Journal of Money, Credit and Banking*, Supplement to Vol. 39, No 1, pp. 3-33.

— (2010). *Modeling inflation after the crisis*, NBER Working Paper No 16488.

SUSSMAN, N. and O. ZOHAR (2015). *Oil prices, inflation expectations, and monetary policy*, Bank of Israel Discussion Paper No 09-2015.

SVENSSON, L. E. O. (2015). "The possible unemployment cost of average inflation below a credible target", *American Economic Journal: Macroeconomics*, vol. 7, No 1, pp. 258-96.

TAKHTAMANOVA. Y. F. (2010). "Understanding changes in exchange rate pass-through", *Journal of Macroeconomics*, vol. 32(4), pp. 1118-1130.

TOOTELL, G. M. B. (1998). "Globalization and U.S. inflation", *New England Economic Review*, July-August, pp. 21-33.

TURNER, A. (2013). "Debt, money and Mephistopheles: How do we get out of this mess?", speech at the Cass Business School, 6 February.

— (2015). *Between debt and the devil. Money, credit and fixing global finance*. Princeton University Press.

VERGARA, R. (2015). "Inflation dynamics in LATAM: A comparison with global trends and implications for monetary policy", presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

WATSON, M. W. (2014). "What's natural? Key macroeconomic parameters after the great recession. Inflation Persistence, the NAIRU, and the Great Recession", *American Economic Review: Papers & Proceedings*, vol. 104(5), pp. 31–36.

WHITE, W. R. (2008). *Globalisation and the determinants of domestic inflation*, BIS Working Papers No 250.

WILLIAMS, J. C. (2006). *Inflation persistence in an era of well-anchored inflation expectations*, The FRB of San Francisco Economic Letter N. 2006-27.

— (2009). "Heeding Daedalus: Optimal Inflation and the Zero Lower Bound", *Brookings Papers on Economic Activity*, Fall 2009, pp. 1-37.

— (2016). *Monetary policy in a low R-star world*. FRBSF Economic Letter, 2016-23.

WOODFORD, M. (2010). "Globalization and monetary control", in J. GALI and M. J. GERTLER, eds., *International Dimensions of Monetary Policy*, University of Chicago Press, pp. 13-77.

— (2013). "Monetary policy targets after the crisis", paper presented at the Rethinking Macro Policy II: First steps and early lessons, conference hosted by the IMF.

YELLEN, J. L. (2006). "Monetary policy in a global environment", speech at The Euro and the Dollar in a Globalized Economy Conference, U.C. Santa Cruz, 27 May.

— (2014). "Labor market dynamics and monetary policy", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

— (2015). "Inflation dynamics and monetary policy", speech at The Philip Gamble Memorial Lecture, University of Massachusetts, 24 September.

— (2016). "The Federal Reserve's monetary policy toolkit: past, present and future", speech at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

YETMAN, J. (2015). *The evolution of inflation expectations in Canada and the US*, BIS Working Paper No 523.

YOON, J-W., J. KIM and J. LEE (2014). *Impact of demographic changes on inflation and the macroeconomy*, IMF Working Paper No 14/210.

ZANIBONI, N. (2011). *Globalization and the Phillips curve*, mimeo.

APPENDIX A. DEFINITIONS AND SOURCES OF VARIABLES

DEFINITIONS AND SOURCES OF VARIABLES

ANNEX A

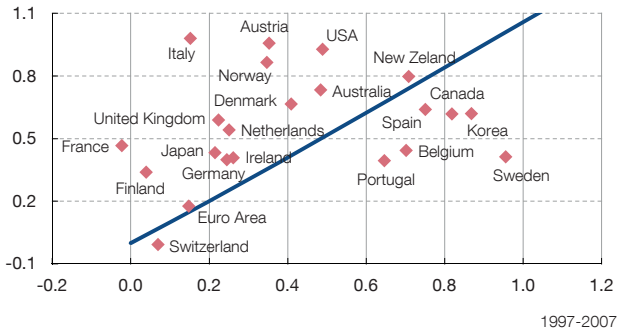
Variable	Definition	Sources
Core CPI	Annualized quarterly core inflation rate	Bureau of Economic Analysis (USA), European Central Bank (Euro Area), Ministry of Economics (Japan), OECD Economic Outlook (Canada, Germany, France, Italy, Denmark, Switzerland, Norway, Sweden, Spain, Finland, Austria, Netherlands, Belgium, Australia, Korea, United Kingdom, Portugal, Ireland, New Zealand),Datastream
Unemployment gap	The difference between the quarterly unemployment rate and the NAIRU	FRED (USA-unemployment rate), CBO (USA-NAIRU), Bank of Japan (Japan),OECD (Canada, Germany, France Italy, Denmark, Switzerland, Norway, Sweden, Spain, Finland, Austria, Netherlands, Belgium, Australia, Korea, Euro Area, United Kingdom, Portugal, Ireland, New Zealand-NAIRU), national statistics institutes (Canada, Germany, France Italy, Denmark, Switzerland, Norway, Sweden, Spain, Finland, Austria, Netherlands, Belgium, Australia, Korea, Euro Area, United Kingdom, Portugal, Ireland, New Zealand-unemployment rate), Datastream, Bloomberg
Long term expected inflation rate	The inflation expectations in 5-10 year or, alternatively, the objective of inflation of the central bank	Consensus (USA, Japan, Canada, Germany, France, Italy), Central Banks webpages (Denmark, Switzerland, Norway, Sweden, Spain, Finland, Austria, Netherlands, Belgium, Australia, Korea, Euro Area, United Kingdom, Portugal, Ireland, New Zealand)
Core import prices	Annualized quarterly import prices rate – excluding fuel –	Bureau of Economic Analysis (USA), European Central Bank (Euro Area), ONS (United Kingdom), Minisitry of Economics (Japan), Oxford Economics (Canada, Germany, France, Italy, Denmark, Switzerland, Norway, Sweden, Spain, Finland, Austria, Netherlands, Belgium, Australia, Korea, Portugal, Ireland, New Zealand), own calculations
Output gap	The difference between actual and potential GDP as a percentage of potential GDP	FRED (USA), Bank of Japan (Japan), Oxford Economics (Euro Area, United Kingdom, Australia, Canada, Denmark, Switzerland, Norway, Sweden, Korea, Germany, France, Italy, Spain, Ireland, Finland, Portugal, Austria, Netherlands, Belgium), WEO (New Zealand)

APPENDIX B. ROBUSTNESS TESTS

CHANGING THE UNEMPLOYMENT GAP BY THE OUTPUT GAP

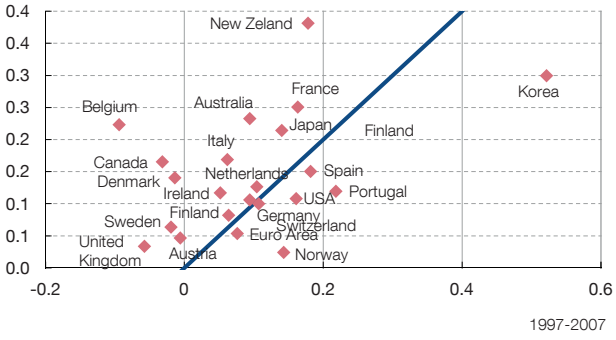
ANNEX B.1

1 COEFFICIENT OF FORWARD-LOOKING INFLATION EXPECTATIONS (λ)



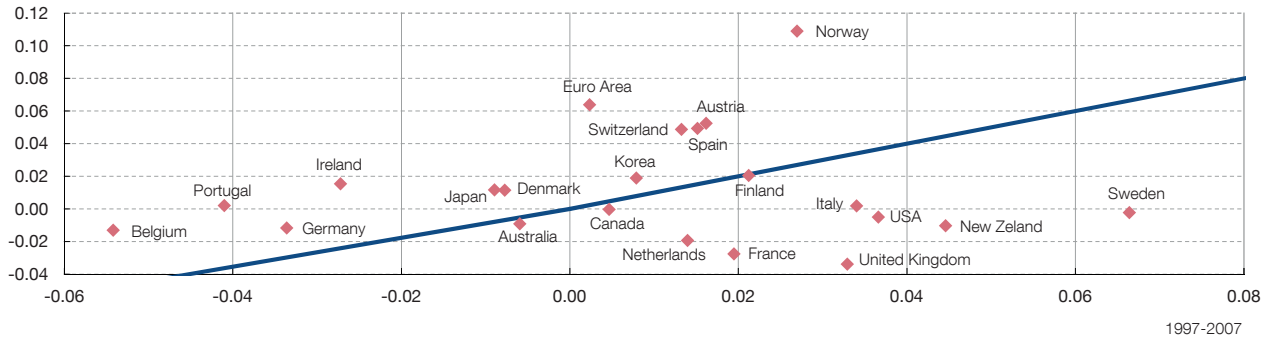
1997-2007

2 COEFFICIENT OF ECONOMIC SLACK - UNEMPLOYMENT GAP (β1)



1997-2007

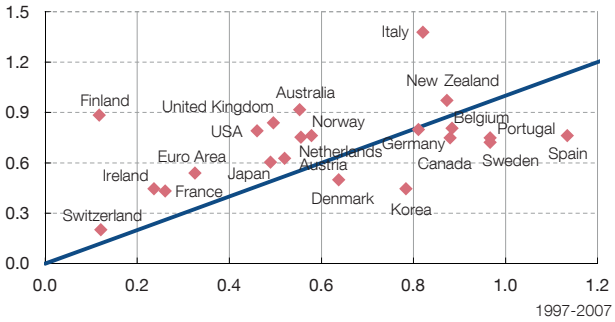
3 COEFFICIENT OF RELATIVE IMPORT PRICES (β2)



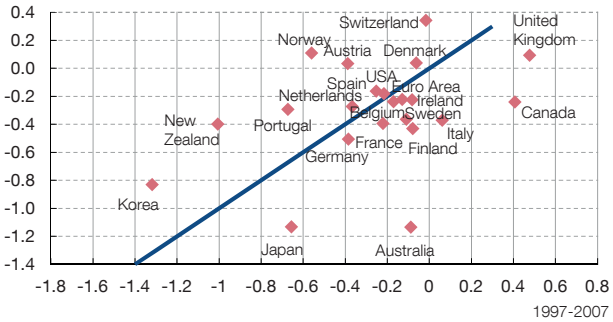
1997-2007

SOURCE: Own elaboration.
NOTE: X-axis before the crisis, Y-axis after the crisis.

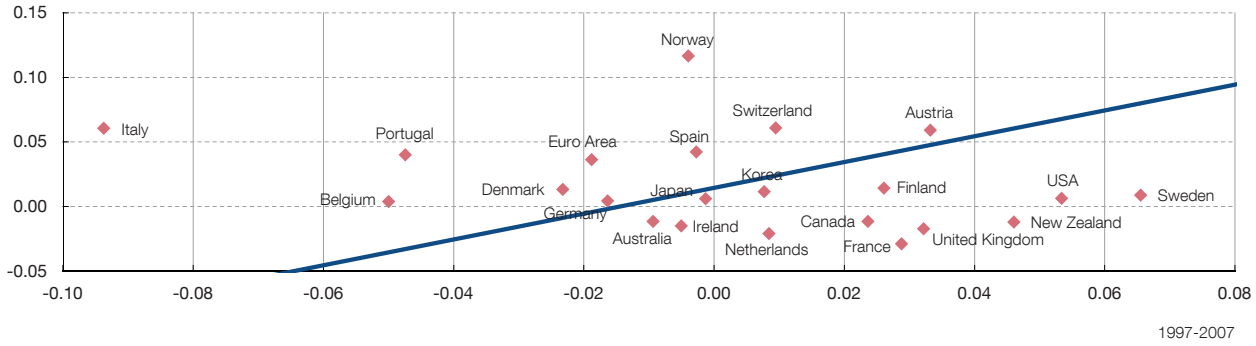
1 COEFFICIENT OF FORWARD-LOOKING INFLATION EXPECTATIONS (λ)



2 COEFFICIENT OF ECONOMIC SLACK - UNEMPLOYMENT GAP (β1)

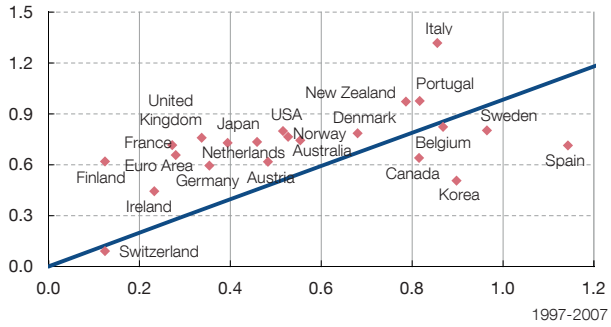


3 COEFFICIENT OF RELATIVE IMPORT PRICES (β2)



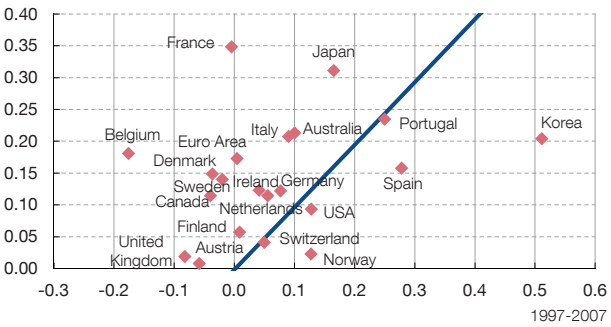
SOURCE: Own elaboration. X-axis before the crisis, Y-axis after the crisis.

1 COEFFICIENT OF FORWARD-LOOKING INFLATION EXPECTATIONS (λ)



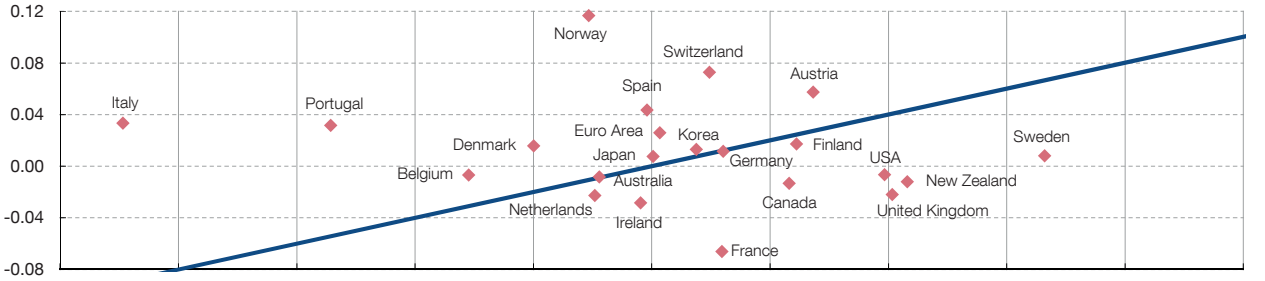
1997-2007

2 COEFFICIENT OF ECONOMIC SLACK - UNEMPLOYMENT GAP (β1)



1997-2007

3 COEFFICIENT OF RELATIVE IMPORT PRICES (β2)



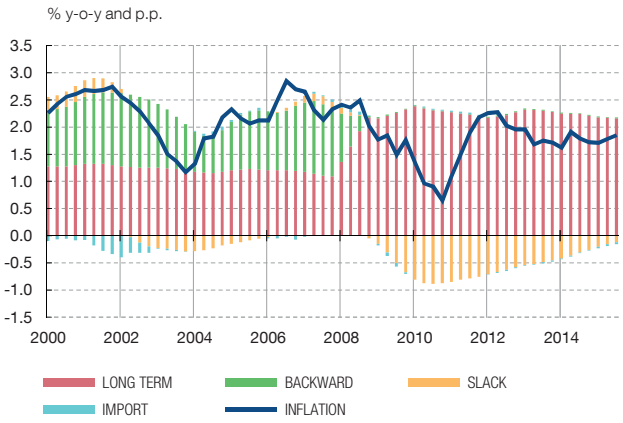
1997-2007

SOURCE: Own elaboration. X-axis before the crisis, Y-axis after the crisis.

APPENDIX C. BREAKDOWN OF INFLATION ACCORDING TO THE BASELINE MODEL

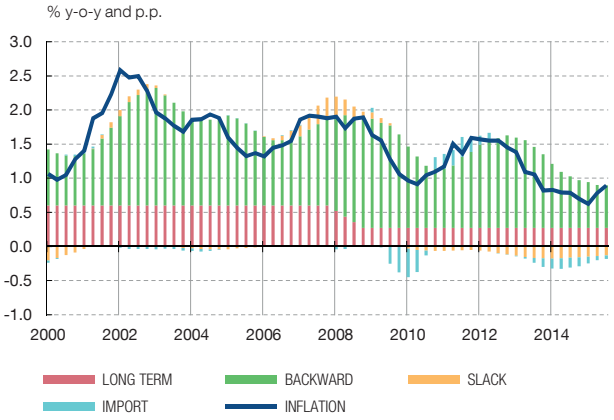
1 UNITED STATES

	All the period	Precrisis	Postcrisis
Long term expectations	0.575 (0.129)	0.498 (0.155)	0.991 (0.298)
Bacwards expectations	0.425 (0.129)	0.502 (0.155)	0.009 (0.298)
Slack	-0.121 (0.050)	-0.293 (0.098)	-0.194 (0.087)
Core import prices growth	0.028 (0.015)	0.054 (0.016)	0.008 (0.022)
DUM1			
DUM2			
DUM3			
R squared	0.200	0.232	0.290



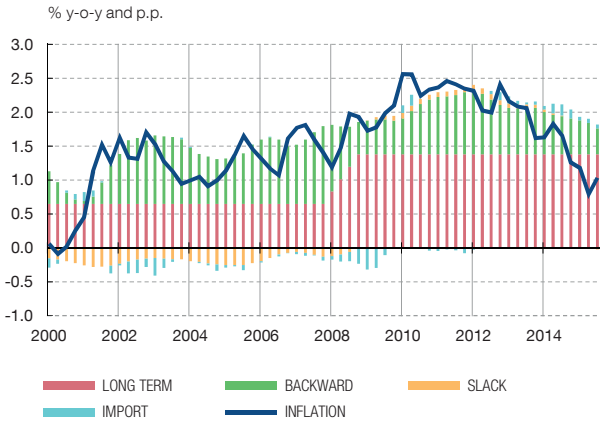
2 EURO AREA

	All the period	Precrisis	Postcrisis
Long term expectations	0.246 (0.105)	0.299 (0.135)	0.136 (0.163)
Bacwards expectations	0.754 (0.105)	0.701 (0.135)	0.864 (0.163)
Slack	-0.137 (0.058)	-0.243 (0.138)	-0.070 (0.082)
Core import prices growth	0.031 (0.012)	0.008 (0.019)	0.053 (0.008)
DUM1			
DUM2			
DUM3			
R squared	0.191	0.182	0.326



3 UNITED KINGDOM

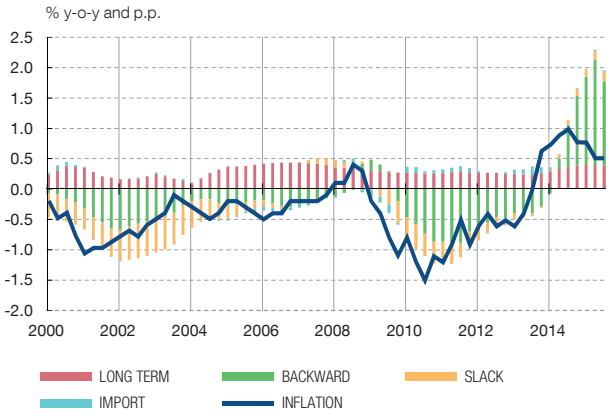
	All the period	Precrisis	Postcrisis
Long term expectations	0.316 (0.170)	0.323 (0.250)	0.684 (0.310)
Bacwards expectations	0.684 (0.170)	0.677 (0.250)	0.316 (0.310)
Slack	0.105 (0.162)	0.302 (0.362)	0.048 (0.166)
Core import prices growth	0.009 (0.016)	0.029 (0.012)	-0.027 (0.026)
DUM1	2.053 (0.189)		2.413 (0.182)
DUM2	-1.434 (0.158)		-1.094 (0.258)
DUM3	0.925 (0.251)		1.070 (0.256)
	0.208	0.168	0.445



SOURCE: Own elaboration.

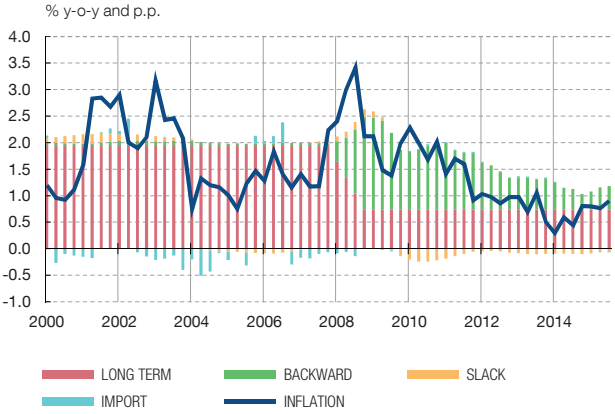
4 JAPAN

	All the period	Precrisis	Postcrisis
Long term expectations	0.099 (0.098)	0.307 (0.149)	0.247 (0.136)
Bacwards expectations	0.901 (0.098)	0.693 (0.149)	0.753 (0.136)
Slack	-0.553 (0.131)	-0.431 (0.243)	-0.369 (0.368)
Core import prices growth	0.002 (0.007)	-0.007 (0.012)	0.010 (0.010)
DUM1	6.308 (0.186)		5.739 (0.227)
DUM2			
DUM3			
R squared	0.440	0.074	0.564



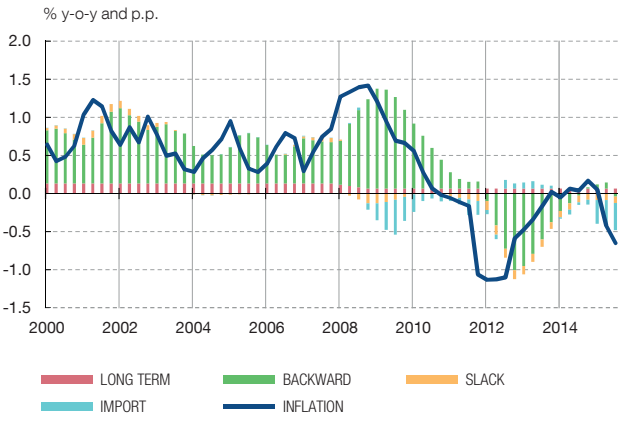
5 SWEDEN

	All the period	Precrisis	Postcrisis
Long term expectations	0.688 (0.688)	0.960 (0.200)	0.368 (0.258)
Bacwards expectations	0.312 (0.688)	0.040 (0.200)	0.632 (0.258)
Slack	-0.133 (-0.133)	-0.109 (0.187)	-0.163 (0.351)
Core import prices growth	0.043 (0.043)	0.065 (0.019)	-0.004 (0.018)
DUM1			
DUM2			
DUM3			
R squared	0.210	0.338	0.070



6 SWITZERLAND

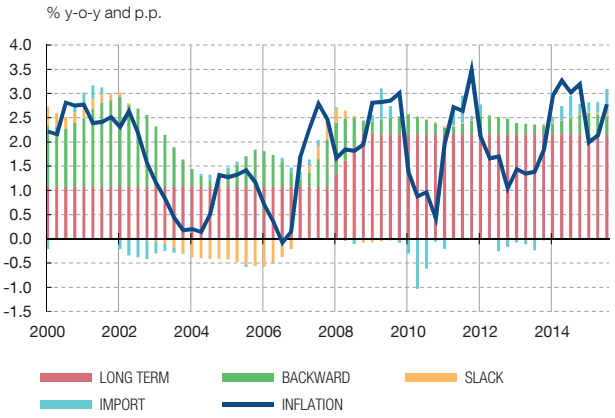
	All the period	Precrisis	Postcrisis
Long term expectations	0.016 (0.047)	0.065 (0.064)	0.032 (0.102)
Bacwards expectations	0.984 (0.047)	0.935 (0.064)	0.968 (0.102)
Slack	0.000 (0.077)	-0.063 (0.083)	0.106 (0.361)
Core import prices growth	0.033 (0.019)	0.002 (0.026)	0.059 (0.027)
DUM1	0.892 (0.109)		0.991 (0.125)
DUM2			
DUM3			
R squared	0.059	0.032	0.181



SOURCE: Own elaboration.

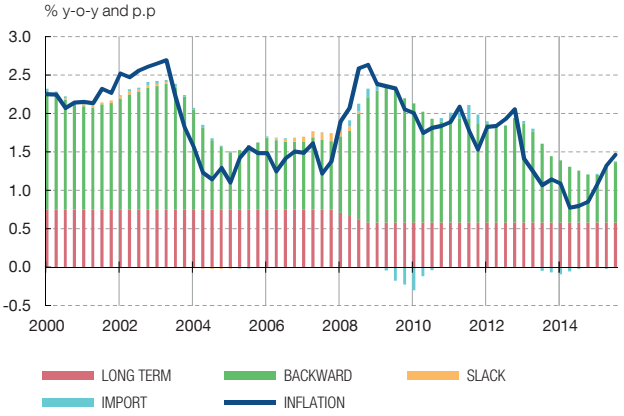
7 NORWAY

	All the period	Precrisis	Postcrisis
Long term expectations	0.527 (0.191)	0.424 (0.252)	0.856 (0.312)
Bacwards expectations	0.473 (0.191)	0.568 (0.252)	0.144 (0.312)
Slack	-0.456 (0.280)	-0.531 (0.358)	0.105 (0.498)
Core import prices growth	0.067 (0.021)	0.032 (0.023)	0.109 (0.042)
DUM1	2.751 (0.128)	2.865 (0.118)	
DUM2			
DUM3			
R squared	0.303	0.289	0.450



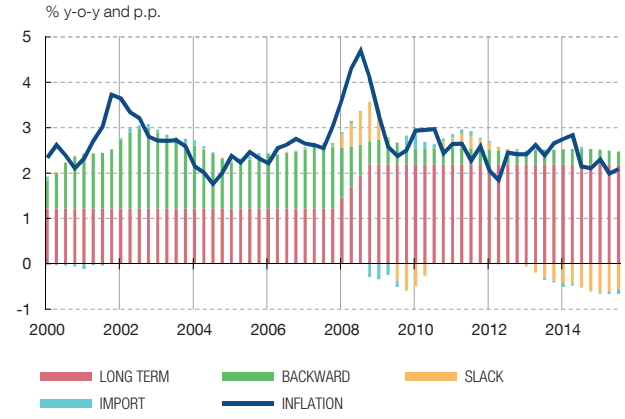
8 DENMARK

	All the period	Precrisis	Postcrisis
Long term expectations	0.325 (0.130)	0.372 (0.194)	0.290 (0.165)
Bacwards expectations	0.675 (0.130)	0.628 (0.194)	0.710 (0.165)
Slack	-0.003 (0.044)	-0.045 (0.097)	0.001 (0.049)
Core import prices growth	0.011 (0.009)	-0.008 (0.016)	0.023 (0.011)
DUM1			
DUM2			
DUM3			
R squared	0.090	0.089	0.135



9 AUSTRALIA

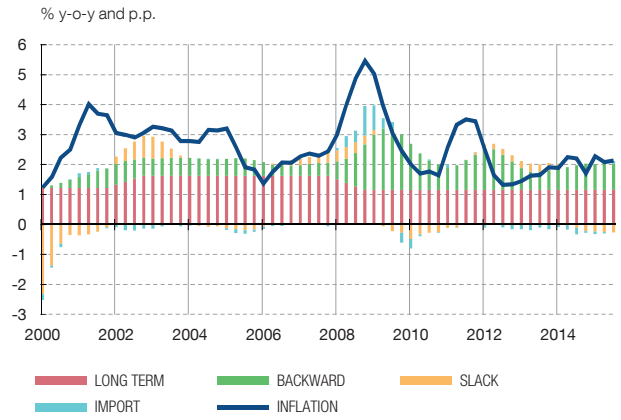
	All the period	Precrisis	Postcrisis
Long term expectations	0.596 (0.172)	0.483 (0.208)	0.868 (0.271)
Bacwards expectations	0.404 (0.172)	0.517 (0.208)	0.132 (0.271)
Slack	-0.408 (0.265)	-0.042 (0.286)	-1.186 (0.471)
Core import prices growth	-0.010 (0.005)	-0.007 (0.008)	-0.013 (0.008)
DUM1			
DUM2			
DUM3			
R squared	0.188	0.109	0.374



SOURCE: Own elaboration.

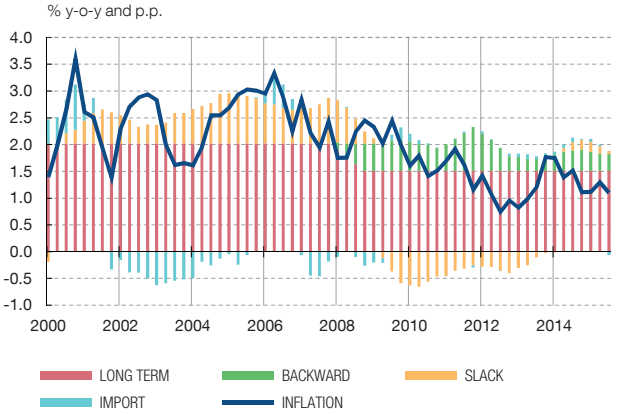
10 KOREA

	All the period	Precrisis	Postcrisis
Long term expectations	0.658 (0.124)	0.807 (0.197)	0.572 (0.187)
Bacwards expectations	0.342 (0.124)	0.193 (0.197)	0.428 (0.187)
Slack	-1.323 (0.179)	-1.411 (0.196)	-1.210 (0.800)
Core import prices growth	0.009 (0.001)	0.008 (0.001)	0.018 (0.009)
DUM1			
DUM2			
DUM3			
R squared	0.689	0.804	0.347



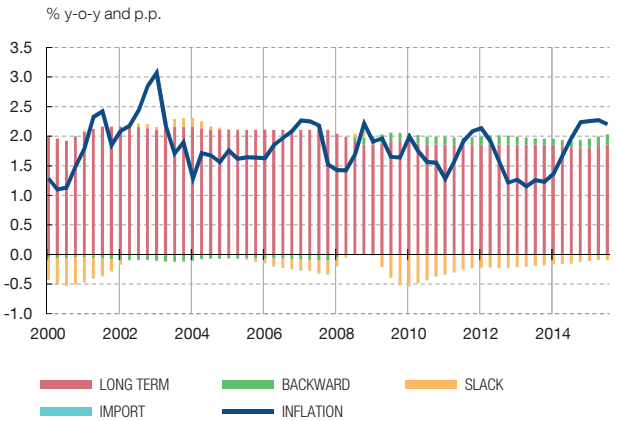
11 NEW ZEALAND

	All the period	Precrisis	Postcrisis
Long term expectations	0.880 (0.172)	1.002 (0.247)	0.748 (0.218)
Bacwards expectations	0.120 (0.172)	-0.002 (0.247)	0.252 (0.218)
Slack	-0.630 (0.275)	-1.051 (0.472)	-0.537 (0.308)
Core import prices growth	0.013 (0.012)	0.043 (0.017)	-0.012 (0.014)
DUM1	6.644 (0.271)		6.269 (0.331)
DUM2			
DUM3			
R squared	0.409	0.336	0.662



12 CANADA

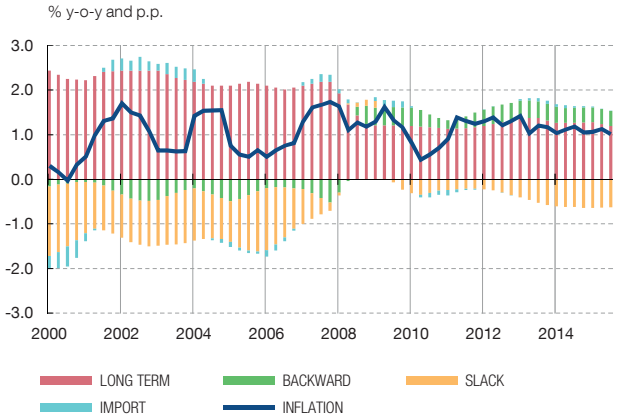
	All the period	Precrisis	Postcrisis
Long term expectations	0.714 (0.193)	1.044 (0.317)	0.920 (0.269)
Bacwards expectations	0.286 (0.193)	-0.044 (0.317)	0.080 (0.269)
Slack	-0.072 (0.113)	0.377 (0.235)	-0.298 (0.135)
Core import prices growth	0.007 (0.009)	0.001 (0.017)	0.001 (0.007)
DUM1	0.384 (0.061)	0.521 (0.101)	0.071 (0.164)
DUM2	0.246 (0.141)		
DUM3			
R squared	0.193	0.208	0.352



SOURCE: Own elaboration.

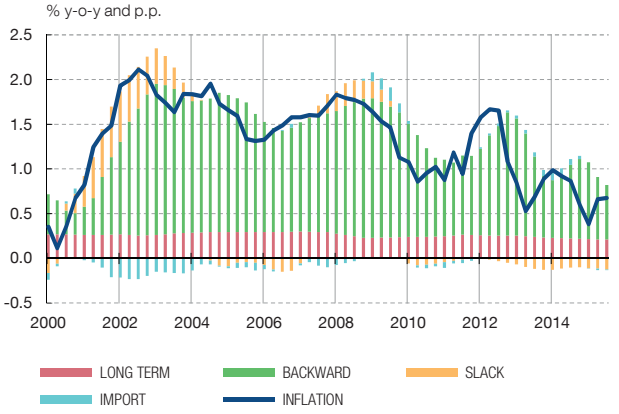
13 GERMANY

	All the period	Precrisis	Postcrisis
Long term expectations	0.951 (0.174)	1.331 (0.285)	0.697 (0.219)
Bacwards expectations	0.049 (0.174)	-0.331 (0.285)	0.303 (0.219)
Slack	-0.445 (0.081)	-0.573 (0.121)	-0.472 (0.146)
Core import prices growth	-0.032 (0.015)	-0.053 (0.020)	-0.018 (0.017)
DUM1	1.540 (0.102)	1.296 (0.168)	
DUM2			
DUM3			
R squared	0.370	0.518	0.233



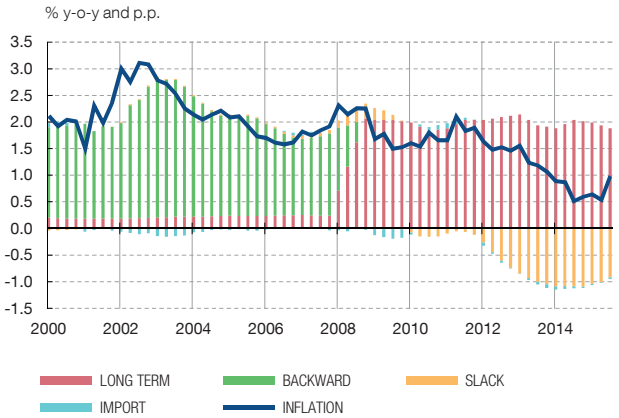
14 FRANCE

	All the period	Precrisis	Postcrisis
Long term expectations	0.178 (0.106)	0.162 (0.112)	0.122 (0.177)
Bacwards expectations	0.822 (0.106)	0.838 (0.112)	0.878 (0.177)
Slack	-0.287 (0.109)	-0.480 (0.126)	-0.158 (0.168)
Core import prices growth	0.007 (0.020)	0.040 (0.024)	-0.024 (0.030)
DUM1	0.703 (0.146)		0.535 (0.195)
DUM2			
DUM3			
R squared	0.133	0.346	0.076



15 ITALY

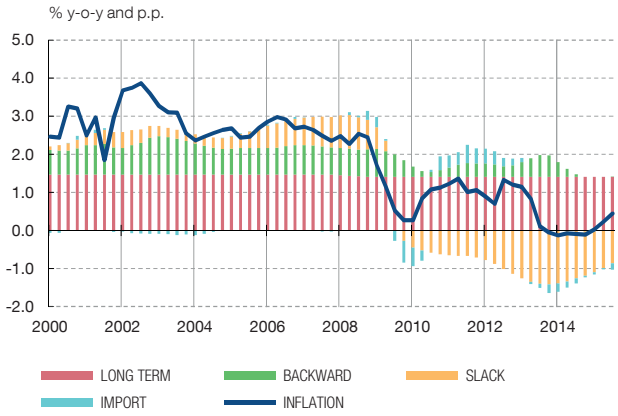
	All the period	Precrisis	Postcrisis
Long term expectations	0.366 (0.155)	0.119 (0.230)	1.010 (0.260)
Bacwards expectations	0.634 (0.155)	0.881 (0.230)	-0.010 (0.260)
Slack	-0.132 (0.050)	-0.037 (0.095)	-0.288 (0.074)
Core import prices growth	0.023 (0.023)	0.034 (0.054)	0.025 (0.018)
DUM1	-0.098 (0.167)		-0.059 (0.168)
DUM2	2.717 (0.092)		2.778 (0.069)
DUM3			
R squared	0.269	0.049	0.572



SOURCE: Own elaboration.

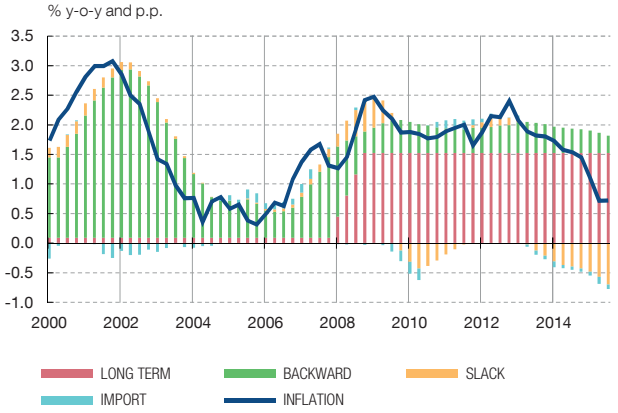
16 SPAIN

	All the period	Precrisis	Postcrisis
Long term expectations	0.688 (0.182)	0.725 (0.452)	0.699 (0.155)
Bacwards expectations	0.312 (0.182)	0.275 (0.452)	0.301 (0.155)
Slack	-0.165 (0.043)	-0.142 (0.092)	-0.176 (0.041)
Core import prices growth	0.035 (0.020)	0.015 (0.045)	0.047 (0.020)
DUM1	-0.078 (0.295)		-0.231 (0.357)
DUM2	4.042 (0.295)		4.123 (0.261)
DUM3			
R squared	0.372	0.161	0.632



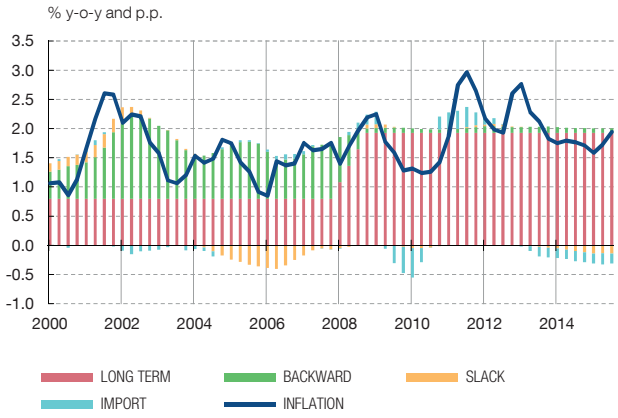
17 FINLAND

	All the period	Precrisis	Postcrisis
Long term expectations	0.115 (0.119)	0.045 (0.126)	0.756 (0.293)
Bacwards expectations	0.885 (0.119)	0.955 (0.126)	0.244 (0.293)
Slack	-0.237 (0.108)	-0.151 (0.152)	-0.441 (0.124)
Core import prices growth	0.023 (0.007)	0.023 (0.010)	0.016 (0.011)
DUM1	-0.895 (0.094)		-0.808 (0.148)
DUM2	-0.440 (0.074)		-0.237 (0.135)
DUM3			
R squared	0.212	0.123	0.464



18 AUSTRIA

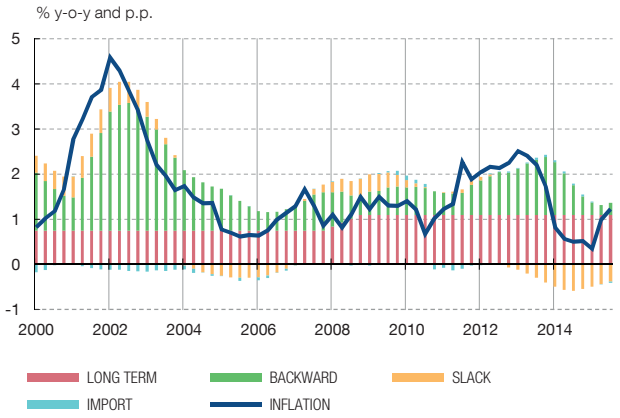
	All the period	Precrisis	Postcrisis
Long term expectations	0.535 (0.161)	0.397 (0.172)	0.956 (0.366)
Bacwards expectations	0.465 (0.161)	0.603 (0.172)	0.044 (0.366)
Slack	-0.250 (0.152)	-0.442 (0.317)	-0.121 (0.141)
Core import prices growth	0.037 (0.019)	0.022 (0.026)	0.052 (0.025)
DUM1			
DUM2			
DUM3			
R squared	0.230	0.159	0.421



SOURCE: Own elaboration.

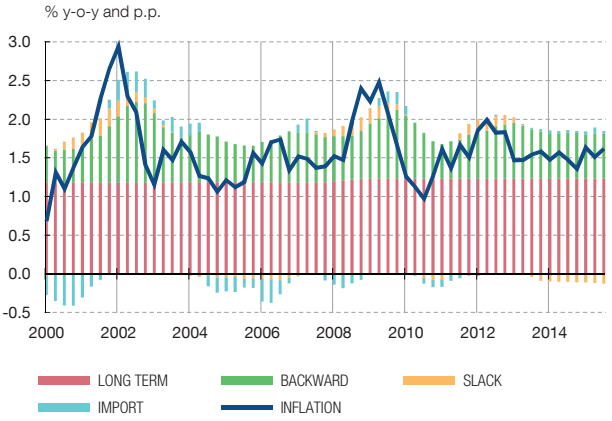
19 NETHERLANDS

	All the period	Precrisis	Postcrisis
Long term expectations	0.448 (0.128)	0.371 (0.196)	0.544 (0.260)
Bacwards expectations	0.552 (0.128)	0.629 (0.196)	0.456 (0.260)
Slack	-0.305 (0.163)	-0.309 (0.352)	-0.317 (0.207)
Core import prices growth	-0.002 (0.029)	0.021 (0.029)	-0.017 (0.050)
DUM1	3.005 (0.313)	3.193 (0.482)	1.932 (0.104)
DUM2	1.929 (0.101)		
DUM3			
R squared	0.278	0.299	0.272



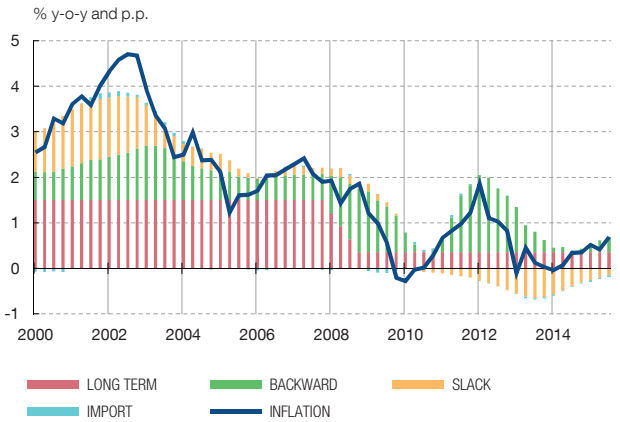
20 BELGIUM

	All the period	Precrisis	Postcrisis
Long term expectations	0.532 (0.155)	0.589 (0.221)	0.611 (0.206)
Bacwards expectations	0.468 (0.155)	0.411 (0.221)	0.389 (0.206)
Slack	-0.187 (0.146)	-0.154 (0.183)	-0.234 (0.229)
Core import prices growth	-0.027 (0.017)	-0.057 (0.025)	-0.013 (0.020)
DUM1			
DUM2			
DUM3			
R squared	0.187	0.220	0.206



21 PORTUGAL

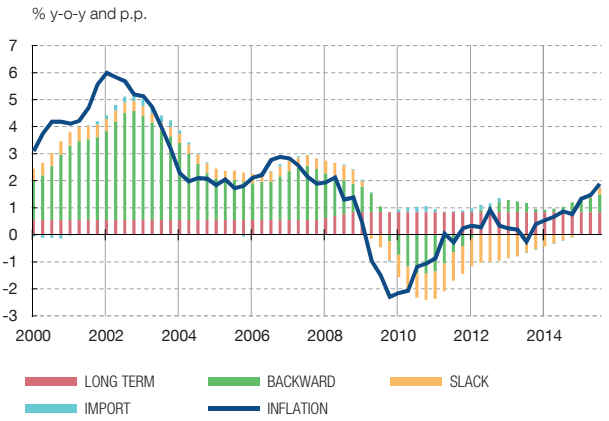
	All the period	Precrisis	Postcrisis
Long term expectations	0.356 (0.167)	0.745 (0.170)	0.175 (0.206)
Bacwards expectations	0.644 (0.167)	0.255 (0.170)	0.825 (0.206)
Slack	-0.223 (0.107)	-0.548 (0.125)	-0.129 (0.132)
Core import prices growth	0.002 (0.022)	-0.014 (0.029)	0.009 (0.028)
DUM1	1.211 (0.280)	1.402 (0.307)	-0.913 (0.336)
DUM2	1.725 (0.208)	1.458 (0.278)	2.592 (0.337)
DUM3	-1.103 (0.250)		3.205 (0.383)
DUM4	2.301 (0.275)		
DUM5	3.170 (0.272)		
R squared	0.355	0.388	0.248



SOURCE: Own elaboration.

22 IRELAND

	All the period	Precrisis	Postcrisis
Long term expectations	0.318 (0.124)	0.273 (0.172)	0.418 (0.183)
Bacwards expectations	0.682 (0.124)	0.727 (0.172)	0.582 (0.183)
Slack	-0.137 (0.054)	-0.109 (0.056)	-0.227 (0.141)
Core import prices growth	-0.020 (0.049)	-0.032 (0.047)	0.029 (0.125)
DUM1	-0.362 (0.294)	-0.394 (0.363)	-1.000 (0.426)
DUM2	-2.363 (0.373)	-2.490 (0.544)	-2.919 (2.348)
DUM3	-0.750 (0.141)		1.167 (1.495)
DUM4	-1.860 (0.864)		
DUM5	1.616 (0.631)		
R squared	0.182	0.226	0.174



SOURCE: Own elaboration.

BANCO DE ESPAÑA PUBLICATIONS

OCCASIONAL PAPERS

0801 MARÍA J. NIETO and GARRY J. SCHINASI: EU framework for safeguarding financial stability: Towards an analytical benchmark for assessing its effectiveness.

0802 SILVIA IRANZO: Delving into country risk. (There is a Spanish version of this edition with the same number).

0803 OLYMPIA BOVER: The Spanish survey of household finances (EFF): Description and methods of the 2005 wave.

0804 JAVIER DÍAZ-CASSOU, AITOR ERCE-DOMÍNGUEZ and JUAN J. VÁZQUEZ-ZAMORA: Recent episodes of sovereign debt restructurings. A case-study approach.

0805 JAVIER DÍAZ-CASSOU, AITOR ERCE-DOMÍNGUEZ and JUAN J. VÁZQUEZ-ZAMORA: The role of the IMF in recent sovereign debt restructurings: Implications for the policy of lending into arrears.

0806 MIGUEL DE LAS CASAS and XAVIER SERRA: Simplification of IMF lending. Why not just one flexible credit facility?

0807 MIGUEL GARCÍA-POSADA and JOSEP M.ª VILARRUBIA: Mapa de exposición internacional de la economía española.

0808 SARAI CRIADO and ADRIAN VAN RIXTEL: Structured finance and the financial turmoil of 2007-2008: An introductory overview. (There is a Spanish version of this edition with the same number).

0809 FRANCISCO DE CASTRO and JOSÉ M. GONZÁLEZ-MÍNGUEZ: La composición de las finanzas públicas y el crecimiento a largo plazo: Un enfoque macroeconómico.

0810 OLYMPIA BOVER: The dynamics of household income and wealth: results from the panel of the Spanish survey of household finances (EFF) 2002-2005. (There is a Spanish version of this edition with the same number).

0901 ÁNGEL ESTRADA, JUAN F. JIMENO and JOSÉ LUIS MALO DE MOLINA: The Spanish economy in EMU: the first ten years. (There is a Spanish version of this edition with the same number).

0902 ÁNGEL ESTRADA and PABLO HERNÁNDEZ DE COS: Oil prices and their effect on potential output. (There is a Spanish version of this edition with the same number).

0903 PALOMA LÓPEZ-GARCÍA, SERGIO PUENTE and ÁNGEL LUIS GÓMEZ: Employment generation by small firms in Spain.

0904 LUIS J. ÁLVAREZ, SAMUEL HURTADO, ISABEL SÁNCHEZ and CARLOS THOMAS: The impact of oil price changes on Spanish and euro area consumer price inflation.

0905 CORAL GARCÍA, ESTHER GORDO, JAIME MARTÍNEZ-MARTÍN and PATRY TELLO: Una actualización de las funciones de exportación e imporción de la economía española.

1001 L. J. ÁLVAREZ, G. BULLIGAN, A. CABRERO, L. FERRARA and H. STAHL: Housing cycles in the major euro area countries.

1002 SONSOLES GALLEGO, SÁNDOR GARDÓ, REINER MARTIN, LUIS MOLINA and JOSÉ MARÍA SERENA: The impact of the global economic and financial crisis on Central Eastern and SouthEastern Europe (CESEE) and Latin America.

1101 LUIS ORGAZ, LUIS MOLINA and CARMEN CARRASCO: El creciente peso de las economías emergentes en la economía y gobernanza mundiales. Los países BRIC.

1102 KLAUS SCHMIDT-HEBBEL: Central banking in Latin America: changes, achievements, challenges. (There is a Spanish version of this edition with the same number).

1103 OLYMPIA BOVER: The Spanish Survey of Household Finances (EFF): description and methods of the 2008 wave.

1104 PABLO HERNÁNDEZ DE COS, MARIO IZQUIERDO and ALBERTO URTASUN: An estimate of the potential growth of the Spanish economy. (There is a Spanish version of this edition with the same number).

1105 ENRIQUE ALBEROLA, CARLOS TRUCHARTE and JUAN LUIS VEGA: Central banks and macroprudential policy. Some reflections from the Spanish experience.

1106 SAMUEL HURTADO, ELENA FERNÁNDEZ, EVA ORTEGA and ALBERTO URTASUN: Nueva actualización del modelo trimestral del Banco de España.

1107 PABLO HERNÁNDEZ DE COS and ENRIQUE MORAL-BENITO: Health care expenditure in the OECD countries: efficiency and regulation. (There is a Spanish version of this edition with the same number).

1201 ELOÍSA ORTEGA and JUAN PEÑALOSA: The Spanish economic crisis: key factors and growth challenges in the euro area. (There is a Spanish version of this edition with the same number).

1202 MARÍA J. NIETO: What role, if any, can market discipline play in supporting macroprudential policy?

1203 CONCHA ARTOLA and ENRIQUE GALÁN: Tracking the future on the web: construction of leading indicators using internet searches. (There is a Spanish version of this edition with the same number).

1204 JOSÉ LUIS MALO DE MOLINA: Luis Ángel Rojo en el Banco de España.

1205 PABLO HERNÁNDEZ DE COS and CARLOS THOMAS: El impacto de la consolidación fiscal sobre el crecimiento económico. Una ilustración para la economía española a partir de un modelo de equilibrio general.

1206 GALO NUÑO, CRISTINA PULIDO and RUBÉN SEGURA-CAYUELA: Long-run growth and demographic prospects in advanced economies.
1207 IGNACIO HERNANDO, JIMENA LLOPIS and JAVIER VALLÉS: Los retos para la política económica en un entorno de tipos de interés próximos a cero.
1208 JUAN CARLOS BERGANZA: Fiscal rules in Latin America: a survey.
1209 ÁNGEL ESTRADA and EVA VALDEOLIVAS: The fall of the labour income share in advanced economies.
1301 ETTORE DORRUCCI, GABOR PULA and DANIEL SANTABÁRBARA: China's economic growth and rebalancing.
1302 DANIEL GARROTE, JIMENA LLOPIS and JAVIER VALLÉS: Los canales del desapalancamiento del sector privado: una comparación internacional.
1303 PABLO HERNÁNDEZ DE COS and JUAN F. JIMENO: Fiscal policy and external imbalances in a debt crisis: the Spanish case.
1304 ELOÍSA ORTEGA and JUAN PEÑALOSA: Algunas reflexiones sobre la economía española tras cinco años de crisis.
1401 JOSÉ MARÍA SERENA and EVA VALDEOLIVAS: Integración financiera y modelos de financiación de los bancos globales.
1402 ANTONIO MONTESINOS, JAVIER J. PÉREZ and ROBERTO RAMOS: El empleo de las Administraciones Públicas en España: caracterización y evolución durante la crisis.
1403 SAMUEL HURTADO, PABLO MANZANO, EVA ORTEGA and ALBERTO URTASUN: Update and re-estimation of the Quarterly Model of Banco de España (MTBE).
1404 JUAN CARLOS BERGANZA, IGNACIO HERNANDO and JAVIER VALLÉS: Los desafíos para la política monetaria en las economías avanzadas tras la Gran Recesión.
1405 FERNANDO LÓPEZ VICENTE and JOSÉ MARÍA SERENA GARRALDA: Macroeconomic policy in Brazil: inflation targeting, public debt structure and credit policies.
1406 PABLO HERNÁNDEZ DE COS and DAVID LÓPEZ RODRÍGUEZ: Tax structure and revenue-raising capacity in Spain: A comparative analysis with the UE. (There is a Spanish version of this edition with the same number).
1407 OLYMPIA BOVER, ENRIQUE CORONADO and PILAR VELILLA: The Spanish survey of household finances (EFF): description and methods of the 2011 wave.
1501 MAR DELGADO TÉLLEZ, PABLO HERNÁNDEZ DE COS, SAMUEL HURTADO and JAVIER J. PÉREZ: Extraordinary mechanisms for payment of General Government suppliers in Spain. (There is a Spanish version of this edition with the same number).
1502 JOSÉ MANUEL MONTERO y ANA REGIL: La tasa de actividad en España: resistencia cíclica, determinantes y perspectivas futuras.
1503 MARIO IZQUIERDO and JUAN FRANCISCO JIMENO: Employment, wage and price reactions to the crisis in Spain: Firm-level evidence from the WDN survey.
1504 MARÍA DE LOS LLANOS MATEA: La demanda potencial de vivienda principal.
1601 JESÚS SAURINA and FRANCISCO JAVIER MENCÍA: Macroprudential policy: objectives, instruments and indicators. (There is a Spanish version of this edition with the same number).
1602 LUIS MOLINA, ESTHER LÓPEZ y ENRIQUE ALBEROLA: El posicionamiento exterior de la economía española.
1603 PILAR CUADRADO and ENRIQUE MORAL-BENITO: Potential growth of the Spanish economy. (There is a Spanish version of this edition with the same number).
1604 HENRIQUE S. BASSO and JAMES COSTAIN: Macroprudential theory: advances and challenges.
1605 PABLO HERNÁNDEZ DE COS, AITOR LACUESTA and ENRIQUE MORAL-BENITO: An exploration of real-time revisions of output gap estimates across European countries.
1606 PABLO HERNÁNDEZ DE COS, SAMUEL HURTADO, FRANCISCO MARTÍ and JAVIER J. PÉREZ: Public finances and inflation: the case of Spain.
1607 JAVIER J. PÉREZ, MARIE AOURIRI, MARIA M. CAMPOS, DMITRIJ CELOV, DOMENICO DEPALO, EVANGELIA PAPAPETROU, JURGA PESLIAKAITĖ, ROBERTO RAMOS and MARTA RODRÍGUEZ-VIVES: The fiscal and macroeconomic effects of government wages and employment reform.
1608 JUAN CARLOS BERGANZA, PEDRO DEL RÍO and FRUCTUOSO BORRALLO: Determinants and implications of low global inflation rates.

BANCO DE **ESPAÑA**
Eurosistema

Unidad de Servicios Auxiliares
Alcalá, 48 - 28014 Madrid
E-mail: publicaciones@bde.es
www.bde.es