The level of the inflation target – a review of the issues

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Most developed countries that conduct inflation targeting have chosen a target level at or close to 2 per cent. Recently, an international debate has arisen on whether this level should be increased. In this article, we review both the arguments in the more policy-oriented debate on the level of the inflation target and what academic research says about the optimal rate of inflation. One conclusion is that the threshold for increasing the target is high, primarily because there are significant practical problems linked to abandoning a target that is already established and changing to another one. The article also discusses the challenges that central banks can face in the near term as regards achieving their current targets.

1 International debate on the level of the inflation target

Recently, an international debate has arisen on the level of the inflation target in developed economies. Several prominent academics and central bank representatives have argued that the inflation target, which is currently at or close to 2 per cent, should be increased.[1] One example that has received particular attention is the open letter written by a number of economists to the US central bank, the Federal Reserve, in June 2017.[2] Federal Reserve Chair Janet Yellen also noted recently that the question of whether the inflation target should be raised is 'one of the most important questions facing monetary policy around the world in the future'.[3]

1.1 Low real interest rates have reduced monetary policy's room for manoeuvre

The background to the debate is that the recovery after the global financial crisis is still sluggish in many parts of the world after almost a decade, while inflation in many countries is below target. A number of central banks have been forced to switch to conducting monetary policy by other means than policy rate adjustments, as this rate has now been cut as far as is deemed possible. The policy rates have been at this level for several years.[4]

The need to keep policy rates so low is not only due to the financial crisis causing such an unusually large negative shock and therefore requiring very expansionary monetary policy.

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1 See, for example, Williams (2009), Blanchard, Dell'Ariccia, and Mauro (2013), Ball (2014), Krugman (2014, May) and Rosengren (2015).

2 http://populardemocracy.org/news-and-publications/prominent-economists-question-fed-inflation-target.

3 See Federal Open Market Committee [FOMC] (2017), p. 14.

4 It is difficult to put an exact number on the policy rate's lower bound, as it varies somewhat among countries, depending on, for example, institutional conditions. It is clear, however, that the bound is not at zero, as most people previously thought.

It is also due to global interest rate levels having fallen for several decades, regardless of the financial crisis. Figure 1 shows real government bond yields in the United States, the United Kingdom and Sweden since 1999.

Figure 1. Real interest rates
Per cent

Note. 10-year yield on indexed-linked government bonds in Sweden, UK and US. Swedish real interest rate is zero coupon rates interpolated from bond rates using the Nelson-Siegel method.
Sources: Bank of England, Federal Reserve, Thomson Reuters and the Riksbank

The reasons for the decline in real interest rates are not fully understood. One explanation that has been put forward is that global saving has increased in recent decades due to, for example, demographic factors. At the same time investment has decreased due to, for example, a falling relative price for capital and lower public investment.[5]

The decline in real rates is a sign of the global, so-called 'neutral', rate of interest having fallen. The neutral rate is an important concept in monetary policy theory. It normally refers to the level of the real rate of interest that neither has an expansionary nor a contractionary effect on the economy.[6] Central banks cannot influence the neutral interest rate but they must consider it when they adjust their policy rates as it is the relation to the neutral rate that determines how expansionary or contractionary a particular monetary policy is. By getting the short-term real interest rate to (temporarily) deviate from the neutral rate, the central bank can influence resource utilisation in the economy. The fact that policy rates around the world are currently low is thus not only due to central banks conducting an expansionary monetary policy. It also depends on the unusually low level of the neutral interest rate, and that the central bank are forced to adapt its policy rates to this low level.

So how does the inflation target fit into the picture? For a given level of the neutral real interest rate, the inflation target determines the level of the neutral *nominal* rate. With a higher inflation target, say 3 per cent, the neutral or normal *nominal* rate would be on average 1 percentage point higher compared to when the inflation target is 2 per cent. There will therefore be 1 percentage point more room to reduce the rate before it reaches its lower bound. An increase in the inflation target to 4 per cent would increase the room for manoeuvre by a further percentage point, and so on. In other words, the purpose of a higher inflation target is to increase the scope for conducting an expansionary monetary policy, by reducing the risk of the policy rate hitting its lower bound.

5 See, for example, Rachel and Smith (2017) for a more detailed account. The Riksbank has discussed the low level of interest rates and its consequences in, for example, Armelius et al. (2014), Ingves (2017) and Sveriges Riksbank (2017).
6 The concept of a neutral or 'natural' interest rate was introduced by the Swedish economist, Knut Wicksell, around 1900. For a detailed discussion, see Lundvall and Westermark (2011).

The scope for stimulating the economy by reducing the rate could also increase in the future if the neutral real interest rate rises. It is difficult to say, however, when this will happen and by how much it will increase. Rachel and Smith (2017) assess that the forces that have pushed the global neutral interest rate down are relatively persistent and that it will remain low for quite a long time to come.[7] Laubach and Williams (2015) and Christensen and Rudebusch (2017) make a similar assessment.[8]

1.2 The structure of the article

The main aim of this article is to provide an overview of both the more policy-oriented debate on the level of the inflation target and the academic research in the field. If Janet Yellen is right in her prediction that the level of the inflation target is an issue that will be much discussed in the period ahead, such an overview may provide a useful starting-point for those wishing to follow the debate.

The rest of the article is organised as follows: In the next section, we go through the benefits and drawbacks of inflation and what inflation targets are in practice. In Section 3, an overview of the academic research on an optimal rate of inflation is presented. Section 4 discusses various arguments against increasing the inflation target. Section 5 focuses in particular on what is perhaps the strongest argument against raising the target – the fact that it can be difficult to change a target that has already become established. There are, however, some challenges that central banks may also face as regards achieving their current targets. These are discussed in Section 6. Section 7 provides a summary.

2 The costs and benefits of inflation, and the inflation target in practice

Before we continue, it may be a good idea to look at why central banks have inflation targets in the first place and why these targets are at their current level.

In developed countries, the most common inflation target level is 2 per cent or slightly above. The level of inflation targets in the OECD countries can be seen in Table 1. Only a few central banks are aiming at an inflation rate lower than 2 per cent. These include the Swiss central bank, whose target is an inflation rate of between 0 and 2 per cent, and the ECB, which defines its target as inflation being below, but close to, 2 per cent.[9]

7 More specifically, Rachel och Smith (2017) estimate that the neutral interest rate will be about or just below 1 per cent in the medium to long term.

8 Goodhart and Pradhan (2017) make a more positive interpretation and argue that global demographic trends will reverse the downward trend in real interest rates over the next decade.

9 The Bank of Canada's and Reserve Bank of New Zealand's target could be interpreted as a target range between 1 and 3, but is, in the case of Canada, formulated as inflation being 'at the 2 per cent midpoint of a target range of 1 to 3 per cent over the medium term', and, in the case of New Zealand, as the focus being to ensure that future inflation is, on average, close to 'the 2 percent target midpoint'.

Table 1. Level of inflation targets in OECD countries

	Target
Australia	2–3%
Canada	2% (mid-point of 1–3%)
Chile	3% ± 1 pp
Czech Republic	2% ± 1 pp
Euro area	Below, but close to, 2 per cent
Hungary	3% ± 1 pp
Iceland	2.5%
Israel	1 – 3%
Japan	2%
Mexico	3% ± 1 pp
New Zealand	2% ± 1 pp
Norway	2.5%
Poland	2.5% ± 1 pp
South Korea	2%
Sweden	2%
Switzerland	Below 2%
Turkey	5% ± 2 pp
United Kingdom	2%
United States	2%

Sources: (Hammond, 2011), www.centralbanknews.info and individual central bank websites

2.1 Problematic with excessively high and excessively low inflation

But why 2 per cent? To begin with, there is a general consensus that *high* inflation can be damaging in many ways. The classic textbook example of costs associated with high inflation is that it can be expensive for companies to change prices ('menu costs') and for private individuals to keep tabs on inflation and adapt to it, partly as a result of the increased cost of holding cash ('shoe-leather costs'). As many social contracts are not entirely indexed to inflation, the costs for unexpectedly high inflation in particular can arise in many ways. For example, it can lead to more people entering higher income tax brackets. It also has a redistribution effect that benefits borrowers at the expense of lenders. When average inflation is high, it also tends to fluctuate substantially from one year to the next. This makes it more difficult to make economic decisions about the future. Experience of historical episodes with high inflation, such as in the 1970s, or even with hyper-inflation, such as in the 1920s, shows that high inflation can be very costly for the economy.

But there are also arguments against inflation being too *low*. One is that wage formation can deteriorate when average inflation is excessively low. The reason is that it has proved difficult in practice to lower nominal wages. If inflation is low and nominal wages cannot be cut, it becomes difficult to adjust real wages between individuals, companies and sectors. This can ultimately bring about both higher unemployment and poorer productivity growth in the economy. These problems can be mitigated if there is a certain underlying inflation in the economy.[10]

Another reason frequently highlighted has to do with the fact that official measures of inflation are normally considered to overestimate actual price rises.[11] This is partly due to the difficulty in differentiating the extent to which a product price rise is a manifestation of

10 See, for example, Akerlof, Dickens, and Perry (1996). As regards discussions about the choice of 2 per cent in Sweden, see for instance Andersson (2003), p. 253.
11 See, for example, Wynne (2008).

improved quality or simply because the price per se has been increased. If such insufficient quality adjustments were common, an inflation target of zero percent would in practice mean that the general price level would fall on average. The exact magnitude of this error component is difficult to estimate, but an inflation target of 2 per cent has been deemed to provide enough latitude.[12]

A third reason is the one we have already discussed. If inflation is low or if economic activity wavers, there should be enough leeway to reduce the policy rate. If the inflation target were, say, 1 or 0 per cent, then inflation would vary around that level. The nominal interest rate will also be lower on average with a lower target. And the lower the interest rate is in normal conditions, the less scope there is to cut it before it reaches its lower bound. With a lower inflation target the policy rate will be at its lower bound more often and for longer periods. Prior to the global financial crisis, the general perception was that an inflation target of 2 per cent would provide enough leeway to lower the policy rate so that this type of problem would not be particularly serious.[13]

2.2 Probably more practical reasons behind the choice of 2 per cent

These arguments may very well have had some significance when inflation targeting was introduced at the beginning of the 1990s. But the main reason was probably more practical. It was probably mostly a question of a quantified target for inflation being an attempt to hold back inflation in countries where this had previously failed. This was definitely the case in Sweden, where higher inflation than in other countries for about 20 years had led to recurrent cost crises and devaluations. When Sweden introduced inflation targeting in 1993 as one of the first countries, the Riksbank noted that underlying inflation at the time was about 2 per cent, and that the aim was to keep inflation at that level.

The fact that 2 per cent became somewhat of a standard for inflation targets did not therefore have much to do with research having established that precisely that figure was the most suitable (see the next section for further details). The practical application of inflation targeting in many ways preceded research and theory development. Probably, 2 per cent seemed for most central banks to be a reasonable level to aim at for average inflation – low enough for participants in the economy not to have to worry about it when making their economic decisions, but at the same time not too high.

When explaining the benefits of an inflation target today, we often focus on a credible target working as a nominal anchor – i.e. a benchmark that guides expectations in the economy. When economic agents have a common view of how prices will develop in the future, it becomes easier to plan for the long term. The inflation target therefore lays the foundations for efficient price and wage formation. If the target succeeds in coordinating inflation expectations, it can also become self-reinforcing. If expectations are in line with the inflation target, and if price and wage formation adapt to these expectations, the probability increases of actual prices becoming consistent with the inflation target.

12 The issue of measurement error in inflation and GDP statistics has been recently brought to the fore by, for example, Summers (2015). In his opinion, measurement errors may well be significant and today's very low inflation can be an overestimation of the actual rate of inflation and the actual real interest rate may correspondingly be underestimated.
13 See, for example, Summers (1991).

3 What does the academic research say?

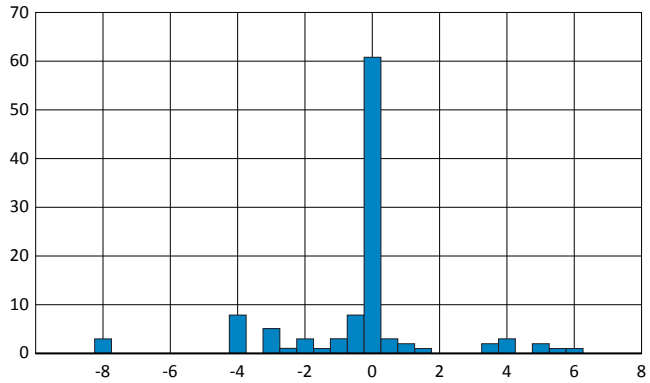
Even if academic research did not play a major role when inflation targeting was introduced, considerable effort has since been expended in attempting to estimate an appropriate target level.

3.1 Optimal rate of inflation

One approach has been to investigate what would be an optimal rate of inflation from a theoretical perspective. Perhaps somewhat surprisingly, the literature has not given particularly strong support for a target of 2 per cent and has even found it difficult to justify why the inflation target should be positive.

Diercks (2017) has compiled all published articles on optimal monetary policy since the mid-1990s. Figure 2 shows the distribution of the different articles' optimal levels for the inflation target. As can be seen, an overwhelming majority of the studies conclude that the optimal rate of inflation is 0 per cent. Many of the studies conclude that optimal inflation is negative, while some state that it is positive. Above all, recent studies tend to result in positive values.

Figure 2. Optimal inflation according to academic studies since the mid-1990s



Source: Diercks (2017)

Our review below is not intended to be a complete review of the literature on optimal inflation. Its aim is partly to explain why so many previous studies concluded that the optimal inflation rate is zero or lower, and partly to provide examples of mechanisms resulting in many newer studies concluding that it is positive.

Two assumptions in particular have led to the result that optimal inflation is zero or negative: that money is demanded for the purposes of making transactions, and that there are price rigidities.

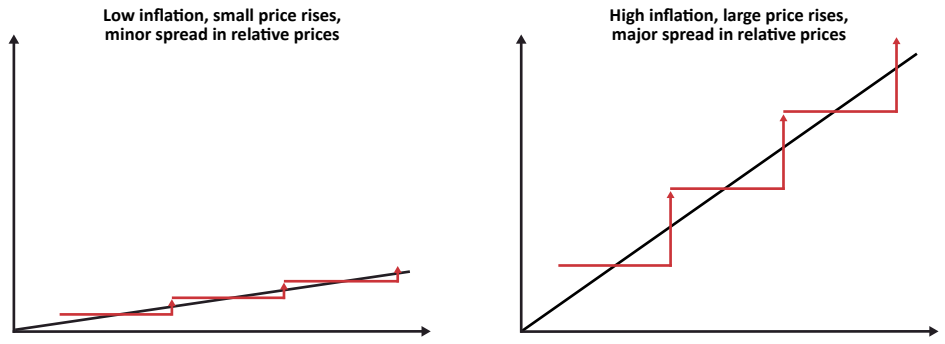
The classic reference for the first assumption is Friedman (1969). His starting point is that money creates social benefit by facilitating transactions but that, at the same time, it is costly to hold as it generates no interest. The participants in the economy thus have an incentive to manage their holdings of money and to retain less of it than they would otherwise. But this is not optimal from a social point of view, because, even if money is costly to hold, it basically costs nothing for the central bank to produce. It is therefore better for the central bank to even out the yields for money and other assets. It does this by setting the nominal interest rate at zero. As the nominal interest rate is the real interest rate plus expected inflation, this means that the central bank strives for inflation to equal the negative of the real interest rate. The so-called Friedman rule says, in other words, that the optimal situation is for prices to *fall* at a rate corresponding to the real interest rate, which is to say a situation with *deflation* rather than inflation.

The presence of price rigidities also means that optimal inflation, in theoretical models, is lower than the inflation targets that central banks have chosen. Many models assume that prices in the economy are adjusted after a delay. A common and relatively robust result from models with sticky prices is that price stability, which is to say inflation of zero per cent, becomes optimal.[14] The reason for this is that price rigidities combined with inflation give rise to inefficient resource allocations. By setting inflation at zero, misallocations and the costs these give rise to can be eliminated.

Assume that companies, for various reasons, are unwilling or unable to adjust their prices particularly often. If there is inflation, companies' relative prices will move away from their optimal values during periods. If companies set their prices for a period to come, their relative prices will decrease over time, apace with inflation, and will not be corrected until the next occasion on which prices are adjusted. As companies are assumed to be able to adjust their prices on different occasions, relative prices for some companies will be too high, while, for other companies, they will be too low. Differences in relative prices among various companies thus do not reflect any fundamental difference, which is to say a distorting effect arises. Companies with high relative prices will produce fewer of their goods than is economically optimal, while those with too low relative prices will produce too much. In other words, the pricing system sends misleading signals over relative production costs and the composition of production therefore becomes inefficient. According to many models, the cost of this is significant. If inflation were instead to be zero, there would be no distorting effects from the spread of relative prices, as companies' prices would constantly stay on their desired, optimal level.

This insight can be illustrated with the help of Figure 3, in which the red line shows how an individual company adjusts its price over time and the black line represents the general level of prices (and the slope of the line is thus inflation). For the sake of simplicity, we assume that the company adjusts its price at specific points in time. When inflation is low (the slope is not steep), price increases for individual companies are small, as is the spread in relative prices. All companies' prices are close to the general price level, regardless of whether the company has recently adjusted its price or has had the same price for a while.

Figure 3. Pricing behaviour and inflation



On the other hand, if inflation is high, price increases for companies will be high. On average, their prices differ more from the average price level and the spread in relative prices becomes greater.

In recent years, a large amount of research has been focused on reviewing the results that suggest that optimal inflation is zero or even negative, and on investigating whether there are mechanisms that make optimal inflation positive and closer to the inflation targets chosen by the central banks. This research can be divided into three different types: Research which (i) add other assumptions to the previous model framework, (ii) assume more

14 See, for example, Schmitt-Grohé and Uribe (2010).

frequent and longer lasting lower bound episodes, and (iii) show how earlier research may have overestimated the costs of higher inflation.

Other assumptions within the previous model framework

An example of the first type of literature is Adam and Weber (2017). Many New Keynesian models assume that companies are randomly given the opportunity to adjust their prices. They usually also assume that companies have the same productivity. Adam and Weber (2017) alter these assumptions so that the possibility of changing a price is connected with an output shock at the firm level. They argue that it can be regarded as the introduction of a new product and that the company can then set whatever price it likes. This increased possibility to adjust prices when necessary (and not just at random) reduces the distortion costs of inflation. This leads to optimal inflation being about 1 per cent in a calibration of the model of US data.

Brunnermeier and Sannikov (2016) analyse the effects of inflation when there are imperfections in financial markets. In their model, households can invest in high-risk physical capital or choose to hold money. There is incomplete insurance against poor outcomes in capital investments (a so-called financial friction), which leads to too low capital investment. The remedy for this is for higher inflation to lower the real interest rate and make it more attractive to invest in capital, which increases the capital stock and thereby growth in the economy.

Just as prices are assumed to be sticky, macro models usually also assume that wages are adjusted after a certain delay and, in particular, that it is difficult to cut nominal wages. Real wages are thus adjusted by nominal wages not being adjusted at the same rate as inflation. Carlsson and Westermark (2016) show that this may lead to higher inflation being optimal. Assumptions over the tax system can also lead to positive inflation becoming optimal. Finocchiaro et al. (2015) analyse the effect of inflation in conjunction with corporate taxation and financial restrictions. In most models, corporate taxation has a distorting effect, as it affects companies' investment decisions, which can lead to insufficient investments. To counteract this, deductible interest has often been introduced. As deductions are based on nominal interest rates, inflation will play a part in companies' decisions. Finocchiaro et al. (2015) show that higher inflation, in total, brings investment decisions closer to the optimal level if corporate loans are limited by demands for collateral, for example in the form of buildings or machines.

The significance of a lower bound for the policy rate

Another aspect that has altered the result that zero inflation is optimal is connected with the policy rate having a lower bound. For the sake of simplicity, this will hereafter be called the zero lower bound (ZLB), even though experience has shown that, in practice, central banks can cut their policy rates some way below zero.

Early studies, which used data from the post-war period until the turn of the millennium, indicated that an inflation target of 2 per cent should entail a lower bound for the policy rate of 0 binding, on average, about 5 per cent of the time (Reifschneider and Willams, 2000). These calculations also indicated that the economy stays in such an episode for about a year, on average. The conclusions from studies including data up until the global financial crisis were similar. Schmitt-Grohé and Uribe (2010) consider that the zero lower bound restriction on the policy rate may occasionally be binding, but finds that optimal inflation is nevertheless about zero.

However, two things that influence this type of calculation have changed. Firstly, the normal level of real interest rates has continued to fall (as was mentioned in Section 1) and, secondly, the policy rate in many large countries has been close to or at the lower bound for long periods in connection with the global financial crisis.

Coibion, Gorodnichenko, and Wieland (2012) allow their calculations to be influenced by the fact that the US economy, at the time of the study, had been at what they assume to be ZLB for three years. This implies that the ZLB episodes are expected to be more frequent, but remain relatively short-lived. The authors conclude that optimal inflation is below 2 per cent.[15] However, the fact that the period of ZLB has subsequently become even longer has led to further reassessments. Dordal-i-Carreras et al. (2016) argue that earlier studies probably underestimate the average duration of ZLB periods and thereby also the gains from higher inflation targets. They adjust the model's shocks to reflect that episodes at the lower bound last longer. In their calculations, the optimal rate of inflation becomes sensitive for how often the lower limit binds, but it ends up somewhere between 1.5 and 4.0 per cent. The midpoint in this interval is 2.7, which is not far from the average among OECD countries at present.

Kiley and Roberts (2017) also conclude that the lower limit binds much more often when they use new data and a lower estimate of the neutral real interest rate. In their simulations, which take into account the latest low interest rate episode, the lower limit binds as often as 40 per cent of the time. The problem becomes so extensive that, on average, production becomes one per cent lower than potential output. According to their calculations, this can be counteracted by the central bank compensating for the low interest rate episodes by allowing higher inflation in normal times. However, the analysis assumes that quantitative easing is not used as an alternative to cutting the interest rate.

Another aspect of ZLB is that there are large differences depending on whether the central bank is able to credibly commit to a particular policy. If the central bank is able to commit, it can reduce the real interest rate and stimulate the economy, even when the policy rate cannot be cut any more, by creating expectations of higher inflation in the period ahead. This makes the effect of a binding lower limit for the policy rate less serious. Billi (2011) finds that the optimal rate of inflation in a model in which the central bank is able to commit becomes between 0.2 and 0.9 per cent. If, on the other hand, the central bank cannot commit but re-optimises in each period, the optimal rate of inflation instead becomes as high as between 13.2 and 15.8 per cent. That there is a large difference depending on whether or not the central bank has a high degree of credibility and can affect inflation expectations is probably an important insight.

Do models with price rigidities overestimate the cost of inflation?

A debate has recently arisen on whether New Keynesian models with price rigidities overestimate the costs of higher inflation. As we noted above, the costs of higher inflation primarily consist of inflation giving rise to an inefficient spread in relative prices among different producers, as the price rigidity means that certain prices remain unchanged while others are changed. The higher inflation is, the greater the spread becomes. If these costs were to be smaller than the theory has so far indicated, optimal inflation would be higher.

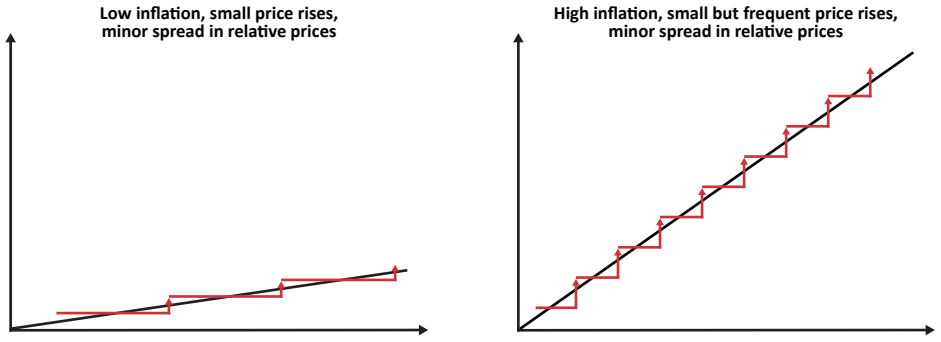
Blanco (2017) uses a model in which higher inflation widens the gap between new and old prices, but where companies also are more inclined to change their prices as a consequence of idiosyncratic shocks. The result is that the spread of relative prices and the misallocation of resources do *not* increase particularly much with inflation. He finds that optimal inflation in such a model is 5 per cent.

Nakamura et al. (2015) investigate the assumption that inflation leads to a large spread of relative prices by studying pricing behaviour in the United States in the late 1970s and early 1980s, when inflation was very high. High inflation means that companies' prices depart from their optimal levels more rapidly and, consequently, it should also be possible to observe greater price changes, as illustrated by Figure 3). The size of the price adjustments should thereby be informative as regards the degree of inefficiency in price allocation.

15 See also Ascari, Phaneuf, and Sims (2015) who draws the same conclusion from a different model.

However, Nakamura et al. (2015) find no signs of greater price adjustments during the period of high inflation – the average price adjustment in the United States has been almost constant over the entire observation period. Instead, they find that the *number* of price adjustments increased notably when inflation was high. As illustrated by Figure 4, this means that companies' prices continually lie relatively close to the general price level, which is to say no great spread in relative prices arises. Nakamura et al. (2015) therefore draw the conclusion that models with exogenous price rigidities overestimate the costs of inflation and that their implications for the optimal rate of inflation should be re-evaluated.

Figure 4. Small and frequent price adjustments and inflation



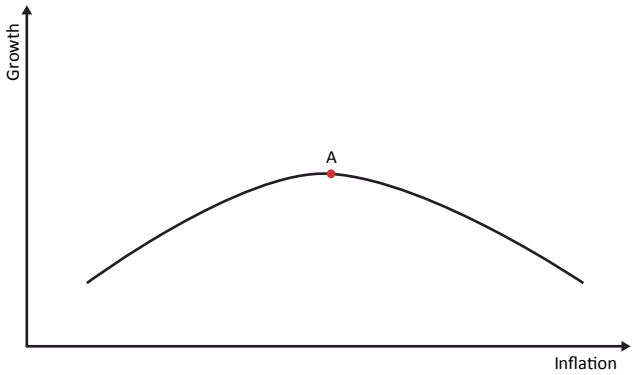
In summary, we can note that there has been a gap between theory and practice in that theoretical models, in many cases, have recommended considerably lower inflation targets than those actually chosen by central banks and governments. Even if the mechanisms in the models are well supported from a theoretical perspective, they do not seem to have been perceived as particularly relevant by economic policy makers. However, models are always simplifications. Newer theories with other mechanisms, also theoretically well supported, have generated higher optimal levels of inflation.

3.2 Empirical studies of the relationship between economic growth and inflation

A completely different approach to finding an appropriate level for the inflation target is to assume a non-linear relationship between inflation and economic growth and empirically attempt to estimate the level of inflation that is most favourable for growth (point A in Figure 5).[16] The literature on this is fairly comprehensive and we only address here some of the most recent and most comprehensive studies.

16 A non-linear relationship between the choice of inflation target and growth does, in a sense, imply that monetary policy can affect the real economy in the long term. However, this does not mean that monetary policy is non-neutral in the sense that this term is normally used – that is to say that long-term growth can be increased by conducting an, on average, more expansionary monetary policy.

Figure 5. The relationship between inflation and GDP growth



López-Villavicencio and Mignon (2011) investigate the relationship in a sample of 44 countries. They find that, in industrialised countries, there is a negative relationship between inflation and GDP growth when rates of inflation exceed 2.7 per cent (this can be seen as the maximum point A in Figure 5). For emerging market economies, the threshold level is significantly higher at 17.5 per cent. For industrialised countries, the relationship is also significant below the threshold, which is to say that, up to a rate of inflation of 2.7 per cent, higher inflation is associated with higher growth. For emerging market economies, on the other hand, the relationship below the threshold is not significant. Kremer et al. (2013) use data for 124 countries and get very similar results. For industrialised countries, they find that the relationship moves from positive to negative at 2.5 per cent and at about 17 per cent for emerging market economies. Neither this study finds that the effect of inflation below the threshold is significant in emerging market economies.

Eggoh and Khan (2014) make a more detailed classification of the 102 countries that they study. They find that the threshold level for high income countries is 3.4 per cent, for middle-income countries (with lower and higher incomes respectively) is 10 and 12 per cent, and for low-income countries about 20 per cent. Cuaresma and Silgoner (2014) study the relationship for 14 EU countries for the period before the European Monetary Union (1960–1999). The method they use allows for several thresholds. They find that the relationship between inflation and growth is positive for rates of inflation of up to 1.6 per cent, then non-significant for an interval and finally negative, albeit not until rates of inflation exceed 16 per cent. All in all, these studies indicate that the estimate for industrialised countries is relatively well in line with the inflation target of 2 per cent chosen by most countries. However, they do not rule out the possibility that the target could be slightly higher.

4 Arguments against raising the inflation target

To sum up, it is not possible to draw any firm conclusions on the appropriate level of the inflation target from academic research. Neither has academic research played any great role in the recent, more policy-oriented debate.

In this debate, the proposal of raising the inflation target has not gone unopposed.[17] One concern raised is that higher inflation could lead to increased uncertainty, making household and corporate economic decisions less efficient.[18] More specifically, and supported by historical data, higher inflation often mean that inflation will also vary more. Apart from leading to increased uncertainty, this could also mean that periods in which the policy rate lies at its lower bound will not necessarily become fewer and shorter. All things equal, greater variation in inflation is reflected by greater variation in the policy rate. It might therefore be that the probability of reaching the rate's lower bound will *not* fall if the inflation target is raised.

17 For compilations of costs linked to a higher inflation target, see, for example, Yellen (2015) (footnote 14), Bank of Canada (2016) and Bernanke (2017).
18 See, for example, Cecchetti and Schoenholtz (2017).

However, if there is confidence in the higher inflation target in the same way as for the lower target, it is not obvious why the variation in inflation should increase. The historically positive covariation between the level and the variation of inflation probably reflects that periods of high inflation have also been periods in which there has been no clear anchor for inflation in the form of an inflation target.[19] Throughout the period of inflation targeting, inflation has varied less than previously and would probably have done so even if the target from the start had been set slightly higher than was the case.

Another argument against raising the inflation target is that it is simply not necessary. Experiences after the crisis show that there are other ways of increasing monetary policy's scope for action. For example, some central banks have shown that the policy rate, in contrast to what was previously thought, does not have to stop at zero but can be cut somewhat further. There is also an ongoing discussion about alternative solutions that would allow the policy rate to be cut to highly negative numbers.[20] But this analysis is still on a fairly abstract academic level. Several central banks have also started to conduct monetary policy via so-called quantitative easing, which is to say purchases of various types of securities on the secondary market. The aim of this kind of measure is to influence rates with longer maturities, which also seems to have been successful.[21]

One possible objection to this argument could be that the possibility of conducting monetary policy via negative interest rates and quantitative easing does not exclude that raising the inflation target can be an effective and useful measure.[22]

Another argument against raising the inflation target has been that it is not certain that a slightly higher inflation target would have made any great difference under the circumstances prevailing during the financial crisis.[23] However, this argument does not seem to be particularly convincing. It is possible that a higher target alone would not have helped, but it would have made it easier for the central banks to conduct a more expansionary policy and could have contributed, at least marginally, to a more positive development than was the case.

Possibly the greatest difficulty in raising the inflation target is discussed in the next section. This is that there are various problems inherent in abandoning an established inflation target and transitioning to another.

5 Difference between changing an inflation target and introducing one

Much of the analysis regarding the suitable level for the inflation target implicitly starts with the question: 'What level would be best if we were starting from scratch and *introducing* an inflation target?' But today the question is more complex and should instead be formulated: 'Should central banks' inflation targets be raised, *given* that there is already a relatively well established inflation target of around 2 per cent?' When answering this question it is necessary to address a number of additional issues that have to do with the transition from one target level to another.

One problem often discussed is that a change in inflation target may give rise to expectations of it being changed again in the future, possibly quite often. Changing the target level too often risks losing the whole point of having an inflation target in the first place. Frequent changes to the inflation target may result in uncertainty regarding what the nominal anchor in the economy actually is, i.e. which inflation figure price and wage formation should be based on.

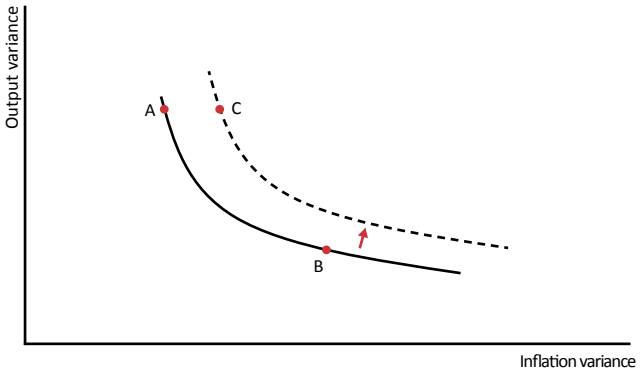
19 See, for example, Ball et al. (2016).
20 See, for example, Agarval and Kimball (2015) and Rogoff (2014).
21 For a more detailed discussion of quantitative easing, see Alsterlind et al. (2015) and De Rezende, Kjellberg, and Tysklind (2015).
22 For a discussion of the repo rate's lower bound, see Alsterlind et al. (2015).
23 See, for example, Yellen (2015).

5.1 Doubts about the inflation target can cause greater fluctuations

If expectations are affected, monetary policy's stabilisation task may become more difficult and economic activity may fluctuate more. Assume that a negative demand shock occurs, that cause inflation to fall. If there is uncertainty about the inflation target, long-term inflation expectations may also fall. This will make the real interest rate increase, i.e. the interest rate corrected for inflation expectations, if the nominal interest rate remains unchanged. The higher real interest rate reinforces the effect of the original negative demand shock and weakens the economy even more, as it is the real interest rate that affects firms and households' investment and consumption decisions respectively. In a corresponding way, a positive shock to demand can make inflation and inflation expectations rise. This lowers the real interest rate and contributes towards further increasing demand. The result thus becomes greater fluctuations in the economy, once confidence in the inflation target is weak and inflation expectations are not well anchored.[24]

This reasoning can be illustrated using Figure 6.

Figure 6. Taylor curve with and without anchored expectations



The curves in the diagram are called Taylor curves and show the trade off the central bank is facing between stabilising inflation and stabilising the real economy.[25] Prioritising the stabilisation of the real economy implies a point like B, in the lower right of the Taylor curve. Such a monetary policy thus results in relatively little variation in the real economy (or output), and relatively much variation in inflation. A monetary policy that places great emphasis on stabilising inflation corresponds to point A in the upper left. The unbroken Taylor curve represents the alternatives available when monetary policy is conducted as well as possible, given the functioning of the economy and the shocks the economy is subjected to – the 'efficient frontier'. Points to the lower left of the efficient frontier, with lower variation in both inflation and the real economy, are thus not possible to attain.

Monetary policy's stabilisation task can thus be more difficult, and fluctuations in economic activity reinforced, if confidence in the inflation target is weak. In Figure 5, this can be illustrated by the Taylor curve being located north-east of the Taylor curve that would apply with a credible inflation target and anchored long-term expectations. The variation in both inflation and output will then be unnecessarily high, as in point C.

24 See, for example, Svensson (2002).

25 The Taylor curve is named after the US economist John Taylor, who first drew attention to this connection, see Taylor (1979).

5.2 Recurrent reviews may play down a change in inflation target

But it could also be problematic if the inflation target is completely irrevocable and set in stone. Even though one should normally stick to an inflation target once it has been determined, the economy may from time to time go through changes that means that a different inflation target would result in more favourable economic development in the long term. It is thus a question of striking a balance: I should be very uncommon to change an inflation target but it should not be impossible.

One way of striking such a balance is to perform recurrent reviews and evaluations of the level of the inflation target and other components of the monetary policy framework as a natural part of the political process.[26] An example of this is the review conducted every fifth year in Canada, which results in a so-called Inflation-Control Agreement between the Bank of Canada and the Canadian Government. This kind of formal process probably helps to play down changes in the inflation target, while at the same time preventing them from happening too often. The Canadian solution provides a 'checkpoint' every fifth year for the level of the inflation target. In practice, however, the target is changed much less frequently. In Canada, the issue of whether the inflation target should be changed was analysed in 2011 as well as in 2016 – the first time whether it should be lowered and the second whether it should be raised. Both times, the decision was to leave the inflation target at 2 per cent.

5.3 … but the initial situation is also important

Even though a formal process with recurrent reviews makes it easier to change the target if necessary, there may be special circumstances to consider on every occasion. One objection to central banks raising the target in the current situation is that it is not very meaningful to announce a new, higher target when inflation has long been below the old target, and already this target seems difficult to reach. Such an announcement may be perceived as rather strange and not very credible. In addition, it means that central banks may initially have to conduct a more expansionary monetary policy to push up inflation. This can be difficult if the policy rate is already very low.

Of course, it can also be argued that the adoption of a higher inflation target need not be so problematic. A higher inflation target can create expectations of higher future inflation, which in turn can reduce real interest rates and stimulate demand and inflation. Another argument is that credibility should in fact be greater for a target higher than 2 per cent. The reason is that the central bank has a greater chance of meeting a higher target, as there is less risk of monetary policy being hampered by the policy rate hitting its lower bound – in the way previously discussed.

Both these arguments are theoretically relevant. But what determines whether the arguments are relevant in practice is how economic agents react. It is they who must be convinced that a higher inflation target is credible and that inflation will indeed rise in the future. It is probably not all that easy to do this in a situation where central banks are finding it difficult even to achieve their existing targets. If long-term inflation expectations are not in line with the target but reflects a belief that inflation will persistently be on some other level, meeting the target becomes considerably more difficult.

5.4 Difficult to raise the target alone

Another aspect is that it can be difficult for a single country to raise the target on its own. Historically, of course, it has not been particularly unusual for individual countries to change their inflation targets. For example, inflation targets in developing countries have often started from a relatively high level. As inflation and inflation expectations have been adjusted downwards, targets have been gradually lowered.

26 See, for example, Ball et al. (2016).

It is much less common that countries *raise* their inflation targets on their own, although this too has happened occasionally. The Reserve Bank of New Zealand expanded its target interval from 0–2 to 0–3 per cent in 1996. In 2003, the interval was reduced to 1–3 per cent. As the Reserve Bank of New Zealand aimed explicitly for the mid-point of the interval, this means that the target has in practice been raised in two steps from 1 per cent to 2 per cent. In 2013, Japan raised its inflation target to 2 per cent from a much lower implicit inflation target. Perhaps the European Central Bank's target definition can be seen as another example. When the ECB introduced its target, the definition was that inflation was to be 'below 2 per cent'. But in 2003, the definition was changed to 'below, but close to, 2 per cent'.

It is important to realise, however, that both when the inflation target in developing countries has been lowered and in those few cases when the target has been raised, the changes have brought the targets closer to the international norm of 2 per cent. If a country were to increase its inflation target from 2 per cent today, it would instead be moving *away from* the prevailing norm. Being the first country to take such a step therefore represents a much greater challenge.

One possible problem with unilaterally changing the target can be that the exchange rate does not adjust as theory prescribes. In theory, differences in the inflation targets of different countries are reflected in adjustments to the exchange rate. If Sweden, for example, had an inflation target of 3 per cent while the inflation target in other countries was 2 per cent, the Swedish krona would depreciate by an average of 1 per cent per year.

Thus, according to theory a flexible exchange rate means that wage and cost developments in Sweden's competitor countries can be ignored when assessing the competitiveness of Swedish companies, as the exchange rate can compensate for differences that may arise. But the social partners in Sweden do not seem to see it this way.[27] The development of the exchange rate is affected by a number of factors, of which competitiveness is just one. It is therefore not possible, they argue, to trust adjustments in the exchange rate to compensate for higher wage increases in Sweden than in other countries and hence to preserve the competitiveness. According to this view, wage and cost developments in Sweden relative to other countries are therefore still just as important as they were when we had a fixed exchange rate. One consequence could be that the social partners conclude agreements that are more in line with price and wage increases in the euro area than with the economic situation and inflation target in Sweden. It will then be more difficult for the Riksbank to achieve the higher target.[28]

Of course, raising the target is not made easier by the fact that opinion is divided as to whether a higher target is a good idea or not. For an increase to be as smooth as possible, it would therefore be desirable for it to be preceded by a reasonable amount of consensus among central banks and in the research community and, moreover, was coordinated so that several central banks decided to raise their targets simultaneously. None of this is, of course, particularly easy to achieve. Even if there is a great deal to suggest that a higher inflation target would be beneficial in the long run, the threshold for actually implementing an increase is nevertheless very high.

27 See, for instance, Enegren (2011), for a more detailed discussion.

28 Such a discrepancy between the domestic economic situation and wage formation – and between the inflation target and wage formation – can probably arise even when the inflation target in Sweden and the euro area is the same, if price and wage increases in the euro area have been unusually low for a long time. It is possible that the development we are currently observing, with low Swedish wage agreements despite strong domestic economic activity, is an example of this.

6 Challenges in the short term with the current inflation target

There are other problems to deal with in the short term. As we noted above, many central banks are finding it difficult to reach even their current targets. The reasons for this are not entirely clear. Despite a general improvement in the labour market, price increases and wage growth are only modest. The relationship between economic activity and inflation, sometimes illustrated by the Philips curve, may have become weaker. High resource utilisation may induce less inflation than it usually does. Underlying structural trends, such as digitalisation and globalisation may also have contributed to subduing inflation.

6.1 Difficult to stimulate more and inappropriate to lower the target

There are basically three ways to act if inflation is expected to be below the central bank's inflation target for a relatively long time in the event of an unchanged monetary policy. The first, and often most natural, is for the central bank to try to conduct an even more expansionary policy to get inflation to rise. But bearing in mind that the policy rate in many countries is already close to or at its lower bound, and that there are still question marks as regards how well inflation can be controlled with the help of quantitative easing, this is not particularly easy.

Another and significantly more drastic way of dealing with the problem of persistently below-target inflation is to simply reduce the target. Even though this has not been a major issue internationally, it has been discussed here and there, perhaps in particular in Sweden. An obvious drawback with such a measure is that the difficulties that an increase in the inflation target would alleviate would of course be even greater if the target was instead *lowered*. One of the biggest problems would be that the leeway for lowering the policy rate in future economic downturns would be *less* than it is with the current inflation target. The whole point of raising the target is, as we have just observed, to increase this leeway.

Lowering the target because it seems difficult to reach would also be interpreted as the central bank 'moving the goal-posts'. This could, in turn, fuel suspicions that the target will be adjusted again in the future as a way of improving goal fulfilment. As we have argued above, this may result in weaker confidence in the inflation target and greater uncertainty as to what the nominal anchor in the economy actually is. From a more practical perspective and in the same way as if the target were to be raised, it would probably be difficult for an individual central bank to change the target in a direction away from the international norm of 2 per cent.

6.2 Allowing more time to reach the inflation target is an option

The third way of dealing with the problem of persistently low inflation is to keep to the inflation target but accept that it will take longer than usual to reach it. The central bank thus continues its expansionary monetary policy but does not make it more expansionary (which may be difficult to do). Using the useful metaphor of driving a car, the central bank continues to keep its foot steadily on the gas, but does not step on it further. The car, that is to say inflation, reaches its goal, but slightly later than it would otherwise have done.

One condition for this to be a feasible strategy is that inflation will actually be able to reach the target. In the Swedish debate in particular, arguments have been put forward stating that underlying structural trends such as digitalisation and globalisation are such strong 'headwinds' as regards inflation that it has become virtually impossible to reach 2 per cent.[29]

29 This has been one of the arguments of debaters who advocate a lower inflation target in Sweden, see for example Mittelman (2013).

Digitalisation and globalisation are probably exerting downward pressure on inflation, see for instance Borio (2017). But this does not mean that actual inflation will be *permanently* lower than the state intends it to be on average. First, the effect of this type of structural trend is basically temporary even if it can be persistent. Second, the central bank can try to estimate how much digitalisation and globalisation will dampen inflation and to compensate for this. This is also what central banks with an inflation target are in practice trying to do. In Sweden, for instance, prices of imported goods have been low since the early 2000's. However, digitalisation and globalisation are not different in this aspect from other factors that affect the economy and that the central bank must try to take into account.

It is also important to realise that if one claims that digitalisation and globalisation lead to *permanently* lower inflation, one also implies that there is no point in central banks and governments setting targets for inflation, as it is determined even in the long term by factors beyond the remit of monetary policy. This claim has a rather heavy burden of proof attached to it, however, as such a view contradicts what at least so far is considered to be established knowledge within economic science.[30]

6.3 … but puts a heavy onus on monetary policy communication

But even if we assume that the central bank has sufficiently effective means for it to be worth setting an inflation target, a strategy whereby it takes longer to reach the target may be problematic, as it is not just central banks but also economic agents who must accept that it takes longer. It is therefore important that these agents do not think that the central bank has abandoned the inflation target simply because it is taking longer to reach. Expectations among economic agents thus play a key role. To maintain the credibility of an inflation target, inflation cannot be allowed to deviate from the target indefinitely. Long-term expectations will then, sooner or later, start to fall, and if price and wage formation starts to adapt to these lower inflation expectations, it will be more difficult for the central bank to achieve the target – it becomes a self-perpetuating vicious circle.

There is no clear answer to how long and how much inflation can deviate from the target without economic agents beginning to lose confidence in the central bank's ability and ambition to reach it. This depends on a number of different circumstances, such as the central bank's general track record and how long the most recent period of target deviation lasted.

The central bank's communication is particularly important in this context. The central bank needs to explain clearly why inflation will continue to deviate from the target for some time to come and why it nonetheless cannot make monetary policy more expansionary, or deems it inappropriate to do so. It also needs to make clear that this does not mean that the target has been abandoned and describe when and how inflation will return to the target.

The strategy of allowing more time than normal to reach the target thereby constitutes a considerable communicative challenge. However, it should not be exaggerated. If flexible inflation targeting is being conducted, it is a natural consequence that the time at which the target is reached will vary. There are examples of central banks, whose inflation forecasts have been quite far from the target at the end of the forecast horizon, without confidence in the inflation target decreasing. In its latest reports, for example, Norges Bank has forecast that inflation will be below target fairly significantly during the forecast period and amount to around 1.5 per cent at the end of 2020, a whole one percentage point under the target of 2.5 per cent.

30 It should be mentioned that, according to the so-called 'fiscal theory of the price level', fiscal policy has crucial influence over inflation in the long term, see for example Christiano and Fitzgerald (2000). To achieve low and stable inflation, a well-balanced monetary policy is therefore insufficient. It also requires fiscal policy to be conducted in a way that is compatible with the inflation target.

As there are no clear answers, it is up to each central bank to make an assessment of how much scope there is. Given that the possibilities for making monetary policy more expansionary are limited and given that one do not want to reduce the target, there may not be any other viable options than to apply such a strategy.

7 Summary

Recently, there has been an international debate on whether the inflation target in developed countries should be increased from 2 per cent, which is currently somewhat of an international standard. The reason is that many central banks have found the policy rate's lower bound to be a binding restriction under surprisingly long periods. They were therefore unable to lower the interest rate as much as they would have preferred. A higher inflation target would help to reduce the risk of this ocurring again in the future. In this article, we have reviewed both the arguments in the more policy-oriented debate on the level of the inflation target and what academic research says about the optimal rate of inflation. Among other observations, we have noted that there has been a gap between theory and practice insofar as the model-based academic literature has resulted in lower optimal inflation rates than the actual targets used by central banks. This gap seems to have decreased in recent years in that models have started to take into account, for instance, that the policy rate can reach its lower bound. This tends to generate a higher optimal level of inflation. One conclusion in the article is that perhaps the greatest difficulty in raising the inflation target is that there are significant practical problems attached to abandoning an already established target and changing to another. We have also discussed the challenges that central banks can face in the near term as regards achieving their current targets.

References

Adam, Klaus and Henning Weber (2017), 'Optimal trend inflation', Discussion Paper No. 12160, Centre for Economic Policy Research.

Agarval, Ruchir and Miles Kimball (2015), 'Breaking through the zero lower bound', Working Paper No. 224, International Monetary Fund.

Akerlof, George, William Dickens and George Perry (1996), 'The macroeconomics of low inflation', *Brookings Papers on Economic Activity*, Vol. 27, No. 1, pp. 1–59.

Alsterlind, Jan, Hanna Armelius, David Forsman, Björn Jönsson and Anna-Lena Wretman (2015), 'How far can the repo rate be cut?', Economic Commentary No. 11*,* Sveriges Riksbank.

Alsterlind, Jan, Henrik Erikson, Maria Sandström and David Vestin (2015), 'How can government bond purchases make monetary policy more expansionary?', Economic Commentary No. 12*,* Sveriges Riksbank.

Andersson, Krister (2003), 'Utformningen av inflationsmålet och den penningpolitiska analysramen [The design of the inflation target and the monetary policy framework]', in *På jakt efter ett nytt ankare: från fast kronkurs till inflationsmål [In search of a new anchor: from fixed exchange rate to inflation target]*, ed. by Jonung, Lars, SNS förlag: Stockholm.

Armelius, Hanna, Paolo Bonomolo, Magnus Lindskog, Julia Rådahl, Ingvar Strid and Karl Walentin (2014), 'Lower neutral interest rate in Sweden?', Economic Commentary No. 14, Sveriges Riksbank.

Ascari, Guido, Louis Phaneuf and Eric Sims (2015), 'On the welfare and cyclical implications of moderate trend inflation', Working Paper No. 21392, National Bureau of Economic Research.

Ball, Laurence M. (2014), 'The case for a long-run inflation target of four percent', Working Paper No. 92, International Monetary Fund.

Ball, Laurence, Joseph E. Gagnon, Patrick Honohan and Signe Krogstrup (2016), 'What else can central banks do?', *Geneva Report on the World Economy No. 18*, International Center for Monetary and Banking Studies and Centre For Economic Policy Research.

Bank of Canada (2016), 'Renewal of the inflation target', Background information, October, Bank of Canada.

Bernanke, Ben S. (2017), 'The zero lower bound on interest rates: how should the Fed respond?', Blog post, 13 April, Brookings. Available at www.brookings.edu/blog/ben-bernanke/2017/04/13/the-zero-lower-bound-on-interest-rates-how-should-the-fed-respond/.

Billi, Roberto (2011), 'Optimal inflation for the US economy', *American Economic Journal: Macroeconomics*, Vol. 3, No. 3, pp. 29–52.

Blanchard, Olivier, Giovanni Dell'Ariccia and Paolo Mauro (2013), 'Rethinking macro policy II: getting granular', Staff Discussion Note No. 3, International Monetary Fund.

Blanco, Andres (2017), 'Optimal inflation target in an economy with menu costs and zero lower bound', Mimeo, 28 August, University of Michigan.

Borio, Claudio (2017), 'Through the looking glass', City Lecture, 22 September, London, Official Monetary and Financial Institutions Forum.

Brunnermeier, Markus K. and Yuliy Sannikov (2016), 'On the optimal inflation rate', Working Paper No. 22133*,* National Bureau of Economic Research.

Carlsson, Mikael and Andreas Westermark (2016), 'Labor market frictions and optimal steady-state inflation', *Journal of Monetary Economics*, Vol. 78*,* pp. 67–79.

Cecchetti, Stephen G. and Kermit L. Schoenholtz, (2017), 'The case for a higher inflation target gets stronger', 3 April. Available at www.moneyandbanking.com/commentary/2017/4/2/thecase-for-a-higher-inflation-target-gets-stronger.

Christensen, Jens H. E. and Glenn D. Rudebusch (2017), 'A new normal for interest rates? Evidence from inflation-indexed debt', Working Paper No. 7, Federal Reserve Bank of San Francisco.

Christiano, Lawrence J. and Terry J. Fitzgerald (2000), 'Understanding the fiscal theory of the price level', *Economic Review*, Vol. 36, No. 2, pp. 2–38, Federal Reserve Bank of Cleveland.

Coibion, Olivier, Yuriy Gorodnichenko and Johannes Wieland (2012), 'The optimal inflation rate in new keynesian models: should central banks raise their inflation targets in light of zero lower bound?', *Review of Economic Studies*, Vol. 79, No. 4, pp. 1371–1406.

Cuaresma, Jesús C. and Maria Silgoner (2014), 'Economic growth and inflation in Europe: a tale of two thresholds', *Journal of Common Market Studies*, Vol. 52, No. 4, pp. 843–860.

De Rezende, Rafael, B., David Kjellberg and Oskar Tysklind (2015), 'Effects of the Riksbank's government bond purchases on financial prices', Economic Commentary No. 13, Sveriges Riksbank.

Diercks, Anthony M. (2017), 'The reader's guide to optimal monetary policy', 19 June, The Board of Governors of the Federal Reserve System.

Dordal-i-Carreras, Marc, Olivier Coibion, Yuriy Gorodnichenko and Johannes Wieland (2016), 'Infrequent but long-lived zero-bound episodes and the optimal rate of inflation', Working Paper No. 22510, National Bureau of Economic Research.

Eggoh, Jude C. and Muhammad Khan (2014), 'On the nonlinear relationship between inflation and economic growth', *Research in Economics*, Vol. 68, No. 2, pp. 133–143.

Enegren, Bo (2011), 'Konkurrenskraften: spelar den någon roll för lönebildningen? [Competitiveness: does it matter to wage formation?]', in *Röster om lönebildning and medling [Voices about wage formation and mediation]*, ed. by Egerö, Anne-Marie, Medlingsinstitutet [The Swedish National Mediation Office]: Stockholm.

FOMC (2017), Transcript of chair Yellen's press conference, Federal Open Market Committee, 14 June, The Board of Governors of the Federal Reserve System.

Finocchiaro, Daria, Giovanni Lombardo, Caterina Mendicino and Philippe Weil (2015), 'Optimal inflation with corporate taxation and financial constraints', Working Paper No. 311, Sveriges Riksbank.

Friedman, Milton (1969), *The optimum quantity of money*, Macmillan: London.

Goodhart, Charles and Manoj Pradhan (2017), 'Demographics will reverse three multi-decade global trends', Working Paper No. 656, Bank for International Settlements.

Hammond, Gill (2011), 'State of the art of inflation targeting', Handbook No. 29*,* Centre for Central Banking Studies, Bank of England.

Ingves, Stefan (2017), 'Monetary policy challenges: weighing today against tomorrow', speech at the Swedish Economic Association, Stockholm, 16 May, Sveriges Riksbank.

Kiley, Michael T. and John M. Roberts (2017), 'Monetary policy in a low interest rate world', *Brookings Papers on Economic Activity,* Spring, pp. 317–372.

Kremer, Stephanie, Alexander Bick and Dieter Nautz (2013), 'Inflation and growth: new evidence from a dynamic panel threshold analysis', *Empirical Economics*, Vol. 44, No. 2, pp. 861-878.

Krugman, Paul (2014), 'Inflation targets reconsidered', draft paper for the European Central Bank Sintra Conference, May.

Laubach, Thomas and John C. Williams (2015), 'Measuring the natural rate of interest redux', Working Paper No. 16, Federal Reserve Bank of San Francisco.

López-Villavicencio, Antonia and Valérie Mignon (2011), 'On the impact of inflation on output growth: does the level of inflation matter?', *Journal of Macroeconomics*, Vol. 33, No. 3, pp. 455–464.

Lundvall, Henrik and Andreas Westermark (2011), 'What is the natural interest rate?', *Economic Review*, No. 2, pp. 7–26, Sveriges Riksbank.

Mitelman, Henrik (2013), 'Dags att sänka inflationsmålet [It's time to lower the inflation target]', Dagens industri [Swedish newspaper], 4 December.

Nakamura, Emi, Jón Steinsson, Patrick Sun and Daniel Villar (2015), 'The elusive costs of inflation: price dispersion during the U.S. great inflation', Working Paper No. 22505, National Bureau of Economic Research.

Rachel, Lukasz and Thomas D. Smith (2017), 'Are low interest rates here to stay?', *International Journal of Central Banking*, Vol. 13, No. 3, pp. 1–42.

Reifschneider, David and John C. Willams (2000), 'Three lessons for monetary policy in a low-inflation era', *Journal of Money, Credit and Banking*, Vol. 32, No. 4, pp. 936–966.

Rogoff, Kenneth S. (2014), 'Costs and benefits of phasing out paper currency', Working Paper No. 20126, National Bureau of Economic Research.

Rosengren, Eric S. (2015), 'Changing economic relationships: implications for monetary policy and simple monetary policy rules', speech at Chatham House, London, 16 April, Federal Reserve Bank of Boston.

Schmitt-Grohé, Stephanie and Martin Uribe (2010), 'The optimal rate of inflation', in *Handbook of Monetary Economics*, Vol. 3B, ed. by Friedman, Benjamin M. and Michael Woodford, Elsevier: San Diego.

Summers, Lawrence (1991), 'Panel discussion: price stability: how should long-term monetary policy be determined?', *Journal of Money, Credit and Banking*, Vol. 23, No. 3, pp. 625–631.

Summers, Lawrence H. (2015), 'Reflections on the productivity slowdown', speech at the conference 'Making sense of the productivity slowdown', Washington DC, 16 November, Peterson Institute for International Economics.

Svensson, Lars E. O. (2002), 'Monetary policy and real stabilization', in Rethinking Stabilization Policy, Jackson Hole Economic Economic Policy Symposium Proceedings, pp. 261–312, Federal Reserve Bank of Kansas City.

Sveriges Riksbank (2017), 'Monetary Policy Report', January, Sveriges Riksbank.

Taylor, John B. (1979), 'Estimation and control of a macroeconomic model with rational expectations', *Econometrica*, Vol. 47, No. 5, pp. 1267–1286.

Williams, John C. (2009), 'Heeding Daedalus: optimal inflation and the zero lower bound', *Brookings Papers on Economic Activity*, Vol. 40, No. 2, pp. 1–49.

Wynne, Mark A. (2008), 'How should central banks define price stability', Working Paper No. 8, Federal Reserve Bank of Dallas.

Yellen, Janet L. (2015), 'Inflation dynamics and monetary policy', speech at The Philip Gamble Memorial Lecture, Amherst, September 24, University of Massachusetts.