Panel Evidence on Finance, Institutions and Economic Growth

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Abstract

This paper considers how institutions affect the link between financial development and economic growth. Using cross-sectional as well as panel approaches on data from 1970-2004, we find strong evidence that banking development and well-functioning institutions are substitutes to each other in the growth process. We find no robust evidence, however, that institutions are either a substitute or a complement for stock market development in economic growth. (*JEL*: O16, P48; *Keywords*: Financial Development, Growth, Institutions)

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I. INTRODUCTION

The literature on economic growth has exploded over the past two decades as economists have investigated the factors associated with economic prosperity. Two significant areas of this literature have focused on the importance of financial development for economic growth (see Wachtel, 2003, Demetriades and Andrianova, 2004, or Levine, 2005) as well as the role of strong institutions in economic growth (see Aron, 2000 or Acemoglu, Johnson and Robinson, 2005). Our paper draws from both strands of literature to investigate whether financial development and institutions are substitutes or complements in the growth process.

Two recent papers have already put these two determinants of economic growth together to consider their individual as well as joint effects on growth. Demetriades and Law (2006) finds that finance has a greater effect on GDP per capita when rooted in a strong institutional environment, while Ahlin and Pang (forthcoming) finds that financial development has less of an effect in countries with better institutions. With these results seemingly at odds, our paper considers the robustness of these findings using a number of financial and institutional measures in cross-sectional as well as panel approaches to consider the interaction of financial development and institutions on growth.

Specifically, with data for ninety countries from 1970-2004, we use one bank development and two stock market development measures along with four institutions measures to consider the individual effects of financial development and institutions on growth, as well as the effect of their interaction on growth (the latter being our key focus). We investigate this interaction effect using standard OLS and IV cross-sectional econometric methods as well as panel econometric methods using System-GMM dynamic panel analysis.

We find robust evidence that banking development and strong institutions serve as substitutes in the growth process. The interaction of stock market development with institutions, however, is sensitive to the inclusion of controls as well as the empirical approach employed. This lack of robustness indicates that the effect of stock market development on growth may be independent of a country's level of institutions.

Our paper adds to the literature on a number of margins. First, our measures of financial development are properly deflated according to the methodology of Beck and Levine (2004)

which reduces mismeasurement problems seen in other finance and growth studies.[1] Second, through the inclusion of a range of institutional quality as well as financial development variables, we are able to consider the robustness of the interaction of finance and institutions on economic growth. Lastly, our results contribute to the general literatures on whether financial development as well as institutions matter for economic growth.

The remainder of the paper is as follows: Section II outlines the literature in this area, while Section III details the data and empirical approaches used in this study. Section IV provides the results and subsequent analysis and Section V concludes.

II. POSSIBLE LINKS BETWEEN FINANCE, INSTITUTIONS AND GROWTH

The notion that finance has a different effect on growth depending on the institutions in a given country is a fairly nascent literature, and so it is interesting to already have such contradictory findings on this topic

Demetriades and Law (2006) argue that finance and institutions, beyond their direct effects on growth, have a separate effect on growth through their interaction. The authors consider 72 countries over roughly twenty years using cross-sectional analysis as well as panel approaches based on mean group and pooled mean group estimators to examine the interaction of finance and institutions on real GDP per capita.[2] The aspect of finance they consider is banking development (three alternative measures), and their measure of institutions is an aggregate measure constructed from variables in the IRIS database. The authors find a positive and significant interaction between bank-based financial development and institutional quality, indicating the effect of finance on growth depends positively on the quality of a country's institutions.[3]

In contrast, Ahlin and Pang (forthcoming) argue that financial development and corruption control have a negative interaction, indicating that finance and control of corruption are substitutes rather than complements in the growth process. For instance, the marginal impact of

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[1] Beck and Levine argue that especially in the case of high inflation countries, the time period used to deflate the finance variable and GDP can impact the resulting measure of financial development. Given that financial variables are often measured at the end of the period, while GDP is measured as an average over the period, Beck and Levine argue that the financial variables should be deflated by end of period CPI while GDP should be deflated by average CPI for the period. Further their financial ratio is derived as the average of the real financial variable over period *t* and *t-1* relative to real GDP in period *t*.
[2] See Pesaran and Smith (1995) and Pesaran, Shin, and Smith (1999) for more on these estimators.
[3] An interpretation that Demetriades and Law consider for this interaction is "quality adjusted finance".

improving financial development is greater when a country has higher levels of corruption versus lower levels of corruption. Ahlin and Pang provide nice intuition behind this result which is essentially as follows. When an economy with low levels of financial development sees a reduction in the level of corruption, the effect on growth should be greater than in a financially-developed country. This outcome occurs because the burden associated with corruption is higher in an economy with little financial development than in one which is financially developed. Alternatively, financial development (and thus a reduction in intermediation costs) should have more of an impact in an economy with a large amount of corruption as the need for liquidity is greatest there relative to an economy with low levels of corruption (Ahlin and Pang, p. 11). Empirically, Ahlin and Pang examine this connection using cross-sectional and panel data measures of financial development (banking and stock market development), corruption, and their interaction to examine their overall effect on economic growth. They find a negative interaction, indicative of substitution between financial development and corruption control in the growth process.

A few other studies are also relevant to this debate. For example, Bagella, Becchetti, and Caiazza (2002) investigate the role of culture and religious backgrounds on institutional and financial development as well as the finance-growth link and find that a positive finance-growth link arises only in countries where the society's cultural background has allowed sufficient financial development. Specifically, the effect of finance on growth is positive for Protestant and Catholic countries but insignificant for Muslim ones. Claessens and Laevan (2003) consider the role of property rights on firm financing, asset allocation, and ultimately economic growth. Here the link between institutions and finance on growth has to do with how property rights (in terms of protection not from government but rather competitor expropriation) impact the asset mix decision of firms. The authors find a significant effect on growth from the interaction of property rights and asset mix.

III. DATA AND EMPIRICAL APPROACH

A. *Data*

We consider the role of finance, institutions, and their interaction using data from 1970-2004. Annual data on real GDP per capita, education, trade openness, government consumption, and inflation draws on the World Bank *World Development Indicators* and the education data

developed by Barro and Lee (2000).[4] We consider three measures of financial development from Beck, Demirguc-Kunt, and Levine's *Financial Structure* dataset. Our bank variable is *Private Credit*, measured as private credit by deposit money banks relative to GDP. This measure of banking development is a common bank measure seen in the finance and growth literature, capturing the allocation of credit by private banks (rather than central banks) relative to the size of the economy. Further, we consider two stock market development measures. The first, *Turnover*, is stock market turnover measured as the ratio of the value of total shares traded to market capitalization, while our second, *Capitalization*, is stock market capitalization measured as the value of shares relative to GDP. Capitalization provides us with a measure of the size of the stock market, while turnover provides us with the liquidity or activity of the stock market.

We also employ four measures of institutional quality in our study. First is *Contract Intensive Money* (*CIM*), developed by Clague, Keefer, Knack and Olson (1999). This measure is constructed as the ratio of non-currency component of M2 to total M2, and is intended to capture the security and enforcement of contracts and property rights (Aron, 2000).[5] Our second institutions measure is *Corruption* from the IRIS/ICRG database, which captures the degree of corruption in the political system, while a third measure, also from IRIS/ICRG is *Rule of Law* (*Rule*). The rule of law measure captures two components, law and order, where law is the quality of the legal system itself and order is the observance of laws by citizens. Finally, for our last measure of institutional quality, we develop an aggregate measure of institutions we term *IRIS*, based on rule of law, corruption in government, and quality of the bureaucracy (also from the IRIS/ICRG database).[6]

B. *Empirical Approach*

For our empirical approach, we use both a standard cross-sectional approach as well as a panel approach. Our cross-sectional model is fairly standard as seen in equation (1) :

(1) $\Delta y_i = \alpha + \beta y_{i,} + \gamma' X_i + \varepsilon_i$

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[4] See appendix for detailed data sources.
[5] At first glance, CIM appears a lot like a financial measure. However Clague, Keefer, Knack, and Olson (1999), show using factor analysis that CIM is a measure of institutions rather than financial development.
[6] Quality of bureaucracy measures the institutional quality and strength of the bureaucracy, with high performing bureaucracies able to act relatively free of political pressure and able to function effectively during times of government turnover. Also note the three measures making up the aggregate institutions measure are scaled such that each enters with the same scale.

where Δy_i is the average growth of real GDP per capita over the sample period, y_i is initial real GDP per capita at the start of the sample period, X_i is the set of explanatory variables including our financial and institutional measures (as well as their interaction) which are initial values or are averaged over the sample period, and ε_i is the error term. To address concerns about the potential endogeneity of our finance and institutions measures we also consider IV methods.

To further substantiate the cross-sectional results, we also rely on System-GMM dynamic panel analysis developed by Blundell and Bond (1998), which is widely used in the recent growth literature due to its ability to account for many of the drawbacks seen in earlier cross-sectional and panel growth studies.[7] The growth equation we want to estimate using panel data then is:

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

where for country i ($i=1…N$) at time t ($t=2…T$), Δy_{it} is the 5 year average log difference of real GDP per capita, y_{it-1} is the logarithm of real GDP per capita at the start of each 5 year period, X_{it} is the set of explanatory variables including our financial development and institutions measures (as well as interaction) measured at the beginning of each 5 year period or averaged over the period, η_i is an unobserved country specific fixed-effect, and ε_{it} is the error term.

IV. RESULTS

A. *OLS Cross Sectional Results*

Our first round of results centers on our cross-sectional OLS analysis and is detailed in Tables 1 through 3.[8] Table 1 provides results based on our banking development measure, private credit, and includes two key panels: Panel A, which details results based on a basic control set of initial GDP per capita and education, and Panel B which provides results based on an extended control set of initial GDP per capita and education as well as government expenditure, trade openness, and inflation.

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[7] See Hoeffler (2002) for a nice overview of the benefits of this approach over other panel approaches.
[8] See the appendix for summary statistics of the data used for our cross-section analysis.

Table 1: Private Credit, Institutions, and Growth Cross-Section

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: CROSS-SECTION WITH BASIC CONTROLS									
Finance: Priv. Credit	0.028 (0.006)	0.028 (0.006)	0.023 (0.030)	0.016 (0.103)	0.015 (0.126)	0.164 (0.010)	0.092 (0.001)	0.082 (0.003)	0.086 (0.001)
CIM		0.046 (0.022)				0.070 (0.004)			
Corruption			0.002 (0.402)				0.008 (0.14)		
Rule				0.005 (0.004)				0.011 (0.000)	
IRIS					0.002 (0.006)				0.004 (0.000)
Interaction (Fin*Inst)						-0.157 (0.029)	-0.016 (0.006)	-0.014 (0.014)	-0.005 (0.002)
Obs	90	89	79	79	79	89	79	79	79
R^2	0.32	0.38	0.38	0.47	0.45	0.41	0.44	0.51	0.051
PANEL B: CROSS-SECTION WITH EXTENDED CONTROLS									
Finance: Priv. Credit	0.020 (0.010)	0.019 (0.029)	0.014 (0.131)	0.010 (0.306)	0.007 (0.444)	0.147 (0.022)	0.093 (0.000)	0.092 (0.002)	0.095 (0.000)
CIM		0.039 (0.043)				0.063 (0.005)			
Corruption			0.002 (0.87)				0.010 (0.001)		
Rule				0.005 (0.006)				0.012 (0.000)	
IRIS					0.002 (0.004)				0.005 (0.000)
Interaction (Fin*Inst)						-0.146 (0.045)	-0.018 (0.001)	-0.017 (0.004)	-0.006 (0.000)
Obs	89	88	78	78	78	88	78	78	78
R^2	0.37	0.42	0.43	0.49	0.48	0.45	0.49	0.54	0.55

The dependent variable is average growth of real GDP per capita over the period 1970-2004. p-values in parentheses based on robust standard errors. Interaction corresponds with the interaction of the financial variable and the respective institutions variable. Basic controls include log of initial GDP per capita and log of education. Extended controls include basic controls as well as inflation and the log of trade and log of government expenditure.

A few results key stand out. First, looking at the results for columns (1)-(5) for Panel A as well as Panel B, there is substantial evidence that both private credit and institutions matter for economic growth when considered separately. Turning to columns (6)-(9), where interactions between private credit and the various institutional measures are considered, we find that the interactions are negative and statistically significant, supporting the notion that bank development and institutional quality are substitutes rather than complements in development. These findings correspond with those of Ahlin and Pang rather than Demetriades and Law's results that suggest

that finance and institutions are complements. In the case of our private credit and institutions results in Table 1, we see these results are very robust across institutional measures as well as basic and extended control sets.

Table 2 details our results using turnover as our financial variable. Focusing on columns (1)-(5), turnover proves to enter positive and statistically significant in terms of impacting growth in most of the specifications. The effects from the institutions variables are generally positive; rule of law and the IRIS composite measure have a significantly positive impact on growth, while the other institutional measures (corruption and CIM) enter positively but are not statistically significant. Allowing for an interaction between turnover and each institutional variable, we see in columns (6)-(9) that in none of the cases is the interaction significant, and while many of the institutional variables continue to enter positive and significant, the significance of the turnover variable is often lost. Based on these results, institutional quality and stock market development as measured by turnover do not appear to share an interaction, suggesting they are independent of one another in terms of their effect on growth.

Lastly, Table 3 provides the results using our alternative stock development measure, stock market capitalization. Here columns (1)-(5) seem to indicate little support for market capitalization influencing growth, while our aggregate IRIS measure and rule of law again provide the most support for institutions impacting growth. Interestingly, when an interaction between market capitalization and institutions is included in the regressions, the significance of market capitalization as well as the institutions measures all improve. Concerning the interaction terms, five of the eight interactions are significant or borderline significant, and all enter with a negative sign, indicative of substitution between market capitalization and institutions in the growth process and in line with the results for banking development in Table 1.[9]

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[9] Ahlin and Pang (2006) using an alternative measure of stock market development, value traded also find a negative interaction for stock market development and institutions (in their case corruption control).

Table 2: Turnover, Institutions, and Growth Cross-Section

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: CROSS-SECTION WITH BASIC CONTROLS									
Finance: Turnover	0.014	0.013	0.013	0.008	0.009	-0.025	0.036	0.032	0.032
	(0.001)	(0.015)	(0.032)	(0.233)	(0.235)	(0.522)	(0.12)	(0.146)	(0.187)
CIM		0.042					0.033		
		(0.388)					(0.541)		
Corruption			0.004				0.007		
			(0.133)				(0.068)		
Rule				0.008				0.010	
				(0.001)				(0.000)	
IRIS					0.003				0.003
					(0.010)				(0.004)
Interaction (Fin*Inst)						0.045	-0.007	-0.007	-0.002
						(0.335)	(0.260)	(0.200)	(0.268)
Obs	61	60	58	58	58	60	58	58	58
R^2	0.20	0.22	0.26	0.43	0.35	0.23	0.27	0.45	0.37
PANEL B: CROSS-SECTION WITH EXTENDED CONTROLS									
Finance: Turnover	0.020	0.019	0.019	0.014	0.015	-0.029	0.040	0.036	0.037
	(0.001)	(0.000)	(0.001)	(0.026)	(0.020)	(0.414)	(0.090)	(0.116)	(0.150)
CIM		0.041					0.028		
		(0.307)					(0.523)		
Corruption			0.002				0.004		
			(0.472)				(0.206)		
Rule				0.007				0.008	
				(0.002)				(0.002)	
IRIS					0.002				0.003
					(0.017)				(0.003)
Interaction (Fin*Inst)						0.058	-0.007	-0.006	-0.002
						(0.180)	(0.296)	(0.260)	(0.325)
Obs	60	59	57	57	57	59	57	57	57
R^2	0.38	0.42	0.40	0.51	0.46	0.43	0.42	0.53	0.48

See notes for Table 1.

Table 3: Capitalization, Institutions, and Growth Cross-Section

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: CROSS-SECTION WITH BASIC CONTROLS									
Finance: Capitalization	0.010 (0.239)	0.009 (0.14)	0.006 (0.501)	0.005 (0.433)	0.002 (0.82)	0.277 (0.015)	0.079 (0.003)	0.013 (0.482)	0.029 (0.349)
CIM		0.040 (0.412)				0.128 (0.023)			
Corruption			0.004 (0.166)				0.010 (0.008)		
Rule				0.009 (0.000)				0.009 (0.000)	
IRIS					0.003 (0.001)				0.003 (0.000)
Interaction (Fin*Inst)						-0.304 (0.017)	-0.017 (0.003)	-0.002 (0.642)	-0.002 (0.345)
Obs	62	61	58	58	58	61	58	58	58
R^2	0.14	0.17	0.19	0.41	0.33	0.28	0.27	0.42	0.34
PANEL B: CROSS-SECTION WITH EXTENDED CONTROLS									
Finance: Capitalization	-0.000 (0.941)	-0.002 (0.777)	-0.004 (0.586)	-0.002 (0.522)	-0.008 (0.172)	0.161 (0.127)	0.062 (0.018)	0.015 (0.260)	0.030 (0.253)
CIM		0.037 (0.384)				0.088 (0.109)			
Corruption			0.003 (0.249)				0.009 (0.006)		
Rule				0.008 (0.000)				0.010 (0.000)	
IRIS					0.003 (0.000)				0.004 (0.000)
Interaction (Fin*Inst)						-0.182 (0.124)	-0.015 (0.007)	-0.004 (0.250)	-0.003 (0.110)
Obs	61	60	57	57	57	60	57	57	57
R^2	0.23	0.27	0.28	0.45	0.41	0.30	0.33	0.46	0.44

See notes for Table 1.

To summarize the cross-sectional results, financial development and institutions prove to be important for economic growth. Further, while there is strong evidence that banking and institutions serve as substitutes in the growth process, the results for an interaction between stock market development and institutions are mixed, with no significant interaction between turnover and institutions, and a negative interaction between market capitalization and institutions.[10]

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[10] For a sense of the magnitude of banking's effect on growth, see the interaction appendix. These figures show the effect of banking on growth at the 25th, 50th, and 75th percentile of banking development with institutional development allowed to vary between the 25th, 50th, and 75th percentile. It can be seen that for a given level of financial development, as institutional development moves from the 25th to the 75th percentile, the overall effect of banking on growth declines.

B. *IV Cross-Sectional Results*

Because of concerns that our finance and/or institution variables may be endogenous, we also estimated the cross-sectional regressions using the initial values of the finance and institution variables as instruments. The results from the banking (i.e. private credit) regressions (presented in Table 4) are qualitatively similar to the results from the basic cross-sectional regressions given in Table 1. Generally, private credit and the institutional variables are significantly positive indicating that finance and institutions both contribute to economic growth. The interaction term between private credit and the institutional variables remains negative for all four institutional terms and is statistically significant for corruption, rule of law, and the IRIS composite measure, again suggesting that institutions and banking may act as substitutes for each other.

Table 5 gives the results from regressions that use turnover as the financial variable. Somewhat surprisingly, in these regressions, there is only limited evidence that institutions affect economic growth and almost no evidence that stock markets influence growth. The interaction term between turnover and the institutional variables is not statistically significant in all eight of the regressions in which it appears. The results from regressions using market capitalization as the finance variable appear in Table 6. Again, there is moderate evidence that institutions positively influence economic growth and somewhat limited evidence that market capitalization affects growth. The interaction term is significantly negative in only one of the eight regressions in which it was included. Overall, the results suggest that institutions and stock markets are independent of each other in their effect on economic growth.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: CROSS-SECTION WITH BASIC CONTROLS									
Finance: Priv. Credit	0.033 (0.034)	0.032 (0.035)	0.029 (0.087)	0.023 (0.100)	0.022 (0.138)	0.204 (0.032)	0.162 (0.000)	0.131 (0.002)	0.121 (0.001)
CIM		0.037 (0.133)				0.076 (0.036)			
Corruption			0.001 (0.764)				0.012 (0.000)		
Rule				0.005 (0.066)				0.013 (0.001)	
IRIS					0.002 (0.107)				0.004 (0.000)
Interaction (Fin*Inst)						-0.198 (0.075)	-0.030 (0.000)	-0.022 (0.004)	-0.007 (0.003)
Obs	90	89	79	79	79	89	79	79	79
PANEL B: CROSS-SECTION WITH EXTENDED CONTROLS									
Finance: Priv. Credit	0.028 (0.066)	0.027 (0.069)	0.026 (0.097)	0.020 (0.152)	0.019 (0.206)	0.158 (0.151)	0.175 (0.000)	0.174 (0.006)	0.146 (0.001)
CIM		0.029 (0.207)				0.063 (0.005)			
Corruption			0.001 (0.774)				0.013 (0.005)		
Rule				0.004 (0.138)				0.017 (0.006)	
IRIS					0.001 (0.210)				0.005 (0.003)
Interaction (Fin*Inst)						-0.151 (0.235)	-0.034 (0.000)	-0.032 (0.007)	-0.009 (0.002)
Obs	89	88	78	78	78	88	78	78	78

The dependent variable is average growth of real GDP per capita over the period 1970-2004. p-values in parentheses based on robust standard errors. Interaction corresponds to the interaction of the financial variable with the respective institutions variable. Basic controls include log of initial GDP per capita and log of education. Extended controls include basic controls as well as inflation and the log of trade and log of government expenditure. Finance and the institutional variables are instrumented for with their initial values in 1970 or the earliest available values for countries missing values in 1970.

Table 5: Turnover, Institutions, and Growth Cross-Section (IV)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: CROSS-SECTION WITH BASIC CONTROLS									
Finance: Turnover	0.003	0.002	0.007	0.006	0.002	-0.060	0.080	-0.011	-0.041
	(0.796)	(0.860)	(0.479)	(0.603)	(0.837)	(0.502)	(0.339)	(0.765)	(0.409)
CIM		0.029				0.013			
		(0.552)				(0.809)			
Corruption			0.006				0.002		
			(0.108)				(0.818)		
Rule				0.008				0.006	
				(0.009)				(0.146)	
IRIS					0.003				0.002
					(0.007)				(0.214)
Interaction (Fin*Inst)						0.074	0.027	0.005	0.004
						(0.506)	(0.296)	(0.631)	(0.365)
Obs	61	60	58	58	58	60	58	58	58
PANEL B: CROSS-SECTION WITH EXTENDED CONTROLS									
Finance: Turnover	0.011	0.010	0.013	0.011	0.009	-0.016	-0.052	0.006	-0.007
	(0.277)	(0.312)	(0.184)	(0.271)	(0.406)	(0.835)	(0.532)	(0.860)	(0.872)
CIM		0.017				0.009			
		(0.706)				(0.851)			
Corruption			0.003				-0.004		
			(0.512)				(0.632)		
Rule				0.007				0.007	
				(0.009)				(0.072)	
IRIS					0.003				0.003
					(0.006)				(0.074)
Interaction (Fin*Inst)						0.032	0.009	0.002	0.001
						(0.749)	(0.436)	(0.862)	(0.715)
Obs	60	59	57	57	57	59	57	57	57

See notes for Table 4.

Table 6: Capitalization, Institutions, and Growth Cross-Section (IV)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: CROSS-SECTION WITH BASIC CONTROLS									
Finance: Capitalization	0.019 (0.077)	0.019 (0.092)	0.017 (0.168)	0.014 (0.093)	0.013 (0.248)	0.324 (0.010)	0.033 (0.670)	0.007 (0.824)	0.007 (0.892)
CIM		0.018 (0.716)				0.138 (0.056)			
Corruption			0.003 (0.540)				0.004 (0.505)		
Rule				0.007 (0.019)				0.006 (0.062)	
IRIS					0.002 (0.038)				0.002 (0.077)
Interaction (Fin*Inst)						-0.351 (0.015)	-0.004 (0.838)	0.002 (0.802)	0.000 (0.927)
Obs	62	61	58	58	58	61	58	58	58
PANEL B: CROSS-SECTION WITH EXTENDED CONTROLS									
Finance: Capitalization	-0.010 (0.180)	-0.012 (0.156)	-0.013 (0.202)	-0.005 (0.388)	-0.011 (0.130)	0.118 (0.484)	0.036 (0.695)	0.040 (0.295)	0.059 (0.393)
CIM		0.016 (0.725)				0.063 (0.450)			
Corruption			0.009 (0.106)				0.012 (0.070)		
Rule				0.008 (0.003)				0.012 (0.001)	
IRIS					0.004 (0.000)				0.005 (0.001)
Interaction (Fin*Inst)						-0.143 (0.438)	-0.011 (0.583)	-0.012 (0.207)	-0.005 (0.308)
Obs	61	60	57	57	57	60	57	57	57

See notes for Table 4.

C. *Panel Results*

For our panel analysis, we use 5-year panels and system-GMM to consider the interaction between finance and institutions. The results from these regressions are provided in Tables 7–9. In columns (1)-(5) of Table 7, there is mixed evidence of private credit mattering for economic growth, however, the institutional measures are significantly positive in five of the eight specifications. In accordance with the cross-sectional results, when considering columns (6)-(9) we again see fairly extensive evidence of a negative and significant interaction between private credit and institutional quality measures.

Table 7: Private Credit, Institutions, and Growth System-GMM Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: SYS-GMM WITH BASIC CONTROLS									
Finance:	0.024	0.029	0.013	0.008	0.009	0.272	0.033	0.048	0.052
Priv. Credit	(0.028)	(0.023)	(0.136)	(0.358)	(0.260)	(0.018)	(0.115)	(0.055)	(0.039)
CIM		0.017				0.059			
		(0.023)				(0.099)			
Corruption			0.003				0.005		
			(0.364)				(0.248)		
Rule				0.008				0.011	
				(0.001)				(0.000)	
IRIS					0.002				0.003
					(0.014)				(0.004)
Interaction						-0.267	-0.005	-0.009	-0.003
(Fin*Inst)						(0.027)	(0.328)	(0.073)	(0.069)
Hansen J	0.255	0.734	0.451	0.545	0.457	0.995	0.711	0.763	0.695
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.480	0.305	0.198	0.271	0.216	0.288	0.228	0.332	0.256
Obs	565	542	376	376	376	542	376	376	376
PANEL B: SYS-GMM WITH EXTENDED CONTROLS									
Finance:	0.007	0.009	-0.004	-0.005	-0.007	0.162	0.035	0.036	0.032
Priv. Credit	(0.394)	(0.292)	(0.550)	(0.592)	(0.284)	(0.052)	(0.127)	(0.169)	(0.199)
CIM		0.004				0.028			
		(0.869)				(0.435)			
Corruption			0.003				0.007		
			(0.343)				(0.081)		
Rule				0.005				0.009	
				(0.003)				(0.000)	
IRIS					0.002				0.003
					(0.033)				(0.006)
Interaction						-0.165	-0.009	-0.009	-0.003
(Fin*Inst)						(0.057)	(0.065)	(0.067)	(0.082)
Hansen J	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.493	0.361	0.186	0.243	0.209	0.371	0.225	0.295	0.243
Obs	553	531	368	368	368	531	368	368	368

The dependent variable is average growth of real GDP per capita over the period of 5 years (ie 1961-1965, 1966-1970, etc). p-values in parentheses based on robust standard errors. Time dummies included but not reported. Interaction corresponds with the interaction of the financial variable with the respective institutions variable. Basic controls include log of initial GDP per capita (ie 1960, 1965, etc) and log of education. Extended controls include basic controls as well as inflation and the log of trade and log of government expenditure (1961-1965, 1966-1970, etc). The p-values for the Hansen test as well as Arellano and Bond tests for AR(1) and AR(2) in first differences are also provided.

Table 8 details the results based on turnover and shows some mixed evidence for turnover mattering positively for economic growth; however, the institutional measures perform poorly in these specifications. Further, in line with the cross-sectional results, the interactions in six of eight cases prove to be insignificant, indicating that their impact on growth is independent.

Table 8: Turnover, Institutions, and Growth System-GMM Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: SYS-GMM WITH BASIC CONTROLS									
Finance:	0.012	0.013	0.013	0.010	0.011	-0.072	0.007	0.011	0.000
Turnover	(0.074)	(0.087)	(0.054)	(0.123)	(0.081)	(0.027)	(0.593)	(0.692)	(0.994)
CIM		0.022				-0.000			
		(0.646)				(0.994)			
Corruption			0.002				-0.001		
			(0.592)				(0.897)		
Rule				0.006				0.005	
				(0.025)				(0.078)	
IRIS					0.002				0.001
					(0.231)				(0.426)
Interaction						0.102	0.002	0.000	0.001
(Fin*Inst)						(0.012)	(0.547)	(0.809)	(0.454)
Hansen J	0.995	1.000	0.999	0.996	0.998	1.000	1.000	1.000	1.000
AR(1)	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001
AR(2)	0.072	0.023	0.706	0.805	0.683	0.049	0.820	0.857	0.668
Obs	241	231	210	210	210	231	210	210	210
PANEL B: SYS-GMM WITH EXTENDED CONTROLS									
Finance:	0.012	0.012	0.012	0.011	0.011	-0.062	0.004	0.011	-0.001
Turnover	(0.011)	(0.009)	(0.021)	(0.030)	(0.027)	(0.039)	(0.728)	(0.624)	(0.994)
CIM		-0.004				-0.025			
		(0.915)				(0.448)			
Corruption			0.003				0.002		
			(0.281)				(0.581)		
Rule				0.003				0.003	
				(0.149)				(0.176)	
IRIS					0.001				0.001
					(0.216)				(0.291)
Interaction						0.087	0.003	-0.000	0.001
(Fin*Inst)						(0.016)	(0.362)	(0.994)	(0.423)
Hansen J	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AR(1)	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001
AR(2)	0.050	0.017	0.336	0.631	0.487	0.015	0.303	0.658	0.467
Obs	235	225	204	204	204	225	204	204	204

See notes for Table 7.

Lastly, Table 9, based on a specification with stock market capitalization, again finds some evidence of market capitalization and institutions mattering positively for economic growth. However, adding an interaction term generally removes the significance of the market capitalization measure and in none of the models is the interaction term significant. Again, this is interpreted as evidence that any impact institutions and stock market capitalization have on growth is independent of each other.

Table 9: Capitalization, Institutions, and Growth System-GMM Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: SYS-GMM WITH BASIC CONTROLS									
Finance: Capitalization	0.011 (0.072)	0.010 (0.100)	0.009 (0.129)	0.009 (0.074)	0.008 (0.154)	-0.009 (0.935)	0.003 (0.895)	-0.011 (0.595)	0.011 (0.657)
CIM		-0.018 (0.742)				-0.044 (0.421)			
Corruption			0.001 (0.847)				-0.001 (0.815)		
Rule				0.006 (0.006)				0.005 (0.124)	
IRIS					0.001 (0.154)				0.002 (0.212)
Interaction (Fin*Inst)						0.021 (0.866)	0.002 (0.702)	0.004 (0.374)	-0.003 (0.884)
Hansen J	0.996	1.000	0.995	0.995	0.992	1.000	1.000	1.000	1.000
AR(1)	0.000	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
AR(2)	0.048	0.017	0.569	0.630	0.514	0.017	0.701	0.746	0.526
Obs	254	244	220	220	220	244	220	220	220
PANEL B: SYS-GMM WITH EXTENDED CONTROLS									
Finance: Capitalization	0.002 (0.679)	0.000 (0.913)	-0.000 (0.939)	0.002 (0.560)	-0.000 (0.977)	-0.097 (0.285)	0.012 (0.483)	-0.005 (0.706)	0.004 (0.817)
CIM		-0.007 (0.842)				-0.048 (0.388)			
Corruption			0.004 (0.177)				0.006 (0.154)		
Rule				0.005 (0.007)				0.004 (0.078)	
IRIS					0.002 (0.021)				0.002 (0.030)
Interaction (Fin*Inst)						0.106 (0.269)	-0.003 (0.503)	0.002 (0.504)	-0.003 (0.811)
Hansen J	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AR(1)	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.000
AR(2)	0.064	0.016	0.382	0.835	0.625	0.013	0.327	0.810	0.593
Obs	248	238	214	214	214	238	214	214	214

See notes for Table 7.

In summary, these results largely mirror the cross-sectional results. Banking development and institutions are substitutes in growth while stock market development and institutions are independent of one another in terms of affecting growth.

C. *What Explains the Negative Interaction between Banking and Institutions?*

The finding that institutions and bank development may serve as substitutes rather than as complements in the growth process may at first blush appear somewhat counter-intuitive. We would argue, however, that perhaps one should not be surprised by this finding.

First, consider what we know about the importance of institutions for exchange and economic activity. As North (1991) points out, institutions impose constraints on human interaction which foster trade by creating order and reducing uncertainty. With effective formal institutions, complex, impersonal market transactions based upon enforceable contracts can occur. If, however, the society's institutional structure is not well-developed, exchange must be accommodated by other methods. Aron (2000, p. 105) makes the point clearly that when there are few or inadequately functioning institutions, economic activity will likely be forced to rely on interpersonal exchange enforced through repeated interaction and cultural homogeneity. Thus, without effective institutions, exchange is likely to be hindered. North (1990, p. 110) additionally argues that in the absence of well-functioning institutions, the institutional set-up that does exist will often define a set of payoffs to activity which does not encourage productive economic activity. Therefore, not only might exchange be hindered, economic agents may engage in less productive activities as well.

While this argument makes sense generally speaking, we must consider more closely how institutions affect growth in order to understand the substitution story we are developing. As noted above, institutions are going to matter for growth because they impact both transaction costs (and thus exchange) as well as transformation costs (and thus the production process). As Aron (2000) points out, with high transaction costs firms will tend to be smaller and more likely to function outside of the formal economy. Additionally, the inability to enforce contracts in a weak institutional setting may result in a shift to less expensive technologies as well as less efficient, more short-term-focused production processes (Aron, 2000, p. 104). Clearly the ability to acquire information cheaply and engage in long-term contracting appears crucial for the amount and sort of economic activity needed for significant economic growth. With weak

institutions, the ability to engage in useful economic activity is hindered and, as mentioned earlier, may provide the sort of incentives which, in fact, cause some market participants to engage in very destructive and perverse economic activity.

Now consider the functions provided by financial development and banks in particular. Levine (2005) argues that financial development provides a number of functions that help reduce the effect of information, enforcement, and transaction costs. More specifically, paraphrasing Levine (2005), Apergis, Filippidis, and Economidou (2007, p. 179) notes that financial markets: "...(i) reduce transaction costs and facilitate management (of) risk, (ii) mobilize and pool savings, (iii) ease the exchange of goods and services, (iv) produce information ex ante about possible investments, and (v) monitor investments and exert corporate governance." It is clear that many of the functions detailed, which much of the finance and growth literature has shown are important for growth, are the same sort of functions provided by well-functioning institutions. This similarity is crucial to our argument and at the crux of why we find a negative interaction between banking development and institutions in their effect on growth. Financial development and institutional development provide many of the same functions that are growth enhancing through their ability to increase investment, allocate capital, engage in productive economic activity, etc. [11]

What remains then is the question of why the interaction is really only negative for the interaction of banking and institutions and not stock market development and institutions. Here we rely on the financial structure literature. As Rajan and Zingales (2001) argues, in a society with weak institutions, it is doubtful that a financial system based upon stock markets will be effective in promoting growth because the legal system cannot be relied upon to fairly enforce the contracts necessitated by a market-based system.[12] On the other hand, functional banking-based financial systems may develop even when institutions are deficient. Banking's potential for success in poor institutional environments, and in fact it's ability to serve as a substitute for strong institutions, arises because banking relationships often have the characteristics required for certain economic activities in the absence of strong institutions.

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[11] See Levine (2005) for a thorough discussion of the functions provided by financial systems.
[12] In fact, based on this sort of argument, we were mildly surprised that our results didn't turn up more evidence of a positive interaction between stock market development and institutions rather than the generally insignificant finding for that interaction.

Modigliani & Perotti (2000, p. 88) argues that "in a context of unreliable contracts, banks have a comparative advantage over market financing. Bank finance relies on repeated interaction and often long-term relations; as a result, banks may be in a better position to supervise borrowers through non-contractual enforcement, such as the threat of refusing further credit." This difference between how banks and stock markets are able to allocate credit, and thus the sort of functions they provide, lies at the heart of why we see the results we do. Modigliani & Perotti additionally note that even in an uncertain institutional climate, banks may mobilize saving because deposits can be withdrawn on demand.

Rajan & Zingales (2001, pp. 472-73) further explains that "Relationship-based [financial] systems can survive in environments where laws are poorly drafted and contracts not enforced. The relationship is largely self-governing; parties intent on maintaining their 'reputations' honour the spirit of the agreement (often in the absence of any written contract) in order to ensure a steady flow of future business within the same network of firms." This argument again highlights the difference between banks and stock markets and demonstrates how banking may operate effectively even under weak institutions.

Overall, it appears that banking systems have the capability to perform functions similar to those provided by institutions. Additionally, in the sense that banking relationships are often personal, long-term, and self-enforcing (virtually the same qualities noted by Aron (2000) as being needed when institutions are weak or non-existent), banking systems can "substitute" for formal institutions.

V. CONCLUSIONS

Using a number of measures of financial development and institutions to test the robustness of the finance-institutions link for economic growth, our research provides a number of conclusions. First, our results indicate that bank and stock market development, as well as quality institutions, independently contribute to economic growth. Second, our results are able to add to the debate on whether financial development and institutions are substitutes, complements, or independent in their effect on economic growth. Based on our cross-sectional and panel results we conclude that institutions and bank development as measured by our private credit measure are substitutes in the growth process. Regarding stock markets and institutions, however, we find that their effects appear to be independent of one another.

We tie these results to the idea that banks, through their ability to provide certain functions such as reducing transaction costs, providing an enforcement mechanism for contracts, and increasing information for many growth enhancing economic activities, can serve as a substitute for many of the features provided by well-functioning institutions. Stock markets, however, provide fewer of the features associated with institutions and, in fact, likely rely on well-functioning institutions in order to function themselves. Our bank results are in line with those of Ahlin and Pang and at odds with Demetriades and Law, while our stock market results prove to be at odds with Ahlin and Pang's stock market findings (keeping in mind they use a different stock market measure). We believe further investigation on this topic using additional finance and institutions measures as well as alternate empirical approaches is warranted.

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DATA APPENDIX

	DATA DESCRIPTION	
VARIABLE	MEASURE	SOURCE
Growth	Constructed as log difference of real GDP per capita (2000 $US)	World Bank WDI
Initial GDP Per Capita	Real GDP per capita at beginning of respective sample period (2000 $US)	World Bank WDI
Education	Average years of schooling in the total population 25+	Barro and Lee (2000)
Trade	Sum of exports and imports to GDP	World Bank WDI
Inflation	Constructed as log difference of GDP Deflator	World Bank WDI
Government	Ratio of Government consumption to GDP	World Bank WDI
Private Credit	Ratio of private credit by deposit money banks to GDP	Financial Structure Dataset
Turnover	Ratio of value of shares traded to GDP	Financial Structure Dataset
Capitalization	Ratio of stock market capitalization to GDP	Financial Structure Dataset
Contract Intensive Money	Constructed as ratio of non-currency component of M2 to total M2.	IMF IFS
Corruption	6 point scale (larger values imply less corruption)	IRIS/ICRG
Rule of Law	6 point scale (larger values imply more law and order)	IRIS/ICRG
IRIS	Constructed 18 point scale (larger values imply more law and order)	IRIS/ICRG

SUMMARY STATISTICS FOR CROSS-SECTION DATA				
VARIABLE	MEAN	STD DEV	MIN	MAX
Growth	0.0174	0.017	-0.039	0.066
Initial GDP	4617.472	6529.456	103.363	41356.83
Education	4.073	2.697	0.376	9.788
Trade	0.718	0.368	0.178	1.983
Inflation	0.184	0.349	0.015	2.237
Government	0.161	0.053	0.067	0.334
Private Credit	0.342	0.247	0.042	1.329
Turnover	0.329	0.306	0.008	1.376
Capitalization	0.372	0.349	0.008	1.872
CIM	0.807	0.124	0.311	0.969
Corruption	3.379	1.291	1.185	6
Rule of Law	3.716	1.392	1.356	6
IRIS	10.631	4.136	2.75	17.965

SUMMARY STATISTICS FOR 5 YEAR PANEL DATA				
VARIABLE	MEAN	STD DEV	MIN	MAX
Growth	0.016	0.029	-0.101	0.138
Initial GDP	6251.433	8237.209	87.113	44756.77
Education	5.156	2.888	0.042	12.247
Trade	0.718	0.409	0.099	2.651
Inflation	0.142	0.318	-0.050	3.898
Government	0.160	0.060	0.041	0.469
Private Credit	0.351	0.297	0.018	1.629
Turnover	0.357	0.437	0.004	3.437
Capitalization	0.389	0.449	0.000	3.415
CIM	0.809	0.137	0.211	0.997
Corruption	3.361	1.431	0	6
Rule of Law	3.700	1.567	0.566	6
IRIS	10.593	4.426	0.625	18

SYSTEM GMM APPENDIX

Our empirical approach uses System GMM based on the xtabond2 command developed by David Roodman for use with STATA. As Roodman (pp. 1-2, 2006) points out: "One disadvantage of difference and system GMM is that they are complicated and can easily generate invalid estimates. Implementing them with a Stata command stuffs them into a black box, creating the risk that users, not understanding the estimators' purpose, design, and limitations, will unwittingly misuse them."

Given the potential to misuse the xtabond2 command line, this appendix details the xtabond2 command line used for our analysis, with discussion of how the variables were instrumented as well as what sub-options were used in order to provide full disclosure.

The xtabond2 command line used for the full model in our analysis is:

xi: xtabond2 *dependent variable independent variables i.year*, gmm(*endogenous variables*, lag (2 .)) gmm(*predetermined variables*, lag(1 .)) iv(*i.year*) robust small

where *dependent variable* is growth, *independent variables* are the control variables and variables of interest (finance, institutions, interaction), and *i.year* are the time dummies.

All finance, institutions, and interaction variables are considered endogenous and so are entered as such in the GMM instruments. Further, inflation, trade, and government spending are also entered as endogenous in the GMM instruments. Initial GDP per capita and education are considered predetermined and enter the GMM instruments as predetermined. Our year dummies enter as IV instruments, and further we use robust standard errors.

INTERACTION APPENDIX (Selected Results)

Effect of Banking at Different Levels of Bank and Institutional Development

OLS (Basic Controls, Priv, CIM)

OLS (Full Controls, Priv, CIM)

OLS (Basic Controls, Priv, Corruption)

OLS (Full Controls, Priv, Corruption)

System GMM (Basic Controls, Priv, CIM)

System GMM (Full Controls, Priv, CIM)

System GMM (Basic Controls, Priv, Corruption)