Kiss Me Deadly:

From Finnish Great Depression to Great Recession*

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Abstract

We investigate the causes of the Finnish Great Depression, 1990-1993. We assess the relative importance of foreign, real and financial shocks. To this end, we estimate a structural VAR model, in which the shocks are identified through the sign restrictions methodology and exogeneity restrictions. In the early 1990s domestic financial factors contributed substantially to the boom-bust cycle. The "usual suspect", i.e. the Soviet trade collapse, although meaningful, can account for approximately half of the slump. We also have a broader look at the Finnish business cycle over the last quarter century. In contrast to the depression, external shocks were the dominating drivers of the cycle during the Great Recession, making it an imported one.

Keywords: business cycles; great depressions; financial shocks; sign restrictions; Finland

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. The cumulative drop of real GDP from its peak in 4Q 1989 to trough in 1Q 1993 was 12.6 percent in absolute terms, and the pre-crisis level of income was achieved again only in 4Q 1996. Recession lasted for four years. It 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 generated a number of different explanations offered to account 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. According to them, the collapse was further 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. 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. The restructuring of the financial sector was also a heavy drag during the recovery phase. 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 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. 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.

The Great Recession in Finland was very different than the early 1990s recession. 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, creditless 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 and the ERM crisis. 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 burgeoning empirical research body on financial market imperfections and the role of financial shocks in driving business cycle fluctuations.[2] In constructing our shock identification scheme we are guided by the theoretical literature which stresses the disruptions between lenders, intermediaries and borrowers.[3] This, combined with a proper selection of variables, allows us to distinguish between two types of financial shocks. The loan supply shock is akin to a shock in monitoring costs considered e.g. by De Fiore et al. (2011) and it may reflect exogenous changes in lending standards and regulatory envoronment. Our

[1] See Jordà et al. (2013). These authors do not include Finland in their sample of countries.

[2] See e.g. Jermann and Quadrini (2012) and Gilchrist et al. (2009).

[3] 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).

work is in this dimension complementary to recent empirical studies by Bassett et al. (2010) and Helbling et al. (2011) who analyze similar shocks in the supply of credit. An asset price shock in turn includes bubbles, exogenous changes in borrowers' wealth as well as a risk shock á la Christiano et al. (2014). Hence, we are able to shed some light on the relative roles and interactions between borrowers and lenders and to say more about which financial frictions actually matter.[4]

This paper is divided into five sections including this introduction. In Section 3 we introduce the model and discuss the identification of structural shocks. We then present the sign restriction methodology and model selection issues. In Section 4 we explain in detail the data used in estimation. The estimation results are then presented in Section 5. 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. Concluding remarks are given in Section 6.

2 Finland before and during the depression

2.1 Financial liberalization and its aftermath

Back in the 1970s the financial and banking systems were still tightly regulated.[5] Capital market was relatively small and the money market virtually non-existent. Banks were at the center of credit creation in the economy. Loan expansion was tied to the inflow of deposits. Banks were not allowed to borrow from abroad. Both deposit and lending rates were very low in real terms. First, they were regulated at low levels relative to inflation rates. Secondly, bank borrowing was subject to tax deductions. The overall result was shortage on the credit market and rationing. Lack of price competition generated a costly and inefficient banking sector structure with low profitability. Finally, savings and cooperative banks were not allowed to raise capital through equity.

A flip side of highly regulated banking sector was its very high effective leverage. According to the 1970 banking law reform, the capital adequacy requirement were set to two percent of equity for savings and cooperative banks and four percent for commercial banks, with a transition period of as much as ten years. Yet, banks had chronic problems to adhere to even these very lenient levels. In 1978 the period was extended by another five years and the requirements were further watered down by changing legal definitions.

Since early 1980s the existing system was gradually transformed. The key regulations came in effect between 1985 and 1987. The link between deposits and lending was broken and rules regarding the lending

[4]Using bank survey data, Ciccarelli et al. (2010) also distinguishes between shocks in credit demand and supply, although their definitions are not guided by a theoretical framework and the specifications of shocks do not overlap with ours.

[5]Detailed accounts of the liberalization and economic events in the 1980s and 1990s can be found in Vihriälä (1997), Kuusterä and Tarkka (2012) and Jonung et al. (2009), from which this subsection draws.

rates were abolished. A genuine liquid money market was created in which certificates of deposits issued by the banks were used by the central bank as instrument of open market operations. became the key asset accepted by the central bank as instrument of open market operations. Foreign banks obtained access to the market as well. All this enabled banks to raise funding on interbank market and allowed for a much more vigorous credit creation. Firms and households were both allowed to borrow abroad, but domestic banks remained the main supplier of credit in the economy. At the same time, however, the system still relied on outdated safety regulation. Savings and cooperative banks were organized in groups around a common commercial bank. The system provided de facto guarantees for individual member banks where idiosyncratic risk was shared by bank-group specific mutual insurance funds. However, it was not designed for dealing with systemic risk.

Soon, the financial reform resulted in an explosion of credit. The ground was fertile all the more so given that interest payments on loans were tax-deductible. Figure 1 shows credit expansion dynamics, measured by the value of new loans (in millions of €$_{2000}$). New credit started to grow steadily already in the years 1985-1986. Then it shot up, and remained at elevated levels between 1987 and 1989. It subsided again in 1990-1991 to pre-boom levels before reaching a prolonged trough between 1992 and 1998.

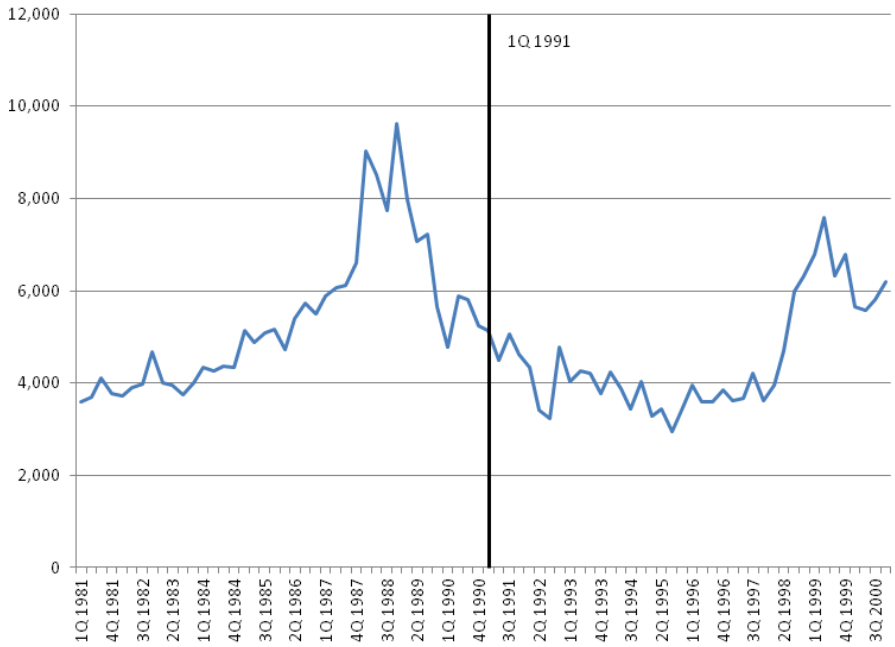


Figure 1: New bank loans issued, 1981-2000.

Notes: New bank loans to the private sector, deflated by the GDP deflator, millions of €$_{2000}$. The black vertical line indicates the quarter of the Soviet trade collapse. Source: Bank of Finland.

Easy access to bank lending was quickly reflected in house and stock prices, as banks started to actively invest in the non-financial corporate sector and to expand mortgage lending. This in turn triggered an asset

price boom, which, through rising collateral values, allowed for further credit expansion. This is shown in Figure 2. With relatively inelastic housing supply, house prices exploded between 1987 and 1988, although the boom was rather short-lived. Stock prices, in turn, were growing sharply since the beginning of 1986.

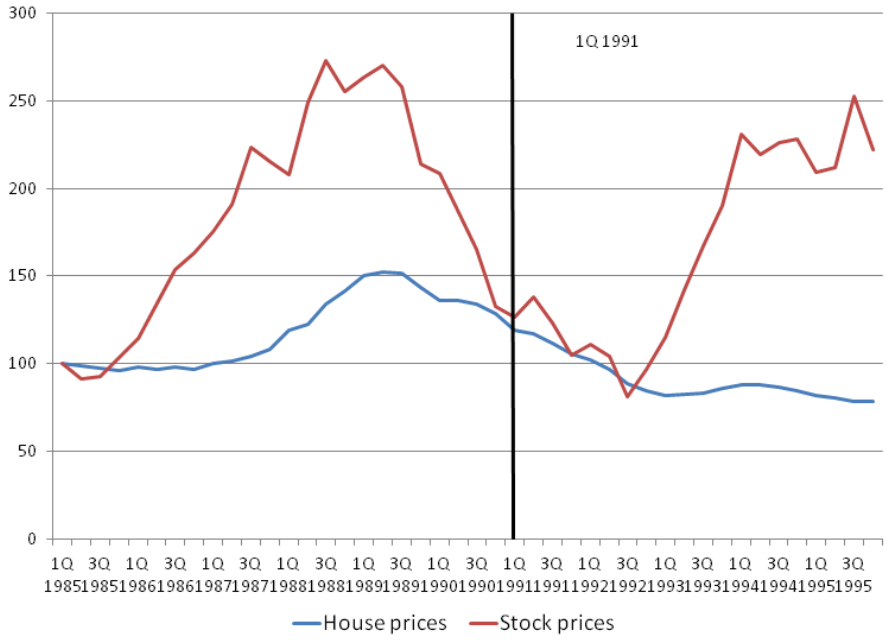


Figure 2: Stock and house prices, 1985-1994.

Notes: All series are real indices, 1Q 1985 = 100. Stock prices is the capped OMXH stock market index. House prices is an index of old dwellings in the whole country. The black vertical line indicates the quarter of the Soviet trade collapse. Sources: Bank of Finland.

A good example of the excesses of the "casino economy" in late 1980s' Finland was the activity of SKOP, the umbrella institution of the savings banks group. The bank borrowed heavily short-term and conducted aggressive lending and investment policies. In early 1987 when easy credit policy started, it took over Tampella, one of the largest Finnish manufacturers at that time. By late 1990, i.e. months before the USSR trade collapse, Tampella was already on brink of bankruptcy and it ultimately took SKOP down as well.

By late 1988 the credit boom became apparent and rised concerns of policy makers. A tax reform, due 1Q 1989, included broader and higher taxes for capital gains, in anticipation of which credit and price dynamics peaked in 4Q 1988. Other indirect taxes were also rised early next year. However, given a healthy surplus of the government in 1989, the support for spending cuts was very limited. Such policy would also have likely been ineffective as fiscal profligacy was not the driver of the preceding boom.

Monetary policy in turn was caught in the impossible trinity. The asset boom was fuelling demand and inflation. Yet, the central bank had to also maintain a fixed rate of the Markka to which it was strongly committed, following the "strong Markka" doctrine. With liberalized financial account and already strong capital inflows, bold interest rate hikes were precluded. Although base rates were increased in spring 1988,

the move was partly reversed at the turn of 1989. However, higher domestic rates could not affect the cost of borrowing in foreign currencies, which were the more attractive the wider the differential grew. The interest rates rose sharply only in late 1989 and early 1990 when the exchange rate peg was put under pressure. The interest rates skyrocketed again in late 1991 before the devaluation and in late 1992 before the peg was finally abandoned altogether. The fall of Markka further squeezed currency borrowers. Neither had the central bank the prerogative to impose reserve requirements and instead it had to rely on discrete agreements with the banking sector. Such new deal, including targeted limits for credit expansion, was eventually implemented in March 1989, but largely ignored by the savings banks group and SKOP.

The dynamics of new credit subsided, as policy actions took some effect, but the stock of loans still grew at double digit rates. In paralell, the economic climate started to turn. Over the course of 1989, the country witnessed a bankruptcy of the major shipbuilding company Wärtsilä Marine and two independent suicides of the CEOs of Nokia and SKOP. The stock market peaked in 2Q 1989 and by the end of 1990 lost almost 50% of its peak value. Falling stock prices affected in the first place the most leveraged financial institutions, predominantly the savings banks group and SKOP. In September 1991, SKOP had to be seized by the Bank of Finland. Next year, the government had to earmark funds for capital injections and established a new institution, the Government Guarantee Fund, with the task of stabilizing the banking sector. Dozens of savings banks were merged into a Savings Bank of Finland (SBF). Untimately, the assets of SBF and SKOP were split, with the healthy bits being sold and toxic ones recycled via special purpose vehicle Arsenal. In 1993 the banking crisis was still in full swing. The GGF budget was increased and the government guarantees were extended to all bank liabilities, not just deposits. As the crisis started to subside, a major restructuring of the industry unfolded and cost-efficiency measures were undertaken. The largest commercial bank KOP, after being rescued as well, was merged with its main competitor SYP in 1995. The whole sector shrank with the number of branches and employees both contracting by half relative to the boom years. The Bank Inspectorate was also shut down and replaced by the new, government-independent Financial Supervision.

Financial liberalization in Finland was not accompanied by parallel introduction of modern safety measures in the financial sector. Throughout the 1980s the country didn't manage to implement regulation which would require banks to keep more equity. To be sure, new rules were debated and in 1986 an interinstitutional working group made some proposals.[6] However, in 1987 the Basel Committee on Banking Supervision issued its own, much tougher recommendations, which made the parliamentary work largely obsolete. In effect, no law was passed until the financial crisis was in full swing. In consequence, the banking sector entered the credit boom era highly leveraged and vulnerable to negative shocks which started to realize in 1989 and 1990.

In parallel to Finland, Sweden experienced a boom-bust cycle which shared many features with the Finnish one, including financial liberalization, asset price and credit booms, a subsequent banking crisis and a prolonged, albeit much shallower recession. Despite many similarities, some characteristics distinguished

[6]The proposals were still quite liberal, suggesting a four percent capital adequacy ratio based on risk-weighted assets across the whole banking system.

Finland from Sweden throughout the 1970s and 1980s. One important example were bank equity buffers. Book-value of equity-to-asset ratios were around 2-2.5% in the former compared to 3.5-4.5% in the latter. As pointed by Kuusterä and Tarkka (2012), another important difference was that whereas in Finland the capital adequacy ratios were defined relative to liabilities, in Sweden they were measured relative to the asset side. This allowed to introduce risk-weighting. As a result, Sweden's capital requirement regulation before the credit boom incorporated many elements of future Basel I regulation (Englund and Vihriälä, 2009). Finally, Swedish banks had, relative to Finland, large, loan loss reserves, possibly because of their tax-deductability (Drees and Pazarbaşıoğlu, 1998). Finland ultimately implemented the Basel-based higher adequacy ratios as well, which came into force in 1991, when the banking system was already in trouble. As the implementation was already overdue at that point, however, the new policy ended up being strongly procyclical, aggravating the credit contraction during the sharp downturn.

2.2 Trade with USSR

The main characteristic that distinguished Finland from other Western European market economies during the Cold War period was its large volume of trade with the USSR.[7] The trade was based on a clearing principle, although the arrangement allowed for short-term imbalances within a bound. Finnish exports to the Soviet Union was rather diversified. It consisted mainly of manufactured goods, including paper, metallurgical products, ships and clothing. Imports was, on the other hand, dominated by crude oil and other energy products, priced at world market prices.[8] These features, combined with a small elasticity of demand for energy made the volume of exchange largely dependent on fluctuations in global oil prices. In consequence, the exchange peaked following the Second Oil Shock and in 1981 sales to the USSR reached 25 percent of Finnish exports. In mid-1980s, as the oil prices subsided, the share started to drop and on the eve of the Finnish Great Depression (in 1989), the Soviet Union was a recepient of around 15 percent of total Finnish exports. Then, between 1991 and 1992 the share collapsed to below 3 percent.

Figure 3 plots the dynamics of Finnish exports of goods and GDP between 1Q 1985 and 4Q 1995. In December 1990 the Soviets gave Finland a notice of termination of the clearing agreement which resulted in collapsing bilateral trade in 1991, as marked by the red and black lines. However, real GDP started to fall earlier, i.e. already in 1990. Total exports was already shrinking in tandem with the GDP, partly due to the recently revalued Markka and worsening international economic conditions. However, by late 1991 the contraction of exports was over and total sales abroad bounced back in the following quarters, restoring the real pre-crisis level already in 1992, despite the vanished eastern market. This was at least partly due to the devaluation in November 1991 and the abandonment of the peg in September of the next year.

Two other important remarks are in order. The first comes from comparing the red with the blue line of Figure 3. Soviet trade constituted less than 2.5 percent of Finnish GDP in 1989-1990, much less than the

[7] For details of Finnish-Soviet trade see Sutela (n.d.)

[8] For this reason Soviet trade provided a buffer for Finland during the two oil crises relative to other western economies.

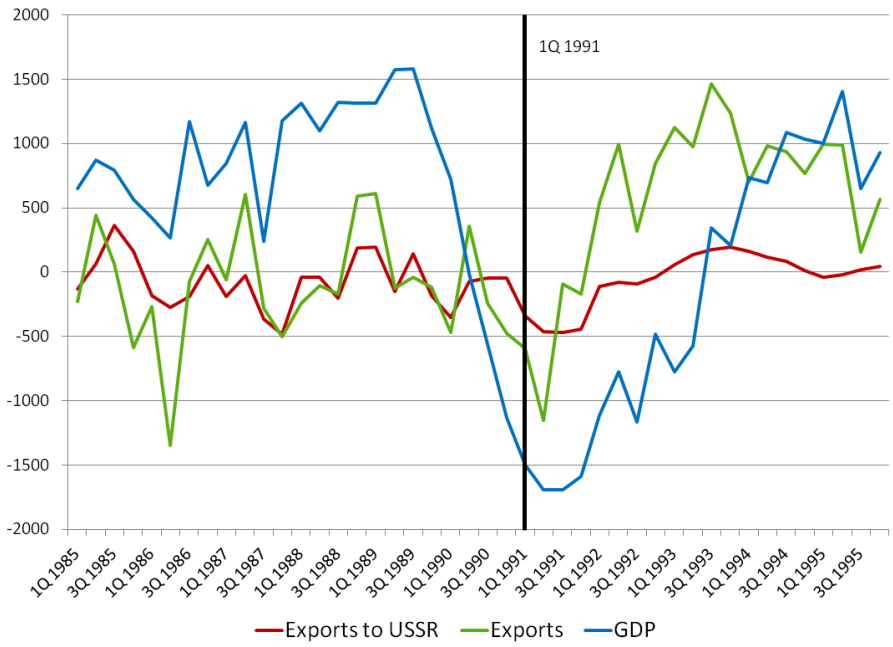


Figure 3: Dynamics of Finnish exports and GDP, 1985-1995.

Notes: All series are in million of 2000 Euros. Exports to USSR is exports of goods (not services). Exports is total Finnish exports of goods (including USSR). Dynamics is measured as year-over-year difference. Sources: Bank of Finland.

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 Soviet trade shrank by 442 mln €$_{2000}$ (28 percent of that number). The second noticeable fact is that back in 1985-1986 Finland recorded a similar, although a bit smaller decline, both in total exports and in sales to the USSR. At that time, lower exports eastwards was due to falling world oil prices which meant that the Soviets had lower revenue to pay for their imports and balance the exchange. What is striking though is that the corresponding GDP dynamics was very different. In 1991 Finland was sliding into a depression, whereas in 1986 it reported only a moderate slowdown in growth.

USSR was a peculiar trading partner for Finland not only because the trade was, as mentioned previously, largely cleared (at least until mid 1980s) and because it was effectively a goods-for-oil scheme. According to Kajaste (1992), this part of exports 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 and made Finnish terms of trade exceptionally favorable. The collapse of Soviet trade translated *de facto* in an increase of energy prices above of more than 10 percent and could therefore be regarded as a negative terms of trade shock. In Figure 4 we plot the Finnish terms of trade alongside the corresponding series for Sweden. Both countries

experienced an increase of their terms of trade starting in 1986 and enjoyed this situation until early 1990s. In the Finnish case the increase and subsequent drop was more pronounced. The relative price of exports also dropped abruptly in 1991 with the end of Soviet trade. Nevertheless, the drop was not a shift from some constant previous level, but rather a correction of a four-year boom. This correction was also at least partly due to the global rise of crude oil prices in the second half of 1990, which was triggered by the Gulf War. More generally, the fluctuations reflect to some extent changes in the prices of oil, of which both countries were importers. The first oil crisis of 1974 can be traced out in the Swedish case, but not in the Finnish. Yet, the second crisis of 1979-1980 is strongly reflected in the Finnish series. In fact, the drop of terms of trade at the time was at least as strong as a decade later. However, we do not observe any particular change around 1985, as we did in the dynamics of exports. This suggests that terms of trade might have played an autonomous role as a transmitter of the Soviet collapse shock, in line with the narrative of the "From Russia with Love" story by Gorodnichenko et al. (2012). Finally, Finland might have been more sensitive to energy price movements than Sweden because it has been a less energy-efficient economy.[9]

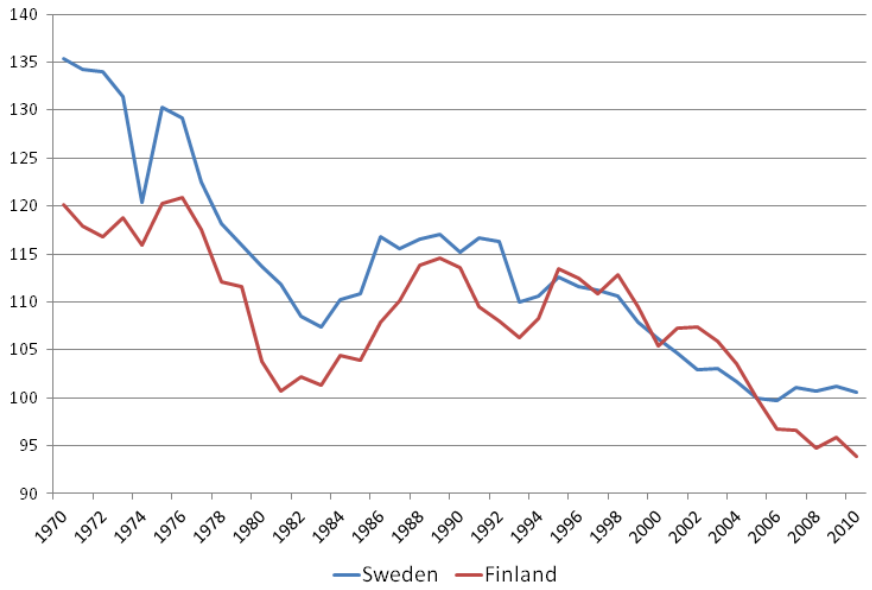


Figure 4: Terms of trade in Finland and Sweden, 1970-2010.

Notes: Terms of trade is defined as price of exports over price of imports. Index, 2005=100. Source: Bank of Finland.

[9]Energy efficiency is defined as PPP output per kilograme of oil equivalent. In fact, Finland has been also less energy-efficient than e.g. the United States.

3 Model Basics and Identification

3.1 The model and the shocks

Our empirical strategy involves estimating a partially identified VAR model of a small open economy. The 9 variables that we choose can be put into three main groups: one foreign and two domestic. The foreign bloc consists of three variables, i.e. world trade volume, Finnish terms of trade and a measure of global financial stress. 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 threefold. 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. Thirdly, as will be discussed in detail below, the behavior of the spread will allow us to distinguish between real aggregate demand and asset price shocks. The group of financial variables consists of asset prices, new bank loans to the private sector and bank loan losses. The details on the series used are provided in Section 4.

The trivariate foreign block is assumed to be fully exogenous to the domestic part. This is done by imposing ex ante zero restrictions on the relevant coefficients of the transition matrix. As discussed in Subsection 2.2, the volume of Soviet trade was closely linked to the price of oil. More generally, Finland has been a small open economy characterized by a diversified exports structure and energy goods constituting a considerable share of imports. Therefore it can be plausibly assumed that Finnish terms of trade were largely exogenous from its point of view. We use Cholesky decomposition in this part of the covariance matrix. World trade is ordered first, terms of trade second, and stress is third. It is conventional to order financial variables after real variables, given that the former tend to be fast-moving and that prices may move faster than quantities. Nevertheless, we don't attempt to identify two separate real structural shocks from world trade and terms of trade series. Ultimately we are interested in the joint effect of real external demand fluctuations on Finnish GDP. As argued by Gorodnichenko et al. (2012) the Soviet trade shock worked through two separate channels: an absolute drop in exports and a collapse in terms of trade. The two variables in the VAR are intended to jointly capture the collapse of exports. However, to the extent that Finnish terms of trade don't react on impact to global financial stress, we are able to identify a separate external financial shock (as opposed to the real external shocks).

Our set of 6 domestic variables allow us to identify four domestic shocks: aggregate demand shock, aggregate supply shock, asset price shock and loan supply shock. For that purpose, we use the sign methodology. 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 $S = 3$ periods after the shock (i.e. four periods altogether). 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.[10] 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

[10] 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.

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.[11] 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.[12] We think it is plausible that loan losses will fall in the short run, given better conditions of the firms.

Asset price shock: The asset price shock is intended to reflect asset price movements and demand for credit which are not due to changes in current fundamentals. In one interpretation, it may reflect market exuberance or bubbles, as in Bernanke and Gertler (1999). 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. The positive shock automatically translates into higher collateral values. As balance sheets of firms and households improve, loan losses and lending rates go down, which reduces interest rate spreads. Lower spreads should in turn increase the amount of new loans. A positive asset price shock will therefore generate responses largely similar to a demand shock. What allows us to distinguish the two is the impact on spreads. 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.

More generally, the asset price shock can be thought of as one directly hitting the entrepreneurial sector in the financial accelerator mechanism proposed by Bernanke and Gertler (1989). In the spirit of that original paper, it may be an effect of wealth redistribution between lenders to borrowers, as in the debt-deflation mechanism.[13] A positive shock, because of being inflationary, reduces the real burden of nominal loan contracts for debtors. This in turn further amplifies the drop in loan losses. This interpretation is useful for our analysis also because it captures the argument of Kiander and Vartia (1996) who argued that the Fisherian effect was at the heart of the Finnish Great Depression. Our specification also encompasses the risk

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

[12] As was argued in Footnote 10 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.

[13] Other papers that analyze direct shocks to borrowers' wealth include e.g. Nolan and Thoenissen (2009) and Fuentes-Albero (2013).

shock proposed by Christiano et al. (2014), i.e. changes in the distribution of idiosyncratic entrepreneurial productivity.

Finally, it remains an open issue whether the shock may reflect information about future productivity, be it true or false signals. The answer depends on whether such news are inflationary or rather deflationary, as in Christiano et al. (2010a). In their model, expected future reduction in marginal cost due to news about higher productivity in the future outweights its current increase, hence prices fall. However, the effect on inflation in initial periods is not clear and depends on the particular specification. Also, a similar shock is analyzed in Gilchrist and Leahy (2002), where it drives prices up. Therefore, to the extent that news are inflationary, they will be reflected in the asset price shocks. If they are, however, deflatory, they will be picked up by the real aggregate supply shock. The hypothesis that booms 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.

Loan supply shock: A loan supply shock stems directly from the sector of financial intermediaries. However, it is not supposed to capture shocks in banks' assets, which ultimately originate in the borrowers' sector. Rather, it captures changes in effective lending standards or regulatory environment. In a theoretical framework, such shock can be thought of as one capturing innovations in the monitoring costs describing the loan contract in a financial accelerator. Financial liberalization and looser credit can be interpreted as a drop in monitoring costs. Higher safety requirements and tougher lending standards would in turn be captured by higher monitoring cost. Examples of studies that analyze this shock include De Fiore et al. (2011) and Fuentes-Albero (2013). What makes the shock distinct from other financial shocks is its impact on default rates of borrowers and loan losses of lenders. For example, a drop in monitoring costs is clearly expansionary. As the availability of bank loans increases, lending rates go down, hence reducing the spread and stimulating credit. Loan expansion stimulates output and consumption. However, as opposed to, for example, risk or net worth shocks, at the same time it also increases default rates and loan losses. Therefore, including the latter variable in the VAR allows us to distinguish this 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. Empirically, loan losses tend to be a lagging variable. 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. In fact, this is also the dynamics in De Fiore et al. (2011). 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 domestic 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. However, looking through a New Keynesian model with a financial accelerator, its effect is inflationary.

Our understanding of the loan supply shock is also similar to that in Bassett et al. (2010), who define a credit supply shock as changes in lending standards which are orthogonal to bank-specific and macroeconomic factors. Whereas they identify the shock using loan officers' surveys, we rely on theoretical model's predictions regarding loan loss dynamics.[14] In that sense, our methodology is an alternative to study this shock.[15] A somewhat similar strategy is taken by Helbling et al. (2011) who also use sign restrictions to identify a credit market shock. They use default rates rather than loan losses and also they do not put any restrictions on the dynamics of macroeconomic variables, which makes their definition broader and harder to interpret.

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. 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.[16] 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.

[14] Ciccarelli et al. (2010) and Lown and Morgan (2006) also use surveys to identify shocks in lending standards, but in their specification the shock is not orthogonal to bank-specific factors, making it a more broadly-defined financial shock that may overlap with our asset price shock.

[15] Although these authors study macroeconomic consequences of credit supply shocks, they do not report their impact on loan losses.

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

3.2 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 $N = 9$. There are $N_x = 3$ 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 3.1. This involves setting $a_{1,4}, ..., a_{1,N} = 0$, $a_{2,4}, ..., a_{2,N} = 0$ and $a_{3,4}, ..., a_{3,N} = 0$ 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.[17] The practical task of the researcher is then to consider a multitude of rotation matrices Q matrices and to retain only these rotations which give rise to the desired impulse response patterns and discard all others.[18]

While collecting admissible models that satisfy the sign restrictions for the identified block, one has to keep track of the multiple shocks problem, initially described by Fry and Pagan (2011). Because the model is only partially identified, one has to make sure that the shocks in the unidentified block (generated by the latter columns of Q) are orthogonal to all of the identified shocks. In other words, the set of impulse responses generated by any of the non-identified shocks has to have a sign pattern that is distinct from all the identified structural shocks' impulse responses. We discard all rotations that do not pass this additional orthogonality requirement and refer to this procedure as "FP filter".

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

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

[18] 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.

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 $\theta^x_{n,j,t}$ be the normalized cummulative effect of shock j on variable n up to period t, obtained through the vector MA representation of model x. 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

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

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.[19] An advantage of this criterion selection, relative to the one based on IRFs, is that it is not sensitive to the chosen impulse 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.

4 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.

External variables: To proxy world trade volume, we use the sum of global exports and imports. The deflator is the world GDP deflator. The data comes from IFS. Finnish terms of trade are defined as price of exports divided by price of imports. Finally, 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 cumulative losses. These measures give rise to five subindices which describe five segments of the financial market: financial (bank and non–bank) intermediaries sector, money market,

[19] 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.

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.[20] The series is used in levels.

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 separately increases the number of sign restrictions (and hence the computational burden) without helping us to identify any of the shocks.[21] 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.[22] 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.[23] 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).

[20]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 1986 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.

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

[22]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.

[23]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.

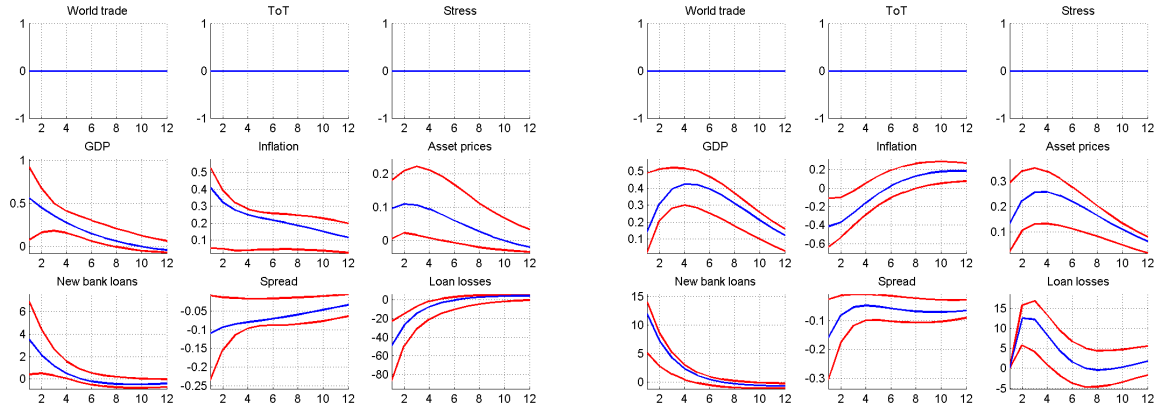
5 Results

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 5,000,000,000 draws of the Q 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 2,700 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 3.2.

5.1 Impulse responses

Figure 5(a) reports the impact of a positive asset price shock. Blue lines denote responses of the median model. Red lines denote 90% bands.[24]



(a) Asset price shock

(b) Loan supply shock

Figure 5: Impulse response functions following financial domestic shocks

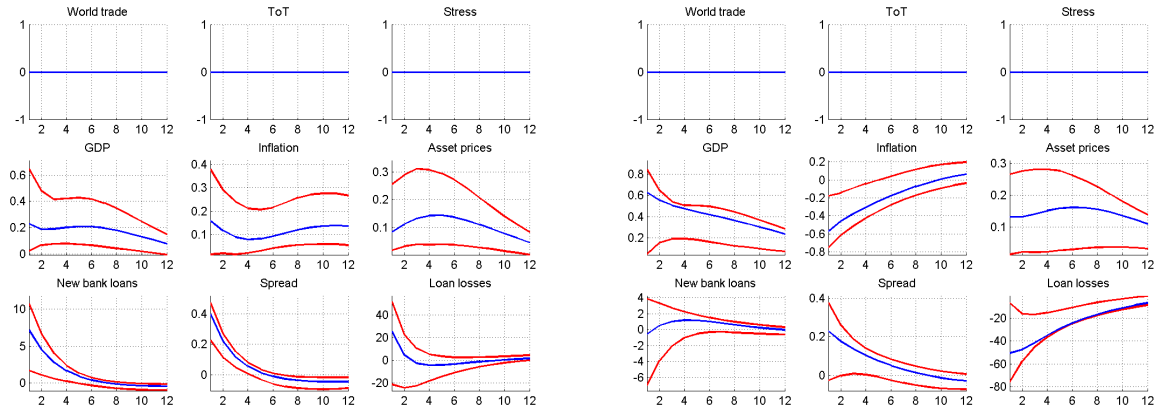
Because of the exogeneity assumption, neither stress nor external demand are affected. All domestic variables are affected on impact, as the rotation matrix Q kills the Cholesky triangularity. Given our identification scheme summarized in Table 1, there's no uncertainty regarding the direction of the reaction on impact and three periods after the shock in any of the domestic variables. Yet, the magnitude of impact,

[24]The bands were constructed pointwise (i.e. for every variable, shock and period), across all admissible structural models. As stressed by Fry and Pagan (2011) these bounds should not be treated in a probabilistic sense (i.e. they are not genuine confidence intervals). This is because each rotation comes from a uniform distribution and is equally likely. They merely illustrate the diversity of dynamics of admissible models.

persistence of the responses and the paths in latter periods are all unrestricted. The growth of the first principal component of asset prices by 0.096 percentage points translates into a growth of the stock price dynamic by 8.74 percentage points and of house price dynamics by 2.38 percentage points. Output dynamics (real GDP growth rate) increases by 0.56 percentage points on impact. Inflation goes up by 0.41 percentage points up. The quantity of new loans goes up by 3.54 percentage points, however, the effect is relatively short-lived and largely dies out after a 6 quarters. At the same time, loan losses drop on impact by €$_{2000}$ 48.97 million per quarter. The gap between lending rates and policy rates shrinks by almost 11 basis points.

Next, consider a shock to the loan supply, reported in Figure 5(b). As implied by sign restrictions, output goes up and the growth rate remains higher for at least 12 quarters. Asset prices behave in a very similar fashion. Loan losses are by construction not allowed to go up on impact. Instead, they rise in the following periods and die out within seven quarters after the shock, around the same time as the increase in new bank loans. The spread remains lower for at least three years, initially by around 15 basis points, and later by 5 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 6(a) shows the responses following a domestic aggregate demand shock. Real variables exhibit rather protracted reactions. Financial variables, on the other hand, are 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.



(a) Aggregate demand shock

(b) Aggregate supply shock

Figure 6: Impulse response functions following real domestic shocks

Following a positive productivity shock, depicted in 6(b), a growth in the GDP is accompanied by a decrease in prices. Interestingly, new bank loans actually drop somewhat on impact (although not much), 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.

Finally, in Figure 7(a) we report the reaction of the economy to the external stress shock. We do not report here impulse responses to world trade and Finnish terms of trade because, as discussed in Subsection 3.1 these shocks are only block-identified. Because this shock is identified through exogeneity restrictions and Cholesky decomposition rather than by sign restrictions, there is no variation due to different rotations of Q. As expected, domestic output goes down following an increase in foreign financial stress. So does world trade, as well as domestic asset and goods prices. Weaker balance sheets drive loan losses up. Interest rate spreads go up in total and new bank loans drop, although the initial reaction of these variables is somewhat counterintuitive.

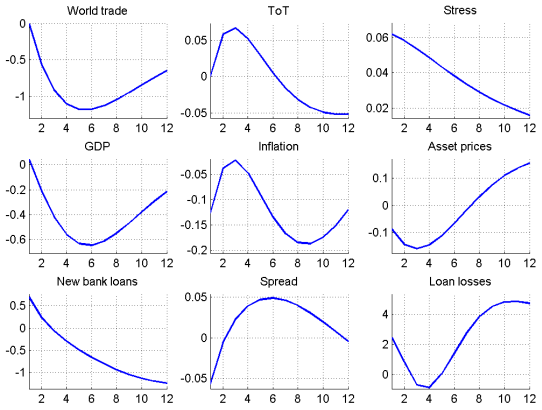


Figure 7: Impulse response functions following global stress shock

5.2 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 8. The first glimpse allows us to make several observations. First, the accumulation of dark and medium blue bars indicates an overall strong role of external shocks. This applies both to fluctuations in real variables (world trade and terms of trade), as well as in the transmission of international financial stress to Finland. In fact, the crisis of 2008 and the recession of 2001 were driven predominantly by these exogenous factors. The impact of global financial distress was negligible around 2001. However, in 2008 it was very large and it affected the economy even more than the contracting external trade. The recovery was then again driven by subsiding stress and the rebound of world trade dynamics.[25] It is worth noting that in neither of the two latest contractions did domestic financial shocks play any substantial role, although we do identify strong positive loan supply shock during the boom of mid-2000s.

[25]Between 2006 and 2010 Finnish terms of trade were largely constant, as reported in Figure 4. Therefore, it is rather safe to attribute the real external shocks to world trade fluctuations around that time.

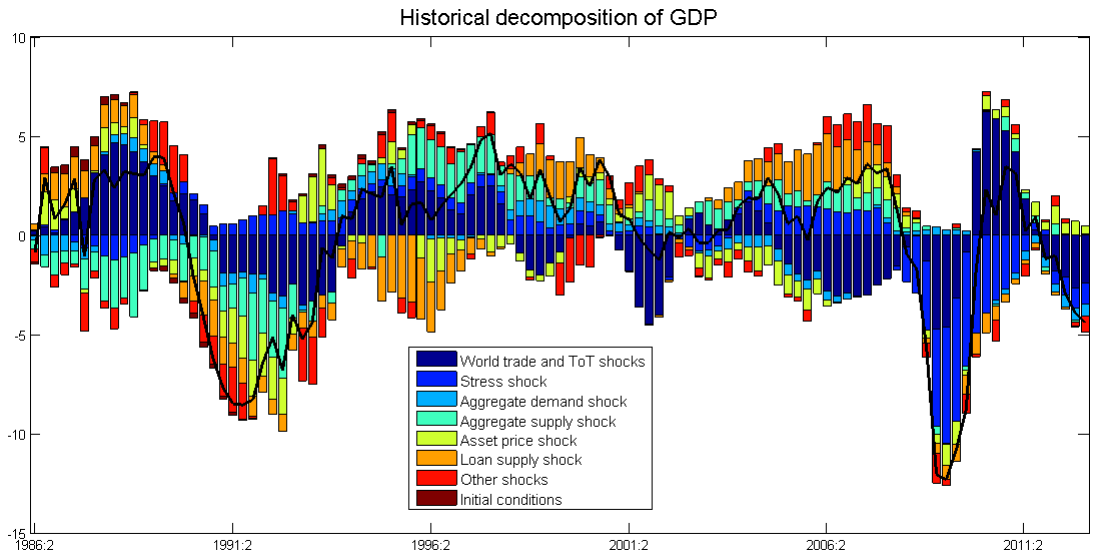


Figure 8: Historical decomposition of the Finnish GDP growth rate.

The large role played by real external shocks might be attributed to two factors. Firstly, Finland is a small open economy in the sense that its exports constitutes a relatively large share of GDP. Secondly, 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, these 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.

The reason why the decomposition does not attribute a large negative role to domestic financial shocks during these contractions may, on the one hand, 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.[26] The interest rate spread was in fact very stable and low 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 joint behavior of the two components of our asset price series, i.e. stock and house prices, was 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

[26]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 during the crisis of 2007-2008.

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 and in real terms house prices in 2001 were around the level observed at the peak of the 1980s boom. Broadly speaking, after the depression of 1990s house prices grew without major interruptions and fell only slightly in 2001 and in 2008. 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. For these two reasons the movement of our asset prices series is quite muted relative to a standard stock market index.

A final observation worth making is the economy's 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 shocks substantially contributed to the downturn. They were also dragging the economy down during the recovery phase. In result, that contraction was much more prolonged and hence resulted in a massive total drop in output. We discuss this episode in detail next.

5.3 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.

The historical decomposition presented in Figure 8 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 the USSR is in the first place attributed to innovations in external trade and terms of trade. We indeed see a large positive role of these shocks in the run-up to the crisis, and negative contributions, especially after 1991. Nevertheless, as discussed in Subsection 2.2, the terms of trade boom of the late 1980s was largely a temporary effect driven by low world oil prices. This boom was wiped out in early 1990s, partly because of the global energy prices increased and partly because Finland lost the implicit energy subsidy from the USSR.

Secondly, considerable parts of the sectors exporting eastwards became obsolete after 1991. The largest firms (e.g. in the shipbuilding industry) were partly able to switch their production profiles. However, most small and medium-size production plants had to shut down which in turn generated structural unemployment. Hence, the collapse of trade eastwards can also be thought of as capital obsolescence or depreciation and interpreted by the model as a negative shock to domestic capital stock. Therefore, the end of Soviet trade may in principle appear in the historical decomposition both in the foreign real block and as a negative domestic supply shock. In principle one could distinguish between these external demand and domestic supply effects by looking at price series. However, these goods, frequently of low quality, didn't find other markets to be sold to and hence largely stopped being produced.

Finally, one could also argue that the Soviet shock is partly reflected in the global financial stress series. The link is nevertheless only implicit and the interpretation rather far-fetched. The causality chain would start with a crumbling Soviet block giving a green light to German unification. Government spending surge to the former GDR increased inflationary pressure in Germany and resulted in interest rate spikes by the Bundesbank. This in turn put under pressure the exchange rate pegs throughout Europe (including Finland, Sweden and the UK), culminating in September 1992.[27] Interestingly, however, the decomposition doesn't associate the depression with the financial turbulence in Western Europe, although the ERM crisis is clearly picked up by the CISS series. In fact, financial stress shocks have mildly positive contribution throughout early 1990s. This might be due to Cholesky being an unsatisfactory identification approach. It is very important to note, however, that, if anything, a failure to properly identify the financial stress shock overestimates the contribution of real external shocks. This is because of the exogenous nature of the external block of the VAR. Regardless of the decomposition of the covariance matrix B, the sum of all structural shocks in the foreign block in a given period will always be the same. Therefore, if our identification of the stress shock wrongly attributes a positive role to Finnish GDP dynamics in early 1990s, then it also overestimates the negative contribution of the other shocks in the foreign block.

The more one is willing to treat the recession and crisis in Western Europe as an event independent from the collapse of the USSR, the more the shocks in the external block will reflect factors unrelated to the end of Soviet trade. For example, innovations in world trade will not only capture the drop of imports by USSR, but also that from Sweden, UK and other countries. Given all the above considerations, the cummulative contribution of the two real external shocks and the domestic supply shock constitutes an upper bound for the Soviet trade collapse shock. Hence, if anything, such proxy generates a bias against alternative hypotheses on the causes of the depression.

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 also contribute negatively, especially during 1990. They

[27] In any case, these events unfolded when the Finnish crisis was already in full swing and can therefore potentially explain only a fraction of its depth.

also played a dominant role around 1994-1995 and were dragging down the economy in the recovery phase. This reflects two empirical effects. The first is the lagging nature of loan losses and the fact that lending was still depressed long after the recession officially ended. In fact, new lending didn't pick up until 1998, which makes the episode a good example of creditless recoveries.[28] 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.[29]

The run-up to the crisis was characterized by a high growth rate. On the domestic side, the GDP was pulled up by positive shocks to loan supply. Hence, the decomposition picks up the credit expansion that followed the financial liberalization in mid 1980s. However, it does not leave much room for asset price shocks. This suggests that the increase in asset prices was largely an endogenous process, ultimately triggered by higher availability of credit.

Figure 9 zooms in on the depression episode. It makes a comparison of the roles of external factors (including Soviet trade collapse) and of domestic financial shocks. The sum of the shocks to world trade, terms of trade and domestic aggregate supply supply 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. They play a dominating role during the run-up to the crisis and are the major hindrance for the recovery.

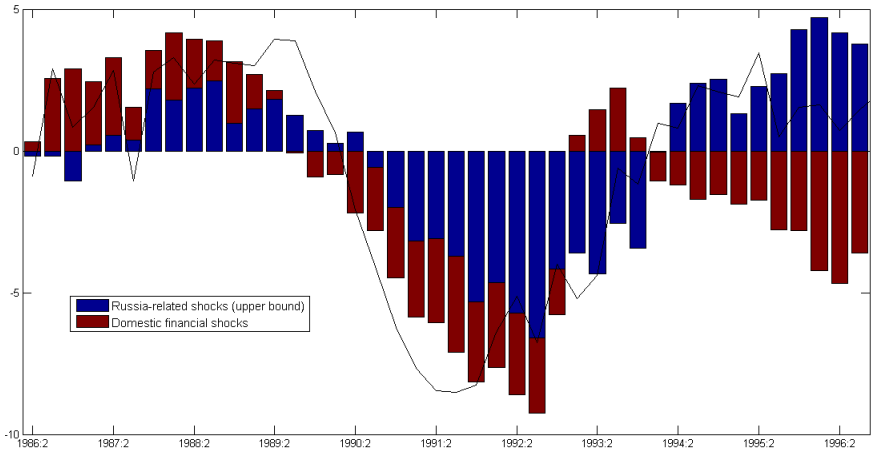


Figure 9: USSR-related versus financial shocks during the Finnish Great Depression.

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

[28] See Claessens et al. (2009) and Calvo et al. (2006).

[29] See Kuusterä and Tarkka (2012).

of shocks and to what extent was it just working as an amplifying mechanism of other shocks buffeting the economy. The results are summarized in Figure 10. The red line depicts Counterfactual 1, i.e. the

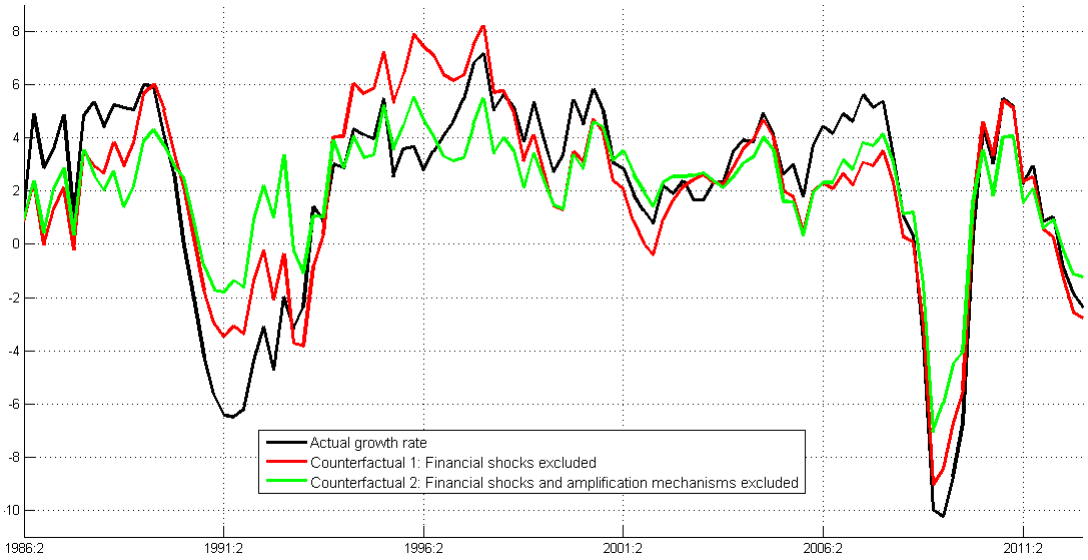


Figure 10: Contributions of different financial factors to the Finnish GDP growth rate.

hypothetical GDP growth rate, if the domestic financial shocks, i.e. the asset price and loan supply shocks, were shut down.[30] As a result, the negative GDP growth rate in the trough of the depression (in 3Q 1991) is almost halved. In 1992 and 1993 the difference is equally striking and without these shocks, the economy would have experienced only a rather mild recession. In Counterfactual 2 (green line) we additionally turn off the channels from domestic financial variables (i.e. asset prices, the spread, new loans and loan losses) to the rest of the economy (all variables in the domestic block). Technically, we impose *ex post* zero restrictions on the appropriate entries of the A matrix. The picture changes yet further. The recession turns into a moderate recovery between in 1992 and 1993. We interpret this result as another 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 two to three 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 negligible. 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

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

within the domestic financial sector, but also as a transmitter of real economic shocks.

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 lending and asset price bubbles followed by a financial and banking crisis with exploding bankruptcy and loan loss rates. 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 about half of what 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. The very different nature of the two episodes is largely explained by the initial state of the financial sector. In 2008 banks were on average less leveraged than in late 1980s and the credit expansion was made within the regulatory framework in place at the time. In contrast, Finnish banks entered the lending boom of late 1980s with outdated safety regulation, very low equity levels and no proper fire-prevention measures that would allow policy makers to act fast.

Our exercise also sheds some more light on the question of which financial shocks actually matter and have contributed to the Finnish business cycle. Relative to some earlier studies which stressed the role of asset price movements (Vihriälä, 1997 and Drees and Pazarbaşıoğlu, 1998), we find a dominating role of shocks moving the loan supply curve. This should per se not be very surprising given the central role played by commercial banks in the Finnish financial system, although our study is the first to reach this conclusion.

Our overall results do not deny a considerable role played by the collapse of the Soviet trade in the making of the Finnish Great Depression. The breakdown of exports to USSR was clearly a strong exogenous shock that aggravated the Finnish situation relative to Sweden. Nevertheless foreign shocks, also those not related to Russia, tell only half of the story. The second half is the one about the "casino economy", starting with financial liberalization and triggering a credit-fuelled boom which collapsed several months before the USSR stopped its import from Finland.

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