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by

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and

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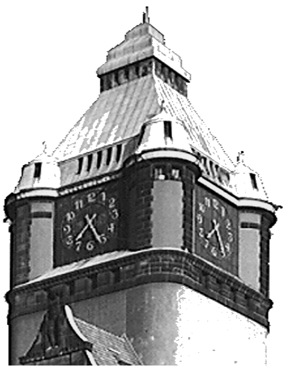

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Does Financial Activity Cause Economic Growth?

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Abstract: To clarify the causal links between financial activity and economic growth, three theoretical models are analyzed and a structural equation path models is estimated. In the modeling part, poverty traps result from large fixed costs or high proportions of real investment to run a financial sector. Human capital allocated to financial activities will improve long-run levels but may reduce growth rates in the short run. Empirically, based on data for 93 countries during the 1980–90 period, it is shown that during the 1980s finance was predominantly a supply-leading determinant of economic growth. Our analysis suggests, however, that this general finding cannot be confirmed for the less developed countries, thereby giving some support to the conclusions derived from the theoretical modeling.

JEL-Classification: 016, 042, E24

Keywords: financial development, economic growth, financial sector, causality

Does Financial Activity Cause Economic Growth?

1 Introduction

The causal relationships between financial activity and economic growth are still very far from being well understood. The literature concerned with these questions can be loosely grouped into the following four categories.

Firstly, financial activity and economic growth are seen as not causally related. In this view, the observable correlation between them is spurious: economies grew, and so did their financial sectors, but the two followed their own logic.

Secondly, financial activity is taken to be the result of economic activity. Financial development is thus demand-driven.[1] As the growing scale of economic activities requires more and more capital, institutional raising and pooling of funds for industry are substituted for individual fortunes and retained profits.

Thirdly, financial activity is seen as a determinant of economic growth. In this view, the line of causation runs from financial to real activity, where finance is one among other growth-inducing factors. Finance thus acts as a supply-leading growth device. Specifically, recent theoretical models give rationales for the assumption that well functioning monetary and banking systems and capital markets may be crucial for economic growth. 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]

Fourthly, some scholars see financial activity – at least occasionally – as an impediment to real economic activity. Thus, as in the previous case, the line of causation runs from finance to real activity; but the focus lies on the potentially destabilizing effects of financial overtrading and crises. Specifically, this view sees the financial system as inherently unstable. While some theoreticians are ready to include commercial banks into the sources of financial distress, most proponents direct their attention towards stock markets or international capital flows. Arguments supporting this view are given by a wide range of distinguished economists including – among others – KEYNES (1936), DIAMOND/DYBVIG (1983), SINGH (1997) and KRUGMAN (1996).

Unfortunately, there is no simple procedure to determine which view is empirically adequate, since the factors that govern economic growth admittedly include many others besides financial development; and interactions among them are likely to prevail. Moreover, the existing cross-country data on financial activity are plagued by poor reliability and dubious validity.

What are the lessons that may be learnt from economic history? 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.

1 The opposition 'demand-following' vs. 'supply-leading' finance was suggested by PATRICK (1966).

2 For a detailed survey cf. LEVINE (1997).

Moreover, financial development – as measured by GOLDSMITH'S financial interrelation 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.

In addition to this, the traditional financial sectors of the present LDC's are very similar to the financial systems 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 center, 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 might be a latent, but unexploited potential for growth.

2 Theoretical analysis

2. Modeling the financial-real development nexus

2.1 The role of physical capital in financial development

2.1.1 Investing in a financial sector

Within New Growth Theory type of models, the financial sector is often referred to as an immaterial production factor (e.g. ROMER 1993: 544). It improves the productivity of physical capital through the activities of the financial system. A key reference is PAGANO'S approach assuming that "a proportion 1-ϕ of the flow of savings is 'lost' in the process of financial intermediation" (PAGANO 1993: 614). Hence, ϕ is a measure of the efficiency of the financial sector. A second measure reflecting financial development is the productivity parameter A, as the financial sector helps improving the allocation of new investment. But PAGANO left open to discussion an explicit link between improving the productivity A and the necessity to invest real resources to improve financial efficiency ϕ. To close this link is the purpose of our first modeling approach.

We assume that the economy's relative effort, $f = (1 - \phi)$ to invest part of total investment I to the financial sector, will improve incrementally the production technology $A_t(K)$ for tomorrows output Y_{t+1} as follows: it affects depreciated, already existing technology $(1-\delta_F)A_{t-1}(.)$ and, in addition, enlarges capital productivity, both, for simplicity, in the same way by some function a_f:

$$A_t(K) = a_f((1-\delta_F)A_{t-1}(K)) \ + \ a_f(K). \qquad (1)$$

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.

Assuming a_f to be proportional to effort f, say $a_f = 1 - \phi$, and linear w.r.t. its impact on technology, and dividing by K, equation (1) may be written as

$$\begin{aligned} A_t &= (1-\phi) + (1-\phi)(1-\delta_F)\, A_{t-1} \qquad \textit{for } t \geq 2 \\ A_1 &= (1-\phi) \\ \textit{or} & \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (1') \\ A_t &= (1-\phi)\left(\sum_{i=0}^{t-1} \lambda^i\right) \qquad \textit{with } \lambda = (1-\delta_F)(1-\phi) \textit{ for } t \geq 1. \end{aligned}$$

Hence, the steady-state technology is characterized by

$$A^* = \lim A_t = (1-\phi)\,/\,(1-(1-\delta_F)(1-\phi)).$$

Together with

$$\begin{aligned} K_t &= I_t + (1-\delta)\, K_{t-1} \\ I_t &= \phi\, s\, Y_t \end{aligned} \tag{2}$$

for the growth rates γ_t of physical capital at time t and its steady-state value γ^* we get

$$\begin{aligned} \gamma_t &= \phi\, s\, A_{t-1} - \delta \\ \gamma^* &= \phi\, s\, A^* \quad - \delta . \end{aligned} \tag{3}$$

Given the technology in equation (1') in the presence of a financial sector to be constructed over time, what does this mean for a developing economy having the choice to stay at "cottage production", characterized by a simple AK technology, say

$$A'_t(K) = A'\, K \tag{3''}$$

resulting in capital growth $\gamma^o = \phi \;\; s\, A' - \delta$, or to switch to production in the presence of a financial sector to be built up over time as in equation (1')? Let us assume that the economy prefers higher steady-state growth rates to lower ones. Then, we get

Proposition1: Financial development, as characterized by equation (1'), is preferable to "cottage production" technology if and only if $A^* > A'$ or, for $A' = 1$; $1-\phi > 1-(1-\delta_F)(1-\phi)$.

In other words, allocating relatively high levels $1-\phi$ of investment to construct a financial sector may be necessary to assure that, in the steady state, real production will favor from the presence of a financial sector though, during the transition period, the efficiency of real production may suffer for some period, i.e.

$$\gamma_1 < \gamma_2 < \ldots < \gamma^o < \ldots < \gamma^* . \tag{4}$$

2.1.2 Big-push solution and poverty trap

In the previous section, we have demonstrated that financial development may improve macroeconomic production if the proportion of total investment the economy is willing to spend in building up the financial sector is not too small, independent of the level of capital available to the economy. The decision for financial development may become more complex if establishing a financial sector surmounts a large fixed cost (see, e.g., MURPHY/SHLEIFER/VISHNY 1989). Here, we assume that real production is characterized by a standard Cobb-Douglas technology but to guarantee the working of the financial sector the economy has to carry fixed costs $c \cdot L$ proportional to population size, or

$$F(K,L) \quad = -cL + A_F K^\alpha L^{1-\alpha} \tag{5}$$

otherwise, "cottage production" prevails:

$$F^o(K,L) \quad = A^o K^\alpha L^{1-\alpha} \qquad \text{with } A^o < A_F .$$

Dividing equation (5) by total population L and using $y = Y/L$, $k = K/L$ and $f(k) = F(k,1)$, this finally results in

$$f(k)/k \quad = -c/k + A_F k^{\alpha-1} \tag{5'}$$

Denoting by s the economy's savings rate and by $n + \delta$ the amount of capital growth necessary to outweigh population growth and depreciation, we get the economy's net capital growth rate γ as

$$\gamma = s(-c/k + A_F k^{\alpha-1}) - (n+\delta). \tag{6}$$

The shape of the functional relation (6) between capital k and growth rates γ (see figure 1) immediately implies, by standard arguments,

Proposition 2: If financial development implies a big-push technology, as characterized by equation (5), there exist two steady states $k_L^* < k_H^*$ *where* k_H^* is stable and $k_L^* < k_H^*$ *where* k_H^* is unstable:
for $k < k_L^*$: $\gamma_k < 0$, i.e. k declines continually otherwise, and for
$k \lessgtr k_H^*$: $\gamma_k \gtrless 0$, i.e. k converges to k_H^* .

This means that in the presence of a big push technology a developing economy will start financial development if its level k of capital is high enough, otherwise it will refrain from doing so as financial development would detrimentally exhaust the existing provision with physical goods. This result reflects in part why the evolutionary paths of developing countries differ in a wide range with regard to their timing in taking up the process of financial development.

2.2 The role of human capital in financial development

In this section, we materialize financial activities to become a production factor when investing in human capital. We extend the UZAWA-LUCAS model to permit the society to choose how much of the scarce resource 'human capital' will be allocated in form of working skills and how much in form of skills employed in the financial intermediation process. Both forms constitute input factors into real production. To simplify matters, our presentation of the model is based on the UZAWA-LUCAS model as described in BARRO/SALA-I-MARTIN (1995). We consider a Cobb-Douglas production function with three input factors, physical capital K with elasticity α, working skills H_R with elasticity β_1, and human capital H_F in the financial sector with elasticity β_2, where $\beta_1 + \beta_2 = 1 - \alpha$ and $u \cdot H = H_R + H_F$ is human capital invested in production and $(1 - u)\,H$ is human capital invested in education. Setting $u_1 = H_R/H$, $u_2 = H_F/H$ and $u = u_1 + u_2$, the economy is described by the process of real production, the accumulation of human capital and the household's utility function as follows

$$Y \quad = \quad C + \dot{K} + \delta K = AK^{\alpha}\,(u_1 H)^{\beta_1}\,(u_2 H)^{\beta_2} \tag{7.1}$$

$$\dot{H} + \delta H = B(1-u)H \tag{7.2}$$

$$U = \int_0^{\infty} u\,(C(t))\,e^{-\rho t}\,dt \tag{7.3}$$

where $u\,(C) = (C^{(1-\theta)} - 1)/\,(1 - \theta)$. Utility maximization of the household, as the producer of goods, leads to the Hamiltonian

$$J\,(\mu, v; u_1, u_2, C) = u\,(C)e^{-\rho t} + v\left[Y - C - \delta K\right] + \mu\,\left[B(1-u)H - \delta H\right] \tag{8}$$

where K, H, Y are state variables and u_1, u_2 and C are control variables. From $\partial J\,/\,\partial u_2 = 0$ for $u_1 = 1 - u_2$, we get

$$u_1 / u_2 \quad = \quad \beta_1 / \beta_2 \tag{9}$$

so that rewriting $u_1 = u\;\beta_1 / (\beta_1 + \beta_2), \quad u_2 = u\;\beta_2 / (\beta_1 + \beta_2)$

results in

$$\widetilde{Y} = \widetilde{A}\,K^{\alpha}\,(u\,H)^{(1-\alpha)} \quad where \quad \widetilde{A} = \; \beta_1^{\beta_1}\;\beta_2^{\beta_2}\,/\,(\beta_1 + \beta_2)^{(\beta_1+\beta_2)} \tag{7.1}$$

Replacing Y by $\widetilde{Y}$ in equation (8), the optimal solution of the resulting Hamiltonian $\widetilde{J}$ differs from the two-sector model of UZAWA-LUCAS only in replacing A by $\widetilde{A}$. Note that the switch from the two-sector technology (here, setting $\beta_2 = 0 = u_2$) to the three-sector technology evolves a transmission from real production efficiency level A to level $\widetilde{A}$ under financial development, where

$$\widetilde{A} \; < \; A. \tag{10}$$

Let $\omega = K/H$, $\chi = C/K$ and

$$\widetilde{z} := \widetilde{Y} / K = \widetilde{A}\;u^{(1-\alpha)}\;\omega^{-(1-\alpha)} \tag{11}$$

the average product of physical capital in real production. The steady-state values as well as the transition paths of the economy on the stable arm are well-known (e.g. BARRO/SALA-I-MARTIN (1995, chap. 5.2.2)). We restate the values in the steady-state

$$
\begin{aligned}
&\widetilde{\omega}^* = (\alpha\ \widetilde{A} / B)^{1/(1-\alpha)} \quad [\varphi + (\theta - 1)/\theta] \\
&\chi^* = B(\varphi + 1/\alpha - 1/\theta) \\
&u^* = \varphi + (\theta - 1)/\theta \\
&z^* = B/\alpha \\
&\gamma^* = (1/\theta)(B - \delta - \rho)
\end{aligned}
\tag{12}
$$

where $\varphi = [\rho + \delta(1-\theta)]/B\theta$.

Hence, only the relation ω between physical and human capital is affected by switching from the two-sector to the three-sector model with financial activities in addition to working skills as input factors. More precisely,

> **Proposition 3:** If financial development implies that human capital is allocated in form of working skills and financial-intermediation skills, as characterized by equation (7.1) then, in the steady state, human capital must be larger relative to physical capital than in case of a unique sector of human capital, i.e.

$$\widetilde{\omega}^* \quad < \quad \omega^* \tag{13}$$

The transitional dynamics for $\widetilde{z}, \widetilde{\chi}, \widetilde{u}$ *and* $\widetilde{\omega}$ are given by

$$\gamma_{\widetilde{z}} \quad = -(1-\alpha)\,(z - z^*) \tag{14.1}$$

$$\gamma_{\widetilde{\chi}} \quad = ((\alpha - \theta)/\theta)\ \ (\mathrm{z} - \mathrm{z}^*) + (\chi - \chi^*) \tag{14.2}$$

$$\gamma_{\widetilde{\mathrm{u}}} \quad = \mathrm{B}\,(\widetilde{\mathrm{u}} - \mathrm{u}^*) - (\widetilde{\chi} - \chi^*) \tag{14.3}$$

$$\gamma_{\widetilde{\omega}} \quad = (\alpha/\theta)(\widetilde{z} - z^*) - \gamma_{\widetilde{\chi}} + B\,(\widetilde{u} - u^*)\ . \tag{14.4}$$

We can now explore the transition dynamics of an economy having switched from a two-sector economy to a three-sector economy with skills differentiated for the working process and the process of financial intermediation. The economy we have in mind is a developing country characterized by scarce human resources (though the analysis below holds generally). In order to derive at well defined starting values of the adjustment process on the stable arm of the three-sector economy, we assume that the two-sector economy was already in its steady state at some time t_0 when it opts for financial development (for given values β_1 and β_2 such that $\beta_1 + \beta_2 = 1 - \alpha$. Furthermore, $\alpha < \theta$). The adjustment process, starting from $t_0 = 0$, to its new steady state can be characterized, according to equation (14), by noting that while switching to a technology with financial intermediation the system starts with

$$\widetilde{z}\ (0) < z^* \quad \textit{and} \quad \gamma_{\widetilde{z}} > 0 \ \text{ for all subsequent } t \tag{15.1}$$

The latter relation follows from (14.1). Similarly,

$$\widetilde{\chi}\ (0) < \chi^* \quad \textit{and} \quad \gamma_{\widetilde{\chi}} > 0 \ \text{ for all subsequent } t\ . \tag{15.2}$$

The first relation holds, because $\tilde{\chi}(0) \geq \chi^*$ together with $\tilde{z}(0) < z^*$ would imply $\gamma_{\tilde{\chi}} > 0$ from equation (14.2), hence $\tilde{\chi}(t) > \chi^*$ which contradicts the convergence property on the new stable arm. The stable path property implies, finally, $\gamma_{\tilde{\chi}} > 0$ (the stability conditions for equations (14) are intensively discussed in BARRO/SALA-I-MARTIN (1995:206-207)).

Similar arguments show that also the control variable u must drop down to reach the new stable path. Hence, on the stable arm, we have

$$\tilde{u}(0) < u^* \quad and \quad \gamma_{\tilde{u}} > 0 \text{ for all subsequent } t. \qquad (15.3)$$

Finally, we get

$$\begin{aligned} \tilde{\omega}(0) &= \omega^* > \tilde{\omega}^* \quad and \quad \gamma_{\tilde{\omega}} < 0 \\ \tilde{H}(0) &= H^*(t_0) \quad and \quad \gamma_{\tilde{H}} > \gamma^* \qquad \textit{for all subsequent } t. \\ \tilde{K}(0) &= K^*(t_0) \quad and \quad \gamma_{\tilde{K}} < \gamma^*. \end{aligned} \qquad (15.4)$$

As is well known, the dynamics for $\tilde{Y}(t)$ are more complex. If we characterize the starting position of a developing economy by scarce human resources relative to physical capital, i.e. $\tilde{\omega}$-values exceeding the new steady-state level $\tilde{\omega}^*$ quite considerably, this economy would realize very high real growth rates at the first instant, which continually decrease thereafter. In an intermediate period, real growth may become negative to be followed by growth rates approaching γ^*: figure 2 represents the dynamic processes, as considered here, graphically.

Summarizing, the adjustment path is characterized by immediate adjustments to a lower consumption level $\tilde{C}(0)$ and a higher fraction $(1-\tilde{u}(0))$ of human capital invested in human capital production. While physical capital will grow at lower levels, human capital accumulation is considerably stimulated to reach the new steady-state relation where, again, physical and human capital are growing at the same rate γ^*. Real production will – after a transition period of, maybe negative, growth – also adjust to the steady-state growth rate. As the points in time when developing economies decide to start with financial development vary considerably, the pattern of observed real growth rates may be quite dispersed. Economies having invested in financial development over a long period of time are more likely to reveal growth rates, at least for broad real output including GDP created for human capital accumulation, whose dynamics are mainly determined by the dynamics of u, the fraction of human capital used in production (for a more explicit discussion see BARRO/SALA-I-MARTIN (1995: 187)).

3 Empirical analysis

The objective of the following empirical cross-country analysis is to investigate the asserted causal relationship from financial development to economic growth in a large sample of countries (DC's as well as LDC's). To this end, a three-stage research strategy will be followed.

Following GRAFF (2000), the first step is to collect for a large sample of countries and various years different indicators for financial development (*FD*) that – as reliably as possible – capture 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/liberalization 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*-indicators suggested here rely on real inputs and, therefore, stand for a well-defined macro-economic concept. Accordingly, we consider them more adequate for investigations into the sources of economic growth than the *FD*-indicators suggested so far.
Moreover, while monetary indicators like M2/GDP are very hard to compare across time and space due to institutional diversity and change, our *FD*-variables are 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, our indicators may be assumed to capture very basic characteristics of an economy's structure. Consequently, the quantitative approximation of the notion 'financial development' suggested here is probably less endogenous to current economic activity than the traditional *FD*-variables.

The second step is to investigate the causal structure between financial and real activity. To this end, a two-wave path (LISREL) model with our indicators suggested here to constitute a 'latent' *FD*-proxy variable on the one hand and the log of per worker income *Y*/*L* (as a straight-forward proxy for the level of 'real' economic development or, if seen from the production side: labor productivity) on the other is estimated.[4]

The third step is to relax the equality-restriction for the structural parameters for different sub-samples that we define by *Y*/*L*. In this way, we shall be looking for potential structural breaks between DC's and LDC's of our sample

3.1 A new proxy for financial development

The construction of our new 'latent' 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. While this intention bears some resemblance to the core argument of transactions cost and institutionalist economics (cf. NORTH 1990, WILLIAMSON 1985), namely that aggregate transaction costs are very far from negligible and that financial institution 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. 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.[5]

The idea to measure the operating costs of a given financial system seems plain enough – why has this not been tried before?[6] Presumably, part of the answer may lie in the fact that no

4 Referring to structural modeling with LISREL, we methodologically depart from Graff (2000), where similar path analyses are conducted by OLS and TSLQ regression techniques.

5 It is not claimed that the traditional notion of financial depth is not useful, but the degree of monetization 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.

6 At least, to the best of our knowledge, there is no cross-country study other than GRAFF (2000) that has attempted to do this.

international statistics supply reliable and readily comparable data. The three indicators which we consider suitable for consideration, the share of the labor force employed in the financial system (EMPL), the share of the financial system in GDP (FINAN), and the number of banks and branches per worker (BANKW), 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 (normalized to labor force or GDP, respectively) by hand.

For a study of finance and development in a cross-sample of countries which intends to cover more than a very limited number of 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 'resources for finance'.

The procedure chosen here is to identify the common variance of the three indicators referring to the concept of 'latent' variables. If the operating costs of the financial system are reasonably well represented by such a latent variable, it can serve as a better proxy for *FD* than individual scores for a single indicator alone.[7]

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 for 1980 and 1990. Then, operational rules had to be formulated how to treat missing values.[8] Finally, the remaining data for 93 countries and five points in time were pooled into a two-wave panel and standardized.

3.2 A two-wave path (LISREL) model

Causality analysis continues to be an unresolved problem in econometrics; usually one will only detect correlation without empirical indication on cause and consequence (if there are any).[9] Our empirical analysis relies on a particular notion of causality, namely "*post hoc ergo propter hoc*", i.e. sequentiality is taken to imply causality. Though posteriority is not sufficient to prove causality, it certainly is – at least in most economic contexts – a necessary condition and therefore a reliable indicator for the possibility of a causal relationship.

The basic statistical intuition – path analysis with panel data – is established in biological research since the 30s, and sociologists have referred to it at least since the 60s (DUNCAN 1966, HEISE 1970). Economists, however, have concentrated more on time series based

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

8 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.

9 Earlier contributions are, therefore, rather skeptical about the possibilities of detecting causal relationships by means of quantitative analyses (e.g. GOLDSMITH 1969).

concepts of causality, so that applications similar to the one presented here are not yet common in the economic literature.[10] Some methodological remarks are therefore in order.

This section presents a structural equation (LISREL) path analysis with two variables, our *FD*-proxy and the log of per worker income ln (*Y*/*L*), both measured in 1980 and 1990. According to the basic assumptions underlying the LISREL approach, all causal relationships are assumed to be linear. The empirically observed covariance matrix will be disaggregated, accordingly. The causal relationship between financial and real development is given by the linear subsystem "structural equation model" of unobserved variables, as illustrated by equation (16). Thereby, the causing factors are the latent exogenous variables of the first observation period 1980 (Y/*L*1980 (= ξ_1), *FD*1980 (= ξ_2)), the depending variables are the latent endogenous variables of the second observation period 1990 (*Y*/*L*1990 (= η_1), *FD*1990 (= η_2)). The impact of other factors is assumed to be unpredictable and characterized by latent errors ζ_1 and ζ_2 or

$$\begin{pmatrix} Y/L1990 \\ FD1990 \end{pmatrix} = \begin{pmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{pmatrix} \begin{pmatrix} Y/L1980 \\ FD1980 \end{pmatrix} + \begin{pmatrix} \zeta_1 \\ \zeta_2 \end{pmatrix}. \tag{16}$$

The relationship between observed and unobserved variables is described by the two linear subsystems '*x*-measurement model' and '*y*-measurement model' (see equations 17 and 18). The observed indicators *x* (of ξ) and *y* (of η) are as defined above (cf. section 3.1) where δ and ε are measurement errors for *x* and *y*, or

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & \lambda_3^x \\ 0 & \lambda_4^x \end{pmatrix} \begin{pmatrix} Y/L1980 \\ FD1980 \end{pmatrix} + \begin{pmatrix} 0 \\ \delta_2 \\ \delta_3 \\ \delta_4 \end{pmatrix} \tag{17}$$

$$\begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & \lambda_3^y \\ 0 & \lambda_4^y \end{pmatrix} \begin{pmatrix} Y/L1990 \\ FD1990 \end{pmatrix} + \begin{pmatrix} 0 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{pmatrix} . \tag{18}$$

In the measurement model, the 'equal to 1' restriction of the respective first indicators of all four latent variables allows to measure the unobserved variables in the scale of the respective first indicator. In this specific context, we may think of subdividing our specific two-wave model into the following two subsystems: a univariate regression model for *Y*/*L* with error ζ_1, suppressing additional measurement errors ($\delta_1 \equiv 0$, $\varepsilon_1 \equiv 0$); and a three-indicator model for *FD*.

The random vectors ε, δ, ζ, ξ and η of the LISREL model are assumed to obey the following assumptions w.r.t. expectations *E* and covariance matrices *Cov*

[10] For an exception, see e.g. FOLLMER and KARMANN (1992)

$$
\begin{aligned}
&E(\varepsilon) = 0,\ \ E(\delta) = 0,\ \ E(\zeta) = 0;\ \ E(\xi) = 0,\ \ E(\eta) = 0;\\
&Cov(\zeta,\xi) = 0;\\
&Cov(\varepsilon,\xi) = 0,\quad Cov(\varepsilon,\eta) = 0;\\
&Cov(\delta,\xi) = 0,\quad Cov(\delta,\eta) = 0.
\end{aligned}
\tag{19}
$$

The first line states that error variables as well as latent variables – because of standardization – have zero mean. Zero correlation between latent exogenous variables and errors is necessary to get consistent estimators, as in the case of standard regression. Moreover, there is no correlation between the measurement errors ε and δ and the latent variables ξ and η. Between the error terms δ and ε, however, correlations are not ruled out *a priori*. In our specification, the δ errors of all three indicators of the latent variable *FD* are allowed to correlate with their respective errors ε of the lagged indicators. Precisely:

$$
\begin{aligned}
&\Theta^{\delta\varepsilon}_{2,6} = \mathrm{cov}(\delta_2,\varepsilon_2) && \text{is a free parameter,}\\
&\Theta^{\delta\varepsilon}_{3,7} = \mathrm{cov}(\delta_3,\eta_3) && \text{is a free parameter,}\\
&\Theta^{\delta\varepsilon}_{4,8} = \mathrm{cov}(\delta_4,\eta_4) && \text{is a free parameter,}\\
&\Theta^{\delta\varepsilon}_{\mathrm{i,j}} = 0 && \text{for } i \neq j \text{ otherwise } (1 \leq i,j \leq 8).
\end{aligned}
\tag{20}
$$

This assumption reflects the possible correlation between the measurement errors of the indicators EMPL80 and EMPL90, FINAN80 and FINAN90, as well as BNKW80 and BANKW90, respectively, as not being covered by the linear relationship of, say, '*FD*1980' and '*FD*1990 or '*Y*/*L*1990' in the structural model. For the sample containing the whole set of countries, no other relaxation's of the standard default values in the LISREL-8 version will be made. To compare the structural relationship of the financial-real-development nexus for sub-samples, here industrialized versus developing countries, however, we fix all λ coefficients in the subsamples to the values estimated for the whole sample set.

The two-wave model as specified by equations (16) to (20) is identified,[11] i.e. the vector θ can be uniquely inferred from the empirical covariance matrix *S*, formally $S = \sum(\theta)$ for one θ.[12]

Concerning the measurement model, we assume the loading factors for the lagged pair of any indicator to be identical. Hence we impose the identity restriction used in the context of time invariant parameters

$$
\Lambda^x \equiv \Lambda^y, \tag{21}
$$

i.e. $\lambda^x_3 = \lambda^y_3$ *and* $\lambda^x_4 = \lambda^y_4$. As the wave model is already identified without these two restrictions, assumption (21) does not destroy this identification and adds two degrees of

11 A formal proof for identification can be obtained from the authors upon request.

12 We submitted the hypothesis of time invariant parameters to a pretest for structural change which it passed without falsification.

freedom (*dg*), so that finally $dg = p \cdot (p + 1)/2 - q = (8 \cdot 9)/2 - 20 = 16$, where *p* is the number of observed variables and *q* is the number of parameters to be estimated.[13]

To estimate our two-wave model, we use the maximum-likelihood method. Its asymptotic properties rely on the assumption that, for the vector $Z = (x, y)^T$ of observed variables, the sample $Z_1,\ldots, Z_N$ ($n = 93$ countries) is independently, identically normally distributed with a positive-definite covariance structure Σ.

The (sequential) structure of causation reveals itself in the estimated elements of γ. If neither off-diagonal element 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 γ_{21} only implies unidirectional causation from *Y*/*L* to *FD*, which is consistent with the demand-following finance hypothesis, whereas significance for γ_{12} only implies unidirectional causation from *FD* to *Y*/*L*, which is consistent with supply-leading finance as defined by PATRICK (1966).

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_1 and t_2, 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. However, given the widespread prevalence of 'financial repression' and turbulence on financial markets due to the oil price shocks, the recycling of 'petro-dollars' and the resulting debt crises in the 1970's, we choose not to include observations for 1970 and 1975. Hence, we determine a fixed lag from 1980 to 1990. Accordingly, our statistical inference refers to the 1980's and generalization are – at least for the time being – restricted to this decade only.

With this qualifications of the nature of the following empirical work, let us proceed to the results.

The fitted values of the LISREL-two-wave-path-model specified in equations (16) to (21) are given in figure 3. For the overall 'goodness of fit' of our path model, the deviation of the empirical covariance matrix *S* from the estimated covariance matrix resulting from the imposed model structure $\Sigma\left(\hat{\vartheta}\right)$, can be evaluated by a χ^2-test $H_0: S = \Sigma\left(\hat{\vartheta}\right)$ versus $H_1: S \neq \Sigma\left(\hat{\vartheta}\right)$, giving in a test statistics of χ^2 = 20.3. With 16 degrees of freedom, this implies a *p*-value of .21, so that the assumption H_1 "all residuals in $S - \Sigma\left(\hat{\vartheta}\right)$ equal zero" cannot be rejected (an overall model fit is considered to be "good" for $p \geq 0.10$; cf. BOLLEN (1989: 266)). An alternative goodness of fit measures are the RMSEA (Root Mean Square Error of Approximation), which equals .031 for our model and should not exceed 0.05 to indicate a good fit (JÖRESKOG/SÖRBOM (1993)). Finally, LISREL's GFI (Goodness of Fit),

---

13 θ consists of the following 22 parameters: two λ, four γ, the free parameters of the covariance matrices Φ (three parameters) and Ψ (two parameters) for the latent variables and, for the indicators, the variances of δ and ε (six parameters) as well as thee error covariances according to (20).

measuring the share of variance/covariance terms in S that is explained by $\Sigma\left(\hat{\vartheta}\right)$, is .96, indicating as well that our model is very far from violating the empirical data.

Regarding the measurement model, the coefficients for our λ-loadings of FINAN and BANKW are close to one, and their t-statistics are highly significantly different from zero, thus giving support to our approach to proxy *FD* as a latent variable of three independently measured, but statistically intercorrelated indicator variables.

The estimates of our 'inner' structural model are crucial to detect (sequential) causal patterns. Here, a positive ($\hat{\gamma}_{12}$ = .18), and statistically highly significant (t = 3.66) path coefficient from *FD*1980 to *Y*/*L*1990 and, on the other hand a path coefficient from *Y*/*L*1980 to *FD*1990 which does not differ significantly from zero (t = –1.58) are consistent with uni-directional causality from *FD* to *Y*/*L*. Thus, our results point towards the conclusion that – at least in the 1980's and from a very global perspective of a large sample of countries – supply-leading finance may have prevailed, i.e. our model supports the supply-leading finance-hypothesis. If anything, the negative (but insignificant) point estimate for $\hat{\gamma}_{21}$ = –.09) may be interpreted to indicate financial 'saturation',[14] whereas demand-following finance would be reconcilable with a positive path only.

3.3 Looking for structural breaks between DC's and LDC's

While the empirical results derived above fit very well into the mainstream of the new empirical growth literature, our theoretical modeling in section 2 is inclined to make us suspicious about the stability of the overall results if the poorer countries are concerned. Therefore, our third and final empirical exploration will be to relax the equality-restriction and, accordingly, re-estimate a series of separate, non nested, two-wave path models for the same period between t = 1980 and t = 1990, but for three sub-samples of our total of 93 countries grouped by Y/L in 1985, resulting in a first group of 31 DC's, a second group of 31 intermediate countries, and a final group of LDC's. As elaborated in section 3.2, in order to maintain the comparability of the latent *FD* variables across groups and, thereby, the structural relationship reflected in the estimates for γ, we fix all λ coefficients to the values estimated for the whole sample set. The results for the off-diagonals of the inner model and the overall fit are as follows:

14 The negative path implies that higher per worker income in t = 1, ceteris paribus, will result in a decline of resources channeled into the financial sector in the period between t = 1 and t = 2 as measured by our latent *FD*-variables for 1980 and 1990.

group	supply-leading path	demand-following path	fit	($df = 18$)
31 DC's	$\gamma_{12} = 1.01$ (3.62)	$\gamma_{21} = -.12$ (–1.56)	$\chi^2 = 11.2$	$p = .88$
31 intermediate	$\gamma_{12} = 2.73$ (1.23)	$\gamma_{21} = -3.60$ (–.53)	$\chi^2 = 20.1$	$p = .29$
31 LDC's	$\gamma_{12} = .21$ (1.16)	$\gamma_{21} = .03$ (.66)	$\chi^2 = 42.1$	$p = .0011$

(*t*–values in brackets)

An inspection of the results reveals that the γ_{12} path (supply leading-finance) is highly significant in the DC group, whereas it is positive, but not significantly different from zero in the lesser developed sub-groups. On the other hand, the γ_{21} path (demand following-finance) is insignificant in all three groups; the point estimates are negative, however, in the two richer subgroups, but positive in the LDC sub-group. Consequently, the general picture is that though there are undoubtedly signs for supply leading finance; on a sub-group level of analysis, this general finding can be replicated for the DC's only. For the 62 poorer countries (roughly: the non OECD world) the standard errors are to large to allow statistical inference. If anything can be said at all, our statistical findings are reconcilable with multiple growth-causality regimes as well as with lack of any causation whatsoever; and signs for demand following-finance (albeit weak and far from conventional significance levels) are detectable among the poorest third of our sample only.

4 Conclusion

Our empirical results indicate that in the 1980's finance obviously mattered for growth. However, while causation ran 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 only), a split of our country sample into DC's and LDC's reveals that the finance-growth nexus is far from being a stable relationship. Specifically, while the results of the overall model can be reproduced in the DC's alone, no clear relationship can be found in the LDC subgroup. Our empirical results thus give some support to our theoretical modeling which sketches formal arguments for the possibility of non-linearities and poverty traps. While the relation between the degree of financial development and increases in output is quite stable and positive for economies having experienced financial development for a long period of time, this relation is vague for LDC's, as the widely dispersed observed growth patterns reveal. Our general conclusion is that proponents of financial development are probably right whenever they restrict their conclusions to developed market economies. For the less developed countries, however, considerably less confidence is advisable. Regarding the possibility of poverty traps as well as the demonstrated shakiness of the empirical regularities established for the DC's among the poorer countries of the world, a policy of financial development should be encouraged only after a careful evaluation with a result which makes it seem likely that – as far as the finance growth-nexus is concerned – a given country's economic system is functioning in a fashion similar to that of developed market economies.

Unfortunately, due to data availability, our framework presently does not allow statements about the 1990s. Hopefully, more evidence on the stability of the finance-growth nexus may be expected from new data, but at the present time we cannot give any empirical indications about possible shifts or reversals of causation that might be due to recent phenomena (financial liberalization and globalization of financial markets, growing numbers of active stock markets as well as the recent financial crises, to name just a few).

5 Appendix: sample, data and sources, figures

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), of countries with centrally planned economies through most of the period 1980–90, 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). The remaining total of countries numbers 93.

Y/L: Our proxy for real economic development is (the log of) per worker income. Data (real gross domestic product per worker) are from the PENN WORLD TABLES (Mark 5.6), revised December 1997, University of Toronto.

BANKW: The number of Banks and branches are counted from the corresponding editions of the BANKERS' ALMANAC AND YEARBOOK, London: Thomas Skinner; labor force data (for normalization) are from ILO and included in the PENN WORLD TABLES.

EMPL: The share of labor employed in the financial system is taken from various issues the ILO YEARBOOK OF LABOUR STATISTICS, 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)

FINAN: 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'.

Figure 1: Steady state and dynamics under big-push technology

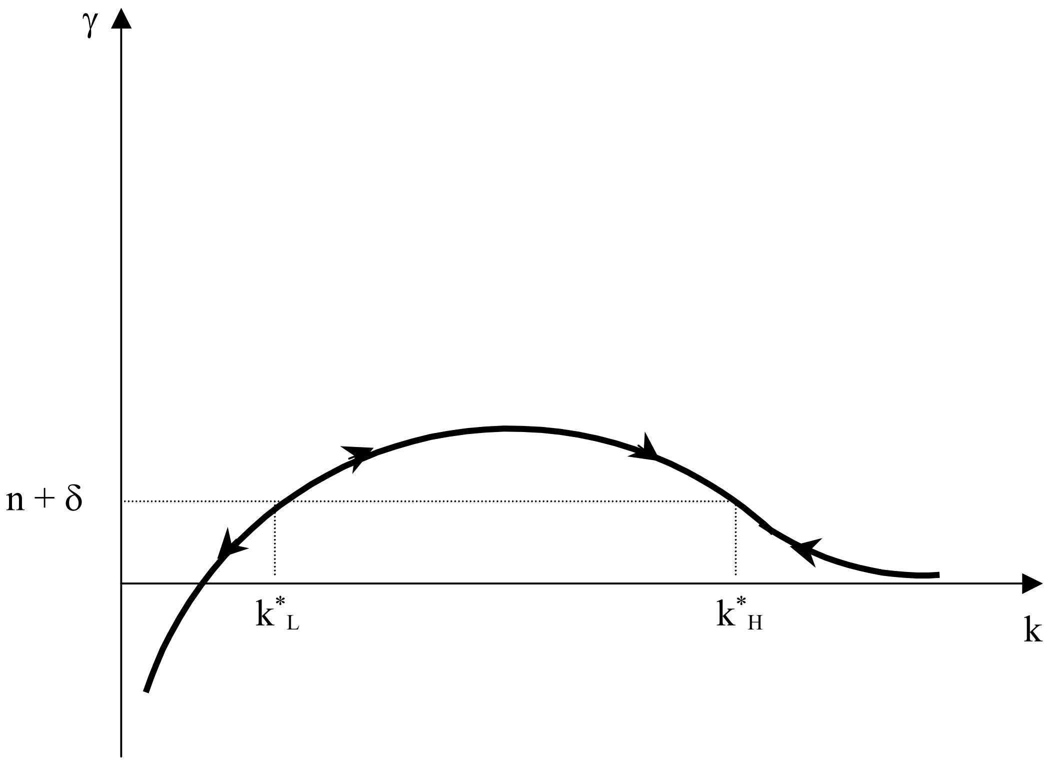


Figure 2a: Adjustment paths after switching to human resource differentiation

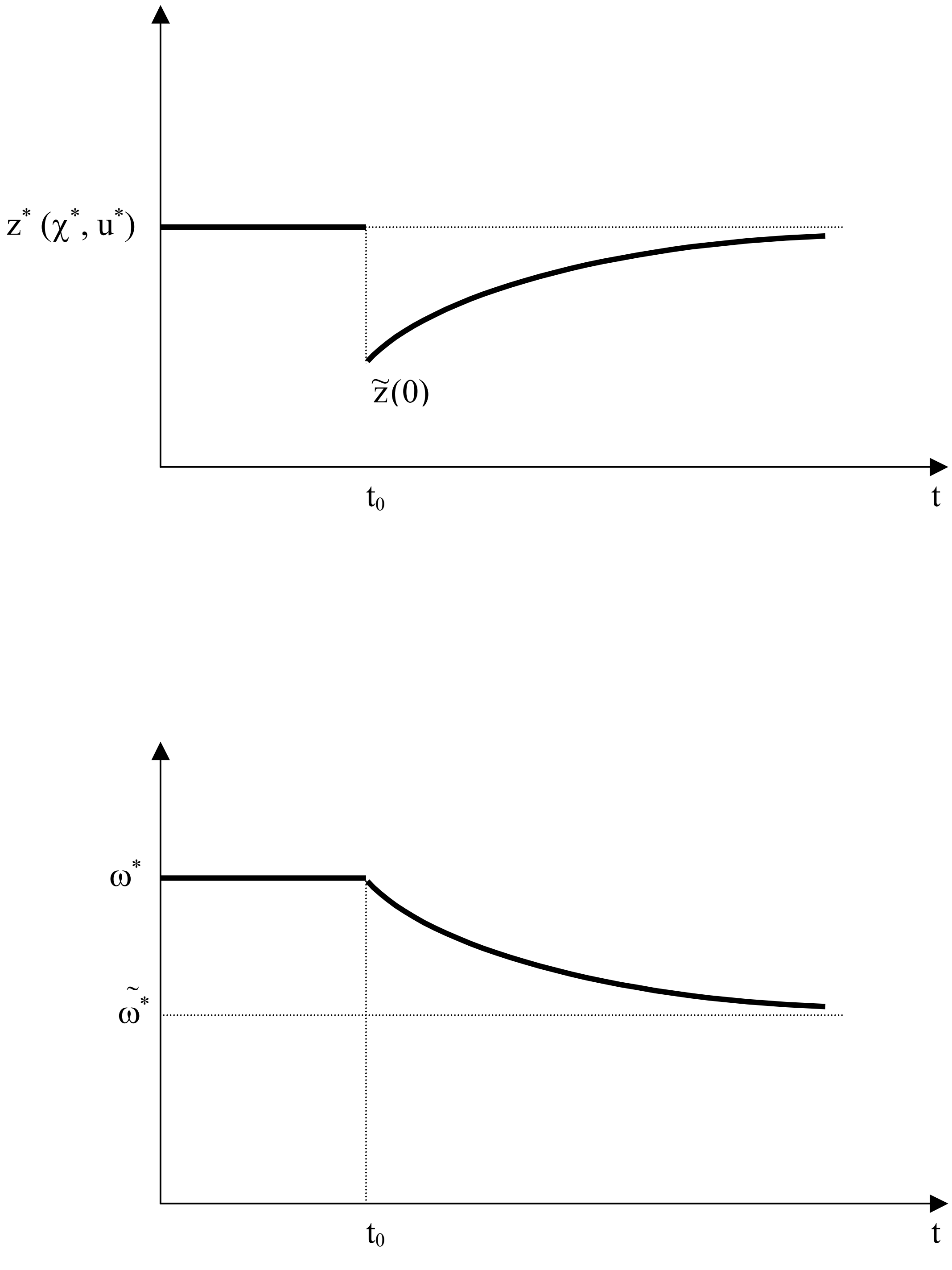


Figure 2b: Adjustment paths after switching to human resource differentiation

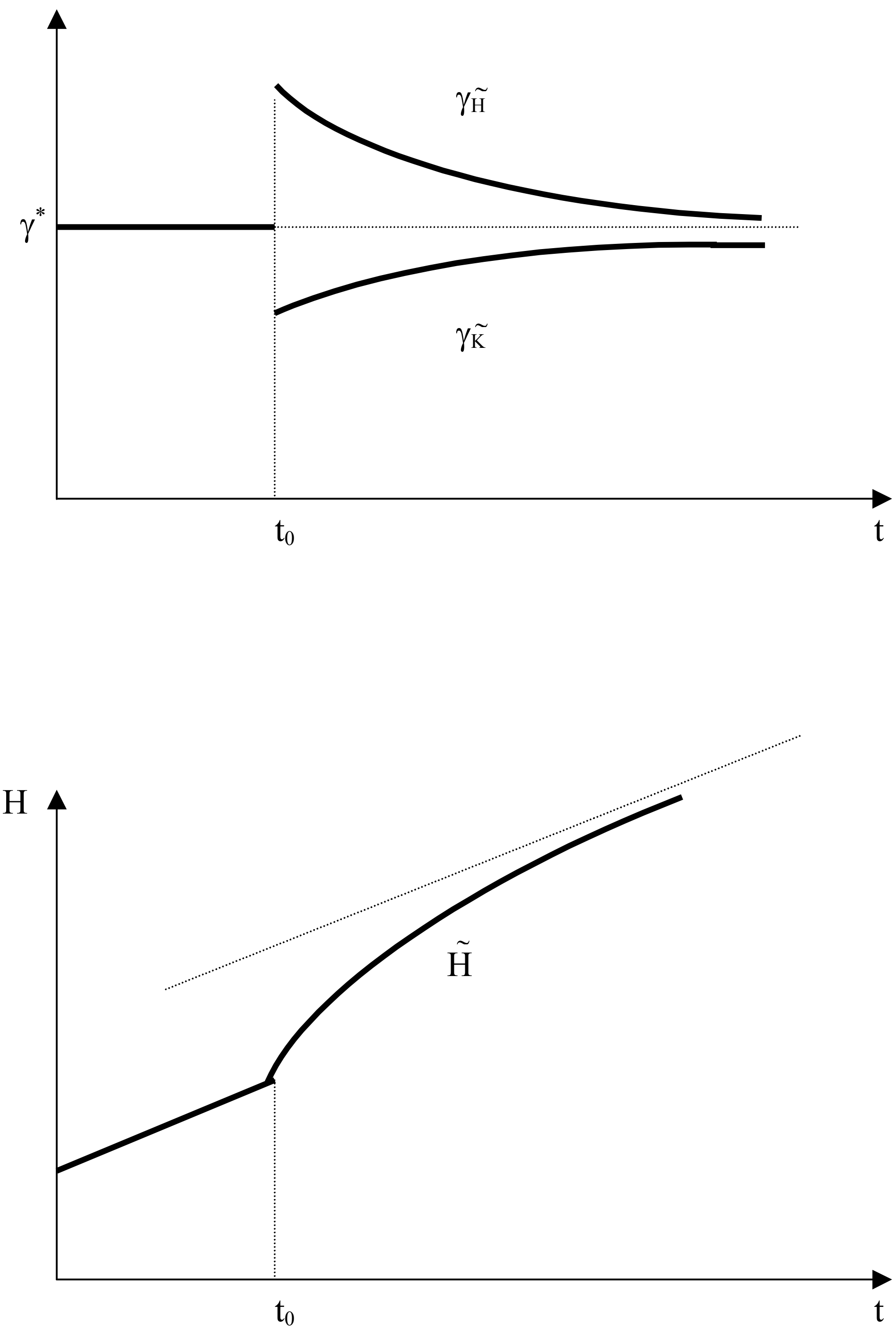
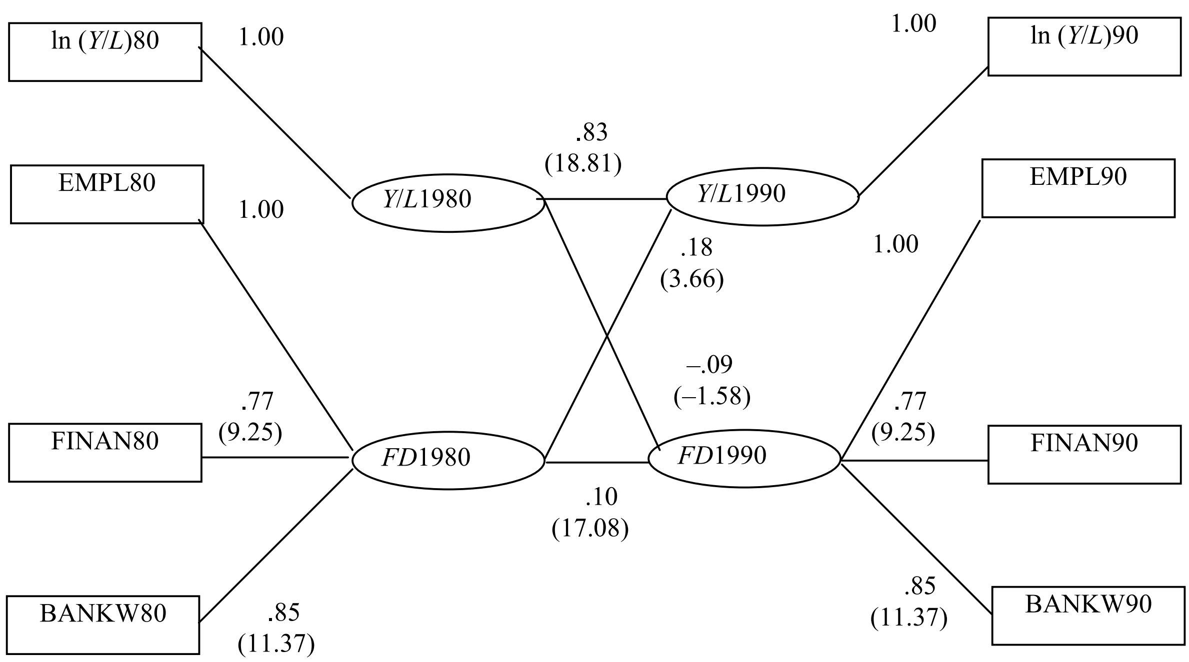


Figure 3: Path model, all countries (*n* = 93)



ML loadings and path coefficients, pseudo *t*-values (γ / σ) in brackets

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