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The Icelandic banking collapse: was the optimal policy path chosen?[‡]

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Abstract

This study examines the economic policies of the Icelandic government in the wake of the banking collapse of 2008 in terms of counter-factual policy options. The path chosen was important for the recovery but policy makers faced alternative policy options for handling the many difficult situations that arose, with potential implications for government finances and economic growth. We utilize two complementary macroeconomic models to assess the decisions taken and the recovery and on that basis develop counter-factual scenarios of how the crisis could have played out if the decisions had been different. Four alternative scenarios are considered involving different ways to deal with the collapse: *i*) adopt a more pro-cyclical fiscal policy, *ii*) allow the ISK exchange rate to drop without imposing capital controls, *iii*) pay the interest expense on the initial Icesave agreement, or *iv*) rescue the banks as Ireland did. Macroeconomic model simulations are performed to assess the impact of different decisions involving public finances on economic growth, unemployment and other macroeconomic variables over the period 2008-2025. The results are compared to the actual path taken. Addressing this question is potentially interesting in its own right and also from the point of view of other countries that have experienced similar crises but have responded differently.

Keywords: Iceland, Financial crisis, Banking reform, Deposit insurance, Fiscal policy, Public debt, Capital controls, Exchange rate, Model simulations, Economic growth
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1. **Introduction**

The banking collapse in Iceland in October 2008 was one of the largest in modern financial history. It involved three large internationalised banks, Kaupthing, Glitnir and Landsbanki. However, while Iceland was one of the first countries to be affected by a financial crisis in 2006 and endured the collapse of its large banks it has also been one of the first countries to begin to recover from the crisis. The policies of the authorities, with assistance from the International Monetary Fund and neighboring countries, contained the damage and prepared the ground for recovery.

While the path chosen was important for the recovery, policy makers faced alternative paths for handling the many difficult situations that arose, with potential implications for government finances and economic growth. This study examines the decisions taken and the recovery and on that basis develops counter-factual scenarios of how the crisis could have played out if the decisions had been different. Four alternative scenarios are considered involving different ways to deal with the collapse:

1) adopt a more pro-cyclical fiscal policy,
2) allow the ISK exchange rate to drop without imposing capital controls,
3) pay the interest expense on the initial Icesave agreement, or
4) rescue the banks as Ireland did.

The research is based on two complementary macroeconomic models, which are used to simulate the impact of different decisions involving public finances on economic growth, unemployment and other macroeconomic variables over the period 2008-2025. The results are compared to the actual path taken. Addressing this question is potentially interesting in its own right and also from the point of view of other countries that have experienced similar crises but have responded differently.

2. **How has Iceland dealt with its banking collapse?**

There were four key policy issues that arose during the economic boom from 2003 to 2007, namely i) a huge internationalised banking system, ii) a highly indebted private sector, iii) an overhang of ISK assets in foreign hands, and iv) an insufficient capacity of the central bank to act as lender of last resort in foreign currency. This chapter focuses on how these issues arose and their resolution following the banking collapse, which is the basis of the baseline scenario.

a. ***Growing domestic imbalances in the boom***. Following the mini-recession of 2002, a construction boom developed in the Icelandic economy, linked to a large-scale investment project, with GDP growing on average 4.6 percent between 2003 and 2007. As seen in the report by the Central Bank of Iceland (2009), private sector debts began to rise at an unprecedented rate, reaching almost 500 percent of GDP before the collapse. Firm debts to the financial system amounted to around 375 percent of GDP in 2008 while household debts were around 125 percent of GDP of debt. The household debt denominated in foreign currency went from around 2 percent of GDP in 2003 to 20 percent in 2008. General government finances, however, continued on a sharply improving trend, with the general government revenue balance improving by 6 percent from 2003 to 2007. The debt of general government, aided also by privatization proceeds, fell from 59 percent of GDP in 1995 to 28 percent in 2007 (see e.g. Ministry of Finance, 2006 and 2009a). Meanwhile, the government's interest expense fell from 3.5 percent of GDP in the mid-1990s to around 2 percent in 2007, also helped by exceptionally low financing costs internationally. To curtail the economic boom, the CBI enacted a restrictive monetary policy, with the policy interest rate rising from 5.3 percent in May 2004 to 15.5 percent in April 2008. Due to a sharp rise in imports, the current account balance swung into a large deficit, averaging 23 percent of GDP in 2006 and 2007. Inflation increased, in part due to booming house prices and rising unit labour costs and in spite of an appreciation in the Icelandic Krona (ISK). As house prices are included in the basket of goods and services that make up the Icelandic consumer price index, different from e,g, the harmonized inflation measure of the EU, the asset price bubble had

an influence to make the domestic monetary policy more restrictive. The restrictive policy stance meant that a growing interest rate differential was developing given the low international interest rates. This situation was accompanied by an unwelcome development. As short term interest rates reached 10 percent in September 2005, foreign speculative investments began to flood the domestic financial market adding to the credit boom and strengthening the ISK (Ministry of Finance, 2009a). However, as explained by e.g. Danielsson (2011), there were other factors contributing to the surge in ISK denominated assets in foreign hands such as the steady improvement in government finances, the international size and scope of the Icelandic banks, the strong domestic credit demand and the stellar credit ratings of the Icelandic banks. These investment positions became a major problem in the autumn of 2008 when ISK asset holders rushed to the exits and the value of the ISK collapsed.

b. ***Bank's expansion abroad***. As brought out by Gudmundsson and Thorgeirsson (2010), the economic boom was profoundly affected by the huge growth of the Icelandic banks which was concentrated on their cross-border activities. In the decade following Iceland's accession to the European Economic Area agreement in 1994, the Icelandic banks were privatised. From 2003, when the bank privatization was complete, the banks began to expand their activities in a number of countries on the Single Market. This development was soon reflected in their balance sheets, with the bank's total assets growing from 1.7 times GDP in 2003 to just over 10 times GDP in 2008 (see e.g. Central Bank of Iceland, 2011a). Over the same time, the share of foreign currency denominated assets went from a relatively low figure to around 2/3 of their total balance sheets. As the foreign assets of the banks increased so did their incentive to lend in foreign currency (Special Investigative Committee of Althingi, 2010a). In 2005 – 2007, the Icelandic banks profited from making increased foreign currency loans in Iceland as the interest rate differential increased. However, the exchange rate risk of their customers also increased and in turn the banks' own credit and default risk associated with a potential depreciation of the Icelandic krona. There were warnings, by e.g. Thorgeirsson (2003), of the potential financial stability risks associated with a high policy interest rate path during the boom linked to a pronounced exchange rate cycle. Few, however, could envision the enormous expansion of the newly privatised Icelandic banks or the behaviour that led to their collapse. For instance, the banks engaged in making large loans to connected parties and each other thereby increasing their vulnerability to each other while rapidly increasing the leverage in the financial system as whole. As a result of such behaviour, the banks sharply increased systemic risk in Iceland. Moreover, the banking practices were in-transparent, making it hard for the domestic and foreign regulatory authorities to understand and react to the risky developments. The actions of the authorities were predicated on the belief that the banks were facing a liquidity crisis when in fact the problems had transformed into a serious solvency issue. In early 2006, concerns began to be voiced abroad about the viability of the business model of the Icelandic banks and they began to experience headwinds on the international wholesale funding market. While the banks managed to refinance themselves in late 2006, an international financial crisis was brewing. In 2007, a full blown crisis was triggered first by defaults in subprime lending in the USA which grew as other banking problems came to light. As the crisis deepened, the Icelandic banks also made extensive use of the liquidity facility of the Central Bank of Iceland and the ECB. Following the collapse of Lehman Brothers bank on 15 September 2008, liquidity on the international wholesale funding markets completely dried up. On 25 September, Glitnir bank asked the Central Bank of Iceland (CBI) for liquidity assistance. As news of the difficulties spread, a deposit run commenced on all of the Icelandic banks both at home and abroad.

c. ***Bank collapse and resurrection.*** While the government of Iceland had been close to bailing out the first casualty of the wholesale funding crisis, Glitnir bank, this option was soon taken off the table (Special Investigative Committee of Althingi, 2010b). As the crisis unfolded, it became clear that the refinancing requirements of Glitnir bank in foreign currency far outweighed the government's capacity to offer lender of last resorts financing in foreign currency.[1] At this time, the CBI granted Kaupthing bank a €500 million loan against collateral in the Danish investment bank FIH and the Central Bank of

[1] Gudmundsson (2007) signaled the scope for such limitations in the case of Iceland in May 2007. However, as late as January 2008, a complete freezing out of the Icelandic government and banks in international lending markets was not everywhere a foregone conclusion. See for example Moody's Global Sovereign (2008).

Sweden extended a loan to Kaupthings' subsidiary in that country. However, in the following days it became clear Landsbanki and Kaupthing bank were likely to fall victim to the crisis as well. Efforts to secure foreign currency loans from other central banks to sufficiently boost the lender of last resort financing capacity of the CBI since early 2008 had proved futile. As no coordinated rescue plan had been identified, the common sense solution for Iceland was to allow the banks to fail rather than try to assume their exorbitant liabilities.

The logic of public rescues of privately held banks is that by buying distressed banking assets at fire sale prices, the government i) stands to gain through asset revaluations once the panic abates, and ii) helps increase welfare by preventing a meltdown of the financial system and the mass unemployment associated with a deep and long lasting recession. A full rescue of the Icelandic banks was not possible as the government lacked foreign currency to rescue the banks and sufficient foreign currency loans were not forthcoming. Moreover, in so far as the majority of creditors benefitting from the purchases were located abroad, the direct welfare benefit was not there. A rescue of the domestic part of the banking system in domestic currency was, however, possible and made good sense. Indeed, continued banking services for the domestic economy needed to be secured.

On October 6, 2008, the parliament passed emergency legislation which gave the Financial Supervisory Authority (FME) the power to intervene in the banks.[2] The decision by the FME to split the banks into domestic and foreign operations was made on October 9.[3] As the old banks were placed into receivership, their domestic assets were ring-fenced in new domestic banks which were created on the following day. Arion bank, Islandsbanki and Landsbanki were erected on the basis of the old banks' domestic operations in order to preserve banking operations in the country. The government then issued a guarantee for the deposits of the new domestic banks, denominated in ISK. The foreign operations of the failed banks were given over to the FME and later resolution committees to resolve their assets and liabilities, with priority having been given to deposits over other claims. The foreign/domestic split involved an assessment of the price to be paid for the domestic assets of the old banks. After this split was completed, the new banks were recapitalised by the government. An agreement was also reached with creditors of Islandsbanki (formerly Glitnir bank) and Arion banki (formerly Kaupthing bank) to give them majority ownership in turn for limiting the government's recapitalisation of these banks. In the bank resolution process foreign creditors acquired further ISK assets which added to the stock that needs to be dealt with in terms of future capital outflows.

d. ***Restructuring of private debts.*** The agreement to purchase domestic assets by the new banks from the old banks was based on a deep discount in view of the expected significant write-down in private sector debts. Following the exchange rate drop in 2008, households were burdened by an almost twenty percent decline in their real income, which was compounded by significant across-the-board tax increases and cutbacks in public expenditure. Despite a program allowing the early withdrawal of voluntary extra pension savings, the number of households unable to service their inflation- or exchange-indexed debts increased sharply. A report by the Prime Minister's Office (2010) finds that in November 2010, upwards of 15 percent of households were estimated to still be having problems servicing their debts. To address the problems of financially distressed households, the government introduced a program of freezing the repayment of loans, individual refinancing for families unable to continue servicing their mortgages, including a write-down of the principal. There was also a program to limit the negative equity to 110 percent of the value of the home. For the remaining households, a program of extending the indexed mortgage loans to reduce the monthly payment was offered. Ameliorating the situation of some households was the ruling by the courts that the use of an exchange rate basket to index consumer loans was illegal. This resulted in further write-downs and the reduction of the debt burden on households with such loans. Bankrupt firms were taken over by the new banks

[2] The drafting of the Emergency legislation began in 2006 in the FME and Ministry of Business Affairs and continued in a legal committee of the Advisory group (Samráðshópur).

[3] A Nordic-Baltic bank rescue exercise in the Autumn of 2007 clarified how to deal with a large international bank default. Helping to refine the foreign-domestic split of the banks was an article by Onundarson (2008) and intensive work of experts on the eve of the collapse.

and refinanced if a suitable business plan and management could be identified but otherwise liquidated.

e. ***Icesave dispute***. Icesave was an online retail savings account operated by branches of Landsbanki in the UK and Netherlands under EU/EEA regulations, subject to surveillance by the Icelandic financial supervisory authority, FME. From 2006, Landsbanki had begun attracting deposits in its branches in the UK and Netherlands, with the minimum deposit guarantees exceeding 4 billion pounds by October 2008. After the old banks collapsed, the on-shore foreign exchange market in Iceland ceased to function. Making things worse was the decision on October 8 by the British government to apply freezing order on the assets of the Icelandic State, the CBI and Landsbanki, based on its Anti-terrorism, Crime and Security Act 2001, ostensibly to stop the Icelandic banks from moving their assets out of the UK. The measure, however, was likely linked to the brewing debate over the obligation of the Icelandic state to guarantee a minimum payment of deposits in Landsbanki branches in the UK and the Netherlands based on EU rules guiding the Depositors' and Investors' Guarantee Fund (DIGF). An emergency situation developed for Iceland's import dependent economy as foreign payments and settlements ground to a halt. After the terrorist legislation was lifted of the Icelandic state and CBI a short while later the international transactions gradually resumed, initially through the Central Bank of Iceland and later through the new banks. Due to the funding shortfall of the Central Bank of Iceland, the deposits at British and Dutch bank branches of Landsbanki were left to the respective governments to deal with. In turn, the British and Dutch authorities made a claim on the Icelandic government to guarantee the deposits in line with their legal interpretation of the applicable EU directives. Moreover, as they had made a unilateral decision to pay out the deposits as guaranteed, they demanded that Iceland pay for the interest cost until such time when the deposit payments were completed. The Icelandic government was of the view, as was later shown to be correct, that assets recovered from the failed bank would cover most of the guaranteed deposits and that it did not have responsibility for the 'obligation of result'. A framework for the resolution of the Icesave dispute was agreed on November 16, 2008, however, when it was accepted that the Icelandic government would have the right to seek a legal resolution of the Icesave dispute even if it entered into negotiations with the British and Dutch governments to settle the Icesave issue. The agreement stipulated that the Deposit Guarantee Directive 94/19/EC is applicable in Iceland in the same way as it is applicable in EU Member States.

Until early 2011, Iceland negotiated several agreements with the British and Dutch authorities to resolve the Icesave dispute. According to estimates of the Ministry of Finance (2012), the memorandum of understanding in November 2008 would have entailed around 17 percent of GDP in interest costs net of assets, with the Icelandic government also responsible for the principal involved. Due to a change in government in 2009, the agreement was not concluded and new negotiations began. The first agreement concluded in June 2009 reduced the interest payment to around 13 percent, with payments beginning in 2009 and lasting until 2017. As the Parliament attached preconditions to this agreement it was rejected by the British and Dutch authorities in September 2009. In December 2009, the Parliament approved a new agreement with the interest cost reduced still further and some concessions on the British and Dutch sides but without the general preconditions of the earlier agreement. Bowing to increasing public pressure, the President of Iceland refused to sign the agreement into law and it was subsequently rejected in a national referendum in March 2010. A new round of negotiations began resulting in a third agreement, with the interest cost being reduced by half. Again, the Parliament approved the agreement but the President refused to sign it. This agreement was also rejected in a referendum. In September 2012, the EFTA Surveillance Authority sued Iceland before the EFTA Court. On January 28, 2013, the court ruled to dismiss the case against Iceland, effectively ending the dispute. During the process, the Icelandic government or DIGF never made any payments, including on the interest cost, although substantial payments were made out of the assets of the failed bank. The court decision removed any uncertainty regarding Iceland's international obligations in this regard. Following the decision, Moody's ratings agency changed the outlook for Icelandic sovereign debt from negative to stable. The judgment is also expected to facilitate the removal of the capital controls, although other challenges remain concerning the ISK assets of foreign residents.

f. ***IMF agreement.*** The IMF entered the picture in October and began to discuss a Stand-By Arrangement (SBA) with the government. The SBA would provide Iceland with sufficient financial backstops but only if the government agreed to certain conditions. On November 25, the government of Iceland and the IMF reached an agreement on a SBA for Iceland with the following three main objectives:

1. Prevent a further sharp ISK depreciation with capital controls.
2. Medium-term fiscal consolidation strategy to return the revenue balance into surplus by 2014, although the automatic stabilisers of fiscal policy were allowed to operate in full in 2009.
3. Develop a restructuring strategy for the domestic banking system.

As part of the agreement, Iceland was to receive financial backstops, amounting to USD 4.6 billion (33.7 percent of average GDP during SBA) in loans from the IMF and neighboring countries. The intended use for these funds was to boost the foreign exchange reserves of the CBI and facilitate the refinancing of the government budget. When the SBA ended on 31 August 2011, it was considered to have been a success in terms of the progress made towards realising the main objectives, although the lifting of the capital controls and future fiscal consolidation targets was recognised to require further efforts.

g. ***The role of fiscal policy.*** Following the banking crisis, the public debt share surged to 88 percent of GDP in 2009, with the interest expense rising to 6.0 percent of GDP. While the debt share rose to 101 percent of GDP in 2011 (Central Bank of Iceland, 2012), the interest expense fell back to 4.0 percent of GDP, in part due to more favourable credit terms associated with the adoption of capital controls (see below). These figures exclude the interest costs associated with the Icesave issue, due to the failure to complete an agreement. The loans obtained through the SBA were expected to be paid back when the IMF program ended, thus reducing the debt level significantly. In the event, some of the loans were refinanced in view of delays in lifting the capital controls. In 2009, the automatic stabilisers of fiscal policy, reflecting cyclical influences, were allowed to operate. The medium term fiscal consolidation strategy included an even blend of tax increases and expenditure cuts. The budget in 2010 was then tightened considerably, but in 2011, some easing of fiscal policy was allowed in view of the good progress of the program, although it continued restrictive. Nevertheless, as foreseen in the plan, the budget deficit of 2012 was quite small and a modest surplus is expected to emerge in 2013. As brought out by Ghosh et al. (2009), the overall policy approach, in line with recommendations by IMF staff at the time, also aimed at dealing with the debt overhang and shortfalls in external demand. Petursson (2013) provides circumstantial evidence that indicates the fiscal multiplier in Iceland has been quite low in the recovery period. Indeed, Ilzetzki, Mendoza and Vegh (2011) find that fiscal multipliers are lower in small open economies because of the crowding out of net exports. If so, the burden of fiscal consolidation has likely been easier in Iceland than in some of the southern euro countries. Frankel (2013), who has surveyed the fiscal multiplier debate, finds that the multipliers can be greater under given conditions. Countries like Greece have found themselves in a situation of pro-cyclical fiscal policy. While an improvement in their deficit and debt should reduce their market based risk premia going forward, especially if the country engages also in structural reforms and has a credible near term financial backstops, their recovery has been made more difficult by the contraction of domestic demand associated with the fiscal consolidation.

h. ***Capital controls and financial conditions.*** The bank collapse caused a major drop in asset prices and in the value of the exchange rate of the ISK, which fell around 45 percent in 2008. Over 90 percent of the value of the Icelandic stock exchange was wiped out. The descent of the ISK was finally arrested with the adoption of widespread restrictions on capital movements on 28 November 2008. The value of the ISK recovered a bit after that, but has since then fluctuated within a fairly narrow range, although there have been strains on it due to imbalances in capital flows associated with the settlement of foreign claims. The adoption of capital controls helped prevent significant outflows of capital, variously estimated at 35 - 60 percent of GDP, which would have further destabilised the Icelandic economy. The outflows involve ISK assets held by foreign residents, either in bonds, bank

deposits or assets in the old bank estates. Within the controls, the liquid funds have served as a source of credit on the domestic financial market, keeping risk premia likely lower than otherwise would have been the case. Nevertheless, nominal interest rates in Iceland have continued considerably higher than in neighboring countries in the post-crash period, associated with persistent inflation pressures. Due to the size of the ISK asset overhang the lifting of the capital controls, a process now in its fourth year, has taken longer than initially expected, although no firm date has been set for the lifting of the controls.In the absence of new lending in foreign currency, the scope for the lifting of capital controls is constrained by the evolution in balance of payments as it determines the outflows consistent with a relatively stable exchange rate (see e.g. Central Bank of Iceland, 2011b).

i. ***Recession and recovery.*** Bankruptcies and unemployment skyrocketed in the winter of 2008 and 2009 and stayed at a high level for several years. GDP growth, which had turned slightly negative in the second half of 2008, contracted by 6.6 percent in 2009 and 4.0 percent in 2010 before stabilising in 2011 with the economy growing by 2.5 percent that year and the next. The unemployment rate, which averaged around 8 percent in 2009 and 2010, declined to 7.4 percent in 2011 and 5.8 percent in 2012. Inflation, which averaged over 12 percent in 2008 and 2009, declined to 5.4 percent in 2010 and 4.0 percent in 2011. Due to a weakening of the ISK in 2012, inflation increased slightly, to 5.2 percent that year. As a result of the improving domestic trends, the financing conditions abroad facing Iceland also began to improve. In August 2011, the Icelandic government sold a 5 year bond worth $1 billion on the US financial market with an annual yield of just under 5 percent. The issue was considered a success given the difficult condition of international credit markets at that time, notably in the euro area. Accordingly, some interpreted this as a sign of growing international market confidence in the prospects for the Icelandic economy and government finances based on policies adopted up to that date. Monetary policy has reflected the inflation trend, with the CBI reducing its interest rates in line with a disinflationary trend. The collateralised loan rate fell from 18 percent in March 2009 to 4.25 percent January 2011. Despite a more pessimistic outlook in the euro-area and some softening in the domestic GDP growth rate, monetary policy interest rates have come back up again since July 2011. Given the stubborn refusal of inflation to drop down to the 2.5 inflation target, the key policy rate stood at 6 percent in early 2013.

3. **What alternative scenarios could have been envisaged?**

We consider four alternative scenarios, the key assumptions of which are summarised in the table below. The first scenario involves a more active counter-cyclical fiscal policy path than was actually pursued, taking the actual development of the Icesave dispute and how the banking collapse was managed as given. The second scenario involves the exchange rate collapsing without the imposition of capital controls but with a somewhat tighter fiscal policy aimed at regaining policy credibility. The third scenario assumes the Icelandic government took responsibility for the Icesave deposits in the UK and Netherlands while following the actual management of the banking collapse and the fiscal policy path of the baseline. In other words, no additional stimulus is assumed and the size of the deficit and debt simply reflects the additional cost. This is in alignment with initial proposals for the resolution of the banking collapse. The fourth path is to explore the consequences of following the Irish way of guaranteeing the three major banks, based on a comparable fiscal policy path taken there. This assumes international backstops would have been provided to refinance and recapitalise the banks.

Table 1: **Overview of main assumptions**

	Baseline	***1. Going for growth***	***2. Tough medicine***	***3. Private to Public***	***4. Full Monty***
Capital controls	*Yes*	*Yes*	*No*	*Yes*	*Yes*
Bank rescue	*Domestic*	*Domestic*	*Domestic*	*Domestic*	*Foreign & domestic (Irish solution)*
Icesave liabilities	*No payment*	*No payment*	*No payment*	*Payment as per Icesave I*	*Payment as per Icesave III*
Fiscal policy	*Consolidat-ion as per IMF agreem.*	*Less restrictive than baseline*	*More restrictive than baseline*	*Baseline + Icesave costs*	*Baseline + Icesave & rescue costs*

*3.1. Alternative 1: ´**Going for growth**‘ - a more counter-cyclical fiscal policy*

Against the backdrop of actual developments it is useful to explore what would have happened if Iceland had adopted a more counter-cyclical policy path, but taking as given the actual development of the Icesave dispute and how the banking collapse was managed. In 2009, there were proposals to apply straight line write-downs of the household mortgage debts held by the new banks. The proposals, by e.g. Gunnlaugsson (2009) and Herbertsson (2009), suggested the scope for such write-downs was in the new banks themselves, some commentators, like Matthiasson (2009), thought it likely the cost would ultimately be borne by the government. A report of the Prime Minister‘s Office (2010), suggested the cost of write-downs could be upto 11 percent of GDP, while the earlier proposals suggested higher amounts. It is also possible to consider the Going for growth exercise to revolve around traditional fiscal policy stimulus. In line with a report by the Ministry of Finance (2009b), which contains a scenario without fiscal consolidation, 16 percent of GDP are assumed to be devoted to boost demand between 2009 and 2013. It is further assumed that financial backstops in foreign currency would have been available despite the absence of fiscal consolidation. Under this scenario, we expect faster economic growth in the short run but that in the longer run it would be outweighed by the adverse growth impact of higher debt and interest rates as. Importantly, this result is expected to derive even if the influence of outside risk premia is not considered important in the period 2009-2013, while interest rates are largely exogenous in the presence of capital controls. However, it is assumed that this would become more important later on as the controls are lifted in the presence of less fiscal space.[4]

*3.2 Alternative 2: **‘Tough medicine‘** - no capital controls and tighter fiscal policy*

Iceland lost access to private and public foreign-denominated liquidity as the global financial crisis deepened in early 2008. By October 2008, the exchange rate of the ISK had fallen by 40 percent since the beginning of the year and inflation began to rise sharply. This development had serious repercussions for financial stability as loans indexed to inflation or a basket of foreign currencies, but serviced with ISK, went into arrears. On November 28, 2008, capital controls were adopted as the depreciation of the ISK reached 50 percent from the same time one year earlier. While measures

[4] In this paper, the theoretical measure of Padoan, Silas and van den Noord (2012) of fiscal policy space is used. For background, Heller (2005) discusses the concept of *fiscal space* in terms of the fiscal balance and the related concept of *fiscal sustainability* in terms of debt servicing requirements. Ostry et al. (2010) bring out how fiscal sustainability requirements have limited the fiscal space in the sovereign debt crisis, with the fiscal space defined as “the difference between the debt limit and current debt.“ By comparison, Elmeskov and Sutherland (2012) define a *fiscal gap*, a more technical measure, as “the immediate and permanent improvement in the underlying primary balance that is required to ensure that debt meets a target at a certain point in time.“

aimed at liberalising aspects of the controls have been introduced over the intervening time, such as permitting outflows of capital that derives from interest income or the sale of new investments, the significant aspects of the controls were still in place in early 2013. The capital controls stabilised the exchange rate of the krona to a large extent and have affected the availability of loanable funds and their costs.

In the second scenario, we assume that capital controls would not have been imposed and the exchange rate would have been allowed to plummet further, finding a market-determined bottom. In doing so, we assume the ISK exchange rate follows the path set by the offshore exchange rate (as opposed to the onshore rate with capital controls), which has been volatile but has mostly fluctuated around 250-280 ISK/EUR while the onshore rate has remained in the 150-180 range. In this scenario, it is likely the policy interest rate and market determined interest rates would have been considerably higher, at least initially. A further tightening of fiscal policy is also assumed beyond the baseline scenario, as the authorities would likely have been forced to seek more policy credibility. We assume the outcome of the bank resolution and Icesave cases to have followed the baseline case. In this scenario, the endogenous nature of the interest rate is allowed to exert itself with negative repercussions for economic activity, as greater instability in financial and economic conditions coupled with a more restrictive fiscal policy path would have sharply curtailed growth at the outset while the longer term development would likely be better in growth terms, albeit at a lower level.

3.3 Alternative 3: ***'Private to public' - paying for Icesave up front***

The third scenario involves the cost of the financial crisis having been greater up front, as assumed in the memorandum of understanding concerning the Icesave issue in November 2008. The change in government in early February 2009 entailed new negotiations. Following the October 2008 collapse of Iceland's three largest banks, Landsbanki went into receivership and Icesave depositors were unable to access their accounts. Subsequently, the UK authorities reimbursed Icesave retail depositors in full, while the Dutch authorities paid up to 100 thousand euros per depositor. Iceland's Depositors' and Investors' Guarantee Fund (DIGF), established under EU legislation, only had assets amounting to a fraction of the Icesave deposits. Talks therefore commenced on the Icelandic Government's possible guarantee of the amount of the EU minimum deposit guarantee, 20,887 euros per depositor. Under the agreement (Icesave I) reached in June 2009, the DIGF would take a State-guaranteed loan from the UK and the Netherlands to reimburse 2.35 billion pounds (496 b.kr.) and 1.33 billion euros (239 b.kr.), respectively, which was the total amount covered by the minimum deposit guarantee. The loan was to be spread over 15 years, with an interest rate of 5,55 percent for the first seven years and thereafter the OECD CIRR1 rate would apply. As for payment on principal, a grace period of seven years was agreed, where repayment would come out of recovered assets only. Sighvatsson and Gunnarson (2011) estimated that the gross interest bearing Icesave-claims amounted to 42 percent of GDP. Further, the Central Bank of Iceland estimated the net present value of the agreed claim, mostly the payment of interest on the principal, as amounting to ISK 220 billion, or 14 percent of GDP in 2009. Reducing the risk to Iceland was the fact that initial estimates of asset recovery from the Landsbanki estate amounted to 75-100 percent of the claimed deposit liabilities. The estimate of recoverable assets has increased over time and now exceeds 100 percent.

In the third scenario, we consider the implications if the Icelandic government would have shouldered the Icesave burden up front. It would likely have represented a more difficult short term development but an uncertain long term outlook, due to the legal uncertainty about where the liabilities really belong. Estimates of the cost of the Icesave agreements have varied. The most recent estimate of the Ministry of Finance (2012) for the cost of the first Icesave agreement of June 2009 is near 13 percent of GDP while the second agreement in December of that year saw the cost decline to 9 percent. In this exercise, we assume the asset recovery from the estate is in excess of 100 percent, as recent information suggests, and that the government pays interest cost amounting to around 12 percent of GDP.

3.4. Alternative 4: ***Full Monty - replicating the Irish rescue***

The fourth scenario explores the consequences of following the Irish path of guaranteeing the domestic and foreign obligations of the three large Icelandic banks. This simulation, even if unrealistic, is useful to gauge the impact on the economy based on a comparable fiscal policy path taken in Ireland, assuming international backstops would have been provided to recapitalise and refinance the banks. Unlike in Ireland, where the government guaranteed the liabilities of the entire domestic banking system with financial support from the European Union, Icelandic policy makers decided it was futile to try to bail out the three large banks. The reason was not only their enormous size, or almost 10 times GDP when the crisis struck, but the fact that over two thirds of their assets and liabilities were in foreign currencies while the foreign currency reserves of the country amounted to only 35 percent of GDP. As government finances were inundated by the crisis, foreign currency loans were secured from the IMF and neighboring governments as part of a stand-by-arrangement.

The Irish and Icelandic banks were largely funded from abroad but their lending pattern differed. The lending of the Irish banks was mostly for domestic housing, while the lending of the Icelandic banks was split between agents in Iceland (1/3) and in neighbouring countries (2/3). Even then some of the domestic lending found its way into projects abroad. The domestic impact of not bailing out the Irish banks would have potentially been more favourable than bailing them out as the losses would have been incurred largely by international creditors and the lower debts of not bailing them out would have implied a lower burden on public finances and economic activity going forward. The Icelandic counterfactual exercise may illustrate this point by simulating the bailing out of senior creditor's equivalent to the Irish bail-out. In other words, the counterfactual aims to illustrate what could have happened in Iceland if a bank rescue would have been attempted. The basic assumption of the Full Monty scenario is that if Iceland bailed out its three large banks, the government ended up with much higher public debt. Moreover, we assume the government was unable to consolidate its budget beyond what the baseline implies. In doing so, the additional burden of a more ambitious bank recapitalisation is shown with a much bigger deficit. We take into account that our deficit and debt numbers overlap with the baseline scenario involving the recapitalisation of Landsbanki bank, which is around one-third of the downsized domestic banking system, estimated to be 1.8 times GDP in 2011. We also assume capital controls in place from November 2008, with the interest rate premium to be unaffected relative to baseline until 2014, when it is assumed the controls are lifted.

In constructing the scenario for a rescue of the Icelandic banks, we first note that the cost of recapitalising the banks is usually much less than the cost of refinancing the liabilities of banks, as the bank's capital is normally only a fraction of their debts (hence the term fractional reserve banking). Indeed, the refinancing needs of the Icelandic banks were estimated to be close to 350 percent of GDP in the ten years following their collapse. The recapitalisation requirement of the Icelandic banks would have been considerably less than this amount, and we assume it is 40 percent of GDP, improving the bank's asset quality problems while also wiping out a large part of shareholder equity. Further, we heroically assume that once the recapitalisation is secured, the more favourable market conditions enable the banks to refinance themselves. We also account for the recapitalisation of the baseline scenario to avoid double counting. According to Sighvatsson and Gunnarson (2011) the Ministry of Finance injected capital equivalent to 14 percent of GDP into the banking system, or ISK 206.5 billion. This amount is taken into account in designing an Irish path for the rescue of the Icelandic banks.

In constructing this scenario we keep in mind that the balance sheets of the Iceland's banks on the eve of their collapse were close to 10 times Iceland's GDP, only slightly larger than the Irish banks, which were around 9 times GDP. Moreover, as the Icelandic banks were two-thirds operating abroad in foreign currency, we assume a "cooperative" rescue involving foreign funds for the refinancing of the foreign operations of the Icelandic banks. As a first approximation, we can consider a figure of €15 - €16 billion for the total cost of the rescue, in line with the estimate in Moody's (2008) report. Iceland would then have had to come up with one-third of that amount, or around €5 billion, around 50 percent of GDP, and the IMF and ECB would finance the remainder, or €10 - €11 billion. However, some further work is necessary to align the costs with the Irish bank rescue. According to estimates by e,g,

Irelands' Department of Finance (2012) and Weymes and Bermingham (2012), the bank rescue cost to the Irish state had risen to €64 billion by 2012, which is around 40 percent of GDP. This is a significant increase over earlier estimates. If we use a ratio of 15 as a rule of thumb in accounting for the relative sizes of the two economies, Iceland would have had to contribute €4.3 billion towards the bank rescue (one fifteenth of the Irish bank bailout cost of €64 billion).[5] Using these assumptions, we obtain a rescue of the Icelandic banks that is similar to the Irish bank rescue costs, or just over 40 percent of GDP, spread over the nine year period from 2009 to 2018, but front loaded. Further, in this scenario, the ECB and IMF are assumed to contribute the remaining two-thirds, or €8.5 billion of the financing of the banks recapitalisation. The full amount of the rescue, €12.8 billion, appears as a rise in the debts of the Icelandic government. In line with the cooperative solution, we assume the cost of the first Icesave agreement is shared in the same 1/3 and 2/3 proportions, with the result that the Icelandic government pays a total of 4.3 percent of GDP over the 7 year period 2009-2016, which happens to be in line with the result of the third and final Icesave agreement. Likely, the fourth case of bailing out the banks would have represented an impossible burden for the state.

4. **What would have been the macroeconomic outcomes?**

The general approach is to assess the four different scenarios for Iceland against a baseline replicating the actual developments and policy stances and assessing their longer-term macroeconomic consequences. The exercise aims to offer a basis for evaluating the implications of pursuing the alternative policy paths discussed above on such variables as GDP growth, inflation, unemployment, interest rates, government deficits and debt. The value-added for policy makers in Iceland and abroad is to provide a quantitative basis for assessing what could have been the optimal policy given the situation.

*4.1 **The methodology***

The research involves simulations of different scenarios with the OECD-wide panel-based model of Padoan, Sila and Van den Noord (2012), hereafter PSV model, as well as with the CBI's own econometric model of the Icelandic economy, QMM, which stands for Quantitative Macroeconomic Model (see Annexes). The use of the two models is intended to combine domestic and international information sets so as to enrich the analysis.

The PSV model provides a stylised analytical framework to analyse the interactions between growth, debt and interest rates under conditions of financial and sovereign debt stress. It is inspired by a model developed by Duesenberry (1958) to analyse the Great Depression which had many characteristics similar to the current situation. The model captures three potentially explosive feedback mechanisms: (i) between the debt ratio and growth (a high debt ratio depresses growth which boosts the debt ratio, etc.); (ii) between the debt ratio and the interest rate (a high interest rate pushes up debt which gives a higher interest rate, etc.); and (iii) between growth and the interest rate (a higher interest rate depresses growth which pushes up the debt ratio and hence the interest rate, etc.). In a financial crisis, and especially in countries exposed to capital flight, these feedbacks can easily become explosive due to shifts in and changes in the slopes of the growth and interest rate equations. The model is estimated on a large dataset, comprising 28 OECD countries and spanning the period 1960 to 2011 in terms of annual data, using panel estimation techniques. While the model has a solid empirical basis, it is uniform across countries and hence not designed to fit the short-run dynamics of any individual country, but does capture medium-run tendencies.

[5] In terms of scaling, the population of the Republic of Ireland is around 4,3 million while the population of Iceland is just over 0.3 million. Ireland is thus just under 15 times larger than Iceland, in terms of population. The IMF estimates the GDP of Ireland to have been around $207 billion in 2011 while the GDP of Iceland was around $14 billion. The Irish economy is thus a little over 15 times larger.

The QMM model is also used for producing the simulations of alternative policy scenarios. It is a one-sector representation of the Icelandic economy, containing empirically estimated behavioral relations and other equations, such as accounting identities and definitions. The model is based on quarterly observations and is oriented towards short-term inflation dynamics as it is used to underpin monetary policy decisions. The inflationary dynamics revolve around expectations, labour costs, the exchange rate and, last but not least, changes in the output gap. As the QMM is a relatively compact model, it is easier to trace the dynamic interaction in the model. A property of the model is that shocks cause perturbations in linked variables over the short- to medium-term but over the longer term the model variables do not necessarily converge on a given steady-state growth path.

In terms of exogenous variables needed for simulating the scenarios in the PSV model, we make assumptions about a) the impact of capital controls on the bond yield, b) the general government primary balance as a share of GDP and c) the initial increase in debt associated with the bank rescue. The subsequent development of the debt ratio to GDP over time is endogenous as a function of the general government primary balance, the real bond yield and the growth rate of GDP. As most of the influence of the different scenarios is reflected in the balance sheets of the central government, we add to these scenarios the baseline evolution of the local governments to fit the general government accounting requirements of the QMM model. In the case of scenario 4, we follow the Irish increase of deficits and debt as a share of GDP associated with their bank bailout as well as aligning the numbers with the estimates of a rescue described in Moody‘s (2008).

The PSV model first runs the baseline scenario to replicate the actual outcome. The alternative scenarios are then run by shocking the debt/GDP and primary deficit/GDP ratios according to the respective assumptions. This gives an alternative time-path for GDP growth and the debt/GDP ratio. In the PSV simulations the bond yield is endogenous, though with its sensitivity to sovereign debt dependent on the assumption with regard to the adoption or lifting of capital controls from 2014 (in scenario 2, without capital controls the yield/risk premium is endogenous from the outset). This simulation yields time-paths for the bond yield and, as already noted, GDP growth and the debt/GDP ratio. In the PSV model the primary deficit is kept constant as a share of GDP at its realised time path in the case of the baseline scenario. The fiscal policy assumptions in the alternative scenarios, in terms of the primary deficit, eventually converge with the baseline.

The proper sequencing in the model simulations is important, based on the logic and nature of each model. As the PSV model has a reduced form quality it gives a consistent solution for public debt, long-term interest rates and economic growth, based on the fiscal policy assumptions. By comparison, the QMM is a more complex model and is focused on reproducing dynamic short- to medium-term properties of the economy. While the QMM model simulations were allowed to work themselves out until 2015, the longer term projections for GDP and related series were constrained by the PSV simulation results. Another complementary feature of the modeling work was to overcome the lack of an extensive public sector with debt and interest rate dynamics in the QMM model, with the PSV model projection for the long term interest rate based on the evolution of the debt stock and GPD. The forward looking short term rate in the QMM model was then calculated based on the long term rate in the PSV model simulation results. Alterations in tax rates, general government consumption and transfers were used to transmit the different fiscal policy impulses in the QMM model. The value-added of the QMM model simulations was to provide more information into how the different policy shocks were expressed in terms of the short– to medium term cyclical properties of the economy, to provide more detailed insight to the repercussions for different sectors and to serve as a check on the salient findings of the PSV model, especially in the short- to medium term.

In terms of deriving the baseline scenario, the actual economic and financial developments through 2012 and official projections 2013-15 are taken as a given, with the authors defining the projections for 2016-25. In terms of the scenarios, fiscal policy, exchange rate and interest rate are taken as exogenous inputs in deriving the author‘s projections for the entire period, 2008.4-2025.4. The PSV model results provide the long term interest rates, economic growth and public debt, while the QMM

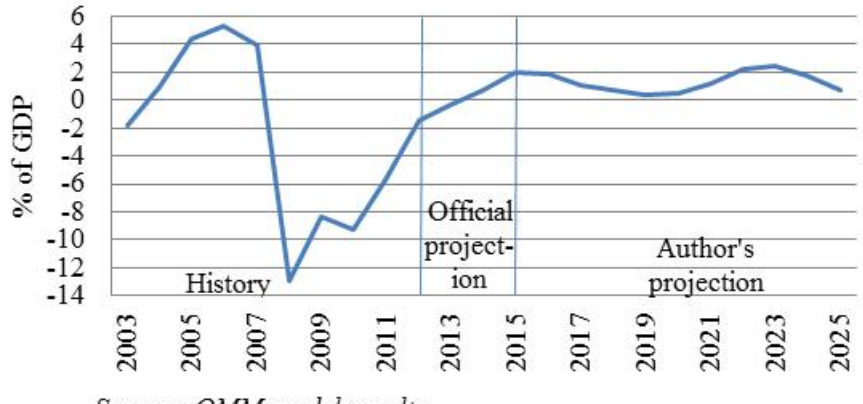
model results, require the short term rates be set as a function of the PSV long term rates.[6] The role of judgment in the QMM projections, input as add-factors, is non-trivial, including over the short-to medium-term. While the model reacts as most models do, such that the bigger the size of the shock the greater the perturbation, there is limited convergence to a long run growth path. The PSV model outcomes were therefore instrumental in guiding the QMM growth paths over the longer term.

The value added and complementarity of the two models is thus quite clear in addressing these questions. The PSV model helped establish the overall outcomes and overcame the limitations in the general government sector of the QMM model concerning the link between debts, interest rates and growth. In turn, the detailed insights of the dynamic QMM model shed light on how the individual policy assumptions played out across a number of other variables, including inflation and unemployment. As such, the QMM simulations were useful in identifying welfare trade-offs, not only between scenarios but also between periods (i.e. inter-temporal). A final point is that these models offer a logical framework to answer these questions, involving complex calculations based on intricate theoretical and empirical relationships. Policy makers took difficult decisions based on the advice given and their judgment under stressful and uncertain conditions. The simulations thus shed light on what the most likely outcome of these and other decisions would have been, offering a way to evaluate the actual decisions taken.

*4.2 **The baseline scenario***

The Baseline scenario establishes a basis for evaluating the outcomes of the alternative scenarios. In the modeling work, fiscal policy is formulated in line with outturns of government finances from 2008 to 2012, by the fiscal budget for 2013 and official projections for government finances through 2015 (See Table B1 in Annex B). No Icesave costs are included in the baseline projection. Likewise, we incorporate historical national accounts figures for GDP growth, the unemployment rate, inflation and other macroeconomic variables and official projections for the same until the fourth quarter of 2015. From the first quarter of 2016, the set of projections is based on our assumptions. The outcome of the baseline projection is evaluated for two distinct periods. First, we consider the five year recession and recovery (RR) period from the fourth quarter of 2008 to the fourth quarter of 2013. Second, we consider the 12 year longer term (LT) period from the first quarter of 2014 to the fourth quarter of 2025. While the PSV projections are fairly linear, the QMM projections contain cyclical variability.

Graph 1. **General Government Revenue Balance**
(Baseline path)



Source: QMM model results

[6] Monetary policy as constructed in the QMM model is endogenous in the baseline scenario but exogenous in the alternative scenarios. Implicit in the model simulation is the assumption that the credibility of the Central Bank‘s inflation target remains unaltered despite often large deviations of inflation from target following the shocks introduced in the exercise. See equation 7.1 in the QMM model handbook of Danielsson et al. (2011).

Importantly, in the baseline scenario the fiscal debt is sustainable if a strict fiscal consolidation regime is maintained, such that a sizable surplus on the primary revenue balance (excluding the interest income balance) is maintained over the entire projection period. Otherwise, the debt trajectory is likely to rise and become unsustainable (see e.g. Ministry of Finance, 2009a, for an exposition of sovereign debt sustainability factors.

In the Baseline projection, GDP is estimated to grow on average -0.5 percent in the RR period. In the LT period, GDP growth is estimated to be more robust, or average 3.3 percent. The unemployment rate is estimated to average 6.7 percent of the labour force in the RR period but to decline to 3.9 percent in the LT period, which is slightly higher than the historical average. Consumer price inflation is found to average 6.6 percent in the RR period but to decline to 2.3 percent, in line with the official inflation target of 2.5 percent in the LT period. To assess the welfare impact of alternative policy paths relative to the baseline scenario it is useful to gauge the outcomes in a single metric. In our case a stylised policy framework can be identified with two instruments: fiscal policy (g) and capital controls (c). Three objectives are then identified, for economic growth (y), unemployment (u) and macroeconomic stability, gauged by the interest rate (i). The government can then be thought of as seeking to minimise the welfare loss function:

$$W= W(yT-y, u, i)$$

where yT is the output target, using instruments g and c. As unemployment and output are not orthogonal (i.e. u=f(y)), we have two instruments and (ultimately) two goals.

With this framework in mind, we can now evaluate the outcome of the scenarios in terms of a welfare-loss or "misery" index, a measure of the economic plight at any given time. As originally formulated by Arthur Okun in the 1960s, the misery index is defined as the unemployment rate plus the inflation rate, where higher rates create economic and social costs for a country. Barro (1999) focused on changes in variables over a given period and added the interest rate and GDP growth rate, arguing that welfare also declines when the long-term interest rates increases or the growth rate of real GDP declines. As the QMM simulations for the projections give a deflationary outcome for one scenario, we include the unemployment rate, the long term interest rate and the economic growth rate but exclude price changes. This is because deflation may be considered welfare reducing while indicating the reverse. The presence of deflation in the index calculation gives a reduced value for the misery index suggesting welfare is greater (or misery less) while the reverse is the case. This change is also sensible on two other accounts. First, in survey-based research Di Tella, MacCulloch and Oswald (2001) find that unemployment weighs more heavily in household estimation of economic misery than inflation, with 1.7 percentage points of inflation found to be equivalent to 1 percentage point of the unemployment rate. Second, the interest rate, which is linked to the inflation rate, may also be viewed as a proxy for price changes (although it does not become negative) in the misery index. Finally, we focus on the period averages of rates in order to compare periods and not the changes within a period.

Table 1. **Misery index** (*excluding price changes*)*

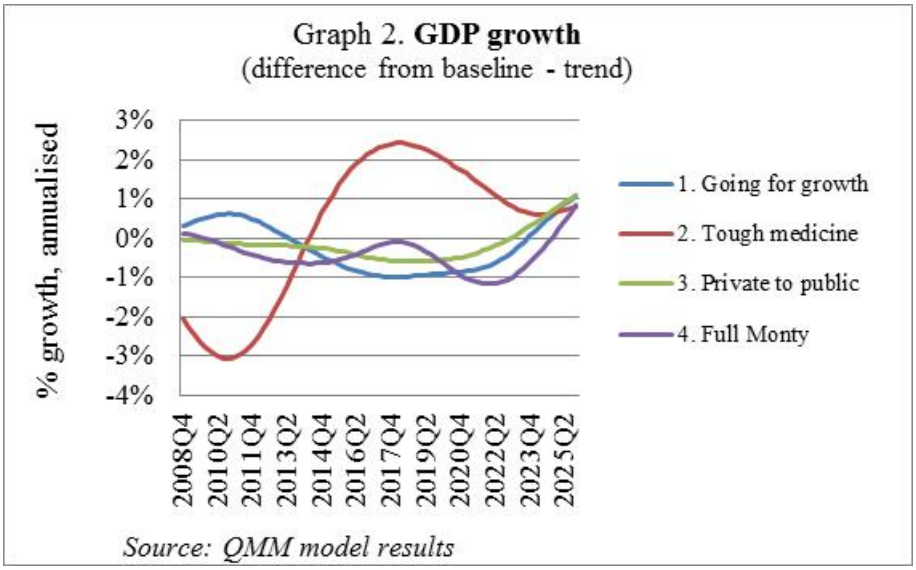
	QMM result			Difference from Baseline		
	2008.4-2013.4	2014.1-2025.4	2008.4-2025.4	2008.4-2013.4	2014.1-2025.4	2008.4-2025.4
Baseline	14,0%	7,8%	9,7%	-	-	-
1. Going for growth	13,4%	8,8%	10,3%	-0,6%	1,0%	0,6%
2. Tough medicine	24,2%	6,8%	12,1%	10,2%	-1,0%	2,4%
3. Private to public	14,3%	8,6%	10,3%	0,3%	0,8%	0,7%
4. Full Monty	14,5%	9,3%	10,9%	0,5%	1,5%	1,2%

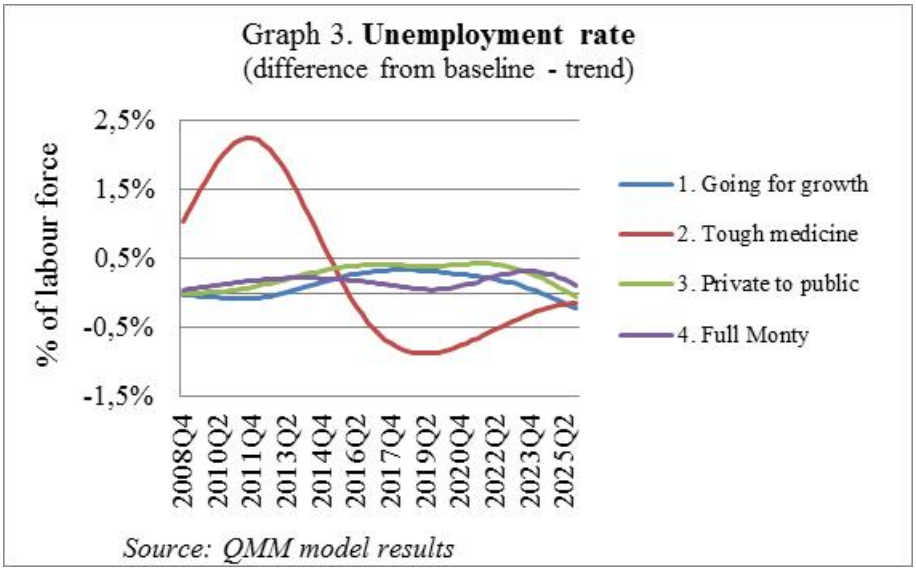
**) u + i - y, where u = unemployment rate, i = long term interest rate and y = GDP growth rate*

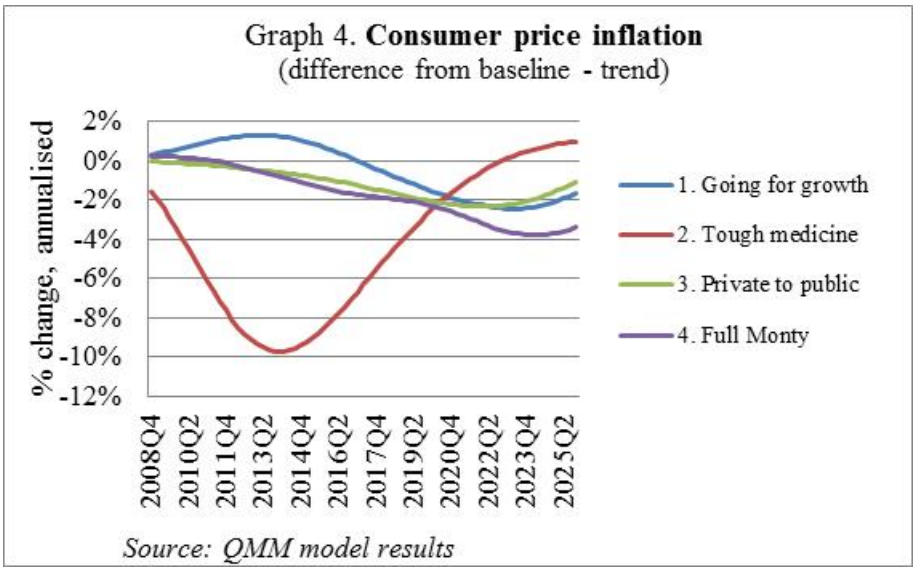
For the Baseline scenario we arrive at a measure of 14.0 percent for the misery index on average in the RR period and 7.8 percent on average in the LT period. This measure is consistent with the considerable misery of the RR period in Iceland. The projections suggest that welfare will increase in the LT period as economic growth lifts and unemployment and interest rates decline.

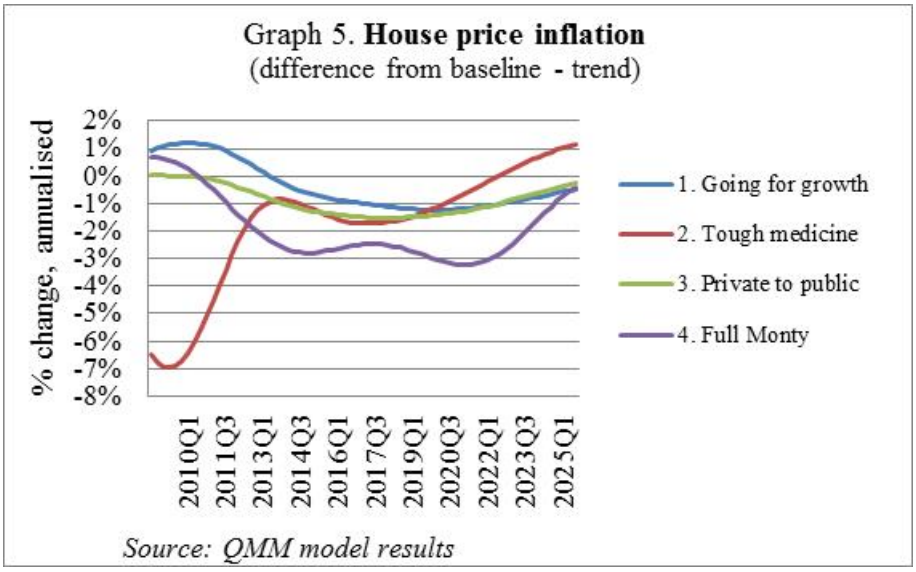
4.3 ***The alternative scenarios***

The alternate scenarios produce different cyclical and trend outcomes. This section reports these outcomes as estimated by our model simulations and relates this to the debate that took place about such policies and their likely outcomes. Graphs 2 -5 show the differences from baseline in the QMM results for the different scenarios in terms of GDP growth, unemployment rate, consumer price inflation and house price inflation. The series have been smoothed based on the Hodrick Prescott filter (using a longer sample to avoid an end-point bias), for clarity of exposition.









Scenario 1: ***"Going for growth"***

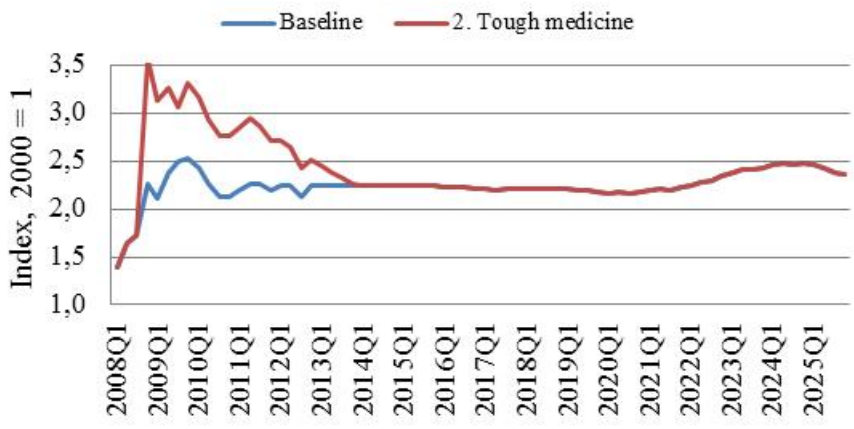
No model estimates were made at the time of the likely impact of a more counter-cyclical fiscal policy than was actually pursued, including the repercussions for debt and risk premia and, hence, economic growth going forward. This scenario thus presents an interesting counterfactual experiment in this regard. The agreement of the Icelandic government with the IMF in November 2008 was explicit about placing the priority on reducing the huge deficits in 2008 and 2009 associated with the collapse of the banking system. Ambitious goals were put in place over six years to eliminate the deficit and attain a surplus in the central government revenue balance, in order to place public debts on a sustainable course. The IMF made an exception by allowing the cyclically adjusted automatic stabiliser of fiscal policy to function in 2009, when the contraction in GDP growth was expected to reach a trough. This decision still required that in the 2009 budget, which was presented by the government on October 1, 2008, sizable expenditure cuts and tax increases, amounting to over 3 percent of GDP in fiscal restriction, needed to be added before the budget was passed by Parliament in December. In the Going for growth scenario, we add a fiscal stimulus equivalent to just over 3 percent of GDP on average per year in the RR period. This results in GDP growth that exceeds the baseline by 0.7 percent on average in the period. However, the resultant rise of public debt raises the long term interest rates and this brings down the GDP growth in the LT period by -0.5 percent on average. The effect on unemployment as a share of the labour force is negligible, or -0.1 percent in the RR period.

In the LT period, the unemployment rate is 0.2 percent higher. Inflation is 1 percent higher in the RR period but 1.1 percent lower in the LT period, due to the disinflationary effect of the wider output gap. Over the entire period, from the fourth quarter of 2008 to the fourth quarter of 2025, GDP growth is 0.2 percent less on average, the unemployment rate is 0.1 percent higher and inflation is 0.5 percent lower. Accordingly, the misery index turns out higher for the entire period, thus vindicating the decision not to "go for growth". Obviously the misery index for the entire period would be lower if a smaller weight was attached to the LT period (in our computations of the misery index equal weights are assumed for both periods). The temptation to do so would undoubtedly have been large at the time, but we see no reason to value past developments higher than future developments today, so all in all we consider Going for growth welfare inferior to the baseline.

Scenario 2: ***"Tough medicine"***

In the Tough medicine scenario, we allow the exchange rate to drop in line with the off-shore rate but to re-converge to the baseline rate by 2016. We also assume a slight tightening of fiscal policy initially, with some easing later on. This results in GDP growth that lags the baseline by 3.2 percent on average in the RR period. As Iceland is vulnerable to external financing conditions without capital controls, the long term interest rates spikes and exceeds the baseline rate by 4.8 percent on average. In the LT period, the GDP growth exceeds baseline by 1.3 percent, as it bounces back from a much lower level. The unemployment rate average 2.2 percent higher than baseline in the RR period but us 0.4 percent lower in the LT period. Inflation is 6.3 percent lower in the RR period, at 0.3 percent, and 3.5 percent lower in the LT period, as outright deflation sets in, due to the much wider output gap. Over the entire period, from the fourth quarter of 2008 to the fourth quarter of 2025, GDP growth is the same on average, but unemployment 0.4 percent higher, inflation is 4.3 percent lower and the long term interest rate is 2 percent higher. The misery index excluding price changes is 2.4 higher on average over the entire projection period, signifying the greater burden of this scenario.

Graph 6. **ISK exchange rate index**



Source: QMM model results

Many argued for not imposing capital controls in the fall of 2008, but without any estimate of the impact on the economy as it fell off a cliff. Danielsson and Arnason (2011) discuss the welfare loss of capital controls in terms of foregone economic growth going forward, or in terms of lost efficiency. They estimate the loss to be around 1 percent of GDP per annum. Our findings, however, suggest that the welfare loss of not having capital controls in the recession, due to the additional depreciation of the ISK exchange rate, would have been so great as to overwhelm the inefficiency costs for a long time. Krugman (2012) notes the "kick" Iceland got to its economy from the exchange rate drop. This view is correct as far as the export sector gains are concerned, which contributes to a recovery in GDP growth and employment. However, this view does not adequately reflect on the burden imposed on the households in terms of the significant decline in their real pre-tax incomes. Effectively there is a

redistribution of income away from the household sector to the export sector. Allowing the exchange rate to drop further would have entailed additional costs for households, adding to the damage of their balance sheets, increasing the financial stability problem of the banks and possibly risking the bankruptcy of the government. Indeed, the vulnerability of the economy to a further drop in the exchange rate when the capital controls are lifted is perhaps the main lesson of our projections in this scenario.

Interestingly, some euro-area countries have gone through a version of this scenario in so far as capital controls have been absent while private capital flowed out and public capital flowed in as financial backstops. Having the euro, the internal rate of exchange remained stable vis-à-vis other euro-area countries, limiting the welfare loss. Had the situation been compounded by an exit from the euro, as many advocated and/or predicted, with a significant drop in the value of the replacement currency (e.g. escudo, drachma, lira, peseta or punt) before capital controls were imposed, the simulation results suggests they would also have been faced with significant welfare costs for households and heightened systemic risk for the financial system from a rise in debts denominated in the new domestic currency. However, export-led growth would provide an offsetting welfare development in terms of reduced unemployment (see also Annex B).

Scenario 3: ***"Private to public"***

In the Private to public scenario, the fiscal cost of the Icesave agreement is not a stimulus to the economy as it leaks out in the form of foreign interest payments. GDP growth is 0.1 percent less than baseline in the RR period and 0.2 percent less in the LT period, or 0.2 percent less on average in the entire period. This is consistent with the rise of public debt which serves to increase the long term interest rates by 0.2 percent on average and this is what brings down the GDP growth rates. The effect on unemployment as a share of the labour force is negligible, or 0.1 percent higher than the baseline scenario in the RR period and 0.4 percent higher in the LT period, or 0.3 percent on average for the entire period. Inflation, however, is 1.2 percent less throughout reflecting the greater slack in the economy. The misery index is 0.7 percent higher for the full period, rising over time as the economy is weighed down with a greater debt burden.

With the decision of the EFTA Court in January 2013, dismissing the Icesave case against Iceland, it is now clear that paying up front would have been a sub-optimal path to go. However, Iceland was being forced to undertake negotiations even when the legal obligation to do so was in doubt. Fortunately, the voters decided against the negotiated results in the last two agreements, after the British and Dutch governments had rejected the first agreement with conditions, which would have limited the liability of the Icelandic government.

Scenario 4: ***"Full Monty"***

In the Full Monty scenario, the fiscal cost of a coordinated bank rescue and the partial Icesave agreement, is a huge burden on the economy. GDP growth is 0.1 percent less than baseline in the RR period and 0.6 percent less in the LT period, or 0.5 percent less on average in the entire period. This is consistent with the significant rise of public debt which serves to increase the long term interest rates by 0.6 percent on average over the entire period and is what pushes GDP growth down ever more as time passes. The unemployment rate is 0.2 percent higher on average over the entire period. Inflation is 2.5 percent less in the LT period reflecting the widening output gap. The misery index is 1.2 percent higher for the full period, rising over time as the economy shudders from the greater debt burden.

The question if Icelandic policy makers made the right decision to not try harder to reach a cooperative solution with the countries of the main creditor banks, or the EU itself, to rescue the Icelandic banking system has been hotly debated. Most have concluded, however, like Joseph Stiglitz, that "Iceland did the right thing by making sure its payment systems continued to function while creditors, not the taxpayers, shouldered the losses of banks." Stiglitz also concludes that Ireland did "all the wrong things" and is "the worst model" (Onaran, 2011). Krugman (2011) concludes that the

situation facing Icelandic policy makers freed them from making a decision to burden taxpayers with excessive liabilities of private banks owed to their creditors. Roubini (2011) notes that the banking crisis has essentially been a crisis of solvency and not one of liquidity. As a result, he finds that creditor participation, through e.g. haircuts or bail-ins, is a necessary component of public policy aimed at restoring economic growth.

5. **Conclusions**

The path of economic policies of the Icelandic government chosen in the wake of the banking collapse of 2008 was important for the recovery. Policy makers faced many alternative policy options for handling the many difficult situations that arose, with potential implications for government finances and economic growth. It was not obvious from the outset what policy options would be optimal. In the event, the authorities intervened in the large international banks and, in effect, rescued the domestic operations while allowing the foreign operations to go into resolution. The authorities also adopted capital controls to arrest a further drop in the domestic currency. A medium term fiscal consolidation program was enacted. Moreover, a claim by the British and Dutch governments that Iceland guarantee the Icesave deposits was not agreed to and was finally adjudicated in Iceland's favour. As part of an IMF Stand-By Arrangement, Iceland received financial backstops at the peak of the crisis. A deep recession in 2009 and 2010 gave way to a recovery in 2011 with the government deficit all but eliminated in 2012 and the unemployment rate significantly reduced. This path is mimicked in a baseline scenario replicating the actual development of the Icelandic economy and public finances up to now and exploring their future development as shocks further unwind up to 2025.

Four counter-factual scenarios of how the crisis could have played out if the decisions had been different are compared to a baseline scenario replicating the actual path chosen. Macroeconomic model simulations are performed to assess the impact of different decisions involving public finances on economic growth, unemployment and other macroeconomic variables over the period 2008-2025. The four alternative scenarios that have been considered are to: *i*) adopt a more pro-cyclical fiscal policy (Going for growth), *ii*) allow the ISK exchange rate to drop without imposing capital controls (Tough medicine), *iii*) pay the interest expense on the initial Icesave agreement (Private to public), or *iv*) rescue the banks as Ireland did (Full Monty).

The welfare costs of the alternative policy paths are estimated to be significant. The most unfavorable outcome is clearly seen in the Tough medicine scenario, where the welfare loss would be acute, especially up front. The Full Monty scenario is not far off in this regard, but with the deleterious debt effects weighing on the welfare going forward. The other two scenarios, while being less optimal than baseline, are somewhat milder in terms of the economic growth and income distribution effects. Whatever growth gains are realised up front with the Going for growth scenario are more than offset by less growth going forward as the costs are shifted into the future. While the Private to public scenario would have been manageable, it is an inferior path. In sum, the outcomes of all four alternative scenarios are found to be inferior to the baseline scenario. This suggests that the path taken was in fact optimal.

An important conclusion emerging from the baseline scenario is that the public debt is sustainable if a strict fiscal consolidation regime is maintained, such that a sizable surplus on the primary revenue balance (excluding the interest income balance) is maintained over the entire projection period. Otherwise, it is likely that the debt trajectory would rise and become unsustainable. The same result is found to broadly hold for the counter-factual scenarios (see Table A2).

Finally, the question could legitimately be asked if the Icelandic experience, or our alternative scenarios, hold any lessons for other nations in comparable circumstances, notably the euro-area periphery. So far that region has been following a variant of the "Tough medicine" scenario in so far as no capital controls are in place but without the possibility of exchange rate depreciation, which may

explain why it may take longer for them to recover. At the same time, being in the euro has freed the household sector from the deleterious effects of significant currency depreciation. However, the effort to salvage the banking systems is bringing difficulty to the countries and the euro area as a whole. Our view is that an exit from the euro area is not the first best option for the countries in the periphery. Barring further creditor participation but with continued international financial backstops the best available option is likely to continue with fiscal consolidation and structural reforms. At the same time it is clear that the creation of a monetary union without a commensurate fiscal and banking union from the outset has come at a high price.

Annex A. **Iceland simulations with the PSV model**

Main features of the model

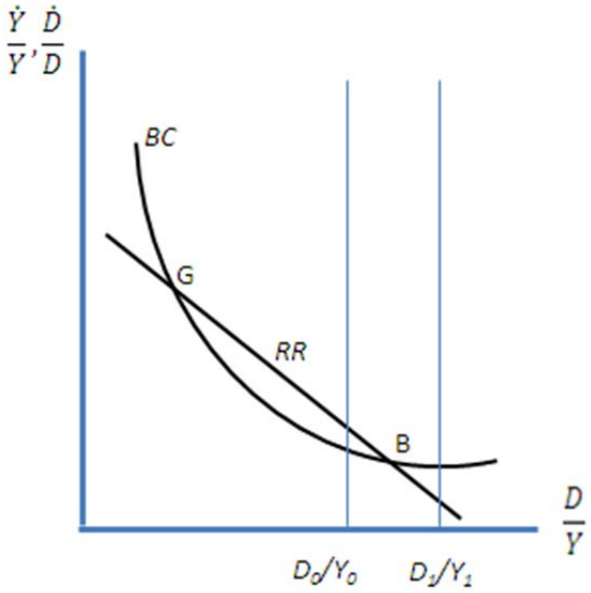
The PSV model (Padoan, Sila and Van den Noord, 2012) is a very stylised description of the relationships between debt, growth and interest rates in OECD economies. It has only three equations.

The first equation describes a negative relationship between economic growth and the ratio of public debt(Y = output, D = real government debt and an over-dot indicates the change in the variable). This is aimed to capture a multitude of possible negative feedbacks of high public indebtedness on growth. For instance, high public indebtedness may feed into expectations of future increases in taxation, or of default, depressing demand. As well, high public debt may squeeze credit provided by banks as these typically hold substantial amounts of sovereign debt on their balance sheets, or raise the cost of financing for the private sector through this channel..

$$\frac{\dot{Y}}{Y} = a - b\frac{D}{Y} - fr + gp \qquad (1)$$

This equation is depicted in Figure A1 as the downward-sloping straight line *RR*. *RR* stands for Reinhart and Rogoff (2010), who were the first to posit this relationship and to have tested it empirically.

Figure A1: **Good and bad equilibria**



Note: the horizontal axis measures the public debt to GDP ratio and the vertical axis the growth rates of public debt and output. *RR* is the relationship between growth and debt and *BC* the government's budget constraint. If the debt ratio is located right from the bad equilibrium *B*, it derails while output contracts at an accelerating pace. Left of *B* the debt ratio converges towards the *G*.

This growth equation is augmented with variables measuring the impact of financial conditions and fiscal policy on growth to the extent these are not already captured by the debt ratio. The financial variables include the real government bond yield r and a financial crisis dummy a that switches from nil to one if a country is in a banking crisis according to certain criteria based on Laeven and Valencia (2008). The fiscal policy stance, proxied by the primary deficit as a share of GDP p, is also included in the growth equation, with a larger primary fiscal deficit assumed to support (and by extension fiscal

consolidation assumed to weaken) output growth in the short run. The associated semi-elasticities represented by the parameters *f* and *g*, respectively.

The second equation of the model is the inter-temporal budget constraint of the government. It relates the primary deficit as a percent of GDP *p* to the real interest rate *r* and real public debt *D*:

$$\dot{D} = rD + pY \qquad (2a)$$

Dividing the two sides of the equation by *D* yields:

$$\frac{\dot{D}}{D} = r + \frac{p}{D/Y} \qquad (2b)$$

This is the hyperbolic relationship between real growth of debt and the debt ratio depicted as *BC* (as in budget constraint) in Figure A1.With the inclusion of this identity in the model the ratio of public debt to GDP is treated as an endogenous variable. This means that an increase in the real bond yield not only affects growth directly via its impact on the cost of lending, but also indirectly through an increase in the debt ratio (the 'Reinhart-Rogoff' effect). Increases in the primary deficit tend to raise debt and mute growth as well, and this weakens the growth stimulus stemming from increases in the primary deficit.

The intersections of the two curves in Figure A1 correspond to, respectively, a 'good' equilibrium (*G*) and a 'bad' equilibrium (*B*). If the debt ratio is located in the interval between the intersections *G* and *B* (indicated by D_0/Y_0), output growth will exceed the growth of debt, and hence the debt ratio is falling until the good equilibrium *G* is attained: the good equilibrium is stable. However, if the debt ratio is located right of the intersection point *B* (e.g. if the debt ratio equals D_1/Y_1), the growth of debt exceeds output growth. So the equilibrium *B* is unstable. Beyond *B* debt keeps growing while output growth keeps falling, hence the debt ratio is on an explosive path.

If a country is in financial crisis and/or the debt ratio is on an explosive path its real interest rate is bound to increase, thus adding momentum to the debt explosion. To capture this effect an interest rate equation is included, which is the third equation of the model. Specifically, we assume that the interest rate responds to the growth in the debt ratio and an (exogenous) factor *h*. So:

$$r = h + c\left(\frac{\dot{D}}{D} - \frac{\dot{Y}}{Y}\right) \qquad (3)$$

The rationale for including the growth rate of the debt ratio as an explanatory variable is that we see this as a possible gauge of unsustainable public finances. Specifically, we expect an accelerating debt ratio to raise the probability of default (for real or as perceived by the markets), *i.e.* the faster the increase in the debt ratio, the higher the risk premium. The parameter *h* captures the impact of swings in market sentiment and contagion effects (in as much as these are unrelated to local debt dynamics) as well as financial backstops to offset such sentiment and contagion effects.

The occurrence of financial crisis thus enters the interest rate equation via the risk premium. This effect is assumed to be stronger if the country is exposed to capital flight. Since the onset of the crisis this has been the case notably in the euro area periphery countries, an effect that is explicitly included in the model. For the purpose of the simulations for Iceland this effect is included for episodes without capital controls and also enters the equation not only by raising the exogenous component of the risk premium *h* but also its sensitivity to changes in the debt ratio to GDP *c*.

The steady-state debt ratio (when debt and output grow at the same rate) can be derived by equating the *BC* and *RR* equations (1) and (2b) and equating the growth rates of debt and output in the interest equation (3), which yields:

$$-b\left(\frac{D}{Y}\right)^2 + [a + gp - (1+f)h]\frac{D}{Y} - p = 0 \quad (4)$$

This has two solutions:

$$\left(\frac{D}{Y}\right)^G = \frac{[a + gp - (1+f)h] - \sqrt{[a + gp - (1+f)h]^2 - 4bp}}{2b} \quad (5a)$$

$$\left(\frac{D}{Y}\right)^B = \frac{[a + gp - (1+f)h] + \sqrt{[a + gp - (1+f)h]^2 - 4bp}}{2b} \quad (5b)$$

Equations (5a) and (5b) are the solutions for the good equilibrium *G* and the bad equilibrium *B*, respectively. It is interesting to note that the parameter *c*, the semi-elasticity of the real bond yield with respect to the growth in the debt ratio, drops out of the equation, which is simply a consequence of the economy assumed to be in a steady state and hence the debt ratio being constant. This implies that the adverse feedback loop from debt via the bond yield on growth does not operate via a change in the bad equilibrium itself but rather by influencing the pace of decline or improvement once the economy finds itself out of the bad equilibrium.

In Padoan, Sila and Van den Noord (2012) we report estimation results for the growth and interest rate equations (1) and (3), respectively. The estimations are based on a sample of 28 OECD countries (including Iceland) and spans over up to 52 years, from 1960 to 2011, depending on data availability. We purposefully used as broad a sample as possible, in order not to make results dependent on an arbitrarily chosen period or group of countries. We also used the GMM estimation technique and only included lagged right-hand side variables so as to minimise the risk of reverse causality.

Simulation results

To simulate the various scenarios assumptions need to be made about the developments in fiscal policy, the exposure to capital flight (capital controls) and banking crisis in each of these scenarios. These are used to "shock" the model so as to generate alternative scenarios against a baseline projection. The results are discussed below.

Baseline scenario

To construct the baseline scenario the model is used to, first, replicate the actual developments and OECD projections for the period 2009-14 and, next, generate projections for the period 2015-25. For the period 2009-14 add factors are identified for each of the three equations (growth, real interest rate and debt equations) based on the OECD's Economic Outlook database. These add factors are subsequently held constant for the period 2015-25. Superimposed on this is an assumed lifting of capital controls on 1 Jan 2014. From that moment on Iceland is assumed to behave like a "euro area periphery country" (i.e. exposed to capital flight) as defined in the PSV model, with the real bond yield shifting upward and its slope vis-à-vis the development of the public debt ratio steepening.

The assumed primary deficit as a percent of GDP -- the single exogenous variable of the model (aside from dummies to capture banking crisis and exposure to capital flight) -- is taken from the Economic Outlook database for the period 2009-14 and projected for the period 2015-2025. The projection simply keeps the primary deficit constant at its last "observed" level in 2014 (see Table A1). Accordingly, the primary deficit averages 2.3 percent of GDP in the period prior to the assumed lifting of capital controls (2009-13) and turns to a projected primary surplus of 4.1 percent of GDP after capital controls are lifted (2014-25).

The resulting baseline projections for growth, real bond yields and the debt ratio to GDP are summarised in the upper rows of Table A2. The most notable development is the increase in the real bond yield after the lifting of capital controls on 1 January 2014. This increase, from 1.5 percent in the period 2009-13 to 4.5 percent in the period 2014-25, is not so large as to endanger the sustainability of

public finances, as the debt ratio is projected to be on a downward path. Hence, with economic growth projected to be close to 3 percent per annum in the period 2014-25, the Icelandic economy would not be in the bad equilibrium of falling growth and soaring debt, in contrast with the countries in the euro area periphery. However, this favourable outturn hinges on the assumption that Iceland would maintain a relatively large primary surplus. A simulation experiment (not reported here) in which the primary balance is assumed to revert to zero after 2014 yields an explosive debt ratio to GDP.

Alternative scenarios

The four alternative scenarios are described in greater detail below.

Scenario 1: ***"Going for growth"***

The "Going for growth" scenario involves simulating a more active counter-cyclical fiscal policy path in the period 2009-13 than was actually pursued, taking everything else as given. Such policy stance would be motivated by expectations that fiscal easing creates faster economic growth in the short run. In the simulations it is assumed that the primary position of the government would return to its baseline level in 2014 and beyond, thus implying a significant fiscal tightening in the projection period, with the primary position turning from an average deficit of 5.5 percent in the period 2009-13 to a projected surplus of 4.1 percent in the period 2014-25 (second column of Table A1).The assumption that capital controls are lifted in 2014 is maintained. The simulation results reported in Table A2 indicate that the debt ratio to GDP would be around 10 percentage points higher than in the baseline scenario in the period 2009-13 and 20 percentage points higher than baseline in the projection period. The debt ratio would still maintain on a downward path, however, and as a result the increase in the risk premium on Icelandic sovereign bonds relative to baseline would be limited. Real GDP growth would have been marginally higher than realised in the period 2009-13 as a consequence of the fiscal stimulus, but it would be significantly lower in the period 2014-2025 mostly on account of the higher level of government debt. This simulation thus suggests that opting for fiscal stimulus in the immediate aftermath of the crisis would not have paid.

Scenario 2: ***"Tough medicine"***

This scenario involves a tighter fiscal policy aimed at regaining policy credibility without the imposition of capital controls. Specifically, as shown in Table 1, the primary deficit is assumed to have been only about one third of its baseline level (0.6 percent of GDP) on average in the period 2009-13 and indeed to have turned to surplus already in 2012. As noted, no capital controls are assumed, meaning that the real interest rate is expected to be significantly higher than in baseline. The latter is indeed confirmed by the simulations (Table A2), with the nominal bond yield almost 5 percentage points higher than baseline in the period 2009-13. Real GDP growth is more than 1 percentage points lower than baseline both in the period 2009-13 and 2014-2025 on account of the much worse profile of the debt ratio of GDP and the higher bond yield, with the latter two developments reinforcing each other. Also in this scenario, however, debt sustainability is not at stake, owing to the large projected primary surplus of the government. It should be noted that the PSV model is likely to grossly under-predict the cyclical swings in output growth (negative in the period 2009-13 and positive in 2014-2025) associated with the non-adoption of capital controls in 2009-12 for a very small open economy like Iceland since there is no exchange rate effect in the model.

Scenario 3: ***"Private to public"***

In the "private to public" scenario Iceland would have assumed up-front the responsibility for the Icesave deposits in the United Kingdom and Netherlands while adopting a similar fiscal policy path as in the baseline. As a result the primary deficit deteriorates considerably relative to baseline (notably in the period 2009-2013). However, the increase in the primary deficit relative to baseline is not allowed to boost growth in the simulation as the additional government expenditure entirely "leaks" to abroad. As a result, the fiscal impact on growth is negative from the outset in this scenario since the increase in the debt ratio and real interest rate do exert a negative impact on growth. These predictions are confirmed by the simulation, with growth marginally lower than in the baseline over the entire period 2009-25.

Scenario 4: ***"Full Monty"***

The final scenario seeks to explore the consequences of following the Irish path of guaranteeing the three major banks, based on a comparable fiscal policy path taken there. This assumes international backstops would have been provided to refinance and recapitalise the banks. As in the previous scenario the primary deficit is much higher, but in this case the increase would have been really dramatic, with the primary deficit more than 8 percentage points of GDP higher on average in the period 2009-13 than in the baseline scenario. It is assumed that only one third of this increase in the primary deficit enters the growth equation by way of demand stimulus while the remainder is transferred to bond holders abroad. As may be expected the debt burden is the highest of all scenarios while growth turns out around 1 percentage point lower than baseline in the period 2013-25. As capital controls are assumed to be in place in the period 2009-13, like in all scenarios except scenario 2, the increase in the real bond yield is limited. Even so, like in all previous scenarios, the debt ratio would remain on a downward path in the period 2014-2025.

Table A1. **Projected General Government Primary Deficit**
(as a percent of GDP)

		Scenario			
	Baseline	1. Going for growth	2. Tough medicine	3. Private to public	4. Full Monty
2009	6.9%	6.9%	2.3%	7.5%	12.8%
2010	7.2%	11.7%	4.8%	9.1%	13.8%
2011	2.3%	8.6%	1.7%	4.9%	9.2%
2012	-2.0%	1.9%	-2.0%	0.6%	4.1%
2013	-3.2%	-1.6%	-4.0%	-1.8%	1.7%
Average	2.3%	5.5%	0.6%	4.1%	8.3%
2014	-4.1%	-4.1%	-4.5%	-3.1%	0.1%
2015	-4.1%	-4.1%	-4.4%	-3.3%	-0.4%
2016	-4.1%	-4.1%	-4.3%	-3.3%	-4.1%
2017	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2018	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2019	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2020	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2021	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2022	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2023	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2024	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
2025	-4.1%	-4.1%	-4.1%	-4.1%	-4.1%
Average	-4.1%	-4.1%	-4.2%	-3.9%	-3.4%

Source: OECD Economic Outlook Database and authors' computations

Table A2. **Simulation results PSV model**

				Difference from baseline	
		2009-13	2014-25	2009-13	2014-25
Baseline					
Real GDP	[a]	-0.6%	2.9%	-	-
Real bond yield	[b]	1.5%	4.5%	-	-
Debt ratio	[b]	124%	84%	-	-
Debt ratio	[c]	120%	56%	-	-
1. Going for growth					
Real GDP	[a]	-0.6%	2.5%	0.0%	-0.4%
Real bond yield	[b]	1.6%	4.7%	0.1%	0.3%
Debt ratio	[b]	132%	104%	8%	20%
Debt ratio	[c]	135%	78%	15%	22%
2. Tough medicine					
Real GDP	[a]	-1.8%	1.8%	-1.2%	-1.1%
Real bond yield	[b]	6.4%	5.2%	4.9%	0.7%
Debt ratio	[b]	133%	129%	10%	45%
Debt ratio	[c]	143%	112%	23%	56%
3. Private to public					
Real GDP	[a]	-0.7%	2.6%	-0.1%	-0.3%
Real bond yield	[b]	1.5%	4.7%	0.1%	0.3%
Debt ratio	[b]	129%	100%	5%	16%
Debt ratio	[c]	129%	74%	9%	18%
4. Full Monty					
Real GDP	[a]	-0.8%	1.7%	-0.2%	-1.2%
Real bond yield	[b]	1.7%	5.2%	0.2%	0.7%
Debt ratio	[b]	141%	136%	17%	51%
Debt ratio	[c]	150%	120%	30%	64%

a. Average annual rate of growth

b. Average level

c. Level at end of period

Annex B. **Simulations with the QMM Model**

Main features of the model

The QMM model of the Central Bank of Iceland is based on and is similar to the Bank of England Quarterly Model (BEQM). It is used for producing the simulations of alternative policy scenarios. The QMM model is a one-sector representation of the Icelandic economy, containing 27 empirically estimated behavioral relations and 101 other equations, such as accounting identities and definitions. It thus contains 128 endogenous variables and another 47 exogenous variables, with a total of 175 variables. The model operates with quarterly observations and is oriented towards short to medium-term inflation dynamics as it is used to underpin monetary policy decisions. Inflation in the model revolves around changes in output gap, but the exchange rate can also have short-term influence in determining the outcome. As a relatively compact model, it is fairly straight forward to trace the dynamic interaction in the model. A property of the model is that shocks cause perturbations in linked variables over the short to medium term. While there is some tendency for convergence over the longer term, the model variables do not necessarily converge to a steady-state growth path.

The QMM model first ran the baseline scenario to 2025. The official data for 2008 to 2012 is used along with the CBI's projection from 2013 to 2015. The author's then developed the baseline scenario from 2016 to 2025. The alternative scenarios were run by shocking the general government revenue balance as share of GDP. In terms of exogenous variables needed for simulating the scenarios in the QMM model, the exchange rate path was defined along with the forward looking short term interest rate being calculated based on the output of the PSV model for the long run interest rate time-path. This allowed the incorporation of the debt shock of the different scenarios into the QMM model which does not have this dynamic fully developed in its general government sector. [7]

An important difference between the PSV model and QMM model work was the fact that the fiscal policy assumptions were introduced into the QMM model in terms of the general government revenue balance, as opposed to the primary balance in the PSV model. A simplifying assumption of a constant 3 percent of GDP deficit on the interest income balance was used to ensure consistency between the two model simulations. As most of the influence of the different scenarios is reflected in the balance sheets of the central government, the baseline evolution of the local governments was added to fit the requirements of the general government sector of the QMM model. An even 50-50 split between revenues and expenditure, consistent with the pattern in recent years, is assumed for fiscal policy changes. The impact of capital controls was assumed the same for scenarios 1, 3 and 4, such that the same exchange rate path derives as in the baseline scenario. No capital controls are assumed for scenario 2, with the ISK exchange rate declining significantly in value, consistent with the historical off-shore rate, but over time it converges to the on-shore or baseline rate. The GDP growth rate result in the PSV model simulations is then used to constrain the growth rate of the QMM model in the longer run.

[7] The general government sector in the QMM model is a flow-based representation of the government accounts. General government revenue in QMM consists of Taxation receipts (TAX), Household tax payments (TJ, TJY, TI and TJO), Corporate tax payments (TC, TCI, TCP, TIC and TWC) and Taxes on expenditure (TE, TV, AT, TSD and TIMP). Further, the tax variables consist of the tax percentage times the tax base less allowed tax exemptions. The tax variables affect disposable incomes in the model which influence aggregate household demand. Government expenditure is composed of Subsidies (SUBS) and other Public sector expenditure (CJ, CJT, UNCOST, UNPM and DI). Government consumption (GN) and Government investment (IGN and IGNNET) are used in the demand and output calculations for the level of GDP and hence the output gap, inflation, etc. In addition, there is a variable for Public sector net borrowing (PSNB), which includes the deficit financing cost.

Simulation results

To simulate the various scenarios assumptions need to be made about the developments in fiscal policy, the exposure to capital flight (capital controls) and banking crisis in each of these scenarios. These are used to "shock" the model so as to generate alternative scenarios against a baseline projection. The results are discussed below.

Baseline scenario

To construct the baseline scenario the model is used to, first, replicate the actual developments and CBI projections for the period 2008.4 to 2014.4 and, next, generate projections for the period 2015.1 to 2025.4. For the former period, the historical data until 2012 and official projections thereafter are used. In the latter period, the author's assumptions determine the projections. The assumed general government revenue balance as a percent of GDP, one of the exogenous variables of the model, is taken from the CBI projections and then projected for the period 2015.4 to 2025.4. The revenue balance is assumed to eventually turn into surplus and stay within a long run range consistent with sustainable public finances. Accordingly, the general government revenue deficit averages 6.3 percent of GDP in the period with capital controls from 2008.4 to 2013.4 and turns to a projected general government revenue surplus averaging 1.3 percent of GDP without capital controls from 2014.1 to 2025.4 (see Table B1). The different fiscal policy paths may also be seen in graphs B1 and B2.

The resulting baseline projections for growth, nominal bond yields, inflation and the unemployment rate are summarised in the upper rows of Table B2. The nominal bond yield does not rise after the lifting of capital controls on 1 January 2014 whereas the real bond yield rises as inflation declines, in line with the PSV simulation result. Moreover, as in the PSV result, economic growth is projected to be close to 3 percent per annum in the period 2014-2025. Unemployment, however, declines from close to 7 percent in the former period to under 4 percent in the latter period, reflecting the attainment of a sufficiently high growth rate consistent with a falling unemployment rate. Welfare is thus seen to improve unambiguously over time in the baseline projection as sustainable growth reasserts itself, although a higher real interest rate, reflecting the higher public debt following the banking collapse, weighs on the overall result.

Alternative scenarios

The four alternative scenarios are described in greater detail below.

Scenario 1: ***"Going for growth"***

The "Going for growth" scenario involves simulating a more active counter-cyclical fiscal policy path in the period 2008.4-2013.4 than was actually pursued, taking everything else as given. Such a policy stance would be motivated by expectations that fiscal easing creates faster economic growth in the short run. In the simulations it is assumed that the fiscal position of the government would return to its baseline level in 2014 and beyond, thus implying a significant fiscal tightening in the projection period, with the revenue balance turning from an average deficit of 9.0 percent in the period 2009-2013 to a projected surplus of 1.3 percent in the period 2014-2025 (second column of Table B1).The assumption that capital controls are lifted in 2014 is maintained. The simulation results reported in Table B2 indicate that real GDP growth would have been 0.7 percent higher on average than in the Baseline in the period 2008.4-2013.4 as a consequence of the fiscal stimulus. However, it would also be 0.5 percent lower on average in the much longer period 2014.1-2025.4 mostly on account of the higher bond yield. Accordingly, the outcome for the entire period 2008.4 to 2025.4 shows less growth on average. Inflation is shown to be slightly higher in the former period but less in the latter period and overall, reflecting the greater slack in the economy in the second period. The outcome for unemployment shows some improvement in the first period but which is more than offset in the latter period and overall. This simulation thus suggests that opting for fiscal stimulus in the immediate aftermath of the crisis would not have been the optimal policy.

Scenario 2: ***"Tough medicine"***

The "tough medicine" scenario is based on not imposing capital controls and thus allowing the exchange rate to drop further and find its own market-determined level. As a result, a somewhat greater tightening of fiscal policy is assumed with the aim to enhance policy credibility. Specifically, as shown in Table B1, the general government deficit is assumed to have been about half a percent of GDP less than the baseline level on average in the period 2008.4-2013.4 and to be almost in surplus in 2012. As no capital controls are assumed, the nominal interest rate is expected to be almost 5 percent higher than in baseline in the RR period and 0.7 percent higher in the LR period. Real GDP growth is 3 percentage points lower than baseline in the period 2008.4-2013.4 on account of the much higher bond yield but 1 percent higher in the 2014.1-2025.4 period as growth revives from a lower level of activity. While GDP growth is similar on average between the QMM and PSV model results, the outcome between the periods is quite different for the two models, owing to the more pronounced cyclical characteristics of the QMM model simulation. The same result applies for inflation. Due to a feature of the QMM model whereby inflation ultimately converges to the inflation target, the widening of the output gap in the first period overwhelms the influence of the exchange rate to push up prices, resulting in a quite pronounced disinflationary development as the credibility of the inflation target is assumed to be unaffected (see footnote 7). Finally, the unemployment rate increases considerably more in this scenario in the first period, but then falls more than in the baseline in the second period. In terms of the welfare implications in the first period, this policy is the least desirable, but the economy then enters a robust recovery from a considerably lower level in the second period. Overall GDP growth is about the same as in the baseline, but inflation is less and unemployment is greater, suggesting this is a sub-optimal policy as well.

An interesting feature of this scenario is that pre-tax household income would have dropped much further than in the baseline (Graph B3), pushing down consumption and imports, while investment and output of the export sector grew sharply as the economy bottomed. This is consistent with the influence of a drop in the value of a currency in a small, open economy. It results in a significant income shift from the household sector to the export sector. This is not the case in euro-area countries suffering from capital flight. However, unemployment has been a greater problem in some of the euro periphery countries, especially for young people. Research indicates that a significant cause of the unemployment problem is insufficient reform of labour and product markets in the afflicted countries (see e.g. Driffill, 2013). Structural reform is therefore needed, along with greater demand, to revive economic growth and reduce unemployment in these countries. As concerns the financial stress caused by the financial crisis for the majority of households, it would likely have been greater in Iceland given the role of the currency in increasing debts in the upswing, while causing the payback to be much more costly in the downswing due to also the inflation indexation of the payment and principal. By comparison, the private sector debt build up in the upswing was far less in most euro periphery countries and the debt principal and payments of households in these same countries remained far less affected by exchange rate or interest rate changes in the post-crisis period.

Scenario 3: ***"Private to public"***

In the "private to public" scenario Iceland would have assumed up-front the responsibility for the Icesave deposits in the United Kingdom and Netherlands while adopting a similar fiscal policy path as in the baseline. As a result the primary deficit deteriorates relative to the baseline (notably in the period 2008.4-2013.4). However, the increase in the general government deficit relative to baseline is not allowed to boost growth in the simulation as the additional government expenditure entirely "leaks" out of the economy. As a result, the fiscal impact on growth is negative from the outset in this scenario since the increase in the nominal interest rate exerts a negative impact on growth. These predictions are confirmed by the simulation, with GDP growth marginally lower than in the baseline over the entire period 2008.4-2025.4, and with unemployment slightly higher but inflation slightly less.

Scenario 4: ***"Full Monty"***

The "Full Monty" scenario seeks to explore the consequences of following the Irish path of guaranteeing the three major banks, based on a comparable fiscal policy path taken there. This assumes international financial backstops would have been provided to refinance and recapitalise the banks. As in the previous scenario the general government revenue deficit is much higher, but in this case the increase would have been really dramatic, with the revenue deficit more than 5 percent of GDP higher on average in the former period compared to the baseline scenario. It is assumed that only one third of this increase in the deficit enters the growth equation by way of demand stimulus while the remainder is transferred to bond holders abroad, even more so than in scenario 3. As capital controls are assumed to be in place in the period 2008.4-2013.4, like in all scenarios except scenario 2, the increase in the nominal bond yield is limited in the first period. Moreover, housing prices are assumed to drop slightly less than in the baseline scenario, reducing the negative wealth effect in the simulation. As a result, GDP growth is only slightly less and unemployment slightly higher while inflation is the same. In the second period, from 2013.4 to 2025.4, however, the nominal interest rate is around 70 basis points higher than in the baseline scenario, with GDP growth turning out to be around half a percentage point less than in the baseline and with unemployment higher. This scenario is thus also quite sub-optimal compared to the baseline.

Table B1. **Projected General Government Revenue Balance** (as percent of GDP)

	Scenario				
	Baseline	1. Going for growth	2. Tough medicine	3. Private to public	4. Full Monty
2008	-12,9	-12,8	-12,4	-12,9	-13,4
2009	-8,3	-8,3	-6,7	-8,9	-13,8
2010	-9,3	-13,8	-7,9	-11,3	-15,4
2011	-5,7	-11,9	-5,9	-8,3	-12,5
2012	-1,5	-5,3	-1,8	-4,0	-8,4
2013	-0,3	-1,9	-0,2	-1,7	-4,1
Average	-6,3	-9,0	-5,8	-7,9	-11,3
2014	0,8	0,8	-0,1	-0,3	-2,8
2015	2,0	2,0	1,0	1,2	-0,8
2016	1,9	1,9	0,9	1,1	0,2
2017	1,0	1,0	0,5	1,0	0,2
2018	0,7	0,7	0,9	0,7	0,0
2019	0,4	0,4	0,4	0,4	0,1
2020	0,5	0,5	0,5	0,5	0,5
2021	1,2	1,2	1,2	1,2	1,2
2022	2,2	2,2	2,2	2,2	2,2
2023	2,4	2,4	2,4	2,4	2,4
2024	1,7	1,7	1,7	1,7	1,7
2025	0,7	0,7	0,7	0,7	0,7
Average	1,3	1,3	*1,0*	*1,1*	0,5

Source: Ministry of Finance and authors' computations

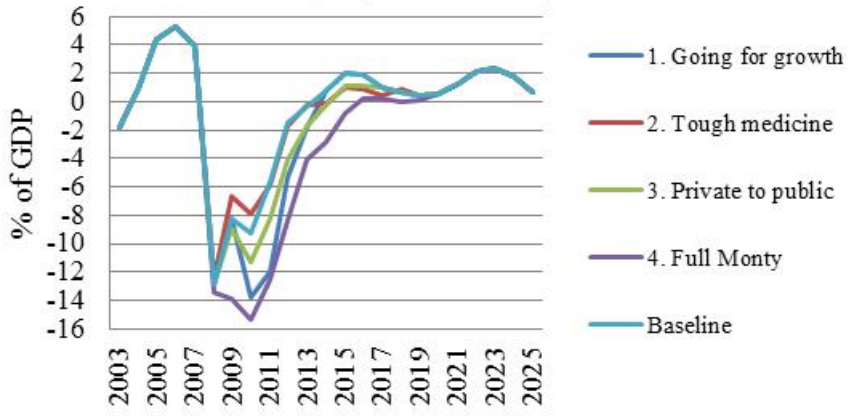
Table B2**. Simulation results QMM model**

					Difference from baseline		
		2008.4-2013.4	2014.1-2025.4	2008.4-2025.4	2008.4-2013.4	2014.1-2025.4	2008.4-2025.4
Baseline							
Real GDP	[a]	-0,5%	3,3%	2,1%	-	-	-
Long term bond rate	[b]	6,8%	7,1%	7,0%	-	-	-
Consumer price inflation	[b]	6,6%	2,3%	3,6%	-	-	-
Unemployment rate	[c]	6,7%	3,9%	4,8%	-	-	-
1. Going for growth							
Real GDP	[a]	0,1%	2,7%	1,9%	0,7%	-0,5%	-0,2%
Long term bond rate	[b]	6,9%	7,4%	7,2%	0,1%	0,3%	0,2%
Consumer price inflation	[b]	7,6%	1,2%	3,1%	1,0%	-1,1%	-0,5%
Unemployment rate	[b]	6,6%	4,2%	4,9%	-0,1%	0,2%	0,1%
2. Tough medicine							
Real GDP	[a]	-3,7%	4,6%	2,1%	-3,2%	1,3%	0,0%
Long term bond rate	[b]	11,6%	7,8%	9,0%	4,8%	0,7%	2,0%
Consumer price inflation	[b]	0,3%	-1,2%	-0,7%	-6,3%	-3,5%	-4,3%
Unemployment rate	[b]	8,9%	3,5%	5,2%	2,2%	-0,4%	0,4%
3. Private to public							
Real GDP	[a]	-0,7%	3,0%	1,9%	-0,1%	-0,2%	-0,2%
Long term bond rate	[b]	6,9%	7,3%	7,2%	0,1%	0,3%	0,2%
Consumer price inflation	[b]	6,3%	0,7%	2,4%	-0,3%	-1,7%	-1,2%
Unemployment rate	[b]	6,8%	4,3%	5,1%	0,1%	0,4%	0,3%
4. Full Monty							
Real GDP	[a]	-0,7%	2,6%	1,6%	-0,1%	-0,6%	-0,5%
Long term bond rate	[b]	7,0%	7,8%	7,6%	0,2%	0,7%	0,6%
Consumer price inflation	[b]	6,6%	-0,2%	1,9%	0,0%	-2,5%	-1,8%
Unemployment rate	[b]	6,9%	4,1%	5,0%	0,2%	0,2%	0,2%

a. Average annual rate of growth

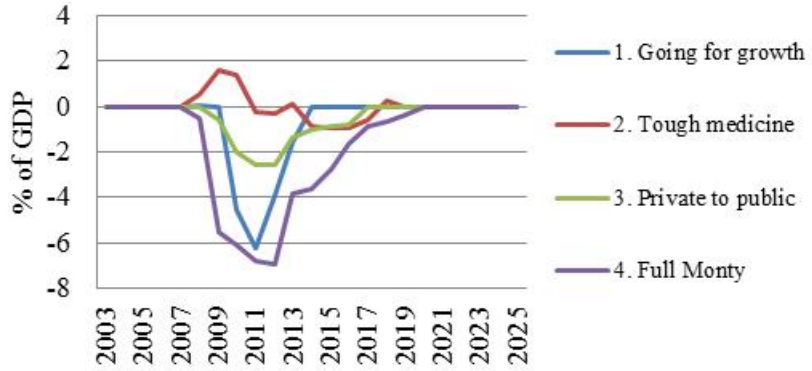
b. Average level

Graph B1. **General Government Revenue Balance**
(as a percent of GDP)



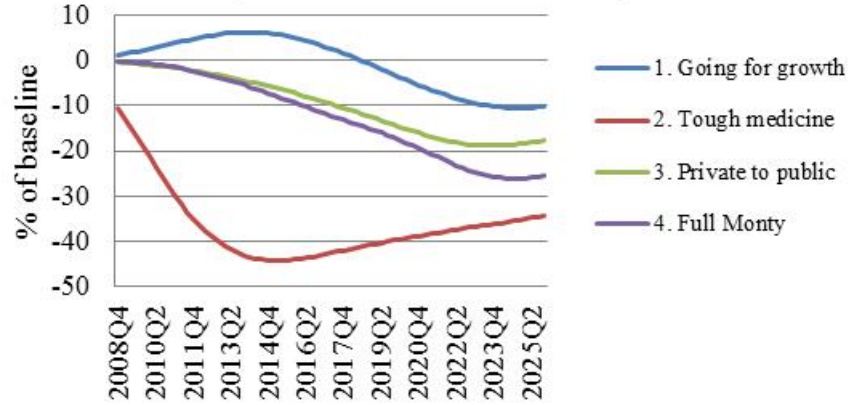
Source: QMM model results

Graph B2. **General Government Revenue Balance**
(Difference from baseline)



Source: QMM model results

Graph B3. **Household income (pre-tax)**
(difference from baseline - trend)



Source: QMM model results

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