The fading link? A new empirical analysis of the relationship between financial development and economic growth

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Abstract:
This paper contributes to the literature on the finance-growth link by presenting new findings based on a new, larger dataset that improves over earlier studies in its greater coverage in terms of time periods and countries, as well as the incorporation of additional control variables like institutional quality and the size of the economy. Our results demonstrate that financial development does not have a statistically significant effect on economic growth. We also find that the economy's size is a statistically significant determinant of growth.

Keywords: financial development, economic growth, institutional quality, market size, dynamic panel analysis.

JEL codes: E44, O16, O43

1. Introduction

There is an extensive literature on the link between financial development and economic growth. However, although many studies have found an association between both variables, the direction of causality remains an issue of debate. Beginning with Bagehot (1873), many scholars believe that the financial sector is a positive force behind economic growth, while others suggest that finance merely follows the dynamics of the real economy (Robinson, 1952) and others are skeptical about the link (Lucas, 1988).

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In the introduction of his elassic and hioncering s information asymmetries among economic agents and the transaction costs involved in their activities. According to these authors, the financial system (1) provides means of payments that facilitate a greater number of transactions, (2) concentrates the savings of a large number of investors, (3) makes possible the allocation of resources to their most productive economic use, through the effective evaluation and monitoring of investment projects, (4) improves corporate governance, and (5) contributes to risk reduction and diversification.

Diverse studies found a relation between development of the financial system and economic growth and suggested a positive influence of the first variable over the second one (Levine, 2005), beginning with Goldsmith's (1969) empirical work and the seminal paper of King and Levine (1993) with a cross-section analysis of 77 countries that included several control variables. The positive link between finance and growth was also highlighted by later works like Beck et al. (2000), who also shown that the relation between financial development and economic growth was basically transmitted through an increase in productivity and not in the growth of capital, a result that would seem consistent with the third mechanism we have earlier mentioned. Nevertheless, the finance and growth link obeys to more complex processes, since the proposed causal mechanisms operate differently according to specific characteristics of the economic environment. Thus, some authors have tried to better specify the conditions under which the positive effect of finance upon growth actually occurs. In this regard, Rousseau and Wachtel (2002a) contend that financial development only has a positive influence on growth in a context of moderate to low inflation. Moreover, Rioja and Valev (2004a), working with the same dataset as Beck et al. (2000), found that the positive relationship between financial development, measured through the financial system size, and growth only occurs in countries with high or middle income, suggesting the existence of a minimum threshold of economic development over which the financial system has a positive influence on the real economy. In another study, Rioja and Valev (2004b) also suggested that there is a threshold of financial system development before which an increase in the size of this system has a negative effect on economic growth. Their argument to account for this finding is that, in countries with poorly developed financial systems, increases in total credit are typically caused by government intervention through state-owned banks that lend money without pay much attention to the productive consequences of the investment projects they are funding. Consistently with this, La Porta et al. (2002) have demonstrated that in financial systems with a greater proportion of state-owned banks, economic growth tends to be smaller. On the other hand, Loayza and Ranciere (2002) warned about the need to differentiate between short and long term effects from finance on growth, showing with panel data techniques that short-term negative effects can be combined with long term positive effects.

In order to determine the direction of causality, or more precisely the statistical feedback of temporary precedence, the relationship between finance and growth has been analyzed with time series methodology. The results have been mixed and dependent upon the countries and periods of time considered. For example, and taking the case of just one country (Tunisia), Boulila and Trabelsi (2004a) indicate that in a sample subperiod (1963-1987) the direction of causality goes from the real economy to the financial sector, whereas there is bidirectional causality in the total sample period sample (1962-1998). Moreover, Calderón and Liu (2003) found that the causal effect of financial development on growth is stronger than the reverse causal effect of the same variables. On the other hand, Christopoulos and Tsionas (2004) with an empirical base of ten developing countries showed evidence of long term Granger causality from finance to economic growth, but not of reverse causality. Among the studies that have detected Granger causality flowing from finance to growth, we can mention Chang and Caudill (2005), who found that finance Granger causes growth in the case of Taiwan, and Rousseau and Wachtel (2002b), whose study concludes with similar results analyzing five industrialized countries over the 1870-1929 period.

Yet there is also evidence contradicting this hypothesis. Shan et al. (2001), using time series of 9 OECD countries plus China, do not find that finance Granger causes economic growth, but of reverse causality in 3 cases and bidirectionality in 5. In a later study, Shan (2005), estimating impulse-response functions for 11 countries, concludes that there is little evidence that finance influences economic growth. With a sample from countries of the Middle East and Mediterranean Africa, Boulila and Trabersi (2004b) point out that, in most cases, the direction of causality goes from the real economy growth to the financial sector. Al-Awad and Harb (2005) obtained analogous results with 10 Middle East countries, suggesting that there is a short-term direction of causality from economic growth to finance. On the other hand, analyzing the empirical case of Kenya, Odhiambo (2008) posits that the link and direction of causality between finance and growth depends on the indicator used as proxy for financial development, but overall the financial sector would seem to follow what happens in the real economy and not otherwise. Likewise, in a study of Latin American countries for the period 1961-2005, Blanco (2009) finds that finance does not have a causal effect on growth, but that economic growth leads financial development. In a similar vein, and using a sample of 63 countries and a new technique to evaluate Granger causality, Hurlin and Venet (2008) do not find evidence of Granger causality from finance to growth but of reverse causality.

As can be appreciated from the aforementioned studies, the time series evidence is in general not conclusive regarding the causal direction from finance to economic growth. In contrast, analyses of dynamic panels have shown a positive relation between both variables, although in these cases causality is exclusively inferred from theory. It is therefore important to see what happens with a panel based on a larger sample than previous studies, a wider observation window and a greater number of control variables as well as an improved methodology, in order to accurately identify the contribution of financial development to economic growth. But before presenting our methodological approach, we will first discuss two methodological limitations pervading most empirical studies on this subject (ours included).

In the first place, to operationalize financial development through the credit size of the banking system involves a problem. In most comprehensive datasets, this indicator does not adequately make a difference between credit to productive firms and credit for consumption, and this latter category is not precisely a minor proportion of total credit in some countries. To differentiate between these two categories is important since both may contribute to economic growth through different channels: credit to firms exemplifies the classic mechanism initially postulated by Bagehot, whereas credit for consumption could affect the rate growth by means of an increase in demand. If these proportions were constant for all countries, there would not be a problem in neglecting this distinction; but this it is not the case, and valuable information about the potential contribution of these two distinct mechanisms to economic growth is therefore lost.

In the second place, empirical studies do not contemplate the possible spillover effects of very developed financial systems over smaller or lesser developed countries. Especially with the globalization of financial markets, large enterprises, typically multinationals, were able to fund their activities through banking systems other than those of their host countries. In developing countries, it was not unusual for foreign firms to get funding at lower interests rates through the financial system of their home countries. In this way, the financial system in country A could, in addition to its own positive domestic effect, contribute to economic growth in country B. The effect of these global financial flows has not been adequately quantified and taken into account in the studies on the finance and growth link.

2. Data and methods

The dependent variable, economic growth, was operationalized by the real GDP rate of growth in 2005 constant dollars (expressed in percentage points). We calculated averages corresponding to five-year periods, in order to smooth the typical yearly fluctuations due to business cycles. The data source is the Penn World Tables version 6.3 (Heston et al. 2009).

Like in most empirical studies in the literature, we operationalized financial development through the total credit to the private sector of banks and other financial institutions as a percentage of the GDP. The data source is Beck et al. (2009), whose dataset reports yearly values for diverse countries from 1961 to 2007, which we used to calculate 5 five-year averages. There were no data available in the case of some developing countries (mostly Latin America ones) in this version of the dataset, so we extended the coverage for these countries by using figures of total credit to the private sector from an earlier version of the dataset (Beck et al., 2000). The yearly time series of total credit to the private sector as percentage of GDP have discontinuities for some countries. In these cases, we replaced the missing values by linear interpolation in order to calculate five-year averages. When the missing values corresponded to the first years of the series, they were replaced by figures calculated from the trend line of the initial five-year period. In all, only 25 observations were the object of these two interpolation procedures**.** Moreover, when there were missing values for three years within the same five-year period, this period itself was considered as a missing observation.

It can be contended that using only one indicator for financial development could limit the relevance of our results. However, since the main hypothesis of the empirical studies that tried to test the validity of the finance-growth link at the microeconomic level is that having better access to credit enhances growth for individual firms (Demirgüç-Kunt and Maksimovic, 1998; Beck, Demirgüç-Kunt and Maksimovic, 2005), we believe that total credit is the best indicator to operationalize the financial development variable for the purpose of our study.

We controlled for the effect of diverse variables deemed by the literature as potential determinants of economic growth. Thus, our analysis includes government size operationalized as government spending share of real GDP, a variable that can have a negative impact upon the growth rate (Scully, 1989; Barro and Sala-i-Martin, 1999), although some authors have also raised the possibility of a positive effect contingent upon the type of government spending considered.

Following Solow's theory of economic growth, we control for the countries' initial level of economic development, operated as the per capita real GDP at the beginning of each period, in order to take into account the potential convergence effect (according to this approach, it is hypothesized that the growth rate of lesser developed countries is greater than that of the most developed countries). Moreover, and unlike most of the empirical studies on the finance-growth link, we have also controlled for the effect of the economy's size under the assumption that larger economies could offer more investment possibilities and financial development could therefore have a higher positive effect in these countries. This variable was operationalized by the real GDP in 2005 constant dollars. Trade openness, which in diverse studies appears as a determinant of economic growth, is also considered and was operationalized as the sum of exports and imports as percentage of real GDP. In all the cases, we calculated five-year average values from the yearly time series of these indicators, whose data source is also the Penn World Tables 6.3.

Human capital also figures prominently in the literature as a determinant of economic growth, and we have controlled for its effect though the average years of secondary schooling in the adult population older than 15 years at the beginnings of each five-year period. The data source is the Barro and Lee's (2000) dataset. Another variable that can affect economic growth is the inflation rate, which at high values typically reflects the degree of macroeconomic instability (Bruno and Easterly, 1998). It was operationalized through the variation of the consumer price index, and the data source for these figures is the World Development Indicators of the World Bank (2008). In a very few cases, the time series of this source were supplemented with the inflation rate data from an earlier version of the Beck et al. dataset.

Also, and unlike previous dynamic panel studies of the finance-growth link, we have controlled for the effect of the countries' institutional quality through an indicator that evaluates the nature of a country's government system, the polity2 variable of the Polity 4 project (Marshall et al, 2010). The indicator ranges from -10 (strongly autocratic) to 10 (strongly democratic). It can be expected that the greater institutional quality (i.e., existence of institutions that give citizens voice to express their political preferences, existence of institutional constraints over the executive branch of government, respect to the rule of law and civil liberties, and related aspects), the better the economic climate, which in turn could generate greater economic growth (Acemoglu et al., 2005; Rodrik, 2000; Shirley, 2008). We have estimated five-year averages of the yearly values of this indicator.

All independent variables are expressed as natural logarithms, with the exception of the institutional quality variable, the human capital variable (average years of secondary schooling in the adult population) and the inflation rate (which enters the equation as the log of 1 plus the inflation rate). Dummy variables were used to control for time period effects.

The resulting dataset is an unbalanced panel that includes information for 98 countries covering nine five-year periods from 1961-1965 to 2001-2005. When the institutional quality variable enters the regression, we lose three countries from the sample

We use the method of dynamic panels, which deals with the problem of omitted unobserved variables by taking first differences and also tackles the issue of reverse causality by using lagged realizations of the explanatory variables as instruments in a GMM framework. The problem of endogeneity is, of course, not fully resolved with this method, but the use of these internal instruments aims at achieving a "weak" form of exogeneity (i.e. the instruments may be correlated with past and current values of the error terms, but not with future realizations of the errors).

We start with the following equation:

$$g_{it} = \alpha + \beta . f_{it} + \gamma . c_{it} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (1)$$

in which *g* is the growth rate, *f* is the financial development variable, *c* is a vector of explanatory variables, which we treat as endogenous, and i and t index units of analysis and time periods, respectively. The coefficients to be estimated are β and γ (a vector of explanatory variables coefficients), while μ_i is a vector of unobserved individual (country-specific) effects, λ_t is a vector of time period effects, and ε_{it} is the error term.

By taking first differences in (1), we eliminate the country-specific effect term:

$$g_{it} - g_{i,t-1} = \beta (f_{it} - f_{i,t-1}) + \gamma (c_{it} - c_{i,t-1}) + (\lambda_t - \lambda_{t-1}) + (\varepsilon_{it} - \varepsilon_{i,t-1}) \qquad (2)$$

This equation can be estimated with GMM using lagged valued of the explanatory variables as instruments. These internal instruments may be correlated with past and current error terms but must not be correlated with subsequent error terms, which is expressed in the following moment conditions:

$$E\left[f_{i,t-s} (\varepsilon_{i,t} - \varepsilon_{i,t-1} \right] = 0 \qquad \text{for each } t = 3 \text{ ....} T \text{ , } s \geq 2 \qquad (3)$$

$$E\left[c_{i,t-s} (\varepsilon_{i,t} - \varepsilon_{i,t-1} \right] = 0 \qquad \text{for each } t = 3 \text{ ....} T \text{ , } s \geq 2 \qquad (4)$$

This difference estimator, however, has some econometric problems, among them loss of information by taking first differences. Therefore, Arellano and Bover (1995) and Blundell and Bond (1998) discuss a system estimator that combines the differenced equation estimated with lagged levels of the explanatory variables with an equation in levels estimated with lagged differences of these variables. It must be assumed that the correlation between the levels of the explanatory variables and the specific country effects is the same throughout all periods. Under this assumption, lagged differences are valid instruments for the levels equation if they are uncorrelated with future realizations of the error terms, hence the following additional moment conditions:

$$E\left[(f_{i,t-s} - f_{i,t-s-1})(\varepsilon_{i,t} + \mu_i) \right] = 0 \qquad \text{for each } t = 3 \text{ ....} T \text{ , } s = 1 \qquad (5)$$

$$E\left[(c_{i,t-s} - c_{i,t-s-1})(\varepsilon_{i,t} + \mu_i) \right] = 0 \qquad \text{for each } t = 3 \text{ ....} T \text{ , } s = 1 \qquad (6)$$

Here, only the most recent differences are used as instruments in the level equation, as the use of additional lags would imply redundant moment conditions (Arellano and Bover, 1995)

This system estimator approach has been widely used in growth regressions. However, many studies using this technique did not take into account a problem discussed by Windmeijer (2005). According to him, the two stage method that is routinely used to compute the system estimator calculates standard errors in defect, which in turn leads to assign high but incorrect levels of statistical significance to the independent variables. It is therefore necessary to make a numerical correction, whose omission leads to the acceptance of results that are actually invalid, an error common in much of the literature until a few years. In the present study, we have used the xtabond2 module for Stata (Roodman, 2006) to implement the Windmeijer's correction for the GMM system estimator

Another problem in this context is the use of too many instruments, which has been analyzed by Roodman (2009). To see if this was really the case in our regression, we have used the Hansen test, under the null hypothesis that the instruments are exogenous. For this test, Roodman recommends to use a high p value of 0.25, instead of the conventional level 0.05. On the other, we also present the results of the system GMM estimator using "collapsed instruments", a technique implemented in Stata by Roodman to limit the proliferation of instruments, which can weaken the usefulness of the Hansen test. In this regard, high p-values of the test, far from being an indicator that the GMM formulation is valid, can paradoxically be a signal that too many instruments are present and, therefore, of the inadequacy of the model to render unbiased coefficients. Hence, it makes sense to also include a model formulation with the less possible amount of instruments, which allow us to have a more stringent test of these instruments' validity. In addition, we have also used the Arellano and Bond test to see whether the error terms have second order autocorrelation (first order correlation is expected by construction), since a basic assumptions for this model specification to be valid is that error terms are not serially correlated.

Finally, in order to evaluate if the finance-growth link, as well as the effect of the other explanatory variables, is contingent upon the countries' level of economic development, we also ran separate regressions for two subsamples of countries classified according to their GDP per capita. To this end, we used the World Bank's country classification by income level, which we applied to each country at the middle observation period of our dataset or at the earliest available period for countries that first appear at later periods. Some countries changed income group, but they were isolated cases, so our subsamples have the same composition throughout all periods. Following this criterion, we identified two groups: one of 27 developed (high-income) countries and the other of 71 developing (low- and middle-income) countries (See composition in Appendix).

3. Results and discussion

In table 1, we report the correlation coefficients for all variables. Of these bivariate relationships, inflation rate is the variable that shows the greatest correlation with economic growth: a moderate negative coefficient of 0.28, while the the size of the economy has a value of 0.20, and log of credit to the private sector, 0.17. Some independent variables show a high correlation between themselves. It is noteworthy the strong correlation between human capital (schooling) and development level (ln GDP per capita initial) of 0.77, as well as that between development and financial development of 0.74. This finding is not surprising, since developed economics are presumed to be at the technological frontier in all industries, and therefore they must also be at the technological frontier in the banking industry. Although the real GDP per capita may not be a perfect indicator of development (it only measures income), in the same way as credit to the private sector may not be a perfect indicator of financial development, this result is interesting. There is also a moderate correlation between institutional quality and development (0.53) and human capital (0.52), respectively. Credit to the private sector is highly correlated with human capital (0.64), which is not surprising given that this latter variable is in turn highly correlated with level of economic development. Both institutional quality and the inflation rate have a moderate correlation with private credit (0.46 and -0.31, respectively).

INSERT TABLE ONE HERE

Bivariate associations, nevertheless, are to be analyzed with caution, although they clearly reflect the potential issue of endogeneity with which we deal through a dynamic panel formulation in our multivariate regressions. In this regard, we have estimated four models, whose results are presented in Table 2. We have used the Windmeijer´s correction in all models. Model 1 is our baseline model, with the use of only the first available lag of the explanatory variables as instrument. Model 2 is the same as model 1, but presents the most stringent formulation of instruments (one lag only with collapsed instruments) in order to facilitate the detection of an invalid specification due to instrument proliferation. In Model 3, we add the variable institutional quality, using again only the first available lag as instrument, while model 4 is the collapsed-instruments version. Financial development is associated positively with economic growth in all but Model 4, but the coefficient lacks statistical significance, which contradicts the dominant perspective in the literature. Some of the control variables do have statistical significance. For instance, the log of initial GDP has a negative and significant coefficient in all models, in consonance with the predictions of the Solow's growth theory. Openness is positively associated with economic growth, but the coefficient has statistical significance only in three models. The human capital variable is positive, but it is only significant in models 2 and 4. The institutional quality variable does not have a statistically significant effect. The inflation level has a negative and statistically significant effect on economic growth, except in the collapsed-instruments models.

Finally, the size of the economy is associated in a positive and statistically significant way with economic growth in all models, a finding that deserves greater attention and that is consistent with the thesis that scale matters not only for individual productive units but for larger aggregates as well. These results are also consistent with the empirical findings of Alesina et al. (2005), in which economic size is measured both as the log of population and as the log of GDP, but contradict the pure cross-sectional analysis of Backhus and Kehoe (1992), who found that the size-growth link, while positive, lacked statistical significance. Measured by GDP, the economy`s size represents "the stock of individuals, purchasing power and income that interact in the market" (Alesina et al, 2005, p 1504), whose effect on the growth rate has been isolated from that of human capital and trade openness (a factor that can potentially offset the benefits of market size), since these are also control variables in our model specification. A larger economy may contribute to economic growth through different mechanisms; for instance (1) there can be economies of scale in the production of public goods, (2) there can also be scale benefits resulting from the generation of human capital and the utilization of technology, and (3) it can have a larger aggregate demand for goods and services. While we cannot ascertain which mechanism is at work here, at least the relationship holds, a result that is also consistent with some approaches of endogenous growth that links the size of the economy (i.e., its number of firms) to growth (Aghion and Howitt, 1998).

INSERT TABLE TWO HERE

It is important to emphasize that if our results had not contemplated the Windmeijer's numerical correction, then all the coefficient in these regressions would be statistically significant, which, among other things, would have led to the incorrect acceptance of the thesis that finance leads economic growth. In addition, we must point out that our specification in all these models is supported by both the Arellano-Bond test of second order autocorrelation, which leads support to the assumption that the error terms are not serially correlated, and the Hansen test, which failed to falsify the null hypothesis that the instruments are exogenous. However, as the instrument count increases, the Hansen test p-level could also increase, and far from being a good sign, very high p-values can actually indicate a real problem of instrument proliferation (Roodman, 2009). Using additional lags produces similar results as models 1 and 3 (not reported here), but increases the p-value of the Hansen test to values closer to 1, so our choice of only one lag seems appropriate. Moreover, the use of collapsed instruments with only the first available lag suggests with their Hansen test p-values that the instruments are valid for these specifications. On the other hand, model 3 may not be acceptable due to its high Hansen test p-value. In all cases, though, private credit is not significantly associated with economic growth.

INSERT TABLE THREE HERE

In Table 3, we present the regressions for the subsample of high-income countries. It can be observed that the initial GDP level enters the regression with a statistically significant effect in all models, while the human capital indicator is significant in model 2 and the inflation rate in model 4. The financial development coefficient has negative sign in models 1 and 3 and positive in models 2 and 4, but it lacks statistical significance. However, models 1 and 3 do not seem to be valid on the basis of the Hansen test, in a clear example of inflated p-values due to the high number of instrument. In the collapsed-instruments models, which show p-values of the Hansen test that would indicate that the specification is valid, the coefficient of financial development becomes positive, yet still lacking statistical significance. Perhaps this can be explained by the fact that firms in advanced economies are not subject to financial constraints to growth, and thus these economies do not necessarily respond to improvements in the financial sector (Aghion et al., 2005). In all four models, the Arellano-Bond tests for second order autocorrelation do not reject the null hypothesis of no serial correlation at a conventional p value of 0.05.

INSERT TABLE FOUR HERE

Regarding, low- and middle-income countries (Table 4), only the size of the economy and the degree of openness have a statistically significant positive effect on economic growth in all four models. Inflation has a negative effect on the dependent variable, whose statistical significance disappears in the collapsed-instruments models. Our main variable of interest, financial development, has a negative coefficient in three models, but lacks statistical significance. In the same way as in the case of the high-income subsamples, models 1 and 3 do not appear to be valid with a suspiciously perfect p-value of 1 for the Hansen tests, which is typically the result of a problem of instrument proliferation (Roodman, 2009). Models 2 and 4 appear as valid, according to the Hansen tests. In these model, the log of GDP per capita has a negative and statistical effect on growth. The institutional quality variable lacks statistical significance.

4. Conclusion

The finance-growth link has received much attention in the economic growth literature. While the empirical time-series evidence is mixed about the direction of causality in this relationship, the approach that has been cited most often as providing the most convincing evidence that finance leads economic growth is the methodology of dynamic panels. We have reexamined this relationship with a new dataset that improves over earlier studies in its greater coverage in terms of both countries and time periods. In addition, we have controlled for the effect of institutional quality and the size of the economy, two variables not considered in earlier studies.

In this regard, it can be argued that the causal mechanism linking financial development with economic growth is, to some extent, contingent on the size of the economy — i.e., one could reasonably expect that the possibilities of funding (and finding) profitable entrepreneurial projects would be different in Papua New Guinea than in Brazil, hence the need to include size as a pertinent control. On the other hand, the existence of an extensive literature claiming that institutional variables (e.g., rule of law, quality of democratic institutions) play a role in shaping a positive investment climate in a country and, therefore, promoting economic growth cannot be ignored, so it is also important to include an indicator of this sort as a control variable.

From the methodological viewpoint, our analysis also represents an improvement over many earlier studies by (1) contemplating the Windmeijer's correction for the GMM system estimator, which avoids the incorrect estimation of standard errors and, therefore, misrepresenting the statistical significance of the explanatory variables — some previous studies concluded that the link between financial development and economic growth was statistical significant based over incorrect estimates of the standard errors—, and (2) explicitly dealing with the problem of instrument proliferation, which appears in many empirical studies on the determinants of economic growth (Bazzi and Clemens, 2009), by incorporating a collapsed-instruments specification.

Our results demonstrate that financial development, operationalized as credit to the private sector, does not have a statistically significant effect on economic growth. This conclusion is independent of the countries' development level, as indicated by separate subsample regressions. Our findings suggest that the finance-growth link is not as firm as portrayed in the literature, which is consistent with Rousseau and Wachtel's (2009) recent empirical analysis, which also casts doubts on the strength of this link. As these authors argue, this relationship could have been valid for the postwar period, but it appears to no longer hold in our current globalized financial world. For them, the recent expansion of financial activity at the international level may have generated greater macroeconomic instability.

On the other hand, the results we obtained for some control variables have also interesting implications for growth economics. First, our findings show that the orientation of a country's political and legal institutions, whether predominantly authoritarian or democratic, is not a relevant factor for economic growth. Second, and most importantly, our analysis highlights the importance of the economy's size for growth, both in the whole sample and in the low- and middle-income countries samples. This happens in all models (with and without collapsed instruments). In comparison with the finance-growth link, which has generated an abundant literature in the last decade, the size-growth link that emerges from our results has received less attention, but we think it is a topic that deserves further study.

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TABLE 1 - CORRELATION COEFFICIENTS

	Growth	Ln.GDP per cap. initial	Ln. Gov	Ln. Openness	Ln. Size	Schooling	Ln. Privo	Ln. Inflat.	Institutional quality
Growth	1	0.09	-0.14	0.05	0.20	0.09	0.17	-0.28	0.13
Ln.GDP per cap. initial		1	-0.11	0.16	0.59	0.77	0.74	-0.10	0.53
Ln. Gov			1	0.04	-0.10	-0.07	-0.11	0.12	-0.01
Ln. Openness				1	-0.40	0.12	0.24	-0.24	0.05
Ln. Size					1	0.55	0.51	-0.00	0.38
Schooling						1	0.64	-0.14	0.52
Ln. Privo							1	-0.31	0.46
Ln. Inflat.								1	-0.07
Institutional quality									1

Note: n = 709

TABLE 2 - DYNAMIC PANEL REGRESSION WITH ECONOMIC GROWTH AS DEPENDENT VARIABLE

	MODEL 1	MODEL 2 (collapsed instruments)	MODEL 3	MODEL 4 (collapsed instruments)
Constant	-4.10203 (5.43967)	-2.27811 (15.74576)	-5.37266 (8.00714)	-11.40596 (16.85041)
Ln. GDP per capita initial	-1.12769 * (0.63369)	-4.79827*** (1.67687)	-1.59634 * (0.83585)	-5.36545 *** (1.74487)
Ln. Gov	-0.16078 (0.83104)	-1.156855 (1.2857)	0.13698 (0.9023)	-0.75514 (1.25772)
Ln Openness	1.26493 ** (0.60168)	2.06363 * (1.19355)	1.06939 (0.67949)	2.56503 ** (1.0225)
Ln. Priv. Cred.	0.4106 (0.35785)	0.00563 (0.77508)	0.33276 (0.42862)	-0.21759 (0.71455)
Ln. Inflat	-1.84619 ** (0.82367)	-1.17317 (1.22506)	-2.41318 ** (0.92596)	-1.44746 (1.58833)
Ln. Size	0.72346 *** (0.238)	1.75956 *** (0.56276)	0.94615 *** (0.26407)	2.35865 *** (0.67728)
Sec. Schooling	0.59278 (0.41343)	2.76944** (1.05328)	0.55657 (0.61097)	2.98692 ** (1.19049)
Instit. quality			0.05043 (0.03428)	-0.05522 (0.06458)
Hansen Test (p value) (x)	0.79	0.40	0.97	0.31
Arellano-Bond test AC(2) (p value) (xx)	0.65	0.63	0.51	0.76
Nr. instruments	106	22	120	24
Nr. obs	730	730	709	709
Nr. countries	98	98	95	95

Notes: period effects not reported
Windmeijer-corrected standard errors in parentheses
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$
(x) The null hypothesis is that the intruments are valid
(xx) The null hypothesis is that the residuals have no second order serial correlation

TABLE 3 - DYNAMIC PANEL REGRESSION WITH ECONOMIC GROWTH AS DEPENDENT VARIABLE (HIGH-INCOME COUNTRIES)

	MODEL 1	MODEL 2 (collapsed instruments)	MODEL 3	MODEL 4 (collapsed instruments)
Constant	61.69043 (78.04013)	82.78671 (22.6505)	42.77116 (51.81945)	55.69873 (29.88015)
Ln. GDP per capita initial	-5.82847 * (2.97042)	-8.68461*** (2.49362)	-8.03177 * (4.41599)	-6.02819 * (3.40508)
Ln. Gov	3.26068 (4.42102)	1.51239 (3.39149)	-1.33755 (7.17663)	4.13414 (4.30558)
Ln Openness	3.22458 (9.21136)	1.18689 (3.19054)	6.72483 (7.48143)	3.37093 (2.44331)
Ln. Priv. Cred.	-1.68707 (2.73548)	3.3844 (2.16274)	-5.99031 (7.94717)	1.58441 (2.7391)
Ln. Inflat	-4.48104 (12.89836)	-7.76867 (9.06377)	-4.92733 (1.11625)	-10.3293 ** (3.70065)
Ln. Size	0.10594 (2.85489)	0.28323 (0.8906)	1.19007 (2.3919)	0.55734 (1.40548)
Sec. Schooling	0.79745 (0.6652)	1.45397 *** (0.49795)	1.17795 (1.56728)	0.48302 (1.02818)
Instit. quality			0.09008 (0.21569)	0.25269 (0.33951)
Hansen Test (p value) (x)	1	0.34	1	0.39
Arellano-Bond test AC(2) (p value) (xx)	0.088	0.19	0.10	0.15
Nr. instruments	106	22	120	24
Nr. obs	225	225	206	206
Nr. countries	27	27	24	24

Notes: period effects not reported
Windmeijer-corrected standard errors in parentheses
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$
(x) The null hypothesis is that the intruments are valid
(xx) The null hypothesis is that the residuals have no second order serial correlation

TABLE 4 - DYNAMIC PANEL REGRESSION WITH ECONOMIC GROWTH AS DEPENDENT VARIABLE (LOW- AND MIDDLE-INCOME COUNTRIES)

	MODEL 1	MODEL 2 (collapsed instruments)	MODEL 3	MODEL 4 (collapsed instruments)
Constant	-11.3181 (8.71235)	-6.16418 (20.24797)	-10.44537 (11.10507)	-13.79899 (15.21334)
Ln. GDP per capita initial	-1.57644 (1.10613)	-4.7069 * (2.39977)	-1.54341 (1.10707)	-4.05824 * (2.32059)
Ln. Gov	-0.17134 (1.30802)	-1.4826 (1.67522)	-0.33638 (1.27295)	-1.54881 (1.49419)
Ln Openness	1.51466 ** (0.73397)	3.29746 *** (1.23524)	1.32378 ** (0.63793)	3.20708 *** (1.08313)
Ln. Priv. Cred.	0.21702 (0.47868)	-0.69252 (0.78283)	-0.00503 (0.48516)	-0.66474 (0.7213)
Ln. Inflat	-2.54271 * (1.27803)	-2.02858 (2.0622)	-3.03774 *** (0.96268)	-2.30743 (2.21491)
Ln. Size	1.16055 *** (0.36585)	1.83755 * (0.92145)	1.06793 ** (0.40646)	1.94197 ** (0.83621)
Sec. Schooling	0.74047 (0.81144)	2.93847 (1.78137)	1.27675 (1.07057)	2.42812 (1.50137)
Instit. quality			0.0114 (0.05758)	-0.05726 (0.0757)
Hansen Test (p value) (x)	1	0.55	1	0.45
Arellano-Bond test AC(2) (p value) (xx)	0.06	0.09	0.08	0.11
Nr. instruments	106	22	120	22
Nro. obs	505	505	503	503
Nro. de países	71	71	71	71

Notes: period effects not reported
Windmeijer-corrected standard errors in parentheses
* p < 0.10
** p < 0.05
*** p < 0.01
(x) The null hypothesis is that the intruments are valid
(xx) The null hypothesis is that the residuals have no second order serial correlation

APPENDIX

Composition of subsamples according to income level

High-income sample:
Australia, Austria, Bahrain, Barbados, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Hong Kong (excluded in Models 3 and 4), Iceland, Ireland, Israel, Italy, Japan, Kuwait, Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, United Kingdom, and United States.

Low- and Middle-income sample:
Algeria, Argentina, Bangladesh, Benin, Bolivia, Botswana, Brazil, Cameroon, Central African Republic, Chile, Colombia, Congo (Dem. Rep), Congo (Rep.), Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gambia, Ghana, Greece, Guatemala, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kenya, South Korea, Lesotho, Malawi, Malaysia, Mali, Mauritius, Mexico, Mozambique, Nepal, Nicaragua, Niger, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Sudan, Swaziland, Syria, Thailand, Togo, Trinidad &Tobago, Tunisia, Turkey, Uganda, Uruguay, Venezuela, Zambia, and Zimbabwe.