Loan Volatility and Wholesale Funding in Iranian Banking System

Mahshid Shahchera
Assistant professor
Monetary and Banking Research Institute (MBRI)
Central Bank of Iran

Abstract

This paper survey the relationship between wholesale liabilities and loan volatility. This paper argue that the low volume of retail deposits introduce costly to adjust to shocks in the volume of bank assets, banks facing more intense uncertainty and more volatile loan demand tend to employ more wholesale liabilities rather than retail deposits. Banks surface high uncertainty as measured by the volatility of loan volumes that have significantly lower ratios of retail deposits to total liabilities. Banks also tend to adjust their retail deposit volumes slower to loan volume shocks relative to banks facing lower volatility. This paper using a unique dataset of Iranian banking system and dynamic panel data show that liability structure hasstatistically strongly significant effect of bank-level loan volatility on the structure of bank liabilities. Banks react to loan shocks by mainly adjusting their wholesale volumes while the later are quicker to modify retail deposit volumes.

Keywords: liability structure, wholesale funding, loan volatility, Dynamic panel data.

Jel: G10,G21,C23.

1. Introduction

The 2007-2009 financial crises had shown that support on wholesale funding increases the exposure of banks to liquidity risk. In the course of the crisis it became evident that banks that fund a substantial share of their assets with wholesale liabilities develop under critical conditions subject to liquidation burdens. These burdens raise the negative externalities with adverse effects for the financial system. Such externalities include higher volatility of bank asset volumes and an extension of macroeconomic shocks (see Ratnovski and Huang 2011, Ivashina and Scharfstein 2010, Segura and Suarez 2012, Brunnermeier and Oehmke 2013).

An extensive theoretical and empirical literature recognizes wholesale funding as afactor increasing the uncertainty of both individual banks and the banking system as awhole (see Ratnovski and Huang 2011, Ivashina and Scharfstein 2010, Segura andSuarez 2012, Brunnermeier and Oehmke forthcoming).according to this literature, wholesale liabilities increases liquidity risks and increase speed of the transmission of financialsystem shocks. In response to the negative externalities of wholesale funding a numberof policy measures such as Basel III's net stable funding ratio and the introduction of atax on non-core bank liabilities (Shin et al 2011) have been proposed.

Flannery's (1982) show that the bank as a firm which employs retail and wholesale liabilities in the invention of loans and alternative assets. Following this approach the key difference between retail and wholesale liabilities is that retail deposits despite their short maturity are typically costly and slow to adjust in both an upward and a downward direction, while wholesale liabilities can give their short maturity and low adjustment costs and adjusted to shocks immediately and free of costs. The costs of adjusting bank retail deposits can be viewed in two alternative directions. Any rise in the volume of retail deposits that goes beyond an exogenous shift in deposit supply will generate substantial costs to the bank. (Hannan and Berger 1991), any decrease in the volume of retail deposits is again costly since depositors haveto be compensated for their decision to "abandon" the bank. These costs of reducing the volume of retail deposits correspond to the irreversibility of investment in a macroeconomic sense. They become particularly relevant in the case when a bank operating in an uncertain environment "overinvests" in retail deposits. (Flannery and James (1984)

According to empirical observations (Shin 2011), wholesale liabilities can typically be adjusted almost free ofcosts. Shin 2011 show that in creditboom times some banks are able to extremely fast inflate their balance sheet by heavieruse of wholesale liabilities. Wholesalefunding can become too costly to adjust in a situation when either the bank orthe banking system as a whole is in distress.

This situation of volatile wholesale adjusts costs that the recent literature (Huang and Ratnovski 2011,Segura and Suarez 2012) has been focused on when modeling the negative externalities arising from short-term wholesale funding.

Bank'suncertainty appears from banking market deregulation which permits market entry of new players and a redistribution of loanmarket shares. Loan volatility certainty can, as well, emerge from global trends not necessarily restricted to the financial industry, such as the globalization and market deregulation of particular industries, which affect firms' investment behavior and therefore the demand for loans of the banks typically serving these industries. These sources of uncertainty correspond closely to the sources of uncertainty faced by non-financial firms discussedby Bloom et al (2007).

This paper contributes to the analysis of bank liability structure in banking and exploring the role that a bank's loan volatility about the demand for its assets plays in the bank's choice between alternative bank liabilities.This paper focused on relationship between loan volatility and funding in Iranian banking system.

This paper is organized as follows. In the section 2, paper show that the relationship between loan volatility and liability structure. The next section overviews the literature on bank funding and loan volatility in banking. Section 4 presents the data and discusses some summary statistics and the econometric framework and discusses the main results. The final section is concludes.

2. Loan Volatility and Liability Structure

A balance sheet is a financial report that shows the value of a company's assets, liabilities, and owner's equity at a specific period of time, usually at the end of an accounting period, such as a quarter or a year. An asset is anything that can be sold for value. A liability is an obligation that must eventually be paid, and, hence, it is a claim on assets. The owner's equity in a bank is often referred to as bank capital, which is what is left when all assets have been sold and all liabilities have been paid. A bank uses liabilities to buy assets, which earns its income. By using liabilities, such as deposits or borrowings, to finance assets, such as loans to individuals or businesses, or to buy interest earning securities, the owners of the bank can leverage their bank capital to earn much more than would otherwise be possible using only the bank's capital. A liability is a source of funds. Liabilities are either the deposits of customers or money that banks borrow from other sources to use to fund assets that earn revenue. Deposits are like debt in that it is money that the banks owe to the customer but they differ from debt in that the addition or withdrawal of money is at the discretion of the depositor rather than dictated by contract.

Banks have been transformed the balance sheet as increased in deposit funding. This is due to decrease of risking of customer balance sheets and slowdown in corporate investment. Also, banks change in structure of asset side of balance sheet,and then banks continue the decrease of risk .increasing in liquid asset and decreasing loan can help to banks in this case. Some banks have balance sheet that are unprepared for new condition, then they use the expensive liabilities. Funding optimization and liquidity optimization is very important for these banks. By reduce of cost of funds banks can gain a signification lift in margin.

Wholesale funding refers to the use of deposits and other liabilities from institutions such as banks, pension funds, money market mutual funds and other financial intermediaries. When a firm relies on short-term wholesale funds to support long-term illiquid assets, it becomes vulnerable to runs by wholesale creditors.

Wholesale funding varies from the traditional source of funding that a commercial bank would use. Traditionally, banks used core demand deposits as a source of funds, and they are an inexpensive source of financing. Deposits denote a liability for the banks, and those deposits are lent out and become income-producing assets. Wholesale funding is a "catch-all" term, but mainly refers to federal funds, foreign deposits and brokered deposits. Some also contain borrowings in the public debt market. Traditional banks can use wholesale funding as an alternative, but commercial finance companies are mainly dependent on this source of funding.

Wholesale funding represents a way to increase or to satisfy funding needs. Sometimes, banks may have trouble attracting new deposits. Wholesale funding can be a good way of expanding the balance sheet, but are more volatile.

This paper investigated the loan volatility and funding in banking then the measure of loan volatility is very important. A key measurement issue in testing the effect of loan volatility on bank liability structureis the choice of appropriate loan volatility measures.

Theaim of explaining the response ofbanking funding structure to uncertainty about the volume of loans needs measures that are not exclusively driven by aggregate factors but can as well affect thevolatility of the environment faced by banks. The volumes of loans may be rising from several sources. Besides business cycle effects and aggregate shocks that affect all banks and therefore make variation of uncertainty.

More specifically, this paper uses the measures for the volatility of loan volumes. According to the Bloom et al (2007), this paper investigates the standard deviation of the loan volume (LOANS SD) as a classical measure of volatility. The other loan volatility measure in this paper is Skewness (NEGATIVE SKEWNESS) of the loan volume.Thismeasure show that the case when a bank is cautious about "overinvesting" in retail deposits which exceed the amount of loan demand. Tornell et al (2008), for example, employ loan volume skewness as a volatility measure in an aggregate level analysis of financial system risk. (dinger, craig, 2013)

The use of loan volume dynamics facesthree major identification challenges. The first one is associated to the fact that both the loan volumesand their volatility can be affected by the liability structure. The bank that heavily relies on wholesale funding finds itself in a situation when it has to liquidate loans since it is unable to rollover short-term wholesale debt. In this casefocus on movements in loan volume that unrelated to liquidity issues. This identification challenge willbe solved in both the static and the dynamic model through the advantages of the highfrequency of the data which allows us to precisely track the timing of loan, deposit andwholesale funding volume changes.The second challenge reflects the spurious relation between securitization, loan volume volatility and funding structure. Using on-balance-sheet loan volume variation investigates the risk of banks. If loans appear on the balance sheet immediately after origination and disappear from the balance sheet once they are transferred to a special purpose vehicle for securitization. For those banks that will observe both a high volatility of the loan volume and a low reliance on retail liabilities for reasons that have nothing to do with uncertainty. The advantage of this measure is that it will not reflect the ups and downs of the loanvolume. The third challenge is related to the fact that the observed positive correlation between wholesale funding and loan volatility can appear from a self-selection of risky banks into both riskier funding as well as riskier (more volatile) assets. This selection distress are on the one hand mitigated, by the fact that our focus is on the volatility of loan volumes rather than on loan returns' volatility (which is a more direct measure of the banks' riskiness). (dinger, craig, 2013)

3. *Literature Review*

The study related with this paper focused on the identification of bank liability structure determinants. This literature investigate reasons for the use of wholesale funding including bank market power (Berlin and Mester 1998; Craig and Dinger, 2010) and market entry barriers (Park and Pennacchi 2008; Dinger and von Hagen 2009); taxes (Pennacchi et al 2010); a shift to a new originate-and-distribute business model (Gorton and Metrick 2011); as well as the fact that in periods of lending booms the growth rate of deposits is insufficient to cover loan demand needs (Shin et al 2011).

A theoretical and empirical literature identifies wholesale funding as aelement increasing the loan volatility in the banking system (Ratnovski and Huang 2011, Ivashina and Scharfstein 2010, Segura and Suarez 2012, Brunnermeier and Oehmke forthcoming). This works show that the extreme use of uninsured bank wholesale liabilities increases liquidity risks and accelerates the transmission of financial system shocks. In response to the negative externalities of wholesale funding a number of policy measures such as Basel III's net stable funding ratio and the tax on non-core bank liabilities (Shin et al 2011) have been suggested. These proposed increase stability in the banking system by limiting the use of wholesale funding.

Altunbas et al. (2011) and Demirgüc-Kunt and Huizinga (2010 find no evidence that banks that depend on wholesale funding are more risky than banks that primarily fund their activities by customer deposits. Song and Thakor, 2007 and Shleifer and Vishny, 2010 show that wholesale funding as a more stable source of funding. Altunbas et al. (2011) and Demirgüc-Kunt and Huizinga (2010) focus on large and listed banks that primarily depend on wholesale funding.

Adrian and Shin (2010) show that leverage among U.S. investment banks, who mainly rely on market-based wholesale funding to fund their investment activities, is strongly procyclical. They do not find such leverage procyclicality for commercial banks who rely less on wholesale funding. As these funding sources are important for high wholesale funding users, when the markets become illiquid, their ability to quickly adjust leverage declines, leading to weaker procyclicality of leverage.

This result is also consistent with Brunnermeier and Pedersen (2009) that investigate a theory that links market liquidity and funding liquidity through the margin requirements for financial intermediaries. Since margin requirements for financial institutions to raise can increase during slumps, available funds for investment decrease, falling market liquidity. Such market and funding illiquidity would show up as weaker procyclicality of leverage, as the financial institution's ability to adjust leverage and investment declines.

Haung and Ratnovski (2010) analyze a model that in this model survey correlation wholesale funding vs. retail deposits.

According to the Damar et al (2011), Bank leverage procyclicality occurs when asset fluctuations are financed with non-equity funding.Wholesale funding is one such funding that allows quick adaptation to leverage. Hence, bankswith wholesale funding are expected to exhibit higher leverage procyclicality. The findings suggest that procyclicality exists and its degree positively depends on the use to wholesale funding. banking-sectorin Canada leverage procyclicality can forecast volatilityin the equity market.

Blum (2008) shows that a simple leverage ratio along with capital requirements based on banks' internal risk assessments can result in exposures of banks' risk levels. Geanakoplos (2010,2012) theoretically examines adverse effects of leverage fluctuations in the environment where leverage is determined in equilibrium together with interest rates. The paper shows how leverage cycles damage the economy and argues for regulations to control them. Bordeleau, Crawford, and Graham (2009) discourse the historical evolution of regulatory leverage limits in Canada and analyze how large Canadian banks manage leverage with respect to these limits. They find some large banks manage the relationship between their leverage and the regulatory limit. Committee on the Global Financial System (2009) provides some international policy discussions regarding leverage procyclicality.

Dinger and Craig(2014) survey empirical study of the relation between bank loan volume volatility and bank retail and wholesale liabilities. We argue that since the volume of retail deposits is inflexible, banks facing volatile lending tend to fund loans with larger shares of wholesale rather than retail liabilities. The results imply that the introduction of regulatory limits on wholesale liabilities will increase the exposure of banks to loan demand shocks. Such a regulation will also inhibit the ability of the banking sector to service more volatile loans. This may smooth the lending cycles, but it will also slow recoveries of lending volume after a substantial recession.

4.The Models and Results

We start the empirical analysis by estimating the relations between loan volatility and wholesale funding in Iranian banking system.

Financial data for the Iranian banks were obtained from the Bankscope Database of Bureau van Dijk's company, macroeconomic information from the Central bank of Iran Database. This model estimated with an unbalanced panel data for 25 commercial banks (private and own state banks) in Iran. The time period (2000-2013) was partly chosen by data availability.

The model of loan volatility and bank wholesale funding is similar to the survey of Dinger and Craig, 2014. Then, this paper focuses the structure of liability and wholesale funding. The independent variable is wholesale funding in Iranian banking system. A static framework using the following econometric model:

$$WSF_{i,t} = \alpha_0 + \alpha_1\ Volatility_{i,t} + \alpha_2 X_{i,t} + \varepsilon_{i,t} \tag{1}$$

Where WSF is wholesale funding thatdenotes the structure of liability and the difference of total liabilities and customer deposits in balance sheet.

Bank$i$ in Year$t$, Volatility$i\ t$, is a measure of the loan volatility the bank.

This paper investigates the standard deviation of the loan volume (LOANS SD) as a classical measure of volatility. The other loan volatility measure in this paper is Skewness of the loan volume. This measure show that the case when a bank is cautious about "overinvesting" in retail deposits which exceed the amount of loan demand.

The$X_{i,t}$ is the Specific bank variable. The variable includes return on asset and return on equity for profitability.

The deposit ratio and adequacy ratio and size are the other variables effectiveness on whole sale funding.

The non-performing loan is effect on the whole sale funding. The independence of variable in macroeconomic effect is inflation. Logarithm asset size will be used as an independent variable for the regression analyses.

It is used the return on equity (ROE) as a measure for the cost of capital and an explanatory variable in model and expects that its impact on capital ratio will be positive. Decreasing in ROE would indicate that banks holding an excess of capital as a cost (Ayuso et al., (2004).then, the decreasing cost of capital increase whole sale funding.

Table1: Summary Statistics

variable	Mean	Median	Std.Deviation
Loan to total asset	0.186	0.125	0.159
Wholesale funding	52.55	53.97	13.73
Nonperforming loan	12.58	10.96	9.02
Adequacy ratio capital	0.47	0.054	2.49
Size of bank	5.008	5.04	0.796
Return on asset	1.25	0.66	1.97
Return on Equity	15.98	14.46	14.23
Current loan to total asset	5.87	4.44	5.19

Descriptive statistics for the variables are displayed in table 1. The average of loan to total asset in the sample is around 52 percent. The mean of return on wholesale funding was 0.186 during the sample period. The share of deposit in total asset is 47.09 percent.

Before estimating the Equation, it is necessary to test unit root of all applied variables in estimations, because unit root variables create quasi regression problem for both time series data and panel data. Therefore, Levin, Lin and Chu test, Im, Pesaran,Shin W-stat test and Fisher test and Hadri stat are used to study common unit root of variables. Results are represented in table (2).

Table2: Results of Common Unit Root Test Related to Variables

Variable	Levin, Lin, Chu t.	Im,Pesaran,Shin W-stat	ADF – Fisher Chi square	PP- Fisher Chi_square	Hadri Stat
Loanto asset	-32.09 (0.000)	-2.18 (0.0145)	94.138 (0.0002)	108.632 (0.000)	11.97 (0.000)
Wholesale funding	-41.65 (0.000)	-11.24 (0.000)	121.19 (0.000)	157.6 (0.000)	3.37 (0.0004)
NPL	-7.66 (0.000)	-1.29 (0.099)	84.5 (0.0016)	78.092 (0.0067)	13.73 (0.000)
Adequacy ratio capital	9.63 (0.000)	-0.332 (0.037)	65.779 (0.066)	152.114 (0.000)	50.13 (0.000)
Size	-37.54 (0.000)	-2.53 (0.0057)	88.05 (0.0007)	116.92 (0.000)	12.48 (0.000)
Roa	-14.64 (0.000)	-1.34 (0.088)	84.74 (0.0016	143.88 (0.000)	8.35 (0.000)
Roe	-17.85 (0.000)	-4.214 (0.000)	104.481 (0.000)	198.43 (0.000)	7.746 (0.000)
Current loan to total asset	-4.22 (0.000)	-3.2 (0.0007)	87.49 (0.0008)	110.55 (0.000)	5.39 (0.000)
Inflation	-33.36 (0.000)	-1.54 (0.063)	90.6 (0.0004)	53.73 (0.033)	51.85 (0.000)

One of the advantages and applications of pooling data is better understanding of dynamisms by the researcher. Dynamic relations are modeled by presence of interrupted dependent variables among explanatory variables of the research. Autocorrelation problem is revealed because of presence of the interrupted dependent variables among explanatory variables and heterogeneous sectional effects among the sections. GLS estimator will be biased by assumption of random effects for dynamic pooling data. Arellano and Bond proposed a process from generalized method of moments in 1991 that was more efficient than previous estimators. Generalized method of moments for dynamic panel models that has been developed by Arellano and Bond, Arellano and Boyer is used to estimate the above model. Tools matrix is applied to eliminate correlation of interrupted variable and other explanatory variables. In this method Arellano and Bond represented two-step GMM estimator.

Validity of tools matrix in this estimation is examined by Sargan test. Null hypothesis in the above test indicates non-correlation of tools with disturbing elements. Amount of probability of Sargan test's statistic is calculated as shown in table 3. Then, null hypothesis indicate non-correlation of tools with disturbing elements could not be rejected. Therefore, we conclude that the applied tools for estimation have the necessary validity.

Table 3 presents the results of estimating equation (1). For all banks in the Iranian banking system, the coefficient of the lag of wholesale funding is significant.

Regarding the coefficient of lagged whole sale funding, the result show that a point estimate of near 0.5(significant at the 1% level) which shows that the dynamic model is a good choice in explaining structure of whole sale funding.Wholesale funding represents a way to expand or to satisfy funding needs. Sometimes, banks may have trouble attracting new deposits. Maybe interest rates are so low that customers don't find the low rates attractive.

Table 3: Results of Estimation Effect of Vitality of loan on whole Sale Funding

Independe nt Variable	Estimation 1	Estimation 2	Estimation 3	Estimation 4	Estimation 5	Estimation 6
Wholesale funding(-1)	0.417 (25.75)	0.4222 (27.1)	0.481 (21.2)	0.502 (22.4)	0.467 (25.4)	0.469 (20.12)
Skew loan	2.63 (24.97)	2.91 (32.7)	3.24 (20.1)	3.33 (25.1)	----	---
Loan SD	---	---	---	---	-1.13 (-1.79)	-1.11 (-2.64)
NpL	-0.0025 (-3.35)	-0.00223 (-4.21)	0.0061 (-2.21)	-0.006 (-2.98)	-0.0081 (-3.13)	-0.0072 (-2.65)
Current loan/total asset	---	---	0.0105 (7.4)	0.106 (10.12)	0.0146 (13.31)	0.0126 (8.21)
Roe	0.000953 (8.2)	---	---	---	---	0.00107 (4.4)
Adequacy capital ratio	-0.00053 (4.26)	-0.0003 (-1.77)	-0.00036 (-2.18)	---	---	---
Roa	---	0.0066 (4.68)	0.0094 (5.03)	0.0117 (2.7)	0.0111 (2.25)	---
Size	---	---	---	0.013 (2.01)	0.0127 (2.29)	0.0064 (2.94)
Inflation	-0.00159 (-2.21)	-0.00168 (-2.25)	-0.00155 (-3.31)	-0.00148 (-3.13)	-0.00165 (-2.98)	-0.0017 (-2.68)
J-static (Rank) Sargan-Test	21.48 (25)	22.88 (25)	22.5 (25)	21.22 (25)	22.8 (25)	20.23 (25)

The volatility of loan as uncertainty of bank has positive effect on whole sale funding. Banks facing volatile loan demand tend to fund loans with larger shares of wholesale rather than retail liabilities. The skew of loan has positive effect and significant but the loan SD has negative and the low significant. The negative skew of loan show that the banks face on exceed of loan demand the banks needs more funding and wholesale funding. The standard deviation of loan as volatility has changed the makeup of investment portfolios across all plan types. This volatility has caused plan sponsors to review and rethink their asset allocation. Then, increasing vitality loan increase the risk and it provide the decreasing in the wholesale funding.

Non-performing loan is negative coefficient in Estimation. Banks with high Non-performing loans facing uncertainty and cannot allocate banking resource.

Return on asset and return on equity is positive and significant coefficient in this model. Then, the profitability is positive effective in liability structure and whole sale funding.   Banks adjust their asset side quickly in the changing the whole sale funding. Loan rates are more sensitive to wholesale funding conditions than household lending growth and rates.Banks realize this adjustment by varying their wholesale lending rather than their retail lending, since in the former has a shorter maturity and a higher risk profile than the latter.Large banks are typically more dependent on wholesale funding. Large banks have more whole sale funding. The coefficient of the size of bank is positive in Iranian banking system.

The adequacy capital ratio has negative effect and significant on whole sale funding. Banks with high capitalization has low whole sale funding in Iranian banking system. The current loan to asset ratio is significant and positive effect on whole sale funding. Banks by whole sale funding can increase in loan and intermediate financing.

Bank size may affect capital structure through several channels. First, if there are economies of scale, large banks should hold relatively less capital. Second, large banks may have better investment and variety opportunities. Thus, they are subject to lower probability of a large negative shock to their capital and need to hold a lower capital. And finally, the 'too-big-to-fail' hypothesis' suggests that larger banks in financial distress are more likely to be bailed out, because of potential systemic effects. Taking into account these considerations, we include size effects with an expected negative sign.

The size of banks effects whole sale funding as a bank capital structure. The tendency which emerges from all the previous studies is that the analysis also suggests that the bank size is an important determinant of capital structure at least and it is inversely related to the capital level. Larger banks have more difficult systems to use capital more efficiently and they are also able to access capital from financial markets at more favorable terms. According to the survey of Kleff and Weber (2008), they find that the large banks maintain less capital ratio than small banks because they are able to cover their funds requirements from external sources easily and the influence to whole sale funding.

The cost of capital proxies by *ROE* has a positive impact (significant) on the whole sale funding. This would mean that banks in Iran preferred to increase profits in order to increase whole sale funding.

5.Conclusion

We explicitly focus on loan volume volatility as a main determinant of the variability of bank funding needs. Banks rely on wholesale funds to supplement traditional retail deposits. During credit booms, the increase in bank lending may exceed the pool of available retail deposits, with powerful competition for household and corporate savings among banks and from alternative investment institutions. Many banks turn to wholesale funding to fill their funding gap and finance a broader range of activities.Banks change their asset side quickly in the changing the whole sale funding. Loan rates are more sensitive to wholesale funding conditions than household lending growth and rates.

The adequacy capital ratio has negative effect and significant on whole sale funding. Banks with high capitalization has low whole sale funding in Iranian banking system.

The current loan to asset ratio is significant and positive effect on whole sale funding. Banks by whole sale funding can increase in loan and intermediate financing.

The vitality of loan as uncertainty of bank has positive effect on whole sale funding. Banks facing volatile loan demand tend to fund loans with larger shares of wholesale rather than retail liabilities.The skew of loan has positive effect and significant but the loan SD has negative and the low significant.The negative skew of loan show that the banks face on exceed of loan demand the banks needs more funding and wholesale funding. The banks reliance on deposit funding would become more difficult to sustain wholesale funding that become more important because of the slowness in overall income increases, the global failure in income shares. Therefore, clarifying the role and the effects of the banks' wholesale funding on the macroeconomic dynamics would be a meaningful work.Although the share of wholesale funding on bank's total liabilities is low volume in Iranian banking system but its impact on the real economy should not be ignored and wholesale funding leads to a more volatile loan.

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