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Puzzles in the Relationship between Financial Development and Economic Growth

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Abstract

This paper provides evidence in support of two important puzzles regarding the relationship of financial development and economic growth documented in a number of recent papers. The first puzzle relates to the finding that banks have a positive effect upon economic growth, when data are averaged, but a negative one when the highest annual frequency is used. The second is about the positive effect of stock markets upon economic growth irrespective of the averaging.

On the first puzzle, although our results provide further empirical support to a negative effect of banks' development upon economic growth in the short run (annual data), they do not provide the expected evidence of a strong positive relationship for the long-run. On the second puzzle related to the impact of stock markets upon economic growth, we find that the sign of the relationship strongly depends on the variables chosen, the method of estimation and the possible role of self-selection bias.

This paper uses recent developments in panel data analysis, including panel unit root tests for a sample of 120 countries for 37 years.

JEL classification numbers: C2, C23, O1, O16.
Keywords: Financial development, panel data, least developed countries, economic growth.

1 Introduction

Despite the description by Rousseau and Wachtel (2002) of the robustness of the cross-sectional relationship between the size of a country's financial sector and its rate of

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economic growth as a "well established fact", the evidence on the impact of finance upon economic growth has been mixed and remains a debated subject.

This paper will contribute to the literature on finance and growth in a number of ways. First, by re-examining the empirical tests, the paper reaches the conclusion that at country level, results are influenced by the introduction of variables capturing the effect of both banks and stock exchanges, although the impact of the latter has frequently been omitted in the past. Second, the paper provides evidence in support of two important puzzles regarding the relationship of financial development and economic growth documented in a number of recent papers (Atje and Jovanovic, 1993, Beck and Levine, 2004, Favara, 2003, Loayza and Rancière, 2006, Saci *et al.*, 2009). The first puzzle relates to the finding that banks have a positive effect upon economic growth when data are averaged, but a negative one when the highest annual frequency is used. This puzzling finding has also been accompanied by another one. In papers that have also included a variable related to the development of stock markets, the above mentioned negative impact of the banking sector upon economic growth is usually accompanied by a positive and significant impact of the stock markets' variables upon economic growth. Tests for joint-significance, such as the Wald test, nonetheless usually support the view that stock and bank development variables together are important for economic growth Beck and Levine, (2004, p.431). Given the fact that commercial banks are usually set up before stock markets and given the fact that stock exchanges usually impose stringent rules to select the companies allowed to issue shares, the two above mentioned puzzles are in need of further research. If they were proven to be robust, they may lead to a rather different set of policy prescriptions, in particular for developing countries.

In the case of the puzzle of the positive relationship between stock markets and economic growth, we also test whether such positive result could arise from self-selection bias (i.e., when only countries with functioning stock markets throughout the entire sample period are included in the study). To circumvent this possible bias, we have created an ad-hoc sub-sample containing countries (almost by definition less developed countries that have established markets very recently) for which we have firm knowledge of the date of establishment of stock markets. In these cases, for all periods in which there was no stock exchange, the variable related to stock market development is awarded a zero, rather than simply a "Not Available" entry.

It must be noted that a number of papers have used averaged data, usually over 5-year periods, to remove the effect of the business cycle. We decided not to follow this course of action, because the averaging is based, in our opinion, on a number of quite strong assumptions that are never really openly discussed in the literature: is the cycle really 5-year long and regular? For every country of the sample? And even more importantly, are the cycles synchronised across all the countries of the sample? We thought that these assumptions were quite strong; therefore it was decided not to arbitrarily average the data.

Third, unlike most other papers in the literature, this paper uses a very large dataset, inclusive of 120 countries (both developed and developing) and panel data analysis over the period 1970-2006. However, the decision of having a large and comprehensive dataset has implied that we had to accept to work with an unbalanced panel (i.e. inevitably there are some observations that are not available for certain countries and for certain years). We believe that this is a price worth paying to use a comprehensive database. Fourth, we make full use of available panel unit root tests (for unbalanced panels), namely the Levin, Li and Chu (2002) "LLC" test.

Fifth, we also experiment with various proxy variables for the impact of stock exchanges.

Furthermore, to complement the above tests, we will also focus on the relationship between finance and economic growth in the context of a sample of LDCs.
The remainder of the paper is organised as follows. Section II briefly reviews the most recent and relevant contributions regarding the two puzzles, while Section III presents the data and variables. Section IV is on methodology and results and finally Section V concludes.

2 Literature Review

Beck and Levine (2004) initially constructed a panel with data averaged over five-year intervals over the period 1986-1998 for 40 countries. The averaging was aimed at removing the effect of the business cycle. The authors found that both financial markets and banks played a positive and significant role in influencing economic growth, even when selected control variables were added to the model.
However, the relationship between financial variables and economic growth broke down, in particular for the banking variable when using annual data Beck and Levine, (2004, p.439). They tentatively suggested that this was due to "credit surges" that had also been found to be good predictors of banking crises and subsequent economic slowdowns.
In a recent paper, Loayza and Rancière (2006) empirically investigated and provided supportive evidence to this apparent puzzle and put forward a number of possible explanations backed up by some empirical evidence.
First, they empirically proved that the relationship between financial variables and economic growth is significant and positive in the long-run; this was done by means of a model with domestic credit by banks and other financial institutions as a percentage of GDP as their financial development variable and a number of other well established control variables. The technique they have used is a panel error-correction model that allows the estimation of both short and long-run effects from a general autoregressive distributed lags (ARDL) model.
Their sample consisted of annual data with 75 countries over the period 1960-2000. The dependent variable is rate of growth of GDP per capita, while the control variables (always included) are government consumption to GDP, volume of trade over GDP, inflation rate and initial GDP per capita. However, they incorporated only domestic credit by banks and other financial institutions as a percentage of GDP as a financial variable, ignoring the stock market.
Unlike Beck and Levine (2004), Loayza and Rancière (2006) did not average the data but they estimated both short- and long-run effects using a database composed of a relatively large sample of countries and annual observations. They suggest that averaging hides the dynamic relationship between financial intermediation and economic activity.
Favara (2003) found a strong relationship between domestic credit by banks and other financial institutions as a percentage of GDP and economic growth after controlling for the effect of inflation, government consumption to GDP, initial GDP per capita, domestic investment to GDP, average years of school of the population aged 15 and over, trade openness to GDP, black market premium and dummy legal origin variables. The sample consisted of 85 countries for the period 1960-1998. However, this strong relationship weakens when an instrumental variable, (IV) estimation, method is applied with dummy variables of the origins of the legal system of each country used as instruments.

When moving to annual data, the effect of domestic credit by banks and other financial institutions as a percentage of GDP is negative when real domestic investment as share of real per capita GDP is included. But it was still positive without the real domestic investment. However, no variables capturing the effect of financial markets were included.

Saci *et al.* (2009) estimated the relationship for 30 developing countries with annual data over the period 1988-2001 applying two-step GMM. They found that the variable domestic credit by banks and other financial institutions as a percentage of GDP has a significantly negative coefficient with stock market traded value over GDP. When "stock market traded value over GDP" is replaced by "stock market turnover ratio" the effect of domestic credit by banks and other financial institutions as a percentage of GDP became insignificant. However, in each case the effect of the stock market variables on growth is positive and significant.

3 Data and Variables

The original sources of the data used in this paper are from the World Bank, the IMF and the UN. We have downloaded data for many of the variables using *Beyond 20/20 Web Data Server* of ESDS International.

Although the "potential universe" of countries in the source dataset is large (e.g. 200 plus countries in the World Development Indicators and IMF for macro data, 225 countries in ED stats of the World Bank for Education related data), continuous and consistent time series for all our variables (in particular the bank and stock market development related, but also some of the control variables, in particular those related to education) are only available for a smaller sample of countries.

The most comprehensive dataset we have covers the period 1970- 2006 and 120 countries. Although we are aware that some papers Favara, (2003), Loayza and Rancière (2006) covered periods starting from 1960, after considerable deliberation we have decided to opt for a later start of 1970 to examine the relationship among a wide number of countries at various levels of economic achievements.[3] The list of the 28 LDCs countries and 92 non-LDCs included in our study is provided in Appendix table A1.

Least developed countries were chosen in accordance to four criteria established by the UN. For these LDCs, we have also collected the dates of establishment of the first commercial bank, the central bank and the stock exchange. With this knowledge, we would award a zero for any year when stock markets did not exist. Because data availability of other variables for these 28 LDCs was reasonably good, this has also helped us create a balanced panel for our entire set of 120 countries at least for our long run analysis. In addition, we believe that we may have avoided a possible problem of self selection bias as we do not include only countries with functioning stock markets.

To approximate the impact of banks upon growth, the literature has identified three possible variables. The first one, *liquid liabilities*, initially suggested by Goldsmith (1969), McKinnon (1973), was then used by King and Levine (1993a), Levine (1997) and Beck *et al.* (2000b). *The variable liquid liabilities* is equal to currency plus demand and

[3]Our sample includes 28 LDCs of which 23 are from Africa. 15 of them were declared independent between 1960 to 1970. Only one country (Sudan) was declared independent before 1960 (in 1956). Similarly, many of them had their central bank opened only after 1970.

interest bearing liabilities of banks and non-bank financial intermediaries divided by GDP. However, since the variable l*iquid liabilities* include deposits by one financial intermediary into another, this may cause a problem of double counting.

Another variable, *commercial to central bank* (King and Levine, 1993a, King and Levine, 1993b, Levine, 1997). This variable, which is the ratio of commercial bank assets divided by commercial and central bank assets, according to Beck *et al.* (2000b) does not account for the effectiveness of banks in researching firms, exerting corporate control, mobilising savings, easing transactions and providing risk management facilities to clients. In addition, commercial banks are not the only financial institutions intermediating society's resources (Beck *et al.*, 2007, p.31)

Finally, *Private credit* is the preferred Beck *et al.*, (2000b) indicator and is therefore used in the majority of literature (Beck and Demirgüç-Kunt, 2008, Beck *et al.* 2007, Beck *et al.* 2001, Beck *et al.* 2000a, Beck *et al.* 2000b, Edison *et al*, 2002, Favara, 2003, Levine, 2002, Loayza and Rancière, 2006, Saci and Holden, 2008, Saci *et al.*, 2009). *Private credit* is the most commonly used indicator in this area mainly because 1) it isolates credit issued to the private sector (i.e. does not account for credit issued to governments, government's agencies, and public enterprises), and 2) it excludes credit issued by central bank, as opposed to gross credit used by King and Levine (1993a), King and Levine (1993b)**,** which includes credit issued by monetary authority and government agencies.

In the finance and growth literature, the impact of Bank credit to all sectors as % of GDP (*bank credit all sectors*) has rarely been considered. This is reasonable as credit to private sector should be more powerful in helping economy growth. However, in many countries a significant portion of bank loans is made available to public enterprises. So we will also use *bank credit to all sectors* as well.

We experiment with *liquid liabilities, private credit, bank credit, and bank credit all sector*. However, like in other papers, *private credit* will be our key variable representing bank's development.

Similarly, we experiment and estimate the relationship for all common stock market variables namely *capitalisation, value traded and turnover.* The first is the measure of the size of the market whiles the second and third indicates market liquidity.

Levine & Zervos (1998) and Beck and Levine (2004) show that *capitalisation* is not a good predictor of economic growth. In addition, liquidity is considered to be more important than the size of the market. Liquid markets provide a ready exit-option for investors. This can foster more efficient resource allocation and faster growth Beck and Levine, (2004), Bencivenga *et al.*, (1995), Levine, (1991). *Value traded* does not measure the liquidity of the market. Since markets are forward looking, they will anticipate higher economic growth by higher share prices. Since *value traded* is the product of quantity and price, this indicator can rise even without an increase in the number of transactions. However, *turnover* does not suffer from this weakness since both numerator and denominator contain the price (Beck and Levine, 2004).

Computationally, *turnover* equals the value of the trading of shares on domestic exchanges divided by total value of listed shares and indicates the trading volume of the stock market relative to its size. *Turnover* will therefore be our preferred stock market variable.

The following section now details the use of various control variables.

Initial GDP per capita
Analysing Maddison (1982)'s data 1870-1973, Baumol (1986) found that the slower rate of productivity growth of a country was associated with its higher level of growth in the past.
Methodologically, beta convergence of the neo-classical approach is obtained by a regression analysis estimating the growth of GDP per capita over a certain period of time in relation to its initial level. If the regression coefficient beta has a negative sign it will indicate that the GDP per capita of countries with lower *initial GDP per capita* grows more rapidly than the countries with higher *initial GDP per capita*. So the variable initial GDP per capita should be appropriate to test the degree of validity of the "convergence theory" i.e. a country with an initial high (low) income measured by GDP per capita should experience lower (higher) growth rates since gradual convergence is expected Rousseau and Wachtel (2002) Therefore the variable is expected to have a negative sign. A lot of care[4] was taken to compute the variable.

Education (gross enrolment rate secondary is the number of total pupils enrolled in secondary expressed as percentage of population in the theoretical age group for secondary education) has been used as a proxy for human capital investment and is expected to have a positive impact upon growth. The source of the data is UNESCO. They are downloaded using ED Stats Data Query made available by the World Bank.
The variable presents a number of challenges because enrolment in most cases is different from actual active participation in the process of education. Moreover, the variable is pretty stable at around 100% for many developed countries, although some variations in the data can be found for countries at different levels (mainly developing) of income. Many countries have already achieved enrolment rates of 100% over time, in some cases even exceeding 100% due to enrolment of people outside the theoretical age group (gross basis).
However, to be consistent with previous empirical research and because we feel that the variable could still be interpreted as an overall indicator of the commitment towards investments in human capital, the variable is included as another control variable in the regression.
Other control variables used are general government consumption to GDP (*government consumption*), gross capital formation to GDP (*capitalisation*), inflation as change of CPI Index (*inflation*), import and export to GDP (*trade openness*) and dummy legal origin variables from La Porta *et al.* (2007).
The list of variables used is provided in Appendix table A3. Sources of the data for the variables are available in Appendix table A4.

4 Methodology and Results

Although some research has claimed that the panel estimation conceals important cross-country differences and therefore pooling of the data is invalid (Arestis *et al.*, 2005), a majority of the literature until recently (Beck and Demirgüç-Kunt, 2008, Beck and

[4]Unlike existing literature that is silent on the definition of *Initial GDP per capita*, we define *initial GDP per capita* as the start year current GDP per capita US $ multiplied by 1+ US inflation of each year.

Levine, 2004, Beck *et al.*, 2000a, Beck *et al.*, 2000b, Favara, 2003, Levine, 2002, Levine and Zervos, 1998, Loayza and Rancière, 2006, Rousseau and Wachtel, 2000, Saci *et al.*, 2009) has used panel techniques. It is more of a standard practice now to use panel techniques in growth equations. We therefore apply panel technique for our estimation, which apart from its various advantages (e.g. allows both cross section and time series nature of relationship, enables to study complicated behavioural models, minimises the bias), will also enable us to compare our results with the existing works.

Table 1 presents descriptive statistics and correlations.

Summary Statistics: 1970 – 2006

	Economic growth	Private credit	Capitalisation	Value traded	Turnover
Descriptive Statistics					
Mean	1.832	0.383	0.293	0.142	0.321
Maximum	13.913	1.466	2.670	1.532	3.681
Minimum*	-2.751	0.036	0.002	0.00003	0.003
Std. Deviation	1.908	0.317	0.410	0.269	0.511
Observations	120	120	120	120	120
Correlations					
Economic growth	1				
Private credit	0.249	1			
	0.006				
Capitalisation	0.171	0.571	1		
	0.062	*0*			
Value traded	0.149	0.789	0.803	1	
	0.062	*0*	*0*		
Turnover	0.024	0.295	0.176	0.383	1
	0.795	*0.001*	*0.055*	*0*	

p-Values are reported in italics

*Countries with no stock markets were awarded a zero for *capitalisation, value traded* and *turnover*.

Therefore zero would automatically be the minimum value. For comparison with other studies, the minimum value that were available in the original dataset have been displayed.

It can be noted that economic growth is more correlated with *private credit, capitalisation* and *value traded* for the sample[5].

While *private credit* for LDCs is only about 13% for the period 1970-2006, it is 48% for other developing and developed countries. This gap is huge in the case of stock market

[5]In case of stock market variables, our summary statistics differ largely from [3] Beck and Levine (2004). We believe it is so because our sample consists of 28 LDCs whereas [3] Beck and Levine (2004) has only one LDC (Bangladesh) in their sample.

variables. *Capitalisation* and *value traded* of LDCs are just over 0.5% with *turnover* at 1%. This is comparatively very high for other countries at 38%, 18% and 41% respectively.

It is well established that the stationarity of the variables in standard OLS regression can lead to spurious regression Granger and Newbold, (1974). Therefore it is very important to establish whether variables are stationary or not.

In this paper we apply various tests but report only the panel unit root test by Levin, Li and Chu LLC (2002) to establish whether the variables are stationary or not. We are aware that the LLC assumes homogeneity among countries and does not deal with possible cross sections dependence[6].

Appendix table A5 gives the results of the stationarity test[7] for 120 (all countries) and 28 LDCs.

As we can see from the table variables namely *private credit, bank credit, capitalisation* and *value traded* were found to be integrated of order 1 in both 120 and 92 countries. In the list of 28 LDCs, we found *private credit, bank credit, bank credit all sector, capitalisation, value traded, capital formation and education integrated of order 1*. Based on the test, these variables will enter the model as first differences, a necessary although not ideal step to be taken.

We now report the results of the estimation using different methods.

Table 2 gives the result of the POLS regression for data averaged over the 1970 – 2006 with one observation per country for all 120 countries to capture the long-run relationships. In case of stock market related variables of LDCs, we have awarded a zero value when there was no stock exchange in such countries.

The dependent variable is *Economic growth* (log difference of real GDP per capita). Each of the three reported regressions controls for logarithms of all five control variables namely *government consumption, capital formation, trade openness, inflation, education* and *initial GDP per capita*. The regressions include *private credit* and *capitalisation, private credit* and *value traded, private credit* and *turnover* in first, second and third regressions respectively. The p-values are provided in italics below the coefficient statistics of each variable.

[6]More recent tests, for instance the unit root test developed by Pesaran for heterogeneous panels with cross-section dependence Augmented Dickey-Fuller (CADF) test [30] Breitung and Pesaran (2008) and [31] Hurlin and Mignon (2004), have been introduced to deal with the issue of cross-dependence. However, they require balanced panels to be conducted.

[7]The result of the stationarity test for 92 countries, the order of integration in particular, is same as that of 120 countries and hence is not reported.

Table 2: Growth Effect with Private Credit and Stock Market - Cross-sectional
Method: Pooled Least Squares

Sample: 1970 2006 (mean of 37 years)

Regressors	1	2	3
Constant	-0.0356	-0.0344	-0.0306
	0	*0*	*0*
Private credit (first difference)	-0.0739	-0.0740	-0.0778
(domestic credit to private sector - % of GDP)	*0*	*0*	*0*
Capitalisation (first difference)	1.4513		
(market capitalization of listed companies - % of GDP)	*0.0229*		
Value traded (first difference)		2.2232	
(stocks traded, total value - % of GDP)		*0.0011*	
Turnover			*-0.2731*
(stocks traded, turnover ratio)			*0*
Government consumption	-0.0076	-0.0078	-0.0069
(government final consumption expenditure -% of GDP)	*0*	*0*	*0*
Capital formation	0.2499	0.2488	0.2456
(gross capital formation - % of GDP)	*0*	*0*	*0*
Trade openness	-0.0016	-0.0012	-0.0022
(trade - % of GDP)	*0.0009*	*0.015*	*0*
Inflation	-0.0099	-0.0088	-0.0117
(inflation, consumer prices - annual %)	*0*	*0*	*0*
Education	0.0047	0.0048	0.0059
(secondary school enrollment - %)	*0*	*0*	*0*
Initial Income	-0.0012	-0.0014	-0.0013
(Initial GDP per capita)	*0.0002*	*0*	*0.0001*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square	0.4307	0.4314	0.4341
Countries	120	120	120

Notes:
p-values are reported in Italics

The results of the POLS estimate do not support the findings of the existing literature on the positive relationship of *private credit* upon *economic growth* in the long run. Our results, if anything, reinforce one of the two puzzles since the coefficient of private credit is negative and strongly significant. The Wald test, however, provides evidence that the bank and market variables together are significant and have an overall positive impact, apart from the combination of private credit and market turnover, when the overall impact is significant but negative. The results for the stock market depend on the variable. The relationship is positive and significant for *capitalisation* and *value traded*, but negative for and significant for the variable usually chosen in the literature, namely *turnover*.
The above estimation for 120 countries includes 28 LDCs. In order to align ourselves to the existing literature for instance Beck and Levine (2004) included only one LDC – Bangladesh and to verify if the inclusion of a large numbers of LDCs had any impact on the relationship, we re-estimated the model for 92 non-LDCs. The results of the estimation are reported in table 3 are consistent with the findings for the entire sample reported in table 2.

Table 3: Growth Effect with Private Credit and Stock Market - Cross-sectional
Method: Pooled Least Squares

Method: Pooled Least Squares Sample: 1970 2006 (mean of 37 years)			
Regressors	1	2	3
Constant	-0.0066	-0.0051	0.0015
	0.0835	*0.1802*	*0.6992*
Private credit (first difference)	-0.0557	-0.0565	-0.0628
(domestic credit to private sector - % of GDP)	*0*	*0*	*0*
Capitalisation (first difference)	0.8511		
(market capitalization of listed companies - % of GDP)	*0.1491*		
Value traded (first difference)		2.3541	
(stocks traded, total value - % of GDP)		*0.0002*	
Turnover			*-0.3351*
(stocks traded, turnover ratio)			*0*
Government consumption	-0.0062	-0.0063	-0.0052
(government final consumption expenditure -% of GDP)	*0*	*0*	*0*
Capital formation	0.1798	0.1797	0.1728
(gross capital formation - % of GDP)	*0*	*0*	*0*
Trade openness	-0.0002	0.0002	-0.0010
(trade - % of GDP)	*0.6603*	*0.6639*	*0.0298*
Inflation	-0.0110	-0.0097	-0.0136
(inflation, consumer prices - annual %)	*0*	*0*	*0*
Education	0.0093	0.0096	0.0110
(secondary school enrollment - %)	*0*	*0*	*0*
Initial Income	-0.0026	-0.0029	-0.0030
(Initial GDP per capita)	*0*	*0*	*0*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square	0.2898	0.2922	0.3008
Countries	92	92	92

Notes:
p-values are reported in Italics

In order to remove a possible endogeneity of the financial variables, the model was also estimated by two-stage pooled least square (TSLS) for both 120 countries and 92 countries (non-LDCs) separately. As in much of the existing literature, variables capturing the origins of the legal system of the countries were used as instrumental variables alongside lagged values of the explanatory variables. The results reported in table 4 (for 120 countries) and table 5 (for 92 countries) are similar to POLS estimation in table 2.

Table 4: Growth Effect with Private Credit and Stock Market - Cross-sectional
Method: Two Stage Least Squares

Method: Two Stage Least Squares Sample: 1970 2006 (mean of 37 years)			
Regressors	1	2	3
Constant	-0.0324	-0.0313	-0.0276
	0	*0*	*0*
Private credit (first difference)	-0.0747	-0.0741	-0.0781
(domestic credit to private sector - % of GDP)	*0*	*0*	*0*
Capitalisation (first difference)	3.2355		
(market capitalization of listed companies - % of GDP)	*0*		
Value traded (first difference)		2.5844	
(stocks traded, total value - % of GDP)		*0.0002*	
Turnover			*-0.2700*
(stocks traded, turnover ratio)			*0*
Government consumption	-0.0069	-0.0074	-0.0065
(government final consumption expenditure -% of GDP)	*0*	*0*	*0*
Capital formation	0.2489	0.2467	0.2433
(gross capital formation - % of GDP)	*0*	*0*	*0*
Trade openness	-0.0019	-0.0012	-0.0022
(trade - % of GDP)	*0.0001*	*0.0148*	*0*
Inflation	-0.0093	-0.0082	-0.0113
(inflation, consumer prices - annual %)	*0*	*0*	*0*
Education	0.0049	0.0051	0.0062
(secondary school enrollment - %)	*0*	*0*	*0*
Initial Income	-0.0015	-0.0017	-0.0015
(Initial GDP per capita)	*0*	*0*	*0*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square	0.4296	0.4312	0.4340
Countries	120	120	120

Notes:
p-values are reported in Italics

Table 5: Growth Effect with Private Credit and Stock Market - Cross-sectional
Method: Two Stage Least Squares

Method: Two Stage Least Squares Sample: 1970 2006 (mean of 37 years)			
Regressors	1	2	3
Constant	-0.0076	-0.0057	0.0000
	0.0464	*0.1351*	*0.9915*
Private credit (first difference)	-0.0564	-0.0576	-0.0632
(domestic credit to private sector - % of GDP)	*0*	*0*	*0*
Capitalisation (first difference)	1.8295		
(market capitalization of listed companies - % of GDP)	*0.003*		
Value traded (first difference)		3.2614	
(stocks traded, total value - % of GDP)		*0*	
Turnover			*-0.3201*
(stocks traded, turnover ratio)			*0*
Government consumption	-0.0060	-0.0063	-0.0052
(government final consumption expenditure -% of GDP)	*0*	*0*	*0*
Capital formation	0.1838	0.1832	0.1761
(gross capital formation - % of GDP)	*0*	*0*	*0*
Trade openness	-0.0002	0.0005	-0.0008
(trade - % of GDP)	*0.6445*	*0.3285*	*0.0869*
Inflation	-0.0099	-0.0082	-0.0125
(inflation, consumer prices - annual %)	*0*	*0*	*0*
Education	0.0090	0.0093	0.0106
(secondary school enrollment - %)	*0*	*0*	*0*
Initial Income	-0.0026	-0.0030	-0.0029
(Initial GDP per capita)	*0*	*0*	*0*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square	0.2890	0.2916	0.3006
Countries	92	92	92

Notes:
p-values are reported in Italics

To briefly summarise our main findings, in the long run, unlike in previous literature, private credit has a robust but negative impact upon economic growth, somehow reinforcing the first puzzle. This is same for both POLS and TSLS estimations. However, the impact of stock markets according to our results is dependent upon the variable used. In the case of *turnover*, the relationship is negative and significant.

To complete the test of the puzzle, we now conduct the estimation for the short run (i.e., with annual data).

Using annual data, as reported in table 6 (for all countries using POLS fixed effects), table 7 [for all countries using Generalised-Method-of-Moments (GMM), TSLS and POLS fixed effects], and table 8 (POLS fixed effects - LDCs only) the relationship between *private credit* and *economic growth* is always negative, although it is not significant in the case of TSLS. This result is very much in line with the findings of the existing literature. We would also emphasise that the results were obtained after controlling whether the variables were stationary. *Private credit, capitalisation* and *value traded* were found to be I(1) for sample involving all 120 countries (all countries in the sample) and 92 countries (without LDCs) and therefore entered the estimations as first difference.

Moreover, when we estimated our model with panel data analysis we ran the estimation with POLS, fixed and random effects. Based on the redundant likelihood test (to select the best method between pooled and fixed effects) and the Hausman specification test (to select the best method between fixed and random), we were able to choose the fixed effect method both for country and time period as our preferred estimation effect (results of the tests available in Appendix table A6).
Table 5 reports the result of POLS estimation with fixed effect for both country and time period. The estimation is based on 120 countries.
The results show that private credit is always negative and significant, and the variables capturing the development of stock markets are always positive and significant.

Table 6: Growth Effect with Private Credit and Stock Market - Annual Data

Sample (adjusted): 1975 2006	Method: Panel Least Square Fixed Effect - Cross section and time		
Regressors	1	2	3
Constant	0.3241	0.3238	0.3108
	0.142	*0.143*	*0.1587*
Private credit (first difference)	-0.0220	-0.0242	-0.0212
(domestic credit to private sector - % of GDP)	*0.0027*	*0.0007*	*0.0042*
Capitalisation (first difference)	0.8306		
(market capitalization of listed companies - % of GDP)	*0.0603*		
Value traded (first difference)		1.0257	
(stocks traded, total value - % of GDP)		*0.0085*	
Turnover			*0.3472*
(stocks traded, turnover ratio)			*0.0716*
Government consumption	-0.0414	-0.0414	-0.0406
(government final consumption expenditure -% of GDP)	*0*	*0*	*0*
Capital formation	0.2407	0.2365	0.2397
(gross capital formation - % of GDP)	*0*	*0*	*0*
Trade openness	0.0307	0.0318	0.0312
(trade - % of GDP)	*0*	*0*	*0*
Inflation	-0.0255	-0.0253	-0.0239
(inflation, consumer prices - annual %)	*0*	*0*	*0*
Education	0.0075	0.0089	0.0069
(Secondary school enrolment - %)	*0.2724*	*0.1875*	*0.3062*
Initial Income	-0.0539	-0.0535	-0.0518
(Initial GDP per capita)	*0.0605*	*0.063*	*0.0712*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square	0.4276	0.4266	0.4281
Countries	120	120	120
Total panel (unbalanced) observations	1396	1412	1378

Notes:
p-values are reported in Italics

Table 7 reports the result derived using GMM, TSLS and POLS fixed effects methods. We can note that the results are consistent for all methods in particular for *private credit*, although the sign and level of significance of the variable capturing the development of

stock markets (*turnover*) is influenced by the estimation method. The relationship is positive and significant only for POLS, while it becomes insignificant for the other two methods.

Table 7: Growth Effect with Private Credit and Stock Market - Annual Data

Cross-section fixed (dummy variables) Period fixed (dummy variables)	GMM	TSLS	POLS
Constant		0.2141	0.3108
		0.5182	*0.1587*
Private credit (first difference)	-0.0376	-0.0330	-0.0212
(domestic credit to private sector - % of GDP)	*0*	*0.2788*	*0.0042*
Turnover	0.0464	-0.3041	*0.3472*
(stocks traded, turnover ratio)	*0.7227*	*0.5918*	*0.0716*
Government consumption	-0.0637	-0.0396	-0.0406
(government final consumption expenditure -% of GDP)	*0*	*0.0004*	*0*
Capital formation	0.2221	0.2427	0.2397
(gross capital formation - % of GDP)	*0*	*0.002*	*0*
Trade openness	0.0531	0.0363	0.0312
(trade - % of GDP)	*0*	*0.0029*	*0*
Inflation	-0.0451	0.0086	-0.0239
(inflation, consumer prices - annual %)	*0*	*0.4901*	*0*
Education	0.0137	0.0012	0.0069
(secondary school enrollment - %)	*0*	*0.9037*	*0.3062*
Initial Income	-0.0298	-0.0384	-0.0518
(Initial GDP per capita)	*0*	*0.3696*	*0.0712*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square		0.5060	0.4281
Countries	118	120	120
Total panel (unbalanced) observations	973	1093	1378

Notes:
p-values are reported in Italics

Finally, we test the relationship for the set of LDCs separately now. In this respect, we believe we have improved over existing literature as we test the puzzles for a sub-set of countries (LDCs) for which we collected the establishment date of stock markets and banks (i.e., any gap in data before that date of establishment are not due to non-availability)[8]. We then award a zero for periods in which there were no banks or stock market in existence. We believe by awarding a zero for a market related data for such period in which market was not in existence we have improved over the existing literature (the literature is silent on this issue).

[8] Please see Appendix table A2 for further details.

Table 8 gives the short run result of the POLS fixed effect estimation for LDCs.

Table 8: Growth Effect with Private Credit and Stock Market - Annual Data (LDCs)

Sample (adjusted): 1991 2006	Method: Panel Least Square Fixed Effect - Cross section and time		
Regressors	1	2	3
Constant	0.2526	0.5192	0.5116
	0.4659	*0.1385*	*0.1453*
Private credit (first difference)	-0.0977	-0.0828	-0.0805
(domestic credit to private sector - % of GDP)	*0.0004*	*0.0028*	*0.0033*
Capitalisation (first difference)	19.8015		
(market capitalization of listed companies - % of GDP)	*0.7255*		
Value traded (first difference)		-127.5116	
(stocks traded, total value - % of GDP)		*0.5865*	
Turnover			*-0.9509*
(stocks traded, turnover ratio)			*0.9268*
Government consumption	-0.0862	-0.0507	-0.0493
(government final consumption expenditure -% of GDP)	*0*	*0.0119*	*0.0143*
Capital formation (first difference)	0.0217	-0.0038	-0.0033
(gross capital formation - % of GDP)	*0.6875*	*0.9455*	*0.953*
Trade openness	0.0840	0.0615	0.0625
(trade - % of GDP)	*0*	*0.0017*	*0.0015*
Inflation	-0.0334	-0.0500	-0.0515
(inflation, consumer prices - annual %)	*0.3841*	*0.207*	*0.1938*
Education (first difference)	0.1626	0.1299	0.1268
(secondary school enrolment - %)	*0.0037*	*0.0228*	*0.0253*
Initial Income	-0.0614	-0.0774	-0.0759
(Initial GDP per capita)	*0.2659*	*0.1723*	*0.1816*
Wald test for joint significance (*p*-Values)	*0*	*0*	*0*
R-square	0.5940	0.5480	0.5442
Countries	28	28	28
Total panel (unbalanced) observations	193	196	197

Notes:
p-values are reported in Italics

As can be noted from table 8, the variable *private credit* is always negative and significant, while the variables capturing the effect of stock markets are also negative and in all cases insignificant.
The findings in the literature of a negative relationship between private credit and economic growth (the first puzzle) are strongly supported even when the possible selection bias is excluded. However, the second puzzle, the positive impact of stock markets, does not survive the elimination of the self-selection bias (i.e. including only countries with established stock markets).

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5 Conclusions

This paper followed the work of Beck and Levine (2004), Favara (2003) and Loayza & Rancière (2006) and re-examined the relationship between financial development and economic growth using updated and improved dataset for a very large number of countries including 28 LDCs.

Unlike many papers that equate financial development to the development of banks, we included variables capturing both bank and stock market development in our model. In addition, we included a wide range of proxies to measure these variables. Moreover, we carefully reviewed the nature of data for our various variables and tested for stationarity of the series.

As we included LDCs in our analysis (many of which are still at a lower level of financial development), we gathered knowledge on the historical development of banks and stock markets in those countries. With the information on establishment dates of financial intermediaries, we were able to award a zero for such countries in which stock exchange did not exist during our sample period. We believe that we may have avoided the problem of self-selection bias in our estimation, since papers showing a positive impact of stock markets upon economic growth seem to have included in their studies only countries which have active stock markets e.g. Beck and Levine (2004).

Our results have provided further and robust evidence of a negative effect of private credit upon economic growth in the short-run (annual data) for a variety of methods and samples. However, unlike previous contributions, we were unable to provide evidence of a strong positive relationship between private credit and economic growth in the long-run, therefore possibly reinforcing the first puzzle.

The results also provide some evidence to mitigate the second puzzle related to the positive and significant impact of stock markets. The results suggest that the impact of stock markets highly depend on the variable chosen to explain stock market development, the method of estimation and the possible role of self-selection bias.

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Appendix

Table A1

List of 28 LDCs countries Bangladesh, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Equatorial Guinea, Ethiopia, Gambia, Guinea-Bissau, Haiti, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Sudan, Tanzania, Togo, Uganda, Vanuatu, Zambia
List of 92 non-LDCs countries Argentina, Armenia, Australia, Austria, Bahrain, Barbados, Belgium, Bolivia, Botswana, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Arab Rep., El Salvador, Estonia, Fiji, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Guyana, Hong Kong, China; Hungary, Iceland, India, Indonesia, Iran, Islamic Rep.; Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, rep.; Kuwait, Kyrgyz Republic, Latvia, Lithuania, Luxembourg, Macedonia, FYR; Malaysia, Malta, Mauritius, Mexico, Moldova, Mongolia, Morocco, Netherlands, New Zealand, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Saudi Arabia, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Swaziland, Sweden, Switzerland, Thailand, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela RB, Zimbabwe

Table A2

Name, establishment date of bank, central bank and stock exchange in LDCs

#	Countries	Oldest / major Bank	Estb	Central Bank	Estb	First exchange	Estb
1	Bangladesh	Standard Chartered Bank	1905	Bangladesh Bank	1971	Dhaka stock exchange ltd	1954
2	Benin	*	1962	BCEAO	1962	BRVM	1998
3	Burkina Faso	*	1962	BCEAO	1962	BRVM	1998
4	Burundi	Banque De Credit Bujumbura	1922	Bank of the Republic of Burundi	1964	NA	
5	Central African Rep.	*	1970	BEAC	1972	NA	
6	Chad	*	1970	BEAC	1972	NA	
7	Equatorial Guinea	*	1970	BEAC	1985	NA	
8	Ethiopia	Bank of Abysinia	1906	National Bank of Ethiopia	1963	NA	
9	Gambia	Standard Chartered Bank	1894	Central bank of gambia	1971	NA	
10	Guinea-Bissau	*	1962	BCEAO	1962	BRVM	1998
11	Haiti	Bank of the Republic of Haiti	1880	Bank of the Republic of Haiti	1880	NA	
12	Lesotho	*	1970	Central Bank of Lesotho	1978	NA	
13	Madagascar	Banque de Madagascar	1926	Banque de Madagascar et des Comores	1973	NA	
14	Malawi	African Lakes Corporation	1894	Reserve Bank of Malawi	1965	Malawi Stock Exchange	1994
15	Mali	*	1962	BCEAO	1962	BRVM	1998
16	Mauritania	*	1970	Central Bank of Mauritania	1973	NA	
17	Mozambique	*	1970	Bank of Mozambique	1975	Maputo Stock Exchange	1999
18	Nepal	Nepal Bank Ltd.	1937	Nepal Rastra Bank	1956	Nepal Stock Exchange	1976
19	Niger	*	1962	BCEAO	1962	BRVM	1998
20	Rwanda	Banque Commerciale du Rwanda	1963	National Bank of Rwanda	1964	NA	
21	Senegal	*	1962	BCEAO	1962	BRVM	1998
22	Sierra Leone	Standard Chartered Bank	1894	Bank of Sierra Leone	1964	NA	
23	Solomon Islands	National Bank of Solomon Island	1978	Central Bank of Solomon Island	1976	NA	
24	Sudan	Bank of Khartoum	1913	Central Bank of Sudan	1960	Khartum Stock Exchange	1994
25	Togo	*	1962	BCEAO	1962	BRVM	1998
26	Uganda	Standard Chartered Bank Uganda	1912	Bank of Uganda	1966	Uganda Securities Exchange	1997
27	Vanuata	*	1970	Reserve Bank of Vanuata	1980	NA	
28	Zambia	Standard Chartered Bank	1906	Bank of Zambia	1956	Lusaka stock exchange	1993

Note:-

** Authors constructed. Details can be made available upon request.*
BCEAO: Central Bank of West African States, BEAC: Bank of Central African States and BRVM: Bourse Régionale des Valeurs Mobilières S.A.
LDCs are defined by UN, Development Policy and Analysis Division (2006 review) based on four criteria -
1) three year (2000 – 2002) average GNI per capita threshold of US $ 745, 2) the level of development of human capital (that includes percentage of undernourished children, mortality rate for children aged five years or under, the gross secondary school enrolment ratio and the adult literacy rate), 3) economic vulnerability index (comprising population, export concentration, remoteness i.e. the distance to world market, share of agriculture, forestry and fisheries in GDP, homelessness due to natural disaster, and instability of agricultural production and export), and 4) excluding low income countries with population above 75 million.

Table A3
Variables used

No.	Variables	Detail
1	Economic growth	Percentage change of Real GDP per capita
2	Private credit	Domestic credit to private sector to GDP
3	Liquid liabilities	Broad money (M3) to GDP
4	Bank credit	Domestic credit to private sector by banks to GDP
5	Bank credit all sector	Domestic credit provided by the banks to all sectors to GDP
6	Capitalisation	Stock market capitalisation to GDP
7	Value traded	Stock market value traded to GDP
8	Turnover	Stock market turnover ratio
9	Government consumption	General government final consumption expenditure to GDP
10	Capital formation	Gross capital formation to GDP
11	Trade openness	Trade - the sum of exports and imports to GDP
12	Inflation	Inflation - change CPI
13	Education	gross enrolment rate secondary education
14	Initial GDP per capita	Initial GDP per capita
15	Black market premium	Black market premium
16	lo_uk	Dummy variable for British legal origin
17	lo_fr	Dummy variable for French legal origin
18	lo_ge	Dummy variable for German legal origin
19	lo_sc	Dummy variable for Scandinavian legal origin
20	lo_so	Dummy variable for Socialist legal origin

Table A4
Source of data

No.	Variable	Source of Data
1	Economic growth *	World Bank national accounts data, and OECD National Accounts data files
2	Private credit	IMF's IFS - via The World Bank
3	Liquid liabilities	IMF's IFS - via The World Bank
4	Bank credit	IMF's IFS - via The World Bank
5	Bank credit all sector *	IMF's IFS and data files, and World Bank and OECD GDP estimates
6	Capitalisation	IMF's IFS - via The World Bank
7	Value traded	IMF's IFS - via The World Bank
8	Turnover	IMF's IFS - via The World Bank
9	Government consumption *	World Bank national accounts data, and OECD National Accounts data files
1	Capital formation *	World Bank national accounts data, and OECD National Accounts data files
1	Trade openness *	World Bank national accounts data, and OECD National Accounts data files
1	Inflation *	IMF's IFS and data files
1	Education **	UNESC
1	Initial GDP per capita *	World Bank national accounts data, and OECD National Accounts data files
1	Black market premium***	Bahmani-Oskooee and Tanku (2006) and Official Exchange Rate from IMF's IFS
1	Legal Origin related****	

** imported from ESDS International*

*** imported from ED Stat of The World Bank*

**** the Official Exchange Rate is from IMF's IFS downloaded via ESDS International*

***** Data on legal origin (lo_uk, lo_fr, lo_ge, lo_sc, lo_so) are from La Porta et al. (2007)*

Table A5

Test on Stationarity of the series using Levin, Lin & Chu (2002) test								
Variable	121 countries				28 countries (LDCs)			
	Intercept and trend	Intercept only	No-Intercept & Trend	Order of Integration	Intercept and trend	Intercept only	No-Intercept & Trend	Order of Integration
LGROWTH	-21.257	-18.848	-20.377	I(0)	-7.453	-9.592	-14.674	I(0)
	0	*0*	*0*		*0*	*0*	*0*	
LPC	1.890	-1.100	-8.899	I(1)	0.289	-1.220	-2.586	I(1)
	0.971	*0.136*	*0*		*0.614*	*0.111*	*0.0048*	
LPCBS	2.119	-1.878	-9.169	I(0)	0.597	-0.493	-2.423	I(1)
	0.983	*0.030*	*0.000*		*0.725*	*0.311*	*0.008*	
LBC	3.473	0.104	2.289	I(1)	1.784	1.018	-2.326	I(1)
	1.000	*0.542*	*0.989*		*0.963*	*0.846*	*0.010*	
LM3	2.924	-3.849	-10.586	I(0)	-0.823	-2.463	-4.633	I(0)
	0.998	*0.0001*	*0*		*0.205*	*0.0069*	*0*	
LMV	4.866	-4.906	5.489	I(1)	0.002	0.022	-0.727	I(1)
	1	*0*	*1*		*0.5006*	*0.5089*	*0.2337*	
LT	-15.568	-10.144	-3.980	I(0)	-2.041	-0.257	-1.378	I(0)
	0	*0*	*0*		*0.0206*	*0.3987*	*0.0841*	
LVT	-48.892	3.344	1.415	I(1)	0.719	-0.187	-1.378	I(1)
	0	*1.000*	*0.921*		*0.7638*	*0.426*	*0.084*	
LGEXP	-2.573	-5.275	-5.232	I(0)	-1.479	-0.859	-1.486	I(0)
	0.005	*0*	*0*		*0.070*	*0.195*	*0.0686*	
LCAPF	0.958	-2.397	-3.580	I(0)	0.730	-0.346	0.740	I(1)
	0.831	*0.008*	*0.0002*		*0.767*	*0.365*	*0.7703*	
LPI	-71.871	-84.549	-35.993	I(0)	-7.631	-6.200	-6.504	I(0)
	0	*0*	*0*		*0*	*0*	*0*	
LOPEN	-4.395	-2.136	-10.689	I(0)	-4.118	-3.149	-5.298	I(0)
	0	*0.0163*	*0*		*0*	*0.0008*	*0*	
LEDU	-2.865	-4.226	-12.744	I(0)	-0.910	0.255	-7.231	I(1)
	0.0021	*0*	*0*		*0.1815*	*0.6006*	*0*	
LSTART	-16.191	0.000	0.000	I(0)	-7.684	-14.206	3.624	I(0)
	0	*0*	*0*		*0*	*0*	*0.9999*	
LBMP	-6.363	-4.774	-1.320	I(0)	-1.562	-1.313	-4.604	I(0)
	0	*0.000*	*0.093*		*0.0591*	*0.095*	*0.000*	

Note:-

Order of Integration for 93 Non LDCs are same as that of all 121 countries.

Table A6
Results of Redundant Fixed Effect (POLS Vs. Fixed effect test)

Test cross-section and period fixed effects

Effects Test	Statisti	d.f	Prob
Cross-section Fixed effect	3.12354	-1,201,226	0
Period Fixed effect	3.24426	-	0
Cross-Section/Period Fixed effect	3.33974	-1,391,226	0

Hypothesis for the test above

Ho: Estimates of the co-efficients of the cross-section dummies are equal to zero therefore fixed effect
is not correct

H1: Estimates of the co-efficients of the cross-section dummies are different from zero therefore fixed effect
is not correct

Correlated Random Effects - Hausman Test (Fixed Vs. Random effect test)

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob
Cross-section random	34.222594	8	0

Hypothesis for the test above

Ho: Estimates by Random are not different from those from fixed effects. Random should be preferred
H1: Estimates by Random effects are different from those from fixed effects. Random are not appropriate