Empirical assessment of the impact of banking sector development on firm external financing, using the MELR model

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Abstract: - By combining microeconomic and macroeconomic factors, this paper aims to present a new approach of assessing the impact of the banking sector development on the financing of businesses with loans in some SEE countries. The firm's probability to have a loan with a commercial bank is assessed taking into consideration it's characteristics as well as banking sector development indicators, thus considering the supply and demand side, this because according to some studies, the banking sector is not always willing to provide loans to all types of businesses or even certain sectors. In order to reach reasonable conclusions we utilized The Mixed effect logistic regression (MELR), which is appropriate for hierarchically structured data. Econometric results show a positive relationship between banking sector development and the financing of businesses with loans, this tested in several models.

Key Words: financial development, financial constraints, mixed effect logistic regression

1 Introduction

Banking sector development analysis is essential to assess its impact on economic growth, this by focusing on the size and trend of its growth. However, it is difficult to measure financial development and to include in the analysis all the indicators and institutions that represent it. We can say that there is no single indicator to measure the financial development, which is why different authors have measured it differently. Beck and Levine [3] measure it through the variable that takes in consideration the overall activity of financial intermediaries and capital markets, i.e. the value of credits by financial intermediaries to the private sector divided by GDP and Value Traded. In the same context Rajan and Zingales [24] emphasize that the development of the financial sector should be measured by the ease of the connection between savers and borrowers which is enabled by the variety of financial institutions, efficiency in their performance and the legal system which ensures their functionality and performance. In this regard, Čihák et al., [8] treat four aspects of the financial sector: depth, access, efficiency and stability, each aspect measured by certain indicators. Thus, following the path applied by Čihák et al., [8] the International Monetary Fund staff has created an index that includes three aspects of the financial sector: depth, access and efficiency.

Analysis of the banking sector's potential to support the business sector with credit using the microeconomic aspect represents the main purpose of this paper, with a particular focus on the firm's access to external financing sources provided by the banking sector. The applied econometric model firstly intends to conclude whether companies are financially

constrained due to their characteristics or the problems on the demand side. One of them is the risks associated with the firm's sector, which is often a barrier for getting a loan, as some sectors may be having a poor performance. Another problem is the firm's financial ability to repay the loan or to secure the loan by fixed assets, or collateral, etc. Secondly, we intend to capture the occurrence of financial constraints due to supply side problems, like insufficient development of the financial sector. The results shows that countries that have a developed banking sector have more credit financed firms, while the firm's characteristics help to reduce asymmetric information problem and have a significant weight on bank decision to approve the loan. In addition, the applied empirical analysis shows that only one indicator cannot do the measurement of the banking sector development; therefore taking into account simultaneously different indicators of its development is essential.

2 Literature review

2.1 A-priori classification of financially constrained firm

In the literature, the firm's financial constraint or the ease of business access to external funds is often used as a measure of business support from the financial sector. This approach follows two directions: first, by analysing the impact that some of the firm's characteristics have on the bank's decision to approve loan request and secondly, by using the Investment cash flow sensitivities.

It is thought that financial constraints occur due to various factors, such as: asymmetric information, agency problems, transaction costs, etc., also known in general as the problems of imperfect markets, on the one hand, and on the other, the lack of financial sector development (11,14, 2]. The dilemma that when a firm is classified as financially constrained, respectively what is the relationship between business needs for external funds and the access, is not yet definitive in the literature of this field, therefore different authors use different definitions for financially constrained firms. One way of classifying firms as financially constrained is the a-priori classification. Bigsten, Collier, Dercon, Fafchampus, Gauthier, Gunning and others [6] use this approach by defining two groups of firms. Unconstrained firms, those who declared that they do not need a loan or have been able to receive the required loan, and as financially constrained, those who declared that the loan was rejected or did not apply because their expectations were that they would be rejected. Similarly, Ferrando and Ruggieri, [10] classify firms as being absolutely constrained if they cannot obtain any external funds; relatively constrained if they have access to external funds but expensive ones; and unconstrained if they have access to external funds but who, on average, pay the lowest cost on the market.

The a-priori classification approach has been subjected to criticism, this because it is said that it is based on the author's intuition rather than on any concrete financial data. Another critique is related to the fact that this classification does not allow a firm to pass over time from one classification to another, knowing the fact that determining factors may differ either on the demand side or on the supply side [12, 23].

Recent literature emphasizes that firm's characteristics are an important factor in order to reduce asymmetric information problem. Therefore banks perform their examination or as Stiglits and Wiss, [27] have called a "screening device" which includes a set of factors that influence decision making on whether the loan should be approved or not. Four mechanisms or phases influence the decision-making on customer financing, such as; signaling, screening, monitoring and self-selection. Signaling means reviewing the documents provided by the firm, examination means proofing them by requesting additional information, monitoring means continuous monitoring of the firm by the bank, while self-selection implies not applying for a loan when firms self-assess their situation.

2.2 Balance sheet data for classification of financially constrained firm

Balance sheet data enable firm's classification based on their level of financial constraints. If

firm's balance sheet shows the increase of investments on the debit side and at the same time an increase of external funds at more expensive costs than bank loans, on the passive side, then we can consider a presence of financial constraints. Balance Sheet data also provides information on leverage levels, which is often used as one of the ways to measure the financial constraints, as it indicates the amount of external debt relative to total assets. Rajan and Zingales [24] used the leverage variable because it is intended that the firm will finance capital expenditures with internal funds until they are not sufficient and then seeks for external funds.

The financially constraint problem stems from imperfect markets which increases borrowing costs, who are called the costs of financial constraints. One of the main factors of different levels of financial constraint is the problem of asymmetric information, which is why many papers have started with the assumption that small firms are more financially constraint compared to large ones, as larger firms have a longer financial history and have physical capital that can be pledged as collateral. In support of this, there is sufficient empirical evidence that the development of the financial sector reduces the financial barriers for all firms, especially small ones [4, 5]. In addition, Love [21] shows that from the development of the financial sector and the legal system mostly benefits small firms as their financial constraints decreases. However, according to Rehman, Wang and Yu, [25] firms of different sizes do not have the same requirement for external funds during their operating cycle. They analyze the leverage levels according to the business cycle performance and ascertain that firms use the "low-high-low" strategy to keep the leverage level. They argue that at the beginning, firms are underdeveloped or at "growing", have fewer external funding opportunities, but with the firm's growth the opportunities to invest increase and so do the external funding needs, while in the decline phase the investments shrink and the demand for external financing falls.

3 Methodology and findings

This paper uses BEEPS data obtained from surveys conducted by EBRD in cooperation with the World Bank. We have used the data for six countries of Southeast Europe (Albania, Croatia, FYR Macedonia, Kosovo, Serbia and Slovenia) conducted in four rounds in the period 2002 - 2013. The data on indicators of banking sector development derived from World Bank Database.

In order to conclude about firm's financial constraint, the impact of the banking sector development on the firm's probability of having a loan with a commercial bank is analysed. For this reason we use the question: "Referring to the most recent line of credit or loan, what type of financial institution granted this loan?". This variable intends to apprehend firm's external funds provided by commercial banks, taking the value of one if the answer was "Private Commercial Banks" and zero otherwise. This is the dependent variable, while the explanatory variables are as follows:

a) Firm's characteristics

- *Profitability* is a variable that demonstrates the ability of the firm to repay the loan, but at the same time shows the performance of management, thus reducing the problem of asymmetric information. For the measurement of profitability, we have used binary values, if the firm in the respective year was profitable, takes the value of one, and zero otherwise.

- *Fixed Assets* intend to capture business capabilities to offer collateral required by banks as a way to reduce the risk of non-payment. According to the so-called Credit Multiplier, if the firm has more collateral, it enables higher lending by the bank, which consequently leads to other investments in fixed assets [18]. This variable is constructed using the value of the firm's fixed assets available in the respective year.

- *Sector* is an important variable included in the model, because different sectors have different risk levels. We use Manufacturing sector as a benchmark for other sectors.

- *Size* is used to capture different bank approaches to different firm sizes due to the risk they carry. We use a dummy variable, taking

the value of one for small firms and zero otherwise.

- *Age*, similar to size, has been used in many researches, as it is believed that older firms are less likely to risk because they have experienced management in taking appropriate decisions. In this research, this variable is defined by calculating years of operation as a difference between the fiscal survey year and the year of business registration.

- *Firm's legal status* is included in the model in order to find out which of these types of businesses are more funded by commercial banks. This variable will also be dummy, using Sole proprietorship as a benchmark

- *Audit of financial statements* is another variable, which is believed to significantly reduce the problem of asymmetric information. It takes the value of one if the business had the audited financial statements and zero otherwise.

b) Banking sector development indicators

- *Private credit to GDP* is an indicator that expresses financial sector depth. This indicator is used either as a measure of the size of the financial system or as an indicator of the distribution of assets (loans) [20]. For the same reason this indicator is also used by [1, 7, 9].

- *Lending-deposit spread (LDS)* as an indicator of the banking sector development, expresses its efficiency as it indicates the interest rate elevation and represents the difference between the interest rate applied for the loan and the rate charged for deposits. The importance of this indicator relies on the fact that, besides showing the efficiency of the banking sector, it is also one of the main determinants of loan demand and supply.

- *Non-performing loans ratio (NPL)* is one of the indicators that expresses the stability of the banking sector. According to Mehl and Winkler [22] to analyse the development of the banking sector, it is also important to take in consideration Basel standards requirements. We consider that banks in SEE countries are stable with regard to these requirements, which are why in this paper we will measure the stability of the banking sector through the credit default rate as a factor that reduces access to finance, as it is an indicator of increased market risk.

- *The FII* or the Index of development of financial institutions is an index developed by the International Monetary Fund, which indicates the level of development of financial institutions in terms of depth, accessibility and efficiency.

Given the data used in this paper, we consider that the appropriate econometric models are multilevel models or hierarchical models. These models are adequate when data is organized hierarchically [17]. These models are appropriate to show the influence that variables at the individual and group level have on the dependent variable [28]. Thus, in this research the data is pooled cross section, which combines time series and cross-section elements [12], where observations do not necessarily mean to be the same in all periods.

The general model employed in the empirical framework represented by different estimation models is as follows:

$$Y_{jkt} = \alpha + \beta 1\, f_{jkt} + \beta 2\, F_{kt} + \beta 3\, (F_{kt} * S_{kt}) + \mu_{jk,t}$$

Y - dependent variable, f - the matrix of the variables that represent the firm's characteristics, F - different indicators of banking sector development, S - the legal system and μ-error; jkt express: j-observation, k-place and t-time. Thus, the primary objective of this paper is to assess the impact of financial sector development on financing of businesses with loans, while the secondary interest is whether this funding differs between countries. Given the used data, which are grouped according to a hierarchical structure, i.e. businesses grouped at country level, we use the Mixed effect logistic regression model. Thus, among others we intend to see the impact of the variance attributable to changes due to the country's banking sector development. Since the dependent variable is dichotomous $Y_{jkt} = 1$ or 0, as the research objective is the probability that Yjkt = 1, π (xjkt), so:

The probability that $Y_{jkt} = 1$, is πjkt,
The probability that $Y_{jkt} = 0$, is 1- πjkt

Following Krasniqi and Williams [19], we test whether the mixed effect logistic regression model is suitable according to available data. We started with the M0 model that examines only the variance between counties.

$$\log\left[\frac{\pi j\, kt}{1-\pi j\, kt}\right] = \beta 0j+\mu 0jt$$

Then we continue to test other models through introducing X, which represent different firm characteristic, and δ, which is represented by four financial sector development indicators. The model will be expanded further through an interaction variable, which expresses the impact of the legal system (γ) on the banking sector, and consequently on the possibility of bank lending (δ* γ), so the final model takes the form:

$$\log\left[\frac{\pi j\, kt}{1-\pi j\, kt}\right]=\beta 0j+\beta 1Xjkt+\beta 2\delta kt + \beta 3(\delta^* \gamma)kt +\mu jt +\eta jk$$

μjt- is the random intercept which represents all the effects of unexplained variables in X which do not change over time. This variable is expected to have a normal distribution with mean zero and constant variance. While *ηjk* - is random intercept which represents all the effects of unexplained variables in δ.

The null hypothesis of the fixed effect is that there are no differences in the average of the treated groups:

$$H0: \mu j1=\mu j2=\mu ji$$
$$H1: \mu j1\neq \mu j2\neq \mu ji$$

Through the random effect, we aim to test whether there are differences between countries regarding the firm ease of obtaining a loan. Thus, the null hypothesis for the random effect states that the variance between countries is equal to zero:

$$H0: \sigma^2\beta = 0$$
$$H1: \sigma^2\beta > 0$$

4 Results and interpretation

The applied econometric model assess the firm probability to have a loan with commercial bank, thus analysing firms that use bank loans in their capital structure, caused, inter alia, by the growth of banking sector development. In order to reach the reasonable results of explaining this link, the model contains variables that are believed to reduce the asymmetric information problem combined with variables that measure the level of banking sector development.

Through the likelihood-ratio test (LR), we test model adequacy. This test compares the applied model with Ordinary linear regression and shows that the use of Mixed effect logistic regression is adequate. In addition, to find out which of the applied models are appropriate in this case, some other diagnostic tests are used. The Deviance Statistic tests the null hypothesis that the addition of explanatory variables does not improve the suitability of the model. The null hypothesis of this test, which says that the explanatory variable coefficients added to the pattern are zero, shows that model M6 has the smallest deviation. This indicates that the additional explanatory variables included in model M6 but which are not included in other models, are more adequate to explain the probability of having a loan with commercial banks. For the same purpose, AIC and BIC tests are used. In addition, according to these tests the appropriate model is M6.

The Intra class Correlation Coefficient (ICC)[1] varies from M0 to M6, showing that including simultaneously all the tested indicators that express the development of the banking sector, significantly increases the model's explanatory power. Thus, ICC of the M1 shows that 2.7% of the variance of probability of having a loan with commercial bank is attributed to the differences between countries, while 97.3% of the remaining variance is attributed to differences between companies. Meanwhile, these figures for model M6 are 21.4% respectively 78.6%.

In model number 1, the development of the financial sector is measured by the index established by the International Monetary Fund. This index shows a positive relationship with the probability of having a loan with

[1] For Mixed effect logistic regression the ICC is calculated based on the formula: $ICC = \frac{ó c^2}{ó c^2+\delta^2/3}$

commercial banks, and that at 1% of significance. If the FII increases for 1%, ceteris paribus, the probability that a business will have a loan with commercial bank rises for 3.005 log-odds.

The Private credit to GDP, as an indicator of banking sector's depth, in all tested models (M2, M5 and M6) shows a positive and significant impact at 1% level in the probability of having a loan with commercial banks. These results remain consistent either when this variable enters alone in the model or together with other indicators of the banking sector development. According to the M6, we can say that in Southeast European countries, with PK/GDP growth per 1%, ceteris paribus, the probability that a business has a commercial bank loan grows for 0.106 log-odds. Meanwhile, these results do not differ much on model M5, but the effect of this indicator is lower when enters alone. A positive impact of financial sector development measured by the PK/GDP also finds Sahay et al., [26], however they point out that the fast pace of financial development can lead to economic and financial instability if the required monitoring is lacking.

Lending- deposit spared (LDS), as an indicator of efficiency, presented in M3 shows a negative and significant impact at 1%, in the probability of having a loan with commercial banks. Therefore, we can say that in the SEE countries, ceteris paribus, with the growth of LDS for 1%, the probability that a company have a loan with commercial bank decreases for 0.113 log-odds. Meanwhile, the M5 and M6 show a positive and significant impact of this indicator, at 1% significant level. Apparently, the positive relationship between LDS and the probability of having a loan with commercial bank, showed on the above-mentioned models, is influenced by the positive trend of private sector lending to GDP ratio.

Non-performing loan ratio, as an indicator of the stability of the banking sector, also shows a significant impact at 1% level, but with a negative sign. Therefore, we can say that in the SEE countries, with the increase of NPL for 1%, ceteris paribus, the probability of a business having a commercial bank loan falls for 0.106 log-odds. This indicator remains consistent either when it enters in the model alone or together with other indicators of the banking sector development. These results show that banks are more conservative when approving a loan, when NPL ratio is high. The high rate of NPL, in double digits in some SEE countries, indicates that the risk of repayment is present in these countries.

To test the impact of public institutions performance in supporting the development of the banking sector, we have used the interaction between the banking sector and the legal system. This is measured in different ways. In model M1 the variable "Legal1" indicates the interaction between the financial institution development index and the Enforcing Contracts - Time (days), the "Legal 2" variable shows the interaction between the PK/GDP and the Enforcing Contracts - Time (days), while the variable "Legal 3" shows the interaction between Non-performing Loans and Enforcing Contracts - Time (days). All three variables, keeping everything else constant, show a negative effect of the legal system on the development of the banking sector.

Variables, which are thought to reduce the asymmetric information problem, are commented below: Profitability shows a positive relationship to the probability of having a loan with commercial banks at 1% significance level in all tested models, except for M1, where significance falls to 5%. The other variable that tests the ability to repay the loan and can be used as an indicator of the companies' ability to grow further is the increase in turnover (ΔSales). This variable shows a positive relationship with the probability of having a loan with commercial banks, but its level of significance is 10%, which is much lower than the Profitability. The availability of collateral, expressed through "Tot.Fixed Assets t-1" variable indicates that if the company in the prior period had high value of fixed assets, the likelihood of having a loan with commercial banks is generally positive but non-significant, except for M5 and M6 where the level of significance is 1%. Testing whether the companies that have audited financial statement are more

likely to have a loan with commercial banks, shows non-significant impact, even negative. The results significantly differ from previous results reported in the literature and are contrary to our expectations. The literature generally shows that access to finance is at lower levels for small companies, and this is also supported by our results. Thus, the probability that a medium or large company has a loan with commercial banks is much higher compared to small companies. The effect is positive and significant at 1% level in all models, this due to the fact that companies with larger numbers of employees have greater investment growth opportunities, while small companies often do not apply for loans believing that it will not be approved. Sector and Age also show non-significant impact. Similar results also show Hashi and Toci [16] arguing that this may be due to the change in the structure of the banking sector in these countries, namely the entry of foreign banks into the market, so the businesses for these banks are new regardless of their age.

Table 1 The impact of financial sector development on increasing the firm's probability of having a loan

Dependent variable: ***Probability of having a loan with commercial bank***							
Independent variables	**Model 0**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Profit.		0.293**	0.378***	0.317***	0.281***	0.372***	
		(0.116)	(0.108)	(0.107)	(0.109)	(0.109)	
ΔSales							0.156*
							(0.0798)
Tot.Fix.Aset (t-1)		0.00692	0.0199	0.00983	0.0155	0.0425***	0.0413***
		(0.0134)	(0.0134)	(0.0130)	(0.0131)	(0.0137)	(0.0141)
Audit.			0.0245	-0.00195	-0.0377	-0.0237	-0.0437
			(0.0731)	(0.0732)	(0.0739)	(0.0744)	(0.0782)
Sector(Manufacturing)							
Services		0.109	0.0878	0.0968	0.127	0.119	0.129
		(0.100)	(0.0972)	(0.0969)	(0.0983)	(0.0989)	(0.106)
Other		0.0791	0.152*	0.114	0.127	0.182**	0.207**
		(0.0879)	(0.0849)	(0.0852)	(0.0861)	(0.0875)	(0.0924)
Size (small <20)							
Medium (20-99)		0.462***	0.499***	0.487***	0.451***	0.460***	0.505***
		(0.0766)	(0.0753)	(0.0751)	(0.0757)	(0.0755)	(0.0788)
Large (>100)		0.731***	0.779***	0.774***	0.764***	0.709***	0.771***
		(0.993)	(0.108)	(0.108)	(0.109)	(0.102)	(0.106)
Legal business organi. (Sole propriorship)							
SHA			-0.151	0.0890	0.593***		
			(0.123)	(0.0891)	(0.0996)		
LLC			0.300***	0.336***	0.225**		
			(0.0967)	(0.0965)	(0.0983)		
Partner.			-0.205	-0.279*	-0.175		
			(0.151)	(0.150)	(0.152)		
Other			-0.284**	-0.266**	-0.335**		
			(0.136)	(0.136)	(0.137)		
Age		0.00180	0.00421	0.00396	0.00534		
		(0.00435)	(0.00433)	(0.00431)	(0.00436)		
Agesq		-4.10e-05	-5.17e-05	-5.05e-05	-5.57e-05		
		(4.01e-05)	(3.99e-05)	(3.97e-05)	(4.01e-05)		
FII		3.005***					
		(0.735)					
PK/GDP			0.0417***			0.105***	0.106***
			(0.0106)			(0.0108)	(0.0116)
LDS				-0.113***		0.173***	0.140***
				(0.0323)		(0.0430)	(0.0467)
NPL					-0.0477***	-0.126***	-0.106***

					(0.0150)	(0.0110)	(0.0130)
Legal1		-0.00277*** (0.000757)					
Legal2			-3.38e-05*** (9.10e-06)			-7.16e-05*** (1.04e-05)	-7.97e-05*** (1.12e-05)
Legal3					-4.85e-05*** (1.87e-05)	-	
Const. (Fixed effect)	-0.314** (0.129)	-1.480*** (0.307)	-1.729*** (0.249)	-0.252 (0.333)	-0.490** (0.229)	-3.230*** (0.590)	-2.766*** (0.595)
Const. (Random effect)	-0.188*** (0.307)	-1.380*** (0.443)	-1.520*** (0.552)	-0.749** (0.327)	-0.885*** (0.308)	-0.0459 (0.324)	-0.0552 (0.340)
Observations	4,382	3,991	4,382	4,382	4,382	4,382	3,986
No. of groups	6	5	6	6	6	6	6
Identity: country	0.305	0.252	0.219	0.473	0.412	0.955	0.946
(variance cons)	(0.093)	(0.111)	(0.121)	(0.154)	(0.127)	(0.310)	(0.321)
Wald chi2	0	100.18***	147.99***	144.15***	210.18***	249.92***	219.97***
LR	84.31***	23.47***	9.87***	51.26***	87.06***	109.99***	63.26***
ICC	0.0275	0.0189	0.0143	0.0636	0.0492	0.2171	0.2139
Deviance	5910.75	5264.54	5730.70	5759.26	5679.15	5614.63	5113.08
AIC	5914.755	5288.539	5764.699	5791.256	5713.151	5640.632	5139.08
BIC	5927.525	5364.04	5873.248	5893.42	5821.7	5723.64	5220.85

5 Conclusion

In order to conclude about the impact of the banking sector development on increasing the financing of companies with loans, we have used models that are suitable for hierarchically structured data. These models are appropriate when considering the interdependence between microeconomic and macroeconomic variables. Our work has led us to conclude that the challenge in measuring the development of the banking sector lies in the fact that there is no single indicator of its measurement. To sum up our work, we found that a more developed banking sector increases financing of companies with loans. Moreover, we have concluded that the model with the greatest explanation of the banking sector's influence on the probability that a company has a loan with commercial banks is one that includes together all the three indicators of the banking sector development.

The evidence from this study suggests that macroeconomic policies should pay attention to the level of development of the banking sector, particularly the aspect of depth and efficiency that should be in the function of access to finance, all followed by necessary supervision. In addition, macroeconomic policies should also focus on reducing the enforcing contracts period, as this would serve to enhance the banking sector's security that the loans granted will be returned. This will lead to facilitation of investor's access to bank sources thus increasing their investments at the same time.

Appendix

Table 2 Descriptive statistics of banking sector development indicators

Variables	Obs	Mean	Std. Dev.	Min	Max
PK/GDP	4382	41.95468	17.9624	8.077337	83.24209
NIM	4382	4.811738	1.701156	2.243307	7.834045
LDS	4382	6.957742	2.197389	2.95735	11.927
KJP	4382	9.196029	5.708639	3	22.2
ASETET/GDP	4382	53.17157	21.33579	20.36886	95.22482
ENF.CON	4382	667.3161	316.7704	390	1440
FII	3991	0.4964875	0.1616081	0.2063757	0.7373692

Table 3 Correlation matrix of banking sector development indicators

	PK/PBB	NIM	LDS	KJP	ASET./PBB	ENF.CON	FII
PK/PBB	1						
NIM	-0.7014*	1					
LDS	-0.2531*	0.4255*	1				
KJP	0.0762*	0.0998*	0.0576*	1			
ASET./PBB	0.9100*	-0.8116*	-0.2213*	0.0940*	1		
ENF.CON	0.4841*	-0.3761*	-0.3953*	-0.0827*	0.3156*	1	
FII	0.3320*	-0.1597*	-0.1683*	0.0439*	0.1971*	-0.3244*	1

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