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THE DIRECTION OF CAUSALITY BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH

César Calderón Lin Liu

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Huérfanos 1175, primer piso.
Teléfono: (56-2) 6702475, Fax: (56-2) 6702231

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César Calderón
Banco Central de Chile

Lin Liu
Cisco Systems Inc.

Resumen

El presente artículo utiliza la prueba de descomposición de Geweke sobre una muestra de datos de panel de 109 países durante el periodo 1960-94 para evaluar la dirección de causalidad entre el desarrollo financiero y el crecimiento económico. Entre nuestros principales resultados, tenemos: (1) el desarrollo financiero precede al crecimiento económico, (2) la causalidad de Granger de desarrollo financiero a crecimiento y viceversa coexisten, (3) la relación causal de profundización financiera a crecimiento tiene una mayor contribución en el grado de asociación de ambas variables en los países en desarrollo que en los países industriales, (4) a medida que el horizonte de los efectos sea mayor, la relación causal de desarrollo financiero a crecimiento económico tiene una mayor importancia, (5) la profundización financiera promueve el crecimiento a través de una mayor acumulación de capital y mejoras en productividad, siendo el último canal el más importante.

Abstract

This paper employs the Geweke decomposition test on pooled data of 109 developing and industrial countries from 1960 to 1994 to examine the direction of causality between financial development and economic growth. The paper finds that (1) financial development generally leads to economic growth; (2) the Granger causality from financial development to economic growth and the Granger causality from economic growth to financial development coexist; (3) financial deepening contributes more to the causal relationships in the developing countries than in the industrial countries; (4) the longer the sampling interval, the larger the effect of financial development on economic growth; (5) financial deepening propels economic growth through both a more rapid capital accumulation and productivity growth, with the latter channel being the strongest.

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E-mail: ccaldero@bcentral.cl.

1. Introduction

Ever since Schumpeter (1911), and more recently McKinnon (1973) and Shaw (1973), the relationship between financial development and economic growth has been extensively studied.[1] It is now well recognized that financial development is crucial for economic growth. Furthermore, the direction of causality between financial development and economic growth is crucial because it has significantly different implications for development policy. However, this causal relationship remains unclear. This paper employs an innovative econometric technique, new financial measures, and new data to gain insight into this issue.

Does financial development promote economic growth, or does economic growth propel financial development? These possible directions of causality between financial development and growth are labeled by Patrick (1966) as the supply-leading and demand-following hypothesis. The *supply-leading hypothesis* posits a causal relationship from financial development to economic growth, which means deliberate creation of financial institutions and markets increases the supply of financial services and thus leads to real economic growth. Numerous theoretical and empirical writings on this subject have shown that financial development is important and causes economic growth. McKinnon (1973), King and Levine (1993a, b), Neusser and Kugler (1998) and Levine, Loayza and Beck (2000) support the supply-leading phenomenon. On the other hand, the *demand-following hypothesis* postulates a causal relationship from economic growth to financial development. Here, an increasing demand for financial services might induce an expansion in the financial sector as the real economy grows (i.e. financial sector responds passively to economic growth). Gurley and Shaw (1967), Goldsmith (1969) and Jung (1986) support this hypothesis.[2]

Apart from these two competing hypotheses, Patrick (1966) proposes the *stage of development* hypothesis. According to this hypothesis, supply-leading financial development can induce real capital formation in the early stages of economic development. Innovation and development of new financial services opens up new opportunities for investors and savers and,

[1] A focus on the contribution of financial development to economic growth is the subject of another study. See World Bank (1989), Levine (1997), and Liu (1998) for a comprehensive review.

[2] According to this view, the lack of financial institutions in some less developed countries is simply a manifestation of the lack of demand for their services.

in so doing, inaugurates self-sustained economic growth. As financial and economic development proceed, the supply-leading characteristics of financial development diminish gradually and are eventually dominated by demand-following financial development. Surprisingly, there has been little empirical analysis of Patrick's hypotheses, for either developed or developing countries. Early empirical studies focused on the role of financial development in economic growth. More recently attention has been shifted to the direction of causality between financial development and economic growth. However, these studies are still scarce, and the causal relationship between financial and economic growth has not been empirically resolved. This paper improves upon the existing literature by using an econometric technique that would allow us to test the hypotheses proposed by Patrick and also to quantify the extent and statistical significance of each hypothesis.

Many approaches have modeled causality in a temporal system (e.g. Granger, 1969; Sims, 1972; Geweke, 1982), however, most existing empirical studies use Granger causality modeling to investigate these competing hypotheses.[3] Previous causality studies have failed to settle the issue of causality between financial development and economic growth, and their simultaneous causal relationship has not been tested. Moreover, when the causal relationship consists of several components, such as the Granger causality from financial development to economic growth, the Granger causality from economic growth to financial development, and the instantaneous causality between them, the level of each component remains unclear. This paper uses an innovative econometric technique and new data to explore the direction of causality between financial development and economic growth. It departs from earlier work and complements recent evidence in three aspects.

First, better financial variables are constructed. Following Levine *et al.* (2000), we address the stock-flow problem in financial measurement (i.e. financial intermediary balance sheet items are stocks measured at the end of the year while GDP is an average flow over the year). Hence, we average the financial intermediary balance sheet items in year t and $t-1$, and deflate end-of-year items by their corresponding end-of-year consumer price indices (CPI).

Second, we conduct a panel analysis on data pooled from 109 industrial and developing countries for the 1960-94 period. Existing studies usually use Granger or Sims' tests on time-series data for a single or small group of countries. In contrast, this paper analyzes pooled data from a large number of countries and relatively long time periods to exploit both the cross-section

and time-series dimensions of the data. To our best knowledge, panel analysis has just begun to be used in causality tests.[4]

Third, we apply the tests of linear dependence and feedback developed by Geweke (1982). The so-called Geweke decomposition test has been recently applied by Chong and Calderón (2000), in the analysis of the relationship between institutions and economic growth. Recent evidence (Levine *et al.*, 2000; Beck *et al.*, 2000) uses panel techniques to support the existence of a causal relationship from financial development to economic growth (i.e. growth in real GDP per capita, and productivity growth). Using a panel of 77 countries for the 1960-95 period, they find that higher levels of banking sector development produce faster rates of economic growth and total factor productivity growth. Our contribution to the literature relies on decomposing the association between financial intermediation (x) and growth (y) into three different causal relationships (causality from x to y, causality from y to x, and instantaneous causality between x and y). Using panel VAR techniques, we test the existence of causality for all the directions mentioned above (note that Levine *et al.* robustly tests only the relationship from x to y), and we calculate the importance of each causal direction in the global association between financial development and growth. In addition, we extend our analysis to the relationship between financial development and the sources of growth. As noted by Beck et al. (2000), financial development might influence growth via improvements in technology (through better allocation of savings) or via a more rapid capital accumulation (by increasing domestic savings rates and attracting foreign capital).

There are five main findings in the paper. First, financial development generally leads to economic growth in 109 developing and industrial countries, which suggests that financial deepening in many countries has yielded the desired result – a more prosperous economy. Second, when the sample is split into developing and industrial countries, the Granger causality from financial development to economic growth and the Granger causality from economic growth to financial development coexist in 87 of the developing countries and 22 of the industrial countries. This shows that financial deepening stimulates economic growth and, simultaneously, economic growth propels financial development. Third, financial deepening contributes more to the causal relationships in the developing countries than in the industrial countries, which implies that the developing countries have more room for financial and economic improvement. Fourth,

[3]Liu (1998) provides a comprehensive analysis of earlier empirical evidence.

the longer the sampling interval, the larger the effect of financial development on economic growth, which suggests that it takes time for financial deepening to impact the real economy. Fifth, we also find that financial development enhances growth through a more rapid capital accumulation and technological change. In addition, the causal relationship from financial development to total factor productivity growth (TFP) is stronger in developing countries, while the converse relationship is stronger in industrial economies. The same result holds for capital accumulation.

The rest of the paper is organized as follows. Section 2 discusses the methodology and data. Empirical results are presented in Section 3. Section 4 draws policy implications and concludes the paper.

2. Methodology and Data

2.1 Geweke Decomposition Test

Recent literature abounds with tests of unidirectional causality between financial development and economic growth, but there has virtually been no investigation on the degree of dependence or the extent of various kinds of feedback between them. The latter approach is more complete since it requires measurement of linear dependence and feedback. Geweke (1982) develops an approach to test the degree of dependence, which states that linear dependence and feedback between two time series x and y can be measured as the sum of linear feedback from x to y, linear feedback from y to x, and instantaneous linear feedback between x and y. The methodology is presented below.

Let us denote $z_t = (y_t, x_t)'$ the vector with information on the variables x and y, and the VAR representation for z_t is $\Gamma_0 z_t = \Gamma_1(L) z_t + \xi_t$, with $\Gamma_1(L) = \sum_{i=1}^{m} \Gamma_{1i} L^i$. The Geweke decomposition test is based on likelihood ratios comparing the following three system representations:

[4] Recently, Levine *et al*. (2000) use GMM-IV estimators in panel data to interpret the coefficient estimates as causal relationships.

System	Representation of Parameter Matrices	Var-Cov Matrix of Residuals	Causality Tests
AR System	$\Gamma_0=I_2$ $\Gamma_1=\begin{bmatrix} \sum_{i=1}^{m} C_{1i}L^i & 0 \\ 0 & \sum_{i=1}^{m} E_{1i}L^i \end{bmatrix}$	$E(\xi_t^{(1)}\xi_t^{(1)}) =$ $\Sigma^{(1)}=\begin{bmatrix} \Sigma_{11}^{(1)} & \Sigma_{12}^{(1)} \\ \Sigma_{21}^{(1)} & \Sigma_{22}^{(1)} \end{bmatrix}$	Current values of y (x) are functions of *m* past values of y (x) only.
Granger System	$\Gamma_0=I_2$ $\Gamma_1=\begin{bmatrix} \sum_{i=1}^{m} C_{2i}L^i & \sum_{i=1}^{m} D_{2i}L^i \\ \sum_{i=1}^{m} F_{2i}L^i & \sum_{i=1}^{m} E_{2i}L^i \end{bmatrix}$	$E(\xi_t^{(2)}\xi_t^{(2)}) =$ $\Sigma^{(2)}=\begin{bmatrix} \Sigma_{11}^{(2)} & \Sigma_{12}^{(2)} \\ \Sigma_{21}^{(2)} & \Sigma_{22}^{(2)} \end{bmatrix}$	Granger Causality: y (x) does not Granger-cause x (y) iff $F_{2i} \equiv 0$ ($D_{2i} \equiv 0$), for all i.
Instantaneous System	$\Gamma_0=\begin{bmatrix} 1 & -D_{30} \\ -F_{30} & 1 \end{bmatrix}$ $\Gamma_1=\begin{bmatrix} \sum_{i=1}^{m} C_{3i}L^i & \sum_{i=1}^{m} D_{3i}L^i \\ \sum_{i=1}^{m} F_{3i}L^i & \sum_{i=1}^{m} E_{3i}L^i \end{bmatrix}$	$E(\xi_t^{(3)}\xi_t^{(3)}) =$ $\Sigma^{(3)}=\begin{bmatrix} \Sigma_{11}^{(3)} & \Sigma_{12}^{(3)} \\ \Sigma_{21}^{(3)} & \Sigma_{22}^{(3)} \end{bmatrix}$	Instantaneous causality between x and y if and only if $D_{30}\neq 0$ and $F_{30}\neq 0$.

From these systems, Geweke (1982) proposes the following *measures of linear feedback*,

Linear Feedback	Statistic	Null Hypothesis
From x to y ($F_{x\to y}$)	$\ln(\lvert\Sigma_{11}^{(1)}\rvert / \lvert\Sigma_{11}^{(2)}\rvert)$	H_0: $F_{x\to y} = 0$, *i.e.* "x does not Granger-cause y." That is, $\lvert\Sigma_{11}^{(1)}\rvert = \lvert\Sigma_{11}^{(2)}\rvert$
From y to x ($F_{y\to x}$)	$\ln(\lvert\Sigma_{22}^{(1)}\rvert / \lvert\Sigma_{22}^{(2)}\rvert)$	H_0: $F_{y\to x} = 0$, *i.e.* "y does not Granger-cause x." That is, $\lvert\Sigma_{22}^{(1)}\rvert = \lvert\Sigma_{22}^{(2)}\rvert$
Instantaneous ($F_{x\cdot y}$)	$\ln(\lvert\Sigma_{11}^{(2)}\rvert / \lvert\Sigma_{11}^{(3)}\rvert) =$ $\ln(\lvert\Sigma_{22}^{(2)}\rvert / \lvert\Sigma_{22}^{(3)}\rvert)$	H_0: $F_{x\cdot y} = 0$, *i.e.* "no instantaneous causality between y and x."
Linear Dependence ($F_{x,y}$)	$F_{x,y} = F_{x\to y} + F_{y\to x} + F_{x\cdot y}$	H_0: $F_{x,y} = 0$, *i.e.* "no linear association between y and x."

In summary, the linear dependence between x and y can be decomposed into three forms of linear feedback: from x to y, from y to x, and "instantaneously" between x and y. Absence of a particular causal ordering implies that one of these feedback measures is equal to zero.

2.2 The Data

Measures of Financial Intermediary Development. The literature usually defines financial development as the improvement in quantity, quality and efficiency of financial intermediary services. This process involves the combination of many activities and institutions.

Given that it cannot be captured by a single measure, we employ two commonly used measures of financial development.[5] The first measure is the ratio of broad money (M2) to GDP (M2/GDP). A higher M2/GDP ratio implies a larger financial sector and therefore greater financial intermediary development. The second measure is the ratio of credits provided by financial intermediaries to the private sector to GDP (CREDIT/GDP). This measure isolates credits issued to the private sector, as opposed to credits issued to the public sector, and it also excludes credits issued by the central bank. We believe that it is better than other measures of financial development used in the literature. For example, King and Levine (1993a, b) use a measure of gross claims on the private sector divided by GDP, which includes credits issued by the monetary authority and government agencies. Levine (1999) use a measure of money bank credits to the private sector divided by GDP, which does not include credits to the private sector by non-money banks, and the intermediation only covers the period 1976-1993. Furthermore, as De Gregorio and Guidotti (1995) argued CREDIT has a clear advantage over measures of monetary aggregates such as M1, M2, or M3, in that it more accurately represents the actual volume of funds channeled into the private sector. Therefore, the ratio of bank credit to the private sector to GDP is more directly linked to investment and economic growth. We interpret higher CREDIT/GDP as an indication of more financial services and therefore greater financial intermediary development.

Finally, our measures of financial development address the stock-flow problem of financial intermediary balance sheets items being measured at the end of the year, whereas nominal GDP is measured over the year. Some authors have tried to address this problem by averaging the balance sheet items in year *t* and *t*-1 and dividing it by GDP in year *t* (King and Levine 1993a). However, this does not resolve the distortion introduced by highly inflationary environments. Levine et al. (2000) suggest deflating end-of-year financial balance sheet items by end-of-year consumer price indices (CPI). Then, we compute the average of the real financial balance sheet items in years *t* and *t*-1 and divide it by real GDP measured in year *t*. See Appendix II for a more detailed description.

Other Variables. Our measure of economic growth is the real GDP per capita growth rate taken from Summers and Heston (1991) database. We also include in our analysis a basic set of controls: initial human capital, initial income level, a measure of government size, black market exchange rate premium, and regional dummies (Latin America, East Asia and Africa). The convergence effect is capture by the log of initial per capita GDP, whereas the level of human

[5] Earlier empirical studies constructed composite indices of financial development based on currency, deposits, money, consumer prices and other indicators (see Fritz, 1984).

capital is proxied by the initial level of secondary school attainment. The ratio of government spending to GDP is used as an indicator of macroeconomic stability, and the black market exchange rate premium as an overall index of trade, exchange rate, and price distortions (Levine, Loayza and Beck, 2000).

3. Empirical Results

We assemble a panel data set of 109 industrial and developing countries, with data spanning the 1960-94 period. In particular, we need to average data over 3 to 10 years to eliminate business cycle effects. In our case, we first consider a panel of seven non-overlapping 5-year period observations over the sample period. Then, given that it takes long time for financial deepening to have an impact on economic growth and viceversa, we consider a panel of three non-overlapping 10-year period observations over 1965-94. Both panels (5- and 10-year) are also divided into two sub-samples: one includes 87 developing countries and the other includes 22 industrial countries. Results for the 5-year and 10-year panels are reported in Tables 1 and 2, respectively.

The main results for the 5-year panel are (see Table 1): First, we find that the causal direction from financial development to growth dominates the linear dependence between these variables for the full sample of countries. It represents 89 percent of the linear dependence if we use M2/GDP, and 81 percent if we use CREDIT/GDP.[6] Thus, the evidence supports the notion that financial development might lead economic growth. Second, we find evidence of bi-directional causality for the sample of developing countries, with the supply-leading relationship being the main source of linear dependence. Specifically, financial development contributes 61 (60) percent when using M2/GDP (CREDIT/GDP), whereas growth contributes 36 (34) percent. Third, we also find evidence of simultaneous causality in industrial countries. However, the demand-following relationship contributes more to the causal relationship. Specifically, the feedback measure from growth to finance represents 48 (63) percent of the linear dependence when we use M2/GDP (CREDIT/GDP). Finally, there seems to be more room for instantaneous feedback between finance and growth in industrial countries than in developing countries.

[6] However, note that in the latter case, the causality from economic growth to financial development is significant and represents about 17 percent of the linear relationship.

For the 10-year panel (see Table 2), we find that: First, the relationship from financial development to growth is the only significant causal direction regardless of the sample of countries used. With the longer sampling interval, finance to growth accounts for 85 (89) percent of the association between these variables when using M2/GDP (CREDIT/GDP) for the ful sample of countries. Second, although there is evidence of bi-directional causality for the sub-samples of industrial and developing countries, the finance to growth channel continues to be the main source of linear dependence between these variables.

If we compare the results from our 5- and 10-year panels, we have some interesting results. First, the contribution of the supply-leading relationship (when using M2/GDP) increases from 61 to 84 percent for the sample of developing countries. Second, the demand-following relationship is more important for industrial countries in the 5-year panel, whereas the supply-leading relationship becomes more relevant for the 10-year panel. In summary, the longer the sampling interval, the larger the effect of financial development on economic growth.

To test the stage of development hypothesis, we construct a sub-sample of low and middle-income countries (i.e. countries with GDP per capita less than US$ 2500 in 1960). Also, we group the data into two sub-periods, one from 1960 to 1979 with 4 observations for each country, and the other from 1980 to 1994 with 3 observations for each country. We divide the sample at 1979 because most countries undertook financial reforms in the late 70s and early 80s, and we assume that these group of countries became more developed after the reforms.

Among the main results reported in Table 3, we have: First, the evidence supports bi-directional causality over the 1960-94 period, with supply-leading contributing more than demand following --approximately 72 (66) percent if we use M2/GDP (CREDIT/GDP). Second, the supply-leading relationship is the dominant force during the early stages of development -- approximately 76 (95) percent when using M2/GDP (CREDIT/GDP) over the 1960-79 period. Third, the contribution of the supply-leading relationship decreases in the later stages. It account for 45 (83) percent of the linear dependence if we use M2/GDP (CREDIT/GDP). Finally, the evidence of strong instantaneous feedback in the later stages of development (when using M2/GDP) implies that these countries where in economic transition during the 1980-94 period. In summary, low and middle-income countries are characterized by the strong dominance of the supply-leading hypothesis, although its dominance decreases and significant simultaneous feeeback arises. Therefore, the evidence from low and middle- income countries does not fully

support the stage of development hypothesis. This may be because the transition from underdeveloped to developed economies has not been completed in these countries.

Finance and Sources of Growth. Financial development may affect growth through a more rapid capital accumulation or through technology changes. The former channel implies that enhanced financial systems may attract capital and raise national savings, thus, increasing both capital formation and growth. The latter channel claims that enhanced financial systems allocate savings more efficiently. Low information costs provided by better financial systems may influence the allocation of resources and productivity growth (Boyd and Prescott, 1986; Greenwood and Jovanovic, 1990). We follow Beck et al. (2000) to construct measures of economic growth, capital per capita growth, and productivity growth. First, we calculate real per capita GDP growth as the geometric rate of growth for each of the five-year periods in our panel data (dy/y). Second, we use the capital figures in Easterly and Levine (2000) to compute the growth rate of the physical capital stock per capita (dk/k). Finally, our measure of productivity growth (dA/A) is consistent with the neoclassical production function with physical capital (K) and labor (L). Assuming a capital share β=0.3, total factor productivity (TFP) growth is given by: $dA/A = dy/y - 0.3*dk/k$.[7]

Among our main findings we have: First, financial development (using M2 or CREDIT) is a good predictor of capital per capita and TFP growth regardless of the sample. Second, the supply-leading hypothesis is the dominant force behind the relationship between finance and the sources of growth (77 percent of the association for dk/k, and 92 percent for dA/A when using M2). However, this result does not hold if we consider the sub-samples of industrial and developing countries. Second, we find evidence of bi-directional causality for developing countries, with the supply-leading being still the dominant force (52 percent for dk/k and 86 percent for dA/A when using M2). Third, we find that the demand following relationship is the most representative for dk/k in industrial countries (69 percent), whereas all causal directions seem to be equally important for dA/A in industrial countries (see Table 1). Fourth, the results for the 10-year panel are analogous, with the supply-leading relationship for the sources of growth being larger than the one obtained for the 5-year panel. That is, the impact of better banks on growth, capital accumulation and TFP growth is larger, the longer is the sampling interval (see

[7] We also computed measures of productivity growth which accounted for human capital accumulation (PROD2 and PROD3 in Beck et al., 2000). The results were analogous to ones that are described below. Results are available from the authors upon request.

Table 2). Finally, we find bi-directional causality between finance and the sources of growth for low and middle-income countries. The causal relationship from finance to sources of growth has the largest share in the linear dependence --65 (58) percent for dk/k and 90 (87) percent for dA/A when using M2 (CREDIT).

4. Policy Implications and Conclusions

The direction of causality between financial deepening and economic growth is crucial because it has different implications for development policies. One could argue that, only in the case of supply-leading, policies should aim to financial sector liberalization; whereas in the case of demand-following, more emphasis should be placed on other growth-enhancing policies. This paper improves upon the existing literature by using econometric techniques that allow us to test both hypotheses (supply-leading and demand-following) as well as to quantify their importance.

Five interesting results are obtained from this study. First, financial development enhances economic growth for all countries. This suggests that financial deepening in many countries has yielded the desired result - a more prosperous economy. Second, we find evidence of bi-directional causality when we split the sample into developing and industrial countries. This implies that financial depth stimulates growth and, simultaneously, growth propels financial development. The expansion of the real sector can significantly influence development of the financial sector, although this is more the case in developed economies. Third, financial depth contributes more to the causal relationships in developing countries, thus, implying that financial intermediaries have larger relative effects in less-developed economies than in more developed ones.[8] Hence, developing countries have more room for financial and economic improvement. Fourth, the longer the sampling interval, the larger the effect of financial development on economic growth. This suggests that the impact of financial deepening on the real sector takes time. Fifth, we find that financial development may enhance economic growth through both more rapid capital accumulation and technological changes, though it appears that the productivity channel is stronger. In addition, the causal relationship from finance to TFP growth is stronger for developing countries, where as the converse is stronger for industrial economies. The same result holds for capital accumulation.

[8] In absolute terms, the financial intermediaries may have larger influence in developed economies.

Finally, this paper provides an empirical basis for promoting financial and economic development. It has two important policy implications, especially for developing countries. First, to gain sustainable economic growth, it is desirable to further undertake financial reforms. Second, to take advantage of the positive interaction between financial and economic development, one should liberalize the economy while liberalizing the financial sector. In other words, strategies that promote development in the real economy should also be emphasized.

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Table 1
Linear Dependence between Financial Development and the Economic Growth
Panel Data of 5-year period observations, 1960-94
(X= Financial Development Indicator, Y= Sources of Growth)

	Full Sample			Developing Countries			Industrial Countries		
	dy/y	dk/k	dA/A	dy/y	Dk/k	dA/A	dy/y	dk/k	dA/A
I. Financial Indicator: M2 to GDP ratio (x=M2/GDPv)									
$F_{x\to y}$	89.34	77.47	91.89	61.17	51.90	85.67	27.14	24.70	37.23
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0165)	(0.0313)	(0.0197)
$F_{y\to x}$	10.53	10.79	6.09	35.58	45.44	13.07	47.99	69.08	26.10
	(0.3476)	(0.3799)	(0.2634)	(0.0025)	(0.0406)	(0.0323)	(0.0007)	(0.0519)	(0.0455)
$F_{x\cdot y}$	0.13	11.74	2.03	3.25	2.66	1.23	24.87	6.22	36.68
	(0.7934)	(0.5343)	(0.7276)	(0.2204)	(0.2431)	(0.7720)	(0.0061)	(0.1976)	(0.2670)
$F_{x,y}$	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)	(0.0000)	(0.0002)	(0.0000)
II. Financial Indicator: Domestic Credit to the Private Sector as percentage of GDP (x=CREDIT/GDP)									
$F_{x\to y}$	81.03	75.94	87.24	59.50	47.94	77.78	14.05	10.15	34.94
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0614)	(0.0099)	(0.0129)	(0.0313)	(0.0209)
$F_{y\to x}$	17.45	18.02	9.63	34.30	44.85	16.03	63.22	79.36	31.88
	(0.0664)	(0.0104)	(0.0289)	(0.0008)	(0.0416)	(0.0068)	(0.0000)	(0.0031)	(0.0041)
$F_{x\cdot y}$	1.52	6.04	3.14	6.20	7.21	6.19	22.73	10.49	33.19
	(0.3430)	(0.1302)	(0.2046)	(0.2107)	(0.2107)	(0.0697)	(0.0002)	(0.0084)	(0.0337)
$F_{x,y}$	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0013)	(0.0011)	(0.0000)	(0.0006)	(0.0004)

Observations: The VAR representation consists of the sources of growth indicator (y), the financial development variable (x) and the basic determinants of growth (Z). For the different samples, Z includes the initial GDP per capita, education, government spending, black market premium and regional dummies. The Sources of Growth (variable y) are identified as the Growth in GDP per capita (dy/y), the Growth rate of Capital per capita (dk/k) and the Growth Rate in Total Factor Productivity (dA/A). In this table, we present the degree of linear dependence between financial development (X) and the sources of growth (Y). The numbers in parenthesis are the statistical significance (p-value) of these associations. Note that the feedback measures are obtained using c^2 tests.

Table 2
Linear Dependence between Financial Development and the Economic Growth
Panel Data of 10-year period observations, 1965-94
(X= Financial Development Indicator,Y= Sources of Growth)

	Full Sample			Developing Countries			Industrial Countries		
	dy/y	dk/k	dA/A	dy/y	dk/k	dA/A	dy/y	dk/k	dA/A
I. Financial Indicator: M2 to GDP ratio (x=M2/GDPv)									
$F_{x\to y}$	85.45	76.22	87.42	84.32	78.94	86.29	56.60	48.63	71.83
	(0.0007)	(0.0000)	(0.0000)	(0.0001)	(0.0012)	(0.0001)	(0.0000)	(0.0030)	(0.0030)
$F_{y\to x}$	10.71	11.21	9.31	15.30	17.27	12.11	43.37	49.10	20.28
	(0.4009)	(0.3998)	(0.3428)	(0.1969)	(0.1557)	(0.1330)	(0.0002)	(0.0074)	(0.0033)
$F_{x\cdot y}$	3.83	12.57	3.27	0.39	3.79	1.60	0.03	2.27	7.89
	(0.4187)	(0.4481)	(0.4520)	(0.7745)	(0.5949)	(0.4535)	(0.9153)	(0.9999)	(0.8362)
$F_{x,y}$	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	(0.0044)	(0.0002)	(0.0001)	(0.0007)	(0.0015)	(0.0129)	(0.0000)	(0.0035)	(0.0041)
II. Financial Indicator: Domestic Credit to the Private Sector as percentage of GDP (x=CREDIT/GDP)									
$F_{x\to y}$	88.61	75.98	92.88	56.49	56.46	68.97	63.97	49.32	76.39
	(0.0009)	(0.0019)	(0.0025)	(0.0001)	(0.0481)	(0.0048)	(0.0001)	(0.0230)	(0.0021)
$F_{y\to x}$	6.25	6.92	5.64	23.53	31.09	15.06	35.73	42.71	22.86
	(0.6095)	(0.6924)	(0.6539)	(0.0228)	(0.0602)	(0.0560)	(0.0055)	(0.0123)	(0.0539)
$F_{x\cdot y}$	5.14	17.09	1.48	19.98	12.45	15.98	0.30	7.98	0.76
	(0.3669)	(0.4313)	(0.5158)	(0.0113)	(0.0141)	(0.0774)	(0.7688)	(0.4231)	(0.4077)
$F_{x,y}$	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	(0.0073)	(0.0025)	(0.0085)	(0.0000)	(0.0006)	(0.0055)	(0.0000)	(0.0088)	(0.0035)

Table 3
Linear Dependence between Financial Development and the Economic Growth
Panel Data of 5-year period observations, 1960-94
Sample of Low and Middle Income Countries
(X= Financial Development Indicator, Y= Sources of Growth)

	1960-94			1960-79			1980-94		
	dy/y	dk/k	dA/A	dy/y	dk/k	dA/A	dy/y	dk/k	dA/A
I. Financial Indicator: M2 to GDP ratio (x=M2/GDPv)									
$F_{x\to y}$	71.73	65.24	89.69	75.70	69.74	90.40	44.76	41.52	55.63
	(0.0000)	(0.0011)	(0.0000)	(0.0003)	(0.0008)	(0.0004)	(0.0213)	(0.0540)	(0.0094)
$F_{y\to x}$	23.75	26.36	9.01	24.06	29.62	6.48	9.30	17.52	12.21
	(0.0009)	(0.0068)	(0.0453)	(0.0792)	(0.0396)	(0.0400)	(0.4497)	(0.4422)	(0.4764)
$F_{x\cdot y}$	4.52	8.40	1.31	0.24	0.64	3.11	45.94	40.97	0.3216
	(0.0598)	(0.0009)	(0.1000)	(0.8233)	(0.7892)	(0.6206)	(0.0050)	(0.0363)	(0.0493)
$F_{x,y}$	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	(0.0000)	(0.0011)	(0.0007)	(0.0008)	(0.0056)	(0.0062)	(0.0042)	(0.0046)	(0.0026)
II. Financial Indicator: Domestic Credit to the Private Sector as percentage of GDP (x=CREDIT/GDP)									
$F_{x\to y}$	65.72	58.45	86.56	95.34	91.98	98.10	82.65	77.59	87.89
	(0.0000)	(0.0077)	(0.0014)	(0.0011)	(0.0065)	(0.0046)	(0.0074)	(0.0066)	(0.0044)
$F_{y\to x}$	32.07	34.62	6.93	4.23	5.57	1.79	17.32	19.34	11.41
	(0.0157)	(0.0380)	(0.0984)	(0.7421)	(0.5852)	(0.7052)	(0.3574)	(0.4130)	(0.3999)
$F_{x\cdot y}$	2.21	6.93	6.51	0.44	2.45	0.11	0.04	3.07	0.70
	(0.3585)	(0.4084)	(0.3209)	(0.8036)	(0.4020)	(0.6134)	(0.9476)	(0.6647)	(0.9179)
$F_{x,y}$	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	(0.0000)	(0.0095)	(0.0002)	(0.0149)	(0.0462)	(0.0374)	(0.0364)	(0.0509)	(0.0757)

Observations: See Table 1. For the sample of low and middle income countries, see Appendix I.

Appendix I. Sample of Countries

I.1. High Income Countries (29)

Argentina	Chile	Ireland	Netherlands	Trinidad and Tobago
Australia	Denmark	Israel	New Zealand	United Kingdom
Austria	Finland	Italy	Norway	United States
Barbados	France	Japan	Spain	Uruguay
Belgium	Germany	Mauritius	Sweden	Venezuela
Canada	Iceland	Mexico	Switzerland	

I.2. Low and Middle Income Countries (80)*

Algeria	Cote d'Ivoire	India	Myanmar	Sierra Leone
Bangladesh	Cyprus	Indonesia	Nepal	Singapore
Benin	Dominican Rep.	Jamaica	Nicaragua	Somalia
Bolivia	Ecuador	Jordan	Niger	South Africa
Botswana	Egypt	Kenya	Nigeria	Sri Lanka
Brazil	El Salvador	Korea, Rep.	Oman	Sudan
Burkina Faso	Ethiopia	Lesotho	Pakistan	Swaziland
Burundi	Fiji	Liberia	Panama	Syrian Arab. Rep.
Cameroon	Gabon	Madagascar	Papua N. Guinea	Tanzania
Cape Verde	Gambia, The	Malawi	Paraguay	Thailand
Cent.Afr.Rep.	Ghana	Malaysia	Peru	Togo
Chad	Greece	Mali	Philippines	Tunisia
China	Guatemala	Malta	Portugal	Turkey
Colombia	Guyana	Mauritania	Rwanda	Uganda
Congo	Haiti	Morocco	Senegal	Zambia
Costa Rica	Honduras	Mozambique	Seychelles	Zimbabwe

** Countries with real per capita GDP less than US$ 2,500 in 1960.*

Appendix II. Data Sources

Financial Measures. M2/GDP is computed using the formula $0.5*[M2_t/CPI_t+M2_{t-1}/CPI_{t-1}]/GDP_t$; where the broad money M2 is line 35l from the International Financial Statistics (IFS) of the International Monetary Fund (IMF), the consumer price index (CPI, 1987=100) and GDP (1987 LC) are from the World Development Indicators (WDI) 1998 CD-ROM of the World Bank. On the other hand, CREDIT/GDP is calculated using the formula $0.5*[CREDIT_t/CPI_t+CREDIT_{t-1}/CPI_{t-1}]/GDP_t$; where private credit (CREDIT) is line 32d from the IFS. The consumer price index (CPI, 1987=100) and GDP (1987 LC) are from the WDI 1998 CD-ROM of the World Bank.

Income and Growth. Real GDP per capita (growth and log levels) is taken from the Summers and Heston Penn World Tables 5.6.

Other Growth Determinants. Human capital is proxied by the percentage of secondary school attained over age 15 in total population from the Barro-Lee dataset. General government consumption as a percentage of GDP is taken from the WDI 1998 CD-ROM of the World Bank. Finally, black market exchange rate premium is from the World Bank Savings Database.

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