How do banking crises spread to the real economy?

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Introduction

In 2007-2008, the world experienced a financial crisis and a severe economic recession ensued. Faced with the staggering costs of the recession, there is an urgent need to understand the channels through which crises in the financial sector spread to the real economy.

A number of existing papers study how adverse shocks to banks affect outcomes in the real economy. In a seminal event study, Slovin, Sushka and Polonchek (1993) show how the distress of a large US bank caused significant losses in the market value of its client firms and how most of these losses were recouped when the bank was later rescued. Subsequent studies have demonstrated that adverse shocks to banks cause client firms to reduce total borrowing (Khwaja and Mian, 2008), borrow at higher interest rates (Santos, 2011), slash investment (Klein, Peek and Rosengreen, 2002) and reduce employment (Chodorow-Reich, 2013).

While there is thus considerable knowledge about how banking crisis affects outcomes in the corporate sector, this project aims to explore how it affects outcomes in the household sector. The ultimate question we are asking is whether adverse shocks to banks cause a reduction in the consumption of client households. This could point to a potentially important mechanism by which bank crisis leads to a drop in aggregate demand that triggers or aggravates a downturn in the real economy. This question has not previously been addressed in the literature despite the fact that knowledge about the social costs of bank distress is crucial for guiding policy responses to financial crises.

Our hypothesis that bank crises affect household consumption draws on the theory of relationship banking. In an environment characterized by imperfect information, banks must gather and process information to ascertain the quality of borrowers (Stiglitz and Weiss, 1981). This represents a costly investment in bank-household relationships, which once established are valuable to both banks and households and make switching banks costly for households (Kim, Kliger and Vale, 2003). The presence of such frictions suggest that bank relationships are durable and that households may face an effective deterioration of their access to credit when their bank suffers an adverse shock. Since credit availability has been shown to shape real consumption decisions (Gross and Souleles, 2002; Adams, Einav and Levin, 2009), it seems plausible that bank distress can depress consumption at the household level. Testing whether this mechanism is empirically relevant and identifying the precise channels through which it operates are the main goals of this project.

Our empirical strategy exploits a unique possibility to link household-level information from a number of administrative sources to bank-level information. Using the significant differences in exposure to the 2007-2008 financial crisis across Danish banks as a source of variation in bank health, we essentially compare the consumption path of households whose banks were severely affected by the crisis to that of households whose banks were much less affected while holding constant observable characteristics such as employment status, income, financial wealth, housing wealth and educational background.

Data and measurement

The compilation of the dataset needed to carry out the empirical analysis involves several steps.

In a first step, we measure the exposure of banks to the global financial crisis. Most accounts of the crisis stress that while its origin was losses on US mortgage-backed securities, it spread within the financial sector through the markets for short-term funding. The losses on securities lead to uncertainty about the solvency of counterparts, which in turn caused repo and interbank markets to freeze (Gorton and Metrick, 2012; Brunnermeier, 2009). For instance, Northern Rock, the fifth-largest bank in the UK, which failed in September 2007, had virtually no direct exposure to the US mortgage-backed securities, but was strongly affected by the financial crisis through its heavy reliance on short-term funding (Shin, 2009).

These considerations have led most recent studies to measure banks' exposure to the financial crisis by the extent to which they relied on short-term funding at the eve of the crisis (Ivashina and Scharfstein, 2010; Aiyar, 2012). For this project, we are able to construct similar measures using detailed bank-level information about the funding structure of Danish banks from the Danish Central Bank. Further, we have access to unique bank-level information on interest rates on unsecured interbank loans also from the Danish Central Bank. This provides a precise measure of banks' marginal funding costs and thus of the shock they suffered during the financial crisis.

In a second step, we identify the relationship between households and banks. In order to do so, we will use a unique dataset with information on every individual's deposit and loan accounts at each financial institution. The data derive from compulsory reports by financial intermediaries to the tax authorities and thus provide a complete picture of the bank relations of all Danish households.

In a third step, we construct outcome measures at the household level. The ultimate variable of interest is consumption, which is not directly observable but may be approximated using information on income and wealth (Browning and Leth-Petersen, 2003; Leth-Petersen, 2010). To further understand *how* consumption is affected by bank crisis, we intend to construct and study a number of intermediary outcome variables such as (i) total household debt; (ii) average and marginal interest rate paid on loans; (iii) probability of being granted a new loan or line of credit through the existing bank relation; (iv) probability of changing the bank relation. Each of these variables may be perceived as outcomes that are interesting in their own right but also shed light on channels through which bank health can affect household consumption.

In a final step, the various data sources described above are merged and anonymized. This step has been approved by the Danish Data Protection Agency ("Datatilsynet"). The approval is enclosed to this application.

Empirical strategy and identification

Before embarking on the econometric analysis, it is useful to establish that the financial crisis in 2007-08 has characteristics that make our choice of empirical methodology suitable. What we need is a *large* and *asymmetric* adverse shock to banks since this will allow us to estimate the causal effect of the crisis on customer level outcomes by comparing customers of banks hit by a large shock to customers of banks hit

by a smaller shock. Figure 1 illustrates how interest rates on the Danish interbank market evolved before, during and after the crisis. The median interest rate increased before and during the crisis, peaked in November 2008 and then decreased sharply following the government and central bank interventions in the financial markets. The *difference* between the interest rate paid by the 75% percentile and the 25% percentile of the distribution of banks was almost constant until the onset of the financial crisis, then increased sharply and only reached normal levels in 2010. This pattern implies a very significant widening of the range of funding costs faced by Danish banks during and after the financial crisis. It is essentially this asymmetry in the severity of the crisis that we will exploit for identification purposes.

Figure 1: Interest rate on lending between Danish financial institutions, 2003-2010
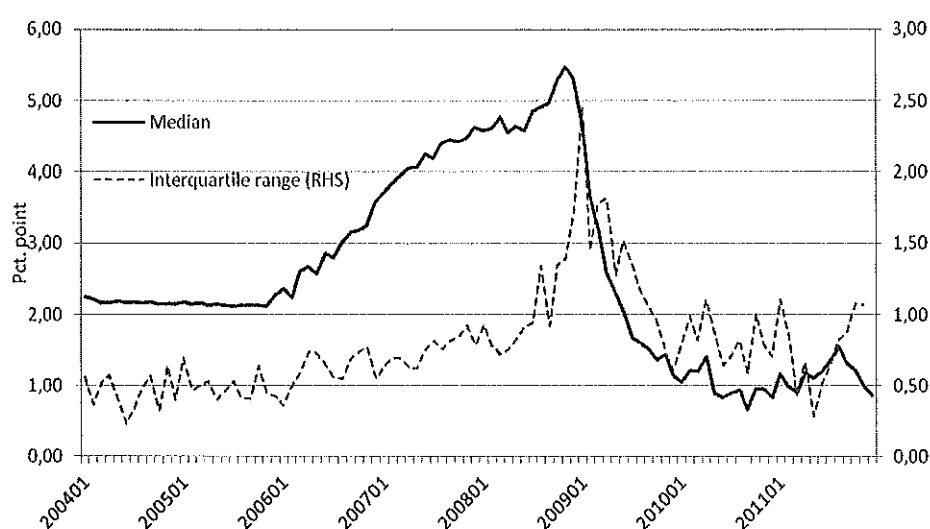
Source: Danish Central Bank, Rentestatistikken

Using the loan-specific information about the interest rates paid by households on their bank loans from the Danish tax authorities (described above), it is possible to determine the extent to which banks passed on the increase in funding costs to their customers through higher interest rates or reduced credit. These are crucial steps to verify that the bank-level shock propagated through the banks to the household sector.

Our main empirical specification estimates how the change in household consumption from pre-crisis to post-crisis correlates with bank exposure to the financial crisis when controlling for other variables that are likely to affect consumption such as employment status, income, financial wealth, housing wealth, household size and educational background. In plain words, this amounts to testing whether two households with similar jobs, incomes and assets, of which one is a client of Danske Bank that was strongly exposed to the global financial crisis and the other is a client of Nordea that was much less exposed, differed systematically in their consumption responses to the crisis.

The most serious identification issue relates to unobserved heterogeneity of households. By using the change in consumption as dependent variable, the specification sketched above effectively accounts for unobserved determinants of the *level* of consumption. However, an identification issue may still remain if

there are important unobserved determinants of *changes* in consumption that correlate with bank exposure to the crisis. If it were the case, for instance, that clients of Danske Bank are intrinsically more prudent than clients of Nordea, this trait rather than the shock to credit access may have made them reduce consumption more around the time of the financial crisis.

The most obvious way to address this concern is by tracing the consumption paths of households during the pre-crisis period. If clients of more exposed banks followed the same consumption path in pre-crisis years as clients of less exposed banks conditional on observables, it is suggestive that these parallel trends would have continued if all banks had been equally exposed to the crisis, which is exactly the identifying assumption of the baseline specification.

An alternative approach, which has used by several papers studying the relation between banks health and firm outcomes (Khwaja and Mian, 2008; Chodorow-Reich, 2013), is to employ borrower fixed effects. This strategy exploits that some borrowers have more than one banking relation, which makes it possible to estimate the effect of bank health on bank-borrower level outcomes while controlling directly for unobservable borrower characteristics. In the present context, this methodology could be used to study the effect of bank health on household debt.

Publication strategy

Given the importance of the research question – how financial crisis spreads to the real economy – and the fact that the link between banking crisis and household consumption decisions is virtually unexplored, we believe that the project has the potential to lead to a publication in a top-5 economics journal or alternatively a top finance journal.