Iceland: Selected Issues

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ICELAND

Selected Issues

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Approved by European Department

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A. Introduction

1. **When economic shocks, either domestic or foreign, are large relative to the size of an economy, maintaining stability in output and prices can be a daunting challenge.** This point has been aptly illustrated in Iceland by inflation's breach of the upper bound of the central bank's tolerance range starting in February 2005. Over 2004, aggregate demand in Iceland received enormous stimulus from investment in energy-intensive projects and innovations in financial markets. The labor income tax cuts that commenced in January 2005 amplified their effects, contributing further to excess demand pressures and high inflation in the first half of 2005. In part, these challenges are recognized in the structure of the inflation targeting framework adopted by the Icelandic government and the central bank in 2001. The targeted rate of inflation, at 2.5 percent, is slightly higher than the rate targeted by many other central banks. In addition, the tolerance range of ±1.5 percentage points is also wider than the more common ±1 percentage point tolerance range of most other inflation targeting frameworks. However, the recent breach of the tolerance band begs the question "How tightly is it feasible to control inflation in Iceland?" This paper provides some empirical insights on this question.

2. **Since its introduction in Taylor (1979), the efficient monetary policy frontier has become widely used to estimate what a monetary authority can achieve in terms of inflation and output stability.** The efficient monetary policy frontier traces out the locus of the lowest combinations of inflation and output variability that are achievable under a range of alternative rules for operating monetary policy when the economy under control is subjected repeatedly to economic disturbances. In this paper, estimated macroeconomic models for Iceland, Canada and the United States are used to trace out efficient monetary policy frontiers under simple inflation-forecast-based monetary policy rules.[2] These frontiers suggest that the inflation-output variability tradeoff faced by the monetary authority in Iceland is much less favorable than those faced by the monetary authorities in Canada and the United States. Although, these results should be interpreted with caution because of the potential empirical limitations, they do point to two directions for possible improvement. First, by effectively communicating the fact that inflation is more likely to be outside the tolerance range in Iceland than in other inflation targeting countries, the central bank may be able to minimize the negative impact that such tolerance-range breaches could have on inflation expectations. Second, consideration should be given to modifications to the inflation targeting framework and other macroeconomic policy innovations that could help improve the inflation-output variability tradeoff.

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[1] Prepared by Ben Hunt.

[2] The author gratefully acknowledges Philippe Karam for providing the initial code for the Bayesian estimation and Dirk Muir for providing examples of the code for constructing efficient frontiers.

3.   **The remainder of the paper is structured as follows.** The small macroeconomic model used for the analysis is presented in section B along with a very brief description of the estimation procedure. More details of the model and the estimation results are presented in the appendices. The resulting efficient policy frontiers under simple inflation-forecast-based policy rules are presented in Section C. Section D concludes.

B. The Model

4.   **The analysis is conducted using a small "New Keynesian" macroeconomic model with rational expectations.** The key behavioral equations in the model consist of an output gap relation, an inflation equation, an exchange rate equation and a monetary policy reaction function given by the following:

1) $ygap_t = \beta_1 \cdot ygap_{t-1} + \beta_2 \cdot ygap_{t+1} + \beta_3 \cdot rrgap_{t-1} + \beta_4 \cdot zgap_{t-1} + \beta_5 \cdot ygap_t^* + \varepsilon_t^{ygap}$,

2) $\pi_t = \pi_t^e + \delta_1 \cdot ygap_{t-1} + \delta_2 \cdot \Delta z_t + \varepsilon_t^\pi$,

3) $z_t = z_{t+1}^e + (rr_t - rr_t^*)/4 + \varepsilon_t^z$, and

4) $rs_t = rs\_eq_t + \alpha_1 \cdot (\pi_{t+4} - \pi^T) + \alpha_2 \cdot ygap_t + \varepsilon_t^{rs}$.

Where *ygap* is the output gap, *rrgap* is the real interest rate gap, *zgap* is the real exchange rate gap, * denotes foreign variables, π is inflation, *e* denotes an expectation, Δ is the first difference operator, *z* is the real exchange rate, *rr* is the real interest rate, *rs* is the nominal policy rate, *rs_eq* is the equilibrium nominal interest rate, and ε denotes error terms. While this model is simple and abstracts from many important features of the economy, such specifications have long been the workhorse of monetary policy analysis.[3] In addition to effectively capturing the key channels of monetary policy transmission, this framework has the virtues of clarity and tractability. For both Canada and Iceland, there are three additional behavioral equations that describe the foreign sector, an output gap equation, an inflation equation and a policy reaction function that are specified as above with the exception that no * variables appear. There are also several identities that complete the models, the details for which can be found in Appendix I.

5.   **The models' parameter values are estimated from the data using a Bayesian technique.** Considerable advancement in both computing power and software have made

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[3] There is a growing literature in which models like the ones used here are derived from microeconomic optimizing foundations, for examples see Gali and Monacelli (2002) and Monacelli (2004).

Bayesian estimation of structural rational expectations models feasible.[4] The Bayesian approach starts with prior distributions for the model parameters which are then combined with the data using the likelihood function to estimate the posterior distributions for the parameters. This approach has two important strengths. First, starting with prior distributions for the parameters allows other empirical evidence from a range of sources to enter into the estimation. Secondly, use of prior distributions makes the highly nonlinear optimization algorithm considerably more stable, making it feasible to apply the technique when sample periods are short. This is a particularly important aspect for Iceland because quarterly National Accounts data only start in 1997Q1. In addition, the estimation procedure also allows for measurement errors in the data. For Iceland this is also extremely important because the data are not seasonally adjusted and tend to be quite volatile. Some of the excess volatility in the data is thus allocated to measurement error which does not enter into the stochastic simulations that are conducted to trace out the efficient policy frontiers.

6.   **The prior distributions for the parameters have relied heavily on inputs from the associated central banks**. For Canada and the United States, impulse response functions from their central banks' policy models, QPM and FRB/US, as well as other feedback from the Bank of Canada and the Board of Governors of the Federal Reserve, as outlined in Berg, Karam, and Laxton (2005), have been used to pin down the prior distributions for the parameters. For Iceland, the starting point was the prior distributions for Canada and these were then augmented where specific Icelandic evidence was available such as in Petursson (2002) and IMF (2002). The models are estimated as open economies, where the United States is treated as the relevant foreign sector for Canada, and Iceland's foreign sector comprises an aggregate of the euro area, the United States, and the United Kingdom. Details on the prior distributions and the resulting posterior distributions can be found in Appendix II.

C. Efficient Policy Frontiers

7.   **Using the estimates of the models' parameters and the estimated distributions for the stochastic shocks, solutions are derived for the variability in the behavioral variables under alternative monetary policy reaction functions.** Here we restrict the choice set to simple inflation-forecast-based rules. Such rules have been found to be quite robust to the types of uncertainty faced by monetary policymakers,[5] can closely approximate the stabilization properties of fully optimal rules,[6] and are generally found to be appropriate

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[4] For a detailed description of the Bayesian estimation technique see Schorfheide (2000) and Geweke (1999). Details on the software for estimation can be found in Juillard (2004).

[5] See Levin, Wideland and Williams (1999) among others.

[6] See Batini an Haldane (1999), Rudebusch and Svensson (1999) and Tetlow and von sur Muehlen (1999) among others.

characterizations of how monetary authorities actually respond.[7] The monetary policy reaction function under consideration has the following form:

5) $rs_t = rs\_eq_t + \alpha_1 \cdot (\pi_{t+4} - \pi^T) + \alpha_2 \cdot ygap_t + \varepsilon_t^{rs}$.

The variance in the behavioral variables is computed for the response coefficients α_1 and α_2 in the interval 1 to 15. By varying the relative dislike for inflation versus output-gap variability (λ_π/λ_y) while minimizing a standard quadratic loss function of the form:

6) $L = \sum_{t=0}^{\infty} \lambda_\pi \cdot (\pi_t - \pi^T)^2 + \lambda_y \cdot (ygap_t)^2$,

the efficient policy frontier is traced out from the set of solutions. The resulting frontiers, when there are no constraints placed on interest rate variability, for Canada, the United States and Iceland are presented in Figure 1.

Figure 1. Efficient Monetary Policy Frontiers
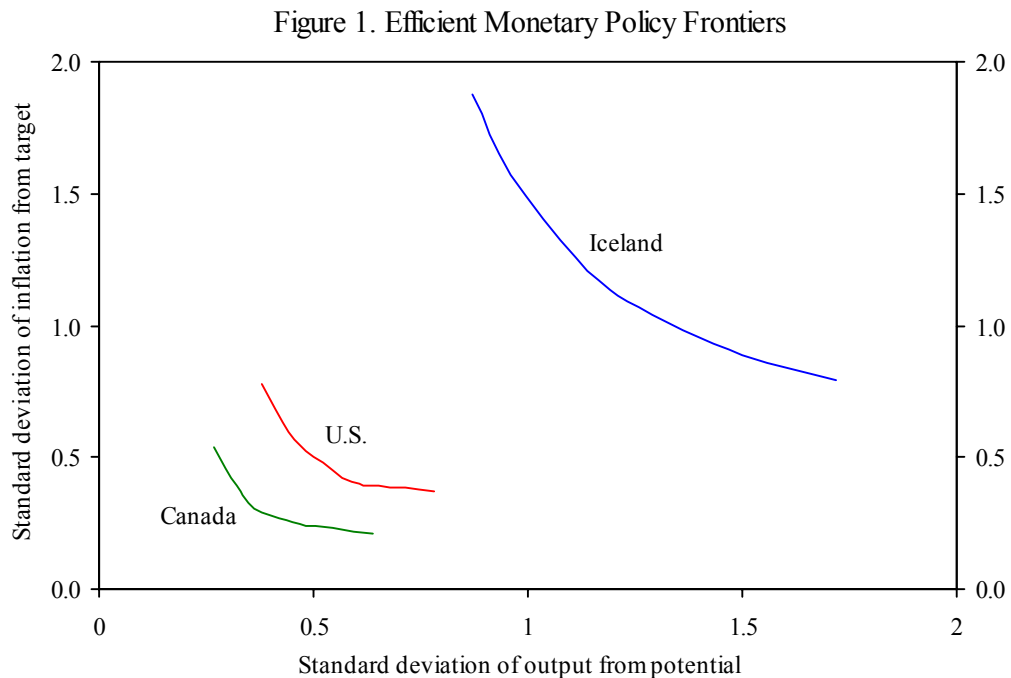
8.   **The efficient policy frontiers illustrate that the relative magnitude of the economic shocks in Iceland result in a considerably less favorable inflation-output**

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[7] See for example, Clarida, Gali and Gertler (1998).

variability tradeoff than in Canada and United States. A key factor determining where these efficiency frontiers lie is the magnitude of the economic disturbances to which the respective economies are subjected. Although Canada is an open economy and subject to shocks from the U.S. economy, the efficient frontier simulated for Canadian lies to the southwest of that for the United States because the estimated standard deviation of the shocks to Canadian aggregate demand is lower than that for U.S. aggregate demand (Appendix II).[8] However, the estimated standard deviation of the shocks to Iceland's aggregate demand are almost 4 times larger than those to Canadian aggregate demand. Consequently, this significantly increases the difficulty of stabilizing both inflation and output in Iceland.[9]

9.   **These frontiers suggests that inflation in Iceland is more likely to be outside the tolerance range than in other inflation targeting countries.** For example, if Icelandic policymakers have equal dislike for inflation and output gap variability, these empirical results suggest that inflation can be kept within the 1 to 4 percent tolerance band roughly 83 percent of the time.[10] In contrast, the significantly lower variability of output and inflation in Canada suggests that inflation can be keep within their 1 to 3 percent tolerance band almost 100 percent of the time.[11] Based on these empirical estimates, for inflation in Iceland to lie within the tolerance range close to 100 percent of the time, the range would have to be roughly ±3.5 percentage points.

10.   **Other factors not included in the above simulation analysis will shift the frontier toward the northeast, lowering the proportion of the time that inflation can be kept with the tolerance band.** Other sources of uncertainty that policymaker face and their preferences over interest rate variability will shift the frontiers. Although the analysis incorporates uncertainty about future shocks, there are three other important sources of uncertainty that are missing: uncertainty about where the economy is today; uncertainty about key unobservable equilibrium variables like potential output, the neutral real interest rate and the equilibrium real exchange rate; and uncertainty about the true structure of the economy. Research work examining the implications of these sources of uncertainty

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[8] It also may be the case that openness can help, as it provides an additional channel, the exchange rate, through which changes in the monetary policy instrument can affect the output gap and inflation. It will be interesting to investigate this possibility in future analysis with this framework.

[9] The estimated variances of the other model error terms, except that for the exchange rate, are all very similar.

[10] This assumes that the realizations of inflation outcomes around the mid point of the tolerance range follow a normal distribution. The optimal point on the frontier when $\lambda_\pi = \lambda_y = 1$ yields a standard deviation in inflation around the target of 1.09 percent and a standard deviation of output around potential output of 1.23 percent. With a standard deviation of 1.09, the tolerance range of ±1.5 encompasses ±1.37 standard deviations (1.5/1.09), which, assuming normality, contains 83 percent of the distribution.

[11] The standard deviation of inflation is 0.31 implying their target band encompasses 3.2 standard deviations which contains almost the complete distribution.

illustrates that they shift efficient monetary policy frontiers to the northeast.[12] This result is obtained primarily for two reason. First, the uncertainty acts like another type of shock leading to additional unexpected volatility in outcomes because policy may be set inappropriately. Second, some uncertainties lead to efficient policy responses that are milder than under certainty. Less aggressive policy responses in turn result in greater variability in output and inflation. Dislike for variability in interest rates can lead to similar policy-response attenuation as illustrated in Figure 2. The thick policy frontiers are the ones that result when the policymaker's loss function is extended to include dislike for interest rate volatility as follows:

$$7) \quad L = \sum_{t=0}^{\infty} \lambda_\pi \cdot (\pi_t - \pi^T)^2 + \lambda_y \cdot (ygap_t)^2 + \lambda_{rs} \cdot (rs_t - rs_{t-1})^2,$$

Where λ_{rs} is the parameter that captures the degree of the policymaker's dislike for interest rate variability. The frontiers in Figure 2 are traced out with $\lambda_{rs} = 0.5$. The frontiers for all countries shift to the northeast. The dislike for interest rate variability is reflected in a decline in the magnitudes of the response coefficients in the policy rules that now lie on the frontier. Less aggressive responses to shocks are required to reduce the variability in interest rates which in turn leads to more volatility in output and inflation.

Figure 2: The Impact of Mild Dislike for Interest Rate Variability

Efficient Monetary Policy Frontiers

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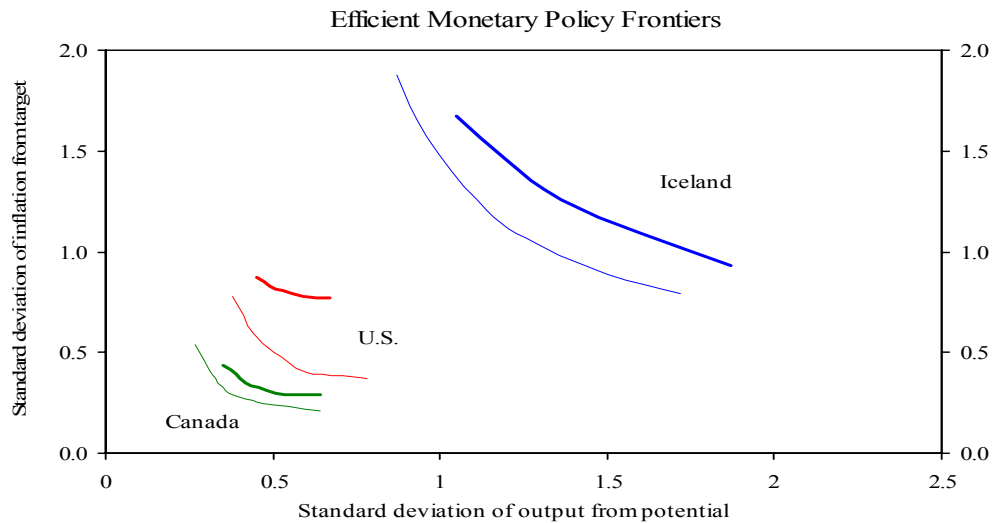
[12] For example see Levin and other (1999), Drew and Hunt (2001), Tetlow and von sur Muehlen (2002) and Hunt and Isard (2003).

11.   **Given the magnitude of the shift in the frontier for Iceland arising from simply limiting interest rate variability, it is conceivable that fully incorporating the impact of uncertainty could increase the achievable standard deviation of inflation to 1.5 percent or higher.** This would reduce the proportion of time that inflation could be kept within the 1 to 4 percent tolerance range to 70 percent or less, imply inflation outside the range in one out of every four quarters on average. If tolerance-range breaches are costly to credibility and thereby add to inflation variability and the real cost of maintaining price stability, these simulation results suggest that policy options to address this should be considered.

12.   **While widening the tolerance range is an obvious option, it may be preferable to adopt a communications strategy that explicitly recognizes the relatively high probability of tolerance-range breaches.** If being outside the tolerance range has detrimental effects on inflation expectations, in part because the central bank is obliged to provide the government with a public explanation for the breach and the prospects for returning inflation to target, widening the range could be an option. However, these empirical estimates, combined with the additional implications of uncertainty, suggest that the tolerance range would have to be ± 4.5 percentage points or larger to ensure that inflation is almost always within the tolerance range.[13] A tolerance range of this magnitude would probably be just as detrimental, if not more so, to the price-stability credibility of the central bank as being outside of the range. Another response could be for the central bank to explicitly communicate the fact that, given the magnitude of the exogenous shocks to which the economy is subjected, inflation outside the tolerance range is likely to occur more frequently in Iceland than in other inflation targeting countries. At the same time, it would also be important for the central bank to stress that policy actions are continually focused on stabilizing inflation at the target rate. This communications strategy could help condition inflation expectations so that tolerance-range breaches become less costly because they would not come as such a surprise nor would they necessarily imply that monetary policy had been inappropriate.

13.   **Other enhancements to monetary policy communication could provide additional anchoring for inflation expectations and thereby improve the inflation-output variability tradeoff.** Inflation expectations in Iceland are heavily influenced by current outcomes. Anchoring these expectation more firmly to the central bank's target rate of 2.5 percent would increase inflation and output stability, shifting the achievable efficiency frontier toward the southwest. One enhancement that could help on this front would be a pre-announced schedule for regular monetary policy meetings that would conclude with a public statement regarding the central bank's decision about interest rates. The media coverage given to such regular announcements would increase the public profile of monetary policy, re-enforcing that the central bank is regularly monitoring economic developments with a

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[13] Assuming a standard deviation for inflation around the target of 1.5 percentage points and a normal distribution, to ensure that inflation will never breach the tolerance range it would have to be ± 4.5 percentage points (± 3·1.5).

view to adjusting interest rates to stabilize inflation at the target rate. A closely related improvement could also be made in the *Monetary Bulletin* by adding a scenario based on an interest rate path viewed by the central bank to be consistent with stabilizing inflation at the target rate. The scenarios currently presented, which are based on fixed or market-expected interest rate assumptions, may be easily misinterpreted because they can often show inflation diverging from the target. At the same time, it will be important to communicate that the path for interest rates is conditional on the central bank's information about the economy at that time. As the economy evolves, the interest rate path required to stabilize inflation will undoubtedly change and the paths published in the *Monetary Bulletin* should not be interpreted as a commitment on the part of the central bank.

14.   **Targeting a measure of inflation that removes some of the more volatile prices that have little information about persistent price pressures could reduce tolerance-range breaches.** Currently the central bank's mandate specifies that it target headline CPI inflation that includes the prices of some goods that other inflation targeting countries have removed from the price indexes that are targeted. Some countries have excluded from the targeted price indexes items such as energy, food, and the user cost of housing, or some combination thereof. In Iceland, there are cogent arguments for not excluding the user cost of housing. First, because mortgage loans are indexed to the headline CPI inflation rate that includes the user cost of housing, this component has very important implication for long-term household welfare. Second, house price inflation is often a leading indicator of economy-wide demand pressures. To effectively target inflation, central banks need to be forward looking, responding early to prospective demand pressures. Having house prices explicitly in the target ensures that the central bank will monitor developments in the housing market closely. Although house prices do not appear to be a likely candidate for exclusion from the inflation target, volatile energy and food prices may be. Provided the central bank remains cognizant of the need to ensure that second-round effects from energy and food prices are not allowed to feed into inflation expectations, removing such volatile components from the target index could be helpful. This would reduce tolerance-range breaches, adding stability to inflation expectation.

15.   **Systematic coordination of monetary and fiscal policy could help improve the inflation-output variability tradeoff, further reducing the probability of breaching the tolerance range.** Beyond the operation of automatic stabilizers, there is no guarantee in most economies that monetary and fiscal policy will be coordinated. For most economies, this is probably optimal given that short-run macroeconomic stabilization can be more effectively managed by monetary policy because it can respond quickly as the economy evolves. This leaves fiscal policy more flexibility to focus on longer-term objectives to which it is better suited. However, in a small economy like Iceland where the shocks are so large, the task faced by the monetary authority appears to be much more challenging and the resulting volatility in interest rates and real activity much higher than in other larger countries. Consequently, more creative solutions need to be considered. One option would be to adopt a rules-based approach in the fiscal budgeting process designed to simultaneously ensure a consistently countercyclical fiscal stance, commensurate with the estimated extent of demand

imbalance, and the achievement of the government's target for public debt. Although such an approach would need to be designed specifically for Iceland and its particular needs, the framework used in the United Kingdom, which embodies simultaneous targets for the cumulative deficit over the business cycle as well as the level of government debt, could provide broad guidance.

16.   **While the efficient frontiers presented in this paper provide motivation to consider policy improvements, it is important to be mindful of the potential empirical limitations and the fact that considerable work remains to test the robustness of the findings.** With the data set for Iceland being so short and encompassing two different monetary policy regimes, the resulting empirical estimates of model parameters and stochastic processes may not be appropriate. Further, the model is simple and may not be an accurate representation of the Icelandic economy. It will be useful to test the robustness of the results under a range of alternative priors for the model parameters as well as extending the range of countries included in the comparison set. In addition, the policy rule that is considered is simple and some researchers have found that, for small open economies, including an explicit response to developments in the exchange rate can improve macroeconomic stability.[14] This possibility should be investigated. Finally, it would be helpful to attempt to quantify the magnitude of the stabilization role that fiscal policy could feasibly play by including in the analysis plausible fiscal policy rules that respond countercyclically to demand conditions.

D. Conclusions

17.   **Although the empirical results presented in the paper should be considered preliminary, they do suggest that Iceland faces a considerably less favorable inflation-output variability tradeoff than do Canada or the United States.** In part, this is recognized in the inflation targeting framework introduced by the government and the central bank in 2001. The mid point of the target range, at 2.5 percent, is slightly higher than that of most other inflation targeting countries and the tolerance band of ± 1.5 percentage points is wider. However, the inflation–output variability tradeoffs presented in this paper suggest that the proportion of time the central bank can reasonably be expected to keep inflation within the tolerance range may be quite low, significantly lower than say the probability that the Bank of Canada can keep inflation within their tolerance band.

18.   **A number of measures should be considered that could help minimize the cost of inflation breaching the tolerance band and help lower the probability of such events occurring.** With breaches of the tolerance band requiring a public statement by the central bank to the government, it would be useful to try to minimize the potential negative impact on inflation expectations. On this front, it might be helpful if the central bank communicated to the public that tolerance-range breaches are more likely in Iceland than in other inflation

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[14] See for example Ball (1998).

targeting countries simply because of the magnitude of economic shocks relative to the size of the economy. In addition, other enhancements in the bank's public communication could more firmly anchor inflation expectations and thereby improve the inflation-output variability tradeoff, reducing the frequency of tolerance-range breaches. A pre-announced schedule for monetary policy meetings that conclude with a public statement regarding the bank's decision for interest rates and the inclusion in the *Monetary Bulletin* of a scenario based on the path for interest rates required to return inflation to target are two possible improvements worth considering. Thought should also be given to removing volatile components such as food and energy from the targeted price index as this would also reduce the probability that inflation would be driven outside the tolerance range. Finally, the unique challenges faced by Iceland because of its size, suggest that innovative policy options need to be considered. For example, ensuring the systematic coordination of monetary and fiscal policy could substantially improve the inflation-output variability tradeoff faced by the monetary authority and consideration should be given to implementing a rules-based system in the fiscal budgeting process designed to achieve this.

The Model

The following provides a detailed description of the open-economy model estimated for Iceland and Canada. The model is specified in gap and rate-of-change terms so that, under inflation targeting, all variables are stationary. For simulation purposes, the equilibrium values for the real interest rate and the real exchange rate are assumed to be time invariant.

Core behavioral equations for the domestic sector.

Aggregate Demand:

1) $\quad ygap_t = \beta_1 \cdot ygap_{t-1} + \beta_2 \cdot ygap_{t+1} + \beta_3 \cdot rrgap_{t-1} + \beta_4 \cdot zgap_{t-1} + \beta_5 \cdot ygap_t^* + \varepsilon_t^{ygap}$,

where *ygap* denotes the output gap, *rrgap* is the gap between the real interest rate and its equilibrium value, *zgap* is the gap between the real exchange rate index and its equilibrium value, *ygap** is the foreign output gap and ε^{ygap} is the stochastic error process.

Inflation:

2) $\quad \pi_t = \delta_1 \cdot \pi_{t+4}^4 + (1 - \delta_1) \cdot \pi_{t-1}^4 + \delta_2 \cdot ygap_{t-1} + \delta_3 \cdot \Delta z_t + \varepsilon_t^{\pi}$,

where π is the quarterly annualized rate of CPI inflation, π^4 is a four-quarter moving average of quarterly annualized CPI inflation, Δz is the first difference in the real exchange rate index, and ε^{π} is the stochastic error process.

The real exchange rate:

3) $\quad z_t = \phi \cdot z_{t+1} + (1 - \phi) \cdot z_{t-1} + (rr_t - rr_t^*) / 4 + \varepsilon_t^z / 4$,

where *z* is the log of the real exchange rate index, *rr* is the domestic real interest rate, *rr** is the foreign real interest rate, and ε^z is the stochastic error process.

The monetary policy reaction function:

4) $\quad rs_t = rr\_eq_t + \pi_t^4 + \alpha_1 \cdot (\pi_{t+4}^4 - \pi^T) + \alpha_2 \cdot ygap_t + \varepsilon_t^{rs}$,

where *rs* is the annualized short-term policy rate, *rr_eq* is it equilibrium real interest rate, π^T is the target rate of inflation, and ε^{rs} is the stochastic error process.

Core behavioral equations for the foreign sector.

Aggregate Demand:

5) $\quad ygap_t^* = \beta_1^* \cdot ygap_{t-1}^* + \beta_2^* \cdot ygap_{t+1}^* + \beta_3^* \cdot rrgap_{t-1}^* + \varepsilon_t^{ygap*}$,

where $ygap^*$ denotes the output gap, $rrgap^*$ is the gap between the real interest rate and it equilibrium value, and ε^{ygap^*} is the stochastic error process.

Inflation:

6) $\quad \pi_t^* = \delta_1^* \cdot \pi_{t+4}^{4*} + (1 - \delta_1^*) \cdot \pi_{t-1}^{4*} + \delta_2^* \cdot ygap_{t-1}^* + \varepsilon_t^{\pi^*},$

where π^* is the quarterly annualized rate of CPI inflation, π^{4*} is a four-quarter moving average of quarterly annualized CPI inflation, and ε^{π^*} is the stochastic error process.

The monetary policy reaction function:

7) $\quad rs_t^* = rr\_eq_t^* + \pi_t^{4*} + \alpha_1^* \cdot (\pi_{t+4}^{4*} - \pi^{T*}) + \alpha_2^* \cdot ygap_t + \varepsilon_t^{rs^*},$

Where rs^* is the annualized short-term policy rate, rr_eq^* is it equilibrium real interest rate, π^{T*} is the target rate of inflation, and ε^{rs^*} is the stochastic error process.

Stochastic processes.

8) $\quad \varepsilon_t^{ygap} = \rho^{ygap} \cdot \varepsilon_{t-1}^{ygap} + \xi_t^{ygap},$

9) $\quad \varepsilon_t^{ygap^*} = \rho^{ygap^*} \cdot \varepsilon_{t-1}^{ygap^*} + \xi_t^{ygap^*},$

10) $\quad \varepsilon_t^{\pi} = \rho^{\pi} \cdot \varepsilon_{t-1}^{\pi} + \xi_t^{\pi},$

11) $\quad \varepsilon_t^{\pi^*} = \rho^{\pi^*} \cdot \varepsilon_{t-1}^{\pi^*} + \xi_t^{\pi^*},$

12) $\quad \varepsilon_t^{rs} = \rho^{rs} \cdot \varepsilon_{t-1}^{rs} + \xi_t^{rs},$

13) $\quad \varepsilon_t^{rs^*} = \rho^{rs^*} \cdot \varepsilon_{t-1}^{rs^*} + \xi_t^{rs^*},$

Identities.

14) $\quad \pi_t^4 = (\pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3})/4.$

15) $\quad \pi_t^{4*} = (\pi_t^* + \pi_{t-1}^* + \pi_{t-2}^* + \pi_{t-3}^*)/4.$

16) $\quad rr_t = rs_t - \pi_{t+1},$

17) $\quad rr_t^* = rs_t^* - \pi_{t+1}^*,$

18) $\quad rrgap_t = rr_t - rr\_eq_t,$

19) $\quad rrgap_t^* = rr_t^* - rr\_eq_t^*,$

20) $\quad zgap_t = z_t - z\_eq_t.$

Estimation Results

The estimation results are presented in this appendix. For Canada, the United States is used as the proxy for the foreign sector as roughly 85 percent of Canada's trade is with the United States. For Iceland, an index comprising the euro area, the United Kingdom and the United States is used to proxy foreign aggregate demand, interest rates and CPI inflation. The trade weighted real exchange rate index published by the central bank of Iceland is used for the real exchange rate. The Bayesian, full system estimation is done in DYNARE. The observable variables are output gaps (real GDP), nominal short-term interest rates (90 day treasury bills or equivalent), CPI inflation rates (headline), and logs of the real exchange rates. Equilibrium values are exogenous and are derived using a variant of the Hodrick Prescott (1997) filter that allows for additional constraints to be added to the minimization problem to prevent the resulting equilibrium value from converging to the actual observed data at the end of the sample period. These constraints can be used so that the equilibrium value converges toward some user-specified value at the end of the sample period. The estimation has been done allowing for measurement error in the observable variables. The priors and the resulting estimates for Iceland and its foreign sector are presented in Tables 1 and 2. The estimates for Canada and the United States are presented in Tables 3 and 4.

Table 1: Iceland Model Parameter Estimation Results
Sample period 1997Q2 to 2004Q4

Parameter	Prior Mean	Distribution	Posterior Mean
Domestic			
β_1	0.85	gamma	0.687
β_2	0.10	beta	0.097
β_3	0.10	gamma	0.101
β_4	0.10	beta	0.095
β_5	0.15	beta	0.169
δ_1	0.20	gamma	0.202
δ_2	0.50	gamma	0.527
δ_3	0.30	gamma	0.292
φ	0.50	beta	0.339
α_1	1.50	gamma	1.201
α_2	0.50	beta	0.527
Foreign			
β^*_1	0.85	gamma	0.767
β^*_2	0.10	beta	0.103
β^*_3	0.10	gamma	0.103
δ^*_1	0.20	beta	0.177
δ^*_2	0.30	gamma	0.227
α^*_1	1.50	gamma	1.536
α^*_2	0.50	beta	0.495

Table 2: Iceland Estimation Results for the Error Processes and Measurement Errors
Sample period 1997Q2 to 2004Q4

Parameter	Prior Mean	Distribution	Posterior Mean
Domestic			
ρ^{ygap}	0.75	beta	0.740
std. dev. ξ^{ygap}	0.75	inverse gamma	0.557
std. dev. mes. er. ^{ygap}	0.20	inverse gamma	1.466
ρ^{π}	0.50	beta	0.5239
std. dev. ξ^{π}	0.75	inverse gamma	0.5144
std. dev. mes. er. $^{\pi}$	0.20	inverse gamma	2.337
ρ^{rs}	0.750	beta	0.765
std. dev. ξ^{rs}	0.25	inverse gamma	0.1542
std. dev. mes. er. ^{rs}	0.20	inverse gamma	0.130
std. dev. ε^{z}	6.00	inverse gamma	9.278
Foreign			
ρ^{ygap*}	0.75	beta	0.767
std. dev. ξ^{ygap*}	0.25	inverse gamma	0.184
std. dev. mes. er. ^{ygap*}	0.20	inverse gamma	0.183
$\rho^{\pi*}$	0.50	beta	0.509
std. dev. $\xi^{\pi*}$	0.25	inverse gamma	0.2165
std. dev. mes. er. $^{\pi*}$	0.20	inverse gamma	1.035
ρ^{rs*}	0.750	beta	0.8194
std. dev. ξ^{rs*}	0.25	inverse gamma	0.136
std. dev. mes. er. ^{rs*}	0.20	inverse gamma	0.111

Table 3: Canada Model Parameter Estimation Results
Sample Period 1992Q2 to 2004Q4

Parameter	Prior Mean	Distribution	Posterior Mean
Domestic			
β_1	0.85	gamma	0.703
β_2	0.10	beta	0.102
β_3	0.10	gamma	0.104
β_4	0.05	beta	0.054
β_5	0.25	beta	0.25
δ_1	0.20	gamma	0.189
δ_2	0.30	gamma	0.258
δ_3	0.10	gamma	0.099
φ	0.50	beta	0.314
α_1	2.00	gamma	2.025
α_2	0.50	beta	0.462
Foreign (U.S.)			
β^*_1	0.85	gamma	0.706
β^*_2	0.10	beta	0.108
β^*_3	0.10	gamma	0.106
δ^*_1	0.20	beta	0.176
δ^*_2	0.30	gamma	0.226
α^*_1	2.00	gamma	1.713
α^*_2	0.50	beta	0.489

Table 4: Canada Estimation Results for the Error Processes and Measurement Errors
Sample Period 1992Q2 to 2004Q4

Parameter	Prior Mean	Distribution	Posterior Mean
Domestic			
ρ^{ygap}	0.75	beta	0.864
std. dev. ξ^{ygap}	0.25	inverse gamma	0.158
std. dev. mes. er. ^{ygap}	0.20	inverse gamma	0.139
ρ^{π}	0.50	beta	0.493
std. dev. ξ^{π}	0.25	inverse gamma	0.138
std. dev. mes. er. $^{\pi}$	0.20	inverse gamma	1.344
ρ^{rs}	0.75	beta	0.722
std. dev. ξ^{rs}	0.25	inverse gamma	0.487
std. dev. mes. er. ^{rs}	0.20	inverse gamma	0.130
std. dev. ε^{z}	4.00	inverse gamma	5.000
Foreign (U.S.)			
ρ^{ygap*}	0.75	beta	0.717
std. dev. ξ^{ygap*}	0.25	inverse gamma	0.227
std. dev. mes. er. ^{ygap*}	0.20	inverse gamma	0.139
$\rho^{\pi*}$	0.50	beta	0.519
std. dev. $\xi^{\pi*}$	0.25	inverse gamma	0.245
std. dev. mes. er. $^{\pi*}$	0.20	inverse gamma	0.639
ρ^{rs*}	0.750	beta	0.824
std. dev. ξ^{rs*}	0.25	inverse gamma	0.184
std. dev. mes. er. ^{rs*}	0.20	inverse gamma	0.117

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II. SOME ILLUSTRATIVE SIMULATIONS OF THE POTENTIAL IMPACT OF INCOME TAX CUTS IN ICELAND[1]

A. Introduction

1.   **The labor income tax cuts commencing in January 2005 in Iceland could contribute notably to the overheating projected over the next two years.** This chapter uses some simulations of MULTIMOD, one of the IMF's multi-country macroeconomic models, to illustrate how the tax cuts could be adding to excess demand pressures, inflation and external imbalances.

2.   **Although MULTIMOD is a particularly useful tool for examining the impact of announced changes in tax policy, the results should be interpreted qualitatively rather than quantitatively.**[2] MULTIMOD's overlapping generations structure means that it affords an important behavioral role for fiscal policy. However, because MULTIMOD has only been estimated for a small group of industrial countries given data limitations, the simulations presented below use the Canada block to proxy what the implication of tax cuts in Iceland might be. Although Canada is also a small open economy, there are no doubt differences in behavioral parameters between Canada and Iceland and, consequently, the results should be interpreted qualitatively rather than quantitatively.

B. The Macroeconomic Impact of Tax Cuts

3.   **Theory suggests that changes in current and future labor income taxes can stimulate current consumption in two ways.** First, in each period, households that don't have access to capital markets (liquidity-constrained households) simply spend their entire disposable income on consumption. A decline in current tax rates raises disposable income and consumption expenditure rises in step. Second, in addition to using higher disposable income, households that have access to capital markets (unconstrained households) are also able to fund current consumption expenditure by borrowing against their human wealth, the present discounted value of their life-time stream of labor income. When taxes fall permanently, and expectations are that they will decline further in the future, human wealth grows. Somewhat impatient households will borrow against that human wealth to fund current consumption. Because MULTIMOD includes both of these types of households, it incorporates the two channels through which cuts in labor income taxes affect consumption expenditure.

4.   **If 40 percent of households face liquidity constraints, a tax cut like the one underway in Iceland generates overheating and requires a tightening in monetary policy** (Figure 1)**.** In the simulation experiment presented, the labor income tax rate declines
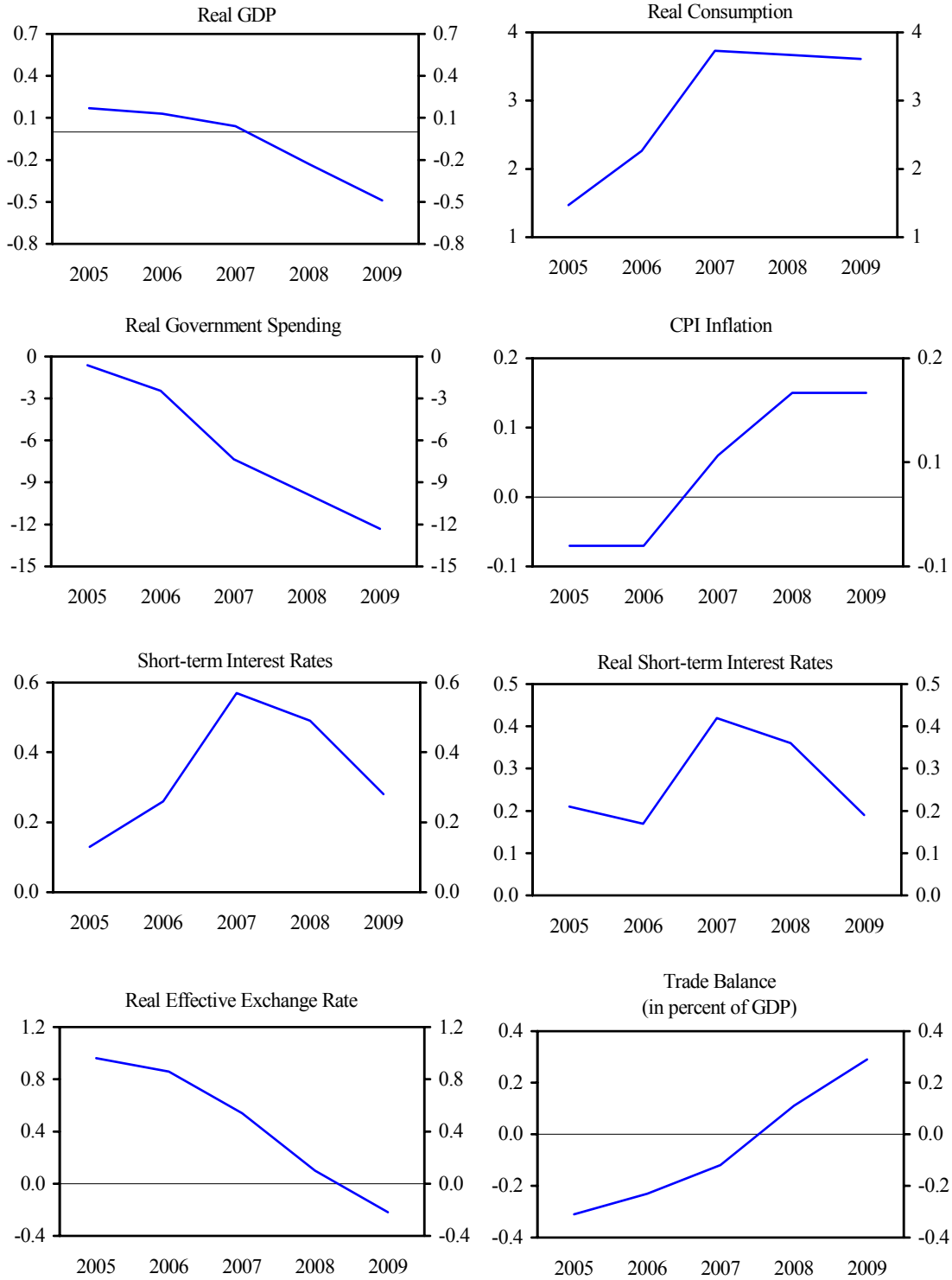
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[1] Prepared by Ben Hunt.

[2] For detailed descriptions of MULTIMOD's structure and dynamic simulation properties see Laxton et al (1998) and Hunt and Laxton (2004).

Figure 1: Permanent Reductions in Labor Income Taxes
(percent or percentage point deviation from baseline)

by 1 percentage point in 2005, a further 1 percentage point in 2006, and then by an additional 2 percentage points in 2007.[3] By 2007 and beyond, labor income taxes are permanently lower by 4 percentage points. To sustain the tax cut in the long run, government expenditure is permanently reduced. The cut in taxes induces households, both constrained and unconstrained, to increase consumption and aggregate demand exceeds supply. In response to the emergence of excess demand and a forecast of rising inflation, the monetary authority raises the policy rate. Through uncovered interest parity, the nominal exchange rate appreciates and this combined with higher domestic inflation leads to an appreciation in the real effective exchange rate. Accelerating domestic demand stimulates imports as does the decline in import prices associated with the appreciating currency. Stronger import demand along with weaker export demand generate a deterioration in the trade balance. These results illustrate how the tax cuts in Iceland, which commenced in January 2005, could be contributing to the growing imbalances in the economy that have been sparked by the new investment projects in the energy and the aluminum-smelting sectors.

5.   **Developments in the mortgage market could amplify the effects of tax cuts.** In August 2004, commercial banks started to compete directly for first mortgages with the publicly guaranteed Housing Financing Fund (HFF). The mortgage products introduced by the banks not only matched HFF loan rates, but in addition, offered higher absolute and loan-to-value limits along with the option to refinance existing loans. In response, planned reforms at the HFF to increase loan limits have been accelerated.[4] Taken together, these developments have enabled households to finance a much larger portion of home purchases as well as access built-up home equity to fund consumption expenditures. To proxy the possible effects of these developments, the tax cut experiment is re-simulated with the proportion of liquidity-constrained households reduced from 40 to 10 percent. The results are presented in Figure 2, with the dashed line tracing out the result when 40 percent of households face liquidity constraints and the solid line the outcome when only 10 percent are liquidity constrained. When more households have the ability to borrow against future labor income, the initial impact of the tax cut on aggregate demand is larger, leading to a sharper pickup in inflation and a stronger monetary policy response. In addition, the magnitude of the secondary cycle in real activity required to re-anchor inflation is larger.

6.   **There are a number of factors that could possibly lead to the tax cuts in Iceland contributing less to overheating that suggested by the these simulation results.** First, offsetting cuts in government expenditure could be larger than those assumed here. Although it should be noted that, as yet, no offsetting cuts in government expenditure have been identified. Second, these simulations assume that households fully believe that the future tax

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[3] The proposed future tax cuts in Iceland also include the elimination of the net wealth tax on individuals and firms in 2006 and cuts in the income surtax from 4 percent to 2 percent in 2006 and zero in 2007.

[4] Details on the mortgage market developments in Iceland are presented in the selected issues chapter, "Mortgage Market Developments in Iceland and the Role of the Housing Financing Fund."

Figure 2: Permanent Reductions in Labor Income Taxes
(percent or percentage point deviation from baseline)

Solid - 10 percent liquidity constrained
Dashed - 40 percent liquidity constrained
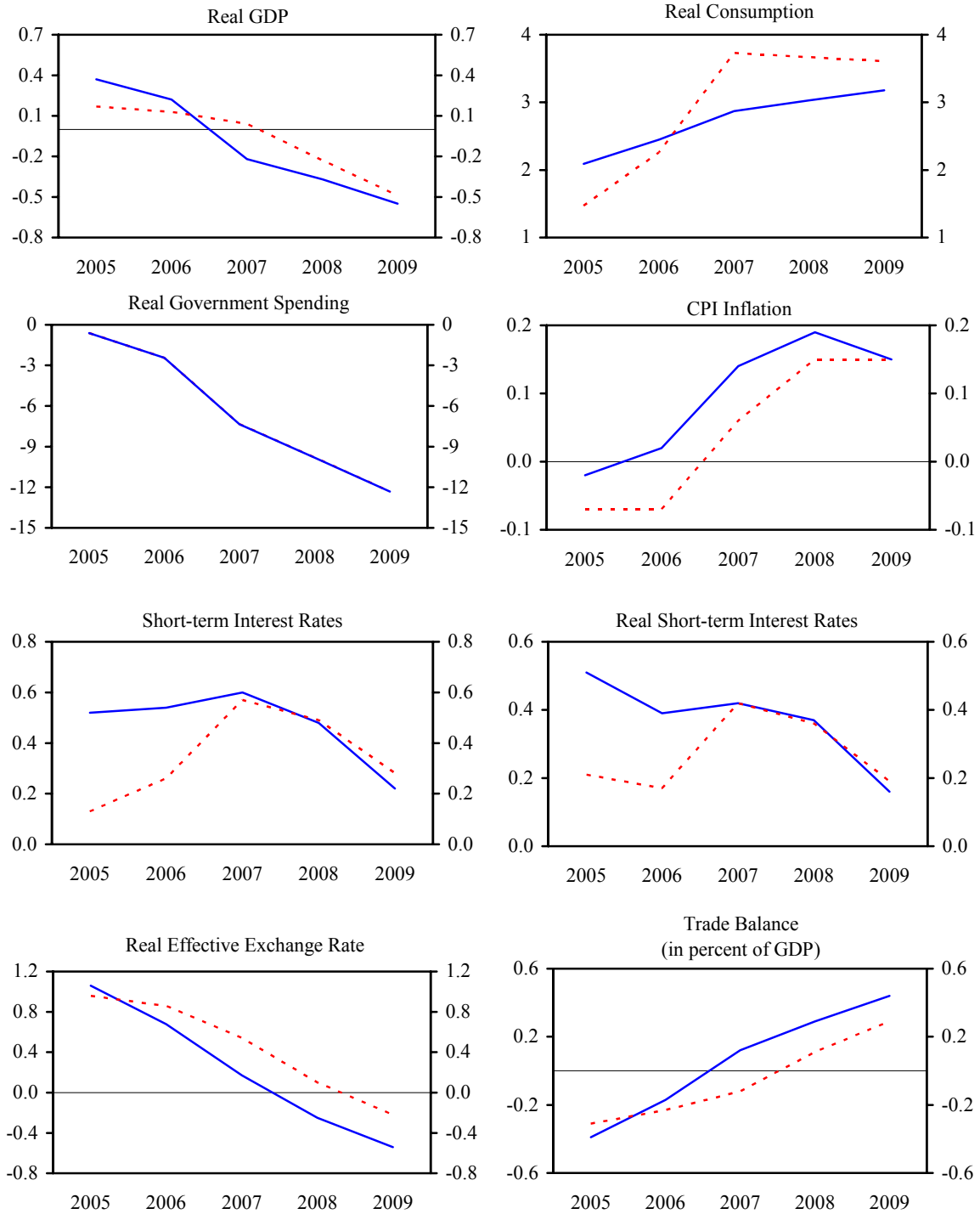
cuts will be implemented. However, if households were less certain, their response to the announced future cuts could be more modest than the simulations suggest. Finally, as noted by finance ministry officials in Iceland, the cuts in labor income taxes could increase the labor supply, thereby adding to the economy's supply capacity sufficiently to accommodate the increase in consumption demand associated with the tax cuts. An additional MULTIMOD simulation that considers this possibility is presented below.

7.   **If the tax cuts result in a permanent increase of 1 percentage point in the labor force participation rate in Iceland, overheating associated with the tax cuts still appears likely.** Ministry officials estimate that the tax cuts will increase the labor supply by 800 people in each of the three years 2005–07. This translates into a increase of roughly 1/3 of a percentage point in the labor force participation rate in each year. To consider the likely impact, such an increase in the participation rate is added to the tax cut simulation in which 10 percent of households face liquidity constraints. Figure 3 contains the resulting paths for GDP, the output gap, consumption and investment when the labor supply also increases (solid line) along with the results from the simulation that does not incorporate the labor supply response (dashed line). The first point to note is that the increase in GDP is now much larger, reflecting the increase in the economy's supply capacity because of the additional labor input. However, the output gap is similar in both scenarios suggesting little difference in the extent of overheating associated with the tax cuts. This output gap arises because of the response of households and firms. Those entering the labor force use the additional income to demand consumption goods. Given the larger labor supply, firms eventually demand more investment goods to build the capital stock to achieve the profit maximizing capital-to-labor ratio. This increase in investment and consumption demand quickly exhausts the new capacity resulting from the additional labor supply.

Figure 3: Permanent Reductions in Labor Income Taxes
(percent or percentage point deviation from baseline)

Solid - Including increase in labor supply
Dashed - No increase in labor supply
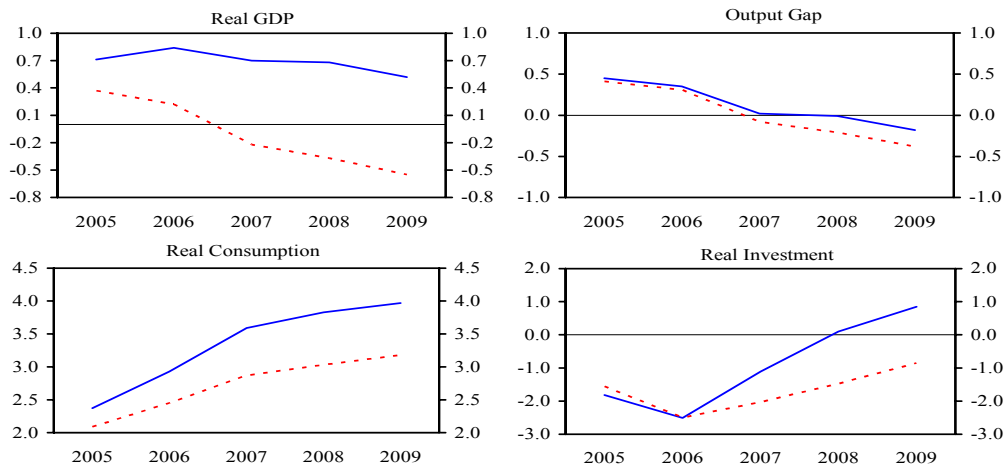
C. Conclusions

8.   **Although past fiscal prudence has enabled the government to be in a position to implement a cut in labor income taxes and announce plans for additional cuts in the future, these tax cuts may be exacerbating the imbalances emerging in the economy.** The MULTIMOD simulations presented in this note illustrate how current and planned future tax cuts in Iceland could be stimulating aggregate demand. As a result, the tax cuts may be adding to the overheating in the economy, inflation, the required tightening in monetary policy, the appreciation of the currency and the current account deficit. Further, the reforms at the Housing Financing Fund and the increased competition from banks in the mortgage market may be amplifying the impact of the tax cuts by increasing households' ability to fund current consumption expenditure by borrowing against the associated increase in their human wealth. A strong labor supply response to lower income taxes is unlikely to reduce the extent of overheating because it will cause both households and firms to also increase demand for goods and services. Looking ahead, to moderate the extent of the projected overheating in Iceland, the government should consider postponing future tax cuts until it is clear that the existing demand pressures in the economy have fully abated. Further, cuts in government expenditure should be implemented as soon as possible to offset the tax cuts that have already been implemented and efforts should be redoubled to identify future expenditure cuts to ensure that once tax cuts proceed, excess demand pressures do not reemerge.

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III. MORTGAGE MARKET DEVELOPMENTS IN ICELAND AND THE ROLE OF THE HOUSING FINANCING FUND[1]

A. Introduction

1.   **During the second half of 2004, there were important developments in the Icelandic mortgage market.** The publicly-guaranteed Housing Financing Fund (HFF) significantly enhanced the efficiency of its mortgage financing and extended its general lending limits. The latter was in part in response to the entry of the commercial banks into the mortgage market in the second half of the year, a welcome development that will increase the banks' domestic financial soundness. As a result, mortgage lending increased sharply and real mortgage rates declined substantially, adding further demand pressures to an already over-heated economy.

2.   **The purpose of this paper is two-fold.** First, it will document the developments in the Icelandic mortgage market in 2004–05, as well as their impact on other parts of the economy, such as the housing market, residential construction, and household debt. Second, in light of these developments, and in line with the trend in other industrialized countries, the paper will suggest possible reforms of the HFF, aimed at maintaining the key positive aspects of the current system while allowing banks to profitably remain in the mortgage market.

B. Mortgage Market

3.   **There has been a rapid expansion in mortgage lending in Iceland in recent years, reflecting both the creation of the HFF in 1999 and its subsequent reforms, in particular in the last year, and the entry of commercial banks into the mortgage market in 2004.** While the HFF has significantly increased the opportunities for affordable mortgage lending, the banks' entry in 2004 provided for mortgage lending at even better conditions than were then currently available, and significantly boosted mortgage market competition. As a result, mortgage lending increased sharply, rising by ISK 119 billion or 63 percent in 2004, most of which took place in the last four months of the year. Mortgage rates have also fallen, with real loan rates declining from 5.10 percent to the current rate of 4.15 percent.

Housing Financing Fund[2]

4.   **The purpose of the public HFF is to promote home-ownership, in particular for low-income households and households residing in remote regions, by providing affordable mortgage credit.** In contrast to its predecessor, the State Housing Board, which received explicit subsidies from the state budget for its social lending, HFF finances its social lending out if its own operations. HFF bonds carry a government guarantee and account for

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[1] Prepared by Ann-Margret Westin

[2] This section is mainly based on HFF (2002–05).

almost 80 percent of total government guaranteed debt. The very thin Icelandic capital markets at the time of the inception of the HFF provided a rationale for such broad-based government support despite a homeownership rate of more than 80 percent. Box 1 gives a short summary of the role and functioning of the HFF and recent reforms.

5.   **Reforms of the HFF, in particular in 2004, have contributed to a rapid increase in affordable mortgage financing.** The HFF has successively been increasing its lending limits ever since its inception to match rising house prices. Still, average loan-to-value ratios have typically been below 50 percent given additional loan restrictions in terms of Icelandic krónur and fire insurance value. In the second half of 2004, the easing in lending limits was accelerated sharply, with already planned reforms moved forward as the HFF struggled to survive in the face of the new competition from the commercial banks. As a result, mortgage interest rates have declined, and mortgage amounts have increased—in the first quarter of 2005, the average HFF mortgage was twice the size of that during the same period in 2004. In the words of the HFF, "[i]n the space of two years, a revolution has taken place in general conceptions as to what should be considered a normal mortgage percentage and nominal interest rate for members of the general public who own or are purchasing real estate."[3]

6.   **The HFF has played a unique and dominant role in the Icelandic mortgage and bond markets.** Before mid–2004, almost 90 percent of households had an HFF loan and HFF bonds account for more than half of the Icelandic bond market. At end–2004, parliament reaffirmed the role of the HFF as a clear option for household mortgage financing, despite the entry of commercial banks into the Icelandic mortgage market.[4]

International Comparison

7.   **Few countries provide public support through the mortgage system to the extent that is done in Iceland today.[5]** In other countries in Western Europe, the trend has rather been to privatize banks that provide mortgages and create a market-oriented environment for housing credit institutions. Remaining interest rate subsidies for single-family housing are generally based on social needs, focusing on low-income households and

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[3] HFF (October 2004).

[4] As the banks entered the mortgage market last fall, there were concerns whether they intended to stay more permanently or not. See e.g. HFF (November 2004).

[5] The focus here is on the mortgage market. However, Iceland has one of the lowest levels of government support for homebuyers through the tax and welfare system compared with other advanced countries.

Box 1. The Housing Financing Fund

The Housing Financing Fund (HFF) was created in 1999, replacing the State Housing Board. It is owned by the central government, exempt from corporate tax, does not pay dividends to its owners, and its bonds carry a government guarantee. The HFF is accountable to the Minister of Social Affairs but is financially independent and should meet its lending and operating costs from own revenues. While initially only the Housing Bonds Department was supervised by the Financial Supervisory Authority (FME), legislation was amended in 2004 to extend the FME's regulation over HFF to cover all its business, in line with the situation of other financial institutions in Iceland.

Until July 2004, the HFF provided mortgage credit by issuing "Housing Bonds" to house buyers, which in turn were sold on the capital markets. In return, the HFF received "Mortgage Bonds," collateralized by the underlying property. Housing Bonds were indexed to CPI, had a government guarantee, carried a fixed real interest rate of 5.1 percent, and had a maximum duration of 40 years. An additional fixed interest surcharge was added to the Mortgage Bond.

In July, 2004, the HFF significantly reformed they way it finances mortgage lending. The bond swap system was abolished and replaced by cash mortgages at market yields, financed by new, more streamlined, HFF bonds issued directly to the international capital markets. HFF bonds are indexed annuity bonds with installments twice a year and maturities of 10, 20, 30, and 40 years. They are listed on both ICEX and at Euroclear and in contrast to the old Housing Bonds, they do not carry a call option but remain open until maturity. As a result of the reforms, HFF's mortgage lending rates, which need to cover HFF's stipulated interest margin of 60 basis points, have declined from a fixed real rate of 5.1 percent to 4.15 percent.

Apart from general single-family mortgage credit, the HFF also provides direct loans to individuals with special needs; municipalities, businesses, and construction companies for rental housing; community homes for children and teenagers; and residential and nursing homes for senior citizens. Until July 2004, such supplementary loans were financed by issuing "Housing Authority Bonds;" now, these loans are also financed through the issuance of HFF bonds.

Loan limits have been successively raised, in response both to rising house prices and, in 2004, increased competition. Initially maximum loan-to-value ratios were set at 65–70 percent (the higher ratio for first-time homebuyers/builders), with a maximum loan amount of ISK 6.5–7.7 million. A "supplementary loan" of up to 25 percent of assessed value could be approved (see above), as long as the total loan amount did not exceed 90 percent of the property value. Maximum loan limits have since been successively raised to the current 90 percent maximum loan-to-value ratio, or ISK 15.9 million.

HFF is the largest institution in the Icelandic financial system. It is particularly dominant in the mortgage market, accounting for about 80 percent of the Icelandic residential mortgage market at end-September 2004. However, while still dominant, the HFF's share of the residential mortgage market had fallen to about 65 percent at end–2004 as a result of the entry of commercial banks into the mortgage market.

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Sources: HFF (2002–05); and Moody's (2004–05).

individuals with disabilities. Also countries that traditionally have had a significant state presence in the mortgage market, such as France, have more limited involvement than is currently the case in Iceland. Box 2 gives a short overview of the degree of state intervention in the mortgage markets in some important comparator countries in Western Europe, the neighboring Nordics and some of the key economies, Germany and France. In contrast to the developments in these countries, the recent easing in the HFF's lending conditions seems to point in the opposite direction, with the HFF reaffirming its position in the mortgage market in face of the increased competition from the commercial banks.

Commercial Banks

8.   **There are currently four commercial banks in Iceland,** Íslandsbanki, Kaupthing Bank, Landsbanki Íslands, and Sparisjóðabanki Islands (Icebank), accounting for almost 90 percent of total bank assets in 2003. Remaining bank assets are with the 24 savings banks, which account for some 25 percent of household deposits and for which Icebank serves as a banking institution. The current structure of the Icelandic banking system is the result of significant consolidation and privatization in recent years.

9.   **In the last few years, the access to international capital markets of the commercial banks has increased significantly.** In particular the three largest banks, i.e., Kaupthing Bank, Landsbanki Íslands, and Íslandsbanki, which are rated by international rating agencies, have started to expand their operations internationally, establishing themselves in some ten countries, including the United Kingdom and Luxembourg. The increased access to foreign capital is evidenced both by the sharp increase in external debt of the banking sector, which had risen to 89 percent of GDP at end–2003, up from 6 percent in 1995, and a marked decline in domestic bank credit rates.

Real Interest Rates

(in percent)

General Bank Lending Rate 1/

Policy Rate 2/
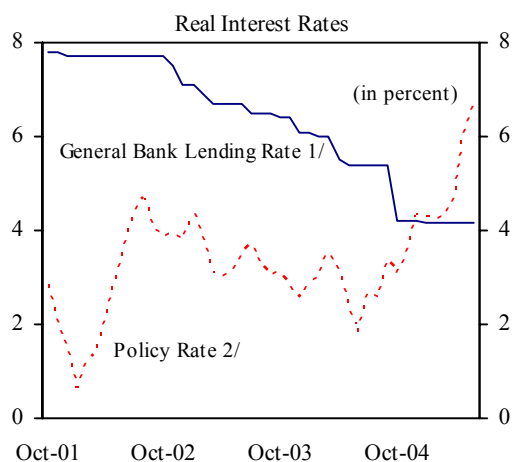
Source: Central Bank of Iceland.
1/ On indexed loans.
2/ Deflated by CPI

10.   **Reflecting both the enhanced access to international capital as well as other important factors, in August 2004 the three largest commercial banks entered the market for first mortgages.** Until then, commercial banks had mainly been active in the secondary mortgage market, offering loans with some 5 years of duration at about 5.6 percent real interest rates. While the improved access to long-term international capital has been important in providing financing assurances, the timing of the banks' entry on the mortgage market mainly reflected:

Box 2. Government Mortgage Market Intervention: A European Perspective

Nordic Countries

Denmark: Mortgage credit is provided by specific private mortgage credit institutes, dating back to the 18th century. Mortgage credit is provided on competitive conditions, financed through the issuance of mortgage bonds. *There are no subsidies of mortgage interest rates.* Homeowners can deduct interest expenditures, including mortgage interest expenses, from their pre-tax income.

Finland: The main task of *ARA*, the State Housing Fund of Finland, is to finance state-subsidized rental housing production—about half of all rental dwellings in Finland are subsidized by the state. *There are no general interest subsidies for private homeownership* (which is mainly promoted through tax relief on mortgage interest payments, in line with the practice in most other Western economies); however, *interest subsidies can be granted based on social needs*.

Norway: *Husbanken*, the State Housing Bank, mainly lends for new housing, but also plays a role in *providing social support targeted at low-income households, seniors, and individuals with disabilities*. In 2002, 0.4 percent of GDP was allocated to grants and benefits, and 0.9 percent was allocated to new lending. The Housing Bank has participated in the financing of approximately 50 percent of existing homes in Norway. Given its focus on social lending, at end-2002 Husbanken only accounted for 14 percent of outstanding mortgages.

Sweden: The publicly owned *SBAB* was founded in 1984 to channel state housing loans; however, today there are *no interest rate subsidies for single-family homes*, and SBAB competes with the private mortgage institutions, accounting for 11 percent of the Swedish mortgage market. Interest rate subsidies are only available for multi-family houses, rental and condominiums, with the subsidy amount corresponding to the tax relief on mortgage interest payments available for homeowners.

Major Economies

France: There is public assistance through the mortgage system, mainly through a dedicated savings scheme—*plan d'épargne-logement*—which has been used for the purchase of 40 percent of owner-occupied housing. There are also regulations on private sector mortgages, and there is a regulated loan scheme—*prét conventionné*—for public sector institutions and lenders. Zero-interest mortgages are offered to low-income households. Although the exact scope of France's public involvement in the mortgage market is difficult to assess, it seems well below that in Iceland, in particular considering a homeownership rate of only 55 percent.

Germany: *Subsidies to the housing sector*, including for the promotion of social housing, have *declined significantly in recent years*, decreasing by 21.4 percent between 2001 and 2004. Looking ahead, these subsidies are expected to decline further over the medium term, through 2007.

Sources: CBI (2004*b*); Federal Ministry of Finance of Germany; Vilhjálmsdóttir (2004); www.ara.fi; www.boverket.se: www.husbanken.no: www.realkreditraadet.dk: and www.sbab.se.

- *HFF reforms of July 2004*, which implied more transparent mortgage financing, with a clearly stated, and quite generous, interest risk premium; left the HFF vulnerable to prepayments, as the new HFF bonds do not carry a call option;[6] and which foresaw the increase in the HFF's loan-to-value ratio to 90 percent, a development that would significantly reduce the secondary mortgage market for the banks;
- *A complaint by the banks to the European Free Trade Association Surveillance Authority regarding the HFF's alleged contravention of the European Economic Area competition rules* was rejected in August 2004. Shortly thereafter, the first bank entered the mortgage market;[7]

- *Excess liquidity* in the banking system, reflecting in part the CBI's decision in 2003 to lower reserve requirements from 4 percent to 2 percent;[8] and a

- *Marketing decision* on the part of Kaupthing Bank, the first bank to enter the market. By taking the initiative, it might have solidified its position as the market leader.

11.   **The banks entered the mortgage market on terms that were more competitive than those provided by HFF at that time.** Banks initially offered mortgages at fixed real interest rates of 4.3 percent, below the HFF's then current rate of 4.8 percent, with maturities of 25 or 40 years. The maximum loan-to-value ratio was set at 80 percent, with no maximum loan limits in Icelandic krónur, compared with HFF's rules at the time of 65–70 percent loan-to-value ratios, and loan limits of ISK 9.2–9.7 million. In addition, the mortgages offered by the banks are not confined to house purchases or construction but can also be used toward refinancing previous mortgages and for equity withdrawal. By end-November 2004, bank mortgage interest rates had come down further to 4.15 percent, the same level as then offered by the HFF. Furthermore, possibly in response to increases in the HFF's lending limits (and in part in reaction to the increased competition among themselves), in November banks started offering 100 percent mortgages, although on more stringent conditions. In particular, these loans can only be used to finance house purchases and cannot exceed ISK 25 million. There is also a more careful evaluation of the house buyer's debt servicing capacity.[9]

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[6] Even under the new system, HFF can add a marked-to-market requirement on prepayments in "extreme circumstances," when the Fund's "viability is in danger." Apparently the HFF has still not exercised this option.

[7] While this ruling has been appealed (no further decision has yet been made), it is likely that the initial decision will prevail as the complaint refers to the situation before banks entered the market when the HFF still was the key provider of first mortgages. However, if successful, the appeal could have a bearing on the focus of the HFF's activities going forward.

[8] Many banks confessed to the need to "park" its liquidity somewhere.

[9] CBI (2004*b*). In the event, few mortgages have so far been issued with 100 percent loan-to-value ratios, with most banks issuing mortgages with an LTV of 70–80 percent at the most.

12.   **As a result, mortgage lending and bank external indebtedness increased sharply in 2004–05.** From August 2004 through May 2005, the domestic banking system extended almost ISK 220 billion in new mortgage credit to households. Still, mortgage lending by the HFF and pension funds shrunk markedly during the same period, suggesting that a significant share of banks' lending has been directed to refinancing of older, less advantageous loans. While total lending by domestic banks had risen by approximately 47 percent year–on-year, total lending by all financial institutions, including the HFF and the pension funds, had increased by less than 21 percent during the 12 months through March 2005. Reflecting the rapid expansion by commercial banks in the mortgage market in the last year, foreign debt of these institutions has also continued to increase, amounting to more than 140 percent of GDP in 2004 and growing by 64 percent over the 12 months through March 2005 .[10] However, their foreign assets have also increased, with net external debt of domestic banks amounting to 74 percent in 2004.

Domestic Money Bank Credit

(12-month change, in percent)

Source: Central Bank of Iceland.

External Liabilities of Deposit Money Banks

(in percent of GDP)

☐ External Debt
☐ Short-term Debt
■ Net Debt
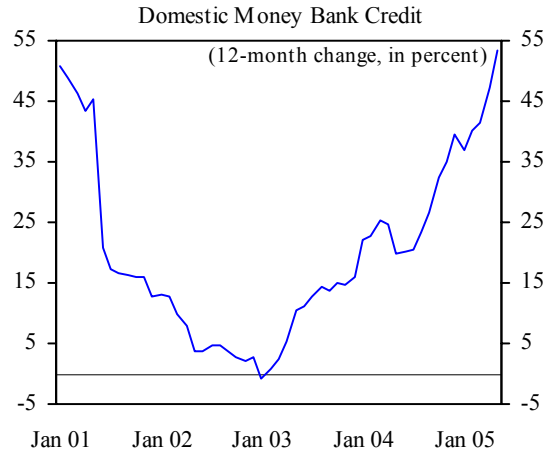
Source: Central Bank of Iceland, Statistics Iceland.

Savings Banks and Pension Funds

13.   **In addition to the commercial banks and the HFF, there are also some 24 savings bank, almost 40 pension funds, five investment banks, four investment funds, and two leasing companies in the Icelandic credit market.** The build-up of the pension funds in particular has contributed a great deal to the development of financial markets in Iceland; in 2003, they held 27 percent of the stock of marketable bonds and 40 percent of housing bonds.[11] In response to the entry of the commercial banks into the mortgage market in the fall of 2004, both the savings banks and the pension funds took measures to adjust to the new competition.

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[10] CBI (2005*c)*.

[11] CBI (2004*c*).

14.   **In December 2004, the HFF and the savings banks reached agreement on cooperation in the mortgage market,** including mutual lending/financing and credit rating. As the commercial banks entered the market for first mortgages, HFF lost its distribution channel for its lending. Instead, HFF and the savings banks have started cooperating, with savings banks now providing the distribution channel for HFF first mortgages. In turn, savings banks are offering second mortgages on top of the HFF loans, up to a total of ISK 26 million (still subject to a loan-to-value ratio of 90 percent). So far, these loans have been offered at the same interest rate as the HFF first mortgages. As a result, HFF's market share of new real estate purchase agreements, which had tumbled to 24 percent by December 2004, had risen to 72 percent as of end-April 2005. Furthermore, with households prepaying (at no penalty) their less advantageous HFF loans and refinancing at better terms (with the possibility of equity withdrawal as well) with the commercial banks, HFF has bought second mortgages from the savings banks with excess liquidity. However, there is no formal agreement on this financing, which may well dry up later on as prepayments to HFF slow.[12] Lastly, the HFF and the savings banks also introduced a new free-of-charge on-line system for credit assessment in December 2004.[13]

15.   **The pension funds have also adjusted to the new mortgage market conditions.** The pension funds are concentrated, with the two largest accounting for 33 percent of total net assets at end-2003, and the ten largest for 70 percent. Total pension fund assets amounted to over 37 percent of the credit system, mostly invested in government guaranteed bonds, housing finance, and loans to members. While mainly maintaining their cautious lending conditions, key pension funds have adjusted or scrapped their lending limits in Icelandic krónur in response to the entry of the commercial banks into the mortgage market. Also, mortgage rates, which are set at a fixed premium above HFF bond yields, have declined.[14]

Mortgage Bond Market

16.   **The Icelandic secondary bond market consists of government bonds, HFF housing bonds, and other bonds issued by other government agencies and private firms and institutions, including the banks.** While the CBI used to act as the market maker for

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[12] Interestingly enough, given its excess liquidity, the HFF has also been extending loans to the commercial banks in the amount of some ISK 80 billion over the past few months, an activity which is not part of HFF's core mandate but rather falls under risk or liquidity management (see Íslandsbanki, 2005).

[13] See e.g. HFF (December, 2004).

[14] E.g. the Commerce Pension Fund, the largest private pension fund, keeps some 20 percent of its portfolio (some ISK 20 billion at end–2003) in mortgages and only lends to members. Mortgage rates are set at 50 basis points above HFF bond yields. While the maximum loan-to-value ratio of 65 percent has been retained, the ISK 6 million lending limit was scrapped last fall, with the median mortgage now at ISK 7–8 million.

the HFF bonds, an active market-making program on the stock exchange now ensures sufficient liquidity for benchmark government bonds and the key housing bonds.

17.   **The bond market is dominated by indexed bonds carrying government guarantees.** Most issues with maturities exceeding 5 years are linked to the CPI and the majority of bonds carry a government guarantee, including the housing bonds, which are the market's most liquid assets. At mid–2004, housing bonds accounted for 82 percent of the Icelandic bond market. Yields have been high by international standards, even in real terms, fluctuating between 4–8 percent over the last decade, even though they have come down significantly over the last few years.[15]

18.   **Yields have continued to decline in the last year.** A s result of the reforms at the HFF in 2004 (which significantly enhanced the efficiency of its mortgage lending financing) and the entry of commercial banks into the mortgage market (which implied enhanced competition and further access to lower-cost foreign financing), HFF bond yields have come down from above a real yield of 3.8 percent July

25-year Housing Bond Yield

Source: Central Bank of Iceland.

2004 to a current yield of about 3.6 percent. Yields dipped temporarily to close to 3.4 percent in mid–February, probably reflecting Standard and Poor's upgraded rating for the Re public of Iceland's and the HFF's long-term foreign obligations.[16] However, yields subsequently rose above 3.5 percent again, where they have since remained. Looking ahead, banks may eventually turn to the domestic bond market to finance their mortgage lending, potentially leading to upward pressure on bond yields.

19.   **The requirement of a real yield of 3.5 percent for the pension funds tends to create**

HFF Bond Yields
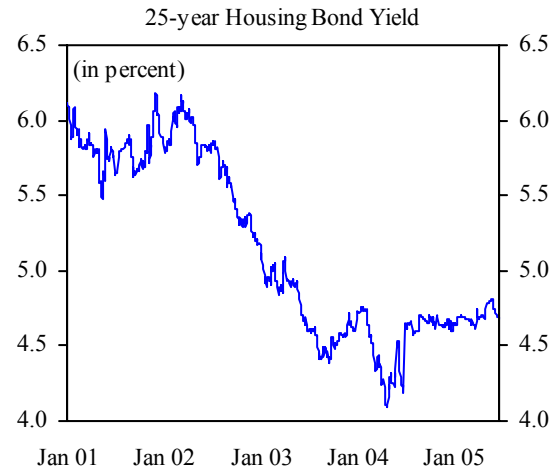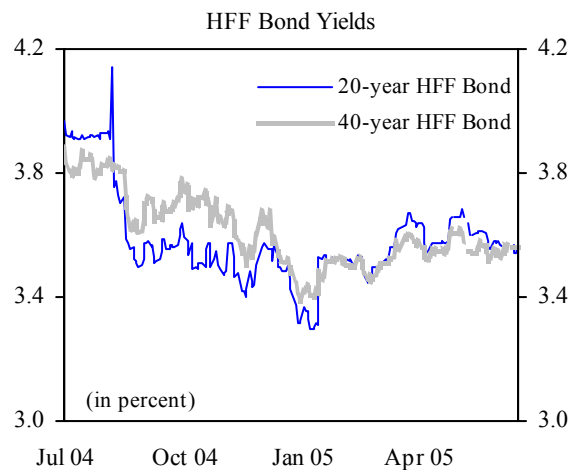
Source: Central Bank of Iceland.

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[15] CBI (2004*c*).

[16] Both ratings were increased from A+ to AA-; however, the HFF's outlook was rated negative, in contrast to stable for the Treasury (Standard & Poor's, 2005).

a floor for the domestic bond market yields. [17] There are concerns that pension funds might lose interest in the bond market if yields dip below this threshold. While such a high expected yield may have been warranted in the past, it may be more difficult to defend in the current environment with very low international interest rates. At the same time, the 3.5 percent real requirement applies to the average yield, with HFF bond yields constituting the lower end of possible returns. Pension funds are allowed to hold up to 50 percent of their assets in equity, which may be particularly attractive given the funds' long planning horizon.

C. Housing Market

House Price Developments

20.   **Rising house prices in Iceland in recent years, in line with the developments in many other advanced economies, have contributed to the higher demand for mortgage lending.** At the same time, the significant easing in mortgage market conditions in Iceland in 2004–05 further contributed to the upward pressure on house prices by allowing households to finance a larger portion of home purchases, facilitating in particular the purchase of housing for first-time buyers and for larger properties, and by lowering the cost of housing finance. The slowdown in housing construction in 2004 also contributed to the upward pressure on prices, as discussed further below. In May 2005, the 12-month increase in house prices for the country as a whole was 28 percent, compared with an increase of 7 percent in construction costs. Most of the increase took place in the capital area, where house prices rose by 18 percent over the first four months of 2005 compared with the same period last year, and for single-family homes, whose prices rose by 37 percent during the 12 months through March 2005; average house prices in the regions increased by 13 percent over the same time period.[18]

House Prices and Construction Cost

(12-month change, in percent)

Nominal house price

Construction Cost Index

Real house price 1/

Mar 01   Mar 02   Mar 03   Mar 04   Mar 05

1/ Deflated by CPI.
Source: Statistics Iceland.

21.   **The sharp increase in house prices has spilled over to CPI inflation.** Housing costs account for about 20 percent of the CPI in Iceland, more than in many other European

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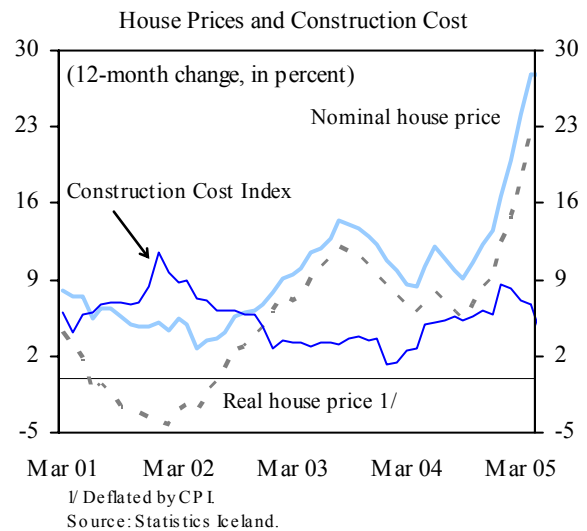
[17] The 3.5 percent real yield must normally be applied for the actuarial assessments for discounting pensions and future premiums. Also, domestic fixed-income indexed bonds are discounted at a 3.5 percent real yield, irrespective of their book value.

[18] CBI (2005*a* and 2005*c*).

countries.[19] Furthermore, between August 2004 and April 2005, mortgage interest rates in the housing cost component of the CPI were based on 5–year moving averages, implying that the sharp fall in rates in the fall of 2004 was only partially reflected in the CPI. Instead, since May 2005, 12–month averages are used to calculate the impact of mortgage rates. In February 2005, 12–month inflation rose to 4.5 percent, above the CBI's tolerance limit, prompting the Bank to issue a report detailing the causes and prospects for bringing inflation down again.[20] After peaking at 4.7 percent in March (CPI excluding housing rose by 2 percent over the same period), inflation has since come down, reflecting in part the revised methodology for calculating average mortgage rates. As a result, 12–month inflation measured 3.5 percent in July 2005; excluding the housing component, inflation was only 0.1 percent during the same period.

Housing Construction

22.   **Housing construction has been reasonably responsive to rising house prices.** After only modest housing construction in the second half of the 1990s, housing construction started taking off in 2001–02 following a considerable rise in house prices (in particular relative to construction costs). Housing construction has since accelerated, increasing by 13 percent in real terms and amounting to 5.5 percent of GDP in 2003; it currently constitutes about one fifth of total investment in the economy, even when taking into account the power-plant investments. In 2004, however, housing construction only increased by a preliminary 3 percent, compared with an expected 13 percent, in turn contributing to the upward pressure on house prices.[21]

23.   **In 2005–06, housing construction is expected to accelerate.** Current forecast are for a 12 percent (or more) increase in 2005 given the strong income growth, falling unemployment, rising house prices, and easing mortgage conditions, and in light of the meager outturn in 2004.[22] The projected strong increase in residential construction should have a dampening effect on house price increases, while at the same time, however, adding to the current investment boom and overheating.

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[19] The EIU (2005). At the same time, it may be argued that the Central Bank's inflation target should exclude house prices, as does the European Economic Area's Harmonized Index of Consumer Prices.

[20] CBI (2005*b*).

[21] These data are preliminary and may be revised later. Also, there were large regional differences in housing construction in 2004, with housing starts declining in the capital area compared with 2003 while rising sharply in the rest of the country in connection with the large-scale investment projects (Republic of Iceland, 2005*b*).

[22] Republic of Iceland (2005*b)*. The Central Bank projects an even stronger increase in construction in 2005, of more than 20 percent (CBI, 2005*c*). At the same time, the ongoing large infrastructure investments in Iceland may put a damper on other investment activities in the economy, including housing construction.

D. Household Debt

24. **After increasing continuously since the lifting of the widespread credit rationing in the 1980s and the subsequent liberalization of the domestic financial market, household debt rose exceptionally fast in 2003.** Household debt increased by more than 15 percent in 2003, mainly reflecting the rapid increase in mortgage lending; at end–year, household debt was estimated at 178 percent of disposable income or 97 percent of GDP, up from 65 percent of GDP in 1995 and 14 percent at the beginning of the 1980s.[23] Preliminary data suggest that household debt stood at 102 percent of GDP in 2004. Close to 70 percent of total debt is related to housing and therefore collateralized, and almost 90 percent consists of price-indexed loans.

25. **Even though at these magnitudes Icelandic households are among the most indebted in the world, there has also been an increase in household assets.** In particular, given the rising house and equity prices, and taking into account pension fund assets, the net worth of Icelandic households has increased and is broadly in line with the G–7 countries. Reflecting the large share of mortgages in household debt, owner-occupied dwellings remain the largest assets, or some 35 percent of total assets.[24]

Household Debt

Source: Central Bank of Iceland.
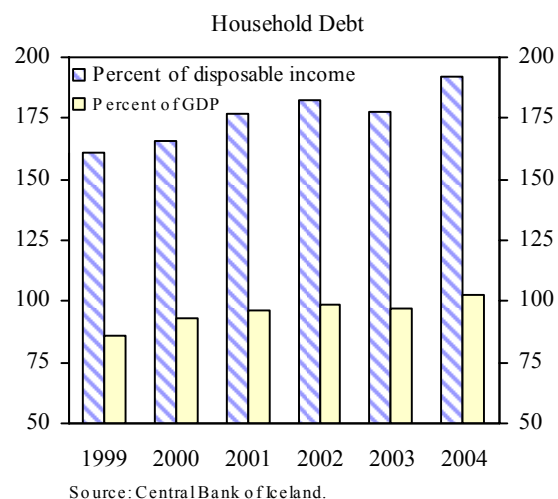
26. **Country-specific factors also account for the relatively high level of household debt in Iceland compared with other countries.** To a large extent, the high level of debt can be explained by the high homeownership rate (83 percent), the well-funded pension system and accumulation of pension rights over the last two decades, and the young age of the population, which has been estimated to account for some 60 percent of Iceland's large external liabilities relative to other countries.[25] Also, debt in terms of disposable income will increase, ceteris paribus, the larger is the government sector.[26]

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[23] These data take into account the reclassification of household debt that was done in September 2003, when some ISK 93 billion, or 10 percent of household debt, was reclassified as corporate or municipal debt.

[24] CBI (2004*c*).

[25] IMF (2003*b*).

[26] Also, in contrast with most other countries, disposable income in Iceland excludes interest payments, hence further reducing the denominator.

27.   **As a result of the rapid increase in household indebtedness, debt service obligations have also increased.** According to CBI estimates, in the last few years total household debt service has increased to almost 40 percent of disposable income from about 15 percent in 1990.[27] For comparison, household debt service in the United States was 13 percent of disposable income in 2003, which however also reflects the higher public sector income (and therefore lower disposable income) and higher homeownership rate in Iceland.[28]

E.   Macroeconomic Concerns

28.   **The significant relaxation in mortgage market conditions in 2004 as a result of both reforms and easier lending conditions at the HFF and the entry of commercial banks into the market has come at a cyclically inopportune time.** The Icelandic economy is currently characterized by strong demand and inflation pressures given the ongoing industrial investment projects. The already strong private consumption has only been further boosted by the enhanced availability of mortgage credit, which has allowed not only for lower interest rates and larger mortgage amounts but also for refinancing and equity withdrawal.

29.   **Lending growth in 2004–05 has so far been significantly faster than when the Icelandic economy began to overheat in 1998–2000**. In the past, episodes of such excessive growth in Iceland have been followed by significant disturbances, including a surge in inflation, negative GDP growth, increased unemployment, and a worsened current account position. The international experience also points to the danger of very rapid credit growth potentially leading to banking sector problems further down the road.

30.   **Private consumption is expected to increase sharply in the next few years as a direct result of the easier mortgage credit.** According to a study by the CBI in June 2004, an increase in the HFF's maximum loan-to-value ratio to 90 percent would imply an additional increase in private consumption of 1.5–2 percent annually for the next three years. These conclusions were reached under quite cautious assumptions, also attempting to take into account the entry of commercial banks into the mortgage market.[29]

31.   **The very high levels of household debt may also give rise to systemic concerns.** While short-term prospects are fairly stable given the low risk of negative income shocks with the large investment projects under way, looking ahead there may be reasons for concerns. In particular the possibilities of negative income effects as the investment projects are completed or of a sharp reversal in house prices (the "bursting of a bubble"), which could

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[27] CBI (2004*a*).

[28] Furthermore, leasing arrangements, which are not formally recorded as debt and therefore not included in strict definitions of debt service, are very common in the United States.

[29] See CBI (2004*b*).

lead to collateral values falling below loan values, give rise to concern. Also, there are general concerns of deteriorating credit quality as mortgage loan limits have been relaxed. In fact, the number of unsuccessful attempts at collecting household arrears has apparently risen significantly in the last number of years, almost tripling since 1999, even though this may also be attributable to other factors, such as enhanced efficiency in collections.[30]

32.   **Looking ahead, for those households that do not have fixed interest mortgages, there are also interest risks.** While most mortgages carry fixed interest rates, some do not. Two of the three banks that entered the mortgage market last year also issue mortgages with interest rates set for 5 years only, although so far, customers have apparently mainly preferred fixed-rate mortgages.[31] As international interest rates return to more normal levels, domestic mortgage rates may also start to increase, adding on to households' debt servicing burden.

33.   **There are also obvious concerns of spillover from mortgage market easing to house price inflation and CPI inflation, as discussed above.** Still, some have questioned the impact of credit easing on house prices. In particular, while noting the short-term inflation concerns, the HFF has consistently down-played the impact of mortgage market easing on long-term house prices, instead stressing the importance of wage developments for the housing market.[32]

F.   Role of HFF in the Mortgage Market

34.   **Given the Icelandic economy's vulnerability to cyclical developments, the timing of reforms such as those at the HFF becomes an important policy tool.** The HFF, as a public institution, should strive for coordinating its policies with other government policies, taking into account the cyclical position of the economy. Indeed, the planned reforms at the HFF were discussed in 2003, when the HFF noted that the main share of the relaxation in lending conditions would come into effect "when the expansionary impact of the approaching heavy industrial developments begins to ebb, and should thus play a role in maintaining stability in the Icelandic economy." It was also noted that " in fact, a basic prerequisite that the planned stages outlined in these proposals should not be introduced unless the objectives of stability are achieved."[33]

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[30] In addition to improved efficiency in handling such distraint actions, the steady decline in the average age of households (with younger households having not only less assets but also smaller debts) may in part help explain the increase in unsuccessful attempts at collecting household arrears (CBI , 2004*a*).

[31] One of the banks only issues mortgages with 5-year reset clauses.

[32] HFF (August–September 2003 and April 2004).

[33] HFF (May 2003).

35.   **However, in the event, the HFF reforms have materialized at the same time as the peak of the investment projects, adding fuel to an already over-heating economy.** In order for the HFF to remain an important player in the mortgage market, the increase in the HFF's loan limits in 2004 was moved forward in response to the entry of commercial banks into the mortgage market. Given these concerns, the cyclical considerations became less important.

36.   **Looking ahead, the recent developments in the Icelandic mortgage market provide an opportunity for reform of the HFF aimed at maintaining the benefits of the current system while also allowing for banks to remain profitably in the mortgage market.** The entry of commercial banks into the mortgage market has been a positive development from a longer-term financial stability perspective. Holding a larger portfolio of first mortgages will help diversify banks' balance sheets and stabilize their earnings provided this activity can be sustained profitably. However, this will not be the case if they are forced to compete directly with the state-subsidized HFF. Consequently, expeditious reform of the HFF is necessary, which should be guided by the following principles:

- Banks and savings institutions should have access to funding that allows them to compete profitably for first mortgages;

- The funding expertise that has been developed by the HFF should be fully utilized;

- Economies of scale in funding should be retained so that Iceland receives the lowest possible cost of mortgage finance, and domestic bond markets remain liquid;

- Competition in the retail mortgage market should continue to be strong; and

- State support should be tightly focused on ensuring access to homeownership for those with low incomes, and those residing in remote regions of the country, where the presence of banks is very limited.

37.   **Such a reformed system could, for example, result in the HFF acting in the whole-sale market for mortgage financing.** This would entail buying first mortgages from the banks, and selling them on to international investors in the shape of mortgage-backed securities.[34] In such a scenario, with the HFF providing finance for private banks, it should not carry a government guarantee. Still, it should be able to receive a favorable international credit rating given the quality of the underlying pooled mortgages as well as the HFF's built-up expertise in this area. Lastly, social lending should be more tightly focused on the needy than is currently the case, and could be channeled explicitly through the government budget.

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[34] This would be in line with the situation in the United States, where Fannie May and Freddie Mac act in the secondary mortgage market.

G. Conclusions

38.   **In most countries, the rationale for the government to provide mortgage interest rate subsidies is to promote homeownership.** In particular, subsidies are typically geared toward the most needy, such as low-income households and persons with disabilities, which may not have access to affordable housing financing in the private market. Meanwhile, in Iceland, the HFF implicitly subsidizes, through its access to government guaranteed borrowing, all households equally, despite very high per capita income and homeownership rate compared with most other countries. While the limited availability of affordable mortgage lending may have provided a justification for this generic subsidization in the past, this justification is no longer warranted given the entry of the commercial banks into the mortgage market, and banks' enhanced access to the international capital markets.

39.   **The entry of domestic commercial banks into the Icelandic mortgage market has increased the soundness of the financial system.** Indeed, with the entry of commercial banks into the mortgage market in 2004, as also recommended by the IMF's Financial Sector Assessment Program on Iceland, the Icelandic capital markets have received a welcome boost of fresh international capital.[35] Furthermore, banks are provided with additional domestic stability and profitability by allowing them to diversify their asset base. Also, banks will be better able than the HFF to undertake the necessary credit checks, which will become increasingly important as loan-to-value ratios increase.

40.   **Forcing banks to compete with the HFF may induce them to take on excessive risk.** Looking ahead, commercial banks are likely to remain in the domestic mortgage market and will increasingly provide competitive alternatives to HFF lending. Meanwhile, forcing banks to compete with the HFF may induce them to take on excessive risk on the liability side.

41.   **These circumstances constitute a golden opportunity for expeditious and bold reform of the HFF aimed at maintaining the positive aspects of the current system, while also enabling banks to profitably remain in the market for first mortgages.** Such reform should be based on the following principles. First, HFF's funding expertise should be fully utilized, and the current economies of scale in funding and pooling of risks should be retained. Second, domestic financial institutions should have access to funding that allows them to compete profitably for first mortgages. Third, public housing support should be tightly focused on ensuring access to homeownership for low-income households and households residing in remote regions of the country**.**

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[35] IMF (2001 and 2003*a*).

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IV. CORPORATE LEVERAGE: HOW DIFFERENT IS ICELAND?[1]

A. Introduction

1. **Icelandic firms' leverage has risen sharply since the mid-1990s.** Measured as a percentage of GDP, corporate debt went from about 80 percent in 1997 to over 160 percent in 2004. High levels of corporate sector debt, including foreign and short-term, and especially sharp growth in the level of liabilities observed in recent years, have been a concern to both domestic policymakers and foreign observers, given the potential impact on financial and macroeconomic vulnerabilities.

Iceland: Corporate Debt, 1968-2004 1/
(In percent of GDP)

Source: Central Bank of Iceland.
1/ New classsfication of lending from 2003.

2. **A proper evaluation of Iceland's corporate leverage requires comparing Iceland's corporate sector with that of similar countries.** A big difficulty is that such comparisons are often marred by differences in tax systems, accounting principles, and valuation methods, as Rajan and Zingales (1995) point out. La Porta and others (1997 and 1998) argue further that the character of legal rules and the quality of law enforcement also affect decisions on external finance. Because of these considerations, we use four Nordic countries (Denmark, Finland, Norway and Sweden), referred in the text as "N4," as an "empirical counterpart" to Iceland in our analysis. It seems reasonable to assume that differences of the sort mentioned above are minimal among these countries. For example, when it comes to legal systems, La Porta and others (1997 and 1998) distinguish between various legal systems but group Nordic countries together, referring to a legal system of a Scandinavian origin. Finally, a geographic proximity implies a somewhat similar composition of domestic production.

3. **The purpose of this paper is twofold.** First, it presents some stylized facts on Iceland's corporate leverage trends and puts those trends in regional perspective. Second, it analyzes whether corporate leverage in Iceland is related to factors similar to those that influence the leverage of firms in other Nordic countries and examines to what extent Iceland's differences can be explained by its institutional structures.

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[1] Prepared by Marialuz Moreno Badia and Robert Tchaidze. Haukur Benediktsson of the Central Bank of Iceland compiled the Icelandic firms' data and contributed to its analysis.

4.   **The rest of the paper is organized as follows.** Section B presents the main stylized facts on Iceland's corporate leverage. Section C analyzes the cross-sectional determinants of capital structure choices and rationalizes the empirical findings. Section D concludes.

B. Stylized Facts

5.   **Following the method commonly employed in the literature, we compare balance sheets of "average" firms**. In particular, we compare medians over years and/or within industries and countries to avoid the influence of extreme values. We also explore cross-sectional differences across firms by estimating a simple regression model where different measures of leverage are presented as a function of variables reflecting characteristics of firms, industries, and countries. The analysis is complicated by several factors, most of which concern data availability. First, data are available only for companies that are listed on stock exchanges. This may introduce a downward bias, as the leverage ratio for nontraded companies may be higher.[2] This is a particularly important problem in the case of Iceland since listed companies are just a small subset of the universe of firms. Second, not all firms "survive" the sample because of exits, entries, mergers, and acquisitions. Third, the data may not be perfectly homogenous because of possible accounting differences across countries.

6.   **Our data come from various sources and cover the period 1995-2003**.[3] To simplify our analysis, we classify firms into 13 industries (Table 1). Following Rajan and Zingales (1995 p. 1424) we exclude financial firms as "their leverage is strongly influenced by explicit (or implicit) investor insurance schemes such as deposit insurance. Furthermore, their debt-like liabilities are not strictly comparable to the debt issued by non-financial firms. Finally, regulations such as minimum capital requirements may directly affect capital structure."

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[2] Debt contracts are usually a preferred source of financing by investors in the presence of asymmetric information. Therefore, given that markets have more information on traded companies, we would expect that traded companies have lower debt and higher equity in their capital structure than nontraded companies.

[3] For a detailed description of the data set see Appendix I.

Table 1. Industry Classification

| Industry	Definition	Coverage
1	Petroleum industry	SIC 13, 29
2	Finance/real estate	SIC 60-69
3	Consumer durables industry	SIC 25, 30, 36-37, 50, 55, 57
4	Basic industry	SIC 8, 10, 12, 14, 24, 26, 28, 33, 39
5	Food/tobacco industry	SIC 1, 2, 9, 20, 21, 54
6	Construction industry	SIC 15-17, 32, 52
7	Capital goods industry	SIC 34-35, 38
8	Transportation industry	SIC 40-42, 44, 45, 47
9	Utilities industry	SIC 46, 48, 49
10	Textiles/trade industry	SIC 22-23, 31, 51, 53, 56, 59
11	Services industry	SIC 72-73, 75, 80, 82, 89
12	Other services	SIC 43, 76, 83, 84, 86, 87, 92, 95, 96, 99
13	Leisure industry	SIC 27, 58, 70, 78-79

7.   **In line with previous literature, we focus on three measures of leverage: debt-to-assets, debt-to-equity, and debt-to-capital ratios.** Although the ratio of total liabilities to assets is the broadest definition of corporate leverage, it may not reflect default risk since it includes many items, like provisions, that may not put a firm at risk of bankruptcy. A better definition is, therefore, debt to assets. One problem with this measure, however, is that it is difficult to determine the true value of assets. For this reason, we also use two alternative measures of leverage: debt to equity and debt to capital, with capital defined as a sum of debt and equity.

8.   **The leverage of Icelandic firms is much higher than of those in N4 countries.** We start by comparing medians across the firms in all industries (except financial firms) and through the whole sample.[4] As the text figure illustrates, leverage in Iceland is much higher, no matter what indicator is used. The debt-to-assets ratio is 2.9 times higher than the average for N4 countries, while the debt-to-capital ratio is 1.9 times and the debt- to-equity ratio 3.6 times higher. Moreover, as Figure 1 illustrates, that is the case

Leverage Measures, Medians
(in percent)

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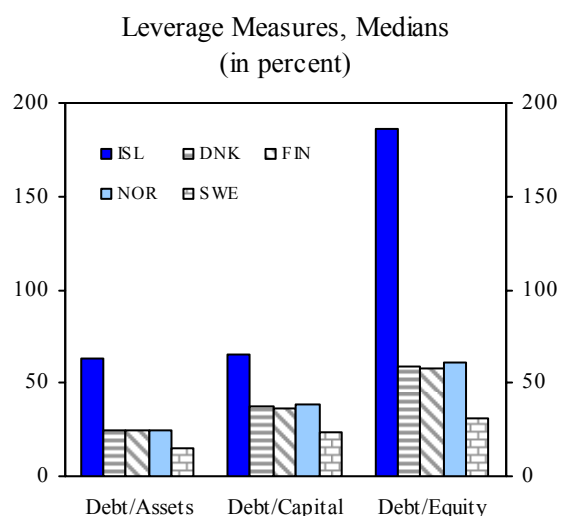
[4] Our calculations exclude those observations for which the leverage measures have negative values.

Figure 1. Median of Leverage Ratios, 1995-2003
(in percent)
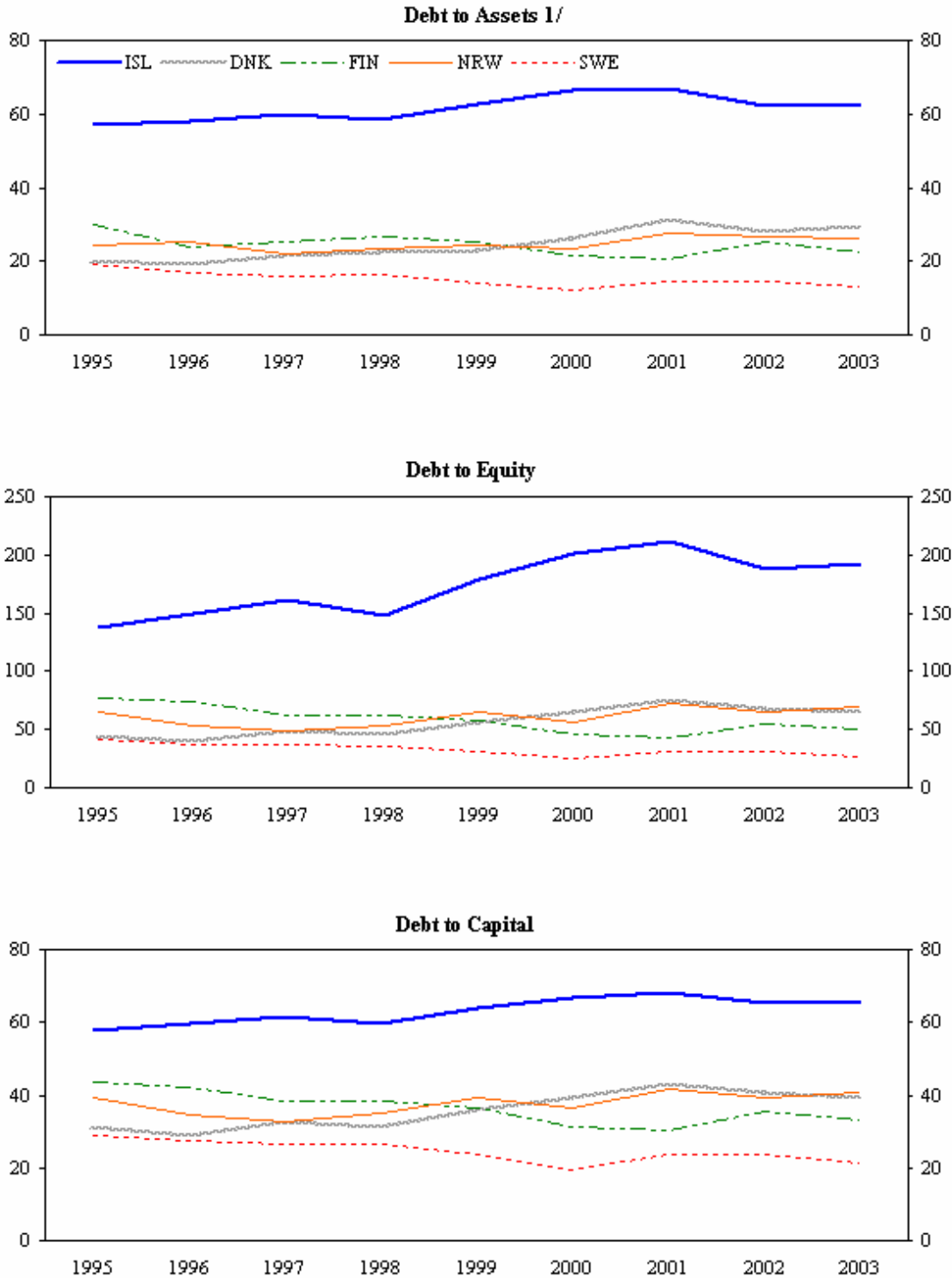
Debt to Assets 1/

Debt to Equity

Debt to Capital

Sources: Thomson Analytics; Central Bank of Iceland; and staff calculations.
1/ Legend applies to all panels.

throughout the sample period. For any given year, Iceland's average debt-to-assets ratio is more than twice that on average across N4 countries. The lowest point is in 1995, when the value for Iceland is 2.4 times higher than for the N4 countries; and the highest is in 2000, when the value for Iceland is 3.2 times higher. The results are similar when alternative measures of leverage are used.

9.   **An industry comparison across countries indicates that this phenomenon is not specific to any industry.** Figure 2 illustrates the debt-to-assets ratio for a given year (2003) in the industries, as defined above. It shows that the leverage of Icelandic firms is higher than that of firms in other Nordic countries in all of the industries for which data are available. While in the transportation industry (industry 8) the leverage of Icelandic firms is 1.4 times higher than the N4 average, it is 6.5 times higher in the services industry (industry 11). Figure 3 demonstrates the dynamics of leverage measures in different industries and shows that all Icelandic industries have high leverage ratios that have remained relatively stable over the whole sample period.

10.   **Iceland's corporate leverage remains the highest when firms are differentiated according to their size.** We classify each firm into one of three size categories (small, medium, and large) by pooling firms from all countries and forming three quantiles based on the real value of assets in U.S. dollars. As expected, most Icelandic firms fall under

Share of Firms in Each Size Category, 1996			
	Small	Medium	Large
Denmark	27.4	34.7	37.9
Finland	25.0	28.8	46.3
Iceland	33.3	55.6	11.1
Norway	29.6	37.0	33.3
Sweden	22.7	35.9	41.4

the category of "medium" size. For each size category, Icelandic firms have the highest leverage by all measures. The size gap between the smallest and largest firms in Iceland is just between 6 percent and 19 percent (see Figure 4), well below the size gap for N4 countries. One possible explanation for this difference in size gaps may be the fact that smaller Icelandic firms are already highly leveraged. Unlike other Nordic countries, leverage is not monotonically increasing in size in Iceland since medium sized firms have lower leverage than small ones.

11.   **Icelandic firms rely on short-term borrowing more than their counterparts in Finland, Norway, and Sweden.** The text figure illustrates the dynamics of the share of the short-term debt in Nordic countries. It shows that in two countries—Iceland and Denmark, reliance on short-term financing is much higher ranging from 29 to 49 percent. At the same time, in Finland the share of the short-term debt has been fairly low and constant over the decade, averaging around 26 percent. In Norway and Sweden it has been on the rise but from rather low levels (15 and 18 percent) and reaching in 2003 levels comparable to those in

Figure 2. Median Leverage Ratios by Industries, 2003 1/
(in percent)
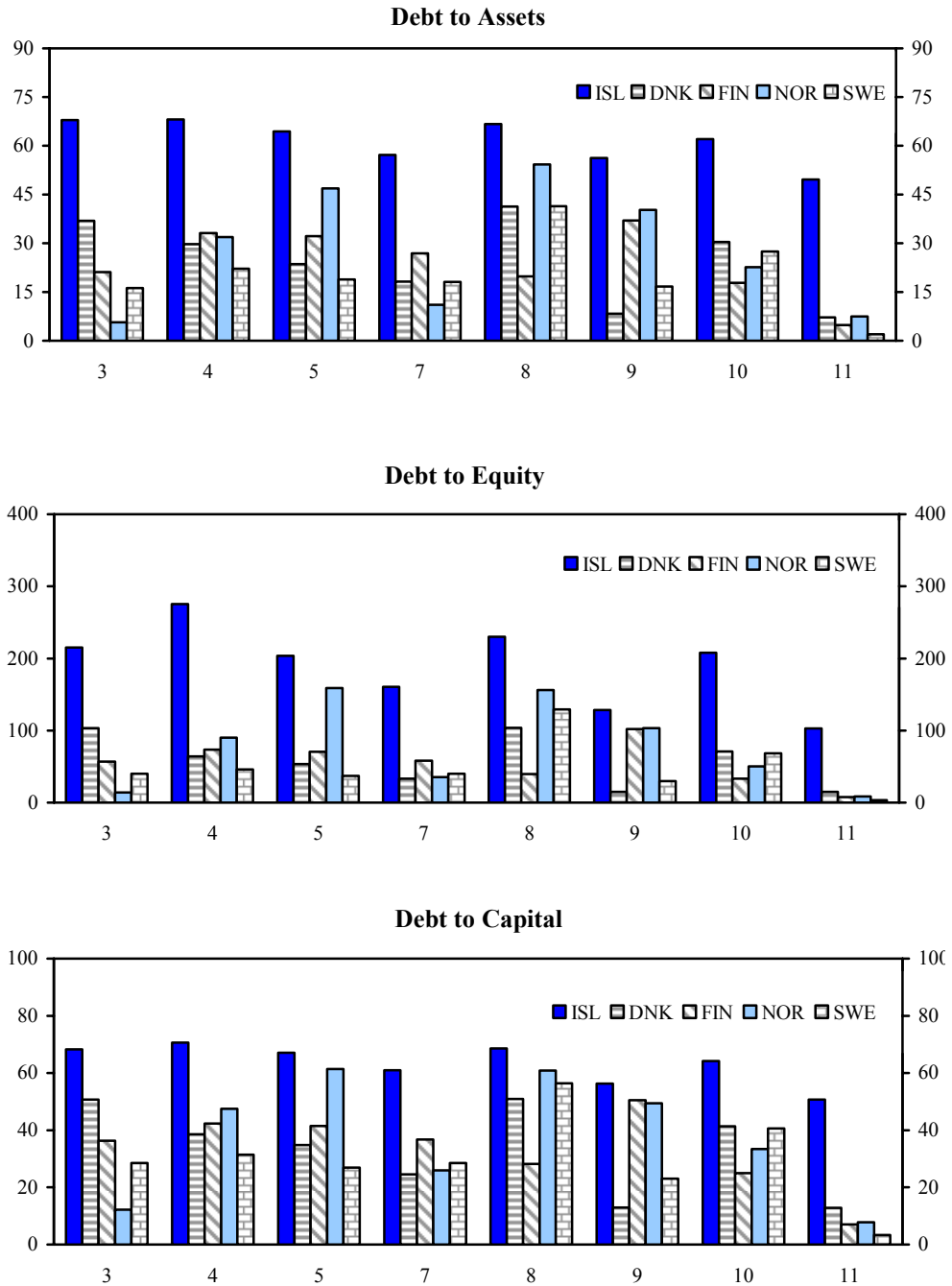
Debt to Assets

Debt to Equity

Debt to Capital

Sources: Thomson Analytics; Central Bank of Iceland; and staff calculations.
1/ See Table 1 for industry classifications.

Figure 3. Iceland: Median Leverage Ratios by Industry 1/
(in percent)
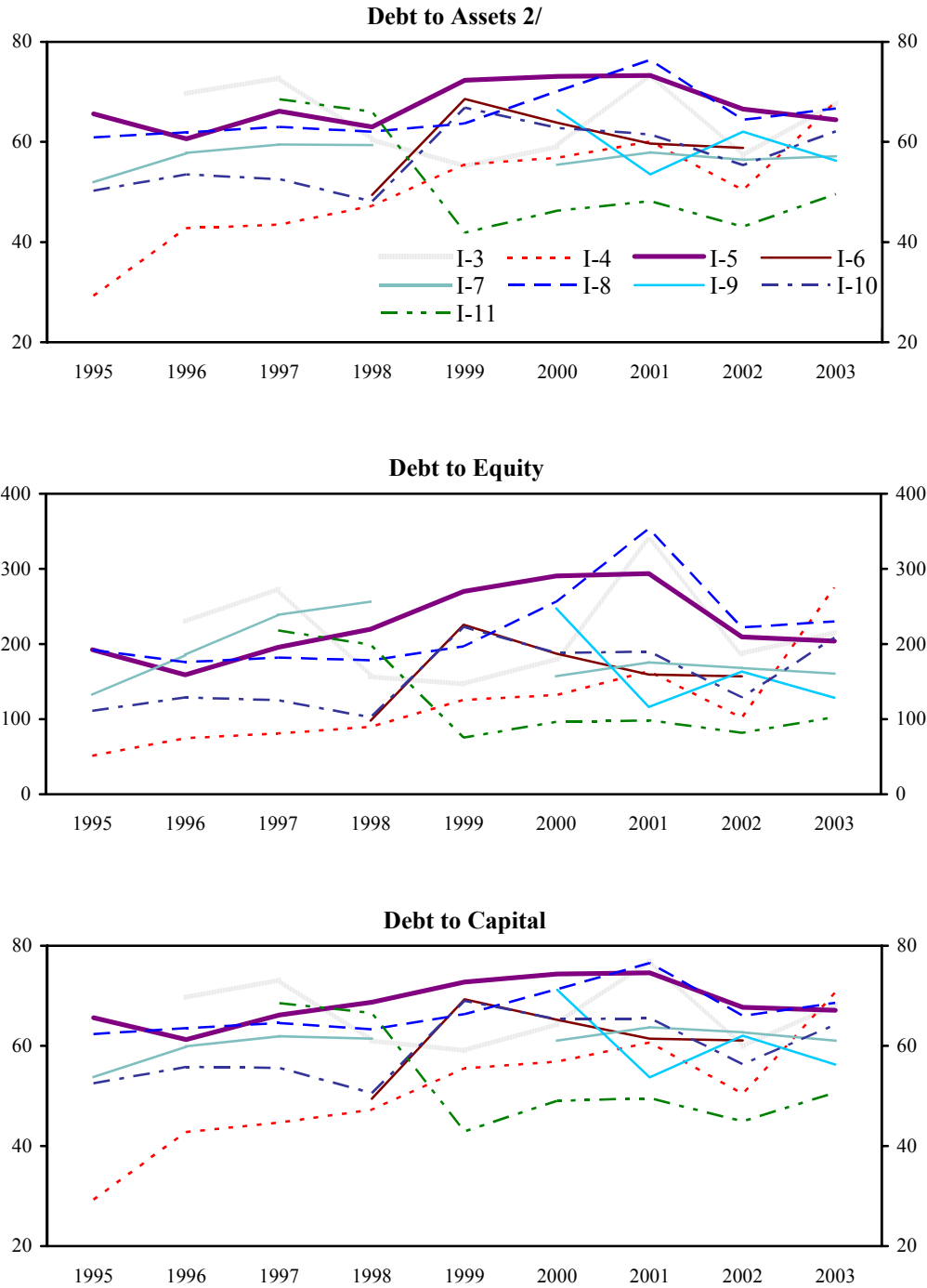
Debt to Assets 2/

Debt to Equity

Debt to Capital

Sources: Thomson Analytics; Central Bank of Iceland; and staff calculations.
1/ See Table 1 for industry classifications.
2/ Legend applies to all panels.

Figure 4. Median Leverage Ratios by Firm Size
(in percent)

Debt to Assets 1/

Debt to Equity

Debt to Capital

Sources: Thomson Analytics; Central Bank of Iceland; and staff calculations.
1/ Legend applies to all panels.

Share of Short-Term Debt, 1995-2003
(in percent)

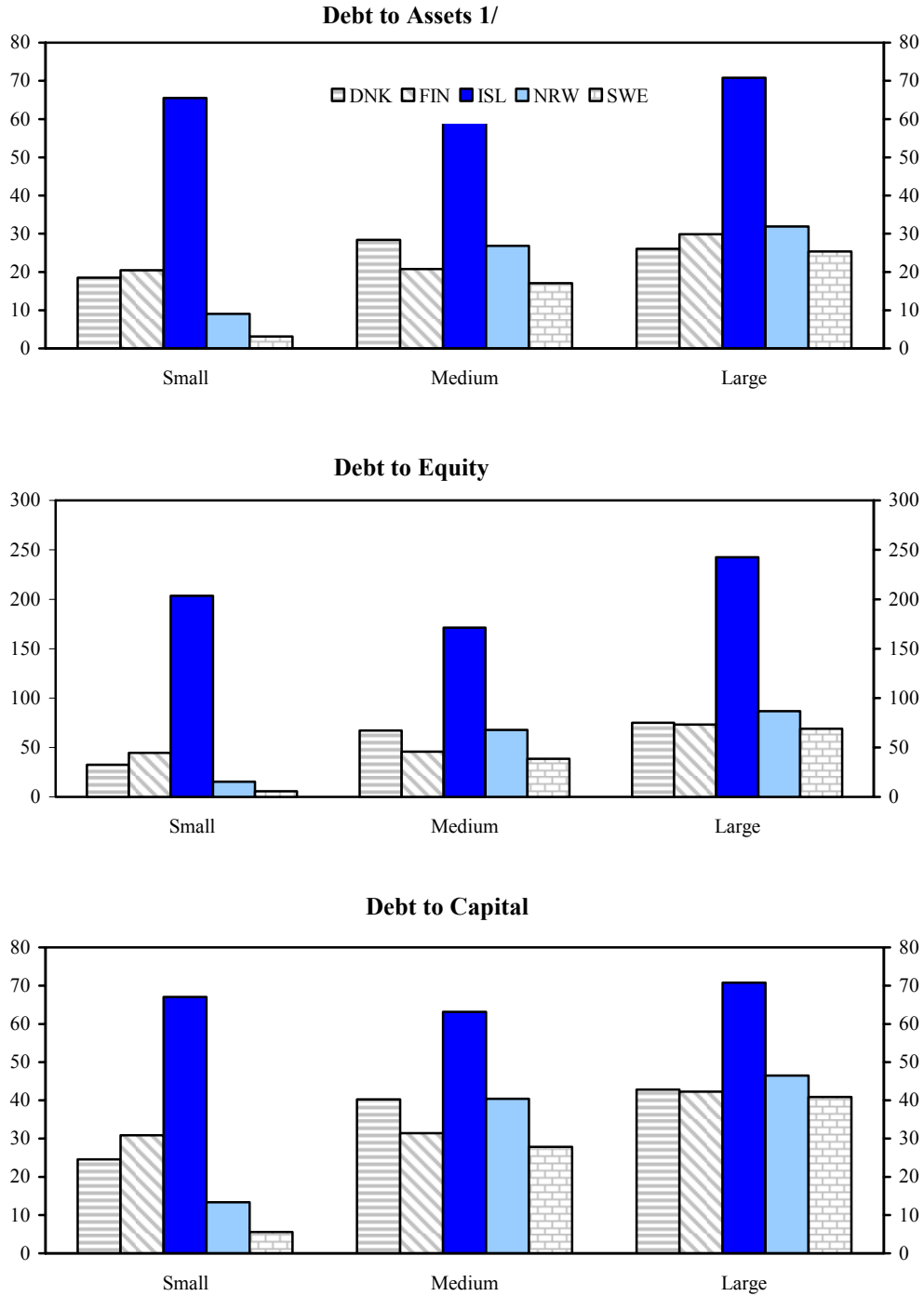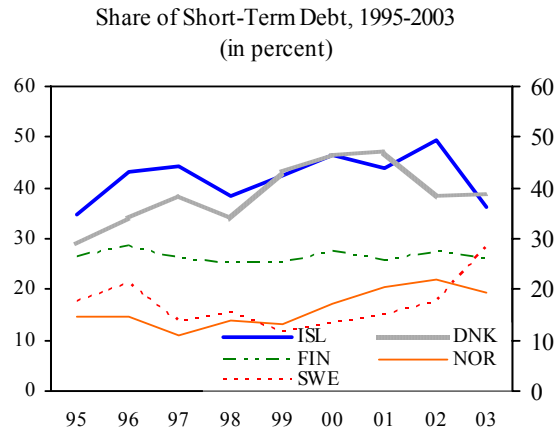Finland (20 and 28 percent versus 26 percent). On average, Icelandic firms have twice the short-term liabilities than their counterparts in Finland, Norway and Sweden do. The difference between these countries was highest in 1997 (44 percent versus an average of 17 percent), while in 2003 it was at the lowest (36 percent versus an average of 25 percent).[5]

C.   What Factors Explain Iceland's Corporate Leverage?

12.   In the previous section, we have identified differences between Iceland's corporate leverage and the rest of the Nordic countries. We now analyze the factors underlying cross-sectional differences among the firms in each country.

Theoretical Considerations

13.   **The existing literature points to several factors that may explain variations across corporate leverage ratios**:

- **Tangibility of assets (+).** Tangibility of assets (*TANG*) is measured as the ratio of fixed to total assets. Theories of capital structure predict that the greater the proportion of tangible assets on the balance sheet, the higher that firm's leverage. The rationale behind this is that tangible assets serve as collateral, reducing agency costs of debt and increasing the liquidation value of the firm. As a result, banks are more willing to lend to firms with a higher proportion of fixed assets.

- **Growth opportunities (-).** Growth opportunities (*GROWTH*) are measured as the growth of total assets, deflated by the consumer price index (CPI). Myers (1977) established that highly leveraged companies may avoid profitable investment opportunities. Therefore, we would expect firms with positive growth prospects to have more equity in their capital structure.

- **Size (?).** Size (*SIZE*) is measured as the logarithm of real assets. The effect of size on leverage is ambiguous. On the one hand, larger firms are diversified and fail less, reducing the bankruptcy risk and, therefore, increasing the willingness of banks to extend credit (+). On the other hand, size may be a proxy for the degree of

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[5] Again, the observed patterns apply only to listed and hence, probably more successful companies.

information of outside investors, increasing the preference for equity rather than debt in the firm's capital structure (-).

- **Profitability (?).** Profitability (*PROFIT*) is measured as the ratio of earnings before interest and taxes (*EBIT*) to total assets. The theoretical predictions on the effects of profitability on leverage are again ambiguous. The relationship between profitability and leverage could be negative if firms prefer to finance with internal funds rather than debt (Myers and Majluf, 1984). However, that relationship would be positive if the market for corporate control forces firms to commit themselves to paying out cash by leveraging up (Jensen, 1986).[6]

- **Volatility of earnings (-).** The volatility of earnings (*VOLATILITY*) is measured as the standard deviation of changes in *EBIT*, scaled by average *EBIT*. Bradley, Jarrel, and Kim (1984) develop a theoretical model showing that firm leverage ratios are negatively related to the volatility of firm earnings if the costs of financial distress (bankruptcy costs and agency costs of debt) are nontrivial. Moreover, Claessens, Djankov, and Nenova (2000) argue that the optimal leverage could decrease with an increase in the volatility of earnings as managers minimize the probability of earnings falling below interest expenses.

- **Tax advantage of debt (+).** Tax advantage of debt (*TAX*) is measured using the formula for the gain from leverage from Miller (1977):

$$\left(1 - \frac{(1 - \tau_c)(1 - \tau_s)}{(1 - \tau_b)}\right)D,$$

where τ_c is the corporate tax rate, τ_s is the dividend tax, τ_b is the interest on income from bonds (i.e. the interest tax rate), and D is the value of outstanding firm debt (in U.S. dollars, logs). Tax advantage arises when tax rates are such that for the same amount of financing, net-of-taxes interest payments are higher than net-of-taxes dividends.[7]

- **Degree of internationalization (-).** The degree of internationalization (*DOI*) is an industry specific variable. It is measured as the exports of the particular industry over

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[6] Nonetheless, if the market for corporate control is ineffective, managers will avoid financing with debt, and, therefore, the relationship will again be negative.

[7] In the absence of taxes, the ratio is equal to 1, and the Modigliani-Miller theorem holds, that is, firms are indifferent between debt and equity financing.

the production in that industry.[8] A common argument is that multinational companies (or companies that are export oriented) have greater costs of debt financing due to higher agency costs as well as greater exchange rate and political risks (Chen and others, 1997; Burgman, 1996; and Fatemi, 1984).[9]

Empirical Analysis

14.   **Our objective is to examine the relationship between the leverage variables and their theoretical determinants, in order to explain Iceland's relatively high leverage.** We used three measures of leverage in 2000 as dependent variables: (i) the debt-to-assets ratio (*DA*); (ii) the debt-to-equity ratio (*DE*); and (iii) the debt-to-capital ratio (*DC*). The explanatory variables are as outlined above—tangibility of assets (*TANG*), growth opportunities (*GROWTH*), size (*SIZE*), profitability (*PROFIT*), volatility of earnings (*VOL*), tax advantage of debt (*TAX*), and degree of internationalization (*DOI*).

15.   **An examination of the sample means of explanatory variables reveals the following** (Table 2):

- Compared with the N4 mean, Icelandic firms have (i) higher proportion of tangible assets (*TANG*); (ii) lower growth opportunities (*GROWTH*); (iii) smaller size (*SIZE*); (iv) similar profitability (*PROFIT*) but higher volatility of earnings (*VOL*); (v) higher tax advantage of debt (*TAX*);[10] and (vi) a lower degree of internationalization (*DOI*).[11] However, some of these results may be driven by outliers. In particular, if we look at median values, we find that growth opportunities of Icelandic firms are higher while profitability is slightly lower.

- A priori, the fact that Icelandic firms have, on average, a higher proportion of tangible assets than the N4 average, relatively lower growth opportunities, higher tax advantage of debt, and a lower degree of internationalization suggests that these factors may help explain the higher degree of indebtedness among Icelandic firms.

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[8] Because of data limitations, we are unable to construct a firm specific variable. Moreover, there are serious data problems in the industry specific variables because data for exports and production come from different sources and do not match fully.

[9] However, research by Reeb and others (2001) has found that international diversification is associated with lower cost of debt financing.

[10] Figure 5 plots the Miller ratio $(1-\tau_c)(1-\tau_s)/(1-\tau_b)$ and shows that Icelandic tax regime up to 2002 used to be more attractive to issuing debt rather than equity.

[11] Caution should be exercised when comparing the degree of internationalization across countries because of differences of data coverage across industries.

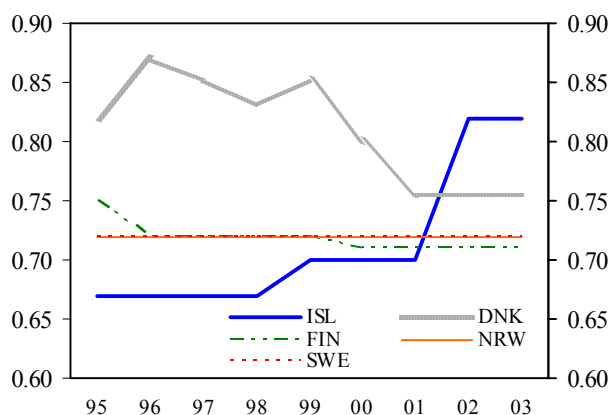Figure 5. Tax Advantage of Debt (Low Values) over Equity (High), 1995-2003

Table 2. Variable Definitions and Mean Values, 1996-2000 1/

Variable	Definition	Mean Value		Median Value	
		N4	Iceland	N4	Iceland
Dependent variables					
DA	Debt-to-assets ratio	22.3	60.5	20.3	61.4
DE	Debt-to-equity ratio	86.3	208.0	45.9	175.2
DC	Debt-to-capital ratio	31.5	63.7	31.5	63.7
Explanatory variables					
TANG	Tangible assets	30.1	56.8	26.6	59.8
GROWTH	Growth	32.6	19.7	2.4	10.5
SIZE	Size	0.1	-0.6	-0.1	-0.4
PROFIT	Profitability	0.0	0.0	0.1	0.0
VOL	Volatility	0.9	1.0	0.8	0.9
TAX	Tax advantage of debt	0.8	1.1	0.7	1.1
DOI	Degree of internationalizatior	614.2	69.2	387.4	96.4

1/ See paragraph 13 for definition of variables.

16.   **The partial correlations between the leverage measures and their potential determinants can be examined in a simple cross-section regression.** In particular, for each country in the sample, the leverage measures (*DA*, *DE*, and *DC*) in 2000 are regressed on the four-year average (1996-99) of the explanatory variables (*TANG*, *GROWTH*, *SIZE*, *PROFIT*, *VOL, TAX,* and *DOI*). [12] The coefficients are estimated using a censored Tobit model.[13] The main results from the cross-section analysis can be summarized as follows (Tables A.1, A.2 and A.3):

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[12] Since not all variables are available for the whole sample period, we have estimated our regressions with data for the period 1996-2000. Following Rajan and Zingales (1995), we average the explanatory variables to reduce the noise and account for slow adjustments. We lag the explanatory variables to reduce the problem of endogeneity.

[13] All measures of leverage are truncated at 0. For this reason, we compute Tobit regressions.

- Tangibility is significant and negatively correlated with the debt to equity in Iceland, but there is no significant relationship with the other two measures of leverage. However, for those N4 countries for which tangibility is significant, it is positively correlated with the debt-to-assets measure.[14] Contrary to the theoretical predictions, it appears that Icelandic firms with many fixed assets are not highly leveraged. One possible explanation is that tangibility matters less in bank-oriented countries like Iceland (see below). This is an argument made by Berger and Udell (1994), who show that firms with close relationships with creditors need to provide less collateral because that relationship (and more informed monitoring by creditors) substitutes the need for collateral.

- Growth opportunities do not have any significant impact on leverage except for Norway, where they are positively correlated with the debt-to-assets and debt-to-equity ratios, and Denmark, where they are positively correlated with the debt–to-capital ratio.

- Size is negatively correlated with leverage for all countries in our sample. One potential explanation is that informational asymmetries between insiders and the equity market are smaller for large firms, and, therefore, larger firms would be able to issue securities more easily and substitute debt for equity. Another potential explanation is that costs of financial distress are low in Nordic countries, and, therefore, size (as a proxy of probability of default) should not matter. However, this does not explain why larger firms in Nordic countries have less debt than smaller firms.

- Profitability is negatively correlated with two measures of leverage (the debt-to-assets and debt-to-capital ratios) for Iceland and Finland. This result is consistent with the empirical findings of the literature (see for example Rajan and Zingales, 1995 and Claessens and others, 2000) and is probably due to the fact that more profitable companies finance themselves to a larger extent with retained earnings.

- Volatility of earnings is insignificant for all countries except in Norway, where it is positively correlated with the debt-to-assets ratio, and in Denmark, where it is negatively correlated with the debt-to-capital ratio.

- A higher tax advantage of debt over equity increases leverage for all countries, as predicted by the theory. Surprisingly, the coefficient of the tax advantage of debt over equity for Iceland is up to three times larger than that of the N4 countries. However, the result for Iceland may be affected by the sample period: we do not cover the years when Iceland decreased its corporate tax rates, which could have made the tax effect less of a factor in determining the capital structure of firms.

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[14] This is the case for Denmark, Norway, and Sweden.

- The degree of internationalization is significant and positively correlated with all measures of leverage in Iceland. However, it is insignificant for the N4 countries for most of the specifications.[15] In contrast to the theoretical predictions, it appears that firms in export-oriented industries in Iceland are highly leveraged. One potential explanation is the small size of the Icelandic capital market, which would make difficult for a firm to finance its activities through equity. Another factor could be that the cost of debt financing decreases with firm international activity. In fact, Mansi and Reeb (2002) find that firm international activity is, on average, associated with a 13 percent reduction in the cost of debt financing and a 30 percent increase in firm leverage.

17.   **The results of our regressions indicate that the factors explaining Iceland's corporate leverage are different from those in N4 countries.** In particular, the observed correlations of the tax advantage of debt and the degree of internationalization with corporate leverage in Iceland are different from the correlations observed in other Nordic countries. This may be a factor explaining accumulation of debt by Icelandic firms. More generally, institutional differences between Iceland and the N4 countries may explain differences in corporate leverage.

18.   **One important institutional difference that may explain Iceland's high corporate leverage is the level of development of its financial markets.** Demirguc-Kunt and Levine (1999) compare financial markets of about 150 countries. Though the study is likely to be somewhat outdated (it is based on data collected in the late 1990s), it nevertheless provides some useful insights. The banking sector is evaluated based on four indicators, all of them measured as a share of GDP: liquid liabilities (a general indicator of the size of financial intermediaries); banks assets (the overall size of the banking sector); claims of deposit money banks on the private sector (an indicator of bank activity in the private sector); and claims of other financial institutions on the private sector (an indicator of nonbank activity in the private sector).[16] As Table 3 shows, indicators for Iceland are somewhat below those for other Nordic countries and an "average" country. However, it seems reasonable to believe that, following the privatization of the banks and especially after their rapid expansion in the last two years, this is no longer the case. At the same time, the stock market in Iceland is less developed than in the N4 countries. The equity markets are evaluated based on two measures: market capitalization as a share of GDP, and total value traded as a share of GDP. The former indicates the size of the market and the latter its liquidity. Another measure of liquidity is the turnover ratio, defined as the value traded as a share of the market capitalization. In contrast to Table 3, Table 4 shows that indicators for Iceland are much lower than those for other Nordic countries and an "average" country.

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[15] The exceptions are Finland, where the degree of internationalization is positively correlated with the debt-to–capital ratio, and Norway, where it is negatively correlated with the debt-to-equity ratio.

[16] Other financial institutions include insurance companies, finance companies, pooled investment schemes (mutual funds), savings banks, private pension funds, and development banks.

Table 3. Comparison of Banking Sector across the Nordic Countries

	Liquid liabilities	Bank assets	Claims of deposit money banks on private sector	Claims of other FI's on private sector
Denmark	0.58	0.48	0.38	-
Finland	0.58	0.8	0.77	-
Iceland	0.37	0.49	**0.45**	-
Norway	0.57	0.69	0.57	0.34
Sweden	0.47	0.54	0.46	0.73
Mean	0.59	0.58	**0.48**	0.21

Table 4. Comparison of Equity Market across the Nordic Countries

	Market capitalization/GDP	Total value traded / GDP	Turnover ratio
Denmark	0.34	0.16	0.45
Finland	0.29	0.12	0.34
Iceland	0.11	**0.01**	0.08
Norway	0.26	0.14	0.53
Sweden	0.62	0.33	0.47
Mean	0.39	**0.17**	0.35

19.   **Overall, Iceland's banking sector is quite active when compared to other Nordic countries, while the stock market is not.** Following Demirguc-Kunt and Levine (1999) methodology, we classify the countries in our sample into bank-based and market-based economies, based on two ratios: (i) the ratio of claims of deposit money banks on the private sector to the total value of traded stocks; and (ii) the ratio of domestic assets of deposit money banks to market capitalization.[17] Table 5 clearly indicates that, in Iceland, the banking sector dominates the stock market, and thus, Iceland falls into the category of bank-based economies.[18] This observation suggests that borrowing from the banks, as opposed to raising equity, may be the easiest way for companies to finance their expansion. While Icelandic firms are now quite aggressively entering foreign markets (especially the United Kingdom and the Nordic countries), it does not seem that they have reached the stage yet when they can easily rely on raising equity on foreign stock exchanges.

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[17] These ratios relate similar aspects of the two markets.

[18] Demirguc-Kunt and Levine (1999) classify Denmark and Sweden as market-based economies, while putting Finland and Norway into a category of bank-based economies. Iceland did not make it into the final classification, as some of the indicators used in the study were missing.

Table 5. Relative Importance of Banking Sector versus Equity Market

	Claims of deposit money banks on private sector/total value traded	Domestic assets of deposit money banks/market capitalization
Sweden	1.38	0.86
Denmark	2.4	1.4
Norway	4.01	2.69
Finland	6.55	2.71
Iceland	**61.7**	**4.5**
Mean	**2.82**	**1.5**

D. Conclusions

20.   **This paper establishes that Icelandic firms are more leveraged than firms in other Nordic countries, thus raising concerns about financial and macroeconomic vulnerabilities.** This result is robust to the use of different measures of leverage—the debt-to-assets, debt-to-equity, and debt-to-capital ratios. Moreover, the result holds both across years (1995–2003) and industries. Icelandic firms also seem to rely more on short-term financing than their counterparts in other Nordic countries. Since high leverage, when accompanied by decreased profitability, can contribute significantly to corporate distress by making firms more vulnerable to income, interest rate, and exchange rate shocks, continuing supervisory vigilance is important to limit excessive risk taking by banks and corporates.

21.   **However, there may be fundamental reasons why Icelandic firms are more leveraged.** Empirical analysis identifies two factors that seem to have a particularly strong impact on leverage in Iceland. One of them is the tax advantage of debt over equity, measured using Miller's ratio of the tax rates (Miller, 1977), which shows that the tax regime has been more beneficial to debt than to equity issuance, at least until recently. The other factor is the industrywide degree of internationalization, as measured by the ratio of exports to production. As expected, leverage is negatively affected by size and profitability, as well as by—contrary to the predictions of the existing literature—tangibility, measured as a share of fixed assets.

22.   **The paper also argues that high leverage may be caused by the degree of development of different segments of the market.** In particular, the paper shows that, while the banking sector is fairly well developed in Iceland, the stock market is not. This observation implies that firms trying to raise funds by issuing equity may face more difficulties than firms issuing debt.

Data Sources

This appendix describes data sources.

Data on firms' balance sheets for the N4 countries come from the Thomson Analytics data set. Data on Icelandic firms' balance sheets come from the Central Bank of Iceland (CBI). In particular, our data set includes information on debt, assets, equity, fixed assets, sales, interest expenses, and earnings before tax and interest payments.

Consumer prices and exchange rate data come from the IMF's World Economic Outlook (WEO) database.

Data on tax rates on corporate income, dividend earnings and bond interest come from the *European Tax Handbook*.

Using the World Integrated Trade Solution (WITS) database from the World Bank, we collect data on exports of goods and services in accordance with the 1996 Harmonized System (HS) classification (six digit level) and using the INDSTAT database of the UN Industrial Development Organization, we collect data on production of goods and services in N4 countries in accordance with the third revision of the International System of Industrial Classification (ISIC, three and four digit level). Data on production in Iceland are obtained from the Iceland Statistics website in accordance with the Classification of Economic Activities in the European Community (NACE, third level).

In the Thomson Analytics database, firms are classified according to the 1987 U.S. Standard Industrial Classification (SIC) system. Following Campbell (1996), we reclassify firms into 13 industries—petroleum, finance and real estate, consumer durables, basic, food and tobacco, construction, capital goods, transportation, utilities, textiles and trade, services, other services, and leisure. Data on exports and production are reclassified as well with the help of concordance tables available from Fifoost.org and Jon Haveman's Industry Concordances websites.[1,2]

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[1] http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeConcordances.html.

[2] The reclassification turns out to be a rather complex procedure as subitems in one classification system often do not have well-defined counterparts in another. Hence, one should take into account that constructed variables are measured with noise.

Regression Results

The cross-sectional regression results are reported in Tables A.1., A.2. and A.3. The dependent variable is the leverage measure in 2000. Independent variables are averaged over the period 1996-99. The coefficients are estimated using a censored Tobit model.

Table A.1. Factors Correlated with Debt to Assets

	Denmark	Finland	Iceland	Norway	Sweden
TANG	0.22	0.05	-0.07	0.19	0.13
	(2.67)**	(0.68)	(1.02)	(2.22)*	(2.21)*
GROWTH	0.02	0.01	0.03	0.17	-0.02
	(1.20)	(0.56)	(0.45)	(1.97)+	(0.44)
SIZE	-9.51	-15.22	-26.05	-11.36	-8.65
	(5.51)**	(7.66)**	(5.97)**	(4.97)**	(7.48)**
PROFIT	2.19	-6.88	-45.91	14.09	4.80
	(0.20)	(1.75)+	(2.20)*	(0.85)	(0.52)
VOL	-3.09	-5.38	-0.73	5.70	-2.36
	(1.44)	(1.59)	(0.25)	(1.89)+	(1.26)
TAX	56.03	46.01	86.07	43.11	26.58
	(6.37)**	(7.26)**	(7.07)**	(6.82)**	(8.54)**
DOI	0.00	0.09	0.09	0.00	0.00
	(0.89)	(1.54)	(4.23)**	(1.49)	(0.18)
Constant	-2.22	-12.91	-43.32	-21.65	3.52
	(0.46)	(2.24)*	(2.69)*	(3.48)**	(0.90)
Observation	90	77	34	64	106
Pseudo R^2	0.07	0.08	0.23	0.11	0.08

Notes: Absolute value of t-statistics in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table A.2. Factors Correlated with Debt to Equity

	Denmark	Finland	Iceland	Norway	Sweden
TANG	0.31	-0.198	-2.98	0.09	0.26
	(0.77)	(0.39)	(2.63)*	(0.15)	(0.72)
GROWTH	0.14	0.06	-0.65	1.31	-0.31
	(1.57)	(0.43)	(0.62)	(2.25)*	(1.30)
SIZE	-40.46	-68.26	-178.24	-54.39	-34.22
	(4.68)**	(5.28)**	(2.28)*	(3.50)**	(4.87)**
PROFIT	64.15	-26.61	-420.04	38.86	35.29
	(1.15)	(1.04)	(1.13)	(0.34)	(0.63)
VOL	-12.79	-33.79	17.48	20.44	-5.17
	(1.19)	(1.53)	(0.34)	(1.00)	(0.45)
TAX	242.92	206.84	560.67	209.60	95.92
	(5.52)**	(5.01)**	(2.58)*	(4.88)**	(5.08)**
DOI	0.007	0.26	1.20	-0.01	0.04
	(1.21)	(0.71)	(3.11)**	(1.95)+	(1.18)
Constant	-29.28	-68.71	-367.76	-103.89	-3.95
	(1.21)	(1.83)+	(1.28)	(2.46)*	(0.17)
Observation	90	77	34	64	106
Pseudo R^2	0.03	0.03	0.07	0.04	0.03

Notes: Absolute value of t-statistics in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table A.3. Factors Correlated with Debt to Capital

	Denmark	Finland	Iceland	Norway	Sweden
TANG	0.16	-0.050	-0.08	0.14	0.08
	(1.47)	(0.51)	(1.15)	(1.31)	(0.90)
GROWTH	0.043	0.012	-0.02	0.154	-0.073
	(1.80)+	(0.44)	(0.25)	(1.42)	(1.24)
SIZE	-13.921	-17.700	-28.40	-14.948	-11.846
	(6.17)**	(7.11)**	(6.09)**	(5.16)**	(6.68)**
PROFIT	20.232	-9.899	-47.03	12.918	10.226
	(1.39)	(2.01)*	(2.11)*	(0.61)	(0.73)
VOL	-5.275	-5.977	-3.25	3.203	-1.741
	(1.89)+	(1.41)	(1.06)	(0.84)	(0.61)
TAX	85.446	54.710	91.76	58.117	38.135
	(7.43)**	(6.88)**	(7.06)**	(7.25)**	(8.00)**
DOI	0.002	0.120	0.08	-0.002	0.001
	(1.44)	(1.72)+	(3.46)**	(1.65)	(0.17)
Constant	-1.711	-7.415	-44.21	-17.408	8.488
	(0.27)	(1.03)	(2.57)*	(2.21)*	(1.42)
Observation	90	77	34	64	106
Pseudo R^2	0.07	0.07	0.21	0.10	0.06

Notes: Absolute value of t-statistics in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%.

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