Financial development and economic growth – new data and empirical analysis

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Abstract

The paper discusses the significance of financial development as a determinant of economic development. An empirical analysis is based on panel data covering 93 countries from 1970–90. It draws on a new proxy for financial development that refers to the input of real resources into the financial system. Moreover, interaction effects between financial development and catching-up as well as education are considered. Finally, to clarify the structure of causal relationships, a two-wave path model is estimated. It is shown that finance was predominantly a supply-leading determinant of growth. From about 1975–80, however, financial activity worked considerably less beneficially.

1. Introduction

There are *a priori* four possibilities concerning the causal relationship between financial development – broadly defined as an increase in the volume of financial services of banks and other financial intermediaries as well as of financial transactions on capital markets – and economic growth:

(1) Financial development and economic growth are *not causally related*. Neither of the two has considerable effects on the other, and the observable (and empirically firmly established) correlation between them

is merely the result of a historical peculiarity: economies grew, and so did their financial sectors, but the two followed their own logic. Modern economic growth was governed by real factors, whereas financial development was rooted in the history of financial institutions; a consequence perhaps of the Italian Commercial Revolution of the Middle Ages or of the English Financial Revolution in the 17th century. The development in other countries, on the other hand, was possibly an imitation of the early Italian and English examples.

The above view follows implicitly from the neglect of institutional questions typical for many neo-classical economists (specifically: mainstream economics after the period of the Classical Political Economy and the German Historical School and before modern Institutionalism and the recent interest in the ultimate determinants of growth).

(2) Financial development *follows* economic development. Economic growth causes financial institutions to change and develop and financial as well as credit markets to grow. Financial development is thus *demand-driven*. As the growing scale of economic activities requires more and more capital (liquid and fixed), institutional raising and pooling of funds for industry are substituted for individual fortunes to start up enterprises, and for retained profits for economic expansion. The present diversity of financial systems stems from the fact that various institutional arrangements can equally well fulfil the two basic functions of any financial system: bringing together savers and investors, and selecting the most appropriate uses for investible funds. Moreover, the reasons for the choice of bank-based vs. capital market-based financial systems are outside the scope of economics (and within the realm of e.g., historical, socio-psychological and administrative analysis).

This view is explicitly held by some modern institutionalists (and other adherents of the Coase-theorem), and explicitly or implicitly by many other economists.

(3) Financial development is a *determinant* of economic growth. The line of causation runs from financial development to real development, where financial development, of course, is only one among the many growth-inducing factors, some of them necessary, and some (or a combination) of them sufficient. The logical distinction between necessary and sufficient conditions helps to clarify a further differentiation between two distinct formulations of hypothesis 3 that can be found in the recent economic literature:

(3.1) Financial development is a *precondition* for economic growth. As can be shown historically as well as on purely theoretical grounds, inadequate financial systems are major impediments to economic growth.

This view is held by most economic historians that have investigated the financial development of the now developed countries, and by theoretical economists, many of whose recent models give rationales for the assumption that well functioning monetary and banking systems and capital markets may be crucial for economic growth.

(3.2) Financial development *actively* promotes economic growth: provided that there are no real impediments to economic development, sophisticated financial systems can generate high and sustained rates of economic growth. Thus, this view attaches highest importance to financial development.

Its proponents generally refer to Schumpeter, but the ancestry is older and can be traced back to Smith and other classics. Contributors include distinguished economists as well as some 'monetary cranks'. The arguments vary, but Schumpeterian authors as well as some Neo-Keynesians usually stress the banking system's ability to create money and channel it into productive and innovative uses. Others claim that it is the information gathering and processing, which is accomplished by professional actors on credit and capital markets, that helps to improve the efficiency of capital allocation.[1]

(4) Financial development may – at least occasionally and in the short run – turn out to be an *impediment* to economic growth. Here, as in hypothesis 3, the line of causation runs from financial development to real development, but the focus lies on potentially destabilizing effects of financial overtrading and crises rather than on the smooth functioning of the financial system. This view conceives the financial system as inherently unstable. While some theoreticians are ready to include commercial banks among the sources of financial distress, most proponents direct their attention towards stock markets or international capital flows.

This view is held by a wide range of economists ranging from Keynes (1936)[2] to Diamond and Dybvig (1983), Singh (1997) and Krugman (1995).

In connection with this, there is a lively debate about the wisdom of government intervention in the credit and capital markets (financial

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[1]   The arguments are elaborated in depth by Fry (1995). For a comprehensive survey cf. Levine (1997).

[2]   Cf. his remark in the '*General Theory*' (1936, p. 159): "When the capital development of a country becomes a by-product of the activities of a casino, the job is likely to be ill-done. The measure of success attained by Wall Street, regarded as an institution of which the proper social purpose is to direct new investment into the most profitable channels in terms of future yield, cannot be claimed as one of the outstanding triumphs of *laissez-faire* capitalism – which is not surprising, if I am right in thinking that the best brains of Wall Street have been in fact directed towards a different object."

repression vs. financial liberalization). Adherents to the financial repression school claim that administered (i.e., artificially low) interest rates discourage financial savings and ration credit, thereby reducing investment and impeding allocative efficiency. On the other hand, proponents of state intervention in the credit and capital markets argue that there are serious market failures which may result in crises and crashes, a shortage of (high-risk) venture capital or other socially undesirable outcomes.

Unfortunately, there is no simple procedure to determine which view is empirically adequate – not even one that would rule out some views as obviously false. First, the factors that govern economic growth admittedly include many others besides financial development, and interactions among them are likely to prevail. Second, mutual causation, which in economic growth may be the rule rather than the exception, makes it difficult, if not impossible, to rule out a specific hypothesis. Third, the existing data on financial development are plagued by poor reliability and dubious validity. Thus, the existing econometric studies do not really rule out any of the main hypotheses; significant results can be cited for any of them.

Moreover, what might be an adequate financial system at one time or in one social, institutional and economic environment may be outright detrimental at another time or in other environments. In other words: there may be various structural shifts or breaks which further complicate identification of causal relationships.

Consequently, economic historians are able to give convincing examples for all possibilities of causality outlined above. There is, obviously, need for further research. This paper aims to contribute to this literature by a number of theoretical and methodological innovations. Therefore, in what follows

 – two hypotheses from economic history, of potential importance for a better understanding of the finance-growth nexus, which have been neglected so far, will be outlined,
 – a new, resource-based (rather than monetary) proxy variable for financial development will be introduced,

– this new proxy will be used to investigate the finance-growth nexus, first, in an extended version of the established cross-country panel growth regression approach, and second, the question of causality will be addressed directly in a two-wave path model.

2. The finance-growth nexus: evidence from economic history

From Hildebrand (1864) to Sombart (1916, 1927) to Chick (1993) – among many others – descriptive theories of the 'stages of financial development' have identified a sequence of roughly three major stages. (1) A rudimentary deposit banking system, in which commercial banks act merely as intermediaries between savers and investors, followed by (2) a more advanced money creating banking system, in which certain bank's liabilities are widely accepted as means of payment, to (3) the present time, in which the financial sector is characterized by a progressive securitization of former bank credit relationships.

These generalizations from economic history offer a first, albeit valuable, insight into the possible causal interrelations between financial and real development: The decisive change in the *macroeconomic* function of a financial sector obviously lies between stages one and two. Deposit banking – widespread during the Commercial Revolution – certainly contributed to a reduction of transaction costs, thereby stimulating trade and manufacturing. Fractional reserve banking, however, which came into being when bank's deposits established themselves as means of payment, allowed new investment through bank credit *without prior saving*. Hence, as has been observed by many economists, most notably by Schumpeter (1911), the banker together with the Schumpeterian entrepreneur can induce phases of a rapid industrial growth and development.

Syntheses of theories of financial stages and the Schumpeterian credit-induced growth hypothesis are given by Gerschenkron (1962) and Patrick (1966). Gerschenkron points to the latecomers' (notably France's and Germany's) situation which, in order to catch up with the then far advanced Britain, had to mobilize massive amounts of capital for real investment which gave room for an active development policy through a state co-ordinated expansion of the national financial systems.

Patrick (1966), inferring from the Japanese industrialization, introduced the now common terms 'supply-leading' and 'demand-following' finance. He suspected demand-following finance to be the rule and supply-leading finance an exception; an exception, however, of major importance, since it concerns the shift from stage one to stage two, which – according to Patrick – not only in Japan, but universally, coincides with the period of most rapid development of industrializing economies.

What are the lessons that can be learned from economic history? The following suggestions seem plausible: First, as Patrick (1966), Goldsmith (1969, 1987), Cameron *et al.* (1967), and others have shown, in the now developed countries, modern financial systems generally evolved during

the very early stages of their industrialization. Moreover, financial development – as measured by Goldsmith's financial interrelations ratio (conveniently proxied by M2/GDP) generally leveled off after a few decades, reaching its fully developed stage[3] by the beginning of the twentieth century. These historical observations imply that in the process of industrialization finance may have been supply-leading rather than demand-following.

Second, the traditional financial sectors of the present LDC's show similarities to those of the DC's prior to their industrialization. As many observers have noted (Shaw 1973, McKinnon 1973, Fry 1995 – to name just the most prominent), financial dualism is the rule outside the developed part of the world. Enclaves of modern finance, mostly located in the commercial centers, serve but a few export-oriented firms, whereas the majority of economic transactions takes place in the traditional sector which – leaving aside local peculiarities – is basically functioning in the same way as it did in the now developed countries before their industrialization. This observation implies that in the financially and economically less developed countries, there is a latent, but unexploited potential for growth.

What may matter in this context is that the sunk capital and the professional skills needed to operate a basic financial system providing a reliable means of payment as well as to ensure smooth financial intermediation between surplus and deficit units need not be extra ordinarily sophisticated and costly. Thus, unlike other economic activities, the LDC's might be able to exploit some of their growth potential quite easily by modernizing their traditional financial sectors with financial technology that can be imitated and borrowed from the more advanced countries at comparatively low cost (cf. Cameron *et al.* 1967). While this hypothesis is not undisputed, it points to a possible positive interaction between a country's level of financial development and its catching-up potential, which is rooted in the country's very backwardness.

Last but not least, economic historians have claimed that in the 19th century high literacy rates in Scandinavia have led to a general "sophistication towards financial matters" (Sandberg 1978: 668). Thus, unlike other, less literate, countries (e.g., France or Southern and South-eastern Europe) where financial development during the 19th century at times was far ahead, the Nordic countries gained more from financial development (Cameron 1993: 315). This hypothesis about a positive

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3   Note, however, that financial interrelation ratios for developed economies vary considerably (from less than unity to up to three) from country to country due to different institutional frameworks such as government provision of pension schemes, structure of the housing market or the level of commitment to rules and norms in financial relations.

interaction between literacy and financial development with respect to economic growth – a new application of the so-called 'impoverished sophisticate' hypothesis – could be important for an assessment of the macroeconomic returns to financial development in LDC's.

To summarize, the empirical material collected by economic historians suggests a number of hypotheses that might likewise apply to the present economic conditions and should therefore be considered when investigating these topics in an econometric framework. Section 3 will address these questions.

3. Empirical analysis

The recent interest in the ultimate sources of economic growth, the revival of the 'Schumpeterian' (1911) view of finance as a means of channeling society's savings into innovative activity as well as the availability of international data sets and the computational resources to handle them have led to a large number of empirical studies that include proxies for 'financial development' (FD) as explanatory variables in cross-country regressions of growth rates of per capita income (or other proxies for economic development and growth) on its supposed determinants.

These studies have repeatedly reported positive partial correlations between different indicators of FD and growth rates of per capita income or investment in subsequent years for large cross samples of heterogeneous countries.

The standard reference as a seminal contribution is King and Levine (1993), though this line of research can be traced back at least to Adelman and Morris (1968). Levine has probably been the most active researcher in this field in the 1990s (for an authoritative survey of his main results, cf. Levine, 1997). This line of research has been followed by, among others, De Gregorio and Guidotti (1995), Berthélemy and Varoudakis (1996) and Benhabib and Spiegel (2001). From simple OLS regressions of the growth rate of per capita income over some decades on M2/GDP at $t = 0$ and some arbitrarily chosen control variables, this literature has by now reached a fairly high standard of econometric sophistication, where the simple cross-country approach is now generally replaced by panel designs with a number of stacked growth periods of (in most cases) five years. Moreover, to cope with the ever-present problem of endogeneity, explanatory variables are lagged.

An innovative addition to this literature is to refer to variables concerning the legal system and other political characteristics as instruments for FD (cf. among others: LaPorta *et al*., 1998), thereby reducing the suspicion of endogeneity bias. Since the instruments

themselves, are mostly very crude categorical variables (such as a classification of 'legal origin') that refer to the fundamental and persistent socio-economic and political constitution of a country, the possibility to evaluate the financial sector's contribution to growth over – at best – a few decades is severely limited.

A major problem with all of these studies, however, is the poor validity of their FD-indicators[4], which severely suffer from ambiguity. Specifically, as Lynch (1996: 6) has noted, monetary aggregates may be highly misleading, since they may indicate monetisation rather than financial sophistication. Thus, for example, M2/GDP (monetisation) for the People's Republic of China around 1990 is 98%, whereas Australia scores only 61%. Private Credit/GDP, which is probably closer to what the theoretical literature associates with 'financial sector development' than the monetisation proxy, likewise poses conceptual difficulties, since highly beneficial credits are lumped together with non-performing loans. Moreover, as Kaminsky *et al.* (1998) have shown, inflated credit aggregates are leading indicators for financial instability and crashes.

In addition, previous studies draw *on the same stock of original data* (money and credit aggregates as published by IMF), which amounts to replications of the very same correlation rather than to independent confrontations of economic hypotheses with empirical data.

Moreover, despite the econometric sophistication, the basic reduced form approach of regressing per capita income or investment growth rates on the usual FD-indicators and a vector of control variables is repeated over and over again.

Hence, we are not quite ready to follow Levine's conclusion that a positive contribution of financial activity to economic growth is today a proven fact.[5]

The objective of the following empirical cross-country analysis is thus to draw on new data and methods to gain independent evidence on the asserted causal relationship from financial development to economic growth. To this end, a three-stage research strategy will be followed.

The first step (section 2.1.) is to construct for a large sample of countries and various years a new proxy for financial development which

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4   The standard variable is M2/GDP (i.e., 'monetisation'), others are some aggregate of outstanding credit over GDP. In addition, ratios of different money or credit aggregates (e.g., M2/M1 or central bank credit over private credit) are used to identify structural characteristics of the financial system.

5   "A growing body of work would push even most skeptics toward the belief that the development of financial markets and institutions is a critical and inextricable part of the growth process and away from the view that the financial system is an inconsequential side show, responding passively to economic growth and industrialization." (Levine, 1997: 688).

captures *the share of resources a society devotes to run its financial system* at any given time. In contrast to the usual indicators, the FD proxy suggested here relies on real inputs and stands for a well-defined macro-economic concept. Therefore, it is possibly more adequate for investigations into the sources of economic growth. Moreover, while monetary indicators like M2/GDP are very hard to compare across time and space due to institutional diversity and change, our FD proxy is likely to be less sensitive to minor changes in institutional regulations, domestic and international shocks, and business cycles. Last but not least, since the shape and the scope of a financial system is firmly rooted in a country's history, this FD proxy may be assumed to capture very basic characteristics of an economy's structure. Consequently, the FD variable suggested here is probably less endogenous to current economic activity than the traditional FD variables.

The second step (section 2.2.) is to plug this new FD proxy into the now well-established cross-country growth regression approach from the new empirical growth literature. Before proceeding, however, it is important to recall the fact that finance is certainly only a minor factor in economic growth – the fundamental determinants being the accumulation of the factors of production and technical progress. Consequently, to avoid serious misspecification, attention has to be devoted to an economically sound specification of the growth equation that is to be estimated. Therefore, in contrast to many other studies, we shall use more right-hand variables than usual,[6] and in addition we shall allow for interaction effects to capture the hypotheses derived from the literature on the history of economic development. Hence, contrary to the prevailing approach, the present econometric model is less restricted from the very beginning.

The crucial problem with this approach is, of course, that in addition to requiring more degrees of freedom than usual, it depends on the collection of more data per observation, thereby reducing the possible sample size. As a means to overcome this difficulty, all observations gathered for this study are pooled into a panel of 93 countries and four 5-year growth periods covering a time period from 1970–90. Apart from dramatically increasing the sample size, this procedure allows for *a priori* unknown country-and period-specific ('fixed') effects using LSDV regression,[7] which further reduces the ever present omitted variable bias, thereby giving more confidence to the interpretation of the estimates for the coefficients of interest.

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6   For an outline of the common procedure cf. Sala-i-Martin (1997).

7   'LSDV' is semantically derived from Least-Squares-Dummy-Variables, referring to the common way of implementation, namely to include $i–1$ dummy variables for i observations.

The third step of analysis (section 2.3.) is to explore explicitly the causal structure between real and financial development. While in the still very much traditional estimation outlined above the question of causality is handled in the usual way (i.e., using lagged values of the exogenous variables of interest), this procedure is far from satisfactory for revealing the causal structure of the problem at hand. Specifically, the traditional approach can do no more than evaluate whether the empirical data contradict the assumption of causality running from exogenous to the endogenous variables; however, reverse and mutual causality (simultaneity) – possibilities that are crucial to the present investigation – cannot be detected. To this end, we shall estimate a two-wave path model with the FD proxy on the one hand and per capita income (as a proxy for the *level* of economic development) on the other.

3.1. A new proxy for financial development

The construction of the new variable, FD, for financial development is motivated by the interest in getting a reasonably reliable and comparable quantification of *the share of resources a society devotes to run its financial system*.

While this intention bears some resemblance to the core argument of transactions cost and institutionalist economics (North, 1990; Williamson, 1985), namely that aggregate transaction costs are very far from negligible and that financial institutions are a major response to this problem, we depart from the closely connected evolutionist argument that prevailing institutions – having survived the selection mechanism of the market – are the 'adequate' solution. Instead, we regard the amount of resources devoted to run these institutions as an indicator of the effort to keep transaction cost (as well as frictions and market failures due to informational asymmetry that are mitigated by the financial system) low. In this view, a higher share of resources for the financial system does not in the first place imply that the ongoing economic activities suffer from excessively high friction, but merely that from a macroeconomic perspective, the economy is devoting substantial means to keep these frictions under control.

This notion of financial development is thus very different from the common notion of financial depth; it signifies a *real* rather than a

monetary phenomenon.[8] Hence, with this notion of financial development, it is possible to address the question, resources should optimally be channeled into financial services. Certainly, the profession's standard formula 'until marginal costs equal marginal benefits' is useful also for this problem. Specifically, as long as a positive contribution of the financial system (measured in operating costs) to output can be detected in a macroeconomic production function framework, it is reasonable to suspect that marginal benefits still outweigh marginal costs.

The idea of measuring the operating costs of a given financial system seems plain enough – why has this not been tried before?[9] Probably, a good part of the answer lies in the fact that international statistics do not supply reliable and readily comparable data. The three indicators which deserve highest consideration, (1) the share of manpower employed in the financial system, (2) the share of the financial system in the national accounts of GDP and (3) the number of banks and branches per capita,[10] though distributed by distinguished institutions, are of rather poor quality. Not only do the numerous footnotes in the sources indicate that the reported numbers are difficult to compare across countries or through time for a given country, but in addition to this, some obvious conceptual changes as well as retrospective recalculations appear in subsequent volumes *without any notice*. Finally, missing entries pose further difficulties.

For a study of finance and development in a cross-sample of countries covering some twenty or thirty years, the mentioned data are thus very far from satisfactory. What follows, therefore, rests on the assumption that the raw numbers can be transformed in a way that turns them into reasonably reliable, complete and valid measures for the intended notion of 'resources for finance'. To this end, we shall identify the *common variance* of the three indicators using principal component analysis. Hence, if the operating costs of the financial system are reasonably well represented by

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8   It is not claimed that the traditional notion of financial depth is not useful, but the degree of monetisation and the aggregate credit volume channeled through the financial system – i.e., the 'traditional' variables – and the amount of resources needed to run a given financial system stand for very different economic functions: While the former inform about the prevailing channels of finance, the latter measure the intensity of financial services.

9   At least, to the best of my knowledge, no cross-country study before Graff (2000) has attempted to do this.

10   For details and sources, see the appendix.

the first principal component[11] the individual scores for this component may serve as a valid proxy for the variable of interest.[12]

Practically, to prepare the raw data, the three normalized indicator-variables (share of manpower employed in the financial system, share of the financial system in GDP, number of banks and branches per capita) were carefully screened for obvious errors and incompatibilities. Next, the yearly values of the normalized variables were transformed into five-year averages around 1970, 1975, 1980, 1985 and 1990. Finally, operational rules were formulated for treating missing values.[13] The remaining data for 93 countries and five points in time were pooled and standardized. Then, principal component analysis was applied to the resulting 465 x 3 matrix. The results are given in Table 1.

Table 1

A Financial Development Proxy from Principal Component Analysis

FD indicator	description	
BANK	number of banks and branches/worker	
FIN/GDP	financial system's share of GDP	
FINPER	share of labor employed in the financial system	

Principal component analysis, 3 FD indicators, $n = 5 \times 93 = 465$

Principal component	explained variance	cumulated explained variance
1 76.7 %	76.7 %	
2 17.3 %	94.0 %	
3 6.0 %	100.0 %	

FD indicator[a]	loading principal component No. 1	communality
BANK	0.94	0.75
FINPER	0.87	0.89
FIN/GDP	0.82	0.67

[a] standardized variables

An inspection of the results presented in Table 1 shows that the suggested procedure reduces the date fairly well by delivering a first principal component that accounts for 77% of overall variance. Moreover, the variance explained by the second and third principal components are

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11   That is, if the correlations between the desired representations are high, but measurement errors as well as stochastic shocks have little common variance.

12   To come close to this goal, a 'technical' condition is that the indicator variables have to be measured independently. This condition is satisfied here. Our three indicators for the size of the financial system are compiled from data published by ILO, UN and Bankers' Almanac, respectively (see appendix).

13   The general strategy was to estimate missing values in time by interpolation, extrapolation, trend analysis, and – where possible – by regression on exogenous variables, but to exclude all observations, where the majority of data would result from estimation rather than from original data.

only 17.3% and 6%, respectively; and all communalities exceed 2/3, indicating that the expected one-dimensional structure of the three variables is indeed reasonably well represented by one principal component only. Accordingly, in what follows, the individual scores for the first component[14] are taken as a new FD proxy for further analysis.

We can thus proceed with a well-defined ($\mu = 0$, $\sigma = 1$) variable that assigns a specific value for financial development as defined here to all 93 countries in our sample through five points in time.

3.2. Cross-country growth regression

The FD proxy from the previous section will now be used as a right-hand variable in the standard cross-country growth regression approach. The standard procedure in the 'new growth' literature is to refer to an 'augmented' aggregate production function that relates GDP in country i at time t to the factors of production

$$Y_{it} = A_{it}\, K^{\alpha}_{it}\, L^{\beta}_{it}\, H^{\gamma}_{it}\,, \qquad\qquad\qquad (1)$$

where Y is GDP, A a constant, K physical capital, L labor and H human capital. Assuming constant returns to scale in K, L and H ($\alpha + \beta + \gamma = 1$),[15] i.e., the production inputs traded on factor markets, dividing by L, and taking logarithms and time derivatives yields

$$\mathrm{g}_{(Y/L)} = \mathrm{g}_A + \alpha\, \mathrm{g}_{(K/L)} + \gamma\, \mathrm{g}_{(H/L)}\,, \qquad\qquad (2)$$

where g_X stands for the continuous growth rate of a variable X and redundant subscripts are suppressed. Starting from here, some further specifications are in order.

In a growth context which allows for catching-up through international diffusion of technology, for a given country i, human capital most likely enters the aggregate production function not only as a factor of production, but also as a variable that may exert its influence through changes in the level of technology and overall efficiency (cf. Benhabib and Spiegel, 1994). In other words, in addition to the growth of human capital as a production input, the starting level of human capital has to be considered as well, since it is a determinant of a country's capacity to absorb technological and organizational knowledge from abroad and a

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14 The resulting 5×93 matrix of FD values can be obtained from the author upon request.

15 A pre-test for economies of scale in $Y = A\, K^{\alpha}\, L^{\beta}\, H^{\gamma}$ using the data to be employed in what follows shows that rejection of the null hypothesis $\alpha + \beta + \gamma = 1$ yields a t-statistic of merely –0.05, so that the null can be maintained at any level of significance. Hence, the assumption of constant returns to scale does not stand in contradiction to our data.

remedy to improve overall efficiency ('total factor productivity') at home (these characteristics being represented by A_{it}).[16]

The same, however, can be assumed of a wide variety of other socio-political and institutional characteristics (Barro, 1991). These different channels of causation can be modeled by assuming that the growth rate of the overall efficiency level variable A is itself a function $g_{A(.)}$ of a set of variables including – among others – the initial level of human capital (H/L) per worker. Established as this reasoning may be, the list of compulsory right-hand variables for the growth function of A and other specification issues are far from universally being agreed upon amongst applicants or observers. It seems fair, however, to summarize the current state of empirical modeling by a linear relationship of the type

$$g_{Ait} = a_0 + a_1(H/L)_{i,t-1} + a_2[(Y/L)_{f,t-1} - (Y/L)_{i,t-1})] + a_3 g_{Ti,t-1} + a_4 t + \Sigma\, a_j X_{ji,t-1} \,,$$

(3)

where (H/L) is human capital per worker, $(Y/L)_f - (Y/L)_i$ is the development gap with respect to the most advanced 'frontier' country f, T is the level of technological competence, t is time, and the last term $\Sigma\, a_j X_{ji,t-1}$ is added to capture other potentially important determinants of g_A, which, of course, remain open to question. In this study, for the X_j, we shall consider – as the variable of primary interest – our proxy FD for financial development. Last but not least, following the hypotheses put forward in the literature and discussed in section 2, we shall allow for two interaction effects by computing the variables FD $\times$ ln (Y/L) and FD $\times$ ln (H/L). Moreover, note that $(Y/L)_f$ is constant across countries, hence it influences only the intercept and can therefore be dropped without biasing the parameter estimates. The usual convergence/catching-up variable is therefore the (log of) per capita income in country i, and the expected sign of the coefficient is negative.

The reduced form of our two equation model is obtained by substituting equation (3) into equation (2). Note that this approach is designed to capture the effects of lagged FD and its two interaction terms on $g_{(Y/L)}$ through g_A. Since $g_{(H/L)}$ is included from (2) as a separate regressor, a potential 'volume effect' of FD on physical capital accumulation (as suggested by the influential contributions of Shaw, 1993 and McKinnon, 1973) is already accounted for. Due to the inclusion of $g_{(H/L)}$, the same applies to the potential benefits of financial development on the rate of human capital accumulation through easier access to educational loans. In other words, what we are isolating is the 'allocation effect', i.e., the potential improvement of total factor productivity through financial activity.

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16   For a broader discussion of overall (in)efficiency cf. Leibenstein (1989).

Since we can draw on a panel data set of $i = 93$ countries and $t = 4$ growth periods, instead of relying on OLS, we shall estimate the less restricted (fixed effects) LSDV-model which allows for individual constants for all i countries and t periods and is therefore *a priori* less likely to suffer from misspecification due to omitted variable biases than the simple OLS model. Consequently, the equation to be estimated is

$$g_{(Y/L)it} = \beta_0 + \beta_1 \ln (Y/L)_{i,t-1} + \beta_2 \ln (H/L)_{i,t-1} + \beta_3\, g_{Ti,t-1}$$
$$+ \beta_4\, FD_{i,t-1} + \beta_5\, FD_{i,t-1} \times \ln (Y/L)_{i,t-1} + \beta_6\, FD_{i,t-1} \times$$
$$\ln (H/L)_{i,t-1} + \beta_7\, g_{(K/L)it} + \beta_8\, g_{(H/L)it} + \varepsilon_{it}\,, \qquad (4)$$

where ε_{it} is specified according to the LSDV-model as $\varepsilon_{it} = \lambda_i + \lambda_t + \mu_{i,t}$ and hence allows for 92 country specific and 3 period specific fixed effects.

Before proceeding to the results, a few remarks concerning the sample and the data are in order.[17]

(1) The sample consists of all countries for which the necessary data could be collected, with the exception of countries that are very small (population less than one million), countries with centrally planned economies through most of the period 1970–90, countries in which oil exports accounted for more than 20% of GDP in 1985, and countries with war or civil war claiming a death toll exceeding 2.5% of total population during 1970–88. The exclusion of these countries is to acknowledge that it may make very little sense to run regressions across countries that are fundamentally different from usual conditions (cf. Harberger 1998).

(2) The usual proxy for labor (L) in studies similar to ours is the size of the population. While this may be adequate as long as the focus is on the standard of living aspects of economic development, we refer instead to the size of the labor force proper for our productivity-oriented study.

(3) Capital accumulation is frequently proxied by the investment rate. We choose to compute capital stock estimates and growth rates instead. The reason is that we assume the well-known problems of capital stock estimates (most of all the arbitrariness of assumptions regarding depreciation and obsolescence) to be more than outweighed by the provision of a variable that is very much closer to the theoretical derivation of the long-run growth equation. Specifically, investment rates are likely to change more than capital stock growth rates along the business cycle and after macro-economic shocks. Moreover, having computed capital stock estimates allows us to compute individual time series for $v = K/Y$, a result that will be useful later for finding estimates for capacity utilization (see below).

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17   For further details, see appendix.

(4) Human capital accumulation $g_{(H/L)}$ is frequently proxied by enrolment rates. We compute instead the rate of change of educational attainment using data on mean years of schooling. In this way, we get a variable that is more reliable as well as closer to the model specification, thereby adding reliability and validity to our estimation as a whole. Apart from $g_{(H/L)}$, there are two other human capital-related regressors in our model: ln (H/L) and the interaction term $FD \times \ln (H/L)$. To keep as closely as possible to the literacy/financial development interaction-hypothesis, we proxy the *level* of human capital by the literacy rate LIT.

(5) Technical progress g_T is generally acknowledged to be one of the major determinants of economic growth. Yet, due to difficulties in finding suitable proxies, it is very rarely explicitly modeled in empirical cross-country growth exercises. However, if the exogenous variable of interest is suspected to be closely related to technical progress – as in the present study – ignoring g_T will almost certainly bias the estimates, thereby casting serious doubt on the adequateness of the model. To avoid this kind of misspecification, we again use a principal component approach: Since no single variable from published statistics is likely to give a valid estimate of technical progress, the procedure followed here is to consider a wide array of information from international statistics on R&D, patenting activity, scientific publications, and direct acquisition of technical knowledge from abroad, and then to take the first principle component of these variables as a proxy for g_T.[18]

(6) Since this study is concerned with long-run characteristics, it is desirable to eliminate business cycle and shock-related influences from our variables.[19] To this end we correct our production input variables K, L and H for capacity utilization, drawing on a method frequently used to determine capital utilization in policy-oriented business cycle research. The basic idea is that the empirical short-run fluctuations of the capital output ratio v are mainly due to cyclical changes in capital utilization. Accepting this line of reasoning, a long-run trend estimate of v can be used to identify the actual deviation of v from its 'equilibrium' level, which in turn allows to quantify capital utilization. Labor utilization would

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[18]   The approach is similar to the FD estimation procedure described above. For the g_T-proxy six technology-related indicators are reduced into one principal component. For further details, see the appendix.

[19]   In accordance with the main body of empirical work, growth rates are calculated as differences of natural logarithms of the values in $t = 0$ and $t = 1$. Since the basic time span of our panel is five years, which might be highly correlated with business cycles, cyclical properties of the underlying data have to be taken into account. Note also that due to the periodic subdivision of our data, the usual alternative to our elimination of cycles, namely the fitting of a long run growth rate through all observations during some decades ('world bank method'), is not feasible here.

of course be adequately measured by the unemployment rate. However, it is hopeless to find reliable and comparable figures for unemployment for more than very few countries, so that for a large sample as ours, one has to resort to less direct methods. Here, taking into consideration potential firm-specific qualifications of labor, the duration of work contracts and other institutional characteristics of labor markets, we assume that labor is laid off to a lesser degree than capital is put idle. To implement this argument, labor's capacity under-utilization is computed as 50% of capital's deviation from its full utilization. A similar procedure is applied to compute the capacity utilization of human capital. In this case, it is assumed that human capital is 'hired and fired' even less than 'raw' labor, assigning a value of 50% of labor's fluctuations in utilization to human capital's.

With the variables defined and computed as described above, the fixed effects model in the pooled sample is calculated by regressing $g_{(Y/L)it}$ on its presumed determinants (with growth rates computed as continuous yearly rates for every 5-year period, and level variables taken from the beginning of the corresponding periods). This yields the following results as presented in Table 2.

Table 2

Cross-country Growth Regressions, Pooled Sample (4×93), Dependent Variable $g_{(Y/L)}$

Estimation	(1) LSDV	(2) LSDV (White)	(3) LSDV (bounded)	(4) LSDV	WLS		
No. observations	372	372	337	372			
fixed effects, df = 95		***	***	***	***		
FD_{t-1}	0.155***		0.155***		0.153***		0.155***
	(2.82)	(2.20)	(2.83)	(4.06)			
$[FD \times \ln (Y/L)]_{t-1}$		–0.015***		–0.015***		–0.014***	–0.015***
	(–2.78)	(–2.17)	(–2.75)	(–3.99)			
$(FD \times \ln LIT)_{t-1}$		0.036***		0.036***		0.033***	0.035***
	(2.51)	(1.89)	(2.57)	(3.46)			
$\ln (Y/L)_{t-1}$	–0.068***		–0.068***		–0.068***		–0.063***
	(–9.23)	(–6.71)	(–10.8)	(–12.4)			
$\ln LIT_{t-1}$	0.025**	0.025**	0.029***		0.025***		
	(1.82)	(1.57)	(2.39)	(2.68)			
g_{Tt-1}	0.025***		0.025***		0.015**	0.021***	
	(2.86)	(2.43)	(2.15)	(3.28)			
$g_{(K/L)t}$	0.62***	0.62***	0.67***	0.66***			
	(22.2)	(15.7)	(30.2)	(33.7)			
$g_{(H/L)t}$	0.045**	0.045**	0.044**	0.036***			
	(2.28)	(3.27)	(3.11)	(3.11)			
R^2	.86	.86	.92	.93			
adjusted R^2	.81	.81	.89	.90			

t-statistics in brackets, one-tailed significance tests for regression parameters:
*** p ≤ .01, ** p ≤ .05, * p ≤ .10

As a first comment, it is obviously justified to say that our model fares extraordinarily well. It explains 86% of the variance of $g_{(Y/L)}$, which is very high compared to the usual 70% in similar exercises, and *all* coefficients are different from zero with their expected signs at the 1% or 5% level (the latter referring to the human capital variables $\ln LIT$ and $g_{(H/L)}$). The good overall fit is of course partly due to the inclusion of the country and period dummy variables for specific 'fixed' effects (coefficients not reproduced here). Highly significant F-tests for the joint significance of the dummy variables ($F_{92/268} = 4.26$ for country dummies and $F_{3/268} = 6.31$ period dummies) indeed certify the appropriateness of their presence for both country and period fixed effects. Consequently, the more restricted, albeit simpler, 'constant effects' OLS-model would suffer from misspecification.

Apart from that, the fact that all growth accounting variables as well as the determinants of overall efficiency are significantly partially correlated with economic growth adds further confidence to our overall specification. Consequently, we interpret the estimated positive and highly significant coefficient for the lagged FD variable (t = 2.82) as a strong indication that finance (as captured here) does indeed matter for economic growth and development.

Moreover, the significantly negative (t = –2.78) coefficient for the interaction term $FD \times \ln(Y/L)$ suggests that the economically less developed countries may indeed gain more from financial development than the more advanced countries, thereby giving new empirical support to the Patrick hypothesis. Finally, the significantly positive (t = 2.51) coefficient for the interaction term $FD \times \ln LIT$ is supporting the literacy/financial development interaction hypothesis.

It is, however, well-known that the parameters obtained in cross-country growth regressions are *sensitive* to statistical peculiarities (hetereoscedasticity and influential observations) and not always *robust* against minor changes in model specification. Therefore, columns 2–4 of Table 2 show the result of three different sensitivity analyses.

White's heteroscedasticity consistent t-statistics are given in column 2. Obviously, dubious precision of our point estimates is not a serious problem; following Beggs' rule (Beggs 1988), the deviations of the LSDV- and the White t-statistics are within the permissible range, so that we can proceed with the traditional t-test.

Column 3 gives the results after eliminating the most influential observations for the parameter estimate of central interest, FD_{t-1}. Specifically, observations with DFBETA $> 2\sqrt{n}$ are dropped, and the regression is run with the remaining 337 observations. The results show that the parameters remain are remarkably stable and – if anything – the precision increases.

The same applies to the results of an alternative bounding of influence on FE_{t-1} by WLS (column 4), where influential observations are not simply dropped, but their weights are reduced according to their DFFIT-statistics (cf. Maddala 1992: 487 ff.).

Finally, to test for robustness according to the extreme bounds criteria, following Sala-i-Martin (1997), we run a series of Leamer regressions with all possible permutations of two variables from a set of 44 socio-political control variables as additional regressors. The distribution of 946 estimates for the parameters of interest, i.e., for our three FD-related regressors reveals that FD_{t-1} and the FD-ln (Y/L)-interaction term are very robust indeed and maintain their sign in every case. The FD-literacy interaction variable, however, appears less robust with some ten percent of

the Leamer regressions resulting in a reversal of the sign for the point estimate, so that the hypothesis of a reinforcement of financial development and educational attainment in their effects on economic growth is less firmly rooted in the data and should be regarded with slightly more doubt.[20]
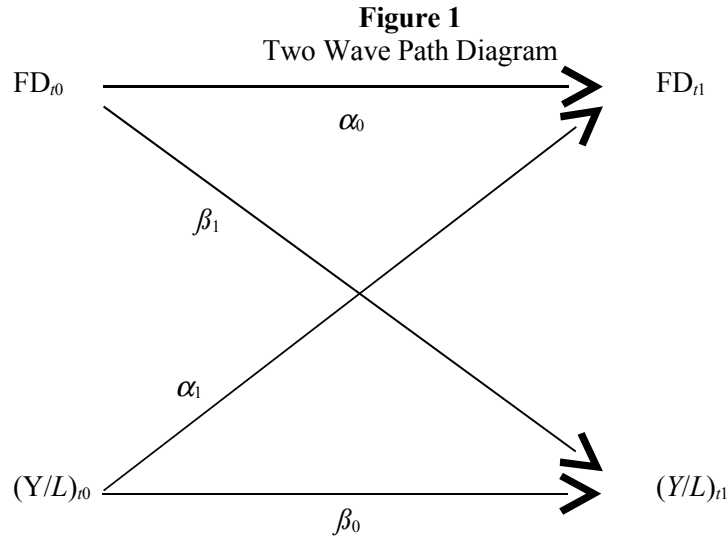
3.3. Causality

The preceding section can be interpreted as an exercise to evaluate whether the empirical data contradict the assumption of causality running from finance to economic growth. To address questions of reverse causation and simultaneity, however a different approach is required. To this end, we present a path analysis with two variables, our FD-proxy and per capita income Y/L, measured at t_0 and t_1. The statistical method – path analysis with panel data – is established in biological research since the 1930s, and sociologists have referred to it at least since the 1960s (Duncan 1966, Heise 1970). Economists, however, have concentrated more on time series based concepts of causality, so that applications similar to the one presented here are not yet common in the economic literature. Some methodological remarks are therefore in order.[21]

The model is conveniently represented in the following path diagram (Figure 1).

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[20]   Further checks for the robustness (not reported in detail, but available from the author upon request) of our results were (1) to re-run the regression with K, H, and L unadjusted for capacity utilization, and (2) to drop the country dummy variables from the regression thereby capturing some of the in-between country variance. While (1) considerably reduced the point estimate (but not the precision) of the coefficient from the physical capital regressor, and rendered the human capital regressor insignificant, it increased the precision of the coefficients for the FD regressor and its two interaction terms while leaving the point estimates unaffected. Dropping the country dummies (check 2) rendered the human capital related regressors and the FD×LIT interaction insignificant, but left the other estimates largely intact. Taken together, these informal tests show that, apart from the FD×LIT-interaction, which already proved to be of dubious robustness in the extreme bounds analysis, the coefficients of primary interest remain intact and significant.

[21]   For a detailed description cf. Finkel (1995); a related model is outlined in Graff (2002).

Figure 1
Two Wave Path Diagram

Hence, the model consists of the following two equations:

$$FD_{t1} = \alpha_0\ FD_{t0} + \alpha_1\ (Y/L)_{t0} + \varepsilon, \tag{5}$$

$$(Y/L)_{t1} = \beta_0\ (Y/L)_{t0} + \beta_1\ FD_{t0} + \varepsilon. \tag{6}$$

Practically, the path coefficients are easily computed as the standardized partial correlation resulting from regressions of the t_1-variables on both t_0-variables.

The (sequential) structure of causation reveals itself in the estimated parameters α_1 and β_1. If neither of the two is significantly different from zero, there is no indication for causation in either direction; if both are, the model indicates mutual (bi-directional) causation. Significance for α_1 only implies unidirectional causation from Y/L to FD, which is consistent with the demand-following finance hypothesis, whereas significance for β_1 only implies unidirectional causation from FD to Y/L, which is consistent with supply-leading finance.

Thus, contrary to the usual strategy to search for patterns of Granger-causality drawing on time series of *within individual* countries, the present approach exploits *inter-country* rather than intra-county variance, thereby possibly allowing more general conclusions. As with Granger-causality, however, a problem with this approach is the determination of the lag. Since the model assumes causality to operate between t_0 and t_1, the lag is crucial. Hence, for a strict statistical test, the proper lag length should be derived from theory and then be specified *a priori*, before running the statistical test.

The general advice for two-wave models is that the lag should be 'long enough'. Our data allow lags to range from five to 20 years. Given the present state of ignorance about the finance-development-nexus, however, we choose not to determine a fixed lag, but rather to run exploratory tests by trying out all possible lag lengths.

With these qualifications on the nature of the following tests, we proceed to the results. Since our interest is directed toward causality issues rather than the magnitudes of the path coefficients, we report only the t-values and the significance levels for one-tailed tests of $\beta_1 > 0$ and $\alpha_1 > 0$, corresponding to path 1 (supply-leading finance) and path 2 (demand-following finance), respectively. Moreover, negative coefficients – not predicted by either of the two hypotheses – are indicated.

Table 3

Path model estimation

t_0	t_1	path 1	path 2
1970	1975	4.17**	2.20*
1970	1980	1.89*	2.48**
1970	1985	2.92**	1.86*
1970	1990	4.43**	1.52
1975	1980	–2.70—	1.31
1975	1985	.04	1.02
1975	1990	2.63**	.87
1980	1985	2.45**	.33
1980	1990	5.24**	.41
1985	1990	5.28**	1.34

One-tailed significance (H$_a$: $\alpha_1, \beta_1 > 0$) of path 1 and 2: ** p < .01, * p < .05 negative sign: —

An inspection of our results reveals that β_1 (path 1) is highly significant in 7 of ten cases, and passes the 5% test in any other case, while α_1 (path 2) is significant at the 1% level only in one case, and at the 5% level in two other cases. Consequently, the general picture is that although there are undoubtedly signs for mutual causation between finance and development, significance is mainly found in the supply-leading finance direction, hence, the most obvious line of causation is running from finance to development. Moreover, in no case do we find a pattern of significance for path 2 only. Thus, while there is evidence for mutual causation, our data do not give any indication for purely demand-following finance. This generalization holds for all time lags (from five to twenty years) that could be tested in our panel data set.

The findings of our two-wave path model obviously do not support the demand-following finance hypothesis, and while the suspicion of mutual

causation between finance and development cannot be rejected, our results clearly indicate that supply-leading finance prevailed.

However, some further qualifications are possible. Note first that the strongest signs of mutual (instead of unidirectional) causation from finance to development are found in the 1970s. Moreover, for the second half of the 1970s, the estimates indicate a strong departure from the usual quinquennial supply-leading pattern. If there is no severe measurement error in our data, the findings suggest that during this special period, a high level of financial activity was detrimental rather than beneficial to economic growth (corresponding to hypothesis 4).

What follows is that the finance-growth nexus is not a stable relationship. Possibly, some special circumstances (such as the oil price shock induced turbulence in the international financial system, the severity of financial repression, or some unintended consequences of radical financial liberalization induced by the McKinnon/Shaw school) in several statistically influential countries may be held responsible for the peculiar results in the 1975–80 period,[22] but more specific answers will require further substantial research.

Moreover, due to data availability, our framework presently does not allow us to make statements about the 1990s. Although more evidence on the stability of the finance-growth nexus may be expected from new data allowing us to conduct similar tests for the 1990–95 and following periods, the data at hand, unfortunately, does not presently give any empirical evidence about possible shifts or reversals of causation that might be due to recent phenomena (globalization of financial markets, growing numbers of active stock markets as well as the recent financial crises, to name just a few).

4. Conclusion

The empirical results from sections 2.2. and 2.3. taken together suggest that the Patrick hypothesis of the supply-leading nature of financial development in periods of rapid growth may indeed be an appropriate characterization of the finance-growth nexus for 1970–90. Specifically, finance obviously matters for growth. Second, it matters more in less developed countries. Third, causation runs mainly from financial to real development with only little evidence for mutual causation and no evidence at all for reverse causation (from real to financial development). A further conclusion is that finance matters more in countries with higher adult literacy.

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22   For empirical evidence indicating that financial repression was a widely spread phenomenon during the late 1970s, see Fischer (1982: 87).

However, our results indicate that the finance-growth nexus is not a stable relationship. Obviously, it did not operate smoothly during the second half of the 1970s; on the contrary, in this period financial activity seems occasionally to have been detrimental to economic growth. At this time we can only speculate whether some special circumstances in the 1975–80 period (such as the oil price shock, financial repression, or financial deregulation) are responsible for this finding. Hence, further research should be conducted to investigate possible interactions between the functioning of the financial system and regulatory issues as well as the given economic situation from a comparative perspective.

Last but not least, it should be kept in mind that the financial system is certainly not the major source of economic growth; and at best, plays an auxiliary role in the process of economic growth and development through its functions as intermediary and allocator. A failure to fulfil these functions, however, may imply that the rate of economic growth is reduced below what is otherwise feasible, which eventually could result in a considerable loss of economic prosperity.

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Appendix: data and sources

If not mentioned otherwise, data are from the Penn World Tables (Mark 5.6, revised December 1997).

Physical capital K is estimated by the perpetual inventory method as specified for LDC's by Harberger (1978) and refined by Nehru and Dhareshwar (1993), using a depreciation rate of 10%.

Human capital (H/L) is taken from Barro and Lee (1996) referring to mean years of schooling in the male population age 15–65.

Capital (K), *Human Capital* (H) and *Labor* (L) are adjusted for capacity utilization as described in section 2.2.

The per capita growth rate $g_{(Y/L)}$ is taken as $[\ln (Y/L)_{1990} - \ln (Y/L)_{1970}]/20$. Data are adjusted RGDPW from the Penn World Tables (Mark 5.6). All other growth rates are computed in the same way. The convergence variable is adjusted RGDPW70.

Literacy Rates (LIT) are from various issues of the UNESCO Statistical Yearbook, Paris.

Technical progress g_T is computed as the fist principal component of six technology related indicators covering the whole panel of 93 countries and five years (1970, 1975, ... , 1990). Indicators are two R&D related ratios (referring to expenditure and professionals engaged, source: UNESCO), patenting activity (domestic and international, source: WIPO, Geneva and ifo-Institute, Munich, scientific publications ('scientometric' data, source: *Scientometrics*), and direct acquisition of technical knowledge from abroad (royalties and expenditure for foreign licenses, source: IMF). The first principal component represents 85 per cent of all the variables' variance and serves as proxy for g_T. (see Graff 2000; the 5×93 g_T-matrix can be obtained from the author upon request).

The number of banks and branches are counted from the 1970 to 1990 editions of the Bankers' Almanac and Yearbook, London: Thomas Skinner.

The share of labor employed in the financial system is taken from ILO Yearbook of Labour Statistics, Vols. 1971–1997, Geneva. The corresponding ISIC-2 ('international standard industrial classification of all economic activities', 1968) classification is 'major division 8' (financial institutions, insurance, real estate and business services).

The financial system's share of GDP is computed from various issues of the UN
    National Account Statistics, New York, referring to 'finance, insurance and
    business services'.

Özet

Finansal gelişme ve iktisadî büyüme: Yeni veriler ve ampirik tahlil

Makale finansal gelişmenin iktisadî kalkınmayı belirleyen bir etken olarak önemini irdelemektedir. 1970-90 yıllarında 93 ülkenin panel verilerini tahlil etmektedir. Tahlil, finansal gelişmeyi finansal sistemde kullanılan reel kaynak girdilerinin miktarı ile ölçmektedir. Finansal gelişme ile kalkınma ve ayrıca eğitim arasındaki etkileşme ihtimali de göz önünde bulundurulmaktadır. İki yönlü yol çözümlemesi, esas itibariyle finansal gelişmenin büyümeye yol açtığını göstermektedir. Ancak 1975-80'den itibaren finansın büyümeye yararı azalmıştır.