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Finance and the sources of growth☆

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Abstract

This paper evaluates the empirical relation between the level of financial intermediary development and (i) economic growth, (ii) total factor productivity growth, (iii) physical capital accumulation, and (iv) private savings rates. We use (a) a pure cross-country instrumental variable estimator to extract the exogenous component of financial intermediary development, and (b) a new panel technique that controls for biases associated with simultaneity and unobserved country-specific effects. After controlling for these potential biases, we find that (1) financial intermediaries exert a large, positive impact on total factor productivity growth, which feeds through to overall GDP growth and (2) the long-run links between financial intermediary development and both physical capital growth and private savings rates are tenuous. © 2000 Elsevier Science S.A. All rights reserved.

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1. Introduction

Joseph Schumpeter argued in 1911 that financial intermediaries play a pivotal role in economic development because they choose which firms get to use society's savings (see Schumpeter, 1934). According to this view, the financial intermediary sector alters the path of economic progress by affecting the allocation of savings and not necessarily by altering the rate of savings. Thus, the Schumpeterian view of finance and development highlights the impact of financial intermediaries on productivity growth and technological change.[1] Alternatively, a vast development economics literature argues that capital accumulation is the key factor underlying economic growth.[2] According to this view, better financial intermediaries influence growth primarily by raising domestic savings rates and attracting foreign capital. Thus, while many theories note that financial intermediaries arise to ameliorate particular market frictions, the resulting models present competing views about the fundamental channels which connect financial intermediaries to growth. To clarify the relation between financial intermediation and economic performance, we empirically assess the impact of financial intermediaries on private savings rates, capital accumulation, productivity growth, and overall economic growth.

This paper is further motivated by a rejuvenated movement in macroeconomics to understand cross-country differences in both the level and growth rate of total factor productivity. A long empirical literature successfully shows that something else besides physical and human capital accounts for the bulk of cross-country differences in both the level and growth rate of real per capita Gross Domestic Product (GDP). Nevertheless, economists have been relatively unsuccessful at fully characterizing this residual, which is generally termed "total factor productivity." Recent papers by Hall and Jones (1999), Harberger (1998), Klenow (1998), and Prescott (1998) have again focused the profession's attention on the need for improved theories of total factor productivity growth. While we do not advance a new theory, this paper empirically explores one factor underlying cross-country differences in total factor productivity growth, namely differences in the level of financial intermediary development.

[1] Recent theoretical models have carefully documented the links between financial intermediaries and economic activity. By economizing on the costs of acquiring and processing information about firms and managers, financial intermediaries can influence resource allocation. Better financial intermediaries are lower cost producers of information with consequent ramifications for capital allocation and productivity growth (Diamond, 1984; Boyd and Prescott, 1986; Williamson, 1987; Greenwood and Jovanovic, 1990; King and Levine, 1993b). For a comprehensive exposition of the Schumpeterian view of growth, see Aghion and Howitt (1988).

[2] See discussion and citations in King and Levine (1994), Fry (1995), Bandiera et al. (2000), and Easterly and Levine (1999).

While past research evaluates the impact of financial intermediary development on growth, we examine the relation between financial intermediary development and what we term the sources of growth. These sources include private savings rates, physical capital accumulation, and total factor productivity growth. King and Levine (1993a, b) show that the level of financial intermediary development is a good predictor of economic growth, even after controlling for many other country characteristics. Time-series studies confirm that finance predicts growth (Neusser and Kugler, 1998; Rousseau and Wachtel, 1998). One shortcoming of these papers is that financial intermediary development may be a leading indicator of economic growth, but not an underlying cause of economic growth. Recent industry-level, firm-level, and event-study investigations, however, suggest that the level of financial intermediary development has a large, causal impact on real per capita GDP growth (Rajan and Zingales, 1998; Demirgüç-Kunt and Maksimovic, 1998; Jayaratne and Strahan, 1996). Using both pure cross-country instrumental variables procedures and dynamic panel techniques, Levine et al. (2000) show that the strong, positive relation between the level of financial intermediary development and long-run economic growth is not due to simultaneity bias. This paper assesses the relation between financial intermediary development and (i) private savings rates, (ii) capital accumulation, and (iii) total factor productivity growth. While Levine et al. (2000) use a very similar data set and identical econometric procedures to study financial development and economic growth, this paper's major contribution is to examine the relation between financial intermediary development and the sources of growth.

Methodologically, this paper uses two econometric procedures to assess the relation between financial intermediary development and the sources of growth. While King and Levine (1993a) and Levine and Zervos (1998) examine this relation, their estimation procedures do not explicitly confront the potential biases induced by simultaneity or omitted variables, including country-specific effects. We use two econometric techniques to control for the simultaneity bias that may arise from the joint determination of financial intermediary development and (i) private savings rates, (ii) capital accumulation, (iii) total factor productivity growth, and (iv) overall real per capita GDP growth.

The first technique employs a pure cross-sectional instrumental variable estimator, where data for 63 countries are averaged over the period 1960–1995. The dependent variable is, in turn, real per capita GDP growth, real per capita capital stock growth, productivity growth, or private savings rates. Besides a measure of financial intermediary development, the regressors include a wide array of conditioning information to control for other factors associated with economic development. To control for simultaneity bias, we use the legal origin of each country as an instrumental variable to extract the exogenous component of financial intermediary development. Legal scholars note that many countries can be classified as having English, French, German, or Scandinavian legal origins. Countries typically obtained their legal systems through occupation or

colonization. Thus, we take legal origin as exogenous. Moreover, La Porta et al., 1997, 1998; henceforth, LLSV) show that legal origin substantively accounts for cross-country differences in (a) creditor rights, (b) systems for enforcing debt contracts, and (c) standards for corporate information disclosure. Each of these features of the contracting environment helps explain cross-country differences in financial intermediary development (Levine, 1999). Thus, after extending the LLSV data on legal origin from 49 to 63 countries, we use the legal origin variables as instruments for financial intermediary development to assess the effect of financial intermediary development on economic growth, capital growth, productivity growth, and private savings rates.

These cross-country regression estimates have at least three drawbacks. First, they do not exploit the time-series dimension of the data. Second, these estimates may be biased by the omission of country-specific effects. Third, they do not control for the endogeneity of all the regressors. Therefore we also use a dynamic Generalized-Method-of-Moments (GMM) panel estimator.[3] We construct a panel dataset with data averaged over each of the seven 5-year periods between 1960 and 1995. We then use the GMM panel estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1997) to extract consistent and efficient estimates of the impact of financial intermediary development on growth and the sources of growth. Relative to the cross-sectional estimator, this panel estimator has a number of advantages. Namely, the GMM panel estimator exploits the time-series variation in the data, accounts for unobserved country-specific effects, allows for the inclusion of lagged dependent variables as regressors, and controls for endogeneity of all the explanatory variables, including the financial development variables. To accomplish this task, the panel estimator uses instrumental variables based on previous realizations of the explanatory variables, referred to as internal instruments. Paradoxically, exploiting the time-series properties of the data also creates one disadvantage with respect to the cross-sectional estimator. By focusing on five-year periods, the panel estimator may not fully distinguish long-run growth relations from business-cycle ones. Thus, taking them as complementary, this paper uses two econometric procedures, a pure cross-sectional instrumental variable estimator and a GMM dynamic panel technique, to evaluate the impact of differences in financial intermediary development on economic growth, capital accumulation, productivity growth, and private saving.

This paper also improves upon existing work by using better measures of savings rates, physical capital, productivity, and financial intermediary development. Private savings rates are notoriously difficult to measure (Masson et al., 1995). As detailed below, however, we use the results of a recent World Bank

[3] By including initial income as an explanatory variable, growth regressions become dynamic in nature.

initiative that compiled high-quality statistics on gross private savings as a share of gross private disposable income over the period 1971–1995 (Loayza et al., 1998). We also use more accurate estimates of physical capital stocks. Researchers typically make an initial estimate of the capital stock in 1950, and then use aggregate investment data, coupled with a single depreciation rate to compute capital stocks in later years (King and Levine, 1994). The figures reported in this paper use capital stocks computed in this way because of data availability. Recently, however, the Penn-World Tables compiled disaggregated investment data into components such as machinery, transportation equipment, and business construction, and provided separate estimates of depreciation rates for each component. These data are available for only a subset of countries and years. Nonetheless, we confirm our results using capital stock estimates constructed using these disaggregated figures. Researchers typically define Total Factor Productivity (TFP) growth as a residual, or what remains when one calculates real per capita GDP growth minus real per capita capital growth times capital's share in the national income accounts, which is commonly taken to be between 0.3 and 0.4. Besides employing this traditional measure, we also control for human capital accumulation in computing TFP growth by using both the Mankiw (1995) and the Bils and Klenow (1998) specifications. Since these alternative productivity growth measures produce similar results, we report only the results with the simple, traditional TFP measure.[4] Finally, this paper also uses an improved measure of financial intermediary development. We measure financial intermediary credits to the private sector relative to GDP. This measure more carefully distinguishes who is conducting the intermediation, and to where the funds are flowing. Further, we more accurately deflate financial stocks than in past studies (e.g., King and Levine, 1993a, b). Finally, we check our results using the King and Levine (1993a, b) and Levine and Zervos (1998) measures of financial intermediation after extending their sample periods and deflating correctly.

We find that there is a robust, positive link between financial intermediary development and both real per capita GDP growth and total factor productivity growth. The results indicate that the strong connections between financial intermediary development and both real per capita GDP growth and total factor productivity growth are not due to biases created by endogeneity or unobserved country-specific effects. Using both the pure cross-sectional instrumental variable estimator and the system dynamic-panel estimator, we find that higher levels of financial intermediary development produce faster rates of economic growth and total factor productivity growth. These results are robust to alterations in the conditioning information set and to changes in the measure of financial intermediary development. Thus, the data are consistent with the

[4] Results with the other productivity measures are available on request.

Schumpeterian view that the level of financial intermediary development importantly determines the rate of economic growth by affecting the pace of productivity growth and technological change.

Turning to physical capital growth and savings, the results are ambiguous. We frequently find a positive and significant relation between financial intermediary development and the growth rate of capital per capita. Nonetheless, the results are inconsistent across alternative measures of financial development in the pure cross-sectional regressions. The data do not confidently suggest that higher levels of financial intermediary development promote economic growth by boosting the long-run rate of physical capital accumulation. We find similarly conflicting results on savings. Different measures of financial intermediary development yield different conclusions regarding the link between financial intermediary development and private savings in both pure cross-section and panel regressions. Thus, we do not find a robust relation between financial intermediary development and either physical capital accumulation or private savings rates. In sum, the results are consistent with the Schumpeterian view of finance and development: financial intermediaries affect economic development primarily by influencing total factor productivity growth.

The rest of the paper is organized as follows. Section 2 describes the data and presents descriptive statistics. Section 3 discusses the two econometric methods. Section 4 presents the results for economic growth, capital growth and productivity growth. Section 5 presents the results for private savings rates, and Section 6 concludes.

2. Measuring financial development, growth, and its sources

This section describes the measures of (1) financial intermediary development, (2) real per capita GDP growth, (3) capital per capita growth, (4) productivity per capita growth, and (5) private savings rates.

2.1. Indicators of financial development

A large theoretical literature shows that financial intermediaries can reduce the costs of acquiring information about firms and managers, and lower the costs of conducting transactions (see Gertler, 1988; Levine, 1997). By providing more accurate information about production technologies and exerting corporate control, better financial intermediaries can enhance resource allocation and accelerate growth (Boyd and Prescott, 1986; Greenwood and Jovanovic, 1990; King and Levine, 1993b). Similarly, by facilitating risk management, improving the liquidity of assets available to savers, and reducing trading costs, financial intermediaries can encourage investment in higher-return activities (Obstfeld, 1994; Bencivenga and Smith, 1991; Greenwood and Smith, 1997). The effect of

better financial intermediaries on savings, however, is theoretically ambiguous. Higher returns ambiguously affect savings rates, due to well-known income and substitution effects. Also, greater risk diversification opportunities have an ambiguous impact on savings rates, as shown by Levhari and Srinivasan (1969). Moreover, in a closed economy, a drop in savings rates may have a negative impact on growth. Indeed, if these saving and externality effects are sufficiently large, an improvement in financial intermediary development could lower growth (Bencivenga and Smith, 1991). Thus, we attempt to shed some empirical light on these debates and ambiguities that emerge from the theoretical literature. Specifically, we examine whether economies with better-developed financial intermediaries (i) grow faster, (ii) enjoy faster rates of productivity growth, (iii) experience more rapid capital accumulation, and (iv) have higher savings rates.

To evaluate the impact of financial intermediaries on growth and the sources of growth, we seek an indicator of the ability of financial intermediaries to research and identify profitable ventures, monitor and control managers, ease risk management, and facilitate resource mobilization. We do not have a direct measure of these financial services. We do, however, construct a better measure of financial intermediary development than past studies and we check these results with existing measures of financial sector development.

The primary measure of financial intermediary development we employ is a variable called Private Credit, which equals the value of credits by financial intermediaries to the private sector divided by GDP. Unlike many past measures (King and Levine, 1993a, b), this measure excludes credits issued by the central bank and development banks. King and Levine (1993a, b) use a measure of gross claims on the private sector divided by GDP. But, this measure includes credits issued by the monetary authority and government agencies, whereas Private Credit includes only credits issued by deposit money banks and other financial intermediaries. Furthermore, it excludes credit to the public sector and cross claims of one group of intermediaries on another. Private Credit is also a broader measure of financial intermediary development than that used by Levine and Zervos (1998) and Levine (1998), since it includes all financial institutions, not only deposit money banks.[5]

[5] Credits by nonbank financial intermediaries to the private sector grow as proportion of total credits by the financial system to the private sector as countries develop. The level of development of these nonbanks is positively correlated with long-run economic growth. The correlation between private credit by nonbanks and real per capita GDP over the 1960–1995 period is 60%, and the correlation between nonbank credit to the private sector and growth is 30%. Both correlations are significant at the 1% level. Also, nonbank credits to the private sector are about equal to that of deposit money bank credits to the private sector in the United States, Sweden, Mexico, and Norway. Finally, across the entire sample, private credit by nonbanks accounts for about 25% of the Private Credit variable, but there is considerable cross-country variation.

Finally, unlike past studies, we carefully deflate the financial intermediary statistics. Specifically, financial stock items are measured at the end of the period, while GDP is measured over the period. Simply dividing financial stock items by GDP, therefore, can produce misleading measures of financial development, especially in highly inflationary environments. Some authors try to correct for this problem by using an average of financial intermediary balance sheet items in year t and $t-1$, and then dividing that average by GDP measured in year t (King and Levine, 1993a). This however, does not fully resolve the distortion. This paper deflates end-of-year financial balance sheet items by end-of-year consumer price indices (CPI), and deflates the GDP series by the annual CPI. Then, we compute the average of the real financial balance sheet item in year t and $t-1$, and divide this average by real GDP measured in year t.

While our measure Private Credit improves significantly on other measures of financial development, it would be valuable to construct a measure of financial intermediary development that identified credits issued by privately owned financial intermediaries. We could only obtain data, however, on 32 countries in scattered years over the 1980–1995 period, yielding a data set that is insufficient for the econometric procedures employed in this paper. Also, it would be valuable to incorporate measures of securities market development, as in Levine and Zervos (1998). Unfortunately, data on stock market activity are not available for a sufficient number of years or countries to perform this paper's econometric methods.

To assess the robustness of our results, we use two additional measures of financial development. One traditional measure of financial development used is Liquid Liabilities, equal to the liquid liabilities of the financial system, calculated as currency plus demand and interest-bearing liabilities of financial intermediaries and nonbank financial intermediaries, divided by GDP.[6] The correlation between Private Credit and Liquid Liabilities is 0.77, and is significant at the 1% level. Unlike Private Credit, Liquid Liabilities is an indicator of size. A second measure available is named Commercial-Central Bank, which equals the ratio of commercial bank domestic assets divided by commercial bank plus central bank domestic assets. Commercial-Central Bank measures the degree to which commercial banks or the central bank allocate society's savings. The correlation with Private Credit is 0.64, and is significant at the 1% level. The intuition underlying this measure is that commercial financial intermediaries are more likely to identify profitable investments, monitor managers, facilitate risk management, and mobilize savings than central banks.

We also used the variable Bank Credit, which equal credits by deposit money banks to the private sector as a share of GDP. This variable is a less

[6] Among others this measure has been used by King and Levine (1993a).

comprehensive measure of financial intermediary development than Private Credit, because Bank Credit does not include nonbank credits to the private sector. Its correlation with Private Credit, however, is 0.92 and it produces very similar regression results, which are available on request.

2.2. Economic growth and its sources

To assess the impact of financial intermediary development on the sources of growth, this paper uses new and better data on capital accumulation, productivity growth, and private savings rates. This subsection describes our data on economic growth, capital per capita growth, and productivity growth. Appendix B presents a detailed list of the data sources used, and describes the construction of the data set employed in this study. The next subsection describes the saving data.

The variable Growth equals the rate of real per capita GDP growth, where the underlying data are from the national accounts. For the pure cross-sectional data, for which there is one observation per country for the period 1960–1995, we compute Growth for each country by running a least-squares regression of the logarithm of real per capita GDP on a constant and a time trend. We use the estimated coefficient on the time trend as the growth rate. This procedure is more robust to differences in the serial correlation properties of the data than simply using the geometric rate of growth (Watson, 1992). Using geometric growth rates, however, yields virtually identical results. We do not use least squares growth rates for the panel data because the data only represent five-year periods. Instead, we calculate real per capita GDP growth as the geometric rate of growth for each of the seven five-year periods in the panel data.

The variable Capgrowth equals the growth rate of the per capita physical capital stock. To compute physical capital growth figures for a broad cross-section of 63 countries over the 1960–1995 period, we follow King and Levine (1994). Specifically, we first use Harberger (1978) suggestion for deriving an initial estimate of the capital stock in 1950, which assumes that each country was at its steady-state capital–output ratio in 1950. While this assumption is surely wrong, it is better than assuming an initial capital stock of zero, which many researchers use.[7] Then, we use the aggregate real investment series from the Penn-World Tables (5.6, henceforth PWT) and the perpetual inventory method with a depreciation rate of seven percent to compute capital stocks in later years. To check our results, we also used disaggregated investment data from the PWT. Specifically, we consider four components of the investment series

[7] Alternative measures of capital growth based on assuming an initial capital stock of zero, tend to produce similar cross-country characterizations of capital growth, as discussed in King and Levine (1994).

independently, excluding the fifth component, residential construction: machinery, transportation equipment, business construction, and other non-residential construction. The capital stock number for each component, i, is then computed using the following formula:

$$K_{i,t+1} = K_{i,t} + I_{i,t} - \delta_i K_{i,t}, \tag{1}$$

where individual depreciation rates are used for the different categories. We again use Harberger's (1978) method for getting an initial capital stock estimate. We were only able to compute this alternative capital stock measure for 42 countries. Nonetheless, using this alternative measure does not alter any of the conclusions that follow.

By using alternative measures of capital growth in this study, a robustness check on our study emerges. The aggregate and disaggregated capital numbers have a correlation coefficient of 0.85. However, the disaggregated measure, which (i) focuses on nonresidential investment and (ii) uses more appropriate depreciation rates for each component of investment, produces quite different information on individual countries, which may influence the choice of capital stock measures in individual country-studies.

Our measure of productivity growth, Prod, builds on the neoclassical production function with physical capital K, labor L, the level of total factor productivity A, and the capital share α. We assume that this aggregate production function is common across countries and time, such that aggregate output in country i, Y_i, is given as follows:

$$Y_i = A_i K_i^{\alpha} L_i^{1-\alpha}. \tag{2}$$

To solve for the growth rate of productivity, we first divide by L to get per capita production. We then take log transformation and calculate the time derivative. Finally, assuming a capital share $\alpha = 0.3$ and solving for the growth rate of productivity per capita, we have

$$\text{Prod} = \text{Growth} - 0.3*\text{Capgrowth}. \tag{3}$$

2.3. Private savings rates

The data on private savings rates draw on a new saving database recently constructed at the World Bank, and described in detail in Loayza et al. (1998). This database improves significantly on previous data sets on saving in terms of country- and year-coverage and, particularly, accuracy and consistency. For example, Levine and Zervos (1998) have only 29 observations in their regressions analyzing the impact of financial development on saving. Here, we have 61 countries in the cross-section regressions. Furthermore, these new data on savings rates represent the largest and most systematic collection to date of annual time series on country saving and saving-related variables, spanning

a maximum of 35 years, from 1960 to 1994, and 112 developing and 22 industrialized countries. These data draw on national-accounts information, and are checked for consistency using international and individual-country sources. Arguably, however, the main merits of the new World Saving Database are, first, the consistent definition of private and, thus, public sectors both across countries and over time and, second, the adjustment of private and public saving to account for the value erosion of private assets due to inflation. Therefore, the World Saving Database presents four measures of private saving, and their corresponding measures of public saving, according to whether the public sector is defined as either central government or consolidated state sector and whether saving figures are adjusted or not adjusted for inflation-related capital gains and losses. For the World Saving Database, the consolidated state sector includes, in addition to the central government, local governments and public enterprises.

The private savings rate is calculated as the ratio of gross private saving to gross private disposable income. Gross private saving is measured as the difference between gross national saving, calculated as gross national disposable income minus consumption expenditures, both measured at current prices, and gross public saving. In this paper, the public sector is defined as the consolidated central government. Using a broader measure of the public sector, instead of the consolidated central government, would be analytically preferable. This requirement, however, limits the sample size. Nonetheless, employing a broader definition of the public sector yields very similar results to those presented below. Gross private disposable income is measured as the difference between gross national disposable income and gross public disposable income, which is the sum of public saving and consumption.

Due to data availability, the sample for the private savings rate regression is slightly different from the sample used in the analysis of real per capita GDP growth, capital per capita growth, and productivity per capita growth. Specifically, we have data available from 1971–1995, so that we have five non-overlapping 5-year periods for the panel data set, and 25 years for the cross-country estimations.

2.4. Descriptive statistics and correlations

Table 1 presents descriptive statistics and correlations between financial development and the various dependent variables. There is a considerable variation in Private Credit across countries, ranging from a low of 4% in Zaire to a high of 141% in Switzerland. GDP per capita growth and capital per capita growth also show significant variation. Korea has the highest growth rates, both for real per capita GDP and for capital per capita, with 7% and 11%, respectively. Zaire has the lowest GDP per capita growth rate with −3%, whereas Zimbabwe has the lowest capital per capita growth rate with −2%. Private savings rates also show considerable cross-country variation. Sierra Leone has

Table 1
Summary statistics

Private Credit is credit by deposit money banks and other financial institutions to the private sector divided by GDP. Liquid Liabilities is liquid liabilities of the financial system, calculated as currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries, divided by GDP. Commercial-Central Bank is assets of deposit money banks divided by deposit money bank plus central bank assets. These three variables are constructed using data from the International Financial Statistics. Economic Growth is the growth rate of real per capita GDP. GDP data are from Loayza et al. (1998). Capital Growth is the growth rate of physical capital per capita and is constructed using data from PWT 5.6. Productivity Growth is Economic Growth $-0.3*$ Capital Growth. Private Saving is the ratio of gross private saving and gross private disposable income. Data on Private Saving are from Loayza et al. (1998). The data are averaged over the period 1960–1995, with the exception of Private Saving, for which data are averaged over the period 1971–1995. The statistics for private saving and its correlation with the three measures of financial intermediary development are from a different sample. P-values are reported under the respective coefficient.

	Private Ctedit	Liquid Liabilities	Commercial-Central Bank	Economic Growth	Capital Growth	Productivity Growth	Private Saving
Panel A: Descriptive Statistics							
Mean	40.86	45.21	79.26	1.95	3.13	1.01	19.21
Median	27.81	41.02	83.89	1.98	3.11	1.15	19.98
Maximum	141.30	143.43	98.89	7.16	10.51	5.14	33.92
Minimum	4.08	14.43	23.72	− 2.81	− 1.84	− 3.39	1.05
Std. Dev.	29.16	26.26	17.37	1.92	2.22	1.52	7.65
Observations	63	63	63	63	63	63	61

Panel B: Correlations

Private Credit	1.00					
Liquid Liabilities	0.77	1.00				
	0.01					
Commercial-Central Bank	0.64	0.59	1.00			
	0.01	0.01				
Economic Growth	0.43	0.56	0.46	1.00		
	0.01	0.01	0.01			
Capital Growth	0.34	0.36	0.25	0.71	1.00	
	0.01	0.01	0.05	0.01		
Productivity Growth	0.39	0.55	0.47	0.95	0.46	1.00
	0.01	0.01	0.01	0.01	0.01	
Private Saving	0.75	0.65	0.73			
	0.01	0.01	0.01			

a private savings rate of 1%, whereas Japan's rate is 34%. Notably, Private Credit is significantly correlated with all of our dependent variables.

3. Methodology

This section describes the two econometric methods that we use to control for the endogenous determination of financial intermediary development with growth and the sources of growth. We first use a traditional cross-sectional, instrumental variable estimator. As instruments, we use the legal origin of each country to extract the exogenous component of financial intermediary development in the pure cross-sectional regressions. We also use a cross-country, time-series panel of data and employ dynamic panel techniques to estimate the relation between financial development and growth, capital accumulation, productivity growth, and savings rates. We describe each procedure below.

3.1. Cross-country regressions with instrumental variables

To control for potential simultaneity bias, we first use instrumental variables developed by LLSV (1998). According to Reynolds and Flores (1996), legal systems with European origins can be classified into four major legal families: the English common law countries, and the French, German, and Scandinavian civil law countries. This classification scheme excludes countries with communist or Islamic legal systems. All four legal families descend from the Roman law as compiled by Byzantine Emperor Justinian in the sixth century, and from interpretations and applications of this law in subsequent centuries by Glossators, Commentators, and in Canon Law. The four legal families developed distinct characteristics during the last four centuries. In the 17th and 18th centuries, the Scandinavian countries formed their own legal codes. The Scandinavian legal systems have remained relatively unaffected from the far-reaching influences of the German, and especially, the French Civil Codes.

The French Civil Code was written in 1804, following the directions of Napoleon. Through occupation, it was adopted in other European countries, such as Italy and Poland. Through its influence on the Spanish and Portuguese legal systems, the legal French tradition spread to Latin America. Finally, through colonization, the Napoleonic code was adopted in many African countries, Indochina, French Guyana, and the Caribbean.

The German Civil Code (Bürgerliches Gesetzbuch) was completed almost a century later in 1896. The German Code exerted a great deal of influence on Austria and Switzerland, as well as on China and hence Taiwan, Czechoslovakia, Greece, Hungary, Italy, and Yugoslavia. Also, the German Civil Code heavily influenced the Japanese Civil Code, which helped spread the German legal tradition to Korea.

Unlike these civil law countries, the English legal system is based on common law, where the laws were primarily formed by judges trying to resolve particular cases. Through colonialism, it was spread to many African and Asian countries, Australia, New Zealand, and North America.

There are two conditions under which the legal origin variables serve as appropriate instruments for financial development. First, they have to be exogenous to economic growth during our sample period. Second, they have to be correlated with financial intermediary development. In terms of exogeneity, the English, French, and German legal systems were spread mainly through occupation and colonialism. Thus, we take the legal origin of a country as an exogenous endowment. Furthermore, we provide specification tests regarding the validity of the instruments. In terms of the links between legal origin and financial intermediary development, a growing body of evidence suggests that legal origin helps shape financial development. LLSV (1998) show that the legal origin of a country materially influences its legal treatment of shareholders, the laws governing creditor rights, the efficiency of contract enforcement, and accounting standards. Shareholders and creditors enjoy greater protection in common law countries than in civil law countries. French Civil Law countries are comparatively weak both in terms of shareholder and creditor rights. In terms of accounting standards, French legal origin countries tend to have company financial statements that are comparatively less comprehensive than the company financial statements in countries with other legal origins. Statistically, these legal, regulatory and informational characteristics affect the operation of financial intermediaries, as shown in LLSV (1997), Levine (1998, 1999), and Levine et al. (2000).

In the pure cross-sectional analysis we use data averaged for 63 countries over 1960–1995, such that there is one observation per country. The cross-country sample for private saving has 61 countries over the period 1971–1995. The basic regression takes the form

$$Y_i = \alpha + \beta\,\text{Finance}_i + \gamma' X_i + \varepsilon_i, \tag{4}$$

where Y is either Growth, Capgrowth, Prod, or Saving. Finance equals Private Credit, or in the robustness checks it equals either Liquid Liabilities or Commercial-Central Bank. In Eq. (4), X represents a vector of conditioning information that controls for other factors associated with economic growth, and ε is the error term. Due to the potential nonlinear relation between economic growth and the assortment of economic indicators, we use natural logarithms of the regressors in the regressions of Growth, Capgrowth, and Prod.

To examine whether cross-country variations in the exogenous component of financial intermediary development explain cross-country variations in the rate of economic growth, the legal origin indicators are used as instrumental variables for Finance. Specifically, assuming that the variables in vector Z are proper instruments in Eq. (4) amounts to the set of orthogonality conditions

$E[Z'\varepsilon] = 0$. We can use standard GMM techniques to estimate our model, which produces instrumental variable estimators of the coefficients in Eq. (4). After computing these GMM estimates, the Hansen test of the overidentifying restrictions assesses whether the instrumental variables are associated with growth beyond their ability to explain cross-country variation in financial sector development. Under the null hypothesis that the instruments are not correlated with the error terms, the test has a χ^2 distribution with (J-K) degrees of freedom, where J is the number of instruments and K the number of regressors. The estimates are robust to heteroskedasticity.

3.2. Dynamic panel techniques

The cross-country estimations help us determine whether the cross-country variance in economic growth and the sources of growth can be explained by variance in the exogenous component of financial intermediary development. There are, however, some shortcomings with the pure cross-sectional instrumental variable estimator. The use of appropriate panel techniques can alleviate many of these problems.

First, besides the cross-country variance, we also would like to know whether changes in financial development over time within a country have an effect on economic growth through its various channels. By using a panel data set, we gain degrees of freedom by adding the variability of the time-series dimension. Specifically, the within-country standard deviation of Private Credit in our panel data set is 15.1%, which in the panel estimation is added to the between-country standard deviation of 28.4%. Similarly, for real per capita GDP growth, the within-country standard deviation is 2.4%, and the between-country standard deviation is 1.7%.[8] Thus, we are able to exploit substantial additional variability by adding the time-series dimension of the data.

We construct a panel that consists of data for 77 countries over the period 1960–1995. We average the data over seven non-overlapping 5-year periods. The panel sample for private saving includes 72 countries and five 5-year periods between 1971 and 1995. The regression equation can be specified in the following form:

$$y_{i,t} = \alpha' X^1_{i,t-1} + \beta' X^2_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}, \tag{5}$$

where y represents our dependent variable, X^1 represents a set of lagged explanatory variables, and X^2 a set of contemporaneous explanatory variables.

[8] The within-country standard deviation is calculated using the deviations from country averages, whereas the between-country standard deviation is calculated from the country averages. The fact that the between-country standard deviations in the panel are not the same as in the cross-section sample results from the different country coverage.

In Eq. (5), μ is an unobserved country-specific effect, λ is a time-specific effect, ε is the time-varying error term, and i and t represent country and 5-year time period, respectively.

We can now observe a second advantage of using particular panel techniques to estimate Eq. (5). In a pure cross-sectional regression, the unobserved country-specific effect is part of the error term. Therefore, a possible correlation between μ and the explanatory variables results in biased coefficient estimates. Furthermore, if the lagged dependent variable is included in X^1, then the country-specific effect is certainly correlated with X^1. Under assumptions explained below, we use a dynamic panel estimator that controls for the presence of unobserved country-specific effects. This approach produces consistent and efficient estimates even when the country-specific effect is correlated with X^1.

Third, the pure cross-sectional estimator that we use does not control for the endogeneity of all the explanatory variables. Instead, it only controls for the endogeneity of financial intermediary development. This approach can lead to inappropriate inferences. To draw more accurate conclusions, the dynamic panel estimator uses internal instruments, defined as instruments based on previous realizations of the explanatory variables, to consider the potential joint endogeneity of the other regressors as well. This method, however, does not control for full endogeneity but for a weak type of it. To be precise, we assume that the explanatory variables are only weakly exogenous, which means that they can be affected by current and past realizations of the growth rate but must be uncorrelated with future realizations of the error term. Thus, the weak exogeneity assumption implies that future innovations of the growth rate do not affect current financial development. This assumption is not particularly stringent conceptually, and we can examine its validity statistically. First, weak exogeneity does not mean that economic agents do not take into account expected future growth in their decision to develop the financial system. This assumption means that future, unanticipated shocks to growth do not influence current financial development. It is the innovation in growth that must not affect financial development. Second, given that we are using 5-year periods, the forecasting horizon for the growth innovation, that is, its unanticipated component, extends about five years into the future. Finally, we statistically assess the validity of the weak exogeneity assumption below.

Before describing the panel estimator more rigorously, note that the panel has a small number of time-series observations (seven), but the number of cross-sectional units is large (77 countries). Qualitatively, these are the characteristics of the data for which the specific panel estimator that we use were designed. Indeed, the panels used in microeconomic studies are usually much larger in the cross-sectional dimension, and a little shorter in the time-series one. The small number of time-series observations should be of no concern given that all the asymptotic properties of our GMM estimator rely on the size of the cross-sectional dimension of the panel.

Chamberlain (1984), Holtz-Eakin et al. (1990), Arellano and Bond (1991), and Arellano and Bover (1995) propose the General Method of Moments (GMM) estimator.[9] Arellano and Bond (1991) suggest to first-difference the regression equation to eliminate the country-specific effect, as follows:

$$y_{i,t} - y_{i,t-1} = \alpha'(X^1_{i,t-1} - X^1_{i,t-2}) + \beta'(X^2_{i,t} - X^2_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}). \quad (6)$$

This procedure solves the first econometric problem, as described above, but introduces a correlation between the new error term, $\varepsilon_{i,t} - \varepsilon_{i,t-1}$, and the lagged dependent variable, $y_{i,t-1} - y_{i,t-2}$, when it is included in $X^1_{i,t-1} - X^1_{i,t-2}$. To address this correlation and the endogeneity problem, Arellano and Bond (1991) propose using the lagged values of the explanatory variables in levels as instruments. Under the assumptions that there is no serial correlation in the error term, ε, and that the explanatory variables X, where $X = [X^1 X^2]$, are weakly exogenous, we can use the following moment conditions:

$$\mathrm{E}[X_{i,t-s} \cdot (\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad \text{for } s \geqslant 2;\ t = 3, \ldots, T. \quad (7)$$

Using these moment conditions, Arellano and Bond (1991) propose a two-step GMM estimator. In the first step, the error terms are assumed to be both independent and homoskedastic, across countries and over time. In the second step, the residuals obtained in the first step are used to construct a consistent estimate of the variance-covariance matrix, thus relaxing the assumptions of independence and homoskedasticity. We will refer to this estimator as the difference estimator.

There are several conceptual and econometric shortcomings with the difference estimator. First, by first-differencing we lose the pure cross-country dimension of the data. Second, differencing may decrease the signal-to-noise ratio, thereby exacerbating measurement error biases (see Griliches and Hausman, 1986). Finally, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1997) show that if the lagged dependent and the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regressions in differences. Simulation studies show that the difference estimator has a large finite-sample bias and poor precision.

To address these conceptual and econometric problems, we use an alternative method that estimates the regression in differences jointly with the regression in levels, as proposed by Arellano and Bover (1995). Using Monte Carlo experiments, Blundell and Bond (1997) show that this system estimator reduces the potential biases in finite samples and asymptotic imprecision associated with the difference estimator. The key reason for this improvement is the inclusion of the regression in levels, which does not eliminate cross-country variation or

[9] The GMM estimator has been applied to cross-country studies, by, among others, Caselli et al. (1996), Easterly et al. (1997), and Fajnzylber et al. (1999).

intensify the strength of measurement error. Furthermore, the variables in levels maintain a stronger correlation with their instruments, as explained below, than the variables in differences, particularly as variables in levels are more serially correlated than in differences (see Blundell and Bond, 1997). However, being able to use the regression in levels comes at the cost of requiring an additional assumption. This requirement occurs because the regression in levels does not directly eliminate the country-specific effect. Instead, appropriate instruments must be used to control for country-specific effects. The estimator uses lagged differences of the explanatory variables as instruments. They are valid instruments under the assumption that the correlation between μ and the levels of the explanatory variables is constant over time, such that

$$\mathrm{E}[X_{i,t+p} \cdot \mu_i] = \mathrm{E}[X_{i,t+q} \cdot \mu_i] \quad \text{for all } p \text{ and } q. \tag{8}$$

Under this assumption, there is no correlation between the differences of the explanatory variables and the country-specific effect. For example, this assumption implies that financial intermediary development may be correlated with the country-specific effect, but this correlation does not change through time. Thus, under this assumption, lagged differences are valid instruments for the regression in levels, and the moment conditions for the regressions in levels are as follows:

$$\mathrm{E}[(X_{i,t-s} - X_{i,t-s-1}) \cdot (\varepsilon_{i,t} + \mu_i)] = 0 \quad \text{for } s = 1;\ t = 3, \ldots, T. \tag{9}$$

The system thus consists of the stacked regressions in differences and levels, with the moment conditions in Eq. (7) applied to the first part of the system, the regressions in differences, and the moment conditions in Eq. (9) applied to the second part, the regressions in levels. Given that lagged levels are used as instruments in the difference regressions, only the most recent difference is used as instrument in the level regressions. Using additional differences would result in redundant moment conditions (see Arellano and Bover, 1995). As with the difference estimator, the model is estimated in a two-step GMM procedure generating consistent and efficient coefficient estimates.[10]

The consistency of the GMM estimator depends both on the validity of the assumption that the error term, ε, does not exhibit serial correlation and on the validity of the instruments. We use two tests proposed by Arellano and Bond (1991) to test these assumptions. The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation procedure. Under the null hypothesis of the validity of the instruments, this test has a χ^2 distribution with (J-K) degrees of freedom, where J is the number of

[10] We are grateful to Stephen Bond for providing us wih a program to apply his and Arellano's estimator to an unbalanced panel data set.

instruments and K the number of regressors. The second test examines the assumption of no serial correlation in the error terms. We test whether the differenced error term is second-order serially correlated. By construction, the error term is probably first-order serially correlated. We cannot use the error terms from the regression in levels since they include the country-specific effect μ. Under the null hypothesis of no second-order serial correlation, this test has a standard-normal distribution. Failure to reject the null hypotheses of both tests lends support to our model.

4. Finance and the channels to economic growth

This section presents the results of the cross-country and panel regressions of real per capita GDP growth, productivity per capita growth, and capital per capita growth on financial development and a conditioning information set.

4.1. The conditioning information sets

To assess the strength of an independent link between financial development and the growth variables, we use various conditioning information sets. The simple conditioning information set includes the logarithm of initial real per capita GDP to control for convergence, and the average years of schooling as an indicator of the human capital stock in the economy. The policy conditioning information set includes the simple conditioning information set plus four additional policy variables that have been identified by the empirical growth literature as being correlated with growth performance across countries (Barro, 1991; Easterly et al., 1997). We use the inflation rate and the ratio of government expenditure to GDP as indicators of macroeconomic stability. We use the sum of exports and imports as a share of GDP and the black market premium to capture the degree of openness of an economy. In our sensitivity analysis for the cross-country regressions, we will also include the number of revolutions and coups, the number of assassinations per thousand inhabitants, and a measure of ethnic diversity. We cannot use the full conditioning information set in the panel estimations since there is not enough time series variation in the additional three variables.

4.2. Finance and economic growth

As noted in the Introduction, this paper's contribution is to investigate the relation between financial intermediary development and the sources of growth. We include this section on overall growth to motivate this inquiry. Levine et al. (2000) use identical econometric techniques to argue that financial intermediaries

Table 2
Financial intermediation and economic growth

The regression equation estimated in columns 1 and 3 is Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Private Credit. The dependent variable is the growth rate of real per capita GDP. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Private Credit is the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in columns 2 and 4 is Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Private Credit. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions in columns 1 and 2 are cross-country regressions, with data averaged over 1960–1995, and using the legal origin of countries as instruments for Private Credit. The regressions in columns 3 and 4 are panel regressions, with data averaged over seven 5-year periods from 1960–1995, and using lagged values as instruments, as described in the text. The regressions in columns 3 and 4 also contain time dummies that are not reported. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported under the respective coefficient. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values of the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation.

	Cross-country data		Panel data	
	(1)	(2)	(3)	(4)
Constant	6.571	2.643	1.272	0.082
	0.006	0.527	0.250	0.875
Initial income per capita	− 1.971	− 1.967	− 1.299	− 0.496
	0.001	0.001	0.001	0.001
Average years of schooling	1.936	1.548	2.671	0.950
	0.008	0.078	0.001	0.001
Openness to trade		0.931		1.311
		0.042		0.001
Inflation		4.270		0.181
		0.096		0.475
Government size		− 1.207		− 1.445
		0.132		0.001
Black market premium		− 0.139		− 1.192
		0.914		0.001
Private Credit	2.215	3.215	2.397	1.443
	0.003	0.012	0.001	0.001
Hansen test	0.577	0.571		
Sargan test (*p*-value)			0.183	0.506
Serial correlation test (*p*-value)			0.516	0.803
Countries	63	63	77	77
Observations			365	365

exert a causal impact on long-run growth, but they do not investigate the links between financial development and productivity growth, capital accumulation, and private savings rates.

The results in Table 2 show a statistically and economically significant relation between the exogenous component of financial intermediary development and economic growth. The first two columns report the results of the pure cross-country regressions using the simple and the policy conditioning information set. Private Credit is significantly correlated with long-run growth at the 5% significance level in both regressions. The Hansen test of overidentifying restrictions indicates that the orthogonality conditions cannot be rejected at the 5% level. Thus, we do not reject the null hypothesis that the instruments are appropriate. The strong link between finance and growth does not appear to be driven by simultaneity bias. The variables in the conditioning information set also have the expected sign, except for inflation. Consistent with Boyd et al. (2000), we find that inflation affects growth by influencing financial sector performance. Specifically, when we omit Private Credit from the regressions in Table 2, inflation enters with a negative, statistically significant, and economically large coefficient. However, when we control for the level of financial intermediary development, inflation has an insignificant effect.

The results are economically significant. For example, Mexico's value for Private Credit over the period 1960–1995 was 22.9% of GDP. An exogenous increase in Private Credit that had brought it up to the sample median of 27.5% would have resulted in a 0.4 percentage point higher real per capita GDP growth per year. This result follows from $\ln(27.5) - \ln(22.9) = 0.18$ and $0.18*2.2 = 0.4$, where 2.2 is the smaller of the two parameter values on Private Credit in the cross-country regressions. This conceptual experiment, however, must be viewed cautiously, as it does not indicate how to increase financial intermediary development. Nonetheless, the example suggests that exogenous changes in financial intermediary development have economically meaningful repercussions.

The dynamic panel estimates also indicate that financial intermediary development has an economically large impact on economic growth. Further, the strong, positive link between financial development and growth is not due to simultaneity bias, omitted variables, or the use of lagged dependent variables as regressors. Columns 3 and 4 in Table 2 report the results of the panel regressions. Private Credit is significant at the 5% level with both conditioning information sets. The variables in the conditioning information set have significant coefficients, with the expected sign. Furthermore, our tests indicate that both our econometric specification and our assumption that the error terms display no serial correlation cannot be rejected. Thus, the pure cross-section, instrumental variable results and the dynamic panel procedure findings are both consistent with the view that financial intermediaries exert a large impact on economic growth.

4.3. Finance and productivity growth

The results in Table 3 show that financial intermediary development has a large, significant impact on productivity growth. The Hansen test for overidentifying restrictions shows that the data do not reject the orthogonality conditions at the 5% level. The variables in the conditioning information set have the expected sign, with the exception of the inflation rate, which reflects the close connection between inflation and financial intermediary development discussed above. To assess the economic magnitude of the coefficients, we continue to use Mexico as an example. Using the coefficient of 1.5 on Private Credit in Table 3, an exogenous increase in Mexico's Private Credit ratio over the 1960–1995 period, 22.9%, to the sample median, 27.5%, would have translated into almost 0.3 percentage points faster productivity growth per year over the 35 year period.

The results for the panel regressions confirm the pure cross-country estimates. The strong link between Private Credit and productivity growth is not due to simultaneity bias or omitted variable bias. The p-values for the Sargan test and the serial correlation test indicate the appropriateness of our instruments and the lack of serial correlation in the error term, ε.

4.4. Finance and capital growth

The empirical relation between financial intermediary development and physical capital accumulation is less robust than the link between financial intermediary development and productivity growth. The results shown in Table 4 indicate that Private Credit enters significantly at the 5% level in both the pure cross-country and the dynamic panel regressions. In the case of the cross-section estimator, we reject the Hansen test of overidentifying restrictions when using the simple conditioning information set. However, when we expand the conditioning information set, the cross-sectional estimator passes the specification test. Thus, Private Credit exhibits a strong, positive link with capital growth that does not appear to be driven by simultaneity bias. Nevertheless, other measures of financial intermediary development do not produce the same results. In the pure cross-section results, none of the other measures of financial sector development enjoys a significant link with capital growth as we discuss below in the subsection on sensitivity results. For completeness, we can get the other measures of financial sector development to enter with positive and significant coefficients in the capital growth equations by using alternative conditioning information sets. However, the other measures are not significant when using the simple or policy conditioning information sets.

The panel results are more robust. Financial intermediary development is positively and significantly correlated with capital accumulation when using alternative conditioning information sets and alternative measures of financial

Table 3
Financial intermediation and productivity growth

The regression equation estimated in columns 1 and 3 is Productivity Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Private Credit. The dependent variable is Productivity Growth, which is growth of real per capita GDP minus 0.3∗ growth of capital per capita. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Private Credit is the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in columns 2 and 4 is Productivity Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Private Credit. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions in columns 1 and 2 are cross-country regressions, with data averaged over 1960–1995, and using the legal origin of countries as instruments for Private Credit. The regressions in columns 3 and 4 are panel regressions, with data averaged over seven 5-year periods from 1960–1995, and using lagged values as instruments, as described in the text. The regressions in columns 3 and 4 also contain time dummies that are not reported. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported under the respective coefficient. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation.

	Cross-country data		Panel data	
	(1)	(2)	(3)	(4)
Constant	3.527	− 1.189	2.473	− 1.611
	0.065	0.717	0.001	0.033
Initial income per capita	− 1.266	− 1.171	− 1.244	− 0.353
	0.001	0.001	0.001	0.001
Average years of schooling	1.375	1.241	3.043	1.174
	0.028	0.060	0.001	0.001
Openness to trade		0.956		1.337
		0.015		0.001
Inflation		3.223		− 0.415
		0.096		0.033
Government size		− 0.647		− 0.431
		0.286		0.088
Black market premium		− 0.191		− 1.003
		0.861		0.001
Private Credit	1.500	1.986	1.332	0.296
	0.004	0.021	0.001	0.001
Hansen test	2.036	3.472		
Sargan test (*p*-value)			0.205	0.401
Serial correlation test (*p*-value)			0.772	0.865
Countries	63	63	77	77
Observations			365	365

Table 4
Financial intermediation and capital growth

The regression equation estimated in columns 1 and 3 is Capital Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Private Credit. The dependent variable is the growth rate of physical per capita capital. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Private Credit is the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in columns 2 and 4 is Capital Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Private Credit. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions in columns 1 and 2 are cross-country regressions, with data averaged over 1960–1995, and using the legal origin of countries as instruments for Private Credit. The regressions in columns 3 and 4 are panel regressions, with data averaged over seven 5-year periods from 1960–1995, and using lagged values as instruments, as described in the text. The regressions in columns 3 and 4 also contain time dummies that are not reported. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported under the respective coefficient. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation.

	Cross-country data		Panel data	
	(1)	(2)	(3)	(4)
Constant	8.448	8.349	− 1.273	5.694
	0.004	0.093	0.219	0.001
Initial income per capita	− 2.075	− 2.225	− 0.933	− 0.070
	0.001	0.001	0.001	0.701
Average years of schooling	0.663	0.628	0.985	− 0.340
	0.427	0.559	0.055	0.552
Openness to trade		0.245		− 0.448
		0.663		0.097
Inflation		4.196		0.445
		0.236		0.360
Government size		− 1.619		− 3.229
		0.082		0.001
Black market premium		0.304		− 0.748
		0.826		0.001
Private Credit	2.832	4.038	3.435	3.005
	0.006	0.012	0.001	0.001
Hansen test	6.747	3.039		
Sargan test (*p*-value)			0.166	0.316
Serial correlation test (*p*-value)			0.014	0.053
Countries	63	63	77	77
Observations			365	365

intermediary development. The test statistic for serial correlation, however, rejects the null hypothesis of no serial correlation at the 5% level when using the simple conditioning information set, and at the 10% level when using the policy information set. By including the private savings rate or lagged values of capital growth in the conditioning information set, however, we achieve three results. We eliminate the serial correlation, we find a positive impact of financial intermediary development on physical capital growth, and we obtain very similar coefficient estimates to those reported in Table 4. These results are available on request. We do not include the results here because we wanted to keep a uniform set of control variables across the growth and sources of growth equations. Since the resulting coefficient estimates are of similar magnitude and significance, we merely want to make the point that the serial correlation reflected in Table 4 is not biasing the results in a meaningful way.

The difference between the panel and cross-country results may reflect data frequency. While the long-run relation between capital accumulation and financial intermediary development is not robust to alternations in different measures of financial intermediary development, the short-term relation, which may reflect business cycle activity, is positive and robust.

4.5. Sensitivity analyses

Tables 5 and 6 present the coefficients on all three measures of financial development in the cross-country and panel regressions, respectively, using real per capita GDP growth as the dependent variable. The coefficient estimates for Liquid Liabilities and Commercial-Central Bank are significantly positive across both samples and both conditioning information sets. All regressions pass the different specification tests. We also run the regressions with the full conditioning information set in the cross-country sample and achieve similar results. These results strengthen the hypothesis of a statistically and economically significant causal impact of the exogenous component of financial development on economic growth.

The sensitivity results in Tables 7 and 8 further suggest that financial intermediary development exerts a positive influence on productivity growth. Tables 7 and 8 present sensitivity analyses of the productivity growth regressions with the three financial intermediary development indicators. In sum, the sensitivity results generally confirm our results with Private Credit. We find confirmatory evidence that greater financial intermediary development is associated with faster productivity growth, and that this positive link is not due to simultaneity, omitted variable, or lagged dependent variable biases.

Tables 9 and 10 present the corresponding results for capital per capita growth. Unlike Private Credit, Liquid Liabilities and Commercial-Central Bank

Table 5
Alternative measures of financial intermediary development and growth, using cross-country data

The regression equation estimated in Panel A is Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Finance. The dependent variable is the growth rate of real per capita GDP. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Finance is either Liquid Liabilities, the log of liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, the log of assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in Panel B is Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Finance. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions are cross-country regressions, with data averaged over 1960–1995, and using the legal origin of countries as instruments for Finance. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. There are 63 countries included in the sample.

Financial variable	Coefficient	*p*-value	Hansen test
Panel A: Regressions using the simple conditioning information set			
Liquid Liabilities	1.667	0.023	1.553
Commercial Central Bank	10.169	0.001	1.403
Private Credit	2.215	0.003	0.577
Panel B: Regressions using the policy conditioning information set			
Liquid Liabilities	2.173	0.020	2.393
Commercial Central Bank	9.641	0.021	2.350
Private Credit	3.215	0.012	0.571

do not have a significant impact on capital per capita growth in the cross-country sample. In the panel estimations, all three financial intermediary development indicators are associated with faster capital per capita growth. However, only in the regressions with Commercial-Central Bank is the null hypothesis of no serial correlation in the error term not rejected in all the specifications. Thus, while evidence suggests that financial intermediary development positively influences physical capital accumulation, the pure, cross-sectional relation between physical capital growth and financial intermediary development is highly dependent on the measure of financial intermediary development used.

Table 6
Alternative measures of financial intermediary development and growth, using panel data

The regression equation estimated in Panel A is Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Finance. The dependent variable is the growth rate of real per capita GDP. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Finance is either Liquid Liabilities, the log of liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, the log of assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated Panel B is Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Finance. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions are panel regressions, with data averaged over seven 5-year periods from 1960–1995, and using lagged values as instruments, as described in the text. The regressions also contain time dummies. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation. There are 77 countries and 365 observations included in the sample.

Financial variable	Coefficient	*p*-value	Sargan set (*p*-value)	2nd order serial corr. test (*p*-value)
Panel A: Regressions using the simple conditioning information set				
Liquid Liabilities	2.093	0.001	0.227	0.522
Commercial Central Bank	4.763	0.001	0.246	0.712
Private Credit	2.397	0.001	0.183	0.516
Panel B: Regressions using the policy conditioning information set				
Liquid Liabilities	2.321	0.001	0.607	0.722
Commercial Central Bank	3.361	0.001	0.390	0.958
Private Credit	1.443	0.001	0.506	0.803

5. Finance and private saving

This section explores the impact of the exogenous component of financial development on private savings rates. As in the previous section, we will use both cross-country and panel samples, but a different set of conditioning information.

Table 7
Alternative measures of financial intermediary development and productivity growth, using cross-country data

The regression equation estimated in Panel A is Productivity Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Finance. The dependent variable is Productivity Growth, which is growth of real per capita GDP minus 0.3* growth of capital per capita. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Finance is either Liquid Liabilities, the log of liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, the log of assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in Panel B is Productivity Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Finance. Openness to trade is the log of the sum of real exports and imports of goods and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions are cross-country regressions, with data averaged over 1960–1995, and using the legal origin of countries as instruments for Finance. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. There are 63 countries included in the sample.

Financial variable	Coefficient	*p*-value	Hansen test
Panel A: Regressions using the simple conditioning information set			
Liquid Liabilities	1.787	0.002	0.253
Commercial Central Bank	5.853	0.001	0.092
Private Credit	1.500	0.004	2.036
Panel B: Regressions using the policy conditioning information set			
Liquid Liabilities	2.168	0.006	3.315
Commercial Central Bank	8.134	0.006	1.284
Private Credit	1.986	0.021	3.472

5.1. The conditioning information set

The set of conditioning information is selectively determined by various theories of consumption, including the classical permanent-income and life-cycle hypotheses and the more recent theories accounting for consumption habits, subsistence consumption, precautionary saving motives, and borrowing constraints (see Loayza et al., 2000). The variables included in the set of conditioning information for the saving regression are listed below.

Table 8
Alternative measures of financial intermediary development and productivity growth, using panel data

The regression equation estimated in Panel A is Productivity Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Finance. The dependent variable is Productivity Growth, which is growth of real per capita GDP minus 0.3$*$ growth of capital per capita. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Finance is either Liquid Liabilities, the log of liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, the log of assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in Panel B is Productivity Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Finance. Openness to trade is the log of the sum of real exports and imports of goods and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions are panel regressions, with data averaged over seven 5-year periods from 1960–1995, and using lagged values as instruments, as described in the text. The regressions also contain time dummies. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation. There are 77 countries and 365 observations included in the sample.

Financial variable	Coefficient	*p*-value	Sargan set (*p*-value)	2nd order serial corr. test (*p*-value)
Panel A: Regressions using the simple conditioning information set				
Liquid Liabilities	0.663	0.001	0.124	0.841
Commercial Central Bank	2.388	0.001	0.242	0.965
Private Credit	1.332	0.001	0.205	0.772
Panel B: Regressions using the policy conditioning information set				
Liquid Liabilities	0.856	0.001	0.552	0.836
Commercial Central Bank	1.669	0.001	0.486	0.758
Private Credit	0.296	0.001	0.401	0.865

The level and the growth rate of private income have ambiguous effects on saving regressions, depending on whether the change in these variables is permanent or temporary. These ambiguous effects also occur depending on whether the change takes place within a generation or across generations. The same argument holds for the terms of trade, which can be considered an exogenous determinant of income. The level of income may have an additional,

Table 9
Alternative measures of financial intermediary development and capital growth, using cross-country data

The regression equation estimated in Panel A is Capital Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Finance. The dependent variable is the growth rate of physical per capita capital. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Finance is either Liquid Liabilities, the log of liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, the log of assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in Panel B is Capital Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Finance. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions are cross-country regressions, with data averaged over 1960–1995, and using the legal origin of countries as instruments for Finance. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. There are 63 countries included in the sample.

Financial variable	Coefficient	*p*-value	Hansen test
Panel A: Regressions using the simple conditioning information set			
Liquid Liabilities	− 0.345	0.767	4.693
Commercial Central Bank	− 1.046	0.832	4.578
Private Credit	2.832	0.006	6.747
Panel B: Regressions using the policy conditioning information set			
Liquid Liabilities	0.511	0.562	4.605
Commercial Central Bank	1.018	0.755	4.722
Private Credit	4.038	0.012	3.039

positive impact on the private savings rate if a large share of the country's population is near subsistence consumption levels. Government saving, expressed relative to GPDI in our saving regressions, is another important variable, serving to account for Ricardian equivalence effects. The expected sign for government saving is negative, reflecting at least a partial private saving offset of changes in public saving. We include a measure of the real interest rate, which has well known negative substitution and positive income effects on consumption, resulting in an ambiguous sign in saving regressions. We include the inflation rate as a proxy for uncertainty, expecting a positive association

Table 10
Alternative measures of financial intermediary development and capital growth, using panel data

The regression equation estimated in Panel A is Capital Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Finance. The dependent variable is the growth rate of physical per capita capital. Initial income per capita is the log of real per capita GDP in the first year of the respective time period. Average years of schooling is log of one plus the average years of schooling in the total population over 25. Finance is either Liquid Liabilities, the log of liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, the log of assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, the log of credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regression equation estimated in Panel B is Capital Growth $= \beta_0 + \beta_1$ Initial income per capita $+ \beta_2$ Average years of schooling $+ \beta_3$ Openness to trade $+ \beta_4$ Inflation $+ \beta_5$ Government size $+ \beta_6$ Black market premium $+ \beta_7$ Finance. Openness to trade is the log of the sum of real exports and imports of goods and nonfinancial services as share of real GDP. Inflation is the log of one plus the inflation rate, calculated using the average annual CPI data from the International Financial Statistics. Government size is the log of real general government consumption as share of real GDP. Black market premium is the log of one plus the black market premium. The regressions are panel regressions, with data averaged over seven 5-year periods from 1960–1995, and using lagged values as instruments, as described in the text. The regressions also contain time dummies. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation. There are 77 countries and 365 observations included in the sample.

Financial variable	Coefficient	*p*-value	Sargan set (*p*-value)	2nd order serial corr. test (*p*-value)
Panel A: Regressions using the simple conditioning information set				
Liquid Liabilities	3.667	0.001	0.192	0.013
Commercial Central Bank	8.848	0.001	0.258	0.172
Private Credit	3.435	0.001	0.166	0.014
Panel B: Regressions using the policy conditioning information set				
Liquid Liabilities	5.162	0.001	0.494	0.076
Commercial Central Bank	6.493	0.001	0.338	0.169
Private Credit	3.005	0.001	0.316	0.053

between saving and the inflation rate, consistent with a precautionary saving motive. This result would only be the partial effect of inflation on saving. The net effect of inflation on saving would also consider the negative effect of inflation on, among other variables, income growth.

We include several demographic variables. The first are the old-age and young-age population dependency ratios, defined, respectively, as the ratios of population under 15 years of age and over 65 year of age to total population. Including the dependency ratios helps account for life-cycle effects. The standard

life-cycle hypothesis predicts a negative effect of dependency ratios on saving, whereas the permanent-income hypothesis predicts insignificance of either. The second demographic variable is the urbanization rate. Since agents engaged in agricultural activities face higher income uncertainty, economies more highly urbanized should have, other things held to be equal, lower private savings rates.

5.2. Regressions results

The results in Tables 11 and 12 do not suggest that financial intermediary development exerts a strong, positive effect on private savings rates. Whereas the coefficient on Private Credit is significantly positive in the cross-country regression, it is insignificant in the panel regression. The results for the cross-country regression indicate a small positive effect of financial development on private savings rates. To see this effect, note that Mexico's value for Private Credit over the period 1971–1995 was 21.7%. If this were exogenously raised to the sample median of 29.1%, the coefficient estimates in Table 11 indicate that Mexico's private saving would have increased only from 20% to 20.6%. The Hansen test of overidentifying restrictions indicates that the orthogonality conditions cannot be rejected at the 5% level, and that the instruments are therefore appropriate.

The panel estimations, however, indicate an insignificant impact of Private Credit on private savings rates. The econometric specification tests indicate that we cannot reject the null hypotheses of the appropriateness of the instruments and the assumption of no serial correlation of the differenced error terms. In sum, the results indicate that there is not a substantial economic impact of financial intermediary development on private savings rates. As shown in Table 12, alternative measures of financial intermediary development do not alter this conclusion.

6. Conclusions

This paper examined the impact of financial development on the sources of economic growth. We use two econometric methods. To assess the long-run impact of the exogenous component of financial intermediary development on the sources of economic growth, we use a cross-country sample with data averaged over the period 1960–1995, using the legal origin of countries as instruments. To exploit the time-series nature of the data, we create a panel data set and use recent dynamic panel techniques as proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1997). This procedure controls for the possible endogeneity of the regressors and for country-specific effects in dynamic, lagged-dependent variable models, such as growth regressions.

Table 11
Financial intermediation and private saving

The regression equation estimated is Private Saving $= \beta_0 + \beta_1$ Real per capita GPDI $+ \beta_2$ Growth rate of real per capita GPDI $+ \beta_3$ Real interest rate $+ \beta_4$ Terms of trade $+ \beta_5$ Old dependency ratio $+ \beta_6$ Young dependency ratio $+ \beta_7$ Urbanization ratio $+ \beta_8$ Government Saving $+ \beta_9$ Inflation $+ \beta_{10}$ Private Credit. The dependent variable is Private Saving which is the ratio of gross private saving and gross private disposable income. Real per capita GPDI is the log of real per capita gross private disposable income. Real interest rate is the log of one plus the real interest rate. Terms of trade is the log of the ratio of export and import prices. Old dependency ratio is the share of population over 65 in total population. Young dependency ratio is the share of population under 15 in total population. Urbanization ratio is the share of population that lives in urban areas. Government Saving is the ratio of gross public saving and gross private disposable income. Inflation is the log of one plus the inflation rate. Private Credit is credit by deposit money banks and other financial institutions to the private sector as share of GDP. The regression in column 1 is a cross-country regression, with data averaged over 1971–1995, and using the legal origin of countries as instruments for Private Credit. The regression in column 2 is a panel regression, with data averaged over five 5-year periods from 1971–1995, and using lagged values as instruments, as described in the text. The regression in column 2 also contains time dummies that are not reported. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported under the respective coefficient. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation.

	(1)	(2)
Constant	− 0.102	0.474
	0.387	0.001
Real per capita GPDI	0.041	0.000
	0.005	0.992
Growth rate of real per capita GPDI	1.378	0.531
	0.001	0.001
Real interest rate	0.172	− 0.101
	0.282	0.130
Terms of trade	− 0.024	− 0.029
	0.534	0.094
Old dependency ratio	− 0.313	− 0.940
	0.170	0.001
Young depencency ratio	0.012	− 0.300
	0.884	0.001
Urbanization ratio	− 0.073	0.107
	0.054	0.010
Government Saving	− 0.129	− 0.273
	0.527	0.001
Inflation	0.039	− 0.327
	0.733	0.001
Private Credit	0.085	0.021
	0.027	0.224
Hansen test	0.708	
Sargan test (*p*-value)		0.311
Serial correlation test (*p*-value)		0.335
Countries	61	72
Observations		247

Table 12
Alternative measures of financial intermediary development and private saving

The regression equation estimated is Private Saving $= \beta_0 + \beta_1$ Real per capita GPDI $+ \beta_2$ Growth rate of real per capita GPDI $+ \beta_3$ Real interest rate $+ \beta_4$ Terms of trade $+ \beta_5$ Old dependency ratio $+ \beta_6$ Young dependency ratio $+ \beta_7$ Urbanization ratio $+ \beta_8$ Government Saving $+ \beta_9$ Inflation $+ \beta_{10}$ Finance. The dependent variable is Private Saving which is the ratio of gross private saving and gross private disposable income. Real per capita GPDI is the log of real per capita gross private disposable income. Real interest rate is the log of one plus the real interest rate. Terms of trade is the log of the ratio of export and import prices. Old dependency ratio is the share of population over 65 in total population. Young dependency ratio is the share of population under 15 in total population. Urbanization ratio is the share of urban population that lives in urban areas. Government Saving is the ratio of gross public saving and gross private disposable income. Inflation is the log of one plus the inflation rate. Finance is either Liquid Liabilities, liquid liabilities of the financial system divided by GDP, Commercial-Central Bank, assets of deposit money banks divided by deposit money bank plus central bank assets, or Private Credit, credit by deposit money banks and other financial institutions to the private sector divided by GDP. The regressions in Panel A are cross-country regressions, with data averaged over 1971–1995, and using the legal origin of countries as instruments for Finance. The regressions in Panel B are panel regressions, with data averaged over five 5-year periods from 1971–1995, and using lagged values as instruments, as described in the text. The regressions in panel B also contain time dummies. *P*-values calculated from White's heteroskedasticity-consistent standard errors are reported. The null hypothesis of the Hansen test is that the instruments used are not correlated with the residuals. The critical values for the Hansen test (2 d.f.) are: 10% = 4.61; 5% = 5.99. The null hypothesis of the Sargan test is that the instruments used are not correlated with the residuals. The null hypothesis of the serial correlation test is that the errors in the first-difference regression exhibit no second-order serial correlation.

Panel A: Cross-country data

Financial variable	Coefficient	*p*-value	Hansen test
Liquid Liabilities	0.075	0.102	3.106
Commercial Central Bank	0.896	0.338	1.370
Private Credit	0.085	0.027	0.708

Panel B: Panel data

Financial variable	Coefficient	*p*-value	Sargan test (*p*-value)	2nd order serial corr. test (*p*-value)
Liquid Liabilities	− 0.012	0.588	0.631	0.286
Commercial Central Bank	0.154	0.001	0.363	0.340
Private Credit	0.021	0.224	0.311	0.335

We find an economically large and statistically significant relation between financial intermediary development and both real per capita GDP growth and total factor productivity growth. Specification tests indicate that the robust, positive relation between financial development and both growth and productivity growth are not due to simultaneity bias or country-specific effects. This

result is robust to the use of different estimation procedures, conditioning information sets, and indicators of financial development. The results, however, indicate an ambiguous relation between financial intermediary development and both physical capital growth and private savings rates. While there tends to be a positive link between financial intermediary development and both physical capital accumulation and private savings rates, these results are sensitive to alterations in estimation techniques and measures of financial intermediary development. This paper's results support the view that better functioning financial intermediaries improve resource allocation and accelerate total factor productivity growth with positive repercussions for long-run economic growth.

Appendix A. Data Appendix

A.1. Countries in the sample

1. Member of the cross-country sample for GDP, capital and productivity growth (63 countries)
2. Member of the panel sample for GDP, capital and productivity growth (77 countries)
3. Member of the cross-country sample for private saving (61 countries)
4. Member of the panel sample for private saving (72 countries)

Algeria (2)
Argentina (1, 2)
Australia (1–4)
Austria (1–4)
Bahamas (4)
Bangladesh (3, 4)
Belgium (1–4)
Belize (4)
Bolivia (1, 2)
Brazil (1, 2)
Cameroon (2, 4)
Canada (1–4)
Central African Republic (2, 4)
Chile (1–4)
Colombia (1–4)
Congo (2)
Costa Rica (1–4)
Cote d'Ivoire (4)
Cyprus (1–4)
Denmark (1–4)
Dominican Republic (1, 2)
Ecuador (1–4)
Egypt (2–4)
El Salvador (1, 2, 4)
Ethiopia (4)
Finland (1–4)
France (1–4)
Gambia (2–4)
Germany (1, 2, 4)
Ghana (1–4)
Great Britain (1–4)
Greece (1–4)
Guatemala (1–4)
Guyana (1, 2)
Haiti (1, 2)
Honduras (1–4)
Iceland (3, 4)
India (1–4)
Indonesia (2, 3, 4)
Iran (2)
Ireland (1–4)
Israel (1, 2)
Italy (1–4)
Jamaica (1–4)
Japan (1–4)
Jordan (4)
Kenya (1–4)
Korea (1–4)
Lesotho (2, 4)
Luxembourg (4)
Madagascar (3, 4)
Malawi (2–4)
Malaysia (1–4)
Malta (1–3)
Mauritius (1–4)
Mexico (1–3)
Morocco (4)
Myanmar (3, 4)
Nepal (4)
Netherlands (1–4)
New Zealand (1–4)
Nicaragua (2)
Niger (1–4)
Nigeria (3, 4)
Norway (1–4)
Pakistan (1–4)
Panama (1, 2)
Papua New Guinea (1–4)
Paraguay (1, 2)

Peru (1–3)
Philippines (1–4)
Portugal (1–4)
Rwanda (2–4)
Senegal (1–4)
Sierra Leone (2–4)
South Africa (1–4)
Spain (1–4)
Sri Lanka (1–4)
Sudan (2)
Swaziland (4)
Sweden (1–4)
Switzerland (1–4)
Syria (2–4)
Taiwan (1)
Thailand (1–4)
Togo (1–4)
Trinidad and Tobago (1–4)
United States of America (1–4)
Uruguay (1–3)
Venezuela (1–4)
Zaire (1, 2)
Zimbabwe (1, 2, 4)

A.2. Data sources

The first eleven variables are from Loayza et al. (1998). These numbers represent National Account data that have been revised and cross-checked for consistency using international and individual-country sources.

1. Log level and growth rate of per capita GDP.

2. Log level and growth rate of per capita gross private disposable income (GPDI).

3. Private savings rates is the ratio of gross private savings and GPDI. Gross private saving is measured as the difference between gross national saving, calculated as gross national product minus consumption expenditure, both measured at current prices and gross public saving. GPDI is measured as the difference between gross national disposable income (GNDI), and gross public disposable income, which is the sum of public saving and consumption.

4. Capital stock numbers are constructed using data from Penn World Tables 5.6.

5. Government size is real general government consumption as share of real GDP.

6. Openness to trade is the sum of real exports and real imports of goods and nonfinancial services as share of real GDP.

7. Government saving is the ratio of gross public saving and gross private disposable income.

8. Real interest rate is defined as $\ln[(1 + i)/1 + \pi)]$, where i is the nominal interest rate and II the inflation rate. The inflation rate is the average of the current and year-ahead inflation.

9. Terms of Trade is the ratio of an export price index and an import price index.

10. Old and young dependency ratios are the shares of population under 15 and over 65, respectively, in total population.

11. Urbanization ratio is the share of urban population in total population.

12. Inflation rates are calculated using average annual CPI data from the International Financial Statistics (IFS), line 64.

13. The average years of schooling in the total population (25 years and over) come from Barro and Lee (1996). Data are taken for the initial year of the period.

14. Data on the black market premium are from World's Currency Yearbook; and Wood (1988).

15. Data on Private Credit are calculated using IFS numbers and the following method:

$$\{(0.5)*[F(t)/P\_e(t) + F(t-1)/P\_e(t-1)]\}/[\mathrm{GDP}(t)/P\_a(t)], \tag{A.1}$$

where F is credit by deposit money financial intermediaries and other financial institutions to the private sector (lines 22d + 42d). If there are no data on 42d, we assume that the value is zero. GDP is line 99b, P_e is end-of period CPI (line 64) and P_a is the average annual CPI.

16. Data on Liquid Liabilities are calculated using IFS numbers and the following method:

$$\{(0.5)*[F(t)/P\_e(t) + F(t-1)/P\_e(t-1)]\}/[\mathrm{GDP}(t)/P\_a(t)], \tag{A.2}$$

where F is liquid liabilities (line 55l) or money plus quasi money (line 35l), if liquid liabilities is not available. If neither liquid liabilities nor money plus quasi money are available, we use time and savings deposits (line 25). GDP is line 99b, P_e is end-of period CPI (line 64) and P_a is the average annual CPI.

17. Data on Commercial Central Bank are calculated using IFS numbers, using the following method:

$$\mathrm{DBA}(t)/(\mathrm{DBA}(t) + \mathrm{CBA}(t)), \tag{A.3}$$

where DBA is assets of deposit money financial intermediaries (lines 22a–d) and CBA is central bank assets (lines 12a–d).

18. Data on legal origin are from La Porta et al. (1998) and from Reynolds and Flores (1996).

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