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Рочност банкарских кредита: детерминанте и ефекти на економски раст

Никола Тасић и Невен Валев

The Maturity Structure of Bank Credit: Determinants and Effects on Economic Growth

Nikola Tasić and Neven Valev

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Рочност банкарских кредита: детерминанте и ефекти на економски раст

Никола Тасић и Невен Валев

Апстракт: У овом раду истражујемо нову базу података о рочности банкарских кредита приватном сектору у 74 земље. Наши резултати указују да је рочност дужа у земљама које имају јачи институционални оквир, ниску инфлацију, развијенија финансијска тржишта и где банке размењују информације о дужницима. Такође, овај рад продубљује литературу о утицају финансијског развоја на економски раст указујући да је рочност кредита битна за економски раст. Економски раст је повишен у земљама у којима економски актери имају приступ дугорочном финансирању. Стога, слабе институције, већа инфлација, и остале променљиве које смањују рочност кредита, имају ефекат на економски раст кроз њихов утицај на рочност кредита. Оцењени ефекти су знатне јачине.

Кључне речи: финансијски развој, економски раст, рочност кредита, ликвидност
JEL Code: G21, O40, O16, O43

Невен Валев је професор на катедри за економију у „Andrew Young“ школи политике на државном универзитету у Џорџији, САД. Овај рад презентован је на годишњој конференцији „The Eastern Economic Association 2008“ у Бостону, на 57ој годишњој конференцији „Midwest Finance Association“ у Сан Антонију и на „2007 Southern Economic Association“ конференцији у Њу Орлеансу.

The Maturity Structure of Bank Credit: Determinants and Effects on Economic Growth

Nikola Tasić and Neven Valev

Abstract: We investigate a new data set on the maturity of bank credit to the private sector in 74 countries. We show that credit maturity is longer in countries with strong institutions, low inflation, large financial markets, and where banks share information about borrowers. Furthermore, we extend the finance and growth literature by showing that credit maturity matters for economic growth. Economic growth is enhanced in countries where agents have access to long-term financing. Therefore, weak institutions, high inflation and other variables that reduce credit maturity have an impact on economic growth via their influence on credit maturity. The estimated effects are substantial in size.

Key words: financial development, economic growth, credit maturity, liquidity
JEL Code: G21, O40, O16, O43

Neven Valev is associate professor at the Department of Economics, Andrew Young School of Policy Studies, Georgia State University. This paper has been presented at The Eastern Economic Association 2008 annual conference in Boston, at the 57th annual conference of the Midwest Finance Association in San Antonio, and at the 2007 Southern Economic Association conference in New Orleans.

Content:

1. Introduction

The literature on financial development and economic growth has established that finance has a positive, statistically significant, and economically large causal effect on economic growth (Levine 2005). There is, however, much less empirical evidence on the channels through which this positive effect is obtained. Levine (2005) points out that even "the organization of the empirical evidence advertises an important weakness in the finance and growth literature: there is frequently an insufficiently precise link between theory and measurement. Theory focuses on particular functions provided by the financial sector, [while the empirical literature] pertains to the proxies for financial development."

Transforming liquid savings into illiquid assets that can fund long-term investment projects is one of the important functions of the financial system. Levine (1997) explains that economic growth is closely linked to the maturity transformation function of the financial system, as high-return projects require a long commitment of capital but savers do not like to relinquish control of their savings for long periods. The financial system plays a key role in preserving the liquidity of savings of individual savers while investing a portion of the funds into illiquid long-term projects. Historical evidence supports this claim. According to Hicks (1969), the capital market improvements that mitigated liquidity risks were the primary cause of England's industrial revolution as individual investors could hold liquid assets but at the same time the financial system transformed these liquid financial instruments into long-term capital investments. As England's industrial revolution required large commitments of capital for long periods, Levine (1997) goes as far as noting that the industrial revolution may not have occurred without this liquidity transformation.

Our objective is to provide empirical evidence for that function of the financial system. For that purpose we collect and analyze a unique data set on the maturity of domestic bank credit to the private sector in 74 countries during the period from about 1990 to 2005. We ask two broad questions. First, what factors determine the differences in credit maturity across countries? For example, only 24% of domestic private credit in Mali has maturity longer than one year, whereas in Hungary 75% of credit has maturity longer than one year. What explains that difference? Second, we investigate whether credit maturity has an effect on economic growth.

Bencivenga and Smith (1991) develop an insightful model that formalizes the relationship between the maturity transformation role of banks and economic growth. There are two savings assets in the model: a *liquid* asset that matures early but returns less of the consumption good and an *illiquid* asset that has a higher (but later) payoff.[1] If liquidated before it matures, the illiquid asset returns less than the liquid asset. Following Diamond and Dybvig (1983), individuals are uncertain about their future

[1] The higher return on the illiquid asset captures the idea of the slow production cycle of high productivity investments, as well as the long gestation periods in capital production as discussed by Böhm-Bawerk (1891), Cameron (1967), and Kydland and Prescott (1982).

liquidity needs at the time they make capital allocation decisions and therefore they invest most of their savings into the liquid low-return asset. Financial institutions emerge as groups of individuals who pool their savings, keep a portion of the pooled savings in liquid assets to meet the liquidity needs of their members, and invest the remaining amount in illiquid high-return project. By the law of large numbers, financial institutions can predict the aggregate demand for liquidity across their members and, therefore, they invest a smaller fraction of the savings in the liquid asset compared to the individual investors. As a result, the proportion of society's savings that are invested in projects with high productivity increases and this enhances economic growth.

In Bencivenga and Smith, economic growth increases in the proportion of savings invested in long-term assets.[2] We provide empirical evidence in support of this hypothesis. We show that, holding constant the level of credit, longer credit maturity enhances economic growth. Our empirical evidence fits well with papers showing that the effect of finance on growth depends on the economic and institutional environment of a country. For example, Rousseau and Wachtel (2002), Choi, Smith, and Boyd (1996), Haslag and Koo (1999), Khan and Senhadji (2000), and Boyd, Levine and Smith (2001) show that the effect of credit on growth is diminished in high inflation countries. It is, however, not clear what function of the financial system is blocked in high inflation environments. Our results suggest that credit has a smaller effect on growth (at least partly) because the financial system shifts resources toward short-term, less productive assets.

Before we present that evidence and in order to become more familiar with credit maturity, we investigate its determinants by testing a number of empirical hypotheses drawn from the literature. The data show that credit maturity varies substantially across countries, even if the countries have a similar level of financial and economic development. We show that credit maturity is shorter in countries with lax rule of law, high inflation, less developed financial markets, and greater economic volatility.

The rest of the paper is structured as follows. We describe the data in the following section. Section 3 draws empirical hypotheses from the literature and investigates the determinants of credit maturity. Section 4 present results for the effect of credit maturity on economic growth and Section 5 concludes.

[2] The notion that long-term lending enhances growth is not universally accepted. Sissoko (2006) combines the monetary and the financial role of intermediaries into a growth model where agents can buy and sell a cash-in-advance constraint. This gives rise to growth enhancing short-term credit, but the author does not test this prediction for lack of data on credit maturity. Also, in Flannery (1986) firms that are not concerned about reevaluation by the credit markets (good firms) will borrow short-term, while firms that fear reevaluation (bad firms) will want to borrow long-term. Therefore, short-term credit could have a positive effect on growth as more short-term credit implies more efficient investments. However, the more realistic setting of Titman (1992) with uncertain interest rate and financial distress costs motivates good firms to use long-term credit despite the lower contractual cost on short-term debt. Diamond (1991) also shows that good firms borrow short- *and* long-term to extract the benefits of good news while lowering liquidity risk.

2. Data on credit maturity

We use data on lending by banks to the private sector in 74 countries spanning the period from about 1990 to 2005, depending on data availability for the individual countries. The data were collected from a variety of sources including publications by central banks and multilateral organizations. Table 1 provides variable definitions and details the sources of the data. The sample includes all countries for which we could identify a consistent data source. The summary statistics of our private credit variable, shown in Table 2, match closely those from the widely used World Bank data set on financial structure [see Beck, Demirgüç-Kunt, and Levine (2000a)] for the entire sample and for each individual country. However, because our sample spans only more recent years, the summary statistics reveal a higher level of financial development compared to the World Bank data that begin in 1960.

Credit is decomposed into two categories: short-term credit that has contractual maturity of one year or less and long-term credit that has contractual maturity longer than one year. Some countries, most notably many of the transition economies, provide more detailed data on credit maturity – up to one year, one to five years and longer than five years. Some countries report maturity longer than seven or even 15 years. While it would be interesting to investigate credit with different maturity structures (e.g. medium-term, long-term, and "very long-term" credit), the only categorization that is consistent across all countries is the one that divides credit into short-term credit with maturity of one year or less and other credits. Therefore, we proceed with this definition of short-term and long-term debt but we also explore other maturity structures in a parallel paper with a smaller sample.[3]

Table 1: **Variable Definitions**

[3] The data do not indicate what portion of short-term credit is rolled over and used to finance long-term projects. Therefore, in some countries our measure of long-term credit is most likely an underestimate of the actual amount of funding available for long-term financing. While this introduces a measurement error, it also serves to produce more conservative estimates of a possible positive effect of credit maturity on economic growth.

Variable	Definition	Sources
Credit / GDP	Credit by deposit money banks and other financial institutions to the private sector divided by GDP.	Central Bank of West African States: Benin, Burkina, Guinea Bissau, Ivory Coast, Mali, Niger, Senegal, and Togo; Economic and Monetary Community of Central Africa: Cameroon, Central African R., Chad, Congo, Equatorial Guinea, Gabon; Eurostat: Austria, Belgium, Cyprus, Czech R.*, Denmark, Finland, France*, Greece*, the Netherlands*, Norway, Poland*, Spain, and Sweden; and FDIC Statistics on Depository Institutions for the United States. For the remaining countries (and as second source for countries with * above) source was corresponding central bank (official publications and website).
Long-Term Credit / GDP	Long-Term Credit is credit by deposit money banks and other financial institutions to the private sector with the original contractual maturity longer than one year divided by GDP.	
Short-Term Credit / GDP	Short-Term Credit is credit by deposit money banks and other financial institutions to the private sector with the original contractual maturity of one year or less divided by GDP.	
Percent Long-Term Credit	Credit with an original contractual maturity longer than one year divided by credit.	
Real per capita GDP Growth	The percent increase in real per capita GDP from the previous year.	International Financial Statistics (IFS) database of International Monetary Fund (IMF). In some cases data were retrieved from Eurostat database and Euromonitor International's World Marketing Data and Statistics (Plus) which uses IMF's World Economic Outlook, United Nations, as well as national statistics in addition to IFS.
Per Capita GDP	The real per capita GDP in US dollars.	
Inflation	The increase in the annual CPI.	
Trade / GDP	Sum of imports and exports of goods and services as a share of GDP.	
Gov. / GDP	General government consumption as share of GDP.	
Rule of Law	Index that measures "the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement."	World Bank data set Governance Matters VI by Kaufmann, Kraay, and Mastruzzi (2007).
Banking Industry Conc.	The assets of three largest banks as a share of assets of all commercial banks.	World Bank data set A new database on financial development and structure by Beck, Demirgüç-Kunt, and Levine (2000a).
Stock Market Turnover Ratio	Stock market volume traded during a year divided by the stock market capitalization at the end of the year.	
Credit Info. Sharing	Dummy variable: one if public credit registry or private credit bureau operates in a country during a year, zero otherwise.	Author constructed from Djankov, McLiesh, and Shleifer (2007), Miller (2003), and Pagano, Brown, and Japelli (2007).
Manuf. Share of Output	Value added by manufacturing divided by total value added.	United Nations' National Accounts Main Aggregates Database.
Output Volatility	Root mean squared errors from $Growth_t = \alpha+\varepsilon_t$, using data from preceding 10 years.	Author constructed from data on Real per capita GDP Growth.

Table 2. Summary Statistics

	Real per capita GDP Growth	Credit / GDP	Percent Long-Term Credit	Per Capita GDP	Inflation	Gov. / GDP	Trade / GDP	Rule of Law	Banking Industry Conc.	Stock Market Turnover Ratio	Credit Info. Sharing	Output Volatility	Manuf. Share of Output
Panel A: Descriptive Statistics													
Mean	2.98	53.04	54.14	9,676	11.82	16.55	90.67	0.33	0.72	0.63	0.64	4.32	4.32
Maximum	13.69	206.61	99.32	52,228	1,058.37	30.68	321.7	2.12	1	16.02	1	21.78	21.78
Minimum	-12.81	0	1.51	82	-9.62	3.91	23.33	-1.94	0.24	0	0	0.56	0.56
Std. Dev.	3.8	44.7	24.35	10,943	55.24	5.47	44.76	1.05	0.2	1.06	0.48	3.73	3.73
Observations	659	659	659	659	652	653	637	510	528	403	659	554	554
Panel B: Correlations													
Growth	1.00												
Credit / GDP	-0.07	1.00											
Percent Long-Term Credit	0.13*	0.57*	1.00										
Per Capita GDP	-0.08*	0.61*	0.45*	1.00									
Inflation	-0.25*	-0.12*	-0.16*	-0.13*	1.00								
Gov. / GDP	-0.04	0.32*	0.32*	0.37*	-0.06	1.00							
Trade / GDP	0.16*	0.20*	0.18*	0.17*	-0.03	0.05	1.00						
Rule of Law	-0.10*	0.72*	0.61*	0.85*	-0.13*	0.50*	0.25*	1.00					
Bank. Ind. Conc.	-0.12*	-0.05	-0.02	-0.10*	0.05	0.08	-0.10*	0.00	1.00				
Stock Mkt. TOR	-0.08	0.07	0.04	0.09	-0.09	0.11*	-0.13*	0.05	0.03	1.00			
Credit Info. Sharing	-0.04	0.17*	0.09*	0.11*	-0.17*	0.07	-0.20*	0.20*	-0.06	0.14*	1.00		
Output Volatility	0.25*	-0.46*	-0.32*	-0.41*	0.07	-0.28*	0.11*	-0.52*	0.03	-0.14*	-0.38*	1.00	
Manuf. Share of Output	0.10*	0.31*	0.26*	0.11*	0.02	0.12*	0.20*	0.35*	-0.15*	0.04	-0.02	-0.00	1.00

Notes: * indicates statistical significance at the 5 percent level. See Table 1 for variable definitions.

Table 3. Country Averages of Credit and Credit Maturity

Country	Credit / GDP	Long-Term Credit / GDP	Short-Term Credit / GDP	Percent Long-Term Credit	Country	Credit / GDP	Long-Term Credit / GDP	Short-Term Credit / GDP	Percent Long-Term Credit	Country	Credit / GDP	Long-Term Credit / GDP	Short-Term Credit /GDP	Percent Long-Term Credit
Albania	5.72	2.99	2.73	45.79	Georgia	8.16	3.73	4.44	35.08	Norway	77.45	66.99	10.45	86.44
Armenia	34.47	21.86	12.61	63.41	Germany	95.36	79.18	16.18	82.82	Poland	15.32	9.09	6.23	59.41
Austria	115.33	86.88	28.45	75.28	Greece	49.15	24.83	24.33	49.18	Portugal	126.82	91.98	34.84	69.32
Azerbaijan	0.08	0.02	0.06	25.44	Guinea Bissau	2.22	0.38	1.84	14.21	Romania	16.48	5.99	10.49	34.9
Bahamas, The	69.18	62.74	6.44	90.6	Hungary	72.23	54.87	17.36	75.41	Russia	14.22	6.51	7.7	47.59
Bangladesh	38.98	5.47	33.5	14.01	Iceland	92.66	31.92	60.75	35.28	Saudi Arabia	29.46	10.09	19.37	33.12
Belgium	101.5	67.62	33.88	66.86	Ireland	119.13	93.2	25.93	77.41	Senegal	19.69	7.26	12.43	37
Benin	13.4	3.94	9.46	29.36	Italy	73.88	39.29	34.59	52.66	Serbia, Rep.	56.97	14.86	42.11	31.44
Bolivia	36.84	27.12	9.72	73.77	Ivory Coast	14.01	3.52	10.49	25.1	Singapore	66.34	41.59	24.75	60.9
Bosnia&Herzegov.	39.75	28.98	10.77	72.56	Jordan	79.9	27.23	52.67	33.74	Slovak Rep.	25.76	17.36	8.39	67.26
Bulgaria	19.13	14	5.12	68.09	Kazakhstan	16.3	9.84	6.46	49.13	Slovenia	28.02	17.02	11	59.68
Burkina	13.55	4.14	9.41	30.39	Kyrgyz Rep.	2.31	0.34	1.97	13.9	Spain	91.64	71.33	20.31	77.31
Cameroon	10.27	2.91	7.36	28.31	Latvia	28.44	21.68	6.77	65.21	Sri Lanka	25.07	10.11	14.96	40.2
Cent. African Rep.	6.88	0.59	6.29	8.76	Lesotho	8.28	2.29	5.99	21.76	Sweden	112.06	109.18	2.88	97.45
Chad	5.82	0.62	5.2	11.45	Lithuania	17.95	11.66	6.29	58.21	Taiwan	143.59	99.66	43.93	69.37
China	106.76	38.89	67.87	36.24	Luxembourg	97.36	58.24	39.12	59.87	Togo	14.97	6.13	8.83	41.47
Congo	11.11	1.13	9.98	21.4	Macau	65.17	39.89	25.28	61.77	Tunisia	65.34	30.35	34.99	46.35
Cyprus	199.09	184.72	14.37	92.77	Macedonia	13.03	6.56	6.47	46.36	Turkey	57.23	52.59	4.64	91.62
Czech Republic	49.27	31.4	17.86	65.02	Malaysia	126.31	60.04	66.27	47.83	Ukraine	7.07	3.72	3.35	27.36
Denmark	23.54	10.03	13.51	40.98	Mali	19.23	4.67	14.55	24.24	United States	62.24	27.58	34.66	44.01
Equatorial Guinea	2.78	0.58	2.2	21.42	Mongolia	23.7	5.39	18.31	20.65	Uruguay	58.8	32.16	26.64	52.16
Estonia	41.37	36	5.37	82.52	Mozambique	14.19	6.12	8.07	44.05	Yemen	5.08	0.28	4.81	5.53
Finland	81.66	74.34	7.32	91.05	Netherlands	134.8	100.64	34.16	74.37					
France	86.22	72.98	13.24	84.64	Nicaragua	24.04	12.92	11.12	53.81	*Sample*	*53.04*	*34.88*	*18.16*	*54.14*
Gabon	12.41	5.41	7.01	43.66	Niger	5.95	1.42	4.54	23.26					

Notes: Presented are country averages for the available years. See Table 1 for variable definitions.

Table 3 shows large differences in terms of financial development measured as private credit as percent of GDP. For example, in Albania, Azerbaijan, Chad and several other countries, private credit is below 10% of GDP whereas in Ireland, the Netherlands, Portugal, Taiwan and several other countries it is well over 100% of GDP. Table 4, which reports the credit averages for three groups of countries based on income, shows that private bank credit has the lowest level in low income countries (25.01% of GDP), compared to middle income countries (58.31% of GDP) and high income countries (93.81% of GDP).

Table 4: **Income and Bank Credit Maturity**

	Real per capita GDP Growth	Credit / GDP	Long-Term Credit / GDP	Short-Term Credit / GDP	Percent Long-Term Credit
Low income countries	2.64	25.01	12.08	12.93	40.38
Middle income countries	3.04	58.31	39.91	18.40	63.17
High income countries	2.20	93.81	69.16	24.65	72.39

Notes: Presented are the average values for each variable for three income groups defined as low income if per capita GDP is below $1,715, middle income if it is between $1,715 and $10,800, and as high income if it is above $10,800. See Table 1 for variable definitions.

On average, 54.14% of bank credit to the private sector has long-term maturity. There are, however, large differences between countries. Long-term credit is less than 30% of total credit in a number of countries including Bangladesh, The Central African Republic, Niger, and Lesotho and it is greater than 70% of total credit in Austria, Cyprus, Finland, Norway, and several other countries. Table 4 shows that there are systematic differences in credit maturity between countries at different levels of economic and financial development. In low income countries, the percent long-term credit is 40.38%, whereas in middle income and high income countries it is, respectively, 63.17% and 72.39%. More developed economies have more private credit and, also, a greater portion of their credits have long-term maturity. However, notice in Table 2 that the correlation coefficient of the level of credit and credit maturity is not very large in magnitude (0.57), i.e. credit maturity differs across countries with similar levels of credit to GDP. For example, credit is 95% of GDP in Germany and Belgium. However, the percent long-term credit is 83% in Germany and 66% in Belgium. Also, private credit is 40% of GDP in both Bangladesh and Estonia. However, in Estonia long-term credit is 83% of total credit and in Bangladesh it is only 14% of total credit.

3. The determinants of credit maturity

Building on Modigliani and Miller (1958), Stiglitz (1974) shows that in a perfect world the maturity of credit, as any other financing decision, is irrelevant. Subsequent research has added transaction costs, informational asymmetries, liquidation costs, and taxes to that framework as a result of which maturity becomes an important factor in financing decisions. There is a large empirical literature on the determinants of credit maturity from individual (mostly industrialized) countries reviewed by Ravid (1996).

In terms of cross country evidence, Qian and Strahan (2007) and Demirgüç-Kunt and Maksimovic (1999) investigate the determinants of credit maturity in samples of, respectively, 43 and 30 countries with a particular focus on the effect of legal institutions. We stay close to their analysis in terms of the selection of the country-level explanatory variables but we expand the number of countries substantially and we also include additional explanatory variables such as economic volatility and banking system concentration. Furthermore, we use the maturity of bank credit to the entire private sector whereas Demirgüç-Kunt and Maksimovic (1999) and Qian and Strahan (2007) analyze the borrowing by publicly traded companies only. Using the total private bank credit allows us to link the paper to the finance and growth literature where that variable is used extensively.

3.1. Empirical hypotheses

3.1.1.Legal institutions

The literature provides substantial evidence that weak legal institutions are a primary reason for the underdevelopment of financial markets as lenders cannot effectively monitor and exert control over borrowers (La Porta et al. 1997; 1998). Inefficient protection of creditor rights leads to a reduction in the volume of external financing provided by financial institutions to the private sector. Furthermore, institutions affect the terms of credits and the maturity of credit in particular. Diamond (1991; 1993) and Rajan (1992) show that short-term lending facilitates the enforcement of credit contracts as it limits the period during which an opportunistic firm can exploit its creditors without being in default. Diamond (2004) argues that "maturity acts as a substitute contracting tool to control borrower risk," and that bank loan maturity is "especially sensitive to the legal environment." Giannetti (2003) also argues that if the law does not guarantee creditor rights, lenders would prefer short-term debt to control entrepreneurs' opportunistic behavior by using the threat of not renewing their loans. In line with these theories, we expect to find that weak institutions contribute to shorter maturity.

3.1.2. High inflation

Similar to weak legal institutions, high inflation is detrimental to the development of the financial system as it limits the amount of external financing available to borrowers (Huybens and Smith 1998, 1999). Furthermore, similar to legal institutions, high inflation affects credit maturity. Boyd, Levine, and Smith (2001) point out that financial intermediaries are less willing to engage in long-run financial commitments in high inflation environments. Rousseau and Wachtel (2002) also argue that high inflation will "discourage any long term financial contracting and financial intermediaries will tend to maintain very liquid portfolios. In this inflationary environment intermediaries will be less eager to provide long-term financing for capital formation and growth." Therefore, we expect that high inflation reduces the fraction of credits with long-term maturity.

3.1.3. Stock market development

Stock market development has an ambiguous effect on credit maturity. According to one view, a well functioning stock market could be a substitute source of long-term financing and would therefore reduce the demand for long-term bank financing. Diamond (1997) argues that increased participation in markets causes the banking sector to shrink, primarily through reduced holdings of long-term assets. An alternative view holds that a developed stock market increases the ability of firms to obtain long-term financing as it helps reveal information about the borrowers and reduces information asymmetries (Grossman 1976; Grossman and Stiglitz 1980). Therefore, theoretically the effect of stock market development on long-term bank financing is ambiguous.

3.1.4. Banking sector competition

Banking sector competition can have a dual effect on the provision of external financing and the provision of long-term financing in particular. A high level of concentration in the banking sector may raise the cost of funds and thus reduce external financing (Pagano 1993). Alternatively, high concentration in the banking industry may foster close relationships between banks and borrowers which reduces information asymmetries and the cost of monitoring borrowers (Mayer 1988; Mayer and Hubbard 1990; Petersen and Rajan 1995). Therefore, the theoretical effect of banking system concentration on debt maturity is ambiguous.[4] Testing the bank-firm

[4] Cetorelli and Gambera (2001) investigate whether the market structure of the banking sector has empirical relevance for economic growth, finding that banking system concentration has a non-trivial impact on growth, but that competition in banking does not necessarily dominate monopoly and vice versa.

relationship hypothesis Giannetti (2003) finds that, contrary to (her) expectations, maturity is shorter in countries where the banking system is more concentrated.

3.1.5. Overall level of bank credit

Diamond (1984) highlights the function of banks as delegated monitors that emerge to reduce the cost of monitoring borrowers by exploiting economies of scale. In the absence of banks, individual savers would incur the cost of assessing and monitoring investment projects. With economies of scale, a larger banking system would have lower monitoring costs, which reduces lending risk and increases the supply of long-term debt. There is, however, an additional effect related to the volume of credit extended in an economy. Diamond and Rajan (2000) argue that a larger pool of smaller, riskier, and less collateralized borrowers would obtain access to external financing with the expansion of the financial system. As most of the credits to these riskier borrowers are short-term, the proportion of short-term debt in total debt would increase as overall lending increases. Thus, the theoretical effect of credit levels of credit maturity is ambiguous.

3.1.6. Real per capita GDP

Ravid (1996) points to the "industry paradigm" of matching maturities introduced by Morris (1976) where a firm with long-term assets should use long-term debt. If the maturity of debt is longer than the asset life, the borrower might have a problem finding new assets to invest in but will have to continue servicing the debt. If debt maturity is shorter than the asset life, then the borrower is exposed to the risk of being short on cash when debt payments are due. Stohs and Mauer (1996) find evidence for this on the firm level. We use per capita GDP to proxy for the amount of fixed assets in a country, with richer countries having a larger stock of long-term assets. Thus, higher GDP per capita is expected to be associated with longer debt maturity.

3.1.7. Credit information sharing

Empirical researchers have shown that countries with institutions that gather and share information about borrowers have higher private credit to GDP ratios (Jappelli and Pagano 2002; Brown *et al.* 2007; Djankov *et al.* 2007).[5] Furthermore, because lack of information reduces the supply of long-term credit (Djankov *et al.* 2007), information sharing is also expected to lengthen debt maturity. Zhang and Sorge (2007) provide a direct link between credit information sharing and credit maturity in a model where information sharing is used by banks as a screening device and leads

[5] Information sharing overcomes adverse selection (Pagano and Jappelli 1993) and moral hazard problems (Padilla and Pagano 2000) in the credit markets. While, theoretically, the impact of information sharing on aggregate lending is ambiguous, the increase in lending to safe borrowers is certain.

to an equilibrium where short-term contracts are not preferred. Empirically, Zhang and Sorge (2007) confirm their main hypothesis using data from publicly traded companies to show that information sharing leads to longer credit maturity. We expect to find the same effect.

3.1.8. Real per capita GDP growth

Smith and Watts (1992) note that GDP growth rates can serve as a proxy for investment opportunities: the demand for external financing would increase in boom times and will recede in recession periods. It is not clear, however, whether expansions would stimulate the demand for long-term and short-term credit in different ways. Nonetheless, we follow the literature (Demirgüç-Kunt and Maksimovic 1999; Qian and Strahan 2007) and include the growth rate of per capita GDP in our estimations.

3.1.9. Output volatility

Booth, Demirgüç-Kunt, and Maksimovic (2001) look at the variability of the return-on-assets to proxy for business risk expecting that an increase in variability would shorten the maturity of credit as it proxies for the short-term operational component of business risk. Giannetti (2003) notes that controlling for such risk has been neglected in the previous cross-country research, at least partly because of lack of suitable empirical proxies. The author uses a similar variable, but at the sectoral level, and shows that the percent short-term debt increases with higher volatility of the return-on-assets of the corresponding sector in that country. It is more difficult to account for such risks at the country level. Nevertheless, if per capita GDP growth is a suitable proxy for investment opportunities as noted in the previous literature, then its variability can be used as a measure of business risk.[6]

3.1.10. Manufacturing share of output

Barclay and Smith (1995) and Scherr and Hulburt (2001) show that the maturity of credit differs substantially across economic sectors with manufacturing firms having a larger fraction of long-term credit as percent of their overall credit. We include the percent of manufacturing in total output as a proxy for the importance of the manufacturing sector on the country level. We expect that credit in countries with a larger manufacturing sector will have longer maturity.

In summary, the empirical hypotheses drawn from the literature are as follows:

[6] In the context of international lending, Valev (2007) relies on the same proxy and shows that higher volatility of per capita GDP growth in a country leads U.S. banks to shorten the maturity of credit to that country.

$$\text{Percentage of Long - Term Credit} = f\left(\begin{array}{l} \overset{+}{\text{rule of law}}, \overset{-}{\text{inflation}}, \overset{+/-}{\text{stock market}}, \\ \overset{+}{\text{credit info. sharing}}, \overset{+/-}{\text{credit}}, \overset{+}{\text{GDP per capita}}, \\ \overset{+/-}{\text{banking industry concentration}}, \\ \overset{+/-}{\text{GDP growth}}, \overset{-}{\text{output volatility}}, \overset{+}{\text{manufacturing}} \end{array}\right). \quad (1)$$

Some of the explanatory variables: legal institutions, inflation, banking sector competition, financial development, and credit information sharing affect the availability of long-term financing primarily through the supply side. Other variables: stock market development, per capita GDP, economic growth, and the share of manufacturing affect the maturity of credit primarily through the demand side.

The correlations in Panel B of Table 2 show that inflation and output volatility are negatively and significantly correlated with the percent long-term credit. Also, rule of law, credit information sharing, and GDP per capita are positively and significantly correlated with the percent long-term credit. The correlation between economic growth and the percent long-term credit is positive and significant as is the correlation between the credit level and the percent long-term credit.

3.2. Methodology

By construction private credit and the percent long-term credit are determined jointly and, therefore, we need to control for the endogeneity of private credit. Following the literature, we could use countries' legal origins as external instruments for the level of credit. However, for those to be valid instruments, we would have to assume that legal origin does not have an impact on credit maturity, except through its effect on credit. This may not be the case as Demirgüç-Kunt and Maksimovic (1999) and Qian and Strahan (2007) find that legal origin has a direct influence on credit maturity. In addition, we would be constrained to using a random effects model (since the legal origin does not change over time) even though the Hausman test reveals that the explanatory variables used in the random-effects model are correlated with the country specific effects and, therefore, we have to use a fixed-effects estimation. To resolve these problems, we implement the Hausman-Taylor (1981) estimator that corrects for correlation between the explanatory variables and the country-level random-effects, and does not require the use of outside instruments.[7]

[7] For robustness, Appendix A presents a set of empirical results where we use a random-effects estimator, a fixed-effects estimator, GLS estimators that control for a heteroskedastic error structure and allow for AR(1) autocorrelation, as well as a two-stage least squares random-effects estimator. The estimated effects are similar across the various estimations.

When explaining the percent long-term credit one concern that arises is that the dependent variable is a ratio (between zero and 100%) making OLS problematic as the predicted values might lay outside the unit interval (Papke and Wooldridge 1996). This may require the transformation of the dependent variable using a log-odds transformation ($\log(y/1-y)$). However, the coefficient estimates using the log-odds ratio are difficult to interpret in a panel setting and therefore we follow the previous literature (Demirgüç-Kunt and Maksimovic 1999; Rodrik and Velasco 1999; Valev 2006; 2007) and do not perform the transformation. Furthermore, less than 1% of the predicted values from the models are outside the unit interval.

3.3. Results

Table 5 presents the empirical results regarding the determinants of credit maturity. We start with a benchmark equation where the percent long-term debt is explained by rule of law, inflation, financial and economic development, and economic growth. Then we add, one at a time, a dummy variable for credit information sharing, banking system concentration, stock market development measured by the stock market turnover ratio, output volatility, and the share of the manufacturing sector in GDP. In column (7) we report the estimations from a regression where we include all explanatory variables.

It is immediately clear that the rule of law has a statistically significant and robust effect on the maturity of credit. Greater rule of law is associated with longer debt maturity. Looking at the estimations from the benchmark equation, a decrease in the rule of law by one standard deviation leads to a decrease of the percent long-term credit by 5.57 percentage points (1.05*5.308). This result compares well with previous findings. In Demirgüç-Kunt and Maksimovic (1999), a decrease of the Law & Order index by 1.05 index points decreases the percent long-term debt by 5.78 percentage points.[8] To illustrate, if the Slovak Republic (where the rule of law index

[8] Demirgüç-Kunt and Maksimovic (1999) use a different index to measure rule of law but their index has a nearly identical definition to ours ("the degree to which citizens of a country are able to utilize the existing legal system to mediate disputes and enforce contracts"). In addition, their index has a similar standard deviation (1.597) and a similar range (4.286).

Table 5: **The Determinants of Credit Maturity (Hausman-Taylor Estimation)**

The dependent variable is credit with an original contractual maturity longer than one year divided by overall credit. The explanatory variables are defined as in Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rule of Law	5.308	5.041	4.490	6.925	4.197	8.331	6.857
	(0.035)	(0.043)	(0.145)	(0.044)	(0.105)	(0.003)	(0.047)
Inflation	-3.939	-3.364	-2.455	-12.418	-2.848	-3.861	-11.418
	(0.000)	(0.000)	(0.006)	(0.021)	(0.002)	(0.000)	(0.070)
Growth	0.266	0.220	0.138	-0.045	0.137	0.261	0.194
	(0.081)	(0.148)	(0.424)	(0.823)	(0.369)	(0.099)	(0.334)
Credit	11.006	10.443	11.291	14.962	13.465	11.516	15.098
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.311	0.362	0.698	0.270	0.148	0.109	0.334
	(0.248)	(0.175)	(0.029)	(0.388)	(0.580)	(0.711)	(0.300)
Credit Information Sharing		6.940					6.573
		(0.001)					(0.001)
Banking Industry Concentration			1.504				5.092
			(0.632)				(0.140)
Stock Market Turnover Ratio				-0.952			0.142
				(0.168)			(0.832)
Output Volatility					-0.678		0.003
					(0.595)		(0.999)
Manufacturing Share of Output						-1.010	-0.611
						(0.000)	(0.038)
U.K. Legal Origin	5.141	7.888	12.948	-2.505	-1.218	0.506	-0.281
	(0.658)	(0.495)	(0.366)	(0.844)	(0.915)	(0.969)	(0.983)
French Legal Origin	9.606	10.718	15.879	1.866	3.427	4.217	3.905
	(0.400)	(0.345)	(0.256)	(0.877)	(0.762)	(0.740)	(0.746)
German Legal Origin	11.818	12.313	15.010	6.453	8.347	14.710	10.642
	(0.394)	(0.375)	(0.379)	(0.660)	(0.581)	(0.360)	(0.491)
Socialist Legal Origin	23.087	26.770	32.466	26.432	16.725	24.301	32.692
	(0.055)	(0.026)	(0.029)	(0.056)	(0.161)	(0.068)	(0.017)
Constant	48.685	40.788	39.351	52.309	59.692	67.446	55.856
	(0.000)	(0.001)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)
Hausman test: χ^2 (d.f.)	6.41 (5)	5.43 (6)	8.83 (6)	4.87 (6)	3.46 (6)	2.09 (6)	0.88 (10)
p-value	0.268	0.490	0.183	0.561	0.749	0.911	0.909
Observations	504	504	419	322	483	418	284
Countries	71	71	67	48	68	65	45

Notes: The results are based on the Hausman-Taylor estimation where Credit is endogenous. *P*-values are reported in parentheses below the coefficients. The Hausman test has a null hypothesis that the explanatory variables are not correlated with the country-specific random-effects.

is 0.288) had the rule of law level of Austria (1.891), its long-term credit would increase by 8.51 percentage points.

Inflation also affects credit maturity in significant ways with higher inflation leading to shorter credit maturity in all specifications. We explore the size of the effect of inflation in more detail later. Countries with deeper financial markets have a greater fraction of long-term credits. The estimates from the benchmark equation in column (1) suggest that if Slovakia (where private credit is 25.67% of GDP) had the level of private credit of Hungary (72.22%), it would also have 11.38 percentage points greater percent long-term credit. Thus, the process of financial deepening is accompanied by lengthening of the maturity of credit as suggested by Diamond (1984).

To test whether information sharing affects credit maturity, we follow Qian and Strahan (2007) and include a dummy variable that equals one if a country had either a public credit registry or a private credit bureau in a particular year, and zero otherwise. Credit information sharing is statistically significant when included in the base estimation model and in the full model. The more conservative yet statistically significant estimate in column (7) suggests that if Luxembourg had established a credit information sharing institution, the percent long-term credit would increase from 59.72% to 66.30%, bringing it to the same percentage long-term credit as in Belgium. Using the same estimate, if China had not established a credit information sharing institution in 2003, the average percent long-term credit would have remained at 29.48%, a level below Congo or Burkina. Instead, the percent long-term credit in China increased to 36.24%.

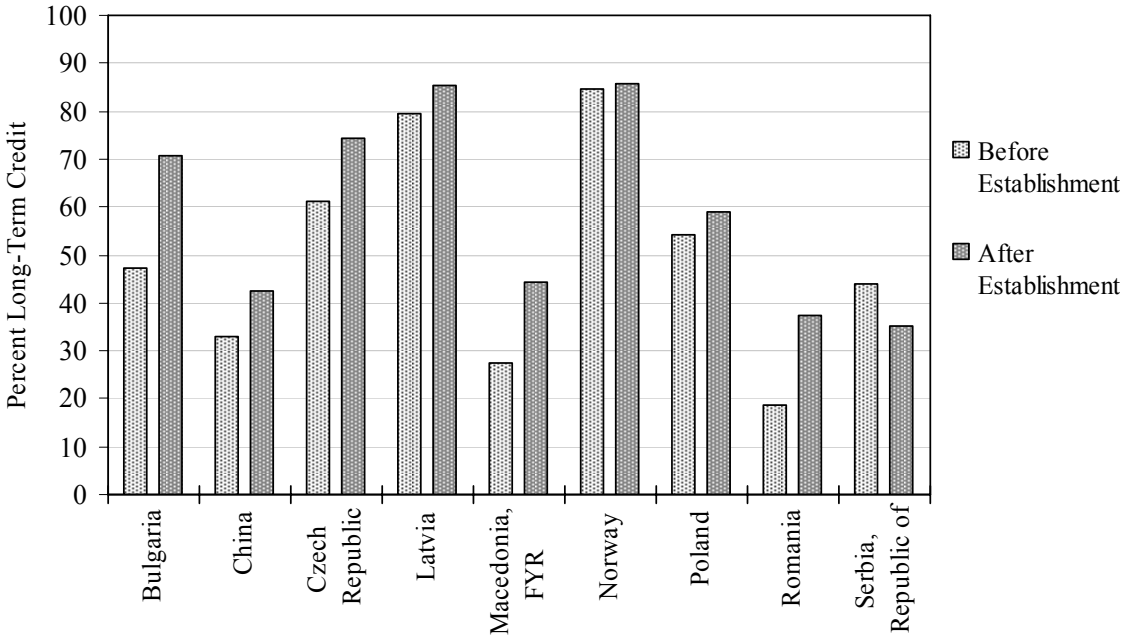
China is not the only country that established a credit information sharing institution during the years covered by our data – Norway implemented one in 1998, Bulgaria in 1999, and Romania in 2000, to name a few. Fig. 1 shows that, perhaps not coincidentally, the percent long-term credit increased in all countries that implemented a credit information sharing institution (except Serbia, where the implementation was preceded by macroeconomic and political turmoil and coincided with financial liberalization, closure of major banks, and overall reduction in credit). This was particularly true in countries that started at a relatively low percent of long-term credit. For example, the percent long-term credit in Romania doubled after the introduction of a public credit registry.

Economic development measured by per capita GDP, which was included to proxy for the importance of long-term capital and to test the hypothesis of maturity matching is not statistically significant. This result differs from Demirgüç-Kunt and Maksimovic (1999) who find evidence for maturity matching on the firm level. The difference in results may be attributed to the imprecise measure of fixed assets that we employ compared to Demirgüç-Kunt and Maksimovic who use a direct measure

of fixed assets as a share of total assets.[9] Similar to us, Qian and Strahan (2007) use per capita GDP to control for economic development and report an insignificant impact on maturity.

Figure 1: **Credit Information Sharing Institutions and Credit Maturity**

Plotted are the averages of the percent long-term credit for the period before and after the establishment of credit information sharing institutions. The years included vary by country depending on data availability. For The Czech Republic each period includes five years; for Latvia, Poland, Romania, and Republic of Serbia four years; for Bulgaria and China three years; for FRY Macedonia two years; and for Norway one year.



GDP growth has mostly a positive coefficient, which implies that faster growing countries have more long-term credit. However, the coefficient is significant at the accepted confidence levels only when we control for the manufacturing share of output in column (6) and therefore we refrain from making stronger claims. Nevertheless, with the results on inflation, we interpret this finding in line with Booth, Demirgüç-Kunt, and Maksimovic (2001): agents can borrow to invest in more

[9] For robustness, we also tried to compile data on per capita capital stock and capital stock as share of GDP to proxy for the fixed assets in a country. However, the initial income and investment data needed to compute the capital stock are available only for a limited number of countries in our sample and are not available for the last few years of the sample period.

productive, longer gestation projects against real, but not against inflationary growth prospects.

The rest of the results suggest that banking industry concentration, stock market development, and output volatility do not affects bank credit maturity. Contrary to expectations, a greater share of manufacturing is associated with less long-term credit. Unfortunately data limitations prevent us from investigating whether this effect is driven by particular non-manufacturing sectors, e.g. utilities, transportation, and/or construction.

3.4. Inflation and credit maturity

To examine further the relationship between inflation and credit maturity, we reestimated the regression reported in column (7) using 40 subsamples ordered by the rate of inflation as in Rousseau and Wachtel (2002) and Boyd, Levine, and Smith (2001). Both papers investigate the effect of inflation on financial sector activity and not on the maturity of credit specifically. However, the authors explain that the effect of financial development on economic growth diminishes with inflation because high inflation limits long-term financial contracting. Here we provide direct evidence for that idea.

Rousseau and Wachtel (2002) find that inflation reduces the availability of bank credit at low inflation rates but after some threshold (which they estimate to be around 16%) the negative effect of additional inflation on credit activity disappears. Similarly, Boyd, Levine, and Smith (2001) conclude that, while there is a statistically significant and economically important negative relationship between inflation and banking sector development, the marginal impact of inflation on bank lending activity diminishes rapidly. The threshold inflation rate above which inflation has no effect on credit market activity in Boyd, Levine, and Smith (2001) is very close to that in Rousseau and Wachtel (2002): 15%. Boyd, Levine, and Smith (2001) conclude that until this threshold is reached "the damage to the financial system has already been done, [and] further increases in inflation will have no additional consequences for financial sector performance or economic growth." This is consistent with the anecdotal evidence from Brazil provided by Demirgüç-Kunt and Maksimovic (1999) who explain that an inflationary environment gives rise to the indexation of financial contracts reducing the negative impact of additional high inflation on credit markets.

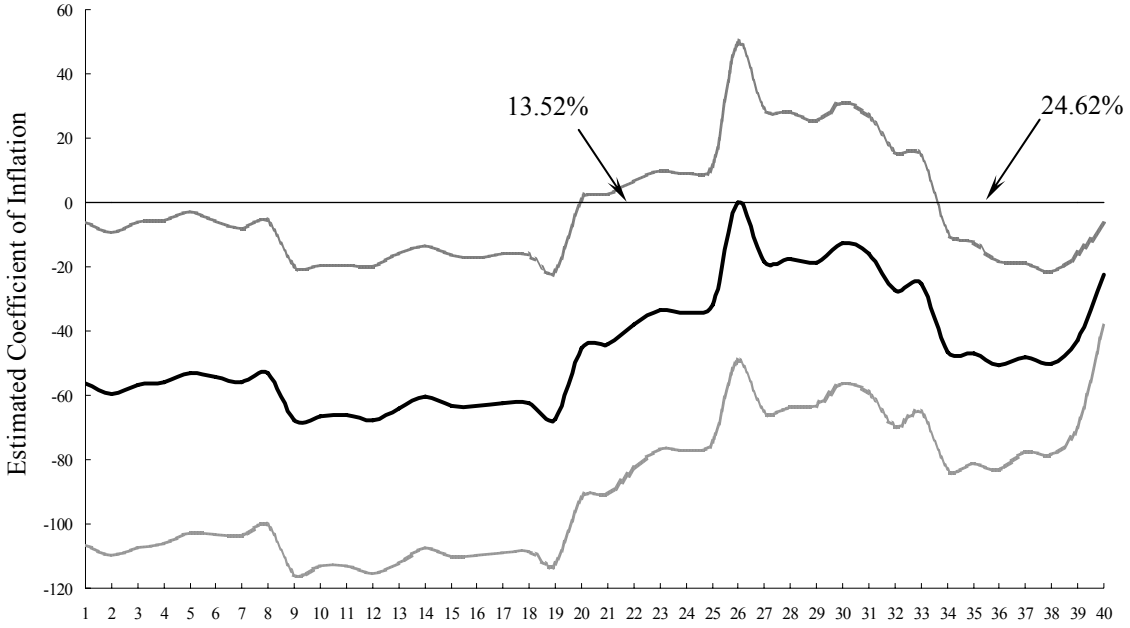
To examine these ideas using our data set, we sorted all observations according to the rate of inflation and estimated repeatedly the full model from column (7) in Table 5 starting with observations one through 244, then on two through 245, continuing until the last subsample that includes observations 40 through 284.[10] The estimated

[10] We need a large enough number of subsamples so that we can observe the variation of the inflation coefficient estimate at different levels of inflation. However, we also need to have sufficient degrees of freedom in each individual subsample. Forty subsamples seem to strike this balance well, but we also

coefficients of inflation, along with the 95% confidence intervals, are plotted in Fig. 2. Looking at Fig. 2, we can identify three regions in terms of the effect of inflation on the percent long-term credit. Inflation significantly reduces the percent long-term credit until inflation reaches about 14%. After that point, the effect of inflation on the percent long-term credit declines markedly. When the inflation rate reaches about 25%, the negative effect of inflation on credit maturity increases again.

Figure 2: **Impact of Inflation on Credit Maturity at Different Inflation Levels**

Plotted are the estimated coefficients of inflation and 95% confidence intervals when we use subsamples ordered by inflation. Each subsample contains 244 observations. The values on the abscissa correspond to the subsamples used in the estimations, while values on the ordinate represent the coefficient (and confidence intervals) estimates of inflation for the corresponding subsample.



The low range of inflation until about 14%age points is very close to the ranges reported by Rousseau and Wachtel (2002) and Boyd, Levine, and Smith (2001). However, our estimations suggest that the negative effect of high inflation reappears at "high" inflation rates. It is possible that the indexations of financial contracts cannot sufficiently reduce the uncertainty about the real value of nominal payments

performed the estimations with 30 to 50 subsamples. The results from these estimations suggest similar relationships to the ones described here.

when inflation becomes too high. In addition, Demirgüç-Kunt and Maksimovic (1999) note that very high inflation rates reveal a deterioration of institutions other than central banking. For example, even efficient legal systems take time to enforce contracts. As Demirgüç-Kunt and Maksimovic argue, while payments can be indexed, borrowers and lenders cannot "index judgment."

To recount, the major determinants of the maturity composition of bank credit to the private sector are rule of law, inflation, the existence of institutions for credit information sharing, and the size of the financial system. These effects are robust across various estimation techniques and specifications of the models. They are also robust to substituting the rule of law measures with alternative indexes (e.g. the ICRG variables and an index of corruption), to different definitions of the credit information sharing variable (public vs. private agencies) and to the inclusion of additional control variables such as the share of foreign banks and the share of government owned banks (which reduce the sample size substantially and are not statistically significant). The next section builds on these results to examine the effect of credit maturity on economic growth.

4. Credit Maturity and Economic Growth

Following the literature, e.g. Beck, Levine, and Loayza (2000b) and Levine, Loayza, and Beck (2000), we estimate the growth equations using dynamic panel generalized-method-of-moments (GMM) techniques to address the potential endogeneity of credit and other explanatory variables. This technique is fully described in Appendix B. The literature usually investigates the effect of finance on growth by averaging data over five years to reduce the impact of business cycles and to concentrate on long-term growth. Proceeding in the same fashion would reduce the number of observations in our data set substantially as the sample period for most countries is about ten years long. Fortunately, the literature has dealt with this issue. Bekaert, Harvey, and Lundblad (2005) investigate the impact of equity market liberalization on economic growth by using overlapping data. The five-year averages are constructed as 1990-95, then 1991-96, 1992-97, and so on producing six five-year averages from any ten years of annual data. While this ingenious methodology increases the number of observations, it calls for the adjustment of the moving average component in the residuals as introduced by Newey and West (1987). Without the adjustment, the standard t-tests lead to a slight over-rejection (Bekaert *et al.* 2001). Although in the panel data context, unlike in the single time series, we do not need the weighting matrix for the estimate of central term in covariance matrix to be positive semi-definite (Petersen 2007), we follow Newey and West (1987) assuming that as the distance between observations goes to infinity, the correlation

between corresponding residuals approaches zero.[11] We adjust the dependence for up to five lags (i.e. we set l_{max} to five) and estimate correlations only between lagged residuals in the same cluster.[12] The procedure provides serial-correlation and heteroskedasticity consistent standard errors.[13]

4.1. Results

Column (1) in Table 6 reports the results of an equation where economic growth is explained by private sector credit, initial GDP per capita, government size, openness to trade, and inflation. This is a standard specification from the finance and growth literature (Beck *et al.* 2000b). Financial development is expected to lead to faster economic growth. High inflation is an indicator of macroeconomic instability and is expected to slow down economic growth. More open economies are expected to grow faster. A large government size is taken as an indicator of inefficient use of resources and is expected to reduce economic growth. Initial income is included to test for income convergence.[14]

The results show that private credit has a positive and statistically significant effect on economic growth. Besides being statistically significant, private credit also has a large economic effect, similar to the effect reported in the previous literature. To illustrate, we compare our results with the estimates of Beck, Levine, and Loayza (2000b): a 10% exogenous increase in private credit leads to an additional 0.216 percentage points of economic growth per year using our estimated coefficient,[15] and to 0.228 percentage point of additional yearly growth using the estimated coefficient of Beck, Levine, and Loayza (2000b). The coefficients on all control variables except government size have the expected signs. Openness to trade and initial income per capita are statistically significant at the accepted confidence levels. The specification tests confirm the validity of our results: we cannot reject the null hypothesis of the Sargan tests or of the serial-correlation test at the accepted confidence levels in all specifications.

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[11] We use a weighting matrix which multiplies the covariance of lag l by $\left(1-\left(l-1\right)/\left(l_{\max}+1\right)\right)$, where l_{max} is the maximum lag order. A weighting matrix with such elements will weigh heaviest the adjacent observation, while the weights decrease as the distance between observations increases.

[12] As suggested by several papers, we have repeated the procedure by including up to T-1 lags, where T is the maximum number of years per country, but doing so leaves our standard errors almost unchanged.

[13] Ranciere, Tornell, and Westermann (2003) also use overlapping averages to provide long-term predictions of the finance and growth relationship and adjust their standard errors according to Newey and West (1987). Petersen (2007) finds that about 7% of authors who use panel data in the finance literature adjust their standard errors using the Newey-West procedure.

[14] We could not obtain recent data on education levels for many countries for the later years in our sample. We carried out all estimations with a smaller sample including education and obtained qualitatively similar, but less statistically significant results on all variables.

[15] The calculation is as performed follows: 2.296 * ln(1.1) = 0.216.

Table 6: **Bank Credit Maturity and Economic Growth (GMM System Estimation, Five-year Averages)**

The dependent variable is the average yearly increase in real per capita GDP. The variables are defined as in Table 1. Credit, Percent Long-Term Credit, Government size, Openness to trade, and Initial income per capita enter the regression as log(variable). Inflation enters the regression as log(1 + Inflation).

	(1)	(2)	(3)
Credit	2.296	2.015	2.469
	(0.031)	(0.095)	(0.016)
Percent Long-Term Credit		6.020	6.267
		(0.001)	(0.100)
Initial income per capita	-2.164	-2.555	-4.747
	(0.031)	(0.012)	(0.000)
Government size	0.709	1.698	0.178
	(0.800)	(0.545)	(0.940)
Openness to trade	17.751	15.090	12.699
	(0.000)	(0.000)	(0.000)
Inflation	-2.607	-0.645	-8.647
	(0.173)	(0.761)	(0.000)
Constant	44.624	-34.207	-68.554
	(0.424)	(0.016)	(0.000)
Sargan test (*p*-value)	0.204	0.263	0.962
Serial correlation test (*p*-value)	0.639	0.207	0.103
Observations	499	499	361
Countries	64	64	62

Notes: *P*-values based on the Newey-West adjusted heteroscedastic-serial consistent standard errors are reported in parentheses below the coefficients. The Sargan test has the null hypothesis that the instruments are not correlated with the residuals. The serial correlation test has a null hypothesis that the errors in the first difference regressions do not exhibit second order serial correlation.

In column (2) we add the percent long-term credit. Credit maturity has a positive and statistically significant effect on economic growth as predicted by Bencivenga and Smith (1991). In terms of economic size a 10% increase in the portion of long-term credit leads to an additional 0.574 percentage points of economic growth per year.[16] As the average growth rate in the sample is 2.98%, the impact of an increase in credit maturity on growth is large (an increase of over 19%).

Consider the following example to illustrate the economic impact of credit maturity. Private credit in Malaysia is 130% of GDP which is well above the average of the middle income group: 58.31%. By this standard measure Malaysia has above average financial development. However, only 46.73 % of private credit in Malaysia

[16] The calculation is as follows: 6.02 * ln(1.1) = 0.574; where 6.02 is the coefficient of the percent long-term credit in column (2).

is long-term, which is below the average of the middle income group of 63.17%. Thus, Malaysian banks extend relatively large volumes of credit but much of the credit is short-term compared to other countries. If private credit in Malaysia declined to the average of the middle income group, economic growth in Malaysia would decline by 1.616 percentage points. However, if the percent long-term credit in Malaysia increased to the average of the middle income group, economic growth would increase by 1.815 percentage points. If these two changes happened simultaneously, economic growth in Malaysia would increase by 0.199 percentage points. Therefore, if most of the reduction in credit originated from a decline in short-term credits, the negative impact of reduced credit to the private sector would be countered by the longer maturity of credit.[17]

4.2. The determinants of credit maturity and economic growth

Section 3 shows that credit maturity is longer in countries that have strong institutions, low inflation, and institutions for sharing credit information among financial institutions. These characteristics also influence economic growth through their impact on credit maturity. Furthermore, the impact is large. Using the estimations in column (2) in Table 5, we obtained the predicted values for the percent long-term credit. Then, we reestimated the growth equation using the predicted values for the percent long-term credit. These results are reported in column (3) of Table 6.

Putting together the estimates from Sections 3 and 4, we estimate that an increase in the rule of law index by one index point would increase economic growth (via credit maturity) by 0.586 percentage points a year.[18] A decrease of inflation by ten percentage points leads to a 0.045 percentage points faster economic growth.[19] The establishment of a credit information sharing institution in a country would raise economic growth by 0.718 percentage points.[20] These effects on economic growth via credit maturity are separate from other channels through which strong institutions, low inflation and institutions for credit information sharing might affect growth.

[17] For robustness, we also added the stock market value traded as a share of GDP, the stock market turnover ratio, and stock market capitalization as a share of GDP as measures of stock market development. The stock market is an alternative source of long-term financing and its inclusion in the model might reduce the effect of credit maturity on economic growth. Although the sample size decreases from 64 to 44 countries, the coefficient on credit maturity remains statistically significant and similar in magnitude. All stock market measures have positive coefficients, while only value traded and the turnover ratio are statistically significant.

[18] 1.00 increase in rule of law leads to (5.308 * 1.00 =) 5.31 percentage points increase in the percent long-term credit. At the average of 54.14% long-term credit, this leads to an increase in yearly GDP growth of (6.27 * (ln(0.541+ 0.053) - ln(0.541))=) 0.586 percentage points.

[19] 0.10 decrease in inflation leads to (3.939 * 0.10 =) 0.394 percentage points increase in the percent long-term credit. At the sample average of 54.14% long-term credit, this leads to an increase in yearly GDP growth of (6.27 * (ln(0.5414 + 0.00394) – ln(0.5414)) =) 0.045 percentage points. Note that this calculation is separate from the independent impact of inflation on growth. Such decrease in inflation independently increases growth by 0.82 percentage points.

[20] The establishment of a credit information sharing institution would increase the percent long-term credit by 6.573 percentage points. At the average of 54.14% long-term credit, this leads to an increase in yearly GDP growth of (6.27*(ln(0.7604+0.06573)-ln(0.7604)=) 0.718 percentage points.

Conclusion

This paper investigates empirically one of the important functions of the banking system: to transform short-term liquid deposits into long-term illiquid financial assets that can fund long gestation activities and enhance economic growth. The paper shows that the extent to which banks perform this function well has an important effect on the relationship between the financial system and economic growth. Economic growth is faster in countries where the banking system extends more long-term credits.

Furthermore, the paper shows that credit maturity depends on a number of institutional and economic factors. Greater rule of law, low inflation, and credit information sharing institutions contribute to lengthening the maturity of bank credit. While policymakers can make improvements along each of these dimensions, the effect of credit information sharing is probably most interesting form a policy perspective. Improvements in the rule of law and sustained low inflation take decades, whereas a credit information sharing institution can be established within a few years. We show that these institutions provide valuable information to banks and are associated with longer maturity of credit. This, in turn, raises economic growth.

In a parallel paper where we use a smaller data set primarily from the transition economies, we show that the rule of law has greater effect on the portion of credit with maturity longer than five years, whereas inflation has a greater effect on the portion of credit with maturity longer than one year. In addition, per capita GDP becomes significant determinant of maturity, as it has a positive impact of the portion of credit with maturity longer than five years. Credit information sharing institutions remain important determinant of maturity.

To our knowledge, the results presented in this paper are the first empirical test of an important theoretical idea – that banks contribute to economic growth by providing liquidity services and increasing the supply of long-term credit. Future work can examine additional channels through which finance enhances economic growth: by producing information about borrowers and allocating capital, by monitoring borrowers, by aggregating savings into large-size investments, and by cross sectional risk diversification. Ideally, we would be able to compare the channels through which finance affects growth in various institutional and economic environments. We would also be able to investigate whether lax rule of law diminishes the positive effect of finance on the economy because banks: 1) cannot assess risk and monitor the behavior of borrowers, and/or as we show here, 2) curtail long-term financing. We would also be able to investigate how the relative importance of different channels evolves as the financial system develops. In summary, investigating the channels through which finance affects growth presents a number of exciting research opportunities.

Appendix A. Determinants of Credit Maturity – Additional Estimators

	Fixed Effects		GLS		GLS – AR(1)		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rule of Law	5.607	4.431	6.407	16.879	5.061	5.173	3.008	5.291
	(0.196)	(0.515)	(0.000)	(0.000)	(0.000)	(0.005)	(0.317)	(0.152)
Inflation	-3.985	-9.321	-3.034	-27.937	-1.600	-6.242	-3.892	-10.247
	(0.014)	(0.360)	(0.092)	(0.000)	(0.025)	(0.323)	(0.000)	(0.126)
Growth	0.268	0.249	0.433	0.527	0.027	0.251	0.257	0.362
	(0.351)	(0.248)	(0.003)	(0.001)	(0.762)	(0.038)	(0.119)	(0.109)
Credit	10.615	14.280	11.748	9.896	10.758	14.238	15.575	14.463
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.684	0.457	-0.073	-0.352	0.200	0.050	-0.158	-0.210
	(0.066)	(0.268)	(0.429)	(0.001)	(0.104)	(0.729)	(0.533)	(0.437)
Credit Information		6.129		4.072		4.060		5.155
Sharing		(0.002)		(0.001)		(0.012)		(0.017)
Banking Industry		4.622		4.147		2.907		4.727
Concentration		(0.427)		(0.009)		(0.080)		(0.181)
Stock Market		0.044		0.492		1.152		-0.085
Turnover Ratio		(0.951)		(0.299)		(0.022)		(0.905)
Output Volatility		-0.864		5.362		0.777		0.382
		(0.545)		(0.000)		(0.441)		(0.837)
Manufacturing Share		-0.788		-0.544		-0.581		-0.647
of Output		(0.082)		(0.000)		(0.000)		(0.022)
U.K. Legal Origin			-8.452	-15.347	-10.670	-11.068		
			(0.038)	(0.001)	(0.022)	(0.032)		
French Legal Origin			-5.440	-10.414	-6.992	-8.857		
			(0.162)	(0.016)	(0.111)	(0.051)		
German Legal Origin			-0.223	-2.672	-1.164	2.929		
			(0.955)	(0.557)	(0.788)	(0.514)		
Socialist Legal Origin			9.951	13.151	10.342	15.960		
			(0.015)	(0.006)	(0.027)	(0.002)		
Constant	58.801	77.625	65.613	65.258	64.472	74.863	71.521	78.519
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hausman test: χ^2			7.48	183.81	8.69	33.67	19.22	9.43
(d.f.)			(5)	(10)	(5)	(10)	(5)	(10)
p-value			0.187	0.000	0.122	0.000	0.001	0.492
Observations	504	284	504	284	504	281	504	284
Countries	71	45	71	45	71	42	71	45

Notes: See Table 1 for variable definitions. *P*-values are reported in parentheses below the coefficients. In 2SLS, legal origin dummies are used as instruments for endogenous credit. Hausman test has a null hypothesis that the explanatory variables are not correlated with the country-specific random-effects. Credit, Banking Industry Concentration, Stock Market Turnover Ratio, and Output Volatility enter the regression as log(variable), while Income is in thousands.

Appendix B. GMM Methodology[21]

Let y_{it} be the logarithm of real per capita GDP in country i at time t. We are interested in the following equation

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (2)$$

where $y_{i,t}$ - $y_{i,t-1}$ is the growth rate in real per capita GDP, $X_{i,t}$ is a set of explanatory variables, including our measures for financial development, η_i captures unobserved country-specific effects, and ε_{it} is an error term. We rewrite Eq. (2) as:

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}, \quad (3)$$

and take first differences to eliminate the country-specific effect, as it is correlated with lagged dependent variable:

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right). \quad (4)$$

By construction, in Eq. (4), the lagged difference in per capita GDP is correlated with the error term, which along with the potential endogeneity of the explanatory variables X, requires the use of instruments. The GMM *difference* estimator uses the lagged levels of the explanatory variables as instruments under the conditions that the error term is not serially correlated and that the lagged levels of the explanatory variables are weakly exogenous (i.e., they are uncorrelated with future error terms). Then the following moment conditions are used to calculate the difference estimator:

$$E\left[y_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \quad \text{for} \quad s \geq 2; t = 3, ..., T, \quad (5)$$

$$E\left[X_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \quad \text{for} \quad s \geq 2; t = 3, ..., T. \quad (6)$$

Since persistence in the explanatory variables may adversely affect the small-sample and asymptotic properties of the difference estimator (Blundell and Bond 1998), the difference estimator is further combined with an estimator in levels to produce a *system* estimator. The inclusion of a levels equation also allows us to use information on cross-country differences, which is not possible with the *difference* estimator alone.

The equation in levels uses the lagged differences of the explanatory variables as instruments under two conditions. First, the error term is not serially correlated. Second, although there may be correlation between the levels of the explanatory variables and the case-specific error term, there is no correlation between the difference in the explanatory variables and the error term. This yields the following stationarity properties:

$$E\left[y_{i,t+p}\eta_i \right] = E\left[y_{i,t+q}\eta_i \right] \quad \text{and} \quad E\left[X_{i,t+p}\eta_i \right] = E\left[X_{i,t+q}\eta_i \right] \text{ for all } p \text{ \& } q. \quad (7)$$

The additional moment conditions for the regression in levels are:

[21] This method is fully described in Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998).

$$E\left[\left(y_{i,t-s}-y_{i,t-s-1}\right)\left(\eta_i+\varepsilon_{i,t}\right)\right]=0 \quad \text{for} \quad s=1 \qquad (8)$$

$$E\left[\left(X_{i,t-s}-X_{i,t-s-1}\right)\left(\eta_i+\varepsilon_{i,t}\right)\right]=0 \quad \text{for} \quad s=1. \qquad (9)$$

In summary, the GMM *system* estimator is obtained using the moment conditions in Eq. (5), (6), (8), and (9). In addition, as Beck and Levine (2004), we use alternative procedure developed by Calderon, Chong, and Loayza (2002) and Loayza, Chong, and Calerdon (1999) to control for the over-fitting by reducing the dimensionality of instruments. This procedure has one shortcoming: in order to perform it we loose one time period from the sample. Nevertheless, given the sample size, we are still able to make robust estimates.

As our data are constructed using overlapping averages, we need to adjust the moving average component in the residuals. We do this by adjusting standard errors according to Newey-West (1987) procedure, modified for the use in panel data. Petersen (2007) points that, unlike for the single time series, in the panel data context the weighting matrix is not necessary for the estimate of central term in covariance matrix to be positive semi-definite. Nevertheless, we follow Newey-West approach assuming that as the distance between observations goes to infinity, the correlation between residuals approaches zero. Therefore, we use a weighting matrix which multiplies the covariance of lag l by:

$$\left(1-\left(l-1\right)/\left(l_{\max}+1\right)\right) \qquad (10)$$

where $l_{\max}$ is the maximum lag order. Weighting matrix with such elements will weigh heaviest the adjacent observation, while the weights decrease as distance between observations increases. We adjust the dependence for up to five lags (i.e. we set $l_{\max}$ to five) and estimate correlations only between lagged residuals in the same cluster. As suggested by several papers, we have repeated the procedure by including up to T-1 lags, where T is the maximum number of years per country, but doing so leaves our standard errors almost unchanged. This procedure provides serial-correlation and heteroskedasticity consistent standard errors.

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