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Working Paper

Financial and economic downturns in OECD countries

Bank of Finland Research Discussion Papers, No. 35/2013

Provided in Cooperation with:

Bank of Finland, Helsinki

Suggested Citation: Haavio, Markus; Mendicino, Caterina; Punzi, Maria Teresa (2013) : Financial and economic downturns in OECD countries, Bank of Finland Research Discussion Papers, No. 35/2013, ISBN 978-952-6699-59-2, Bank of Finland, Helsinki,
<https://nbn-resolving.de/urn:nbn:fi:bof-20140807297>

This Version is available at:

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35 • 2013

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Abstract

This article empirically studies the linkages between financial variable downturns and economic recessions. We present evidence that real asset prices tend to lead real cycles, while loan-to-GDP and loan-to-deposit ratios lag them. Using a probit analysis, we document that downturns in real asset prices, particularly real house prices, are useful leading indicators of economic recessions.

Keywords: macro-financial linkages; turning point analysis; probit models

JEL classification numbers: C53, E32, E37, G17

Financial and Economic Downturns in OECD Countries*

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December 19, 2013

Abstract

This article empirically studies the linkages between financial variable downturns and economic recessions. We present evidence that real asset prices tend to lead real cycles, while loan-to-GDP and loan-to-deposit ratios lag them. Using a probit analysis, we document that downturns in real asset prices, particularly real house prices, are useful leading indicators of economic recessions.

*We thank the Working Group on Econometric Modelling of the Eurosystem of Central Banks (ESCB) for useful comments and suggestions.

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1 Introduction

Are bursts in asset prices and credit systematically followed by economic recessions? Could downturns in financial variables be used as leading indicators of economic recessions?

The financial history of the United Kingdom and the United States is replete of episodes of stock market crashes, unrelated to the evolution of productivity, that were associated with economic recessions (see Bordo (2003)). Earlier historical episodes have also resonance for the most recent cycles. For example, the 2000-2001 decline in economic activity in several advanced economies followed the collapse of the Dot-com bubble and the stock market crash of the early 2000s. The latest financial crisis following the global real estate bubble bust also had important macroeconomic consequences.

The aim of this article is to establish whether downturns in financial variables lead to economic recessions in advanced economies. We focus on four financial variables: real house prices, real stock prices, total loans to GDP and total loans to deposits. First, we use turning point analysis to identify downturns in the financial variables and real GDP. Subsequently, we estimate the probability of recession during the downturn phase of the financial cycle.

Our findings indicate that peaks in real asset prices do tend to lead recessions. This pattern is stronger for real house prices than for real stock prices. In contrast, loan market developments tend to lag developments in real activity. Our results also suggest that there is a tighter connection between financial variables and real output during recessions than during booms. When testing the performance of financial downturns as predictors of economic recessions, we find that downturns in real asset prices are significant predictors of economic recessions. In particular, downturns in real house prices increase the probability of a recession to a range between 12 and 30 per cent, depending on the model.

Our article contributes to a large body of literature investigating macro-financial linkages. Beginning with Bernanke and Gertler (1989), Kiyotaki and Moore (1997) and Bernanke, Gertler and Gilchrist (1999), several theoretical works have studied the interlinkages among credit variables, asset prices and economic activity, and the amplification of shocks through credit market imperfections.¹ More recently, some authors have explored the role of shocks originating from the financial market as sources of business cycle fluctuations.²

A growing number of empirical papers also analyze the relationship between financial variables

¹More recent studies include, among others, Aoki et al. (2004), Iacoviello (2005), Campbell and Hercowitz (2004).

²See among others, Jerman and Quadrini (2012), Liu, Wang and Zha (2013) and Christiano, Motto and Rostagno (2013).

and economic activity over the business cycle.³ Claessen, Rose and Terrones (2009) and Claessen, Rose and Terrones (2011, 2012) are closely related to our article. Claessen, Rose and Terrones (2009) investigate the behaviour of macro and financial variables during periods of financial and economic downturns for 21 OECD countries over the 1960-2007 period. They find that the changes in house prices is the financial variable that tends to be the most strongly associated with the depth of an economic recession. Using a sample of 44 advanced and emerging economies between 1960-2010, Claessen, Rose and Terrones (2012) study the interaction between real and financial variables during various phases of the cycle. They document that cycles in economic activity have a higher degree of synchronization with cycles in house prices and credit rather than equity prices. Further, recessions coupled with financial disruptions, such as equity and housing price busts, tend to be longer and deeper. This article contributes to their findings in that it assesses the ability of financial variables in predicting economic recessions.

2 Financial and Economic Downturns

This analysis is based over the sample period 1980Q1-2010Q2 for the following 17 OECD countries: Belgium, France, Finland, Germany, Ireland, Italy, Luxemburg, Netherlands, Spain, Denmark, United Kingdom, Sweden, Australia, Switzerland, New Zealand, United States and Japan.⁴ For each country, we collect quarterly data on real GDP, real house prices, real stock prices, total loans to GDP, and total loans-to-deposits.⁵ For euro area countries the data sources is ECB, while for non-euro area countries data comes either from OECD or IMF.⁶

We identify the peaks and troughs of real GDP and of the financial variables using the Bry-Boschan (1971) algorithm (see also Harding and Pagan 2002, and Mönch and Uhlig 2005). Quite intuitively, a downturn phase in a time series is a period between a peak and a trough, while an

³See among others, Borio et al. (2001), Engel and West (2005), Bordo and Haubrich (2010), Helbling et al (2011), Égert and Sutherland (2012), Ciccarelli, Maddaloni and Peydro (2010), Drehmann et al (2012).

⁴The selection of countries is based on the availability of the selected financial data at a quarterly frequency for the whole sample period.

⁵Chari, Christiano, and Kehoe (2008) and Cohen-Cole et al. (2008) highlight the importance of going beyond aggregate measures to study the dynamics of credit markets. Example of alternative measures is to use loans granted to non-financial firms or to households. Unfortunately, such disaggregated credit series are not available for a large number of countries over the sample period we analyze. Therefore as in Mendoza and Terrones (2008) and Claessens, Kose, and Terrones (2011, 2012) we use the stock of total loans.

⁶The data used was collected by the Working Group on Econometric Modelling of the Eurosystem of Central Banks (ESCB) and used in Hubrich et al. (2012). It is available upon request under a confidentiality agreement.

upturn is a period starting with a trough and ending with a peak.⁷ Applying this methodology we find that the unconditional probability (or the unconditional relative frequency) of a country being in recession in a given period is 0.12. The unconditional probability of the financial variables being in downturn phase are 0.39 for real house prices, 0.37 for real stock prices, 0.36 for the loans-to-GDP ratio and 0.44 for the loans-to-deposits ratio. The expansion phases of both financial variables and real GDP are longer than the downturn phases. However, the downturn phases of the financial variables tend to last considerably longer than the downturn phases of real GDP.

Concordance Index and Probability of Recessions

Before assessing how effective financial downturns are as indicators of economic recessions, we try to identify some patterns between downturns in GDP and downturns in the four financial variables.

The Concordance Index (CI) developed by Harding and Pagan (2002), offers a relatively simple and flexible way to analyze the linkages between downturns in distinct time series. This index provides a measure of the fraction of time the two time series are in the same phase (expansion or downturn) of their respective cycles. A variable is perfectly pro-cyclical (countercyclical) if its Concordance Index with GDP is equal to unity (zero). The concordance indices shown in Figure 1 indicate that, in our sample, real house prices and real stock prices are (mildly) procyclical, while the loan-to-GDP ratio and the loan-to-deposit ratio are acyclical. The plot also reports the hypothetical case with independent cycles.⁸ The value of the Concordance Index exceeds the value corresponding to independent cycles, when a variable is procyclical. In contrast, the value of the concordance index matches the value corresponding to independent cycles, when a variable is acyclical.

In order to test if the phases of the real economy are more related to the past or to the future phases of financial variables, we also compute Concordance Indices of GDP with lags and leads of the financial variables (see Figure 2). The concordance of GDP with the past phases of real house prices and real stock prices (0.70 for 1-quarter lag and 0.67 with a 2-quarter lag, respectively) is somewhat higher than the concordance with the contemporaneous phases (0.65 and 0.66, respectively). The concordance of GDP with the future phases of the loan-to GDP ratio and loan-to-deposit ratio (0.68 with an 8-quarter lead and 0.60 with an 3-quarter lead, respectively) is also higher than with the contemporaneous phases (0.60 and 0.58, respectively). These findings indicate that asset prices

⁷If the first turning point of the sample period is a peak (trough), the sample begins with an upturn (downturn).

⁸For instance, if the phase of, say, real house prices were independent of the phase of output, the concordance index would take the value $CI=0.125*0.37+(1-0.125)*(1-0.37) = 0.58$ (given that the unconditional relative frequency of GDP contractions in our sample is 0.125, while the unconditional relative frequency of falling house prices is 0.37).

tend to lead real activity, while developments in credit markets typically lag developments in the real economy.

While the Concordance Index provides useful information about the interaction between the financial cycle and the economic cycle over the entire sample, it may downplay the stronger link between financial variables and real activity during recessions. To address this issue, we compute separate Concordance Indices, conditional on GDP expanding or contracting in a given period. For instance, the conditional Concordance Index of real house prices and GDP is simply the conditional probability that house prices are rising during an expansion in GDP and falling during a contraction.

During phases of expansion in GDP, the conditional probabilities that the financial variables are in an upturn phase do not differ much from the unconditional probabilities (left panel of Figure 3). During economic downturns, real GDP and real asset prices are more tightly tied together (right panel of Figure 3). If real output is contracting in a certain period, then the conditional probability that real house prices are also falling in that period is 0.81, i.e. roughly twice the unconditional frequency of downturns in house prices. The conditional probability of real stock prices being in a downturn phase is 0.66 which is also higher than the unconditional probability (0.37). Remarkably, the conditional probability of real stock prices being in a downward phase is still higher when we consider lags of this variable, with the highest conditional probability value of 0.8 reached with four lags (Figure 4). Thus, it is highly unlikely that a country will experience a recession without real asset prices having first fallen. In contrast, when the economy is entering a recession, the downturn phase of credit is often still ahead. In particular, the probability of a downturn phase, conditional of being in a recession, is higher for the loan-to-deposit ratio (0.68) relative to the loan-to-GDP ratio (0.38). See the right panel of Figure 3 and Figure 4).

Next, we study the conditional frequency of recessions around peaks in financial variables. When either real house prices or real stock prices peak, the (conditional) probability that the economy is in recession is low (see Figure 5): at 0.05 it is roughly half the unconditional probability of recession (0.12). However, once asset prices enter a downturn phase, the probability of a recession increases sharply, reaching 0.4 (almost 4 times the unconditional probability of 0.12) five quarters after the peak in house prices, and 0.25 (roughly twice the unconditional probability of 0.12) five quarters after a stock market peak. This observed time pattern reinforces the view that real asset prices lead real activity. The relationship is stronger for real house prices than for real stock prices.

As for credit variables, when the loan-to-GDP ratio peaks, the conditional probability of the economy being in recession is 0.15 which is roughly equal to the unconditional probability of an output contraction, while the probability of being in a recession when the loan-to-deposit ratio peaks

is about 0.20. The highest value of the conditional probability of a recession is 0.30, i.e. roughly three times the unconditional probability four quarters before the peak in the loans-to-GDP ratio. This finding also indicates that movements in the loan-to-GDP ratio tend to lag movements in real activity. When loan-to-deposit ratio peaks, a recession reaches its highest probability value exactly. Note that the loans-to-GDP ratio and the loans-to-deposits ratio are based on the stock of existing loans which is a slow-moving variable by definition.

3 On the Predictive Power of Financial Downturns

We complement the analysis presented above by testing the performance of downturns in house prices, stock prices, loan-to-GDP and loan-to-deposits as predictors of economic recessions by using a probit model. The binary variable, $S_t = \{0, 1\}$ used as a proxy for the state of the economy, takes on the value of 1 during GDP downturns and 0 otherwise.

A downturn in house prices increases the probability of an economic downturn occurring in the same period, $Pr(S_t = 1)$, by 30 per cent whereas a downturn in stock prices increases the probability by only 5 per cent. Regarding the credit variables, we find that downturns in the loan-to-GDP ratio are not significant predictors of downturns in GDP. In contrast, a downturn in the loan-to-deposit ratio significantly increases the probability of a downturn in GDP by 20 per cent. In Table 1 (Panel A), we present our results.

Next, we explore the role of downturns in financial variables in predicting economic downturns 1- and 4-quarter ahead periods, $Pr(S_{t+1} = 1)$ and $Pr(S_{t+4} = 1)$, respectively. Column (II) shows that periods of downturns in house prices, stock prices and loan-to-deposits tend to significantly spill over into economic activity and can therefore predict GDP recessions 1-quarter in advance. In particular, being in a house price downturn phase leads to a probability of a economic downturn in the next period, i.e. $Pr(S_{t+1} = 1)$, of 30 per cent. In the case of downturns in the loan-to-deposit ratio and in stock prices the probability of an economic downturn is about 10 and 5 per cent, respectively. Downturns in loan-to-gdp and are not significant.

In columns (III), we also consider as predictors GDP growth and the index of the current state of the economy, S_t , as predictors of economic recessions. We find that GDP growth has little predicting power likely because, in many countries, there is very little persistence in growth rates of GDP. Moreover, if the economy is in an expansion at the time the prediction is made, GDP growth is not a useful indicator. In contrast, the current state of economic activity is a good predictor of the

next period's state of the economy. Notice that the marginal information about the loan-to-deposit ratio becomes insignificant when the information from the additional two variables is accounted for. Including the index of the current state of the economy improves the fit of the model substantially. The $pseudo - R^2$ from the Probit model increases from .1731 (with only the the four indexes of downturn in financial variables) to 0.4842.

Columns (IV) assesses the robustness to the inclusion of other macroeconomic variables. CPI inflation, the spread between long and short term interest rates and the real exchange rate are also significant predictors of economic downturns. However, we find that these macroeconomic variables only marginally contribute to predicting economic downturns. Indeed, with their inclusion, the $pseudo - R^2$ is only marginally larger (0.5021 vs 0.4842).

Table 1 (Panel C) reports the estimates of the occurrence of a recession 4 quarters ahead, $Pr(S_{t+4} = 1)$. The same results hold as in Panel B. The predictive power over longer horizon is substantially reduced.

4 Conclusions

The recent financial crisis has generated interest in analyzing financial cycles and understanding the linkages between financial and economic cycles. The aim of this article is to study the synchronization of financial and real cycles in advanced economies. In particular, we aim to establish whether downturns in financial variables lead to economic recessions. We focus on four financial variables: real house prices, real stock prices, the loan-to-GDP ratio and the loan-to deposit ratio. We show that real asset prices tend to lead real cycles, while the loan-to-GDP and loan-to-deposit ratios lag them. Using a probit analysis, we show that financial downturns are good predictors of economic recessions. In particular, a downturn in house prices sizably increases the probability of an economic downturns.

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Table 1: Probit Regression - GDP Downturns

	(A) Current	(B) 1Q-ahead			(C) 4Q-ahead		
House Price	0.32***	0.31***	0.148***	0.138***	0.118***	0.090***	0.075***
Downturn	(11.93)	(11.40)	(4.41)	(3.96)	(4.53)	(3.22)	(2.59)
Stock Price	0.048***	0.049***	0.0298***	0.027***	0.012***	0.0085	0.006
Downturn	(8.94)	(9.40)	(4.55)	(4.09)	(2.46)	(1.58)	(1.24)
Loan-to-Gdp	0.004	0.002	0.0071	0.0158	-0.036	-0.0335	-0.037
Downturn	(0.14)	(0.09)	(0.23)	(0.50)	(-1.45)	(-1.35)	(-1.35)
Loan-to-Deposit	0.201***	0.102***	-0.044	-0.031	0.035***	0.0173	0.025
Downturn	(6.04)	(3.08)	(-1.10)	(-0.77)	(1.10)	(0.52)	(0.74)
GDP			0.023***	0.0222***		0.032***	0.002***
Downturn			(19.56)	(18.98)		(2.88)	(2.10)
GDP			-0.023	-0.0233		-0.010	-0.0145
Growth			(-0.48)	(-0.47)		(-0.27)	(-0.37)
CPI				0.095*			0.128*
Inflation				(1.68)			(2.89)
Spread				-0.119***			-0.123***
				(-4.66)			(-5.86)
Exchange				-0.003**			-0.004**
Rate		10		(-2.14)			(-3.37)
Log Likelihood	-616.68	-636.28	-396.88	-383.09	-748.04	-743.58	-718.30
Pseudo R2	0.2007	0.1731	0.4842	0.5021	0.0222	0.0281	0.0611

Figure 1: Concordance of real output and financial variable concordance index.

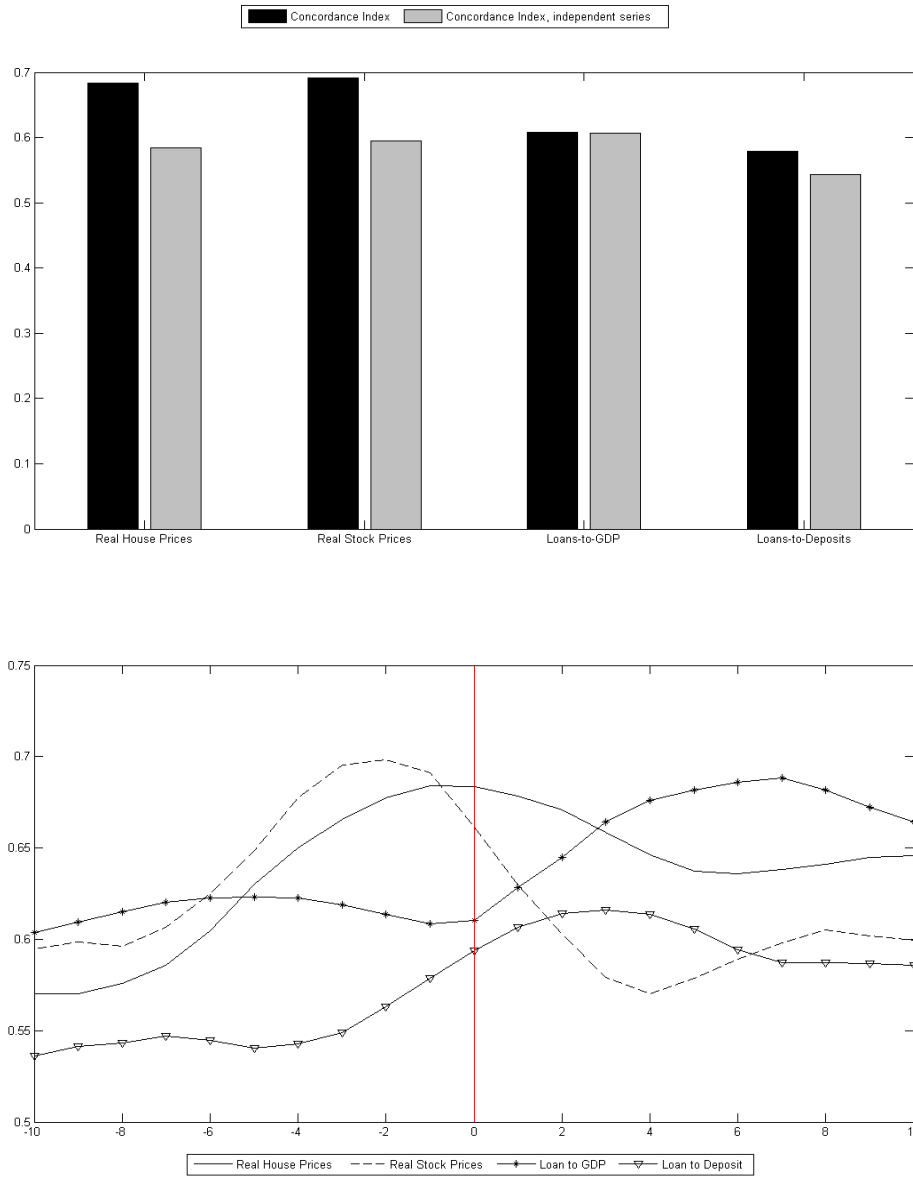


Figure 2: Concordance of real output with past and future phases of financial cycle concordance with lags and leads.

Figure 3: Conditional (contemporaneous) concordance of financial variables and real activity in expansions and recessions.

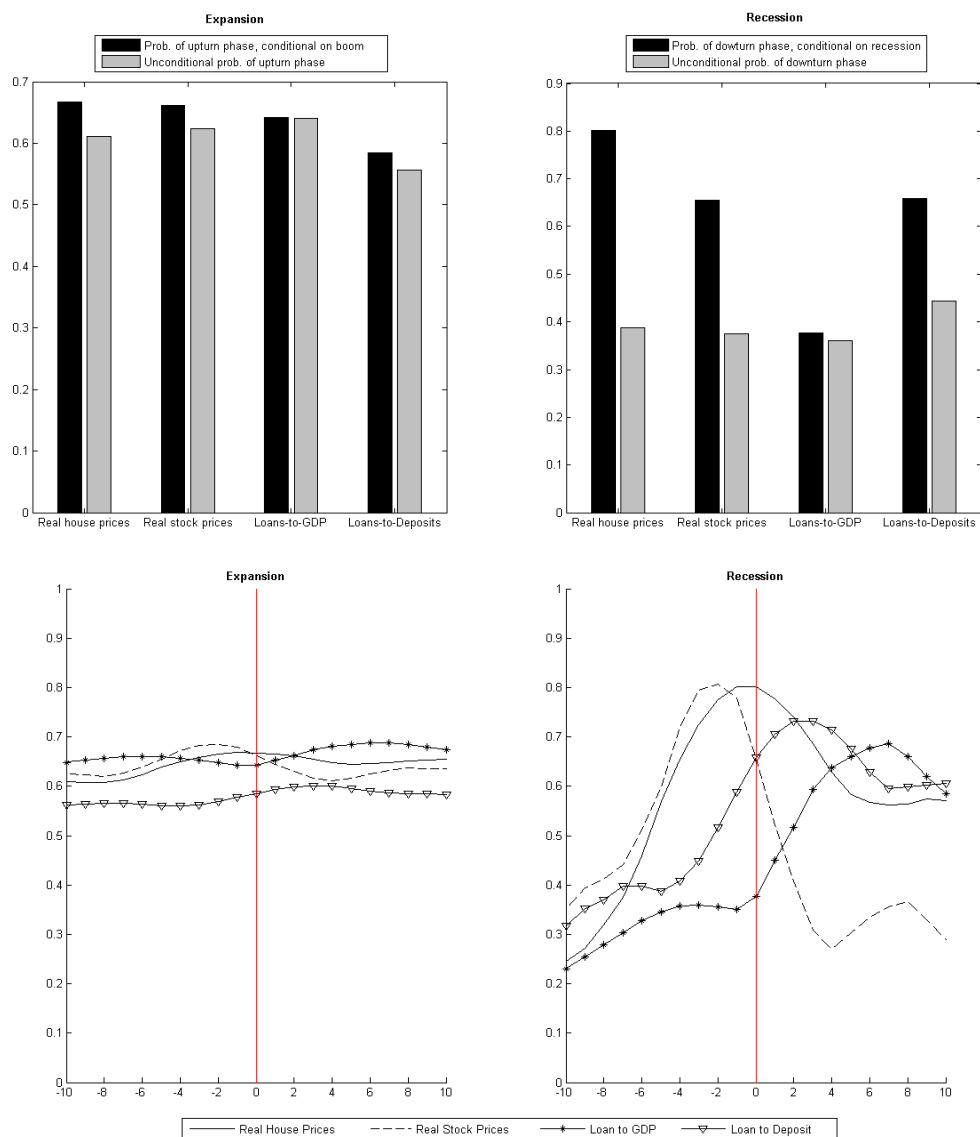


Figure 4: Conditional concordance of real activity with past and future phases of financial cycles.

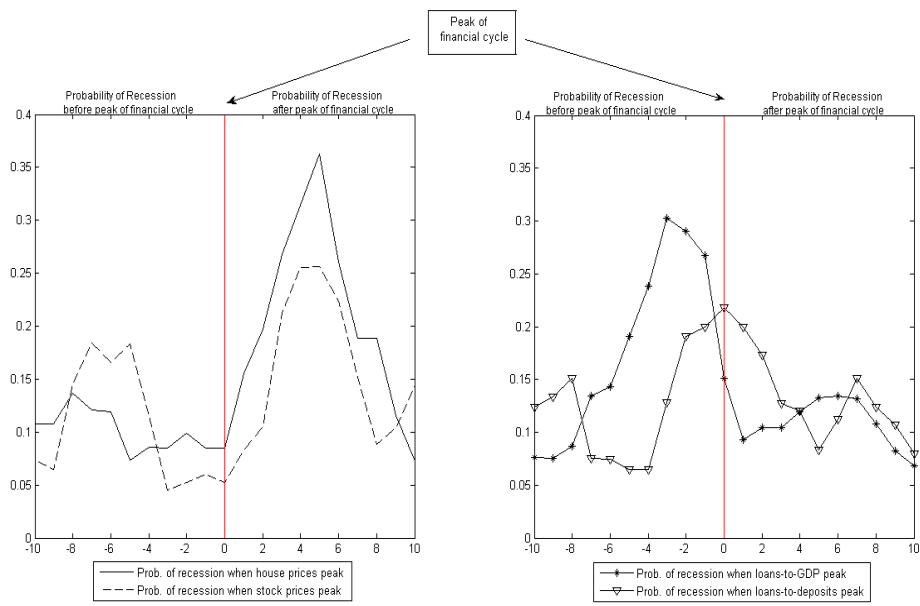


Figure 5: The probability of a recession before and after the peak of a financial cycle.

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