Graff, Michael

Working Paper

Financial development and economic growth: A new empirical analysis

Dresden discussion paper in economics, No. 05/99

Provided in cooperation with:
Technische Universität Dresden

Suggested citation: Graff, Michael (1999) : Financial development and economic growth: A new empirical analysis, Dresden discussion paper in economics, No. 05/99, http://hdl.handle.net/10419/48112

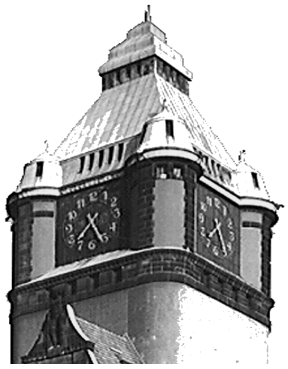
TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Wirtschaftswissenschaften

Financial Development and Economic Growth – A New Empirical Analysis

by

Michael Graff



Dresdner Beiträge zur Volkswirtschaftslehre
Dresden Discussion Paper Series in Economics
Nr. 5/99

ISSN 0945-4829

Financial Development and Economic Growth – A New Empirical Analysis[1]

Michael Graff

Dresden University of Technology

JEL classification: G20, N20, 016

Keywords: finance, development, growth, causality

Summary: The paper describes tests of hypotheses from economic history concerning the significance of financial development as a determinant of economic growth. It goes beyond the existing studies in drawing on a large panel data set covering 93 countries from 1970-90 and includes a new proxy for the resource input into the financial system. Moreover, interaction effects between financial development and catching-up as well as education are considered. Finally, to clarify causal relationships, a two-wave path model is estimated. It is shown that during the 1970s and 1980s finance was a significant and predominantly supply-leading determinant of growth.

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 Commercial Revolution of the Middle Ages or of the Financial Revolution in 17th century. The development in other countries, on the other hand, was possibly an imitation of the Italian and British examples.

The above stated view follows implicitly from the neglect of institutional questions typical for many neo-classical economists (i.e. after the period of 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

---

1 Report of current research. Fist results were presented at the 47th International Atlantic Economic Conference, Vienna, March 16-23, 1999.

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 (e.g. historical, socio-psychological, administrative).

This view is explicitly held by some modern institutionalists (and other believers in the famous 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 some combination) of them sufficient. The logical distinction between a necessary and a sufficient condition helps to clarify the difference 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.[2]

(4) Financial development is 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 destabilising 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 theroreticians are ready to include commercial banks into the sources of financial distress, most proponents direct their attention towards stock markets or

---

2 The arguments are elaborated in FRY (1995). For a recent survey cf. LEVINE (1997).

international capital flows. This view is held by a wide range of economists ranging from KEYNES (1936)[3] to DIAMOND/DYBVIG (1983), SINGH (1997) and KRUGMAN (1998).

In connection with this, there is a lively debate about the wisdom of government intervention in the credit and capital markets (financial repression vs. financial liberalisation). 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 a state intervention into 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.

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. Moreover, the existing econometric studies do not really rule out any of the possibilities either, significant results can be cited for any of them. There is, obviously, need for further research.

2 Some hypotheses 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 characterised by a progressive securitisation of former bank credit relationships.

These generalisations from economic history offer a first, albeit valuable, insight into the possible causal interrelations between financial and real development: The decisive change in the *macro-economic* function of a financial sector obviously lies between the stages one and

---

3 Cf. his remark in the 'General Theory' (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 triupmhs 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."

two. Deposit banking – widespread during the Commercial Revolution – certainly contributed to a reduction in the 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 SCHMPETER (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 latecomer's (notably France's and Germany's) situation which, in order to catch up with then far advanced Britain, had to mobilise 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, inferring from the Japanese industrialisation, introduced the now common termini 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 industrialising economies.

Does economic history offer any lesson for the present? In what follows, I shall outline why I think it does.

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 industrialisation. Moreover, financial development – as measured by GOLDSMITH'S financial interrelation ratio (conveniently proxied by M2/GDP) generally levelled off after a few decades, reaching its fully developed stage[4] by the beginning of the twentieth century. These historical observations imply that in the process of industrialisation 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 industrialisation. 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 centre, 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 industrialisation. This observation implies that in the financially and economically less developed countries, there is a latent, but unexploited potential for growth.

---

4 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.

What may matter in this context is that the sunk capital and well as the professional skills 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 extraordinary sophisticated and costly. Thus, unlike to other economic activities, the LDC's might be able easily to exploit their growth potential by modernising their traditional financial sectors with financial technology that can be easily imitated and borrowed from the more advanced countries (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 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 macro-economic returns to financial development in LDC's.

To summarise, 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 this question.

3 Empirical analysis

The objective of the following empirical cross-country analysis is to investigate – more thoroughly than in previous cross-country studies – the asserted causal relationship from financial development to economic growth, i.e. hypothesis 3, which – if found to be true – would allow important policy recommendations. To this end, a three-stage research strategy will be followed.

The first step (section 3.1) is to construct for a large sample of countries and various years a new proxy for financial development (FD) which captures *the share of resources a society devotes to run its financial system* at any given time. In contrast to the usual indicators of financial repression/liberalisation and financial depth, which frequently suffer from ambiguity (expressing monetary and credit volumes as well as financial overheating and likelihood of financial crash), 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 3.2) is to use the new FD-proxy in the by 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 mis-specification, attention has to be devoted to an economically sound specification of the growth equation to be estimated. Therefore, in contrast to many other studies, we shall use more right-hand variables than usual,[5] and in addition we shall allow for interaction effects to capture two prominent hypotheses put forward in the theoretical literature and cited above. Hence, contrary to the prevailing approach that uses sample splits to examine structural relationships, 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 dregrees 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 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 enables to allow for a priori unknown country and period specific ('fixed') effects using LSDV-regression,[6] which further reduces the ever present omitted variable bias, thereby giving more confidence to the interpretation of the estimates for the coefficients of interest.

The third step of analysis (section 3.3) 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 to reveal 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 which 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 to get a reasonably reliable and comparable quantification of *the share of resources a society devotes to run its financial system*.

---

5 For an outline of the common proceedure cf. SALA-I-MARTIN 1997.

6 'LSDV' is semantically derived from '**l**east **s**quares **d**ummy **v**ariables', referring to the common way of implementation, namely to include i–1 dummy variables for i observations.

While this intention bears some resemblance to the core argument of *transactions cost* and *institutionalist* economics (NORTH 1990, WILLIMASON 1985), namely that aggregate transaction costs are very far from negligible and that financial institution are a major response to this problem, I depart from the closely connected evolutionist argument that prevailing institutions – having survived the selection mechanism of the market – are the 'adequate' solution. Instead, I 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 friction 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.[7] Hence, with this notion of financial development, it is possible to address the question, how many resources should optimally be channelled into financial services. I believe that 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 macro-economic production function framework, it is reasonable to suspect that marginal benefits still outweigh marginal costs.

The idea to measure the operating costs of a given financial system seems plain enough – why has this not been tried before?[8] I think a good part of the answer lies in the fact that no international statistics supply reliable and readily comparable data. The three indicators which I found suitable for consideration, (1) the share of manpower employed in the financial system, (2) the share of the financial system in GDP and (3) the number of banks and branches per capita,[9] though distributed by distinguished institutions, are strikingly unreliable. Not only do the numerous footnotes indicate that the reported numbers are neither comparable across countries nor through time for a given country. Worse is that conceptual changes as well as retrospective recalculations sometimes appear in subsequent volumes *without any notice*. Moreover, missing values and obvious errors add to the trouble. Finally, these numbers have to be transformed into the desired ratios (normalised to labour force or GDP, respectively) by hand.

For a study of finance and development in a cross-sample of countries covering some twenty or thirty years, all mentioned variables are thus very far from satisfactory. What follows, therefore, rests on the assumption that the raw numbers can be transformed in a way that makes them reasonably reliable, complete and valid measures for the intended notion of 're-

---

7 I do not claim that the traditional notion of financial depth is not useful, but I believe that the degree of monetisation and the aggregate credit volume channelled 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.

8 At least, to the best of my knowledge, I know of no cross-country study that has attempted to do this.

9 For details and sources, see appendix.

sources for finance'. The procedure chosen here is to identify the *common variance* of the three indicators using principal component analysis. If the operating costs of the financial system are reasonably well represented by the first principal component[10] the individual scores for this component may serve as a valid proxy for the interesting variable.[11]

Practically, to prepare the raw data, the three normalised 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 normalised variables were transformed into five-year averages for 1970, 1975, 1980, 1985 and 1990. Finally, operational rules had to be formulated how to treat missing values.[12] The remaining data for 93 countries and five points in time were pooled and standardised. Then, principal component analysis was applied to the resulting 465 x 3 matrix, delivering a first component representing 77% of overall variance.[13] Finally, the individual scores for the first component were taken as our FD-proxy for further analysis.

We can thus proceed with a well-defined (μ=0, σ=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 usual cross-country growth regression approach. Established as it may be, the list of compulsory right-hand variables and other specification issues are far form universally being agreed upon amongst applicants or observers. It seems fair, however, to summarise that 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:

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

where Y is GDP, A a constant, K physical capital, L labour and H human capital. Assuming constant returns to scale in K, L and H ($\alpha + \beta + \gamma = 1$),[14] i.e. the production inputs traded on factor markets, dividing by L, and taking logarithms and time derivatives yields

---

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

11 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 BANKER'S ALMANAC, respectively.

12 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.

13 The variances for second and third principal component are 17% and 6%; and all communalities exceed 67%, indicating that the expected one-dimensional structure of the three variables is reasonable well represented by the first component.

14 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 (not reported in detail for space considerations) shows that the null hypothesis $\alpha + \beta + \gamma = 1$ cannot be rejected at

$$g_{(Y/L)} = g_A + \alpha\, g_{(K/L)} + \gamma\, g_{(H/L)} ,$$

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.

(1) 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/SPIEGEL, 1994). In other words, the level of human capital has to be considered as a determinant of a country's capacity to absorb technological and organisational knowledge from abroad as well as a remedy to improve overall efficiency at home (these characteristics being represented by A_{it}),[15] and the same can be assumed of a wide variety of other socio-political and institutional characteristics (BARRO 1991).

These different channels of causation can be modelled by assuming that the growth rate of the overall efficiency level variable A is a function of a vector of n variables (X_1, X_2 ..., X_n) including – among others – the initial gap to the technological frontier ($A_{f0} - A_{i0}$) and the initial level human of capital $(H/L)_{i0}$. Thus, assuming a linear specification for $g(A(\cdot))$ and suppressing time subscripts

$$g_{(Y/L)} = a_0 + a_1\,(H/L)_i + a_2\,(A_f - A_i) + a_3\,X_3 + ... + a_n\,X_n$$
$$+ \alpha\, g_{(K/L)} + \gamma\, g_{(H/L)} .$$

For empirical estimations in cross-country studies, A_i is usually proxied by initial (log) per capita income (Y/L) and $(H/L)_i$ by a measure of (log) educational attainment (H/L).[16] Since g_A is certainly not governed by human capital and the technology lag alone, however, the specification of X_3 to X_n remains open to questions.

Here, we shall consider a proxy $X_3 = g_T$ for technical progress proper, and – of course – as the variable of primary interest the proxy X_4 = 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 defining the variables X_5 = FD ln (Y/L) and X_6 = FD ln (H/L).

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

---

any conventional level of significance; so that this assumption at least does not stand in obvious contrast with our data.

15 For a broader discussion of overall (in)efficiency cf. LEIBENSTEIN (1989).

16 For a formal growth theoretical justification to include initial log per capita income Y/L and educational attainment H/L relying on the assumption that countries are close to their steady states, see MANKIW ET AL. (1992).

Moreover, note that A_f is constant across countries, it influences only the intercept and can therefore be dropped without biasing the parameter estimates. Consequently, the equation to be estimated is

$$g_{(Y/L)it} = ß_{0i} + ß_{0t} + ß_1 \ln (Y/L)_{i,t-1} + ß_2 \ln (H/L)_{i,t-1} + ß_3 g(T)_{i,t-1}$$
$$+ ß_4 FD_{i,t-1} + ß_5 FD_{i,t-1} \ln (Y/L)_{i,t-1} + ß_6 FD_{i,t-1} \ln (H/L)_{i,t-1}$$
$$+ ß_7 g_{(K/L)it} + ß_8 g_{(H/L)it} + \varepsilon_{it} .$$

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 exceedingly small (population less than one million), of 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 which are fundamentally different from usual conditions (cf. HARBERGER 1998).

(2) The usual proxy for labour (L) in studies similar to ours is the size of the population. While this may be adequate as long as the focus is on standard of living aspects of economic development, we rather refer to the size of the labour 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 later help to find estimates for capacity utilisation (see below).

(4) Human capital accumulation $g_{(H/L)}$ is frequently proxied be enrolment rates. Instead, we compute the rate of change of educational attainment using data on mean years of schooling. In this way, we get a variable which is more reliable as well as closer to the model specification, thereby adding reliability and validity to our estimation as a whole. Apart from $g_{(H/L)}$, in our model there are two other human capital-related regressors: ln (H/L) and ln (H/L) FD. To stick 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 to find suitable proxies, it is very rarely explicitly

---

17 For further details, see appendix.

modelled in empirical cross-country growth exercises. However, if the exogenous variable of interest can be 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 mis-specification, we again use a principal component approach: Since no single variable from published statistics is likely to give an 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. To this end we correct our production input variables K, L and H for capacity utilisation, drawing on a method frequently used to determine capital utilisation 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 utilisation. 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 utilisation. Labour utilisation would 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 labour, the duration of work contracts and other institutional characteristics of labour markets, we assume that labour is laid off to a lesser degree than capital is put idle. To implement this argument, labour's capacity under-utilisation is computed as 50% of capital's deviation from its full utilisation. A similar procedure is applied to compute the capacity utilisation of human capital. In this case, it is assumed, that human capital is 'hired and fired' even less than 'raw' labour, assigning a value of 50% of labour's fluctuations in utilisation 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:

---

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 appendix.

$$g_{(Y/L)} = \beta_i + \beta_t - .068^{**} \ln (Y/L) + .025^{*} \ln LIT + .025^{**} g_T + .155^{**} FD - .015^{**} FD \ln (Y/L) + .036^{**} FD \ln LIT + .63^{**} g(K/L) + .045^{*} g_{(H/L)}$$

N = 372, $R^2 = .86$
one-tailed significance tests: ** $p < .01$, * $p < .05$

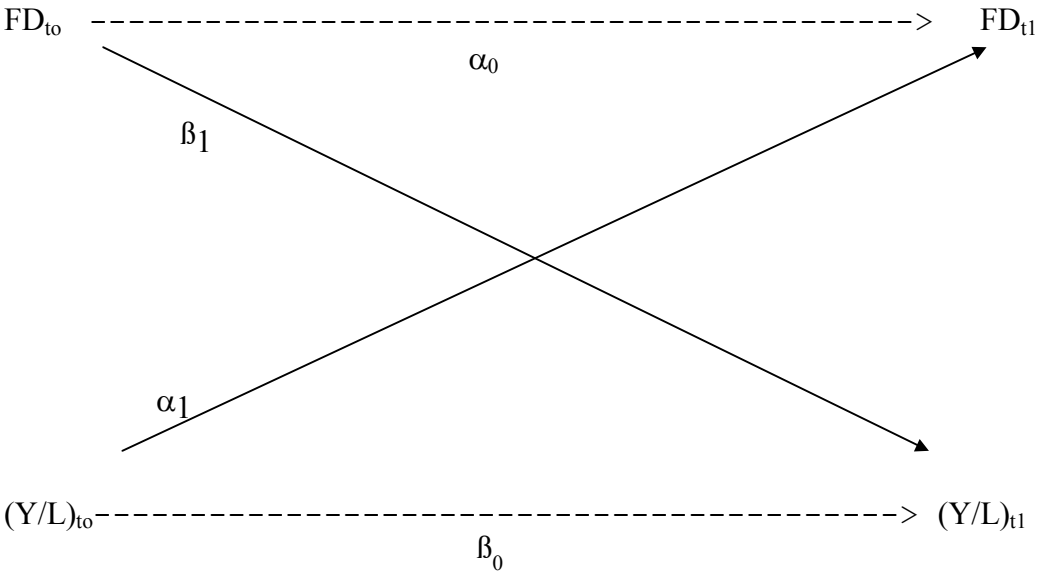
As a first comment, it is obviously justified to say that our model fares extraordinary well. It explains 86% of the variance of $g_{(Y/L)}$, which is very high compared to the usual 70% in similar exercises, and *all* coefficients are different from zero with their expected signs at the 1% or 5% level (the latter refering 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 ($F_{92/268} = 4.26$ and $F_{3/268} = 6.31$) 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 mis-specification.

Apart from that, the fact that all growth accounting variables as well 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 = 2,83) as a strong indication that finance (as captured here) does indeed matter for economic growth an development.

Moreover, the significantly negative (t = –2,78) coefficient for the interaction term FD ln (Y/L) suggests that the economically less developed countries 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 ln LIT is supporting the literacy/financial development interaction-hypothesis.

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 in this section, 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 model is conveniently represented in the following path diagram.



Hence, the model consists of the following two equations :

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

$$(Y/L)_{t1} = ß_0 (Y/L)_{t0} + ß_1 FD_{t0} + \varepsilon.$$

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

The (sequential) structure of causation reveals itself in the estimates parameters α_1 and $ß_1$. 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 $ß_1$ only implies unidirectional causation from FD to Y/L, which is consistent with supply-leading finance as defined by PATRICK.

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 probably 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'. The data base allows lags to range from five to 20 years. Given the present state of our 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 this qualifications of 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 the significance levels for one-tailed tests of $ß_1 > 0$ 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.

t_0	t_1	path 1	path 2
1970	1975	**	*
1970	1980	*	**
1970	1985	**	*
1970	1990	**	
1975	1980	—	
1975	1985		
1975	1990	**	
1980	1985	**	
1980	1990	**	
1985	1990	**	

One-tailed significance (H_a: α_1, $b_1 > 0$) of path 1 and 2:
** $p < .01$, * $p < .05$
negative sign: —

An inspection of our results reveals that $ß_1$ (path 1) is highly significant in 7 of ten cases, and passes the 5%-test in an other case, while α_1 (path 2) is significant at the 1% level only in one case, and at the 5% level in tow other cases. Consequently, The general picture is that though there are undoubtedly signs for mutual causation between finance and development, significance is mainly found in the supply-leading finance-column, 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 demand-following finance. These generalisation holds for all time lags (from five to twenty years) that could be tested in our data panel set.

These 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 the 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 in (such as the oil price shock induced turbulence in the international financial system, the severity of financial repression, or the of radical financial liberalisation induced by the McKINNON/SHAW school) me be held responsible for the peculiar results in the 1975-80 period, but more specific answers will require further substantial research.

Moreover, due to data availability, our framework presently does not allow statements about the 1990s. Though more evidence on the stability of the finance-growth nexus may be expected from new data allowing to conduct similar tests for the 1990-95 and following periods, with the data at hand, unfortunately, we cannot give any empirical evidence about possible shifts or reversals of causation that might be due to recent phenomena (globalisation 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 3.2 and 3.3 taken together suggest that the PATRICK-hypothesis may indeed be an appropriate characterisation of the finance-growth nexus from about 1970-90. First, 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.

However, our results indicate that the finance-growth nexus is not a stable relationship. It did not operate during the second half of the 1970s; on the contrary, in this period financial activity seems 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 beween the functioning of the financial system and regulatory issues as well as the given economic situation from an international perspective.

5 Appendix: data and sources

If not mentioned otherwise, data are from the PENN WORLD TABLES (Mark 5.6, revised December 1997).

Physical capital is estimated by the perpetual inventory method as specified for LDC's by HARBERGER (1978) and refined by NEHRU/DHARESHWAR (1993), using a depreciation rate of 10%.

Human capital (H/L) is taken from BARRO/LEE (1996) referring to mean years of schooling in the male population age 15-65.

Capital (K), Human Capital (H) and Labour (L) are adjusted for capacity utilisation as described in section 3.2 (6).

The per capita growth rate $g_{(Y/L)}$ is taken as $ß_1$ from $[\ln (Y/L)_{1990} - \ln (Y/L)_{1970}] / 20$. Data are adjusted RGDPCH from the Penn World Tables (Mark 5.6). All other growth rates are computed in the same way. The convergence variable is adjusted RGDPCH70.

Literacy Rates (LIT) are from various issues of the UNESCO STATISTICAL YEARBOOK, Paris.

Technical progress: 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 and sources are from GRAFF (1995).

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 labour 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'.

6 References

BARRO, Robert and J.W. LEE (1996), International Measures of Schooling Years and Schooling Quality, in: American Economic Review, Papers and Proceedings, Vol. 86: 218-223.

BENHABIB, Jess and SPIEGEL, Mark M. (1994), The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data, in: Journal of Monetary Economics, Vol. 34: 143-173.

CAMERON, Rondo (1993), A Concise Economic History of the World, 2. ed., New York: Oxford University Press.

CAMERON, Rondo, CRISP, Olga, PATRICK, Hugh T. and TILLY, Richard (1967), Banking in the Early Stages of Industrialization. New York: Oxford University Press.

CHICK, Victoria (1993), The Evolution of the Banking System and the Theory of Monetary Policy, in: Stephen F. FROWEN (ed.), Monetary Theory and Monetary Policy, London: Macmillan: 79-92.

DIAMOND, Douglas W. and DYBVIG, Phillip H., (1983) Bank Runs, Deposit Insurance, and Liquidity, in: Journal of Political Economy, Vol. 91: 401-419.

FRY, Maxwell (1995), Money, Interest, and Banking in Economic Development, 2nd ed., Baltimore: Johns Hopkins University Press.

GERSCHENKRON, Alexander (1962), Economic Backwardness in Historical Perspective. A Book of Essays, Cambridge: The Belknap Press of Harvard University Press.

GOLDSMITH, Raymond W. (1969), Financial Structure and Development, New Haven: Yale University Press.

GOLDSMITH, Raymond W. (1987), Premodern Financial Systems. A Historical Comparative Study, Cambridge: Cambridge University Press.

GRAFF, Michael (1995), Bildung und technischer Fortschritt als Determinanten wirtschaftlicher Entwicklung, Heidelberg: Physica.

HARBERGER, Arnold C. (1978), Perspectives on Capital and Technology in Less Developed Countries, in: M.J. ARTIS and A.R. NOBAY (eds.), Contemporary Economic Analysis, London: Croom Helm: 15-40.

HARBERGER, Arnold C. (1998), A Vision of the Growth Process, in: American Economic Review, Vol. 88: 1-33.

LEIBENSTEIN, Harvey (1989), Collected Essays, Vol. 2, X-Efficiency and Micro-Macro-Theory, Aldershot: Edward Elgar.

MANKIW, N. Gregory, ROMER, David and WEIL, David N. (1992), A Contribution to the Empirics of Economic Growth, in: Quarterly Journal of Economics, Vol. 107: 407-437.

MCKINNON, Ronald I. (1973), Money and Capital in Economic Development, Washington, D.C.: The Brookings Institution.

NEHRU, Vikram and DHARESHWAR, Ashok (1993), A New Database on Physical Capital Stock: Sources, Methodology, and Results, in: Revista de Análisis Económico, Vol. 8: 37-59.

HILDEBRAND, Bruno (1864), Natural-, Geld- und Kreditwirtschaft, in: Jahrbücher für Nationalökonomie und Statistik, Vol. II: 1-24.

KEYNES, John Maynard (1936), The General Theory of Employment, Interest, and Money, London: Harcourt Brace.

KRUGMAN, Paul (1996), Cycles of Conventional Wisdom on Economic Development, in: International Affairs, Vol. 72: 717-732.

LEVINE, Ross (1997), Financial Development and Economic Growth: Views and Agenda, in: Journal of Economic Literature, Vol. 35: 688-726

NORTH, Douglass C. (1990), Institutions, Institutional Change and Economic Performance, Cambridge: Cambridge University Press.

PATRICK, Hugh T. (1966), Financial Development and Economic Growth in Underdeveloped Countries, in: Economic Development and Cultural Change, Vol. 14: 174-199.

SALA-I-MARTIN, Xavier (1997), I Just Ran Two Million Regressions, in: American Economic Review, Vol. 87: 178-183.

SANDBERG, Lars G. (1978), Banking and Economic Growth in Sweden before Word War I, in: Journal of Economic History, Vol. 38: 650-680.

SCHUMPETER, Joseph (1911), Theorie der wirtschaftlichen Entwicklung, München: Duncker & Humblot.

SHAW, Edward S. (1973), Financial Deepening in Economic Development, New York: Oxford University Press.

SINGH, Ajit (1997), Financial Liberalisation, Stockmarkets and Economic Development, in: Economic Journal, Vol. 107: 771-782.

SOMBART, Werner (1916), Der moderne Kapitalismus, Band I: Die Vorkapitalistische Wirtschaft; Band II: Das europäische Wirtschaftsleben im Zeitalter des Frühkapitalismus, 2. Aufl., München: Duncker & Humblot; (1927), Der moderne Kapitalismus, Band III: Das Wirtschaftsleben im Zeitalter des Hochkapitalismus, München: Duncker & Humblot.

WILLIAMSON, Oliver E. (1985), The Economic Institutions of Capitalism, New York: Free Press.