Kiss Me Deadly:

From Finnish Great Depression to Great Recession*

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Comments welcome

Abstract

In this paper we investigate the causes of the Finnish Great Depression and, more broadly, the drivers of the Finnish business cycle over the last quarter century. We confront several explanations of the depression by assessing the relative importance of foreign, real and financial shocks. To do this, we estimate a structural VAR model, in which the shocks are identified through the sign restrictions methodology. The exercise reveals very diverse causes of the recent recessions in Finland. In the early 1990s domestic financial factors contributed substantially to the boom-bust cycle. The Soviet trade collapse, although meaningful, can account for at most half of the slump. In contrast, external shocks fully dominated during the Great Recession, making it an imported one.

Keywords: business cycle; depression; Finnish Great Depression; Finland; Sign restrictions; financial crisis

JEL Classification: E32; E44; O52

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1 Introduction

In early 1990s Finland witnessed a protracted economic contraction, one of the biggest to be experienced by an industrialized economy after World War II. This "Finnish Great Depression" started at the beginning of 1990, after several years of rapid economic expansion and lasted for almost four years. The cumulated drop of real GDP from its peak in 4Q 1989 to trough in 1Q 1993 was 12.6 percent. The depression was preceded by major credit and asset price booms which came to an abrupt end in late 1989. The episode also witnessed a collapse of the Finnish–Soviet trade in 1991, a currency devaluation and a full-fledged banking crisis. In the same time period stock markets fell by 67 percent while the unemployment rate increased from 3.4 percent up to 17.9 percent.

The multitude of headwinds that the economy experienced during the depression naturally generated a number of very different explanations offered to accout for it. One of the commonly stressed external factors was the collapse of trade with the disintegrating Soviet Union in the first months of 1991. Before the crisis USSR was, alongside Sweden, a major trading partner of Finland. As argued by Gorodnichenko et al. (2012) this shock translated into higher production input costs for Finland. It was also largely amplified by sectoral and labor market rigidities and hence accounted for the bulk of the depression. A competing explanation has emphasized the role of financial liberalization of the 1980s which led to sharp credit expansion and exploding house and stock prices. When the asset bubble burst, a major financial and banking crisis unfolded leaving the economy with a large pile of debt (see e.g. Honkapohja and Koskela (1999), Kiander and Vartia (1996) and others).

In this paper we analyze various factors that likely contributed to the Finnish Great depression and assess their relative importance. In particular, we estimate a structural VAR of a small open economy, in which we identify a range of structural shocks using the sign restrictions methodology. The shocks are both of foreign and domestic origin. They stem from both the real and the financial sectors of the economy, from the demand as well as the supply side. We analyze the historical decomposition of Finnish GDP and construct counterfactuals which help us understand the interactions between the foreign, real and financial sectors.

We find a considerable role of the collapse of Finnish–Soviet trade around 1991. However, we also find a large impact of shocks which capture a collapsing banking sector and the asset price bust. Moreover, a major asset price boom fueling domestic demand was the main driver of the GDP in the run-up to the crisis. Our counterfactual simulations suggest that without shocks and transmission mechanisms stemming from the domestic financial sector to the real economy, the collapse of Finnish–Soviet trade would have had a considerably smaller impact on Finnish GDP. It was the eponymous "deadly kiss" of the financial sector that turned the Finnish economy into a true film noir in the early 1990s.

We also take a broader look at the Finnish business cycle. Apart from the 1990s, the country experienced two other major recessions over the last quarter century, all of them being very different in nature. The turn of the century witnessed a burst of the dot-com bubble in a "Nokia economy". The country was also severely

hit by a global financial crisis of 2007–2008 and the Great Recession that followed. With a record of two major crises and one recession within just two decades the Finnish experience constitutes an excellent laboratory for the study of business cycles' driving forces, macroeconomic policy choices and macro-financial linkages. We find strong evidence for interactions between financial and real variables throughout our sample. The VAR estimates suggest that financial variables affect the real economy not only in the form of shocks, but also as amplifiers of real shocks, especially during crises. The Great Recession in Finland was very different than early 1990s. The drop of GDP is attributed solely to external shocks, i.e. an increase in global financial stress and a slump in global demand. In fact, the negative export demand shocks around 2008 were much stronger (although much more short lived) than those that capture the collapse of Finnish–Soviet trade. A comparison of these two episodes lends strong support to the hypothesis that financial crises of domestic origin, possibly including a banking crisis and preceded by inflated asset prices and high debt levels of the private sector, have a protracted effect on the real economy and are followed by slow recoveries.[1]

Our work is at the intersection of many literature strands. First, we contribute to the debate on the Finnish Great Depression and its origins. Financial liberalization that triggered vast capital inflows and fueled stock and housing market bubbles has been pointed to as the initial culprit by Vihriälä (1997). According to Kiander and Vartia (1996), when the bubble burst a Fisherian debt–deflation spiral unfolded. Many interesting narrative essays on the episode, some of them stressing the financial factors, have also been collected in Jonung et al., eds (2009). However, the Finnish downturn was more severe than that of Sweden after a somewhat similar credit boom. This led many to blame the depression on the breakdown of trade with the USSR in 1991, e.g. Tarkka (1994), alongside the aforementioned paper by Gorodnichenko et al. (2012). In the words of Honkapohja and Koskela (1999) in turn, the episode was a "tale of bad luck and bad policies". The bad luck, was, apart from the vanishing Soviet trade, the recession in the OECD area. Bad policies included the defense of the fixed exchange rate regime during the crisis which elevated real interest rates to double-digit numbers. Working within the real business cycle framework, Conesa et al. (2007) point to increases in taxes on labor and consumption combined with higher government spending. Freystätter (2011) instead employs a New Keynesian model with a financial accelerator and considers three scenarios: a lending boom, a trade collapse and an exchange rate devaluation.

We also contribute to the growing empirical research body on financial market imperfections and their role during major economic crises. In constructing the shock identification schemes we are guided by the theoretical literature which stresses the disruptions between lenders, intermediaries and borrowers.[2] This, combined with a proper selection of variables, allows us, for example, to distinguish loan supply shocks (for example an

[1] See Jordà et al. (2011). These authors do not include Finland in their sample of countries.

[2] Early contributions, e.g. Bernanke and Gertler (1989) and Kiyotaki and Moore (1997), focused on frictions between lenders and borrowers. More recently, the debate moved the role of financial intermediaries and their balance sheets, e.g. Holmström and Tirole (1997) or Gertler and Kiyotaki (2010).

exogenous "credit crunch") from those to the demand for credit (e.g. a "collateral squeeze"). Hence, we are able to shed some light on the relative roles and interactions between borrowers' and intermediaries' balance sheets say more about which financial frictions actually matter. Our work is therefore complementary to some recent studies, including Ciccarelli et al. (2010), Lown and Morgan (2006) and Bassett et al. (2010). In distinction to these studies, our analysis focuses on a small open economy which allows us to assess the degree and channels through which global financial stress or a recession propagate domestically.

This paper is divided into five sections including this introduction. In Section 2 we introduce the model and discuss the identification of structural shocks. We then present the sign restriction methodology and model selection issues. In Section 3 we explain in detail the data used in estimation. The estimation results are then presented in Section 4. We briefly discuss the properties of the estimated model by studying impulse responses. We then move to historical shock decompositions. We have a close look at the Finnish Great Depression. We also conduct some counterfactual simulations which assess the importance of financial factors for business cycle dynamics. In Section 5 we report some robustness results. Concluding remarks are given in Section 6.

2 Model Basics and Identification

2.1 The model and the shocks

Our empirical strategy involves estimating a partially identified VAR model of a small open economy. The 8 variables that we choose can be put into three main groups: one foreign and two domestic. The foreign bloc consists of two variables, i.e. a measure of global financial stress as well as external demand for Finnish exports. The second bloc is the standard New Keynesian monetary VAR variables, i.e. the real output, inflation and an interest rate measure. For the latter, we use the spread between the lending rate and the money market rate, rather than the short-term policy rate itself. The motivation for this is twofold. First, our estimation encompasses several monetary regimes (peg to ECU, float, Eurozone) which can generate structural breaks in the interest rate series, whereas the spread doesn't suffer from this problem. Secondly, the spread reflects the actual lending conditions and tightness of credit better than the short-term money market rate alone. Also, as will be discussed in detail below, the behavior of the spread will allow us to separately identify domestic demand and asset price shocks. Finally, we include a group of three financial variables — asset prices, new bank loans to the private sector and bank loan losses. This set of variables will allow us to identify four domestic shocks: aggregate demand shock, aggregate supply shock, asset price shock and loan supply shock as well as two foreign ones: shock to global financial stress and an export demand shock. The details on the series used are provided in Section 3.

The bivariate foreign block is assumed to be fully exogenous to the domestic part. Shocks to global

financial stress and to Finnish export demand are identified through Cholesky decomposition, in which stress is ordered first. We additionally impose ex ante zero restrictions on the relevant coefficients of the transition matrix. In particular, the global stress indicator is assumed to be fully exogenous to all other variables in the model, so it is effectively an AR(1) process. Global demand for Finnish exports affects all domestic variables. It is affected by financial stress (on impact and beyond), but not by any of the domestic variables at any time.

In addition to the two external shocks we identify the following four shocks using the sign restriction methodology: aggregate demand, aggregate supply, asset prices and loan supply. The method involves imposing a set of restrictions on the signs of impulse response functions. Based on economic theory one may e.g. postulate that a particular variable should go up on impact (and possibly also in the next S periods) after a given structural shock. It allows to identify a maximum of N_d shocks in an N_d-variate domestic block. Our model is therefore partially identified in the sense that the number of sign-identified shocks is lower than the number of variables in the domestic block, as $N_d = 6$ in our case. The unidentified block is a linear combinations of all other possible shocks that we do not try to identify and which are orthogonal to the four identified ones. In particular, this includes the monetary policy shock. We discuss this block in detail in the paragraph on *"Other shocks"* below.

Table 1 summarizes the response restrictions of the 6 domestic variables that we impose to identify the shocks. The sign of the response is required to hold on impact and for at least $S = 1$ periods after the shock. The signs highlighted in red circles denote the minimum set of restrictions necessary to make the structural shocks identifiable from each other. All black signs are motivated by economic theory but are not necessary to distinguish the shocks from each other. Question marks denote cases in which the shock impact on the variable is either not clear or in which economic theory delivers opposite mechanisms that may offset each other.

Table 1: Sign restrictions for positive domestic shocks.

	Real shocks		Financial shocks	
Variable	Aggregate demand	Aggregate supply	Asset price	Loan supply
GDP	$\oplus$	$\oplus$	$\oplus$	$\oplus$
Inflation	$\oplus$	$\ominus$	$\oplus$	?
Asset prices	+	+	+	+
New bank loans	+	?	+	+
Interest rate spread	$\oplus$	?	$\ominus$	$\ominus$
Loan losses	?	$\ominus$	$\ominus$	$\oplus$

Aggregate demand shock: The postulated reaction of the variables after aggregate demand shock is fairly standard. On the real side, the price level should go up alongside an increase in the GDP growth rate.

The shock should also increase the demand for credit and hence the interest rate spread.[3] Asset prices, proxied by a weighted average of stock and house prices, should arguably go up after the shock. It reflects higher profitability of firms and increasing household income. This in turn should strengthen firm collaterals and household wealth and increase lending, as it is also the case in models with a financial accelerator, e.g. Bernanke et al. (1999), hence further pushing up the demand. Finally, we do not impose restrictions on loan losses. Losses may go up if their volume and average quality deteriorates. However, the wealth effects may actually improve private balance sheets, due to higher stock or house prices, and reduce the loan losses in the private sector.

Aggregate supply shock: What distinguishes a supply shock from a demand shock is that here prices go down, rather than up. A positive shock increases asset prices reflecting higher competitiveness and, in the case of some degree of price stickiness, profitability. However, the impact on lending volumes is less certain. On the one hand, higher productivity may trigger new investment, partly financed by increased lending. On the other hand, it allows firms to operate at lower costs, increase profits and increase inside equity, which would then finance the expansion of assets.[4] Since the reaction of loan demand is not clear, it is also hard to argue whether and how would the lending rate, and therefore the spread, move either.[5] We think it is plausible that loan losses will fall in the short run, given better conditions of the firms.

Asset price shock: In our interpretation, an asset price shock is intended to reflect asset price movements which are not due to changes in fundamentals, neither current or future (as those considered e.g. by Christiano et al., 2010a). Rather, it reflects market exuberance or bubbles. A positive shock will generate responses largely similar to demand shocks. GDP should respond positively as the shock generates positive wealth effects and stimulates both domestic demand and production. Higher demand puts in turn an upward pressure on the general price level as in Bernanke and Gertler (2001). The hypothesis that bubbles can be inflationary seems to be in line with the Finnish experience from late 1980s and that of many troubled European countries in the first decade of 2000s, although not with the U.S. experience in the run-up to the crisis of 2007-2008. The positive shock automatically translates into higher collateral values. As balance

[3] It is plausible to assume that the reaction of the central bank is not immediate after the demand shock so the policy rates do not immediately follow the lending rates. The reason why we are able to make this assumption is the fact that Finland was on some form of a fixed exchange rate regime for the most part of the sample. Until 1992 the Markka was pegged to a basket of currencies and monetary policy focused on exchange rate movements rather than on the domestic demand, as it is the case in the standard Taylor rule. Similarly, in 1996 Finland entered ERM2 and later the Eurozone in 1999. Arguably, the European Central Bank does not immediately react to idiosyncratic Finnish demand shocks.

[4] Alternatively, firms would have an incentive to issue new outside equity or corporate bonds, as in Holmström and Tirole (1997).

[5] As was argued in Footnote 3 in the context of the aggregate demand shock, it is likely that monetary policy reaction will not be effective within two quarters after the shock, so the spread will not be affected though movements in the policy or interbank rate.

sheets of firms and households improve, lending rates go down, which reduces interest rate spreads. Lower spreads should in turn increase the amount of new loans. Loan losses decrease mainly because of stronger balance sheets, but this drop can be reinforced by the Fisherian effect in which higher price levels reduce the real burden of nominal loan contracts for debtors.[6]

The impact on spreads allows us to distinguish the asset price shock from a standard aggregate demand shock. In the former case, the rising collateral values and improved balance sheets have a direct impact and allow borrowers to take on cheaper loans. In the case of a standard aggregate demand shock this channel is only indirect and arguably much weaker. In consequence, the spreads go up because of the directly higher demand for loans.

Finally, it should be reiterated that the asset price shock can not be interpreted as news about future productivity. This is because news about a future increase in productivity are not likely to be inflationary but, if anything, deflationary, as in Christiano et al. (2010a).

Loan supply shock: A positive loan supply shock stems from the sector of financial intermediaries. It may, for example, reflect changes in effective lending standards or regulatory environment. An exogenous credit crunch can also be thought of as large negative loan supply shock.[7] As the availability of bank loans increases, lending rates go down, hence reducing the spread. However, ceteribus paribus, the amount of bad loans goes up. This allows us therefore to distinguish the loan supply shock from the asset price shock. Yet, it may be plausibly argued that there is a considerable time lag between the increase in loans availability and the surge of actual banks' loan losses. For that reason we impose a zero restriction on the impulse responses in the benchmark setting. Loan losses are expected to go up only in the first period after the shock, not on impact. We do not make assumptions on which sectors of the economy will benefit from lower lending rates. If it is the entrepreneurial sector, real supply and profits should go up. If it is households, then the shock would fuel the aggregate demand. In both cases both the GDP and asset prices should go up. However, both channels would generate opposite movements in prices and therefore the reaction of inflation remains unclear.

Other shocks: Since we define only four shocks in the domestic block, there remains an unidentified part into which all other possible shocks that are orthogonal to the ones identified above fall. One clear candidate is the shock to monetary policy, i.e. an exogenous drop in the policy, and hence market rates. Since this shock is associated with higher real demand and higher prices, one could argue that it is likely to be confounded with the aggregate demand shock defined above. If the pass-through from policy to lending rates was weak, one should observe an increase in spreads after an expansionary monetary policy shock. However, since the lending rates and hence loan volumes would not react on impact, demand should not really pick up instantenously either. Yet, as documented by Kauko (2005), lending rates in Finland tend to be flexible.

[6] See Fisher (1933)

[7] A collateral squeeze can be represented by any of the three other domestic shocks.

The pass–through from policy rates to lending rates has been quick ever since 1993. Nevertheless, it could have been much slower prior to 1993 when policy rates were much more volatile and reacting promptly to currency market fluctuations. This suggests that our model may partly interpret monetary policy shocks as demand shocks prior to and during the Finnish Great Depression. Otherwise, though, monetary shocks are a part of the unidentified set of shocks.

Another comment is related to the reactions of new bank loans after positive aggregate demand and asset price shocks. In principle one could argue that rising asset prices would increase the incentive to switch from more costly bank financing to cheaper equity financing, in the spirit of the Holmström and Tirole (1997) framework.[8] However, bond and capital markets in Finland have been relatively shallow (when compared, for example, with the US) and entrepreneurial activity is predominantly financed by bank credit rather than through outside equity or debt. Yet, to the extent that these sign restrictions are too strict, some fraction of aggregate demand and asset price shocks will then be reflected in the block of unidentified shocks.

2.2 Model selection issues

We now discuss the details of the sign restriction methodology that we apply to identify the domestic shocks. Consider a reduced–form VAR(1) model is of the following form:

$$y_t = A y_{t-1} + u_t \tag{1}$$

where y_t is a vector of variables and the reduced–form errors are $u_t \sim N(0, \Sigma)$. Structural shocks are then linked to the errors through some structural identification matrix W, so that $u_t = W\varepsilon_t$ with $\Sigma = WW'$. In our case, the total number of variables $N = 8$. There are $N_x = 2$ foreign (exogenous) variables and $N_d = 6$ domestic ones.

Shocks in the international block are are uniquely identified by the Cholesky decomposition and ex ante exogeneity restrictions on the transition matrix, as discussed in Subsection 2.1. This involves setting $a_{1,2}, ..., a_{1,N} = 0$ and $a_{2,3}, ..., a_{2,N} = 0$ in the reduced form model. To identify the $J = 4$ structural shocks in the 6-variate domestic block, we apply the sign restriction methodology. To facilitate the exposition we proceed by focusing only on the domestic block and treat it as a complete VAR for the rest of this subsection. In practice, the identification procedure begins with the MLE estimation of the reduced-form model and the standard Cholesky decomposition of the covariance matrix $\Sigma = BB'$. Now, consider an orthonormal matrix Q, called a rotation matrix, such that $QQ' = I$. Hence,

$$\Sigma = BB' = BIB' = BQQ'B'$$

so that $W = BQ$ and $u_t = BQ\varepsilon_t$. Obviously, there exists an infinity of matrices Q, which all give rise to different structural models.[9] The practical task of the researcher is then to consider a multitude of rotation

[8] A similar mechanism occurs in Christiano et al. (2010b), where a positive wealth shock decreases the number of total loans.

[9] The rotation procedure applies only to the domestic block, the international block is the same same over all Q's.

matrices Q matrices and to retain only these rotations which give rise to the desired impulse response patterns and discard all others.[10]

At this stage though, the identification of the model is still not exact because in principle there exists an infinity of structural models (and Q rotation matrices) that satisfy the sign restrictions. This is what Fry and Pagan (2011) refer to as "multiple models problem". One then needs to select the ultimate model from the set of admissible candidates based on some optimality criterion. These authors suggest to select the final model which is closest to the pointwise median of impulse response functions.

If the researcher is more concerned about some particular historical decomposition than a specific path of impulse responses, as it is in our case, one can consider another model selection criterion. The modified criterion involves choosing a model that is closest to the normalized pointwise medians of historical shock contributions. To be specific, let $\theta_{n,j,t}$ be the normalized cummulative effect of shock j on variable n up to period t, obtained through the vector MA representation. For the purpose of model selection, we take into account only the J identified shocks. Unidentified $N - J$ shocks, initial conditions carried over from period $t = 0$ of the decomposition, as well as the constant of the VAR are ignored. The model choice criterion is

$$x^* = \arg\min \sum_{n}^{N} \sum_{j}^{J} \sum_{t=1+p}^{T} (\theta^x_{n,j,t} - \bar{\theta}_{n,j,t})^2 \tag{2}$$

where the $\bar{\theta}_{n,j,t}$ denotes the median over all model candidates, p is the number of lags in the VAR (in our case $p = 1$) and T indicates the length of the sample.[11] An advantage of this criterion selection, relative to the one based on IRFs, is that it is not sensitive to the chosen impluse response horizon. Instead, the minimization is naturally based on the whole available data sample. As a final remark, it is important to observe that in the context of our model the minimization can really be carried over just the domestic block. The international block is by assumption fully exogenous and the rotation matrices do not affect the magnitude and relative contributions of international shocks.

3 Data

In this section we provide more details regarding the time series used in estimation. The dataset is of quarterly frequency and spans from 1Q 1986 until 4Q 2012. All series are stationary and, where appropriate, deflated by the GDP deflator. We use year over year (YoY) growth rates of the series, unless indicated otherwise.

[10] It is a matter of computational speed how to generate candidate Q matrices quickly. An efficient method based on Householder's transformation has been postulated by Rubio-Ramírez et al. (2010). The procedure involves drawing a matrix M from a multivariate standard normal distribution. The QR decomposition of M then delivers an orthonormal matrix Q.

[11] The $\theta_{n,j,t}$ contributions are normalized by their respective standard deviations $\sigma_{n,j}$, i.e. $\tilde{\theta}_{n,j,t} = \theta_{n,j,t}/\sigma_{n,j}$, where $\sigma_{n,j}$ are computed across all models and periods.

Stress: The indicator of global stress that we use is the Composite Indicator of Systemic Stress (CISS), constructed by Holló et al. (2012). The index is constructed from 15 individual measures of financial stress, which mainly include volatilities of realized asset returns and risk spreads as well as measures of cumulated losses.[12] These measures give rise to five subindices which describe five segments of the financial market: financial (bank and non–bank) intermediaries sector, money market, bond market, equity as well as exchange rate markets. The CISS index then takes into account correlations between these markets and puts more weight on situations in which the stress prevails on many markets simultaneously to capture the degree to which the stress is systemic. Because of this feature, the series exhibits by far the strongest dynamics around the recent financial crisis and the subprime market collapse. Nevertheless, the series also picks up all major international financial events since mid 1980s, including stock market crashes and crises. However, by costruction, they are given much less weight.[13] The series is used in levels.

External demand: As a proxy for the external demand for Finnish exports, we use the Export Demand Index of the ECB, developed by Hubrich and Karlsson (2010). The index is constructed as a weighted geometric average of the import volumes of the trading partners of Finland. The total imports of a given foreign country can plausibly be considered fully exogenous to the Finnish economy.[14]

It is also worth stressing that because the external demand series captures the demand of all Finland's trading partners. This includes not only USSR or Russia, but also Sweden, Germany and the UK. Therefore it picks up swings in imports from Finland due e.g. to recessions in these countries.

New Keynesian VAR components: We use standard measures, i.e. growth rates of total GDP and of the GDP deflator. For the monetary policy stance we use (the level of) the spread between the lending rate on new non-financial loans and the nominal short-term interest rate (3M interbank rate).

Financial variables: The final set of variables describes the Finnish financial sector. The series on asset prices is constructed for the purpose of this paper. It is the first principal component (PC) of stock– and house–price growth rates. The primary reason why we use the hybrid series is because treating the series

[12]The CMAX measures maximum cumulated losses on a given market over a two–year moving window.

[13]The indicator is used in levels. The data on CISS is available only from 1Q 1987 onwards. We extrapolate the CISS data backwards until 1Q 1985 using the Financial Stress Index (FSI) of the IMF. In a robustness check, we replace CISS with VIX, but do not find meaningful differences between the two in our results.

[14]The weights are three-year moving averages of the shares of total Finnish exports going to a particular trading partner. The moving average strikes a compromise between three potential problems. The first one is a degree of endogeneity of Finnish exports to domestic conditions. The second is the problem of "disappearing importers". If weights were means over a very short period (e.g. only the last one), then the disappearing Soviet trade would show up as a drop of the index only on impact. In following periods, the index would not reflect collapsing demand for Finnish exports anymore because the weight of USSR would be updated to zero and shares of other countries will go up. Both of these problems call for some degree of fixedness of the weights and rather long memory. The third problem is the threat of making the export structure in the index obsolete, hence the need of updates.

separately increases the number of sign restrictions (and hence the computational burden) without helping us to identify any of the shocks.[15] Both series are normalized, i.e. divided by their standard deviations, before extracting the PC. This allows us to dampen the share of stock price series which would otherwise dominate the PC due to its very high relative variance. Given that stock prices are more volatile by nature, a one percent increase in house prices may contain more economic information than a corresponding increase in stock prices. Stock market series is the capped OMXH index of the Helsinki Stock Exchange.[16] The house price index tracks the prices of old dwellings in the whole country.

Finally, we include two variables describing the lending market: real new loans to the private sector (households and non-financial firms) as well as total loan loss provisions of the banking sector.[17] We focus on new loans (flow) rather than the total loan pool (stock). Here, we take acknowledge the argument of Geanakoplos (2010) that given a large existing volume of loans, the latter indicator will be changing very slowly and will not pick up major changes in lending conditions quickly. In that sense, new loans is a much more up-to-date barometer of the loan market, especially when combined with the interest rate spread for new loans. The data on loan losses come from Pesola (2011) and from Vihriälä (1997).

4 Results

In this section we discuss the results of our model estimation. We start with a quick look of the performance of the final model in terms of impulse responses. In the next subsection we perform a historical shock decomposition of the Finnish GDP growth rate. This is the key empirical exercise of this paper, as it allows us to answer what were the driving forces of Finnish GDP over the last quarter century. We then zoom into the early 1990s and join in with the debate on the causes of the Finnish Great Depression.

We generated 500,000,000 draws of the M matrix. To improve efficiency, the columns in the Q_{ID} block were additionally permuted with respect to sign, in the spirit of Rubio-Ramírez et al. (2010). This increased the number of candidate matrices by the factor of $2^{N_{ID}} = 16$. We found 18,407 matrices that satisfy the sign restrictions and pass the FP filter. The reported median model of choice was selected using the methodology described in Section 2.2.

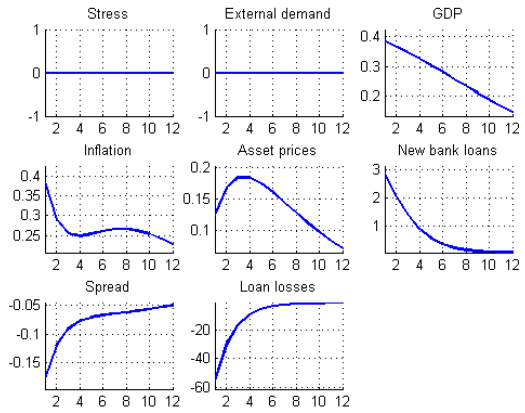
4.1 Impulse responses

Figure 1(a) reports the impact of a positive asset price shock. Because of the exogeneity assumption, neither

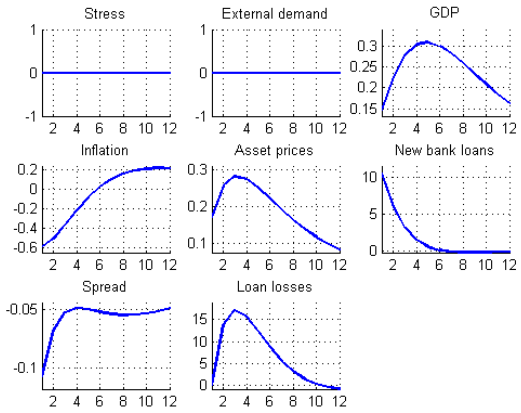
[15] Nevertheless, the results do not change qualitatively if the two series are handled separately.

[16] The index is capped, which means that the capitalization of a single company cannot exceed 10 percent share in the index. This allows us to mitigate the impact of Nokia and have a broader view of Finnish corporate performance.

[17] The latter variable is differenced, not log-differenced, relative to the corresponding quarter of the previous year. This is to eliminate the strong base effect which occurs when the crisis explodes and turns the growth rates into extremely large numbers.



(a) Asset price shock



(b) Loan supply shock

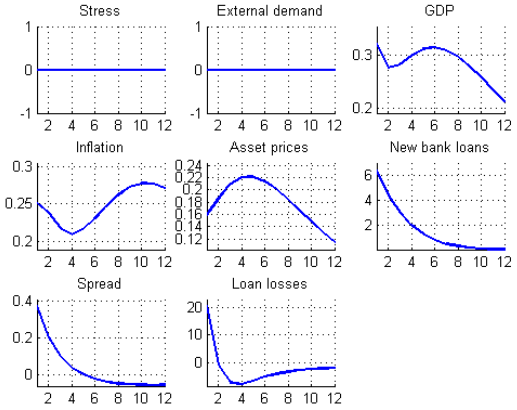
stress nor external demand are affected. All domestic variables are affected on impact, as the rotation matrix Q kills the Cholesky triangularity. Given our identification scheme summarized in Table 1, there's no uncertainty regarding the direction of the reaction on impact and one period after the shock in any of the domestic variables. Yet, the magnitude of impact, persistence of the responses and the paths in latter periods are all unrestricted. The growth of the first principal component of asset prices by 0.12 percentage points translates into a growth of the stock price dynamic by 2.54 percentage points and of house price dynamics by 0.81 percentage points. Output dynamics (real GDP growth rate) increases by 0.39 percentage points on impact. Inflation goes up by a similar magnitude. The quantity of new loans goes up by 2.8 percentage points, however, the effect is relatively short-lived and dies out after a 6 quarters. At the same time, loan losses drop on impact by €$_{2000}$ 55.8 million per quarter. The gap between lending rates and policy rates shrinks by almost 18 basis points and the effect on spread largely dies out within 8 quarters.

Next, consider a shock to the loan supply, reported in Figure 1(b). As implied by sign restrictions, output goes up and the growth rate remains higher for 12 quarters. Asset prices go up for about three years after impact. Loan losses are by construction not allowed to go up on impact. Instead, they rise in the following periods and die out within three years after the shock, Hence they remain higher long after the increase in new bank loans vanishes, which happens roughly one year after the shock. The spread remains lower for at least three years, initially by 10 basis points, and later by 5 basis points. Inflation is the only unrestricted variable in our identification scheme. The fact that it drops suggests that new credit affects more the supply side of the economy (entrepreneurs) than the demand side (households).

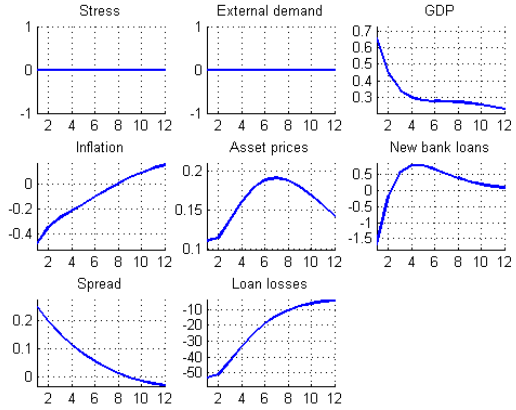
Figure 1(c) shows the responses following a domestic aggregate demand shock. Real variables exhibit rather protracted reactions. Financial variables, on the other hand, are much shorter lived and largely die out within a year after the shock. Loan losses, the only variable not restricted by signs, go up on impact. This suggests that the volume of new loans goes up enough to deteriorate the overall quality of loans. This

effect initially dominates the positive wealth effects coming from stronger balance sheet and higher asset prices.

Following a positive productivity shock, depicted in 1(d), a growth in the GDP is accompanied by a decrease in prices. Interestingly, new bank loans actually drop somewhat on impact, but they start growing in latter periods. This may suggest that firms initially use higher retained earnings to expand their assets but then also take up more loans. However, the interest rate spread goes up already on impact.



(c) Aggregate demand shock

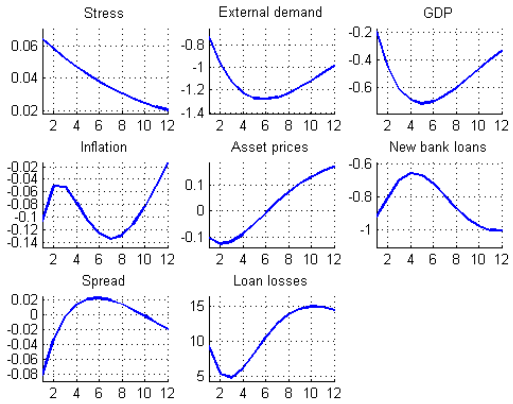


(d) Aggregate supply shock

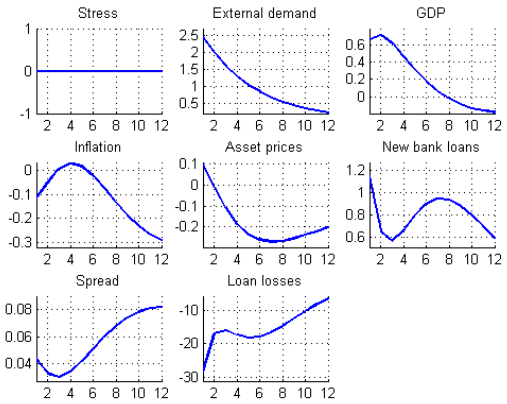
Finally, in Figures 1(e) and 1(f) we report the reaction of the economy to external shocks. Recall that shocks to stress and external demand are identified through exogeneity restrictions on the model rather than by sign restrictions. As expected, output goes down following an increase in foreign financial stress. So does external demand, asset prices and new bank loans. Weaker balance sheet drive loan losses and the interest rate spread up. Following a higher demand from abroad, output goes up. Inflation falls on impact, but then dies out after a year and then drops again. Asset (stock and housing) prices go slightly up on impact, but then, somewhat puzzlingly, fall for several quarters. Less surprisingly, higher demand from abroad triggers a higher demand for new loans which is accompanied by a protracted increase in the spread. Nevertheless, loan losses remain lower for several periods.

4.2 Historical Decomposition

We now move to the central exercise of the paper, i.e. the decomposition of Finnish GDP dynamics into shocks. The results are presented in Figure 1. The first glimpse allows us to make several observations. First, the accumulation of dark and medium blue bars indicates a strong role of the external shocks. This applies both to fluctuations in the demand for Finnish goods, as well as in the transmission of international financial stress to Finland. In fact, the crisis of 2008 (and, to some extent, the mild recession of 2001) was driven predominantly by exogenous factors.



(e) Stress shock



(f) External demand shock

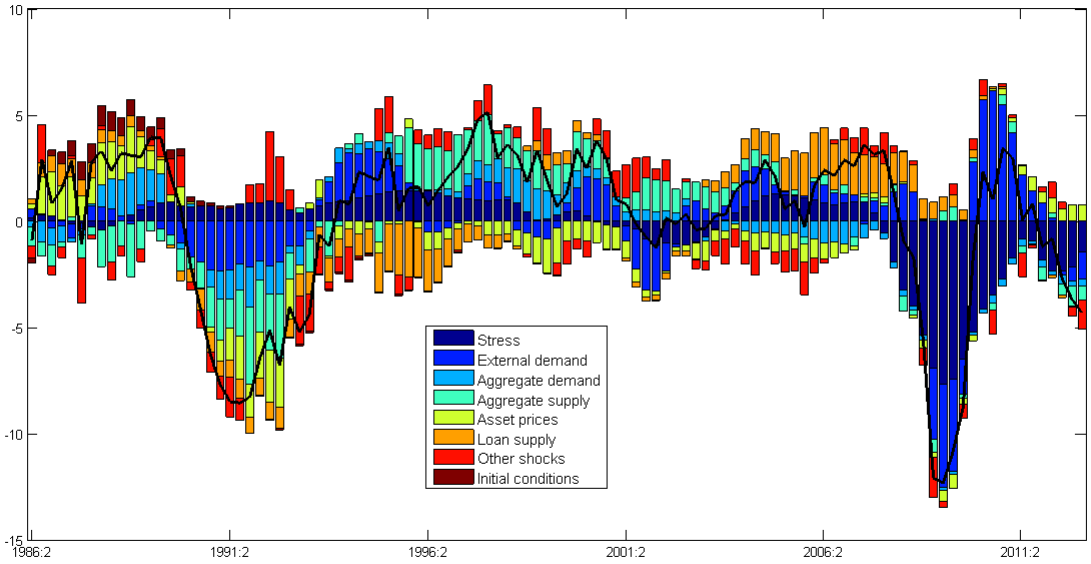


Figure 1: Historical decomposition of the Finnish GDP growth rate.

The reason why external demand might play such a large role is not only because Finland is a small open economy, but also because for most of the time in our sample it was on some form of a fixed exchange rate regime, first against a trade-weighted basket and ECU until 1992 and then, from 1996 on in the ERM2 and the Eurozone. Therefore it couldn't count on a fluctuating exchange rate as an automatic stabilizer, although it resorted to a devaluation in the midst of the depression of early 1990s. In fact, export demand shocks seem to amplify the cycle rather than dampen it in the sense that they are positive in the time of high growth and negative in the times of recessions and slowdowns.

Global financial distress played some, yet relatively minor role around 2001. However, in 2008 its impact

was very large and it affected the economy even more than the contracting external demand. The recovery was then again driven by subsiding stress and a quick increase in external demand, which reflected the bounce–back of world trade. It is worth noting that in neither of the two latest contractions did domestic financial factors play a substantial role, although we do identify strong positive loan supply shock during the boom of mid-2000s. During the last two recessions, however, the domestic contribution was almost nil. The reasons why the decomposition does not attribute a large negative role to domestic financial shocks during these contractions may be related to the behavior of interest rate spreads and asset prices. According to our identification scheme, a negative asset price shock should increase spreads through falling collateral values. However, since mid-1990s Finland was characterized by a quick pass-through from policy rates to lending rates, which kept the spreads at bay. The expansionary policy rate of the ECB was then quickly reflected in the credit conditions.[18] The interest rate spread was in fact very stable and low (close to zero or negative) between 1999 and 2008, which also partly explains the rather large role of the positive loan supply shock in mid-2000s. On the other hand, the dynamics of stock and house prices were considerably different in 2000 and in 2008 than around 1990. The two series, although related, have largely decoupled by the turn of the millenium, after being highly correlated in late 1980s and early 1990s. The housing market didn't experience any clear booms prior to the dot-com bubble bust or in the run-up to the Great Recession. Around the turn of the century the real estate sector was in fact still recovering from the depression. The real housing prices continued growing without major interruptions, although they fell somewhat in both in 2001 and in 2008. In real terms, the were still around the level observed at the peak of the 1980s boom over the last years. The movement of our asset prices series is therefore muted by this rather moderate dynamics of house prices. The stock market on the other hand, experienced a major price bubble during the era of dot-coms and of the preponderance of the Finnish IT sector. However, the series that we use is capped. Therefore it can only fractionally be associated with the dynamics of Nokia corporation. Furthermore, that company was largely foreign-owned already in 2000 and so the drop of its share prices affected mainly foreign rather than Finnish balance sheets.

A final observation worth making is that the economy rather quick recovery after both of the two most recent recessions, despite their strikingly different magnitudes. This stands in sharp contrast to the experience of early 1990s. During the Finnish Great Depression domestic financial factors substantially contributed to the downturn. That contraction was also much more prolonged and hence resulted in a massive total drop in output. We discuss this episode next.

[18]European Central Bank lowered the interest rate from 4.75 percent to 2 percent between October 2000 and June 2003 and the response was even bolder response during the crisis of 2007-2008.

4.3 Finnish Great Depression 1990–1993

The Finnish Great Depression started at the beginning of 1990, after several years of rapid economic expansion. The contraction lasted for almost four years. The cumulated drop of real Finnish GDP from its peak in 4Q 1989 to trough in 1Q 1993 was 12.6 percent, making it one of the biggest contractions experienced by an industrialized economy after World War II. As it was the case with many other major recessions, several hypotheses have been proposed to explain the collapse and the debate is, in our view, not settled. The primary reason of the multitude of offered explanations is that several factors came into play around the time, many of which could potentially explain a large share of the Finnish Great Depression. In the words of Honkapohja and Koskela (1999), it was a "tale of bad luck and bad policies". Our exercise attempts to confront some of these views and to assess the relative importance of different factors that have been at work during and before the crisis.

One of the commonly stressed external factors was the collapse of trade with the disintegrating Soviet Union in the first months of 1991. As argued by Gorodnichenko et al. (2012) this shock was largely amplified by sectoral and labor market rigidities and accounted for the bulk of the depression. USSR was, alongside Sweden, a major trading partner of Finland before the crisis. Figure 2 plots the dynamics of Finnish goods exports and GDP between 1Q 1985 and 4Q 1995. Finland experienced a drop in total goods exports in 1991. Back in 1986 it recorded a similar, although a bit smaller decline. What is striking though is that the corresponding GDP dynamics was very different. In 1991 the country was sliding into a depression, whereas in 1986 it reported only a moderate slowdown with GDP growth rate still above 1 percent. The figure also plots counterfactual trade dynamics in which it is assumed that exports to the Soviet Union stayed at the level from 1Q 1984. Comparing actual exports with the counterfactual shows that the collapse of trade with the USSR was a major ingredient of the total drop of Finnish exports observed during the depression. Nevertheless, a fraction of the decline was also reported vis-à-vis other trading partners, mainly due to the economic crisis in Sweden and a paralell recession in the UK. Even without the end of Soviet trade Finland would have experienced falling exports, albeit half of the actual size. Back in 1986, the country also experienced a drop in goods exports to all its major trading partners, although at that time it was much more evenly distributed. Lower exports to USSR was due to falling world oil prices which meant that the Soviets had lower revenue to pay for their imports and balance the exchange.

On the eve of the Finnish Great Depression, the Soviet Union was a recepient of around 15 percent of total Finnish exports. This share dropped considerably from its peak around 1981 when it reached 25 percent due to falling oil prices in mid-1980s. During the depression it shrank further to below 3 percent in 1992. Soviet trade constituted less than 2.5 percent of Finnish GDP in 1989-1990, much less than the total experienced output loss of 12.6 percent. Finland's GDP contracted from peak to trough by 3,465 mln €$_{2000}$ whereas trade with the USSR plummeted by 457 mln €$_{2000}$, i.e. 13 percent of that number. Even in the year of the trade collapse (i.e. from 4Q 1990 to 4Q 1991) the drop of GDP was 1,586 mln €$_{2000}$ (-6 percent), whereas

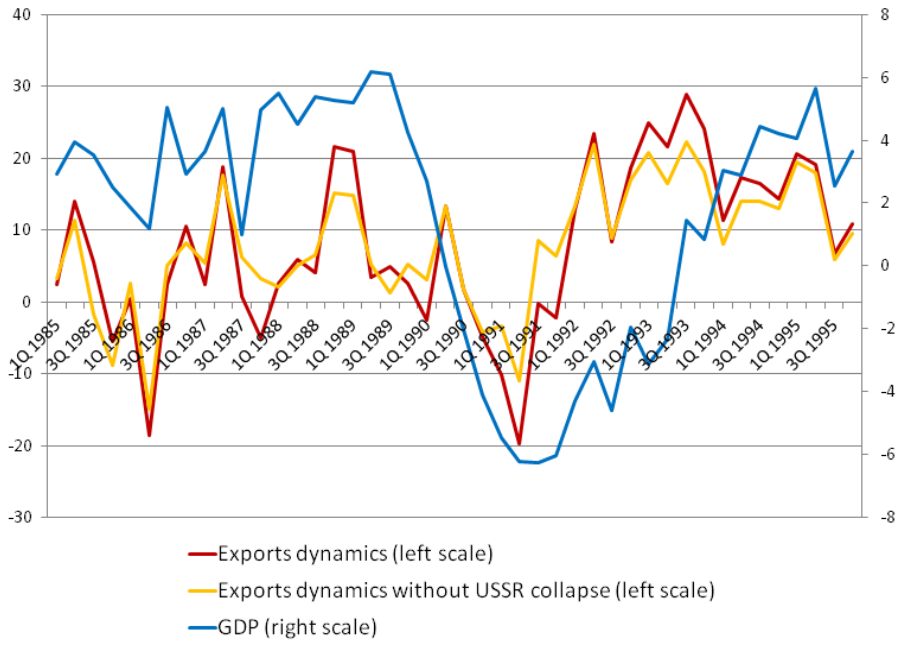


Figure 2: Exports of goods with and without USSR collapse.

Soviet trade shrank by 442 mln €$_{2000}$ (28 percent of that number). As Sutela (n.d.) points out, the collapse of exports to the Soviet Union was not a sudden disaster and the Soviet exports share had declined already starting from 1986, with no dramatic consequences.

The historical decomposition presented in Figure 1 allows us to make an assessment on how much did the Soviet trade collapse contribute to the decline in Finnish GDP. The drop in demand from USSR can be attributed to shocks in external demand. However, a considerable part of the "Soviet" sector of the Finnish economy became obsolete after 1991. Most small and medium-size production plants concentrated on Soviet markets shut down which in turn generated structural unemployment. The largest ones (e.g. in the shipbuilding industry) were partly able to switch their production profiles. Hence, the collapse of trade can also be thought of as capital obsolescence or depreciation and interpreted by the model as a negative shock to domestic capital stock.[19] Hence, the Finnish–Soviet trade collapse may in principle appear in the historical decomposition both as a negative export demand shock and a negative domestic supply shock. Both of these shocks will, however be contaminated by other factors. For example, external demand shock will also reflect the drop of exports demand to other countries, notably Sweden and the UK. Hence, associating with both shocks fully with the Soviet trade breakdown will, if anything, generate a bias against an alternative hypotheses on the causes of the depression. Figure 1 indeed picks up a drop in external demand peaking at the turn of 1990. It also reveals several quarters of negative impact of domestic supply between 1990 and

[19]In general, one could distinguish between these two effects by looking at prices. However, these goods, frequently of low quality, didn't find other markets to be sold to and hence largely stopped being produced.

1994.

Interestingly, the decomposition doesn't pick up the other "bad luck" factor, which is the ERM crisis in September 1992 when the UK and Sweden abandoned their pegs to ECU. In fact, financial stress shocks have mildly positive contribution throughout that episode in our decomposition, although the EMR crisis is picked up by the CISS series.

Another large part of the decomposition is made by domestic financial factors. This includes both the asset price shock as well as the loan supply shock. The collapse of the asset price bubble plays an important role between 1990 and 1992. Negative loan supply shocks play a smaller part during around the trough but were dragging down the economy in the recovery phase, around 1994-1995. This reflects several factors. The first is the lagging nature of loan losses and the fact that lending was still depressed.[20]. On the other hand, the banking sector underwent considerable restructurization. An independent Financial Supervision Authority was established in October 1993. Banks were required to recapitalize. The total sector shrank considerably, especially after 1993 and by 1996 the total number of employees in the industry went down to 30,000 relative to 55,000 in late 1980s.[21]

The run-up to the crisis was characterized by a high growth rate. The GDP was pulled up by positive shocks to asset prices, followed by increasing domestic demand. Hence, the decomposition picks up the bubble on stock and housing markets that followed the financial liberalization in mid 1980s. It also points to strong domestic demand. However, it does not leave much room for loan supply shocks. Why? Looser credit is identified by rising, after some time lag, loan losses. Although we impose the zero restriction on the reaction on impact, it is likely the case that empirically losses start picking up with a lag longer than one quarter after a shock. In Finland, credit was becoming tighter already in 1989 which was quickly reflected in higher interest rate spreads. However, loan losses were still small and they didn't really shoot up until 4Q 1990. Hence, the decomposition might be overemphasizing the role of asset price shocks relative to loan supply shocks in the boom phase because high asset prices kept collateral values high and, in consequence, loan losses at bay.

Figure 3 zooms in on the depression episode. It makes a preliminary comparison of the roles of external factors (including Soviet trade collapse) and of domestic financial shocks. The sum of the external demand shock and the domestic supply shock is a proxy for the Soviet trade impact, or, more precisely, an upper bound for this proxy. Domestic financial shocks are asset price shocks and loan supply shocks. We see a large role played by external factors, domestic financial shocks play, however, a considerable role as well.

To gain further insight into the role of financial factors during the Finnish Great Depression, we construct two counterfactual scenarios. In particular, we ask to what extent was the domestic sector the actual source of shocks and to what extent was it just working as an amplifying mechanism of other shocks buffeting the

[20] In fact, new lending didn't pick up until 1998.

[21] See Kuusterä and Tarkka (2012).

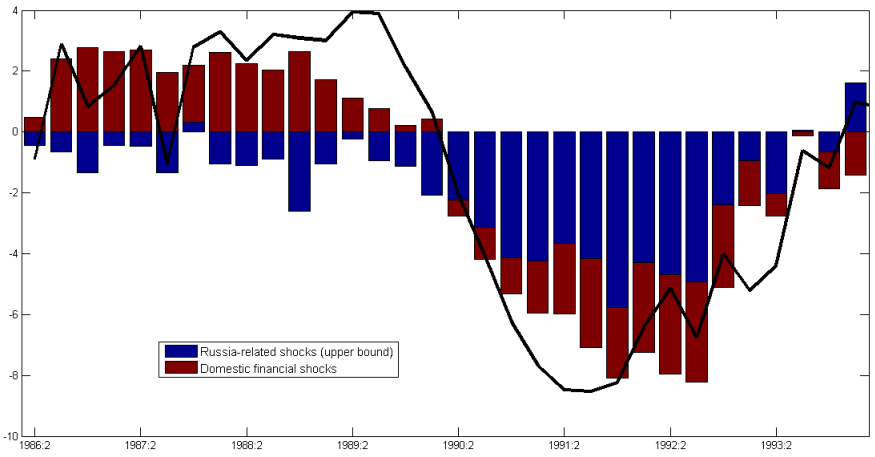


Figure 3: USSR-related versus financial shocks during the Finnish Great Depression.

economy. The results are summarized in Figure 4. The red line depicts Counterfactual 1, i.e. the hypothetical

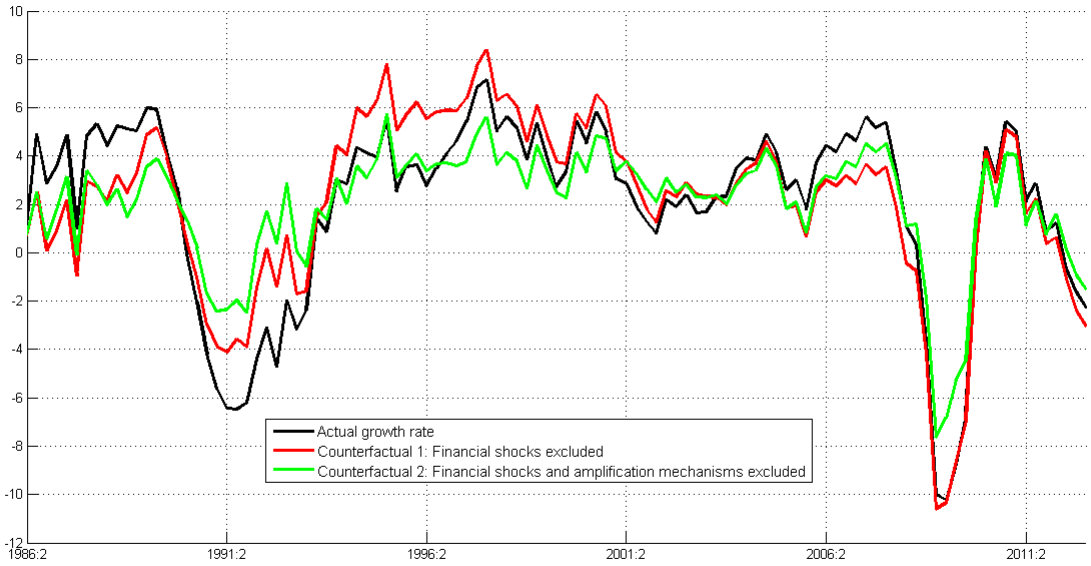


Figure 4: Contributions of different financial factors to the Finnish GDP growth rate.

GDP growth rate, if the domestic financial shocks, i.e. the asset price and loan supply shocks, were shut down.[22] As a result, the drop in GDP in the trough of the depression is smaller by one third. In 1992 and 1993 the difference is even more striking and without these shocks, the economy would have experienced only

[22]Technically this is done by imposing zeros on appropriate entries of the B matrix.

a rather mild recession. In Counterfactual 2 (green line) we additionally turn off the feedback from domestic financial variables to the real economy. Technically, we impose *ex post* zero restrictions on the feedback from domestic financial variables (i.e. asset prices, the spread, new loans and loan losses) to the rest of the economy.[23] The picture changes yet further. The recession becomes very moderate between in 1992 and 1993. We interpret this result as a strong evidence that financial factors indeed played an important role in deepening the Finnish Great Depression. A large role played by domestic financial factors is also clear during the run-up to the crisis, i.e. in late 1980s. Positive financial shocks add around two percentage points to the GDP growth rate in 1987 and 1988. Amplification effects make this impact even more pronounced.

It is also worth noting some differences between the Finnish Great Depression and other episodes over the last quarter century. During the Great Recession, the financial sector acted mainly as an amplifier of negative shocks (green line). However, the shocks that drove the economy were almost exclusively of foreign origin. Comparison of red and black lines shows that the role of domestic financial shocks was essentially nil. In that sense, the latest recession was very different than the early 1990s. In sum, we find a significant feedback from financial variables to the real economy. This feedback is most clear during boom and bust episodes. However, the role of finance is not only about shocks generated within the domestic financial sector, but also as a transmitter of real economic shocks.

5 Robustness

In this section we explore plausible changes in model specification and ask to what extent are our main results robust. One could possibly argue that the external demand variable used in the benchmark is not fully exogenous because it is not constructed by identifying demand and supply curves on the market for Finnish exports. Therefore, one could use another proxy for external demand which would more plausibly satisfy the exogeneity assumption. To this end, we replace the external demand series with the dynamics of global trade volume. A potential drawback of this series is that it may not fully reflect the specific features of Finnish exports.

The other change is to introduce the Finnish terms of trade, defined as price of exports over price of imports, to the international block. This allows us to better reflect the nature of Finnish-Soviet trade and its collapse. The trade was based on clearing agreements. Finland's exports consisted mainly of manufacturing goods, for example metallurgic products, ships and paper. Imports was dominated by crude oil, priced at world market prices. These features made the volume of Finnish trade with USSR closely linked to world oil prices.[24] The mutual exchange peaked during and after the Second Oil Crisis when oil prices shot up. By mid-1980s, they went significantly down, which explains the diminishing role of USSR in Finnish exports

[23] This is done by putting zeros in the appropriate entries of the A matrix.

[24] For the same reason it also provided a buffer for Finland during the two oil crises relative to other western economies.

from 25 percent to 15 percent already in the latter half of 1980s. Nevertheless, exports to USSR was sold for a hefty markup relative to world prices. As argued by Gorodnichenko et al. (2012), this constituted an implicit energy subsidy for Finland. The collapse of Soviet trade translated *de facto* in an increase of energy prices above of more than 10 percent and should therefore be regarded as a negative terms of trade shock. Because the volume of the Soviet trade and Finnish terms of trade were closely linked to the price of oil, it can be plausibly assumed that ToT was exogenous from the point of view of Finland. This is the assumption we make for the purpose of this exercise. This argument has, however, its limitations to the extent that Finland might have not been a price taker on all markets on which it traded its goods, despite being a small open economy.

Introduction of world trade and terms of trade variables also requires a re-specification of the exogeneity restrictions in the international block. We impose no zero restrictions on the transition matrix. In other words, world trade, terms of trade and international stress are allowed to affect each other. Shocks to these variables are still identified through Cholesky triangularity. World trade is ordered first, followed by terms of trade. Stress is ordered third. This reflects the idea that global financial variables can react to real global shocks on impact, whereas global real variables will react to financial shocks with a one-period lag.

The results of the historical decomposition are reported in Figure 5. The picture remains qualitatively unchanged. We still find a significant contribution of negative domestic financial shocks between 1990-1993. Starting in 1991, the economy experiences negative terms of trade shocks, which can be linked to the collapse of Finnish-Soviet trade. We still recover large negative loan supply shocks starting in 1993. What changes qualitatively is the role of external variables in the run-up to the crisis. Relative to the benchmark case, now terms of trade contribute substantially to the boom. On the one hand, this may be associated with the falling price of oil. On the other, it may reflect the revaluation of the markka and relatively high inflation. The latter two cast some doubt on the exogeneity assumption of the terms of trade series.

Finally, Figure 6 reports the counterfactual exercise in which we turn off financial shocks and the feedback from financial to real variables. The results are very much in line with the benchmark model.

6 Conclusions

In this paper we conducted an empirical study of the Finnish business cycle, focusing on the Finnish Great Depression 1990–1993. We find a strong role of financial factors in driving the business cycle in general, and in amplifying recessions in particular. The origins of the depression in Finland were very different than of the Great Recession in late 2000s. The former was associated with a bust of the asset and lending bubbles followed by a financial and banking crisis. In consequence, the decline was prolonged and turned into a depression, with negative GDP growth rate lasting for 13 consecutive quarters. In a counterfactual exercise in which the feedback from financial to real variables is shut down, the drop in GDP is less than half of what

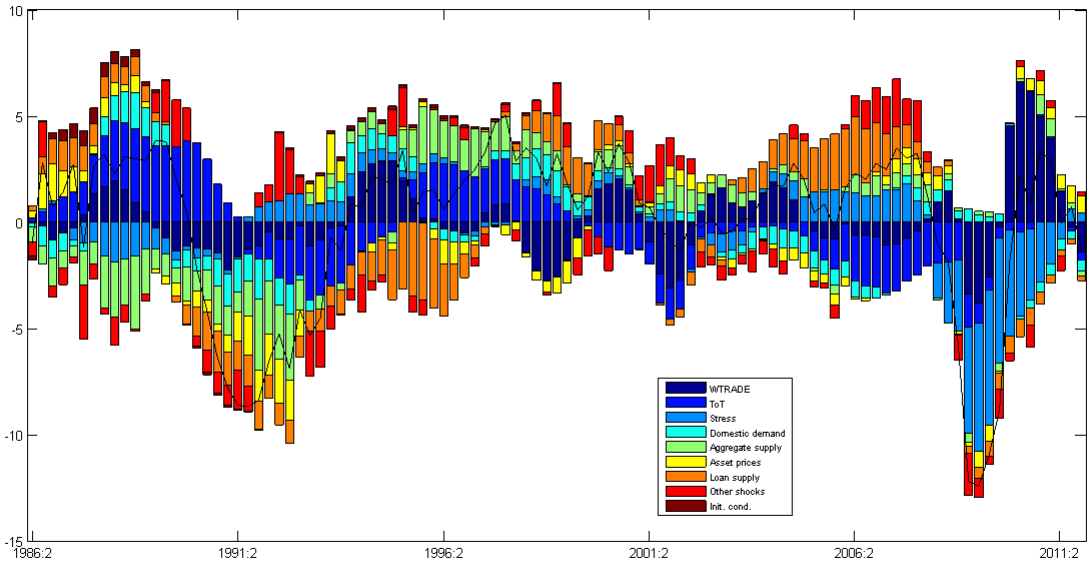


Figure 5: Contributions of different financial factors to the Finnish GDP growth rate. Robustness.

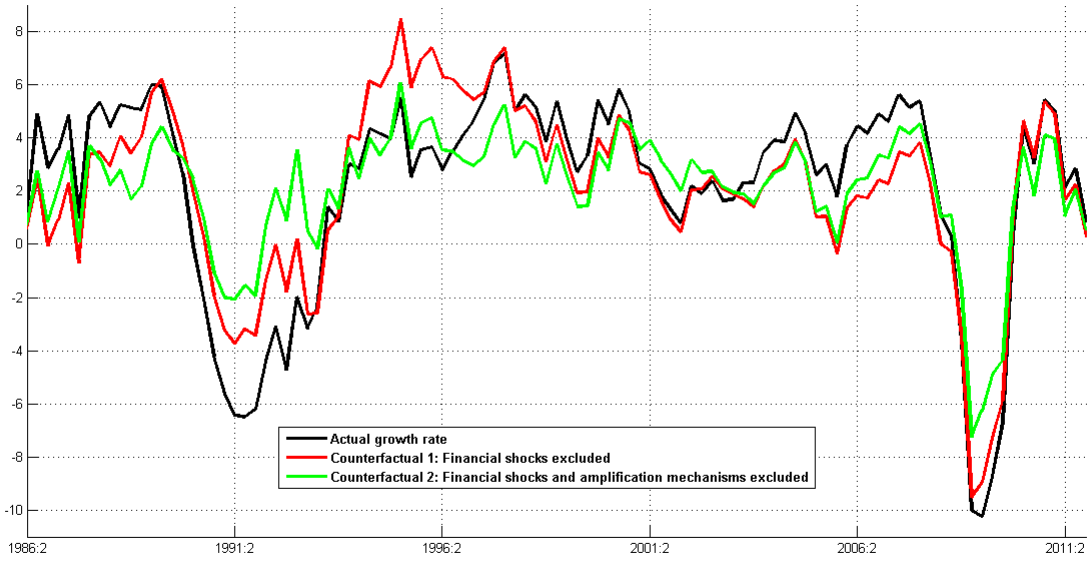


Figure 6: Counterfactual GDP with the robustness specification.

was actually observed in early 1990s. The crisis of 2008–2009 was, on the other hand, very different. We find no evidence for domestically generated financial shocks that contributed to the contraction at that time. It was in fact an imported recession. Nevertheless, the feedback from the financial sector to the real economy

amplified the recession substantially, although to a lesser extent than in early 1990s.

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