The Deposits Channel Revisited

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Abstract

Drechsler, Savov, and Schnabl (2017) present a novel reformulation of the bank lending channel of monetary transmission based on market power in deposits markets, which they term the "deposits channel." We perform a successful narrow replication, reconcile their results with a related empirical literature, and control for an alternative theoretical mechanism. Inconsistencies with related studies can be explained by differences in market power measure, monetary policy instrument, and sample period. When controlling for an alternative mechanism, our results suggest that the "deposits channel" only partially explains the response of loan supply to monetary policy.

Keywords: Monetary policy, bank lending channel, market power.

JEL Classification code: E44, E52, E58, G21.

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1 Introduction

Drechsler, Savov, and Schnabl (2017) (DSS henceforth) offer a new theoretical explanation for the response of loan supply to monetary policy, which the authors term the "deposits channel." The traditional theory behind the bank lending channel of monetary transmission posits that due to binding reserve requirements, a monetary policy induced change in reserves will lead to a corresponding change in insured deposits, resulting in an expansion or contraction in loan supply. While there is significant empirical evidence supporting the existence of a bank lending channel, the traditional theoretical explanation is implausible.[1] First, total reserves are too small to produce a quantitatively significant loan suppy effect. Second, since 2008 there has been a large quantity of excess reserves rendering reserve requirements irrelevant. The "deposits channel" on the other hand explains an outflow of deposits following a monetary tightening as driven by bank market power in deposit markets, rather than by an outflow of resereves due to binding reserve requirements. Specifically, following an increase in the short-term policy rate, banks will increase deposit spreads more in markets where they have greater market power. This increase in deposit spreads will lead to an outflow of deposits, resulting in a contraction in lending.

DSS present two sections of empirical evidence in support of their model. The first section focuses on results on deposits, specifically how deposit spreads and deposit flows respond to an increase in the federal funds rate. Using a unique within-bank estimation method, they find that for branches of the same bank, there is a greater increase in deposit spreads and a larger outflow of deposits for branches located in more highly concentrated markets. They further show in a weekly event study analysis that the increase in deposit spreads occurs contemporaneously with the increase in the federal funds rate. Overall, DSS provide robust evidence that market concentration influences the reaction of deposits to monetary policy as predicted by the "deposits channel" model.

The second section focuses on the relationship between the "deposit channel" and bank lending. The reported evidence is also consistent with the model, showing that banks which raise deposits in more concentrated markets reduce lending to a greater degree following a monetary tightening. Moreover, the estimates imply that the "deposits channel can account for the entire transmission of monetary

[1] For empirical evidence on the bank lending channel see Kashyap and Stein (2000), Kishan and Opiela (2000), and Gambacorta (2005) among many others.

policy through bank balance sheets" (page 1869). This result is difficult to reconcile with two strands of related literature.

First, a number of empirical studies investigating the relationship between bank competition and the lending channel report conflicting results. Most notably, Adams and Amel (2011), Brissimis, Delis, and Iosifidi (2014), and Segev and Schaffer (2019) provide evidence using U.S. data that lending is *less* responsive to monetary policy for banks with greater market power.[2] Second, the DSS analysis does not consider an alternative theoretical reformulation of the lending channel presented by Disyatat (2011). In this reformulation, Disyatat (2011) proposes that the lending channel works through bank balance sheet strength and risk perception, implying that greater reliance on non-deposit funding will increase a bank's sensitivity to monetary policy.

In this paper we first perform a narrow replication of the DSS results based on publically available data using the R software. We then attempt a wide replication aimed at reconciling DSS with the two strands of literature discussed above. The diverging conclusions reached by other empirical studies can be explained by differences in sample period, measure of bank market power, and measure of monetary policy. When controlling for the alternative theoretical mechanism proposed by Disyatat (2011), we find evidence in favor of both the DSS "deposits channel" and the Disyatat (2011) "non-deposit funding channel". Our results confirm that the "deposits channel" plays an important role in explaining the effect of monetary policy on lending. However, contrary to the claim that the "deposits channel can account for the entire transmission of monetary policy through bank balance sheets," our results suggest that the response of lending to monetary policy is best explained by a plurality of mechanisms.

2 Empirical Analysis

2.1 Baseline Specification

The online appendix contains results for the full narrow replication.[3] In the following we focus on Table VI from DSS, as it contains the key results on lending. Table VI reports results from bank-county regressions, where the dependent variable is the log of bank j's new small business lending in county c, and the independent variable of interest is an interaction between

[2] A number of cross-country studies including Olivero, Li, and Jeon (2011) Fungáčová, Solanko, and Weill (2014), and Leroy (2014) also conclude that greater bank market power weakens the response of lending to monetary policy.

[3] We replicate all DSS results that do not require private data.

the annual change in the federal funds rate and one lag of bank j's Herfindal-Hirschman index (HHI).[4]

$$y_{jct} = \alpha_{jc} \; + \; \delta_{ct} \; + \; \beta Bank\text{-}HHI_{jt-1} \; + \; \gamma \Delta FF_t \times Bank\text{-}HHI_{jt-1} \; + \; \epsilon_{jct} \tag{2.1}$$

Narrow replication results for Table VI are presented in Table 1 and are almost identical to the original. As shown in the online appendix, all other results are replicated with a high degree of accuracy.

2.2 Related Empirical Studies

A recent empirical literature has found that bank market power dampens the effect of monetary policy on loan supply (Adams and Amel 2011; Brissimis, Delis, and Iosifidi 2014; Fungáčová, Solanko, and Weill 2014; Leroy 2014; Segev and Schaffer 2019).[5] The results in DSS, both theoretical and empirical, appear to contradict these findings. In this section we investigate the factors driving the opposing results. An obvious starting point is the measure of bank market power used in the analysis. DSS use bank-level HHI whereas the majority of the above studies use the Lerner index. Interestingly, Adams and Amel (2011) also use HHI yet nonetheless find that greater market power weakens, rather than strengthens, the response of lending to monetary policy. We proceed by first considering differences between DSS and studies using the Lerner index, before attemtpting to understand the conflicting results in Adams and Amel (2011).

While the literature often refers to bank market power generically, it is important to note that market power can exist on either side of the balance sheet.[6] Market power over deposits exists on the liability side and market power over loan pricing exists on the asset side. The focus in DSS is on the former, but the latter may have an independent influence on the lending channel. For instance, Corbae and Levine (2018) develop a model where banks with greater power over loan pricing will enjoy larger interest spreads and profit margins which can help to insulate loan supply from adverse monetary shocks. Their model therefore predicts that greater market power will weaken the response of lending to monetary policy. In this view, it is perhaps unsurprising that studies using the Lerner index, which is most directly interpreted as a proxy for loan pricing power, report opposite findings from DSS.[7]

[4] Bank-HHI is calculated as a weighted average of branch-level county HHI, with branch deposit shares used as weights.

[5] Reviewing the theoretical argument for the dampening impact of banks' market power on the monetary policy transmission is beyond the scope of this paper. See section 2.2 in Brissimis, Delis, and Iosifidi (2014) for an in-depth discussion of potential mechanisms. Additionally, see Corbae and Levine (2018) for a theoretical model where monetary policy has a larger effect on lending in more competitive banking systems.

[6] To their credit, DSS consistently refer to market power *in deposits markets*. Many other studies fail to make such a distinction however.

[7] The Lerner index is calculated as (P-MC)/MC, where P is loan price and MC is the marginal cost of loan production. See the online appendix for details regarding the calculation of the Lerner index used in our analysis.

However, there is debate in the literature over whether the Lerner index may also contain information related to market power over deposits. Beck, De Jonghe, and Schepens (2013) argue that even if the Lerner index is constructed to capture market power over loans, it also captures the impact of market power over deposits through marginal cost. On the other hand, Jiménez, Lopez, and Saurina (2013) use a unique Spanish data-set to compute a separate Lerner index for loan and deposit markets. The correlation between the two measures is positive but very low, suggesting that each type of market power should be estimated separately. It is therefore unclear how well the Lerner index captures market power in deposits markets, and to what degree it may be driving the conflicting results.

We first re-estimate equation 2.1 substituting the Lerner index for bank-HHI, with results reported in column 1 of Table 2. The coefficient on the interaction between the Lerner index and federal funds rate remains negative but is no longer statistically significant. Thus it appears measure of market power alone can't explain the diverging results surrounding the effect of market power on the potency of the lending channel. We next turn our attention to two issues beyond measure of market power.[8] The first issue is related to the zero lower bound (ZLB) period. Many empirical monetary policy studies end their samples in 2008 due to the lack of variation in the federal funds rate during the ZLB period. In contrast, DSS extend their sample until 2013 and include county fixed effects interacted with a post-2008 indicator to control for asymmetries stemming from this period. Therefore, we once again estimate equation 2.1 with the Lerner index substituted for bank-HHI and with the sample now ending in 2008 rather than 2013. Column 2 of Table 2 shows that the interaction coefficient between the Lerner index and federal funds rate turns positive but remains statistically insignificant.

The last potential difference is related to how the change in monetary policy is calculated. DSS use the difference between the end-of-the-year federal funds rate and beginning-of-the-year federal funds rate, whereas other studies use the change in the annual average. Column 3 of Table 2 shows that the positive coefficient on the interaction term increases and becomes statistically significant at the 10% level when the change in the annual average federal funds rate is implemented as the monetary policy shock (with Lerner index proxying for bank market power and the sample ending in 2008). Thus, using the DSS data and regression specification we find results which are consistent with the related empirical literature. This exercise is not meant to call into question the results of any of the noted studies.

[8] It is also worth noting that DSS use data on small business loan originations whereas most of the other studies use balance sheet data. As shown below however, the opposing results can be reconciled using the loan origination data from DSS.

Instead, it highlights the potential importance of disaggregating bank market power. Specifically, the results suggest that market power may have opposing effects on the potency of the bank lending channel, depending on the type of market power. Power over deposits, as captured in the original DSS results, strengthens the effect of monetary policy on lending. Power over loan pricing, as is likely captured in these results, may weaken the effect of monetary policy on lending.

Next, we turn our attention to reconciling DSS and Adams and Amel (2011) (A&A henceforth). Like DSS, A&A use data on small business loan origination and focus on local deposit based HHI as a measure of market power. Despite these similarities, A&A report opposite results from DSS, i.e., that lending is less responsive to monetary policy in more highly concentrated markets.[9] There are three notable differences between the two analyses. A&A use the change in the annual average federal funds rate whereas DSS use the end-of-year change. A&A have a shorter sample period of 1996-2004 compared to DSS' sample period of 1997-2013. Finally, DSS include time fixed effects and no county-level controls whereas A&A do the opposite.

A&A conduct their analysis at the county-level rather than the bank-level. Table VII in DSS reports results for a county-level regression analogous to equation 2.1 which closely corresponds to A&A.[10] We estimate the DSS county-level regression for the full DSS sample in panel (a) of Table 3 and for the A&A subsample in panel (b). We vary the level of fixed effects and inclusion of county controls across four specifications for each sample.[11] Results are similar for the shorter A&A sample period regardless of which method is used to calculate the change in the federal funds rate. Table 3 therefore reports results using the end-of-year change only. The results show that the major factor driving the opposing DSS and A&A results is sample period, as the coefficients of interest are negative and significant across all four columns for the full sample, whereas they are positive in three of the four columns for the subsample (and significant in two). Interestingly, these estimates suggest the "deposits channel" mechanism may be a relatively recent phenomenon.

To summarize, we find that apparent inconsistencies between DSS and the related empirical literature are driven by differences in measure of market power, monetary policy, and sample period. These results highlight the fact that further work is needed to better understand the relationship between banking

[9] See Table 3a of A&A.

[10] See the online appendix for our replication of DSS Table VII.

[11] County level controls include the log change in house prices, population and per capita income. See online appendix for details on the sources of the county-level controls used in the analysis.

sector competition and monetary transmission, especially when market power affects both sides of banks' balance sheets. One possible approach is to use an adjusted Lerner index which captures market power only in deposit markets and compare it to the deposit based HHI. We leave this important extension for future work.

2.3 Alternative Mechanism

DSS provide strong evidence that the response of loan supply to monetary policy is driven by the "deposits channel." However, DSS do not attempt to account for an alternative mechanism proposed by Disyatat (2011). According to this mechanism, monetary policy impacts loan supply by altering bank balance sheet strength and thus influencing the external finance premium banks face on non-deposit funding. A key implication of this "non-deposit funding" mechanism is that greater reliance on wholesale funding vis à vis retail deposits should render a bank's loan supply more sensitive to monetary policy.

DSS state the key condition for the "deposit channel" to impact loan supply is that "deposits are a special source of funding for banks, one that is not perfectly substitutable with wholesale funding" (page 1857). However, it is questionable whether the modern U.S. banking system fits this condition.[12] In light of these considerations, it is possible that the DSS results are at least partially driven by stronger reliance on wholesale funding for banks with higher levels of HHI.[13] To test for the relevance of this alternative mechanism we construct a bank-level ratio of wholesale funding to retail deposits and include it, along with its interaction with the change in the federal funds rate, in equation 2.1.[14] A higher value of this ratio indicates that a bank is relatively more reliant on wholesale funding relative to retail deposits.

Results are presented in Table 4. The coefficients on the bank-HHI interaction remain negative and significant with somewhat smaller magnitudes than in Table 1. Interesetingly, the coefficient on the wholesale funding interaction is also negative and significant across all four specifications, indicating that loan supply reacts more strongly to changes in the federal funds rate for banks which rely more heavily on wholesale funding. The results therefore lend support to the existence and relevance of both

[12] See Oura et al. (2013) for an extensive discussion of the shift of the banking system towards wholesale liabilities.

[13] In the full data-set the correlation between the bank level HHI and the ratio of wholesale funding to retail deposits is 0.31. One possible reason for this positive correlation is that banks which operate in more concentrated markets might be perceived as safer and, therefore, have easier access to wholesale sources of funding.

[14] Wholesale funding is defined as the sum of brokered deposits (rcon2343), time deposits of $100,000 or more (rcon2604), federal funds and repurchase agreements (rcon2800), and other borrowed money (rcon2850). Retail deposits are total deposits minus brokered deposits and large time deposits. Data is from the Call Reports.

the DSS "deposits channel" and the Disyatat (2011) "non-deposit funding channel." This has important implications for future studies of the lending channel. While the "deposits channel" certainly appears to play an important role in explaining the transmission of monetary policy through bank balance sheets, these estimates suggest that the response of loan supply to monetary policy may in fact be driven by a plurality of mechanisms.

3 Conclusion

The mechanisms underlying the bank lending channel are key to understanding monetary transmission. DSS provide an intriguing new theoretical foundation based on market power in deposits markets. They present convincing evidence that following an increase in the federal funds rate, deposit spreads increase more and deposits shrink more for bank branches in more highly concentrated markets. They go on to show that this deposit outflow leads to a corresponding contraction in lending. They argue that their proposed "deposits channel" can explain the entire transmission of monetary policy through bank balance sheets.

In this paper we perform a successful narrow replication of DSS in R. We then investigate inconsistencies with the related empirical literature and control for an alternative theoretical channel. Divergences with related studies can be explained by differences in sample period, federal funds rate measurement, and measure of bank market power. When controlling for a theoretical reformulation of the lending channel proposed by Disyatat (2011), we find evidence supporting the existence of both the DSS "deposits channel" and an alternative mechanism driven by the external finance premium on non-deposit funding. While the "deposits channel" may not be able to account for the entire response of loan supply to monetary policy, our evidence supports its importance for the overall lending channel. Further investigation into the theoretical foundation of the lending channel remains a critical area for future research.

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A Tables

Table 1: Narrow Replication (Bank-County Results)

	log(new lending)			
	(1)	(2)	(3)	(4)
Δ FF x Bank-HHI	-0.208**	-0.198**	-0.168**	-0.167**
	(0.099)	(0.097)	(0.077)	(0.076)
Δ FF x Branch-HHI		0.027	0.009	
		(0.018)	(0.023)	
Time f.e.	Y	Y	Y	Y
Bank f.e.	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y
County-bank f.e.	Y	Y	N	N
County-time f.e.	Y	N	N	N
Observations	620,960	620,960	620,960	620,960
R^2	0.831	0.816	0.247	0.247

This table replicates Table VI from Drechsler, Savov, and Schnabl (2017). *p<0.10; **p<0.05; ***p<0.01.

Table 2: Reconciliation with Related Literature

	log(new lending)		
	(1)	(2)	(3)
Δ FF x Bank Market Power	-0.067	0.139	0.303*
	(0.077)	(0.095)	(0.173)
Lerner Index	Y	Y	Y
End in 2008	N	Y	Y
Annual Avg Δ FF	N	N	Y
Observations	579,682	404,237	404,237
R^2	0.851	0.852	0.853

This table estimates the specification corresponding to column (1) of Table VI from Drechsler, Savov, and Schnabl (2017), accounting for three changes from the related literature. When Lerner = Y, the Lerner index is substituted for HHI as a measure of bank market power. When End in 2008 = Y, the sample period is 1997-2008 rather than 1997-2013. When Annual Avg Δ FF = Y, Δ FF is the change in the annual average of the fed funds rate rather than the end-of-year change. *p<0.10; **p<0.05; ***p<0.01.

Table 3: Consistency with Adams and Amel (2011)

	log(new lending)			
	(1)	(2)	(3)	(4)
Panel A: 1997-2013				
Δ FF x HHI	-0.119***	-0.086***	-0.123***	-0.056**
	(0.025)	(0.024)	(0.024)	(0.023)
Δ FF	0.006	-0.007		
	(0.007)	(0.006)		
Observations	54,097	42,813	54,097	42,813
R^2	0.919	0.921	0.938	0.943
Panel B: 1997-2004				
Δ FF x HHI	0.037	0.121***	-0.020	0.065**
	(0.035)	(0.033)	(0.033)	(0.029)
Δ FF	-0.024***	-0.035***		
	(0.009)	(0.008)		
Observations	25,345	18,855	25,345	18,855
R^2	0.916	0.918	0.941	0.949
Time f.e.	N	N	Y	Y
County f.e.	Y	Y	Y	Y
County controls	N	Y	N	Y

This table reports results reconciling differences between Table 3a of Adams and Amel (2011) and Table VII of Drechsler, Savov, and Schnabl (2017). *p<0.10; **p<0.05; ***p<0.01.

Table 4: Controlling for Wholesale Funding

	log(new lending)			
	(1)	(2)	(3)	(4)
Δ FF x Bank-HHI	-0.141*	-0.133*	-0.116*	-0.115*
	(0.080)	(0.077)	(0.062)	(0.062)
Δ FF x WSF	-0.041**	-0.044***	-0.038**	-0.038**
	(0.017)	(0.015)	(0.016)	(0.016)
Time f.e.	Y	Y	Y	Y
Bank f.e.	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y
County-bank f.e.	Y	Y	N	N
County-time f.e.	Y	N	N	N
Observations	579,682	579,682	579,682	579,682
R^2	0.836	0.820	0.240	0.240

This table estimates the specifications from Table VI of Drechsler, Savov, and Schnabl (2017) while controlling for bank reliance on wholesale funding. WSF is the ratio of wholesale funding to retail deposits (see footnote 16 for details). *p<0.10; **p<0.05; ***p<0.01.