



## Explaining Irish Inflation during the Financial Crisis

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### Abstract

The recent financial crisis resulted in a steep contraction in the domestic economy together with a sharp decline in inflation. The Phillips curve model of inflation argues that inflation should be negatively related to economic performance and this would seem to be a potential explanatory factor in the behaviour of Irish inflation during the financial crisis. However, Ireland is a very open economy and the Phillips curve has been criticised as an inappropriate model of inflation for Ireland on the basis that inflation is primarily imported from abroad with little role for domestic factors. We formally assess what role domestic economic activity has on inflation in Ireland. We find that while external factors are important in terms of explaining Irish inflation, there are episodes when the domestic economy has an important influence on inflation. In addition, our preferred Phillips curve model predicts actual Irish inflation during the financial crisis quite accurately.

## 1 Introduction

Given the small highly open nature of the Irish economy, economists have long questioned whether the performance of the domestic economy matters in terms of explaining Irish inflation. Many have argued that Irish inflation is primarily determined by external factors such as the exchange rate, oil prices and import prices with little role given to domestic factors. However, following the onset of financial crisis, Ireland suffered a large decline in output and a dramatic increase in unemployment. In addition, the inflation rate also fell precipitously and a period of sustained deflation ensued. The deflation experienced during the crisis is very unusual by domestic historical standards and also relative to the experiences of

other countries during the so called Great Recession. Figure 1 shows the inflation rates of Ireland together with other Southern European countries which have experienced financial difficulties. The deflation witnessed in Ireland is greater in magnitude than the other countries. More salient, however, is the length of the period of deflation in Ireland. Other countries return to inflation quickly but Ireland remained in deflation for 22 consecutive months. This large fall in the inflation rate associated with the financial crisis means that it is natural to re-examine if there is a link between the economic conditions and inflation and, secondly, if this link can explain the large fall in inflation which followed the onset of the crisis. In this letter, we present a selection of results from a research technical paper of the same name (9/RT/12).<sup>1</sup>

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<sup>1</sup>Please refer to that technical paper for a more detailed analysis and the full spectrum of results.

## 2 Measuring Economic Slack

The Phillips Curve model of inflation (Phillips, 1958) predicts a relationship between economic slack, i.e. the degree to which economic factors are being utilised, and the inflation rate. Critical to its estimation is deriving measures of economic slack. Frequently such measures of slack include the output gap, defined as the difference between actual output and trend (potential) output, or the unemployment gap, defined as the gap between actual unemployment and the natural rate of unemployment. The natural rate of unemployment is an equilibrium level of unemployment in the economy such that there is no upward or downward pressure on wages or prices. When the unemployment rate is higher than its natural rate (positive unemployment gap), all those willing to work at current wage rates cannot find a job and this puts downward pressure on wages and prices in the economy. We estimate a variety of output gaps and unemployment gaps. We find that output gap estimates are less credible than those based on (un)employment for Ireland (see Technical Paper for details). However, in terms of unemployment gaps, we find it useful to make a distinction between long-term and short-term unemployment. This is consistent with some earlier research.

For example, Laudes (2005) breaks the unemployed into a short-term and long-term component with the former referring to those unemployed for less than one year. The usefulness of such a dichotomy stems from the belief that the long-term unemployed may not exert a significant influence on wages or prices with the pool of desirable candidates in the labour market being either the employed or the newly unemployed. Firms are less keen to hire the long-term unemployed as their human capital may have depreciated substantially and it may be more costly to retrain them. In this sense, the long-term unemployed are not considered an active part of the labour market so they should not exert pressure on wages or prices. Alternative mechanisms which imply such a distinction include union based insider outsider models of unemployment or efficiency wage type stories. Finally, Kruger and Mueller (2011) show that job search intensity declines (fewer hours per week) with duration of unemployment, again indicating that long-term unemployed may be less influential in the job market.

Rather than use the short-term unemployment rate directly, we construct the trend in the short-term unemployment rate using a HP filter. We then calculate the short-run unemployment gap (cyclical component), as the difference between the actual rate and the trend. We have also calculated the short-run unemployment gaps using alternative detrending methods: the exponential filter and state space methods. Figure 2 shows the growth rate of employment while Figure 3 displays estimates of the short-term unemployment gap based on the HP, exponential and state space filtering but over a slightly shorter period relative to Figure 2. Noting that a positive short-run gap means that short-run unemployment is high (above its trend level), we can see that the employment growth figures and the short-run gap estimates are in agreement and capture the same features of the business cycle. Cross-checking the gap estimates with an observed variable is an important validity check. Among the various gap estimates, we can also see that there is a high degree of commonality between them. The HP-filtered short-run unemployment gap, which we label STURGAP, is our preferred measure of economic slack. However, the similarity of the gap estimates means that the results of the quantitative analysis presented later are not sensitive to the choice of gap estimator.

## 3 Estimating the Phillips Curve

Having constructed measures of slack, the next step is to test if there is a relationship between these measures of slack and domestic inflation. This amounts to estimating a Phillips curve relationship. There are many potential formulations of the Phillips curve. In this section, we estimate models which generally correspond to Robert Gordon's (1997,98) triangular approach in which a Phillips curve is estimated with three different types of explanatory variable. The specification is:

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \beta_2 (y_{t-1} - y_{t-1}^*) + \beta_3 Z_t + \epsilon_t$$

The first explanatory variable in the equation is the lag of inflation. This captures the persistence of the inflation process and is consistent with a backward looking Phillips curve specification where lagged inflation proxies inflation expectations. The

second type of variable is the activity variable, generally specified in gap form (STURGAP in our case). The third variable is normally a supply side variable. Given the open nature of the Irish economy, we consider both oil prices and the nominal effective exchange rate as supply variables. Specifically, we calculate the growth rates of these variables and then take a lagged four quarter moving average. This captures persistent trends in these variables. The dependent variable is the CPI inflation rate. When we estimate the model, the coefficient on the short-run unemployment gap is statistically significant indicating evidence of a relationship between inflation and the cyclical component of short-run unemployment. The exchange rate is also statistically significant, indicating that external factors are important.

## 4 Stability of the Phillips Curve Relationship

Some recent papers have argued that the output gap has a stronger impact when the economy is in recession. Stock and Watson (2010) make this argument based on the empirical properties of US inflation during recessions. All major disinflations in the US in the post-war period have occurred during or following a recession but it is far more difficult to pin down any single cause of inflationary periods. For this reason, they advocate an asymmetric approach to modelling inflation. Meier (2010) conducts a cross country analysis of 25 episodes in advanced economies where output remained below potential for a long period of time. These periods are associated with a strong decline in inflation although disinflation has tended to dissipate at low levels of inflation rather than lead to deflation.

We estimate a threshold model, which allows the coefficients to change depending on whether our measure of the short-run gap is positive or negative, i.e., depending on whether we are in a recession or not. The results are presented in Table 1. It shows that the coefficient associated with the short-run unemployment gap is over four times greater in magnitude during recessionary periods relative to the boom periods. During the recessions, the activity variable is the only statis-

tically significant explanatory variable but during the booms, external variables also help to explain inflation.

## 5 Forecasting Inflation During the Crisis

Taking the coefficient estimates over the period 1988 to end of 2006, prior to the onset of the crisis, we construct dynamic forecasts of inflation over the crisis period conditional on the known values for the independent variables used in the regression. This is in the spirit of Ball and Zundander (2011) who do a similar exercise for the US. By taking known values for the unemployment gap and other variables, we can determine if the model provides an accurate description of inflation over the forecast period, abstracting from possible mistakes made when forecasting these independent variables. For comparative purposes, we also generate forecasts using coefficients estimated over the full sample to predict the fall in inflation during the crisis.

Figure 4 graphs observed CPI inflation vis-a-vis predicted inflation based on the pre-crisis period coefficients (labelled F Short), and the predicted values based on the full sample coefficients (labelled F Full). When the full sample coefficients are used, the predicted fall is very close to the actual fall. This is to be expected as it is effectively the in-sample fit of the model. When we take the coefficients based on the pre crisis sample and construct forecasts over the crisis period, we see that the expected fall is again in line with actual path of inflation. This indicates the Phillips curve model augmented with external factors, estimated in a threshold format, can provide an accurate description of Irish inflation even during a turbulent period.

It is natural to ask to what extent is the short-run unemployment gap driving the forecasts. In models with lagged dependent variables, it is possible to generate a good fit and good forecasts based purely on the lagged dependent variable.<sup>2</sup> We construct a second forecast of CPI inflation during the crisis in which we omit the short-run unemployment gap from the model specification.

<sup>2</sup>Note that we construct forecasts dynamically over the sample in the sense that the forecast for the previous period is used as the autoregressive term. This means that the forecast accuracy is not a result of using actual values of lagged inflation in the forecasting process.

In every other way, the forecast is constructed in the same way as it was for Figure 4. We graph the forecast when the gap is absent from the model in Figure 5 and include the comparable forecast using pre-crisis coefficients from 4. The results show that the inclusion of the gap in the forecasting model allows us to capture the decline in inflation during the crisis period. The model excluding the gap variable doesn't pick up this fall in inflation. The importance of including the gap variable in the forecasting model highlights the link between slack in the economy and inflation, particularly during this crisis period.

## 6 Conclusion

The results in this letter can be summarised as follows. First, the deflation in Ireland was unusual

by domestic historical and international standards. Second, we find the short-run unemployment gap is the most appropriate way to measure slack in the domestic economy. Third, having controlled for international factors, there is a relationship between the domestic economy and inflation. Fourth, the relationship is not stable over time but seems to depend on the state of the business cycle. Fifth, these types of models predict the actual fall in inflation during the financial crisis quite well. We conclude that these results provide support for the idea that inflation is not purely externally determined in Ireland. There is a role for the domestic economy to play in terms of understanding inflation, particularly during recessions.

## References

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Table 1: **Threshold Model based on Short-Run Unemployment Gap**

$\pi_t$	$\alpha_0$	$\pi_{t-1}$	$STURGAP_t$	$SNEER_t$	$SOIL_t$	$R^2$
Positive	0.503 (0.004)	0.790 (0.000)	-0.346 (0.032)	-0.044 (0.000)	0.001 (0.002)	0.891
Negative	1.124 (0.000)	0.680 (0.000)	-1.474 (0.000)			0.942

Coefficients of Phillips curve model when sample is split into periods of positive and negative short-run unemployment gaps.

$STURGAP_t$  is short-run unemployment gap,  $SNEER_t$  is the smoothed real exchange effective rate and  $SOIL_t$  is smoothed oil prices. Dependent variable is annual CPI inflation. P-values in brackets. Sample:1988Q1-2011Q4.

 Figure 1: **HICP Inflation Rates for Southern Europe**

*Inflation for Spain, Portugal, Ireland and Greece*

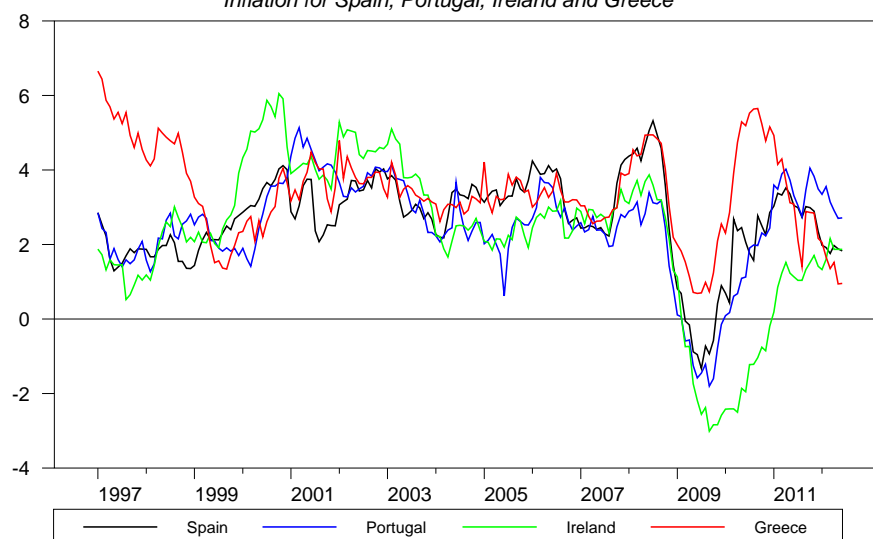


Figure 2: **Employment Growth**

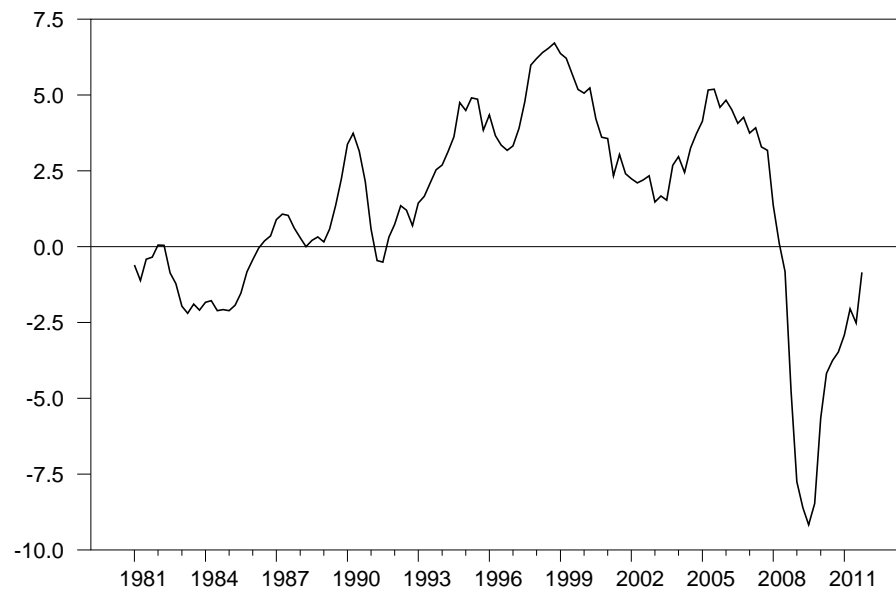


Figure 3: **Short-Run Unemployment Gap Estimates from Various Statistical Filters**

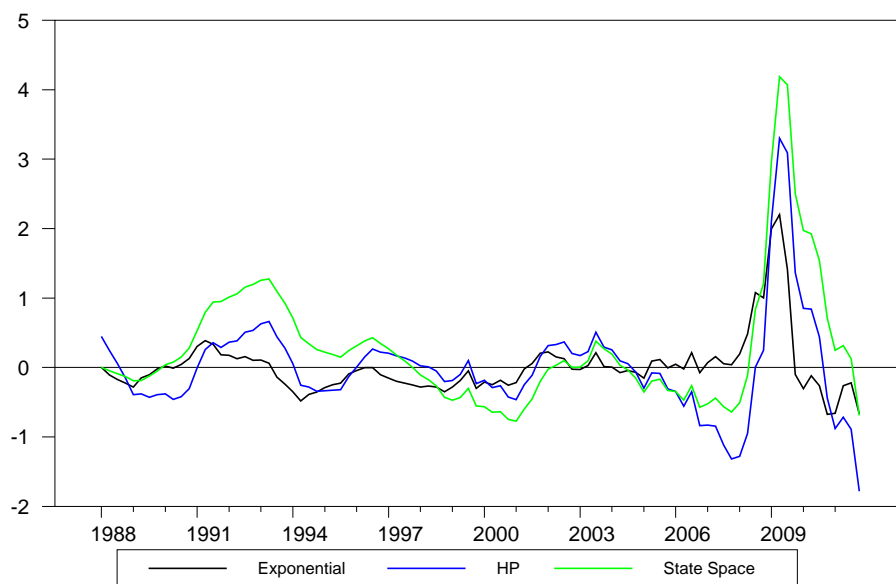


Figure 4: **CPI Inflation Forecast Using Ex-Post Data**

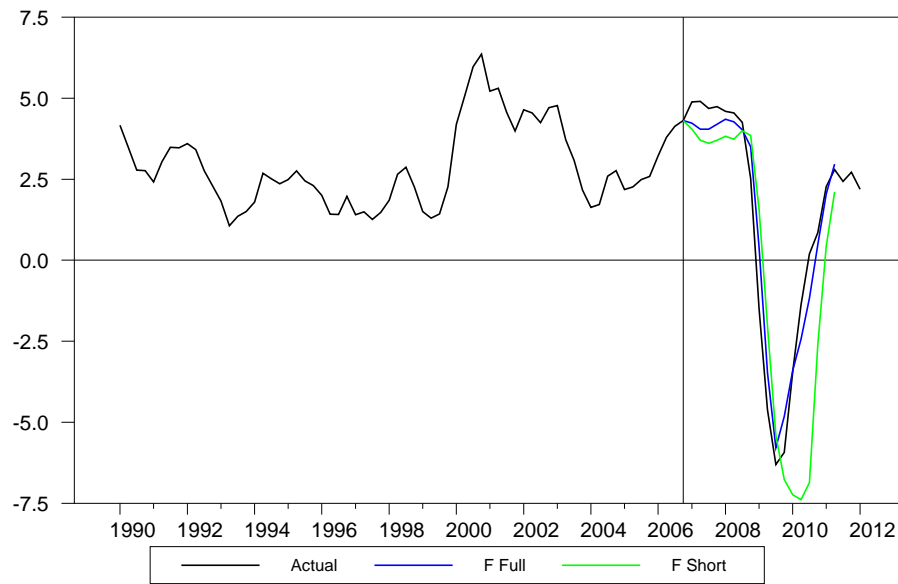


Figure 5: **CPI Inflation Forecast Without Short-Run Unemployment Gap**

