Iceland and the financial crisis:
Would EMU-membership have helped?

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Abstract

After the global financial crisis erupted in the fall of 2008 the Icelandic economy was thrown into recession. It has been suggested that Iceland would have been better off had it been a part of the EU and the European Monetary Union (EMU) and this essay aim at investigating that claim. Entering the EMU entails losing the ability to carry out an independent monetary policy. Therefore I have estimated a model of the relationship between the real interest rate and GDP growth rate in Iceland and also included a parameter for the relationship between exchange rate fluctuations and GDP growth rate. My result suggests that with the interest rate of the European central bank (ECB), GDP growth in Iceland would have been around 0.6 percentage point higher in 2006 and 2007 and 0.8 percentage point in 2008. With the already high growth rates and credit growth in the Icelandic economy during these years this would have posed a risk of an even larger overheating, and subsequently an even deeper downfall into recession in 2009. Part of this downfall would have been offset by the fact that ECB continued to pursue a much more expansionary monetary policy than the central bank of Iceland also in 2009. In my model I cannot establish a significant exchange rate effect on GDP. This suggests having the euro would not have had a significant effect on the recovery of the Icelandic economy.

Keywords: Iceland, financial crisis, euro, EMU, interest rate
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1. Introduction

When the financial crisis erupted in the fall of 2008 the Icelandic banking sector collapsed in the span of a single week (SIC, 2010), the country was thrown into recession in 2009 and has since then been on a road of recovery. In the aftermath of the worst crisis years there has been a discussion about whether or not Iceland would have been better off as a member of the EU and the European Monetary Union? The aim of this essay is to provide an answer to that. This is not only interesting in order to retrospectively see what could have been, but it may also serve as an evaluation from which lessons can be learned in preparation for future crises.

The foremost implication of entering the European Monetary Union (EMU) is loosing the national currency and giving up the ability to carry out an independent monetary policy. Therefore I have set up a statistical model of the relationship between the interest rate level and GDP growth in the Icelandic economy. I have then used this model to estimate the hypothetical effect on Icelandic output if the key interest rate before, during and after, the financial crisis would have been set by the European Central Bank (ECB) instead of the Central bank of Iceland (CBI). The ECB generally pursued a more expansionary monetary policy than the CBI in the years leading up to the crisis and the ECB rate would have had a potential positive effect on GDP growth of around 0.6 percentage point in 2006 and 2007 and 0.8 percentage point in 2008.

In reality Iceland already experienced a period of high growth during these years with GDP rising at an average pace of more than 7 percent annually between 2004 and 2007. Rapid credit growth at the same time was driving up share and property prices in the small economy (Benediktsdottir, Danielsson, Zoega, 2011). This suggests that a further stimulating monetary policy, which would have been the case with the ECB rate, would have posed a risk of an even larger overheating of the Icelandic economy. Subsequently the downfall into recession in 2009 might have been even deeper (the Icelandic economy shrank with 5.1 percent in 2009).

Part of this potentially even steeper economic downturn would have been offset by the fact that the ECB continued to pursue a much more expansionary monetary policy than the CBI also in 2009. According to my model the Icelandic GDP growth would have been 0.8 percentage point higher in 2009 with the ECB interest rate. However, after that the positive effect is halved in 2010 and continues to drop in 2011.
The model also includes a parameter for the real exchange rate effect. However, I cannot establish any significant effect on GDP growth from fluctuations in the real value of the Icelandic króna against either US dollar or the Euro. This may be connected to what Wade and Sigurgeirsdotir (2012) points out about the Icelandic export sector historically having been heavy on lightly processed natural resources that cannot to the same extent take advantage of exchange rate depreciations as more refined products. If this is true, then adopting the euro would have made no difference for the development of the Icelandic GDP. However, my result is contradicted by among others the International Monetary Fund (IMF, 2015), which believes that the real exchange rate does have important implications for competitiveness in the export sector and thus growth in Iceland. A possible explanation is that this effect might come with a lag of several quarters and therefore is not detectable within my model.

After this introduction the remainder of the essay consist of three main parts: Section 2 is a more detailed background on the rise and fall as well as the recovery of the Icelandic economy. Section 3 introduces theories about advantages and disadvantages in entering a monetary union. Section 4 describes the regression model and how I have conducted my studies. The time series data is displayed and the choice of variables is explained. Then results from my investigations is presented in detail and analysed. The last part of section 4 includes conclusions about whether or not an EMU-membership would have been good or bad for Iceland given my results and the theoretical background on advantages and disadvantages of entering a monetary union presented in section 3.

2. The rise and fall of the Icelandic economy

The high Icelandic growth rates, averaging more than 7 percent between 2004 and 2007, was largely due to the boom in the Icelandic financial sector. During these years the three major Icelandic banks had been heavily expanding their business overseas, which enabled them to increase their consolidated assets from around 100 percent of Icelands GDP in 2004 to over 900 percent of GDP by the end of 2007. Over 50 percent of
these assets were at the end of 2007 held abroad. Credit growth during this time was averaging around 50 percent annually from 2004 to 2006. Inflation had been growing above the 2.5 percent target since early 2004 and for the most part of 2006 it was hovering around 7-8 percent. The CBI responded by raising the key interest rate from 5.2 percent in early 2004 to 7.3 percent by the end of that year and then further to 9.8 percent by the end of 2005. By the end of 2007 the CBI’s interest rate was almost 14 percent but credit growth kept edging higher to around 60 percent in that year and inflation was still above target. (IMF, 2008)

The expansion of credit drove up share prices and there was also a smaller scale housing bubble, where house prices grew by an average of 16.6% per year nominally during the period 2003-2007. Since the loan portfolio was either indexed to inflation or denominated in foreign currency, borrowers were very vulnerable to accelerating inflation as well as a depreciation of the Icelandic króna. (Benediktsdottir, Danielsson, Zoega, 2011).

That businesses, and to some extent also households, circumvented the high domestic interest rates set by the CBI through borrowing in foreign currency is one reason why the CBI was never successful in fighting the inflation, despite ever-increasing interest rates that kept strengthening the currency (Benediktsdottir, Danielsson, Zoega, 2011). Because Iceland is an import dependent nation the large capital inflows was to a large extent spent on foreign goods which resulted in double digit current account deficits, culminating at over 25 percent of GDP in 2006 (IMF, 2008).

### 2.1 The fall

Although some voiced concerns about the rapid expansion of the financial sector, most international analyst viewed Iceland as a success story and so did the Icelandic government (Hilmarsson, 2013). But when the global financial crisis erupted in September 2008 the Icelandic banks were hit hard. According to the post-crisis Special Investigation Commission, SIC, that was established by the Icelandic parliament, most of bank’s funding during their rapid expansion came from short-term securities, which are

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¹ Acquisitions were made mainly in the U.K., Norway and Denmark and Kaupting bank, the biggest of the three, were at this point considered as one of the biggest investment banks in the world.
sensitive to market conditions, and when liquidity dried out in the international financial markets the Icelandic banks were faced with refinancing problems. (SIC, 2010)

This more or less forced the CBI to increase its responsibility for domestic liquidity. However, this policy was associated with a risk of undermining other macroeconomic objectives and exposed the CBI to possible losses and the risk of that generating a need for recapitalization of the central bank further down the line. (IMF, 2008)

As investors started to distrust the banks the Icelandic króna sharply depreciated. From the third to the fourth quarter of 2008 the króna lost almost half of its value compared to the dollar (48.6 percent). This furthered the crisis by making servicing of the banks loan portfolios increasingly difficult and in October 2008 all of the three major Icelandic banks Glitnir, Kaupthing, and Landsbanki collapsed in the span of a single week. (Thorhallsson, Kirby, 2012)

During this whole turmoil the Central Bank of Iceland (CBI), because it was too small, did not constitute a credible lender of last resort and thus had nothing to offer in terms of calming international investors: “the CBI’s foreign currency reserve was low in terms of both the economy’s short term liabilities and also in terms of foreign currency deposits at the banks” (SIC, 2010). Also, the deposit insurance fund was underfunded. (SIC, 2010)

After the collapse of the banking sector the Icelandic government immediately entered negotiations with the IMF and agreed to a program to stabilize the economy. The 7 percent average growth rate in the years leading up to the crisis was replaced by recession and the Icelandic economy shrank with 5.1 percent in 2009 and 3.1 percent in 2010. Before the crisis unemployment was virtually non-existing in Iceland but by 2010 it had increased to 7 percent, all according to OECD figures. The central government debt rose from the pre-crisis level at around 20 percent of GDP up to a peak of 95 percent of GDP in 2011. (IMF, 2015)

The economic turbulence led to the collapse of the ruling coalition government in Iceland, which was replaced. Heads were rolling also in the CBI where all of the senior management was replaced along with managers at the Icelandic Financial Supervisory Authority, FME. (IMF, 2009)

The IMF program involved an initial 2.1 billion dollar loan and support in the complicated task of restructuring the nations failed banks. On the advice of the IMF the
CBI also immediately introduced capital controls. This enabled the CBI to gradually lower the nominal key interest rate, from 18 % by the end of 2008 to 13.5 % in mid 2009 and 9.3 % in the beginning of 2010, in order to stimulate aggregate demand without risk of vast outflows of capital and further downward pressure on the already sharply depreciated Icelandic króna\(^2\) (IMF, 2009). However, according to the IMF the depreciated domestic currency helped the Icelandic economy in the years to come both by stimulating tourism and by making foreign goods relatively more expensive which helped reduce Iceland’s persistent current account deficit, which peaked in 2006 at about 25 percent of GDP (IMF 2015).

2.2 The recovery

After the years of financial sector-driven growth the post-crisis Icelandic economy can be described as a return to basics. Iceland has for example been using its virtually unlimited resources of cheap renewable geothermal energy and water power to build up an aluminum sector. Fisheries still dominates export but aluminum products now represent an almost as big part along with tourism, which picked up in 2011 and has been breaking records each year since then. (IMF, 2015)

Six years after the collapse of Glitnir, Kaupthing, and Landsbanki it can be concluded that Iceland has made a turnaround. Growth rates have been positive since 2011, exceeding those in many other crisis hit nations in Europe. In 2015 Iceland’s GDP is forecasted to surpass pre-crisis levels. The budget deficit has come down from an immediate post-crisis high of about 10 percent of GDP to now approaching zero. As a result the central government has been able to reduce the debt from its peak of 95 percent in 2011 down to around 85 percent of GDP at the end of 2013. Even the current account deficit has been turned around and in 2013, after more than a decade of deficits, Iceland displayed a current account surplus of 3.7 percent. After hitting a low of 4.25 percent in mid 2011 the CBI gradually started raising the interest rate. From early 2013 it was kept steady at 6 percent up until the end of 2014 when CBI decided to make a cut back down to 5.7 percent. (IMF, 2015)

\(^2\) From the third to the fourth quarter of 2008 the króna lost almost half of its value compared to the dollar (48.6 percent)
The recovery, however, has not been without costs. "Despite recent growth, private consumption remains subdued. Credit growth to businesses is weak and business investment has just started to show signs of revival. Public investment has suffered amid ongoing fiscal consolidation, and with debt reduction a medium-term objective, is unlikely to recover soon. All in all, domestic demand remains below its historical average" (IMF, 2015).

3. Theory

3.1 Advantages with the EMU

For a small economy (such as the Icelandic) the aspect of having a larger union joint central bank (like the ECB) as a lender of last resort is more important than for a larger economy. This is because this does not only include government debts but extends to private sector liquidity problems as well. For example the ECB can protect solvent, but illiquid, financial firms in the Eurozone by extending euro-denominated loans to the troubled firms. Since the ECB can always issue more euros this ability is unlimited and thus it is pointless for financial markets to speculate against it. For a small national central bank (such as the CBI) it is not possible to provide this function as a lender of last resort to the national banks if their creditors refuse to roll over foreign-currency loans or if they refuse to extend additional foreign currency credit. This is because the central bank does not hold enough foreign currency to do this and it is unable to issue more. (Buiter, Sibert, July 2008)

Internationally active banks (like the Icelandic before the crisis) requires international cooperation when it comes to supervision and control, and after the crisis a number of measures have been taken in the EU to increase preparations and counteract the appearance of crises. There are today four main European authorities for supervision of financial activities in the union under the framework called the European System of Financial Supervision (ESFS); The European Banking Authority (EBA), which has a clear mandate to obtain information from national supervisory authorities in order to increase transparency and assess risks and vulnerabilities in the EU banking
sector (Pisani-Ferry, Sapir, 2010); the European Securities and Markets Authority (ESMA) for supervision of the financial markets; and the European Insurance and Occupational Pensions Authority (EIOPA) for insurances and pensions. To complement these three there is also the European Systemic Risk Board (ESRB), which is an independent EU body responsible for the macro-prudential oversight of the financial system within the union.

The EMU does seem to increase trade. A number of studies over the years have been investigating a currency union’s ability to increase international trade and most of them, including coverage of the EMU, has supported such a claim, although with different estimations of the magnitude of this effect. For example, Micco, Stein and Ordonez (2003) find that the increasing effect of EMU on bilateral trade between member countries ranges between 5 and 10 percent, when compared to trade between all other pairs of countries, and between 9 and 20 percent, when compared to trade among non-EMU countries. Their results suggest that the monetary union increases trade not only with countries within the union, but also with the rest of the world. (Micco, Stein and Ordonez, 2003)

Flam and Norström (2006) estimate that the EMU has increased trade within the eurozone by on average around 26 percent and trade between the eurozone and outsiders by around 12 percent. This is for the years 2002-2005 compared to 1995-1998. The effect was concentrated to trade with “semi-finished and finished products, in particular to industries with highly processed products such as pharmaceuticals and machinery” (Flam, Norström, 2006).

There is also empirical evidence that the EMU has affected foreign direct investments in member countries. A study by de Sousa and Lochard (2011) indicates that over the period 1992–2005 euro adoption has increased intra-EMU foreign direct investments stocks on average by around 30 percent. The reason for this is that the EMU reduces transaction costs by: (1) removing currency conversion costs; (2) cutting in-house costs of maintaining separate foreign currency expertise; (3) making it easier to compare international costs and thus ease price decisions; (4) removing all exchange rate risk. (de Sousa and Lochard 2011)

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A country like Iceland with a relatively open economy will have less to lose from abandoning its own currency than a country that is very open to international trade. The reason is that changes in the nominal exchange rate will quickly be offset by changes in domestic prices in an open economy, so the real exchange rate will not be affected. (McKinnon, 1963)

Lastly, simply entering a union implies forging closer ties to other countries that may stimulate all sorts of sharing of ideas and thereby innovations⁵. There is for example evidence that the EU Single Market Programme has “increased product market competition, as measured by a reduction in average profitability, and with a subsequent increase in innovation intensity and productivity growth for manufacturing sectors” (Griffith, Harrison, Simpson, 2010).

### 3.2 Disadvantages with the EMU

The main cost for a country to enter a monetary union is connected to losing its ability to carry out an independent monetary policy (Mundell, 1961). For one thing there may be economic-cultural differences among countries about what level of unemployment and inflation is considered tolerable or even desirable. But with a joint central bank such as the ECB there is little room to consider specific preferences in individual states. (Calmfors et al., 1996)

A joint central bank will also have difficulties adjusting the monetary policy if one or just a few countries are experiencing a recession while the rest of the member states are booming. Not having a business cycle that is relatively well synchronised with the rest of the member states thus can be a problem for a country that joins a monetary union. (De Grauwe, 2014)

Looking at this further, let us take an example with country A and country B, which decides to form a monetary union together. Let us also assume that there is a shift in preferences from goods produced in country A towards country B’s products. Lower aggregate demand in country A will then eventually have to be met by lower

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⁵There may also be positive political aspects connected to this, which I however will not comment on here and which also might be hard to put a price tag on.
output and consequently unemployment will start to rise. Country B at the same time experiences a hike in aggregate demand, which will be met by a higher output level. This will put inflationary pressure on the economy with rising prices and wages. Given that country A has a social security system and laid off workers can collect unemployment benefits, the spending of the residents in country A will fall less than the value of the decline in domestic output. So country A will suffer from a current account deficit which in turn will lead to an increase in country A:s budget deficit. In country B the situation is the opposite, which will lead accumulation of current account surpluses. (De Grauwe, 2014)

Without the monetary union each country’s central bank, under a flexible exchange rate regime, could have used the interest rate to either achieve a depreciation or appreciation of the national currency (or with a fixed exchange rate regime simply revalue or devalue the currency). A depreciation of country A:s currency would immediately have made its products cheaper and thus increased competitiveness. Country B could have done the opposite and raised its interest rate which would have cushioned the inflationary pressure and resulted in an appreciation of the currency bringing its current account back towards balance. However, within a union this is no longer possible. (De Grauwe, 2014)

A pioneer on this subject, Robert Mundell (1961), instead suggested other mechanisms that can bring back equilibrium to the two countries and states two criterions that needs to be fulfilled for an optimum currency area, 1: sufficient flexibility in wages, and 2: sufficient mobility in labour.

The intuition behind the first criterion is; if country A can swiftly reduce wages, and thus cut production costs, it will increase its competitiveness and stimulate aggregate demand. This in turn will raise output, reduce unemployment and improve country A:s current account. For country B the opposite would reduce inflationary pressure and bring the current account back towards balance. Labour mobility is important because if laid off workers in country A easily can and are willing to move to country B, where aggregate demand is booming and producers are looking to hire, then this will have a balancing effect. Wages then will not have to decline in country A and rise in country B and the unemployment problem in country A will be eliminated along with the inflationary pressure in country B. (Mundell, 1961)
There may be many components that determine the level of mobility of labour within a union, such as how easy it is to travel (both in the sense of infrastructure and communication as well as attaining visas and finding accommodation), cultural and language barriers, bureaucratic barriers such as transfer of pensions and other social security arrangements.

However, for labour mobility to hold as an efficient adjustment mechanism it requires similarities in industry structure within the union in terms of labour intensity in the production and skills required in the workforce. Taken to the extreme this would suggest very small optimum currency areas, basically narrowed down to single-product regions with a homogenous collective of workers. This is not feasible for a number of reasons including raging cost for currency exchange and increased difficulties for investors as they will have no stable-valued and liquid currency to hold as a store of value or use as a standard of value when allocating capital to investments among all these single-product regions.

Kenen (1969) instead argues that countries with a well-diversified economy will be better equipped to enter a currency union since it will be less vulnerable to asymmetric shocks to specific sectors. Iceland however, cannot be counted among such countries with three major industries, fishing, tourism and aluminum, dominating the export sector. Although not as paramount as it once was, fish and other marine products still contribute to around 10.9 percentage of GDP and account for 41 percentage of the exports, all according to statistics Iceland (data from 2011).

4. Empirical analysis

4.1 Econometric model and data

The statistical model I use to estimate the hypothetical effect on Iceland's GDP if the key interest rate was set by the ECB instead of the CBI is based on a version of the IS curve equation. The IS curve represents the negative relationship between the interest rate and output and the slope reflects how efficient monetary policy is as a tool of adjustment in the economy. Intuitively a flat curve means that a small change in the interest rate
level causes a relatively large change in output, and vice versa; a steep IS curve suggests that a relatively large change in the interest rate level is needed in order to significantly influence output. Using equation 3.2 in Woodford (2007) as a base I add a couple of extra variables and define two equations:

\[
\text{(1) } \log Y_t = \beta_0 + \beta_1 \log Y_{t-1} + \beta_2 R_t + \beta_3 E_t^{USA} + \beta_4 E_t^{EURO} + \beta_5 \log F_t + \epsilon_t \\
\text{(2) } \log Y_t = \beta_0 + \beta_1 \log Y_{t-1} + \beta_2 R_{t-1} + \beta_3 E_{t-1}^{USA} + \beta_4 E_{t-1}^{EURO} + \beta_5 \log F_{t-1} + \epsilon_{t-1}
\]

where in equation (1) $Y_t = GDP$ growth rate in period $t$, $\beta_0 =$ intercept, $Y_{t-1} = GDP$ growth rate in the period just before period $t$, $R_t = real$ interest rate in Iceland, $E_t^{USA} = real$ exchange rate with the US, $E_t^{EURO} = real$ exchange rate with the Eurozone, $F_t = growth$ rate in fish meal price and $\epsilon_t =$ error term. $\beta_1, \ldots, \beta_5 =$ coefficients and log means that it is the logarithm of the variable. Equation (2) is basically the same as equation (1), only with a 1 period lag in the variables; real interest rate in Iceland, real exchange rate with the US, real exchange rate with the Eurozone and growth rate in fish meal price.

Since it is a log-linear model in terms of the estimated correlation between real interest rate ($R_t$) and GDP growth rate ($Y_t$), it suggests that a one percent change in the real interest rate in Iceland is associated with a $(100 \times \beta_2)\%$ change in the GDP growth rate\(^6\). The variable growth rate in fish meal price is included because the fishing industry has been, and still is, very important for the Icelandic economy. Fish and other marine products contribute to around 10.9% of GDP and account for 41% of the exports\(^7\). Therefore it is crucial to include some control variable capturing the fluctuations in income from this sector. I also tested a variable with growth rate in a weighted index of the world market price on fish but since it was not even close to being significant in the regression, and since including too many and insignificant variables for control comes with a cost of loosing precision in the estimate of the variable of interest, I decided to drop it. Also it seemed too similar to the growth rate in fish meal price variable (which is very close to being significant).

The motivation for using GDP t-1 as a control variable is that the development of GDP in one period is likely to influence the development in the next, as well as

\(^6\) However, in table 1 in the result section I have converted all the estimates into percent in order to make it consistent and easy to interpret.

\(^7\) Data from 2011. Source: Statistics Iceland
influencing the central banks monetary policy decisions. Leaving that out would then be a possible threat to the estimation through omitted variables bias (OVB). The same goes for the real exchange rate variables, especially in a small open economy such as the Icelandic, which is very dependent on trade, mainly with Europe but also with the US. The real exchange rate with the US is computed using rate of change in the nominal exchange rate (ISK)/US Dollar + inflation in the US – inflation in Iceland and the real exchange rate with the Eurozone is computed using rate of change in the nominal exchange rate ISK/Euro + inflation in the Eurozone – inflation in Iceland.\(^8\)

In order to model equation (1) and (2) in statistical software I have used quarterly time series data ranging from Q1 1980 to Q4 2014. The data sources are as follows; GDP data from the OECD, fish meal price data from the IMF; nominal interest rate data from the CBI; Iceland inflation data and USA inflation data from the OECD; Eurozone inflation data from the ECB; nominal exchange rate ISK/Euro and ISK/USD from the CBI. After examining the data it can be concluded that the time series looks consistent. There is a large peak in the real exchange rate for both the US and the Eurozone around 2010 (Figure 1: Panel 1 and Panel 2), this however is consistent with the actual development at this time, and other than that there no large outliers or extreme values suggesting there should be any structural problems with the data.

The GDP data at level is non-stationary, which means there is a clear trend in the data and the mean and variance is not constant, but changing over time. After performing an Augmented Dickey-Fuller test (ADF-test) for unit root it could be concluded that the real interest rate data and the fish meal price data at level is also non-stationary. Non-stationary data makes it hard to draw correct conclusions about correlation between different variables since the size of the fluctuations between different time periods are almost impossible to relate to each other. However, by differencing non-stationary data it can be converted into stationary time series.

In this case first-differencing turned out to be enough for the non-stationary variables to become stationary. First differencing means taking the data from each observation and subtract the value of the observation immediately before. However, before I first differenced the GDP and the Fish meal price I took the logarithm of the data. This is because if the data is in logarithms, then the first-difference is approximately

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\(^8\) Since there was no euro before 1999 the earlier data is based on the ECU rate, which was a weighted basket of European currencies. This has been considered a legitimate proxy in earlier and acknowledged research.
equivalent to the percentage change in the variable. Figure 1: Panel 3 shows GDP growth rate, which is stationary. Obviously the fluctuations in the data looks much smoother up until 1997, this is because the earlier quarterly data points have been interpolated (estimated) from annual GDP data. Figure 1: Panel 4 shows percentage change in the Fish meal price. Because the real interest rate is already in percentage I did not log that before first differencing. Figure 1: Panel 5 shows the first differenced real interest rate data, that is, the change in the real interest rate in percentage points in one quarter compared to the previous quarter.

A concern regarding the risk of omitted variables bias (OVB) in the regression is that there is a possibility that financial policy decisions, such as tax cuts or increased government expenditures, have influenced both GDP and the decisions of the board of the CBI when determining the interest rate level. In Iceland the risk is perhaps even greater since the governance of the CBI has been perceived as closely connected with the central government, raising doubts about its independence. This is due to the special structure of the CBI which, unlike most central banks, has not one but three governors and historically at least one of them has been a former politician (Danielsson, 2008)

There is also a possibility, especially with a small open economy such as the Icelandic, that the economic development in the rest of the world influences both the CBI:s interest rate decisions and the domestic GDP. This could potentially cause OVB in the regression. However, to some extent the variables for real exchange rates towards the Eurozone and the US may to some extent control for this. I also experimented with running Icelandic GDP against GDP of the Eurozone but did not get a significant correlation, which suggest that if a potentially biasing effect exists, at least it is not very big.

While trying different specifications of the regression model using some control variables that I later decided to drop (for example I included a variable for the world market price of crude oil at one point but since it was very far from being significant I dropped it) the estimate for the real interest rate variable was more or less the same. This bares some evidence of its robustness.
Figure 1

**Panel 1:** Real exchange rate USA

![Graph of Panel 1: Real exchange rate USA](image1)

Unit: Percentage rate of change

**Panel 2:** Real exchange rate Eurozone

![Graph of Panel 2: Real exchange rate Eurozone](image2)

Unit: Percentage rate of change

**Panel 3:** GDP growth rate

![Graph of Panel 3: GDP growth rate](image3)

Unit: percentage change

**Panel 4:** Growth rate in fish meal price

![Graph of Panel 4: Growth rate in fish meal price](image4)

Unit: percentage change
4.2 Results

The regressions results for model 1 presented in table 1 corresponds to equation (1) and suggests that, holding everything else constant, a 1% change in the real interest rate in Iceland is associated with a −0.064% change in GDP growth. With a p-value of 0.018, the estimate is significant above the 95 %-level that is usually considered a threshold.

The results for model 2 presented in table 1 corresponds to equation (2) which has a lag of one period in the explanatory variables; real interest rate in Iceland, real exchange rate with the US, real exchange rate with the Eurozone and growth rate in fish meal price. The results for model 2 suggests that, holding everything else constant, a 1% change in the real interest rate in Iceland is associated with a −0.049% change in GDP growth. With a p-value of 0.028, the estimate is significant above the 95%-level.
**Table 1:** Regression estimates

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
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<tbody>
<tr>
<td>Intercept</td>
<td>0.861 ***</td>
<td>0.849 ***</td>
</tr>
<tr>
<td></td>
<td>(0.210)</td>
<td>(0.196)</td>
</tr>
<tr>
<td>GDPt-1</td>
<td>(-0.221 **)</td>
<td>(-0.224 **)</td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td>(0.082)</td>
</tr>
<tr>
<td>Real interest rate</td>
<td>(-0.064 *)</td>
<td>(-0.049 *)</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Real exchange rate Eurozone</td>
<td>(-0.003)</td>
<td>(-0.012)</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Real exchange rate USA</td>
<td>(-0.016)</td>
<td>(-0.016)</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>Fish meal price</td>
<td>(-0.024 .)</td>
<td>(-0.009)</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.017)</td>
</tr>
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<td>Adjusted R squared</td>
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<td>0.0374</td>
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<td>Significance codes:</td>
<td>0 ‘<em><strong>’ 0.001 ‘</strong>’ 0.01 ‘</em>’ 0.05 ‘.’ 0.1 ‘’ 1</td>
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</tbody>
</table>

NOTE: Since the Durbin-Watson null-hypothesis of no auto-correlation cannot be rejected the model is computed using Newey-West standard errors in order to compensate for possible autocorrelation (correlation between a time series value and its lagged value) and possible heteroscedasticity (non-constant variance) in order to attain robust standard errors for the estimates.

Beside the real interest rate variable, **Model 1** also shows significant result on the 99% level for the control variable for *GDP growth in period t-1*. The variable for percentage change in the *fish meal price* is also significant, but only on the 90% level. In **model 2** *GDP growth in period t-1* is significant at the same level as in **model 1**, but the *fish meal price* variable is not. However, since non of the models are designed to estimate the effect on *GDP growth* from changes in *fish meal price* or *GDP growth in period t-1*, no real conclusions can be drawn about these potential correlations. The variables for *Real Exchange rate Euro* and *Real Exchange rate US* are not significant at any relevant level in any of the models.

In **Model 1** the adjusted r-squared is 0.049. This means that the included explanatory variables in the regression only explain about 5 percent of the fluctuation in the response variable *GDP growth*. This is a small number which means that there are other major factors influencing the GDP growth in Iceland except for those included in my regression. However, that does not necessarily mean that there is a problem with the model or the result. The main rule still applies; as long as the variables that are not included in the model are not correlated with both the *GDP growth* variable and my
main variable of interest, *Real interest rate*, there will be no risk of omitted variables bias distorting the result. The adjusted r-squared in **model 2** is lower, 0.037, or just below 4 percent.

Choosing between the two models there are a couple of things to take into consideration. On the one hand it is reasonable to believe that the effect from the explanatory variables on *GDP growth* can to some extent be coming with a lag of one or more periods. On the other hand you have to be careful when it comes to lagged effects of variables, since if you only lag sufficiently you can eventually find a correlation between pretty much any two variables. Also if policy changes propagate through the system slow then it is harder for the central bank to control the economy so lagged effects of policy changes therefore have less value to the central bank than more direct effects.

The estimate effect of the main explanatory variable of interest, the *Real interest rate*, is larger in the un-lagged **model 1**, which is in its favour compared to **model 2**. Less important is that model 1 has one more variable, the *fish meal price*, that is significant at the 90% level. But since **model 1** also has a higher value for adjusted r-squared, which means it explains more of the fluctuation in the response variable *GDP growth* than **model 2**, I choose to use the regression results from **model 1** (going forward with the empirical analysis I will refer to the results from **model 1** only as the regression result in **table 1**).

**Table 2** displays the *actual real interest rate* in Iceland from 2004 to 2014 along with the *counterfactual real interest rate*, which is the real interest rate that Iceland would have had if it had been part of the EMU and the nominal interest rate was set by the ECB instead of the CBI. In the third column is the percentage point difference between them. On average the *counterfactual real interest rate* would have been around 7.3 percentage points lower than the *actual real interest rate* in the period between Q1 2004 and Q4 2014. **Figure 2** displays an overview of the first two columns in **table 2**.

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9 I also tested models with 2 and 4 lags in the explanatory variables but when the lag is -2 observation periods or more the estimate of the coefficient for the real interest rate variable changes sign from negative to positive. This suggest that there are other factors, perhaps some sort of economic shock, that dominates the effect of the interest rate over longer periods but it may also be a sign of possible weakness in the specification of the model. In the end this further motivated the choice of using an un-lagged model.
Table 2: Actual real interest rate in Iceland and counterfactual if it had belonged to EMU

<table>
<thead>
<tr>
<th>Year</th>
<th>φActual real interest rate (%)</th>
<th>φCounterfactual real interest rate (%)</th>
<th>φDifference (counterfactual - actual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>2.9</td>
<td>-1.2</td>
<td>-4.0</td>
</tr>
<tr>
<td>2005</td>
<td>5.0</td>
<td>-1.9</td>
<td>-7.0</td>
</tr>
<tr>
<td>2006</td>
<td>5.1</td>
<td>-3.8</td>
<td>-8.9</td>
</tr>
<tr>
<td>2007</td>
<td>8.4</td>
<td>-1.1</td>
<td>-9.5</td>
</tr>
<tr>
<td>2008</td>
<td>3.5</td>
<td>-8.9</td>
<td>-12.4</td>
</tr>
<tr>
<td>2009</td>
<td>1.4</td>
<td>-11.1</td>
<td>-12.5</td>
</tr>
<tr>
<td>2010</td>
<td>2.2</td>
<td>-4.4</td>
<td>-6.6</td>
</tr>
<tr>
<td>2011</td>
<td>0.4</td>
<td>-2.8</td>
<td>-3.2</td>
</tr>
<tr>
<td>2012</td>
<td>0.3</td>
<td>-4.3</td>
<td>-4.6</td>
</tr>
<tr>
<td>2013</td>
<td>2.2</td>
<td>-3.4</td>
<td>-5.5</td>
</tr>
<tr>
<td>2014</td>
<td>3.9</td>
<td>-1.9</td>
<td>-5.8</td>
</tr>
<tr>
<td>Overall average</td>
<td>3.2</td>
<td>-4.1</td>
<td>-7.3</td>
</tr>
</tbody>
</table>

φ = average over the year

Figure 2: Actual versus counterfactual real interest rate

Applying the estimated coefficient of the real interest rate variable from the regression result in table 1 to the average difference between the counterfactual real interest rate and the actual real interest rate (third column in table 2) suggests that the GDP level that would have brought equilibrium to the goods market in the Icelandic economy during these years would, on average, have been $(-7.3) \times (-0.064) \approx 0.47$ percentage
point higher if Iceland had been a member of the EMU. That is when holding everything else constant.  

In table 3 the estimated coefficient of the real interest rate variable, which says that a 1 percent change in the real interest rate in Iceland is associated with a −0.064% change in GDP growth, is applied to the difference between the counterfactual real interest rate and the actual real interest rate for all the years between 2004 and 2014 respectively. The second column in table 3 displays the effect in percentage points that the counterfactual scenario of Iceland being part of the EMU would have had on the Icelandic GDP growth rate for each year respectively according to the regression estimate. The third column in table 3 shows the actual economic growth rate in Iceland during these years. The fourth column in table 3 displays what the GDP growth rate in Iceland would have been for each year respectively between 2004 and 2014 in the counterfactual scenario of Iceland being part of the EMU according to the regression estimate.

It can be concluded the ECB has consistently pursued a more expansionary monetary policy than the CBI during the survey period and the effect of a counterfactual scenario is positive on GDP for every single year given the regression estimate. In the years before the crisis the positive effect is incrementally increasing up to around plus 0.6 percentage point in 2006 and 2007. The largest effect can be seen in 2008 and 2009 when the ECB interest rate would have had a potential effect of adding 0.8 percentage point on GDP growth in Iceland. After that the positive effect is halved going into 2010 and then continues at a lower level the following years.

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10 The counterfactual real interest rate is computed using the nominal interest rate of the ECB and the actual inflation in Iceland in the period 2004-2014. The weight of the Icelandic economy would have been low with the ECB in the counterfactual scenario so it is reasonable to assume that the ECB key interest rate would not have been any different with Iceland in the union. However, inflation is influenced by the nominal interest rate which means that in the counterfactual scenario Iceland’s inflation might have been different under the ECB rate. An alternative would have been to run a regression on inflation as a function of nominal interest rate in Iceland before the crisis and then use that to compute the counterfactual real interest rate instead. However, since that solution is not perfect either, and since the main driving force behind the inflationary pressure in the years leading up to the crisis probably was the boom in the financial sector rather than the nominal interest rate, I decided to go with the simplifying assumption. Nonetheless, this is a possible source of error in the result.
Table 3: What would have happened if Iceland had belonged to the EMU

<table>
<thead>
<tr>
<th>Year</th>
<th>Real interest rate difference (counterfactual – actual)</th>
<th>Effect on GDP growth % according to regression estimate</th>
<th>Actual GDP growth Iceland, annual growth rate (%)</th>
<th>Counterfactual GDP growth Iceland, annual growth rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>–4.0</td>
<td>+0.26</td>
<td>8.2</td>
<td>8.5</td>
</tr>
<tr>
<td>2005</td>
<td>–7.0</td>
<td>+0.45</td>
<td>6.0</td>
<td>6.5</td>
</tr>
<tr>
<td>2006</td>
<td>–8.9</td>
<td>+0.57</td>
<td>4.2</td>
<td>4.8</td>
</tr>
<tr>
<td>2007</td>
<td>–9.5</td>
<td>+0.61</td>
<td>9.7</td>
<td>10.3</td>
</tr>
<tr>
<td>2008</td>
<td>–12.4</td>
<td>+0.80</td>
<td>1.2</td>
<td>2.0</td>
</tr>
<tr>
<td>2009</td>
<td>–12.5</td>
<td>+0.80</td>
<td>–5.1</td>
<td>–4.3</td>
</tr>
<tr>
<td>2010</td>
<td>–6.6</td>
<td>+0.42</td>
<td>–3.1</td>
<td>–2.7</td>
</tr>
<tr>
<td>2011</td>
<td>–3.2</td>
<td>+0.21</td>
<td>2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>2012</td>
<td>–4.6</td>
<td>+0.30</td>
<td>1.3</td>
<td>1.6</td>
</tr>
<tr>
<td>2013</td>
<td>–5.5</td>
<td>+0.35</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>2014</td>
<td>–5.8</td>
<td>+0.37</td>
<td>1.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Average</td>
<td>–7.3</td>
<td>+0.47</td>
<td>2.8</td>
<td>3.3</td>
</tr>
</tbody>
</table>

From 2004 to the end of 2007 the Icelandic economy was growing at an average pace of more than 7 percent annually, at the peak in 2007 the growth rate was 9.7 percent. In the counterfactual scenario when Iceland would have been part of the EMU the growth rate in 2007 would have been even higher, 10.3 percent, according to the regression estimate. The statistical model, however does not take into consideration what Keynesian theory suggests about further expansionary monetary policy in a situation where the economy is already booming. According to Keynes monetary policy should be expansionary in recessions in order to stimulate aggregate demand and fight unemployment. In a boom on the other hand, monetary policy should be contractionary in order to stop the economy from overheating and inflation to spiral out of control.

Keeping that and the high growth rates in mind, it should also be added that the resource utilization in the Icelandic economy in the years before the crisis 2008/2009 was high. In 2004 only 3.1 percent of the Icelanders were unemployed and the rate was dropping, in 2007 it was down to 2.3 percent according to Statistics Iceland. Starting from the second quarter in 2004 inflation was above the 2.5 percent target adopted by the CBI in 2001 and between then and the end of the second quarter in 2008 inflation was on average 5.5 percent, edging up to more than 12 percent by the end of that period.
At the same time credit growth was high, averaging around 50 percent annually from 2004 to 2006, going even higher at around 60 percent in 2007.

During the 2000s the Icelandic government took a string of stimulating financial policy decisions, for example; lowering corporate taxes from 30% to 18% at the end of 2001 and in February 2008 even further to 15%, cutting the personal income tax rate by 1% each year from 2005 to 2007, abolishing wealth taxes and lowering the value added tax in 2007 (Benediktsdottir, Danielsson, Zoega, 2011). Taking all this into consideration it can be concluded that there are a number of factors suggesting that even lower interest rates during the years leading up to the crisis, as would have been the case within the EMU, would have fuelled the overheating of the Icelandic economy.

Looking at the worst crisis years 2008-2010 when the Icelandic output fell and the economy shrank with 5.1 percent in 2009 and 3.1 percent in 2010, unemployment went from very low levels before the crisis to around 7 percent in 2010, then Iceland would have benefitted from the lower interest rates of the ECB. According to my model the estimated positive effect on output growth in 2008 and 2009 would have been almost 0.8 percentage points, all else equal, and around 0.4 percentage points in 2010.

Since then however, the Icelandic economy has recovered. The spread between the actual real interest rate and the counterfactual real interest rate if Iceland had been part of the EMU is narrowed down in 2011 and the estimated positive effect on GDP growth is subsequently smaller than during the most critical years of the crisis. One reason for this is that the capital controls that was introduced on the advice of IMF in the end of 2008 enabled the CBI to lower the interest rate without risk of vast outflows of capital and further downward pressure on the, by then already sharply depreciated Icelandic króna. The capital controls (still in place May 2015) however do not come without a cost since one consequence is suppression of international capital investments in the Icelandic economy. Within the EMU these controls would neither have been necessary nor possible.

A number of south European examples, Greece to name one, bares evidence of the sacrifices that is associated with trying to increase competitiveness by reducing wages. Unlike for these countries within the EMU Iceland benefitted from the sharp depreciation of the króna due to the crisis which resulted in an immediate gain in competitiveness, according to the IMF (2015). This should have a positive influence on
GDP growth, but in my regression (table 1) I cannot establish a significant estimate for either the variable Real Exchange rate Euro nor the variable Real Exchange rate USA.

This may be connected to what Wade and Sigurgeirsdotir (2012) points out about the Icelandic export sector historically having been heavy on lightly processed natural resources that cannot to the same extent take advantage of exchange rate depreciations as more refined products. If this is true, then adopting the euro would have made no difference for the development of Iceland's GDP. However, a possible explanation is also that this effect might come with a lag of several quarters and therefore is not detectable within my model.

4.3 Conclusion

After four years with annual GDP growth rates averaging more than 7 percent Iceland experienced a sharp economic downturn with the eruption of global financial crisis in the fall of 2008. The country's booming financial sector was literally wiped out in the span of a single week and the country went into a recession in 2009, which extended into 2010. The economic downturn sparked a debate in Iceland about whether or not the country would have been better off if it would have been a member of the EU and the European Monetary Union and in 2009 Iceland filed an application for EU membership.

My study of the counterfactual scenario where Iceland would have been part of the EMU before and during the crisis shows that there are a number of factors suggesting that the consistently more expansionary monetary of the ECB compared to the central bank of Iceland would have fuelled the overheating of the Icelandic economy in the years between 2004 and 2008. According to my estimates the ECB interest rate would have had a potential effect of adding approximately an extra 0.6 percentage point on the annual GDP growth in 2006 and 2007. That would have resulted in a staggering 10.3 percent growth rate in Iceland in 2007 and this at a point when resource utilization was already very high in Iceland. For example unemployment was down at 2.3 percent in 2007 and credit growth at the same time was around 60 percent. Given this, basic Keynesian theory suggests that the more expansionary policy of the ECB compared to the CBI (which was at this time raising the key interest rate to try to fight inflation which
was hovering around 7-8 percent in 2006) would have resulted in a even steeper economic downturn in Iceland in 2008/2009.

The three major Icelandic banks that collapsed in 2008 might have been saved if they had been backed up by the ECB instead of the CBI, which was too small to constitute a credible lender of last resort (Hilmarsson, 2013). But having a financial sector that in 2007 had consolidated assets equivalent to 900 percent of Iceland’s GDP may not have been a sustainable and benign situation for the Icelanders anyway.

Since 2011 the Icelandic economy is growing again, but at a more moderate pace than before the crisis. Although I cannot establish a significant effect on GDP from exchange rate fluctuations in my model, it is reasonable to believe that the depreciation of the króna in fact has helped the Icelandic export sector to gain competitiveness, an advantage that crisis hit Eurozone countries have not had.

Last year the Icelandic economy grew a solid 1.9 percent and in 2015 it is expected to surpass the pre-crisis GDP level (IMF, 2015). At the same time Iceland pulled back its application to enter the EU. My assessment is that it might have been a wise decision.
5. References


