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DATING AND EXPLORATION OF THE BUSINESS CYCLE IN ICELAND

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Dating and Exploration of the Business Cycle in Iceland

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Abstract

The paper explores the quarterly sequence of business cycles in Iceland for 40 years between 1970 and 2009 using the business cycle technique of Leamer (2009). We apply first a turning point (TP) dating identification procedure based on the Hendrick- Prescott (HP) filter of the quarterly growth rates of GDP and then we use different candidates for leading indicators for turning points. We find that the Iceland economy has a rather short business cycle of about 3 years and most macroeconomic indicators are in accordance with the business cycles. Only a few indicators have a predictive potential, some variables like consumption show a one quarter lag. Furthermore, we apply the concept of abnormal contributions to growth for candidates as a leading indicator of turning points. We find that over the last decade there is some evidence that abnormal growth contributions are better indicators for troughs than for peaks.

Keywords: Business Cycle dating, HP filtering, exploratory turning point analysis, lead and lag indicators, abnormal growth contributions, gross domestic product (GDP) growth.

JEL classification: E32, E60, G01.

1. Introduction

The Icelandic economy attracted lots of attention in the last years, since Iceland has been one of the first victims of the global financial crisis of 2008. Clearly, the rapid rise of the Iceland economy in the last 100 years out from a fishing community and in particular the economic miracle of the last 20 years has been remarkable. After 3 major banks of Iceland collapsed in fall 2008, the IMF started a major financial support program, and main political attention now focuses on the recovery of the Iceland economy. The current downturn of the economy since the last peak in 2007 has not ended, and many people want to know at what time point the downturn can be stopped. The answer to this question is a topic of the economic business cycle (BC) analysis and relates to the question as how has the Iceland economy responded to shocks and cycles in the past. Clearly, the current financial crisis is unprecedented in many respects – and hopefully remains a unique event for the future- but

nevertheless the quest for the past and potential solutions for a cure might be found in the a study of the BC over the last 20 years.

A previous analysis of the business cycle was given in Pétursson (2000) based on a Markov switching model of yearly GDP data since 1945. Other business cycle dating procedures based on quarterly data are not available, so we decided to create an own business cycle dating method, which follows the spirit of the BC dating method of the NBER (national bureau of economic research).

The quarterly data were provided by the Central Bank of Iceland (CBI)[1], which were originally used to build a quarterly GMM model (Daníelsson et al. 2009).

The paper is structured as follows: In the next section we describe the business cycle dating method. Then we turn in section 3 to the exploratory business cycle analysis were we investigate several macro-economic variable for their potential to lead and lag turning points. Also, we explore if the cumulated growth accounting method of Leamer (2009) will give more insight into the turning point analysis (TPA). In section 4 we analyze some financial data. In a final section we conclude.

1.1. Definition of a recession

The definition of a recession according to NBER is: „A recession is a significant decline for more than a few month in … real GDP, Real income, Employment, Industrial production, and Wholesale retail sales.“ (See www.nber.org/cycles.html)

Leamer (2009, p. 111) criticizes the NBER definition to be too much descriptive, because it concentrates only on symptoms. Thus he suggests to replace the definition by the following one: „Recession is a persistent and substantial increase in unwanted idleness.“ Idleness is measured (in Leamer's analysis for the US) by the unemployment rate (UR), the intensity of work (hours in manufacturing), and the excess capacity in manufacturing.

Furthermore, Leamer (2009, p.111) goes on in classifying the business cycle into 5 phases (or "episodes"):

Normal growth, Recessions and Recoveries, Sputters and Spurts.

Sputters are defined as "declines of indicators that did not lead to a recession" and spurts as "declines of unemployment (UR) during expansions". There had been only a few sputters and spurts during the last 50 years in the US, most of them were caused by special economic policy acts by presidents, like the Kennedy tax cuts in the 1960ies or the Bush tax cuts in the 1990ies.

Analyzing the US business cycle, Leamer (2009, p. 179) is interested in the following question: What causes (normal) recessions? He comes up with the following indicators: Inventories, homes, cars, and equipments. Furthermore, he notes that industries that suffered most by employment losses during recession were: Manufacturing and construction.

[1] Special thanks go to Helgi Tomáson, the CBI and the University of Iceland who made this data set available.

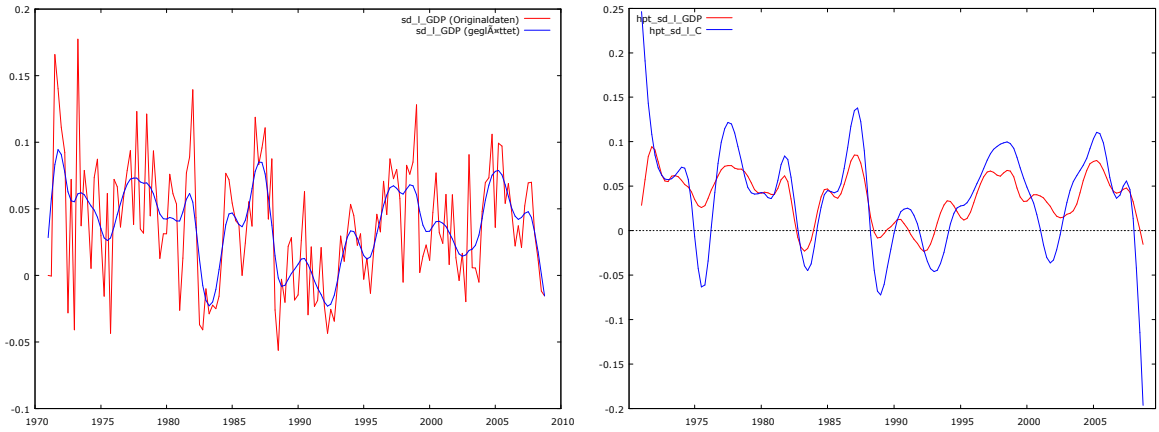
Overall, Leamer has provided us with new insights into the US business cycle and in the following paper we try to find out if the Iceland business cycle follows similar regularities and patterns as in the US.

2. Dating the business cycle in Iceland

We use the quarterly real GDP series, in logs and with seasonal (S=4) differences, and we apply a Hewitt-Prescott (HP) filter with a small smoothing parameter to remove the high frequency noise. The results can be seen in Figure 2.1.

Figure 2.1 a) Iceland, quarterly real GDP and consumption;

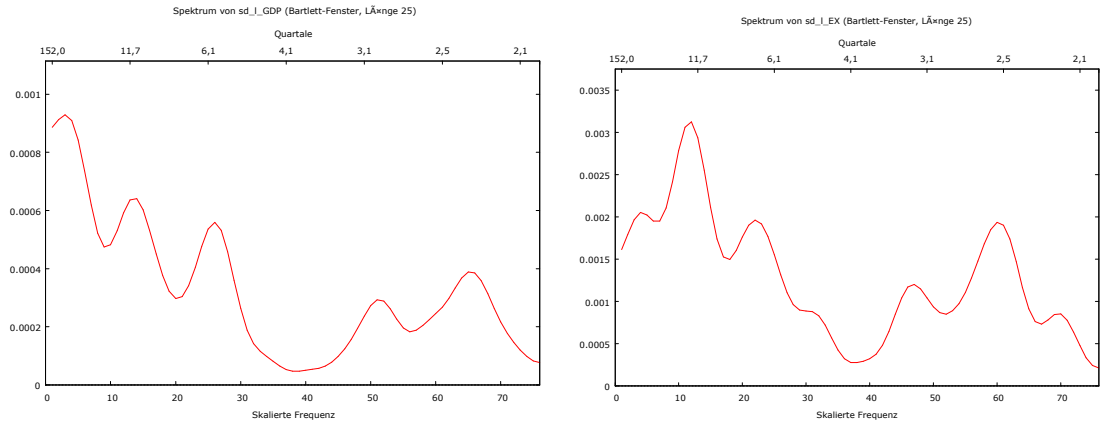
b) HP filters of quarterly real GDP and consumption



The spectrum of real GDP is estimated with a Bartlett window, and is shown in Figure 2.2. It reveals is a cyclic component of about 12 quarters, together with a strong first harmonic component of 6 quarters, which indicates a non-symmetric form of the business cycle.

Figure 2.2 a) Iceland, quarterly real GDP series, spectral density (with Bartlett window);

b) Quarterly export series, spectral density (with Bartlett window).



While the consumption pattern does not follow the business cycle, the exports do so with a similar spectrum as we see from Figure 2.4a. Also the imports follow the business cycle of about 12 quarters, but without harmonic cycles, as we can see from Figure 2.4b.

Imports and Exports (time domain)

Figure 2.3 Iceland, a) quarterly import and b) export series, smoothed with the HP filter.

a) Imports b) Exports

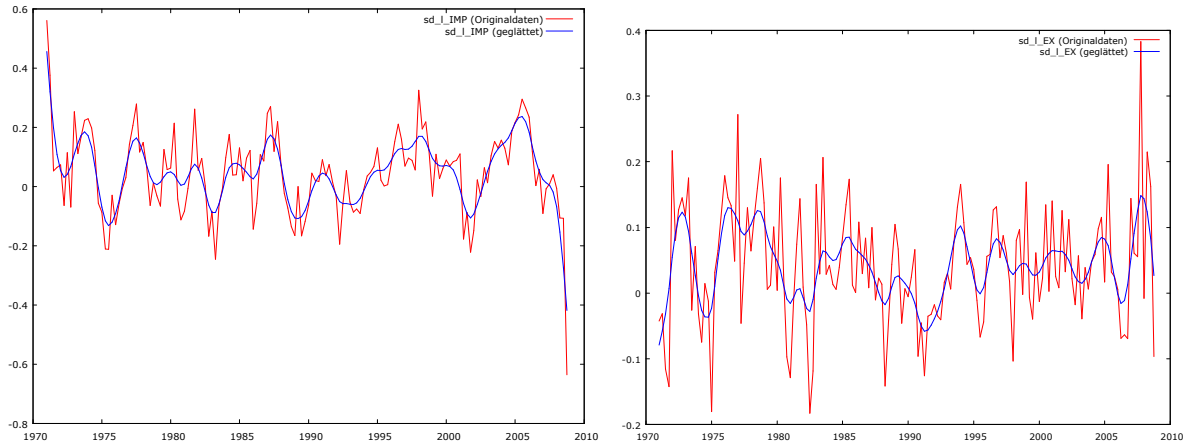
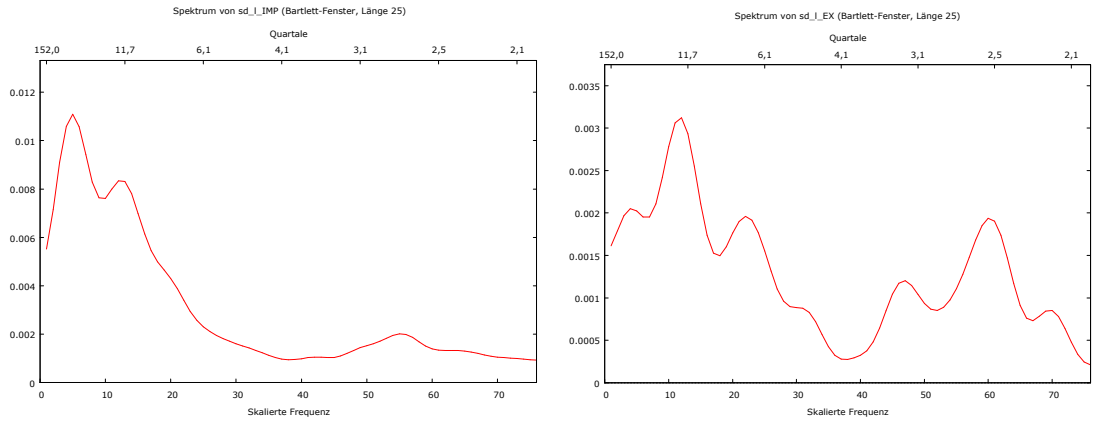


Figure 2.4. Iceland, spectral density (estimated with Bartlett window) for

a) Imports (quarterly) b) Exports (quarterly)



Both, the spectrum of import and exports show a strong business cycles component. While for the exports the dominating cycle is the business cycle frequency, this is not the case for the imports, where a longer term trend/cycle dominates. This might reflect a secular catching up trend of world trade goods in Iceland, since the country has no diversified consumer goods industry, but the exports of Iceland reflect also the high specialization in basically two industries: Fisheries (marine exports) and the aluminum industry. (Bauxit has to be imported, but a high value added can be achieved because of the cheap hydroelectric energy that is available in Iceland. These economic strategies were developed in the last years to utilizes the country's resources and diversify the export industry.)

Since Iceland has no official dating of the business cycle based on quarterly data, I decided to apply the HP filtering technique to the GDP growth rates and to come up with an own dating of the quarterly business cycle. The HP method (Hodrick and Prescott, 1997) is been used widely in applied macro-economics to smooth irregular time series. We will employ a HP-8 and a HP-64 filer where the 8 and 64 stands for the smoothing constant of the penalty term. A high penalty term smoothes more and will give less turning points (see Figure 2.5a), while a small smoothing values will give more peaks and troughs.

The results of the BC dating are summarized in the next Table 2.1.

Table 2.1. Quarterly Icelandic business cycle dating 1970-2009 based on HP-8 filtering

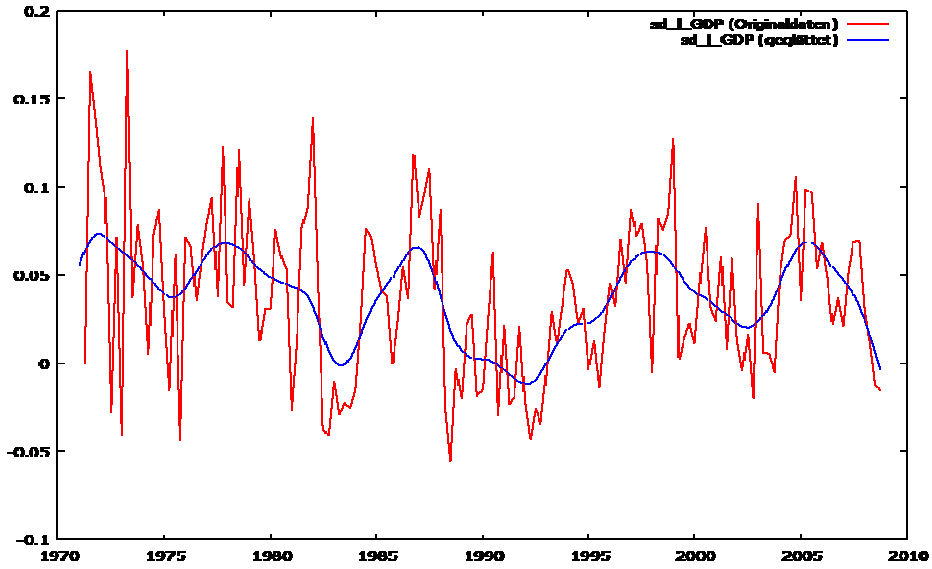
BUSINESS CYCLE REFERENCE DATES		**DURATION IN QUARTERS**			
Peak	**Trough**	**Contraction**	**Expansion**	**Cycle**	
*Quarters (**fat**: main cycle)*		*Peak to Trough*	*Previous trough to this peak*	*Trough from previous Trough*	*Peak from previous Peak*
1971:4	*1973:1 (spurt)*	*5*	*-*	*-*	*-*
1973:3	**1975:3** *(sputter)*	*8*	*2*	*10*	*7*
1977:3 (1980:2)	1980:1 *(1980:4) (flat)*	*10*	*8*	*18*	*16*
1981:4	**1983:2**	*6*	*7*	*13*	*17*
1985:1	*1985:4 (sputter)*	*3*	*7*	*10*	*13*
1987:1	1988:4	*7*	*5*	*12*	*8*
1990:3	**1992:2**	*7*	*7*	*14*	*14*
1994:1	*1995:2 (spurt)*	*5*	*7*	*12*	*14*
1998:3	1999:4	*5*	*13*	*18*	*18*
2000:4	**2002:3**	*7*	*4*	*11*	*9*
2005:2	*2006:4 (spurt)*	*6*	*11*	*17*	*18*
2007:3		*>8*	*3*	*>11*	*9*
Prediction	*2011:2?*	*15?*		*18 max*	
Average		6,3	6,7	13,5	13,0
Standard Deviation		1,8	3,3	3,1	4,1

The first column displays the dating of the troughs, the second for the peaks. The quarterly dates that are printed in fat denote the main cycle with the dominating troughs and peaks, while the non-fat numbers show the minor peaks. The last two columns show the length of the business cycles in terms of trough-to-trough and peak-to-peak lengths of the business cycle. The last row of the table shows a summary of the contraction and expansion lengths of the business cycle.

We see that the average contraction length (peak to through, in the last row) is 6.3 quarters while the average expansion length is 6.7 quarter, together they give a sum of just 13 quarters. The standard deviation of the expansion phases is about double the size of the contraction phase, which agrees well with findings of other country's business cycle, where expansion phases are also lasting usually longer. Furthermore, this finding agrees well with the average lengths of peak-to-peak and through-to-through phases, both being about 13 quarters long. Note that the standard deviation of the peak-to-peak phases is about 1 quarter longer than the through-to-through phases.

Summary: The smoothing with the HP-64 filter gives 6 peaks and 5 troughs (see Figure 2.5a) while the smoothing with the HP-8 filter yields 13 peaks and 13 troughs (see Figure 2.1).

Figure 2.5a HP-64 filter: 6 peaks and 5 troughs



An aside: The prediction of the current phase of the BC/TP in Iceland

In the last line of Table 2.1 we have made a simple prediction of the next through point after the last peak of 2007:3. If we look in the pre-last column we see that until now the maximum period between a peak and a through lasted in Iceland for about 18 month. Applying this estimate for the length of the current contraction phase produces a worst case scenario: After a long decline phase of 18 month we end up with 2011:2 as a most likely turning point for the next upturn.

In the next Table 2.2 we show the quarterly business cycle dating in Iceland but the smaller peaks are now removed from Table 2.1. This dating procedure now corresponds to a HP filtering method with larger smoothing constant (lambda= 64 instead of 8) as can be seen from Figure 2.5.

From the pre-last lines of Table 2.2 (Average length (quarters)) we see that the length of the contraction and expansion phase have now increased to 16 quarters (= 4 years), implying that the current business cycle is now lasting between 8 and 9 years. Following this reasoning, we see that the peak-to-peak phases for the main business cycles are 2 quarters shorter than the trough-to-trough cycles.

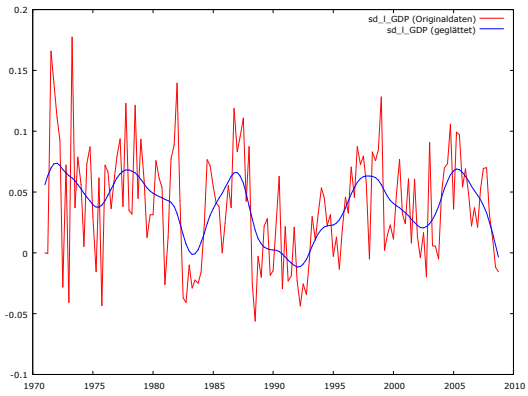
Table 2.2 Main Quarterly Icelandic Business Cycle dating 1970-2009 based on HP-64 filtering

BUSINESS CYCLE	**DURATION IN QUARTERS**

REFERENCE DATES

Peak	Trough	Contraction	Expansion		Cycle
1971:4		-	-	-	-
	1975:3	*13*			
1977:3			*8*		*23*
	1983:2	*16*		*31*	
1987:1			*19*		*38*
	1992:2	*21*		*36*	
1998:3			*25*		*46*
	2002:3	*16*		*41*	
2005:2		*?*	*11*		*27*
2007:3 (spurt)		*?-9*	*>20*	*>11*	*>38*
Prediction	*2011:2?*	*15?*		*18max*	
Average(quarters)		16,5	15,8	36,0	33,5
St.Dev. (quarters)		3,3	7,7	5,0	10,5

Figure 2.5b: GDP and HP-64 filter for the main business cycles phases in Iceland



Finally we look at the profile of growth contributions over the Iceland business cycle. The growth contributions GC(i) of component i out of n contributors are defined generally in the following way:

$$GC(i) = \text{increase}(i) / (\text{level}(1) + \ldots + \text{level}(n)) \quad \text{for} \quad i = 1,\ldots,n,$$

where the increase at time t is defined as increase(i) = level(i,t) - level(i,t-1).

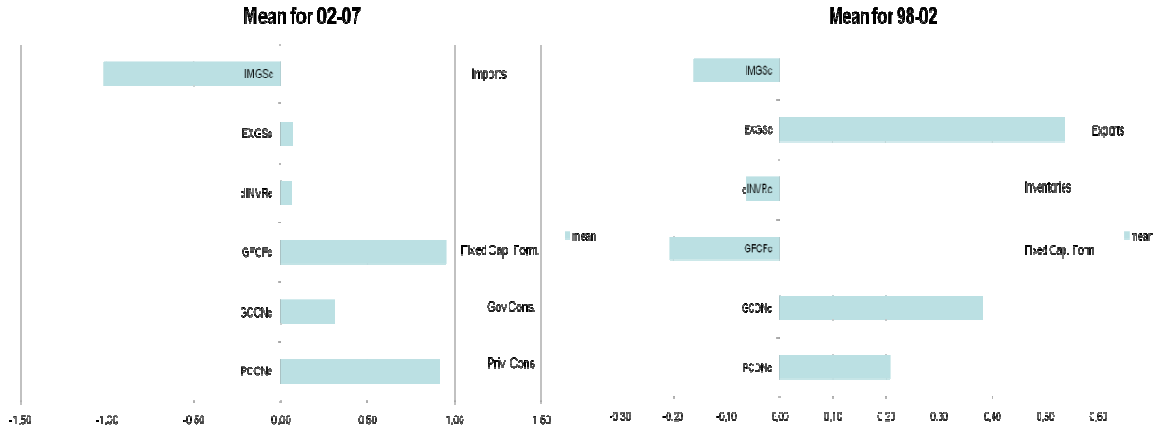
Growth contributions can be used to determine the relative importance of each component in the contribution to the overall growth of the aggregate at time t. All growth contributions together can

be used to create a growth profile as it can be seen in the next Figure 2.6 for comparing GDP growth in expansion and contraction phases.

We see that imports are not contributing to growth, neither in expansion nor in contraction phases. The main 'driver' of the BC in terms of growth contributions is the variable fixed capital formation. Exports and government consumption are the positive contributors during contraction phases, which prevent worse developments.

Figure 2.6: Iceland: growth contributions during the 3 recent expansion and contraction phases

a) Expansion b) contraction



3. Business Cycles and Explorative Turning Point Analysis

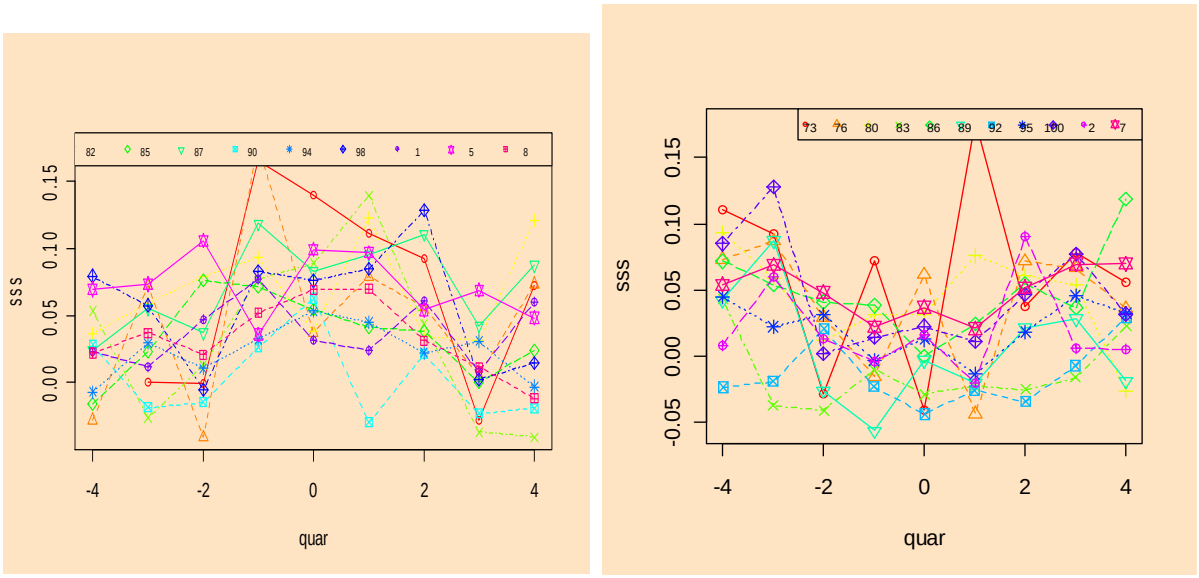
In this section we explore the potential of some macroeconomic indicators to predict turning points (TPs). For this purpose we look at the behavior of the indicator 4 quarters before and after the TP that we obtained from our HP-TP dating analysis in the section 2. We are interested in the behavior of macro-economic indicators for turning points and therefore we study the behavior of the indicator in "TP synchronization plots" as in Leamer (2009). To apply this technique we need the quarterly dating of the upper or lower turning points and then we overlay the observations before and after the turning points. To make the comparison easier we can shift the indicator observation in such away so to make them pass it through the same point at the predefined turning point. Successful pattern recognition from such synchronization plots makes the candidate series a potential BC indicator. In the next section we discuss a series of turning point synchronization plots to explore the possibility of a reliable leading indicator.

3.1 GDP growth synchronization around peaks and troughs

We start with a “confirmation plot” to find out how the own GDP growth is behaving around the turning points. The confirmation plot shows if the dating of the turning points, which were done by the HP filters, also leads to the expected tent-type behavior of the growth rates of GDP before and after a turning point. Such confirmation plot were not necessary for the US, because NBER is doing the dating of the turning points, but can be used to confirm any other reasonable method for dating turning points as well.

As we see from Figure 3.1 the movement of the growths rates of GDP around the turning point have the right curvature but the variance is quite high (about 10 percentage points). This shows that the business cycle activity around the turning points in Iceland is quite heterogeneous across cycles.

Figure 3.1 Confirmation plot: GDP growth rates behavior around the a) upper and b) lower turning point of GDP

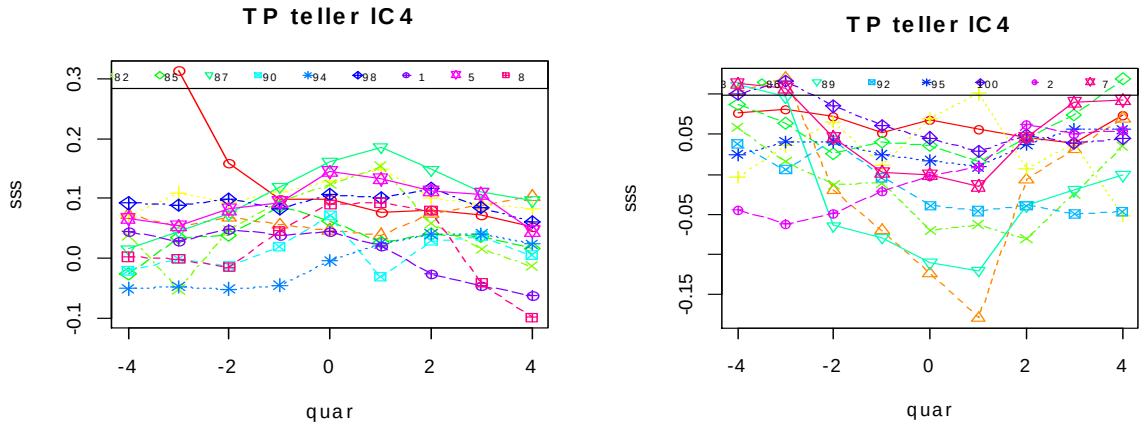


The next diagrams are turning points analyses to make guesses for potential leading indicators. We gave these exploratory procedures and diagrams the title: “TP teller” or “TP explorer”.

If we look at the macro-economic indicator (real) consumption growth, we see that consumption lags the GDP turning point by 1 quarter.

Figure 3.3. GDP turning point exploration for consumption growth

a) upper and b) lower turning point of consumption



In the next Figure 3.4 we look at TAX revenues as a potential turning point indicator. Surprisingly we see no pattern. It should be interesting to find out if this TAX revenue behavior extends e.g. to direct and indirect taxes.

Figure 3.4. GDP turning point exploration for TAX revenue growth

a) upper and b) lower turning point of TAX revenues

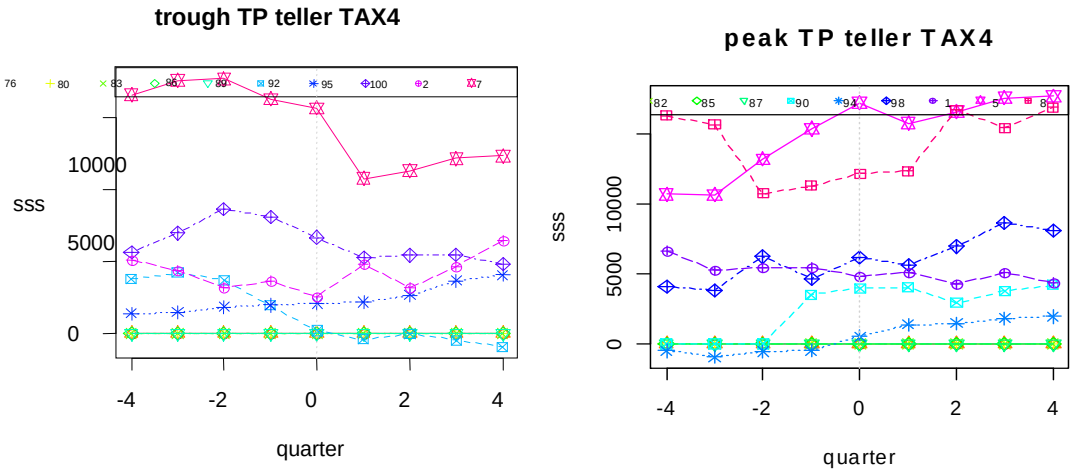
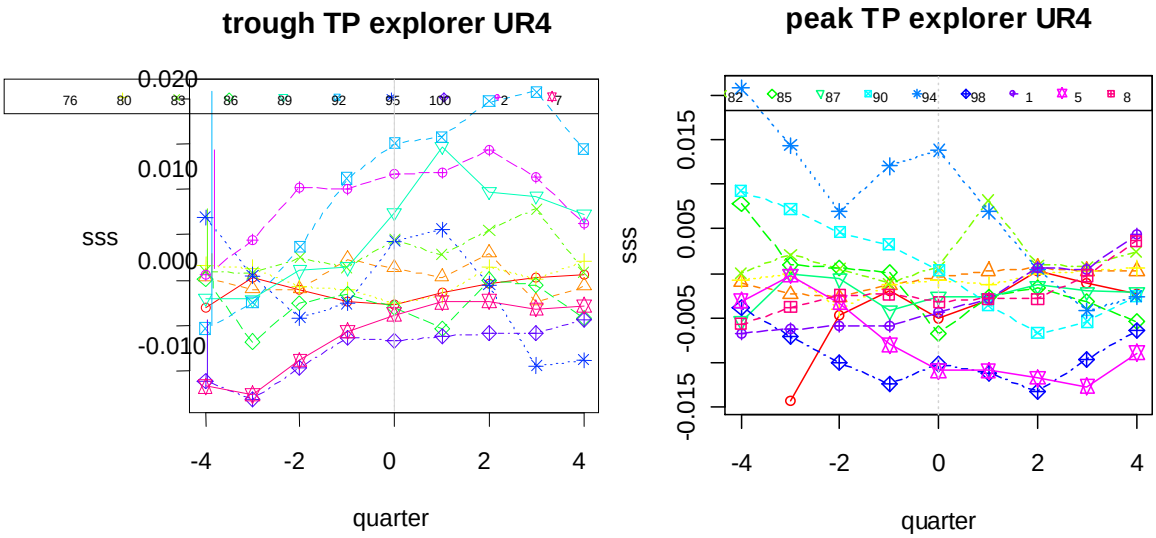


Figure 3.4. GDP turning point exploration for the unemployment rate (UR)

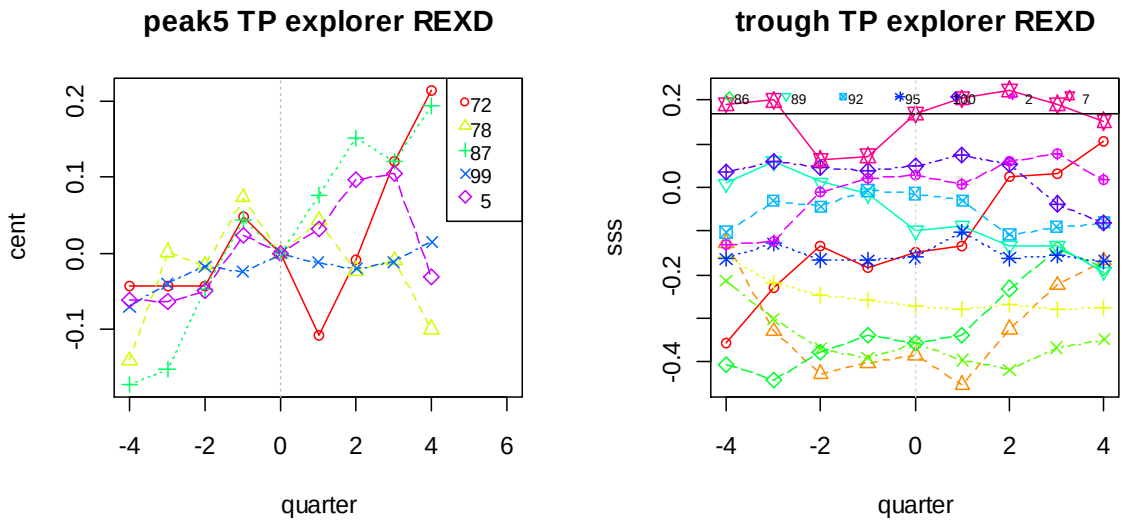
a) upper and b) lower turning point of UR



From the trough explorer in Figure 3.4a we see that the unemployment rate rises up to 3 quarters after the lower turning point. Also for the peak TP we see that for about 2-3 quarters after the TP the series are quite stable.

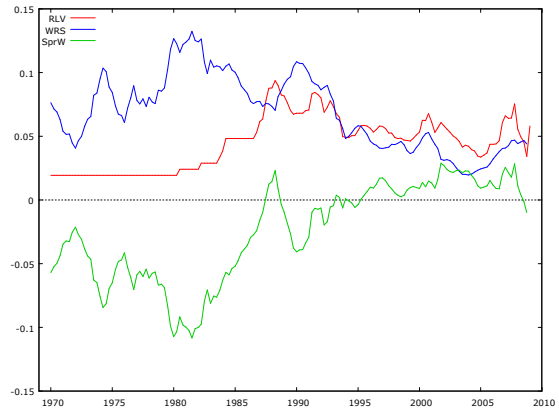
Figure 3.5. GDP turning point exploration for real exchange rate differences REXD = REXX-REXM, where REXX and REXM are the real exchange rates for exports and imports respectively.

a) upper and b) lower turning point of exchange rate differences



The next Figure 3.6 shows why the long (LS) and short term (RS) interest rate in Iceland (together with the RISK premium and the world short term interest rate) have no predictive power. First of all, the interest rates were not recorded until 1988 and then they started at astronomical heights. Thus it makes no sense to use the spread as a leading indicator.

Figure 3.6 Iceland interest rates and the world short term interest rate (WRS)



3.2 Summary of the turning point exploration plots

Generally, we found no convincing evidence for a leading indicator of the GDP turning point behavior in Iceland. There are 2 possibilities for this finding: Either the turning point dating method by peaks/troughs of the HP filter is not a reliable procedure to locate the extremes of a growth rate series or the turning point prediction for a small economy is much more difficult.

Nevertheless, there is some weak evidence for turning point leaders and laggers that we can summarize in the following way:

- GDP peak leaders are: Exports (EX), pretax income (YJ), real exchange rate difference (REX-RIM), and real exchange rate ratio (REXM/REX).
- The only GDP lagger we found is exports of non-durable consumption.
- GDP trough leaders are: Unit labor costs (ULC), exports of maritime products (EXMAR), and consumer price index (CPI).
- No pattern: TAX revenues, money M3, long and short interest rate.

Weak evidence means that the indicator peaks 1-2 quarters before the GDP turning point, but there is a large chance (up to 50:50) chance that the indicator is not correct. Again this type of behavior contrasts sharply with the findings in Leamer (2009), where the indicators have a much large chance of being correct (up to 90:10). It remains to be seen if such a weak evidence for turning point indicators can be also observed for other European economies and why the US turning point behavior over the last 50 years seem to be more regular than for other economies.

4. Abnormal contributions to growth

In this section we follow up the idea of using the time series of contributions to growth as predictors for turning points (TPs). This idea was proposed by Leamer (2009) in the following way: Since the series of growth contribution is not stable and exhibits up and downs that depend on the structure of the economy, we are only interested in the abnormal (excessive high or low) growth contributions. Thus, we need a non-linear smoother of the series of growth contribution, and we use as in Leamer (2009) a piecewise linear regression model. As knots (regime dividers) of the 3 regimes we use the lower TP 2003:3 and the upper turning point 2007:3. To use the regression model to obtain the abnormal contributions to growth we first cumulate the series of growth contributions and fit the 3-regime spline model to the cumulated series. In this way we can obtain the abnormal growth contribution as the residuals of the linear spline fit. Thus, we define as abnormal growth contribution the deviations from an average of growth rates between two turning points.

First we analyze the contributions to growth as they are reported by the CBI but only for the period 1998:1 to 200:9. These series are given only for the following variables:

"GDP" … gross domestic product, "CON" … consumption,

"EX"… exports, "IMP"… imports,

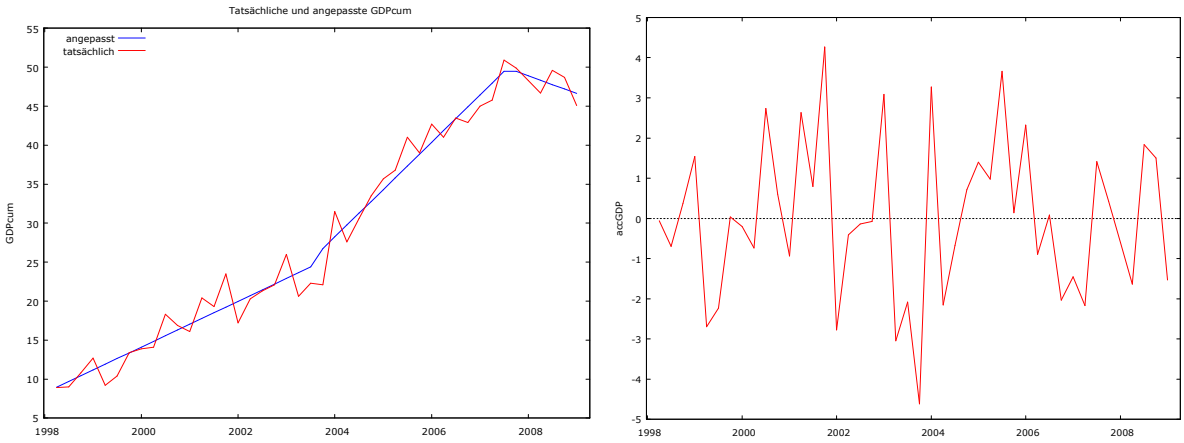
"INVR"… inventories, "GC"… government consumption,

"GFCF"… gross fixed capital formation.

During the period 1998:1 to 2000:9 we find one trough turning point at 2002:3 and 2 peak TPs: the first one at 1998:3 and the second at 2005:2. The first peak TP is too close to the start of the series of growth contributions, so we can only make a complete plot for the second one.

In order to forecast the next lower turning point after the last peak of GDP growth, we pretend that 2009:1 is a possible lower turning point and we observe the traces of abnormal growth indicators to predict this lower turning point.

Figure 4.1 The abnormal cumulated growth of **GDP** (spline and residuals)



The left panel of Figure 4.1 shows that during the first regime up to 2003, the contraction period of GDP, and the growth contributions were smaller than in the subsequent expansion period. Over the last quarters of the series (since 2008) the growth contributions of GDP are falling. The right panel shows the residuals of the spline fit and should exhibit a stationary behavior.

Figure 4.2 The abnormal cumulated growth of **consumption** (spline and residuals)

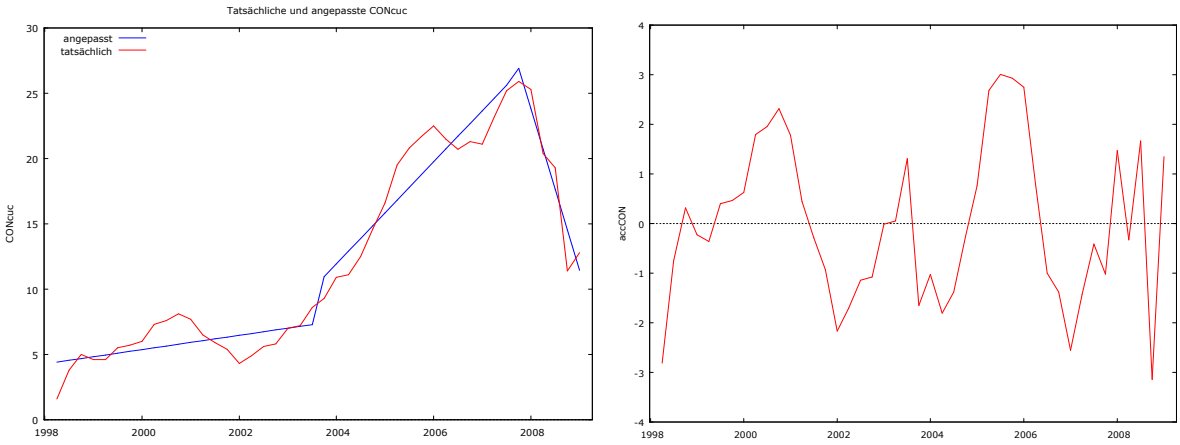


Figure 4.2 shows that the fitted spline of the cumulated growth contributions for consumption follows the same pattern as the one for GDP but for consumption the patterns are more cyclical. Especially the steep decline in the growth contributions of consumption in the current contraction phase implies that there is no hope for growth stimuli stemming from domestic consumption. The residuals show that there had been 2 more peaks of the growth contributions of consumption in the first (around 2001) and in the second regime (around 2005).

Figure 4.3 The abnormal cumulated growth of **government consumption** (spline and residuals)

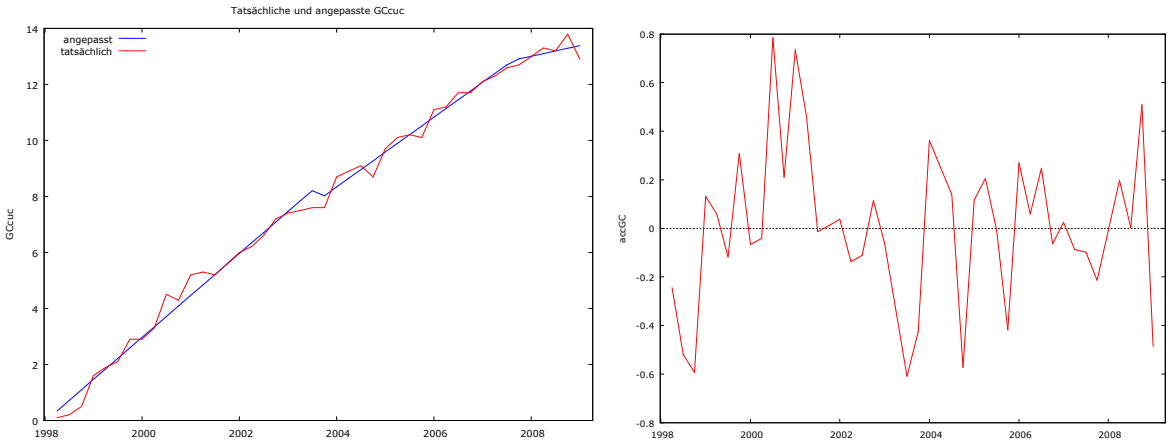


Figure 4.3 shows that the growth contributions for government consumption follows a strong increasing path, which only started to level off during the quarters in the last regime. It could well be that the growth contributions will turn negative if the government has no reserves to stimulate growth.

Figure 4.4 The abnormal cumulated growth of **exports** (spline and residuals)

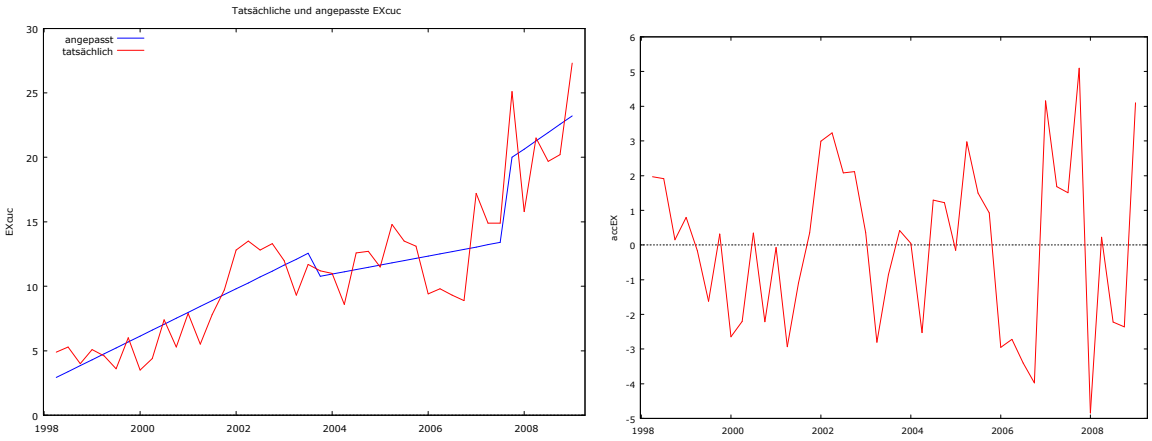
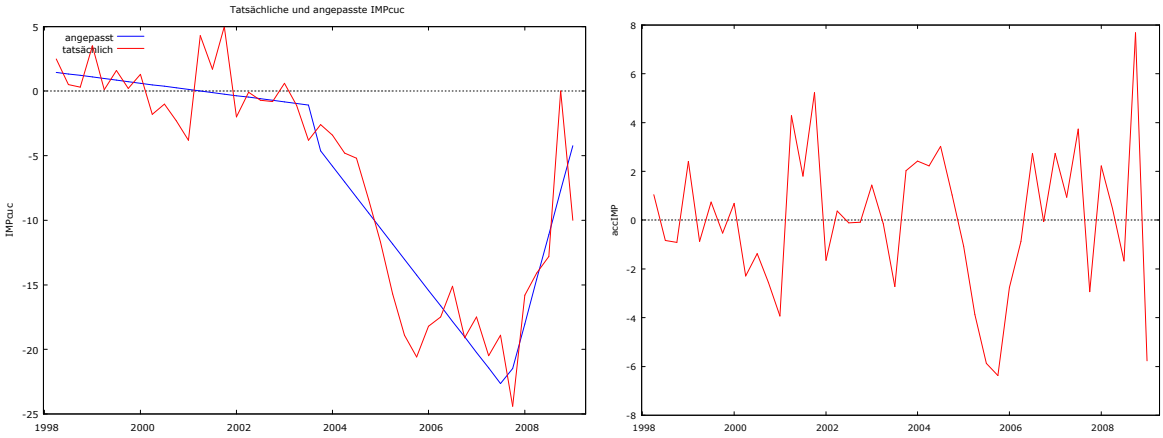


Figure 4.4 displays the acyclic path of the growth contributions (GC) for exports: The growth contributions have been higher during the contraction phases than in expansion phases, and have gained momentum in the last regime. During a booming economy domestic consumption seem to draw upon the goods that are otherwise exported in contraction phases. Thus, exports remain the only big abnormal growth contribution or extra stimulus during the current slump (contraction) of GDP. Note from the residuals that we see a heteroskedastic trend, which means that despite the positive overall feature the growth contributions of exports adds to the volatility of growth rates in the future

Figure 4.5 The abnormal cumulated growth of **imports** (spline and residuals)



From Figure 4.5 we see that the growth contributions (GC) for imports are almost a mirror image of the growth contributions of the exports. The recent increase might just offset the negative development that could be observed during the last expansion of the business cycle. The large decline of the growth contributions in 2005-2006 might indicate the last phase of the excessive bubble economy resulting in heavy imports that led to lower turning point in 2008.

Figure 4.6 The abnormal cumulated growth of Gross Fixed Capital formation (GFCF)

From Figure 4.6 we see that GFCF had sent a large impulse during the last expansion phase to GDP growth. In the current contraction phase the positive trend of the previous expansion phase is completely offset. Judging from the steepness of the spline the current contraction phase has a larger negative impact on GDP growth than the contraction phase until 2003. During the “bubble years” 2006-2007 we see from the residuals a large abnormal contribution to GDP growth.

Figure 4.7 The abnormal cumulated growth of **Inventories** (spline and residuals)

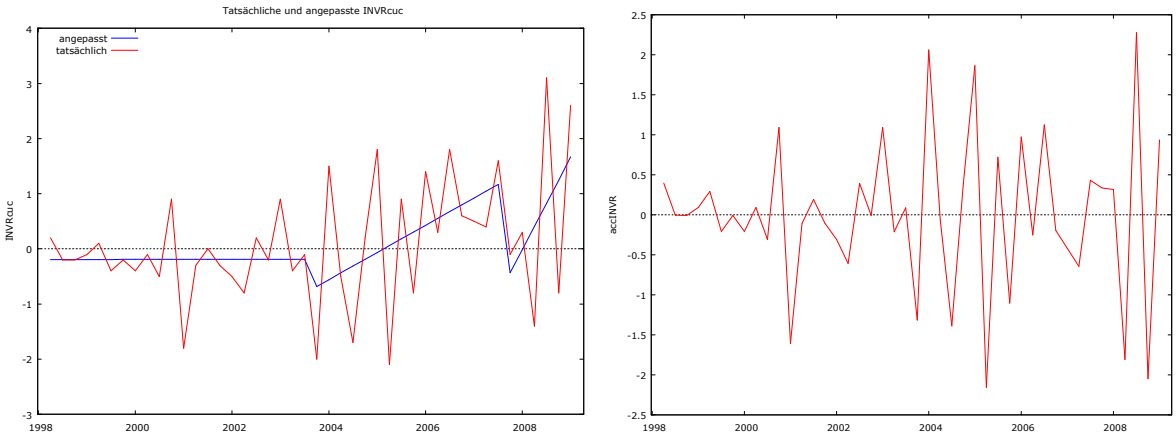


Figure 4.7 shows that abnormal growth contributions of inventories have increased over the 3 regimes and exhibit an atypical pattern. Comparing the growth contribution results of Iceland with the ones for the USA in Leamer (2009) we see that the growth contributions in the USA follow a much smoother development (and cover a much longer period, i.e. the last 50 years). The Icelandic growth contributions seem to be much more dependent on the specific phases of the business cycle, especially in the last decade. This might be an indication that growth contributions for small economies are subject to much more volatile influences. Note that fitting spline regressions results usually in a R-square of above 0.9 and only a few coefficients are not significant. In Iceland the growth contribution over the first declining phase has been essentially zero. The current positive trend might reflect the inventory built up after the bubble years.

As a next step we look at the predictive power of the abnormal growth contribution for the turning points of the business cycle. We start in Figure 4.8 with the first lower turning point in 2002:1.

Figure 4.8 The trough turning point of 2002:1

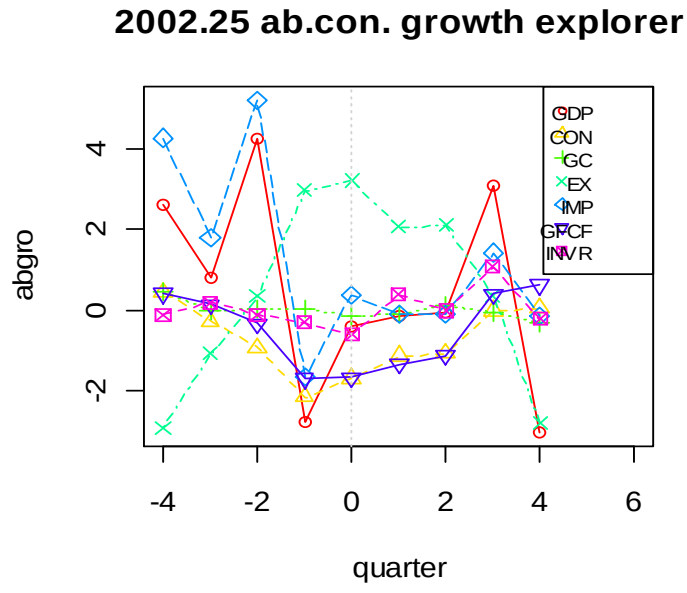
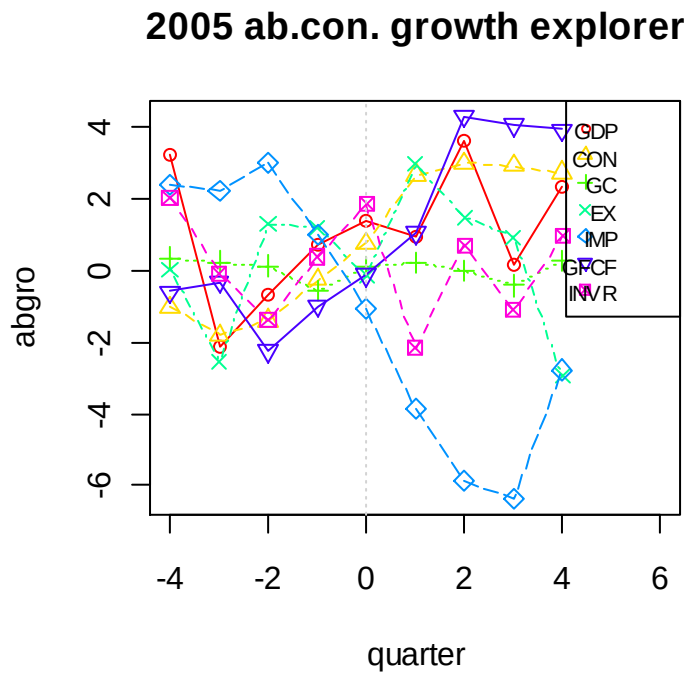


Figure 4.8 shows that most of the abnormal growth contributions (except exports) decline during the time before the lower turning point 2001:1. The sharpest decline before the turning points - and therefore have the role of a leading indicator - can be found for GDP and Imports, followed by Consumption and GFCF. Exports seem to have anticline predictive power since it peaks just at the trough turning points. Surprisingly, Inventories show a flat behavior.

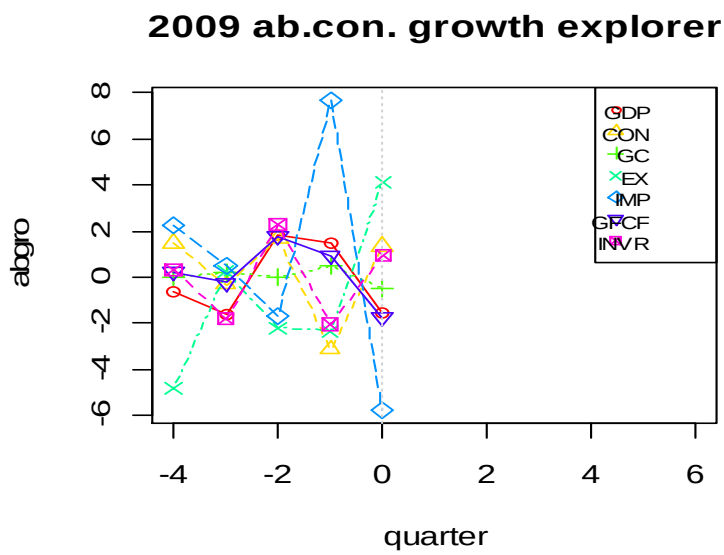
Figure 4.9 displays the behavior of the growth contributions at the peak turning point of 2005:2. Unfortunately, we cannot see any strong pattern for a leading indicator. Most indicators peak after the peak. GDP, Consumption and GFCF are upward moving while Imports follow a negative trend. The analysis of a second peak, if data were available, might bring more light on this issue.

Figure 4.9 The behavior of abnormal growth contributions at the peak turning point of 2005:2



In Figure 4.10 we follow up the question if 2009:1 could have been a lower turning point if we analyse the behavior of the abnormal growth contribution in the 4 quarters before this point. As we see, there is no clear picture, the only decrease we see for Imports, followed by GDP and Gross Fixed Capital formation (GFCF). The other indicators move up. A more reliable indicator would be that export growth contribution move further up while Imports and GDP have already reached the bottom line.

Figure 4.10 Prediction by indicators: Is there a possible trough turning point in 2009:1?



4. Business cycle accelerators

Leamer (2009) proposes in analogy to the Samuelson multiplier-accelerator model an exploratory search diagram that shows if certain abnormal growth of variables accelerate the phases of the business cycle. For this purpose we correlate the abnormal growth contributions of GDP with those of the available indicators: Has such acceleration happened in Iceland and if so for what variables? If abnormal growth contributions are positively correlated, then expansion phases of the business cycle are accelerated, if abnormal growth contributions are negatively correlated, then contraction phases of the business cycle are accelerated, i.e. growth shrinks more rapidly. (Otherwise abnormal growth contributions are neutral.)

From the abnormal growth contributions of the Icelandic business cycle we found the following two positive accelerators: Consumption and Gross Fixed Capital formation (GFCF), while Inventories are negative accelerators.

Figure 5.1 Abnormal growth contributions of Consumption is a positive growth accelerator for GDP

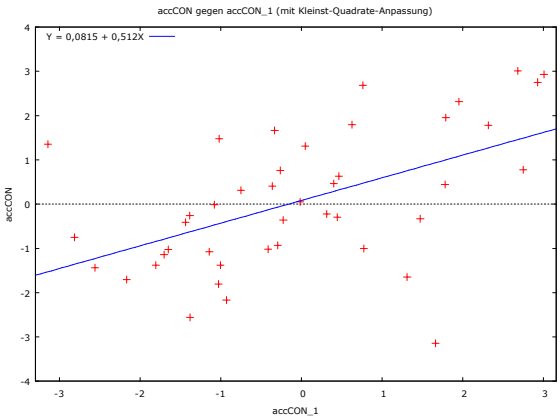
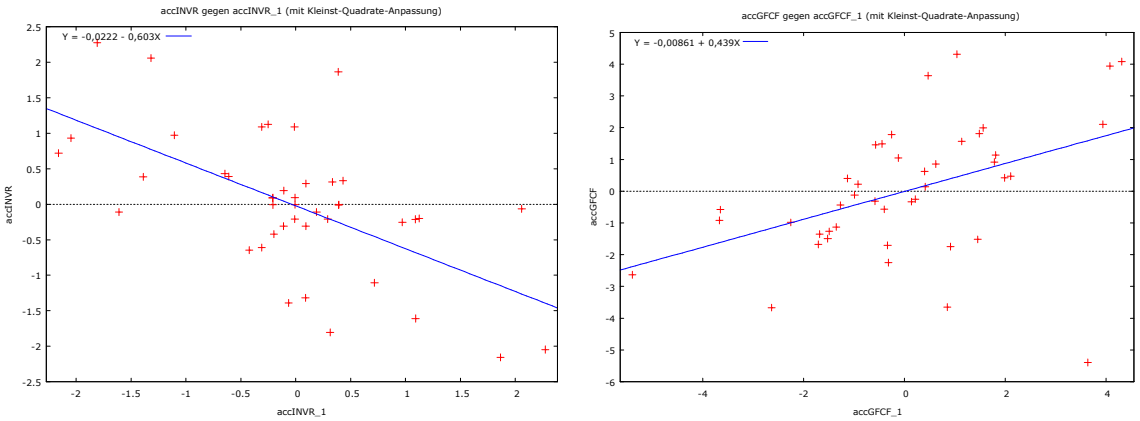


Figure 5.2 Inventories are negative accelerators and GFCF is a positive accelerator



6. Summary

This paper has dated the Icelandic business cycle by a simple HP filtering method of the GDP growth rates. Depending on the smoothness constant we find a long or a short business cycle (see Table2). We find that the business cycle in Iceland between 1970 and 2009 is on average rather short: 12 quarters. Most macro-economic variables are pro-cyclical and there is little evidence for leading indicators. The financial variables are not reliable indicators for the BC since most financial indicators are useful after 1990.

The current downturn of the Iceland economy is one of the sharpest in history and it might a long time for recovery. The analysis of the main macro-economic variables in Iceland has shown that the business cycle in Iceland follows a familiar cyclical pattern but the internal dynamic laws of the business cycle cannot be fully understood with the current tools of macro-economic analysis as e.g ., the exploratory tools in Leamer (2009). One reason might be that the data base in Iceland is short, because the economic growth in Iceland has started quite lately. Having reached a high level of income in a relative short time, the challenge now is to maintain a high standard of economic activity and to lay out a sustainable growth path.

Unfortunately, many early warnings and advices for cautious development (see Krugman (1991) or Stiglitz (2001), and the main points are summarized in the appendix) were not put into practice and resulted in a bubble economy. The task for economic policy is now twofold: Firstly, to heal the wounds of the financial crisis 2008 and to lay out a growth path for the Iceland economy. Secondly, to restore the confidence of the domestic consumers and of foreign investors, like the implementation of a reliable institutional framework for future financial developments.

At this point a caution with respect to the data base has to be made and creates a potential challenging task for the future: Despite the fact that the macro-economic data base for the last 2 decades is quite good, some important macro variables that might be important indicators for the business cycle of the Iceland economy are not recorded. These missing data recordings should be implemented quite quickly, together with more detailed research as what additional variables are needed and important to understand the latent mechanism of the Iceland economy. Iceland is a good example how economic prosperity is tied to the financial system in a globalised world. Early warning system should be developed to prevent uncontrolled financial developments since they backfire to the real economy. Again, a detailed study of the recent developments in Iceland might give new insights.

Further research problems are: This paper could not find reliable indicators for the business cycle in Iceland. One reason could be the macroeconomic data base: Iceland has started to build up a reliable quarterly data base over the last 20 years, but some important indicators are still missing. Like e.g. housing starts, consumer debts, mobile goods, foreign currency accounts, and short and long term interest rates. This is an argument for the refinement of the macro-economic measurement process. Another reason could be the size effect: it seems that small economies like Iceland have a more irregular synchronization patterns around turning points than in larger economies (US). In support of this argument we point out that the abnormal growth contributions across the phases of the BC in Iceland seem to vary much more than in the US. Both features might be related to an economic size effect of an economy and this "small size effect" could be more explored for e.g. economies in Europe.

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Appendix: Business Cycle Chronology in the USA

The NBER's Recession Dating Procedure[2]

The National Bureau's Business Cycle Dating Committee maintains a chronology of the U.S. business cycle. The chronology identifies the dates of peaks and troughs that frame economic recession or expansion. The period from a peak to a trough is a recession and the period from a trough to a peak is an expansion. According to the chronology, the most recent peak occurred in March 2001, ending a record-long expansion that began in 1991. The most recent trough occurred in November 2001, inaugurating an expansion.

A recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales. A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough. Between trough and peak, the economy is in an expansion. Expansion is the normal state of the economy; most recessions are brief and they have been rare in recent decades.

In choosing the dates of business-cycle turning points, we follow standard procedures to assure continuity in the chronology. Because a recession influences the economy broadly and is not confined to one sector, we emphasize economy-wide measures of economic activity. We view real GDP as the single best measure of aggregate economic activity. In determining whether a recession has occurred and in identifying the approximate dates of the peak and the trough, we therefore place considerable weight on the estimates of real GDP issued by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. The traditional role of the committee is to maintain a monthly chronology, however, and the BEA's real GDP estimates are only available quarterly. For this reason, we refer to a variety of monthly indicators to determine the months of peaks and troughs.

The committee places particular emphasis on two monthly measures of activity across the entire economy: (1) personal income less transfer payments, in real terms and (2) employment. In addition, we refer to two indicators with coverage primarily of manufacturing and goods: (3) industrial production and (4) the volume of sales of the manufacturing and wholesale-retail sectors adjusted for price changes. We also look at monthly estimates of real GDP such as those prepared by Macroeconomic Advisers (see http://www.macroadvisers.com). Although these indicators are the most important measures considered by the NBER in developing its business cycle chronology, there is no fixed rule about which other measures contribute information to the process.

The committee's approach to determining the dates of turning points is retrospective. We wait until sufficient data are available to avoid the need for major revisions. In particular, in determining the date of a peak in activity, and thus the onset of recession, we wait until we are confident that, even in the event that activity begins to rise again immediately, it has declined enough to meet the criterion of depth. As a result, we tend to wait to identify a peak until many months after it actually occurs.

[2] **Business Cycle Dating Committee, National Bureau of Economic Research, January 7, 2008**

BUSINESS CYCLE REFERENCE DATES		DURATION IN MONTHS			
Peak	**Trough**	**Contraction**	**Expansion**	**Cycle**	
Quarterly dates are in parentheses		*Peak to Trough*	*Previous trough to this peak*	*Trough from previous Trough*	*Peak from previous Peak*
	Dec 1854 (IV)	--	--	--	--
June 1857(II)	Dec 1858 (IV)	18	30	48	--
Oct. 1860(III)	June 1861 (III)	8	22	30	40
April 1865(I)	Dec 1867 (I)	32	46	78	54
June 1869(II)	Dec 1870 (IV)	18	18	36	50
Oct 1873(III)	March 1879 (I)	65	34	99	52
March 1882(I)	May 1885 (II)	38	36	74	101
March 1887(II)	April 1888 (I)	13	22	35	60
July 1890(III)	May 1891 (II)	10	27	37	40
January 1893(I)	June 1894 (II)	17	20	37	30
December 1895(IV)	June 1897 (II)	18	18	36	35
	December 1900	18	24	42	42
June 1899(III)	(IV)	23	21	44	39
September	August 1904	13	33	46	56
1902(IV)	(III)	24	19	43	32
May 1907(II)	June 1908 (II)	23	12	35	36
January 1910(I)	January 1912				
January 1913(I)	(IV)	7	44	51	67
	December 1914	18	10	28	17
August	(IV)	14	22	36	40
1918(III)		13	27	40	41
January 1920(I)	March 1919 (I)	43	21	64	34
May 1923(II)	July 1921 (III)				
October	July 1924 (III)	13	50	63	93
1926(III)	November 1927	8	80	88	93
August	(IV)	11	37	48	45
1929(III)	March 1933 (I)	10	45	55	56
		8	39	47	49
May 1937(II)	June 1938 (II)				
February	October 1945	10	24	34	32
1945(I)	(IV)	11	106	117	116
November	October 1949	16	36	52	47
1948(IV)	(IV)	6	58	64	74
July 1953(II)	May 1954 (II)	16	12	28	18
August	April 1958 (II)				
1957(III)		8	92	100	108
	February 1961	8	120	128	128
April 1960(II)	(I)		73		81
December	November 1970				
1969(IV)	(IV)				
November	March 1975 (I)				
1973(IV)	July 1980 (III)				
January 1980(I)	November 1982				
July 1981(III)	(IV)				
July 1990(III)	March 1991(I)				
March 2001(I)	November				
December	2001 (IV)				
2007 (IV)					

Average, all cycles:				
1854-2001 (32 cycles)	17	38	55	56*
1854-1919 (16 cycles)	22	27	48	49**
1919-1945 (6 cycles)	18	35	53	53
1945-2001 (10 cycles)	10	57	67	67

* 31 cycles
** 15 cycles

Source: NBER

Appendix B: Stiglitz (2001) on Iceland (selected in bold)

p.18: "While the growth benefits of **capital market liberalization** are dubious at best, there is clear evidence concerning the adverse effect on the risk facing a country.

Moreover, the contention that short-term flows are stabilizing is simply empirically incorrect, and was known to have been incorrect before the crisis: short-term capital flows are pro-cyclical, not countercyclical, and thus almost inevitably exacerbate, not dampen, fluctuations.20

The instability of these flows contributes to overall economic instability; capital market liberalization is systematically related to more frequent and deeper crises. Moreover, the evidence is that these crises have long-lasting effects, with growth slower for five years or more after the onset. "

"**Capital market restrictions**, or as I prefer to refer to them, interventions, can take a variety of forms: disclosure requirements, tax laws, banking and financial sector regulations, direct controls. These interventions can be combined. As in other arenas, there is some argument for market- or price-based mechanisms, such as Chile's effective tax on capital inflows. Malaysia converted its controls on outflows into taxes. Iceland does not face the problem that many developing countries have regarding high levels of corruption associated with different forms of exchange rate controls. Nonetheless, as discussed below, there is some preference for price-based mechanisms in the current environment."

p.20: "Such interventions can be WTO-consistent, by simply imposing **excise taxes** on commodities in which imports have a relatively high share; this is especially easy for a small country, like Iceland. Since the country does not produce automobiles, for example, an excise tax on automobiles is de facto (though not de jure) a tax on imported goods."

On Financial Systems

p.20: "Major collapses, with longer-lasting effects, are especially associated with the vulnerability of the **banking system**, which is one of the reasons that it is important for the government to play a role in prudential regulation. While the recent emphasis on risk management systems is welcome, a broader "portfolio" approach to regulation is required, especially given the high levels of volatility associated with asset prices in small open economies. A bank that might have looked as if it were acting prudently, with high levels of collateral requirements, will find that the value of the collateral collapses in the event of a crisis. "

p.27: "Furthermore, rigid enforcement of capital adequacy requirements can be self-defeating, not only failing to improve the balance sheet of the banks, but also contributing significantly to an economic downturn. Indeed, it has been shown that excess reliance on capital adequacy standards is Pareto inefficient.

Other regulations are an important part of the regulatory "portfolio" with emphasis on different parts changing as circumstances change. For instance, speed limits (limiting the pace of expansion of banks) and limits on the exposure to different risks can play an important role.

Speed limits are restrictions on the rate at which banks can increase their lending. Experience in the United States (in the savings and loan debacle) and elsewhere show that banks which increase

their lending most rapidly are most prone to crisis. This may be partly because banks cannot manage expansion beyond some rate; their ability to hire additional personnel to do the requisite screening and monitoring is limited.

It may also be because banks with low or negative net worth are more willing to undertake the risks of rapid growth. It may be because those willing to expand most rapidly are those most optimistic about the future, and they genuinely believe that the loans are good loans; but with deposit insurance (whether implicit or explicit) it is taxpayers who pay for their excessive exuberance, and they are not subjected to the kind of market discipline that they might be without that deposit insurance. Particularly relevant in this connection are limits on the exposure to foreign exchange risks. "

…

"The design of the financial system should take into account the risks associated with systemic failure. The fact that real estate prices are highly volatile means that real estate lending is especially risky. Separating out such lending from other lending may thus reduce the "contagion" effect of a collapse in real estate prices, and the benefit of doing so may exceed the cost in terms of risk reduction from diversification (the effect which has been most often emphasized in the argument for the creation of broad-based financial institutions.)"

p.28: "Many of the most recent crises have been related to the collapse of real estate bubbles. Governments can, and should, also try to dampen investments in real estate when there appears to be a real estate bubble, and these investments are a major contributing factor to the trade deficit (through exchange rate effects). Though it may in many circumstances be difficult to ascertain with certainty whether there is such a bubble, there are a number of indicators, and policy can adjust, e.g., to increase taxes or collateral requirements, as the evidence mounts. This is a policy I would have recommended, for instance, for Thailand. In a sense, one might argue that it tried to do this, through the traditional instrument of increasing the interest rate. But what matters is not the interest rate paid on government bonds (the instrument that monetary authorities typically focus upon), but the interest rate borrowers pay and the amount of credit that is available. An increase in the former interest rate may not translate one-for-one into an increase in the latter, and may not result in a significant reduction in credit availability. "

Plus on: 5. POLICY ISSUES FACING ICELAND

"The overall policy framework of the previous section can be used to frame some of the key policy issues facing Iceland today, as set out in Section 3. The large current account deficit may or may not be a real problem, but it represents a risk, and it would therefore be prudent to take actions to reduce it. The current account deficit has been associated with a credit boom financed by foreign borrowing. The conjunction of an economic upswing that began in 1996 and the very recent liberalization of financial markets laid the foundations for the foreign financed credit boom. It was in turn fuelled by the policy of exchange rate stability and explicit and implicit government guarantees of the banking system. The increased degree of competition for market shares among financial institutions that accompanied the start of the privatization process in 1998 gave the credit boom a further boost. All these issues have to be addressed in order to reduce the risks that the Icelandic economy is facing. "