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ABSTRACT

This paper examines panel evidence concerning the role of financial development in economic growth. I decompose the well-documented relationship between financial development and growth to examine whether financial development affects growth solely through its contribution to growth in factor accumulation rates, or whether it also has a positive impact on total factor productivity, in the manner of Benhabib and Spiegel (2000). I also examine whether the growth performances of a sub-sample of APEC countries are uniquely sensitive to levels of financial development. The results suggest that indicators of financial development are correlated with both total factor productivity growth and investment. However, many of the results are sensitive to the inclusion of country fixed effects, which may indicate that the financial development indicators are proxying for broader country characteristics. Finally, the APEC sub-sample countries appear to be more sensitive to financial development, both in the determinations of subsequent total factor productivity growth and in rates of factor accumulation, particularly accumulation of physical capital.

Key words: Growth, investment, human capital, financial development

JEL Classification: N10; N30

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1. Introduction

A large literature exists which documents a positive and robust relationship between financial development and economic growth for a cross-section of countries [e.g. King and Levine (1993a,b), Levine and Zervos (1993, 1998), Levine, Loayza and Beck (2000), and Beck, Levine, and Loayza (2000)]. There are a number of theoretical arguments for financial development to have an influence on economic growth rates. The first group of arguments focuses on market imperfections and borrowing constraints. These studies argue that such imperfections can inhibit the accumulation of physical and human capital [e.g. Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Banerjee and Newman (1991), and King and Levine (1993b)].

It has been also argued that these effects are particularly strong in poor economies or in economies with unequal income distributions [Galor and Zeira (1993), Benabou (1996), and Ljungqvist (1993)]. These studies suggest that financial backwardness may hinder the ability of agents to invest. This would be particularly true for, but not limited to, an agent's own human capital, as liquidity constraints may preclude an agent from investing in his own human capital at optimal levels. These studies also predict that the role of financial development in factor accumulation would be particularly strong for economies with skewed income distributions. The more skewed the distribution of income, the larger would be the share of the population unable to acquire financing for profitable investments in either physical or their own human capital.

The above studies identify reduced rate of physical and human capital investment as the channel through which imperfections in financial markets can hinder economic growth performance. However, it is also plausible that financial development can have a positive impact on economic growth through the enhancement of total factor productivity. For example, developed financial markets can lead to a superior allocation of factors across the economy [e.g. Greenwood and Jovanovic (1990)].

In a recent paper, Benhabib and Spiegel (2000) decompose the well-documented relationship between financial development and growth into these two components. They examine whether financial development affects growth solely through its contribution to growth in "primitives," or factor accumulation rates, or whether it also has a positive impact on total factor productivity growth. Their results suggest that the indicators of financial are correlated with both total factor productivity growth and investment. However, they find that the indicators that are correlated with total factor productivity growth differ from those that encourage investment. In addition, they find that many of the results are sensitive to the inclusion of country fixed effects, which may indicate that the financial development

indicators are proxying for broader country characteristics. This result conflicts with earlier studies that suggested a robust correlation between financial development and growth.

This paper repeats the Benhabib and Spiegel (2000) study, paying special attention to results concerning a sub-sample of APEC nation countries.[1] A well-known controversy during the recent Asian crisis concerned the role that total factor productivity growth had played in the remarkable growth experience of many Asian nations prior to the crisis. Papers such as Young (1992) argued that the rapid growth of many Asian nations prior to the financial crisis was due to remarkable rates of factor accumulation rather than total factor productivity growth. As such, they argued that a slowdown in the growth rates of these nations was inevitable as human and physical capital deepening reduced the marginal products of these factors to levels found in developed nations.

The decomposition exercise in this paper addresses a similar issue. If financial development only influences growth through the encouragement of greater rates of factor accumulation, then the contribution of financial development to economic growth must eventually diminish, as the increase in physical and human capital stocks exhaust the gains from financial development. However, if financial development directly enhances total factor productivity growth, it can increase the steady state rate of factor accumulation and thereby permanently increase economic growth rates.

The question of whether financial development plays a unique role in growth among the APEC countries is interesting precisely because of these questions raised concerning the importance of total factor productivity growth in the growth experience of Asian nations. The consensus that emerged after the Asian economic crisis was that the Asian nations had indeed experienced some degree of total factor productivity growth, but not as much relative to their overall growth experience as other developing nations. As a result, if financial development could be identified as a channel that had particular positive impact on total factor productivity growth in Asia, it would suggest that policies to encourage financial development in Asia could have a more permanent impact on growth performances than other potential growth-enhancing policies.

As in Benhabib and Spiegel (2000), I decompose the impact of financial development on economic growth into its impact on total factor productivity growth in standard growth accounting exercises, and its impact on the rate of growth in national factor stocks, or "primitives." The latter group includes standard factors of production, such as labor and physical capital, as well as human capital. If

[1] The APEC sub-sample includes Australia, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, the Philippines, South Korea, Taiwan, Thailand, and the United States. The sub-sample includes all APEC countries for which adequate data was available to construct the balanced panel below.

financial development influences growth primarily through its impact on factor accumulation, we should not expect indicators of financial development to appear in standard growth accounting exercises that already incorporate rates of factor accumulation as explanatory variables.[2]

I first introduce a variety of specifications for "base" growth equations. I then add the indicators of financial development to the base specifications and examine whether they contain any further explanatory power, with and without allowing for country-specific fixed effects. If financial development directly affects total factor productivity growth, it will enter into the growth accounting equations even after accounting for disparities in factor accumulation rates.

I then directly examine the impact of financial development on the rates of investment in physical and human capital, again with and without accounting for country fixed effects. To the extent that the financial development facilitates growth by encouraging factor accumulation, their impact will be observable in these direct specifications, even after accounting for country fixed effects. For example, Clague, et al. (1999) suggest that financial depth will be correlated with the strength of contract enforcement in an economy. As result, movements in indicators of financial depth may acually be proxying for other omitted variables, such as the strength of property rights.

Estimation is conducted through a panel generalized-method-of-moments (GMM) specification that pools cross-country and time series data to allow for the fixed-effects accounting discussed above. The panel specification also accommodates some response to the issue of simultaneity. As is well known, the potential endogeneity of factor accumulation rates, particularly physical capital accumulation rates, implies that an OLS treatment of the data may yield biased coefficient estimates [for example, see Benhabib and Jovanovic (1991)]. Benhabib and Spiegel (1994) demonstrate that the coefficient estimate bias on physical and human capital accumulation is likely to be positive. This is of particular concern to our study here. If our physical capital coefficient estimate is biased, it is likely that some of the coefficient estimates on the ancillary variables in the growth regressions will also be biased.

To diminish simultaneity bias problems, I follow a number of recent studies by using lagged values of endogenous variables as instruments for all of the right-hand-side variables in the growth regressions below.[3] I use the generalized method of moments (GMM) application because it does not rely on the presence of random individual effects.

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[2] Hall and Jones (1999) provide a similar decomposition, analyzing the impact of social infrastructure on levels of output per worker.

[3] For example, see Barro and Lee (1993), Caselli, et al (1996), Easterly, et al (1997), Benhabib and Spiegel (2000), and Levine, et al (2000).

The use of a panel sample of indicators of financial development is likely to provide a significant increase in information relative to a simple cross-sectional study. Benhabib and Spiegel (2000) show that there is a lot of variability across time in financial development measures, in addition to the cross-country variation that would be available in simple cross-sectional studies. As such, a panel specification provides more information than would be available from a simple cross-sectional study. Moreover, a panel specification also allows the consideration of the robustness of the performance of the financial variables to country-specific fixed effects.

I examine the distinctions in the entire APEC group, rather than a smaller subset, for two reasons: First, using the entire group increases the sample size, which should enhance the quality of estimation. Second, as the APEC group discusses policy issues for the group as a whole, some understanding of any uniqueness of the group would have relevance. Nevertheless, the APEC nations are a very heterogeneous group, and I demonstrate below that in terms of general characteristics they do not appear notably different than the rest of the world.

The results demonstrate that indicators of financial development are correlated with both total factor productivity growth and investment. However, the indicators of financial development that are correlated with total factor productivity growth differ from those that encourage investment. In addition, many of the results are sensitive to the inclusion of country fixed effects, which may indicate that the financial development indicators are proxying for broader country characteristics. Finally, there is a strong indication that the APEC nations in the sample are more sensitive to levels of financial development than the rest of the sample in both facilitating increases in total factor productivity and the enhancement of factor accumulation rates.

This paper is divided into five sections. The following section discusses the methodology used in the paper and introduces the "base" growth accounting specifications. Section three discusses the results from the growth accounting exercises. Section four examines the determinants of rates of physical and human capital accumulation. Section five concludes.

2. Methodology

2.1 Data

The data set is grouped into balanced panels of five-year periods from 1965 through 1985. Details concerning the data set are contained in the data appendix. Data for PPP-adjusted income and labor force participation were obtained from the Summers-Heston Data set, version 5.6. Human capital,

which is proxied by average years of schooling in the population above 25 years of age, was obtained from the updated version of the Barro-Lee (1993) data set.[4] Constant dollar estimates of physical capital stocks in local currencies based on a 4 percent decay rate were obtained from Dhareshwar and Nehru (1993).

However, efforts to convert the local currency capital stock estimates into common currency estimates by deflating with nominal exchange rates yielded implausible results due to deviations from purchasing power parity, particularly during the early 1980's period of U.S. dollar appreciation. Instead, I used the conversion method in Benhabib and Spiegel (2000). This method uses local currency GDP levels, also calculated by Dhareshwar and Nehru, to construct unit-free capital-output ratios. PPP-adjusted estimates of output levels obtained from the Summers-Heston data set are then used to construct "PPP-adjusted" capital stock estimates according to the formula[5]

$$K_{it} = \left(\frac{K_{it}^{DN}}{Y_{it}^{DN}} \right) Y_{it}^{PPP}, \qquad (6)$$

where K_{it}^{DN} and Y_{it}^{DN} represent real capital stocks and real gross domestic product in country i in period t in constant 1987 dollars from the Dhareshwar and Nehru data set and Y_{it}^{PPP} represents real gross domestic product of country i in period t, adjusted for purchasing power parity, obtained from Penn World Tables, version 5.6.

Indicators of financial development were obtained from King and Levine [(1993a) and (1993b)]. The first variable is *DEPTH,* a proxy for the overall size of the formal financial intermediary sector, measured as the ratio of liquid liabilities of the financial sector to GDP.[6] The second indicator is *BANK,* the ratio of deposit money bank domestic assets to deposit money bank assets plus central bank domestic assets. King and Levine (1993a,b) introduce this variable to emphasize the risk-sharing and information services stressed in their theory that banks are most likely to provide. The third variable is

[4] Other studies [Hall and Jones (1999), Klenow and Rodriguez-Clare (1997)] adjust the years of schooling measure using the Mincer (1974) estimates of the values of various years of schooling in terms of increased wages. We do not follow this procedure, as it is understood that such estimates only capture pecuniary, rather than social, returns to education [see Mankiw (1997)].

[5] The Penn World Tables provides some direct estimates of PPP-adjusted capital stocks based on PPP-adjusted investment rate estimates. However, these are only available for a small set of relatively developed countries over a short time period.

[6] King and Levine (1993a) use M3 as a proxy for liquid liabilities when available, and M2 when M3 was unavailable. As in Benhabib and Spiegel (2000), I use M2 throughout, which is available for all countries.

PRIV/Y, the ratio of claims on the non-financial private sector to GDP, which indicates the share of credit funneled through the private sector.

Financial development is likely to be endogenous with respect to current income levels and investment rates [e.g. Greenwood and Jovanovic (1990)]. To address these endogeneity issues, I use beginning-of-period values of the indicators of financial development. Nevertheless, to the extent that financial markets may develop in anticipation of future investment and growth, simultaneity issues may arise in the analysis.

A cursory first-hand look at the data can be accomplished by comparing the proxies for financial development with labor productivity growth over the entire twenty-year sample. Figure 1 compares labor productivity growth from 1965 to 1985 with initial *DEPTH*. It can be seen that there is a positive but weak relationship for the entire sample. A univariate regression slope of 0.061 is drawn in. This estimate is actually insignificant in OLS estimation. Figure 1 also compares the relationship between initial financial depth and labor productivity growth for the 13 APEC nations in the sample. Here, the estimated slope is actually negative, at –0.018, but also very insignificant.

Figure 2 compares the twenty-year growth experience to the *BANK* variable, the measure of the share of domestic assets in the banking system. The slope coefficients are again very close to zero and highly insignificant for both the full sample and the APEC countries.

Finally, Figure 3 compares the twenty-year growth experience to the *PRIV/Y* indicator of financial development. Here the relationship is more positive, with a coefficient point estimate of 0.086 for the full sample and 0.139 for the APEC nations. Nevertheless, both relationships are insignificant at standard confidence levels.

The raw data therefore fail to demonstrate much of a relationship at all between initial financial development levels and labor productivity growth. This is surprising in light of the extensive evidence in favor of such a relationship cited above. However, a formal model specification is needed for a proper test of the relationship.

2.2 Base Model Specification

I consider two alternative specifications for a base model of economic growth: The first specification would be associated with the standard neoclassical growth model with human capital added as a factor of production, as in Mankiw Romer and Weil (1992). Under this specification, the income of country i in period t, Y_{it}, will be a function of labor, L_{it}, physical capital, K_{it}, and human

capital, H_{it}.[7] Adopting a Cobb-Douglas technology, $Y_{it} = A_{it} L_{it}^{a} K_{it}^{b} H_{it}^{g} e_{it}$, where ε_{it} represents in i.i.d. disturbance term, and taking log differences, the specification follows:

$$\Delta y_{it} = \Delta a_{it} + \alpha \Delta l_{it} + \beta \Delta k_{it} + \gamma \Delta h_{it} + e_{it} \qquad (1)$$

where lower-case letters represent logs and $\Delta x_{it} = \log X_{it} - \log X_{it-1}$ and $e_{it} = \log e_{it} - \log e_{it-1}$.[8]

The second specification I consider is an endogenous growth specification, similar to that considered in Benhabib and Spiegel (1994). In this model, the growth rate of total factor productivity depends upon both the current level of human capital as well as an interactive term with the disparity of technology levels from the "leader country," i.e. that country which has the maximum level of initial TFP in the world. This specification allows the possibility of "catch-up," or technology diffusion across countries, as in Nelson and Phelps (1966).

I adopt the Cobb-Douglas technology, $Y_{it} = A_{it} L_{it}^{a} K_{it}^{b} v_{it}$, where v_{it} represents an i.i.d. disturbance term and the following structural specification for the rate of TFP growth

$$\Delta a_{it} = c + g h_{it} + m\left[\frac{h_{it}(y_{maxt} - y_{it})}{y_{it}}\right] + ft + qi \qquad (2)$$

where y_{maxt} represents the total factor productivity of the "leader nation," approximated in our sample by output per worker in the country with the greatest level of output per worker, and t and i represent time and country-specific fixed effects. Under this specification, the level of human capital in a nation, rather than its growth rate, affects the growth of income.

This leads to the following growth specification:

$$\Delta y_{it} = c + (g - m) h_{it} + m\left[\frac{h_{it} y_{maxt}}{y_{it}}\right] + a \Delta l_{it} + b \Delta k_{it} + ft + qi + u_{it} \qquad (3)$$

where $u_{it} = \log v_{it} - \log v_{it-1}$.

[7] This specification would also be consistent with an "AK-type" endogenous growth model if the coefficients on human and physical capital sum to one.

[8] Note that the above specification does not include initial income since it already incorporates capital accumulation rates directly.

The coefficient *m* is predicted to be positive, reflecting the positive interaction between the amount of technology adoption a country can conduct, which is an increasing function of its degree of relative backwardness, and its capacity to adopt technology, which is an increasing function of its human capital stock. g is also predicted to be positive. It reflects the importance of human capital as a source of technological innovation [Romer (1990)]. However, the coefficient on h_{it} is of ambiguous sign, depending on the relative magnitudes of *g* and *m*.

I examine the performance of the two "base regressions" with and without country-specific fixed effects. A number of recent studies [Knight, et al (1993), Islam (1995), Caselli, et al (1996), and Benhabib and Spiegel (2000)] have used such fixed effects to capitalize on the information available through the full panel of cross-country data by adjusting for country-specific characteristics which are constant across time. In particular, our fixed effects may be associated with technological differences that go beyond the choice of technique based on the availability of human or capital resources. Alternatively, they may reflect other country-specific factors that we have not yet properly identified.

Finally, as in Mankiw, Romer and Weil (1992), I also constrain the factor coefficients to levels consistent with constant returns to scale. In the case of the neoclassical model [equation (1)], this corresponds to the restriction $\alpha + \beta + \gamma = 1$. In the endogenous growth specification [equations (3)], this corresponds to the restriction $\alpha + \beta = 1$.

I estimate the growth regressions using generalized method of moments (GMM) to account for the endogeneity of physical capital accumulation. This methodology has been used in a number of panel growth regressions, including Caselli, et al (1996) and Easterly, et al (1997), following techniques advanced by Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991). Essentially, consistency of the estimators under GMM requires the assumption that all factors except physical capital accumulation are strictly exogenous, while physical capital is only weakly exogenous. For example, for equation (1) I require $E(\Delta k_{it} e_{is}) = 0$ for all $s > t$.

Nevertheless, even after accounting for the endogeneity of physical capital accumulation, the assumptions required for the estimation method to be valid are not innocuous. For example, a number of studies have argued that the financial development indicators will be dependent on rates of income growth [Levine (1999)]. I therefore test the validity of the instruments by first testing for serial correlation in the residuals, and then conducting the Sargan test of the over-identifying restrictions suggested by Arellano and Bond (1991).

I then consider whether financial development plays a role in the determination of economic growth rates. Except for the backwardness variable considered in the endogenous growth specifications, the above models place no structure on the determinants of TFP growth. To consider the role of financial development in TFP growth, I add the indicators of financial development discussed above to the base growth specifications.

3. Growth Accounting Results

3.1 Base model specification

Results for the base growth regressions, obtained through generalized methods of moments (GMM) estimation are displayed in Table 2. The results for the neoclassical growth model [equation (1)] and the endogenous growth model [equation (3)] are displayed with and without the inclusion of country-specific fixed effects.[9] All of the specifications also include time dummies to account for global shocks over time.

Overall, the significance of rates of accumulation of physical capital and labor are very robust, both with and without the inclusion of fixed effects, although the labor coefficient is insignificant in the presence of fixed effects. In addition, it appears that the model specification does not have a large impact on the factor share estimates. However, the inclusion of fixed effects does influence the coefficient values. Without fixed effects, the coefficient point estimate for physical capital accumulation is around 0.62, while with the inclusion of fixed effects, the coefficient rises to 0.91 in the neoclassical specification and 0.74 in the endogenous growth specification. Of course, the labor share estimate exhibits an opposite decline.

The neoclassical specification does most poorly in motivating a role for human capital accumulation. Human capital accumulation enters very insignificantly with a point estimate close to zero. The endogenous growth specification results do suggest a role for human capital in facilitating technological catch-up, but even here the coefficient estimates on levels of human capital are mixed depending on the presence or absence of fixed effects. This result is not surprising given the ambiguity about the predicted coefficient sign in the theory above, depending on the relative importance of technological innovation and catch-up.

[9] Estimates of the fixed effect coefficients are available upon request.

Table 1 also includes the test results for serial correlation and the Sargan test of the over-identifying restrictions. The Sargan tests determine the validity of the instruments in the absence of first-order serial correlation.[10] In all specifications, I fail to reject the absence of serial correlation, which allows us to use the Sargan test. The results of this test fail to reject the validity of the over-identifying restrictions.

3.2 Financial Variables Added to Growth Specifications

Table 3 reports the results for adding the measures of financial development to the neoclassical base specification without the inclusion of fixed effects. The base growth specification results are quite similar to those without the inclusion of the financial variables. In particular, the ΔH_{it} variable is again very insignificant, casting doubt on the importance of human capital in the textbook neoclassical specification.

The financial variable results demonstrate that the *DEPTH* and *PRIV/Y* measures do enter significantly positive, suggesting that these measures of financial development do facilitate economic growth, even after accounting for factor accumulation rates. However, none of the APEC variables are significant, indicating that there is nothing particularly unique about the relationship between financial development and growth among the APEC countries in the sample.

Table 4 reports the results for the neoclassical base growth model with fixed effects added. Here, the coefficient estimates for the factor shares are quite sensitive to the inclusion of the financial development indicators. Nevertheless, the poor performance of the human capital specification continues to be robust.

In terms of the financial variables themselves, none of the variables enters significantly for the entire sample. However, the interactive APEC dummy is positive and significant for the *DEPTH* variable. This suggests that after controlling for country fixed effects, the relationship between financial depth and growth is particularly strong for the APEC nations in the sample.

Table 5 adds the financial development indicators to the endogenous growth specification without the inclusion of country fixed effects. The factor accumulation variables are again significant, with an increase in the average estimated labor share for approximately 0.39 to 0.43. The catch-up terms again failed to enter significantly. It can be seen that the *DEPTH* and *PRIV/Y* variables enter positively

[10] Since Arellano and Bond (1991) difference the data, the validity of their Sargan test requires the absence of second-order serial correlation. However, I do not difference the data to allow comparisons of specifications with and without fixed effects. The reported first-order serial correlation test is therefore valid.

and significantly at a five-percent confidence level, while the *BANK* variable is insignificant. As in the case of the neoclassical specification, the APEC interactive variables fail to enter significantly, suggesting no distinct relationship for the APEC sub-sample.

Table 6 adds country fixed effects to the specification. Interestingly, the *DEPTH* variable no longer enters significantly, but the interactive *DEPTH*APEC* variable does. This provides some indication that the APEC sample does have a distinct reliance on financial depth after accounting for country fixed effects. The *PRIV/Y* variable again enters significantly, but not with the introduction of the interactive APEC variable.

In summary, the results provide some evidence that a subset of the indicators of financial development have an influence on growth rates even after accounting for differences in rates of factor accumulation. As such, these indicators would be interpreted in the context of the model specifications above as having a positive impact on total factor productivity. The indicators that entered significantly were the *DEPTH* and *PRIV/Y* variables. However, with the inclusion of country fixed effects, the *DEPTH* variable was not significant on its own in either the neoclassical or endogenous growth specifications.

Nevertheless, the interactive *DEPTH*APEC* variable did enter with fixed effects included in both the neoclassical and endogenous growth specifications. This was the only case in which the data suggested a special role for financial development in total factor productivity growth for the APEC sub-sample. The *PRIV/Y* variable was also not robust to the inclusion of country fixed effects under the neoclassical specification, and was not robust to the introduction of the fixed effects and the interactive APEC variable in the endogenous growth specification.

4. Impact of financial development on factor accumulation

The mixed results for financial development in the growth accounting regressions may be considered surprising in light of the strong evidence of a positive relationship between financial development and economic growth in the literature. However, rather than facilitating total factor productivity growth, financial development may encourage factor accumulation. In this section, I examine this possibility by regressing factor accumulation rates on the indicators of financial development listed above. As in the growth regressions, I introduce the financial development indicators into the specification one at a time. As the independent variables in this specification are all pre-determined, I use ordinary least squares estimation.

4.1 Physical Capital Accumulation

Table 7 reports the results of regressing ratios of investment in physical capital to income on the fianncial development indicators without the introduction of country fixed effects. I find a strong positive and robust relationship between all of the indicators of financial development and physical capital investment rates. Moreover, the *DEPTH*APEC* and *PRIV/Y*APEC* interactive variables are positive and significant as well, indicating that the APEC countries in the sample are particularly dependent on financial development for their rates of physical capital accumulation.

Table 8 repeats the exercise with the inclusion of dummies for country fixed effects. As in the growth regressions above, the performance of the financial indicators deteriorates, suggesting that to some extent indicators of financial development are proxying for a broader set of country characteristics that are conducive to enhancing economic growth. The *DEPTH* and BANK variables fail to enter significantly, while the *PRIV/Y* variable actually enters significantly with the wrong sign when the interactive APEC variable is introduced. Nevertheless, the interactive *DEPTH*APEC* and *PRIV/Y*APEC* variables are robust to the inclusion of country fixed effects, indicating again that there is a special dependence on financial development as measured by these variables on rates of physical capital accumulation among the APEC nations in the sample.

4.2 Human capital accumulation rates

I next turn to investment in human capital. I interpret the investment in human capital as the change in the log of average years of schooling in the labor force, Δh_{it}. However, since the potential years of schooling one can attain is censored from above, I include the initial years of schooling in the specification. I expect a negative coefficient on initial years of schooling.

The results for human capital accumulation without the inclusion of country fixed effects are reported in Table 9. h_{it} enters significantly with its expected negative sign. However, the performance of the financial variables is weaker than in the physical capital regressions. *BANK* enters significantly with the correct sign, but *DEPTH* and *PRIV/Y* are both insignificant. The interactive APEC variables *APEC*DEPTH* and *APEC*BANK* also enter positively and significantly, indicating a special relationship between financial development and human capital accumulation rates among the APEC countries.

Table 10 repeats the exercise with the inclusion of country fixed effects. The *DEPTH* and *BANK* variables both enter significantly positive. However, none of the interactive APEC variables are significant after accounting for country fixed effects. The *PRIV/Y* variable is also insignificant.

5. Conclusion

It is commonly believed that financial development plays an important role in facilitating economic growth. However, a simple correlation between initial levels of financial development and subsequent growth performance fails to reveal much of a pattern at all in a large cross-section. Nevertheless, after accounting for other cross-country differences in a standard formal growth model, one can find evidence that financial development has a positive impact on both total factor productivity growth and rates of factor accumulation.

This paper pursued such a path by repeating the empirical methodology used in Benhabib and Spiegel (2000). Indicators of financial development were first introduced into a growth specification to examine whether financial development facilitated total factor productivity growth, and then directly into regressions of rates of factor accumulation.

The results demonstrate that different types of financial development are important for different channels of economic growth. Without accounting for country-specific fixed effects, I find that the liquidity measure of the ratio of financial assets of the private sector to GDP, *PRIV/Y,* significantly enhance rates of total factor productivity growth. However, the liquidity measure is not robust to the inclusion of country-specific fixed effects.

I found much stronger results concerning the importance of financial development for physical capital accumulation rates. Without accounting for country-specific fixed effects, all of the financial development indicators were shown to significantly increase the rates of physical capital accumulation. However, even here there was some lack of robustness to the inclusion of fixed effects. With country fixed effects included, only the proxy for the share of domestic assets mediated by the banking sector, *BANK,* remained robust.

The results for human capital accumulation rates were similar. Only the *BANK* variable entered as a significant predictor of rates of human capital accumulation, and it was robust to the inclusion of country-specific fixed effects. The *PRIV/Y* variable also entered positively into the determination of rates of human capital accumulation after accounting for country-specific fixed effects.

The lack of robustness of the financial variables to the introduction of country fixed effects raises the issue that the financial variables may in fact be proxying for a number of other factors that are correlated with financial development. To some extent, then, the country fixed effects results cast doubt on a special role for financial development in enhancing economic growth rates.

I also examined whether the relationship between financial development and economic growth was unique for the subset of the nations in the sample that were APEC countries. I did find evidence that the APEC nations were more dependent on financial development than the rest of the sample. The APEC countries were significantly more dependent on the financial depth measure for total factor productivity growth than the rest of the sample after accounting for country-specific fixed effects in both the neoclassical and the endogenous growth specifications.

These countries were also found to be particularly sensitive to financial development in the determination of rates of physical capital accumulation. Both the measure of financial depth and the ratio of financial sector claims on the private non-financial sector to GDP entered significantly positive and were robust to the inclusion or exclusion of country-specific fixed effects in the specification.

Finally, the financial DEPTH and BANK variables were both found to be significant predictors of rates of human capital accumulation without accounting for country-specific fixed effects, although neither of these results were robust to the inclusion of fixed effects.

The relatively positive results for the unique relationship between financial development and growth were somewhat surprising, given the extensive heterogeneity in the set of APEC nations in the sample. These results suggest that while financial development appears to be generally beneficial to economic growth, there should be a particular effort to encourage financial development within the APEC nations. The positive role for financial depth in encouraging total factor productivity growth also suggests that the payoffs from increased financial development may have long-lasting effects on steady-state rates of economic growth, rather than only temporarily increasing rates of physical capital accumulation.

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Data Appendix:

Data is a balanced panel of five year periods from 1960 through 1985.

For each regression, if any of the observations from the set of independent and dependent variables were missing, we excluded the country that contained the missing data.
For each regression, the 1960 observation for each country was deleted.

Depth is average from time *t*-4 to *t* of M2/GDP. Source. IFS, lines 34 + 35/line99b.

Bank is average from time *t*-4 to *t* of deposit money bank domestic assets divided by deposit money bank domestic assets plus central bank domestic assets.
Source: IFS lines 12a- f/(lines 12a- f + lines 22a - f)

PRIV/Y Average from time *t* - 4 to *t* of credit issued to private enterprises divided by GDP. Source: IFS, lines 32d/line 99b.

$h_t - h_{t-1}$ Log difference in years of schooling per worker

I/Y_{it} Investment per unit of GDP

Δh_{it} Growth of human capital

Δk_{it} Growth of physical capital

h_{it} log level of average years of schooling for adults over 25 years of age in country *i* and time *t*. Source: Barro-Lee (1993).

Δl_{it} Growth of labor

l_{it} Log of labor force in country *i* at time *t*. Source: PWT5.6.

y_{it} is Log of GDP in country *i* at time *t*. GDP defined as RGDPW*LAB, where LAB refers to the labor force and is defined as RGDPCH/RGDPW*POP, where RCGDPCH is output per person measured by the chain rule, RGDPW is output per worker, and POP is the population Source: PWT 5.6.

$h(Y_{maxt}/Y_{it})$ is output per worker in "leader" country for time *t* divided by output per worker for time *t*

Apec is a dummy variable, that is one when the country in the sample is an Apec country and zero otherwise. APEC countries are Australia, Canada, Chile, Japan, Korea, Malaysia, Mexico, New Zealand, Peru, Philippines, Thailand, USA, Indonesia, Taiwan, and Singapore.
This variable is used with Bank, Priv/Y and Depth to create interactive variables.

Table 1
Summary Statistics

	Non-Apec Sample	Apec Sample	Apec Developing	Apec Industrial
ΔY_{it}	.03558	.04732	.0549	.036633
	(.0289)	(.03137)	(.03545)	(.0208)
ΔI_{it}	.0188	.0231	.0271	.0176
	(.0125)	(.008)	(.0058)	(.0076)
Δk_{it}	.048	.0647	.0758	.049
	(.0285)	(.0401)	(.044)	(.027)
H_{it}	1.4892	1.8029	1.4862	2.2462
	(.5404)	(.4452)	(.2803)	(.1579)
Δh_{it}	.1055	.09829	.1349	.04698
	(.15515)	(.1032)	(.1099)	(.06610)
I/Y_{it}	.2462	.2624	.2668	.2562
	(.08023)	(.0646)	(.0685)	(.0594)
DEPTH	.4041	.3777	.2747	.5220
	(.2256)	(.1967)	(.1018)	(.2081)
BANK	.7369	.7868	.7048	.9016
	(.1914)	(.1681)	(.1687)	(.0752)
PRIV/Y	.3256	.3072	.2132	.4388
	(.2267)	(.23155)	(.1458)	(.2659)
# of observations	190	60	35	25

Table 2
Base Growth Regressions[1]

Dependent Variable: ΔY_{it}

	Without Fixed Effects		Fixed Effects Included	
	Neoclassical	**Endogenous**	**Neoclassical**	**Endogenous**
c	.0070**	.0004	-.0043	-.0080
	(.0028)	(.0079)	(.0088)	(.0198)
Dl_{it}	.3861**	.3845**	.0934	.2583
	(.069)	(.0698)	(.2452)	(.1592)
Dk_{it}	.6168**	.6154**	.9111**	.7416**
	(.0694)	(.0698)	(.2473)	(.1592)
Dh_{it}	-.003		-.0045	
	(.0078)		(.0169)	
h_{it}		.0018		-.0328*
		(.0019)		(.0182)
$h_t(Y_{maxt}/Y_{it})$		.0008		.0271**
		(.0026)		(.0130)
Durbin-Watson	1.901	1.9087	2.1189	2.1117
Sargan	12.8796	14.6714	34.9616	20.4263
# of observations	305	305	305	305

[1] Estimated by generalized method of moments with ΔY_{it-1} and Δk_{it-1} used as instruments. All specifications include time dummies. Dummy coefficients estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 3
Neoclassical Specification[1]

Dependent Variable : ΔY_{it}

	1	2	3	4	5	6
c	.0006	.0002	.006	.0053	.0009	.0006
	(.0038)	(.0038)	(.0058)	(.0059)	(.0035)	(.0035)
Dl_{it}	.4858**	.49**	.4553**	.4495**	.4045**	.3926**
	(.0757)	(.0788)	(.0691)	(.0703)	(.0798)	(.0811)
Dk_{it}	.5127**	.5086**	.5410**	.5471**	.5965**	.6083**
	(.0774)	(.0806)	(.0704)	(.0716)	(.0808)	(.0821)
Dh_{it}	.0014	.0013	.0035	.0032	-.0010	-.0009
	(.0087)	(.0086)	(.0079)	(.008)	(.008)	(.008)
DEPTH	.014**	.01335**				
	(.0057)	(.0057)				
DEPTH*APEC		.004				
		(.0062)				
BANK			.0020	.0027		
			(.0065)	(.0068)		
BANK*APEC				-.0011		
				(.0034)		
PRIV/Y					.0110*	.0096*
					(.0058)	(.0056)
PRIV/Y*APEC						.0031
						(.0071)

[1] Estimated by GMM with ΔY_{it-1} and Δk_{it-1} used as instruments. All specifications include time dummies. Dummy coefficients estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 4
Neoclassical Specification [1]

(Fixed Effects Added)

Dependent Variable : ΔY_{it}

	1	2	3	4	5	6
c	-.0196*	-.0145	-.0236	-.0287	-.0137	-.0129
	(.0103)	(.0111)	(.0244)	(.026)	(.0121)	(.0120)
D***l*****it**	.3919	.4545*	.9662**	.9324**	.1818	.1871
	(.2492)	(.2388)	(.2936)	(.2828)	(.2222)	(.2355)
D***k*****it**	.6059**	.5439**	.0251	.0592	.8217**	.8169**
	(.2508)	(.2405)	(.2959)	(.2851)	(.2247)	(.238)
D***h*****it**	.0020	.0015	.0086	.0082	-.0035	-.0004
	(.0182)	(.0180)	(.0127)	(.0121)	(.0171)	(.0181)
DEPTH	.0234	.0037				
	(.0246)	(.0279)				
DEPTH*APEC		.0849*				
		(.0435)				
BANK			.0045	.0111		
			(.0249)	(.0268)		
BANK*APEC				-.0496		
				(.0502)		
PRIV/Y					.0275	.0233
					(.0302)	(.0299)
PRIV/Y*APEC						.018
						(.0524)

[1] Estimated by GMM with ΔY_{it-1} and Δk_{it-1} used as instruments. All specifications include time dummies. Dummy coefficients estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 5
Endogenous Growth Specification[1]

Dependent Variable : ΔY_{it}

	1	2	3	4	5	6
c	-.0138	-.0133	-.0010	-.0055	-.0077	-.0068
	(.0105)	(.0106)	(.0140)	(.0152)	(.0089)	(.009)
D***l*****$_{it}$**	.4565**	.4478**	.436**	.4325**	.4044**	.394**
	(.0767)	(.0786)	(.0782)	(.0788)	(.0796)	(.0804)
D***k*****$_{it}$**	.5434**	.5521**	.5639**	.5674**	.5955**	.6059**
	(.0767)	(.0786)	(.0782)	(.0788)	(.0796)	(.0804)
h**$_{it}$**	.00009	.00008	.0008	.0011	.0011	.0009
	(.0028)	(.0029)	(.0027)	(.0027)	(.0021)	(.0021)
h**$_t$(*Y*$_{maxt}$/*Y*$_{it}$)**	.0047	.0044	.0018	.0027	.0019	.0017
	(.0033)	(.0033)	(.0036)	(.0038)	(.0028)	(.0028)
DEPTH	.0144*	.0138*				
	(.0080)	(.008)				
DEPTH*APEC		.0015				
		(.0060)				
BANK			.0019	.0043		
			(.0105)	(.0109)		
BANK*APEC				-.0026		
				(.0035)		
PRIV/Y					.012*	.0111*
					(.0062)	(.0061)
PRIV/Y*APEC						.0015
						(.0068)

[1] Estimated by GMM with ΔY_{it-1} and Δk_{it-1} used as instruments. All specifications include time dummies. Dummy coefficients estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 6
Endogenous Growth Specification [1]

(Fixed Effects Added)

Dependent Variable : ΔY_{it}

	1	2	3	4	5	6
c	-.0203	-.0136	-.0299	-.0334	-.0182	-.0189
	(.021)	(.0209)	(.0328)	(.0343)	(.0194)	(.0200)
Dl_{it}	.4822**	.5909**	.7723**	.7528**	.3187**	.3453**
	(.1538)	(.1502)	(.1856)	(.1808)	(.1455)	(.1566)
Dk_{it}	.5177**	.4090**	.2276	.2471	.6812**	.6546**
	(.1538)	(.1502)	(.1856)	(.1808)	(.1455)	(.1566)
h_{it}	.-.0338*	-.0518**	-.0331*	-.0317*	-.045**	-.0439**
	(.0190)	(.019)	(.017)	(.0171)	(.0186)	(.0186)
$h_t(Y_{maxt}/Y_{it})$	.0272**	.0437**	.0269**	.026**	.0365**	.0369**
	(.0135)	(.0137)	(.0128)	(.0129)	(.0135)	(.0135)
DEPTH	.0231	-.0122				
	(.0233)	(.0253)				
DEPTH*APEC		.1496**				
		(.0319)				
BANK			.0162	.0201		
			(.0235)	(.0254)		
BANK*APEC				-.0331		
				(.0476)		
PRIV/Y					.035**	.0246
					(.0169)	(.0178)
PRIV/Y*APEC						.0351
						(.028)

[1] Estimated by GMM with ΔY_{it-1} and Δk_{it-1} used as instruments. All specifications include time dummies. Dummy coefficients estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 7
Financial development and investment per unit of GDP

Dependent Variable I/Y_{it}.

	1	2	3	4	5	6
c	.1778**	.1751**	.1342**	.1359**	.1911**	.1915**
	(.0133)	(.0133)	(.019)	(.0191)	(.0128)	.0128
DEPTH	.0921**	.0869**				
	(.0182)	(.0183)				
DEPTH*APEC		.0524**				
		(.0243)				
BANK			.1253**	.1198**		
			(.0226)	(.0233)		
BANK*APEC				.0131		
				(.0136)		
PRIV/Y					.0753**	.061**
					(.0217)	(.0227)
PRIV/Y*APEC						.0619**
						(.0303)
# of observations	310	310	305	305	325	325
DF	304	303	299	298	319	318
R-Square	.1402	.1532	.148	.150	.094	.106

Table 8
Financial development and investment per unit of GDP

(Fixed Effects Included)

Dependent Variable I/Y_{it}	1	2	3	4	5	6
c	.2256**	.2357**	.1669**	.1752**	.2471**	.2645*
	(.034)	(.0341)	(.0482)	(.0504)	(.0315)	(.0312)
DEPTH	.0178	-.0183				
	(.0485)	(.0510)				
DEPTH*APEC		.2194**				
		(.103)				
BANK			.0741*	.0647		
			(.044)	(.0471)		
BANK*APEC				.0765		
				(.1345)		
PRIV/Y					-.0463	-.1301**
					(.0507)	(.0549)
PRIV/Y*APEC						.3119**
						(.0880)
# of observations	310	310	305	305	325	325
DF	243	242	239	238	255	254
R-Square	.573	.581	.591	.591	.594	.613

Table 9
Log difference in years of schooling per worker

Dependent Variable: $h_t - h_{t-1}$

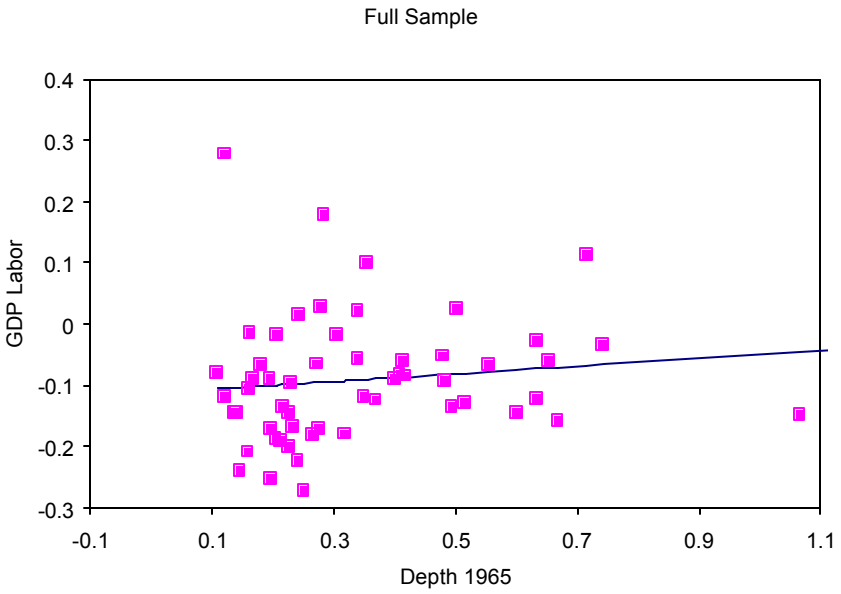
	1	2	3	4	5	6
c	.2477**	.2516**	.1695**	.1767**	.1990**	.201**
	(.0232)	(.0232)	(.0298)	(.0299)	(.022)	(.0222)
h_{it-1}	-.1121**	-.1182**	-.1132**	-.1184**	-.0831**	-.0848**
	(.0120)	(.0124)	(.0128)	(.0130)	(.0112)	(.0114)
DEPTH	.0342	.0336				
	(.0295)	(.0294)				
DEPTH*APEC		.0675*				
		(.0396)				
BANK			.1200**	.1126**		
			(.039)	(.0395)		
BANK*APEC				.0388*		
				(.0208)		
PRIV/Y					.0218	.0153
					(.039)	(.0398)
PRIV/Y*APEC						.0418
						(.0515)
# of observations	236	236	232	232	244	244
DF	230	229	226	225	238	237
R-Square	.321	.330	.298	.309	.239	.241

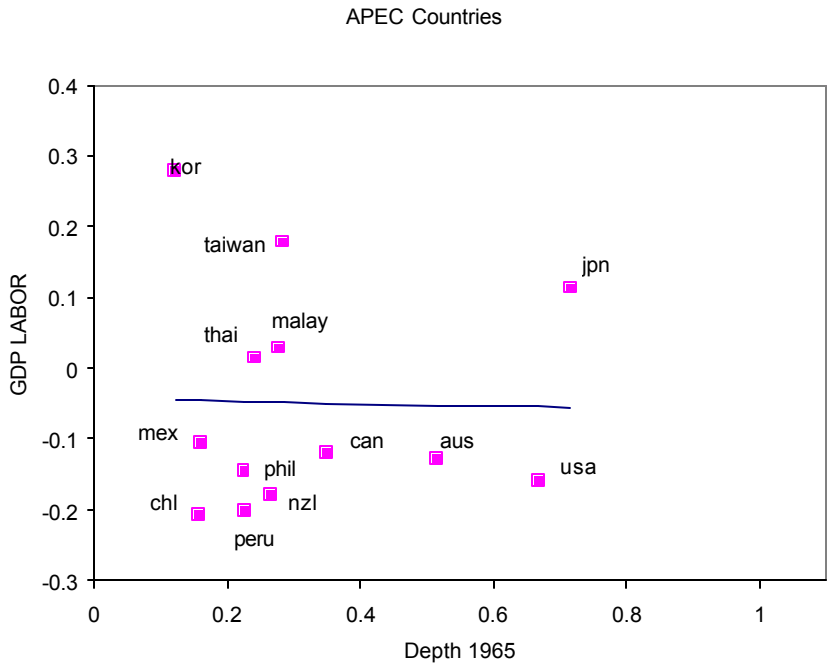
Table 10
Log difference in years of schooling per worker
(Fixed Effects Included)

Dependent Variable $h_t - h_{t-1}$

	1	2	3	4	5	6
c	.8527**	.853**	.7516**	.7656**	.9647**	.9649**
	(.1032)	(.104)	(.1414)	(.1483)	(.109)	(.1093)
h_{it-1}	-.591**	-.5909**	-.5695**	-.5707**	-.5882**	-.5886**
	(.068)	(.0685)	(.0673)	(.0676)	(.0678)	(.0682)
DEPTH	.3507**	.3488**				
	(.1293)	(.1403)				
DEPTH*APEC		.0089				
		(.2540)				
BANK			.1971**	.1838*		
			(.0917)	(.1008)		
BANK*APEC				.0773		
				(.2416)		
PRIV/Y					-.0168	-.0137
					(.1201)	(.1243)
PRIV/Y*APEC						-.0271
						(.2687)
# of observations	236	236	232	232	244	244
DF	172	171	169	168	178	177
R-Square	.5604	.5604	.5586	.5589	.5319	.5319

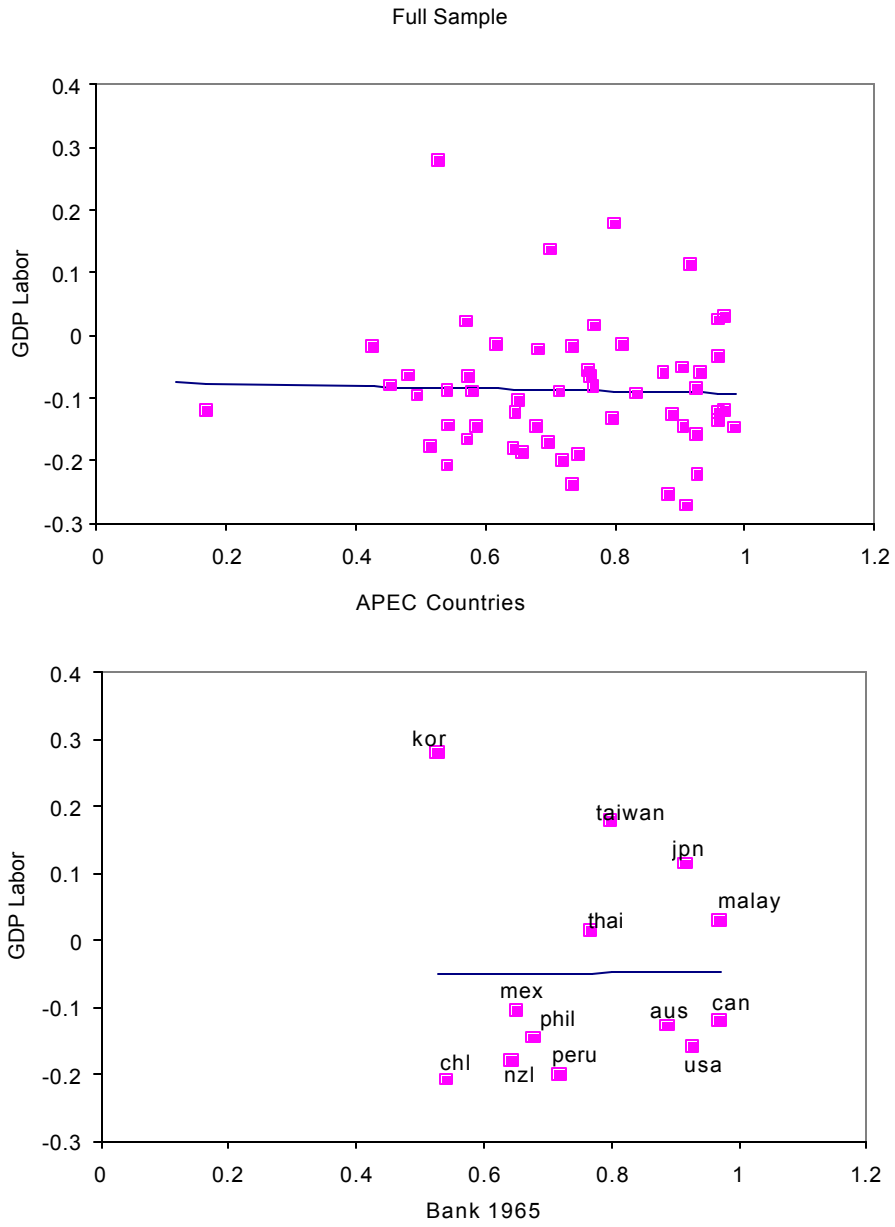
Figure 1: Growth in GDP/ LABOR 1965-1985 and 1965 Financial Depth.[1]





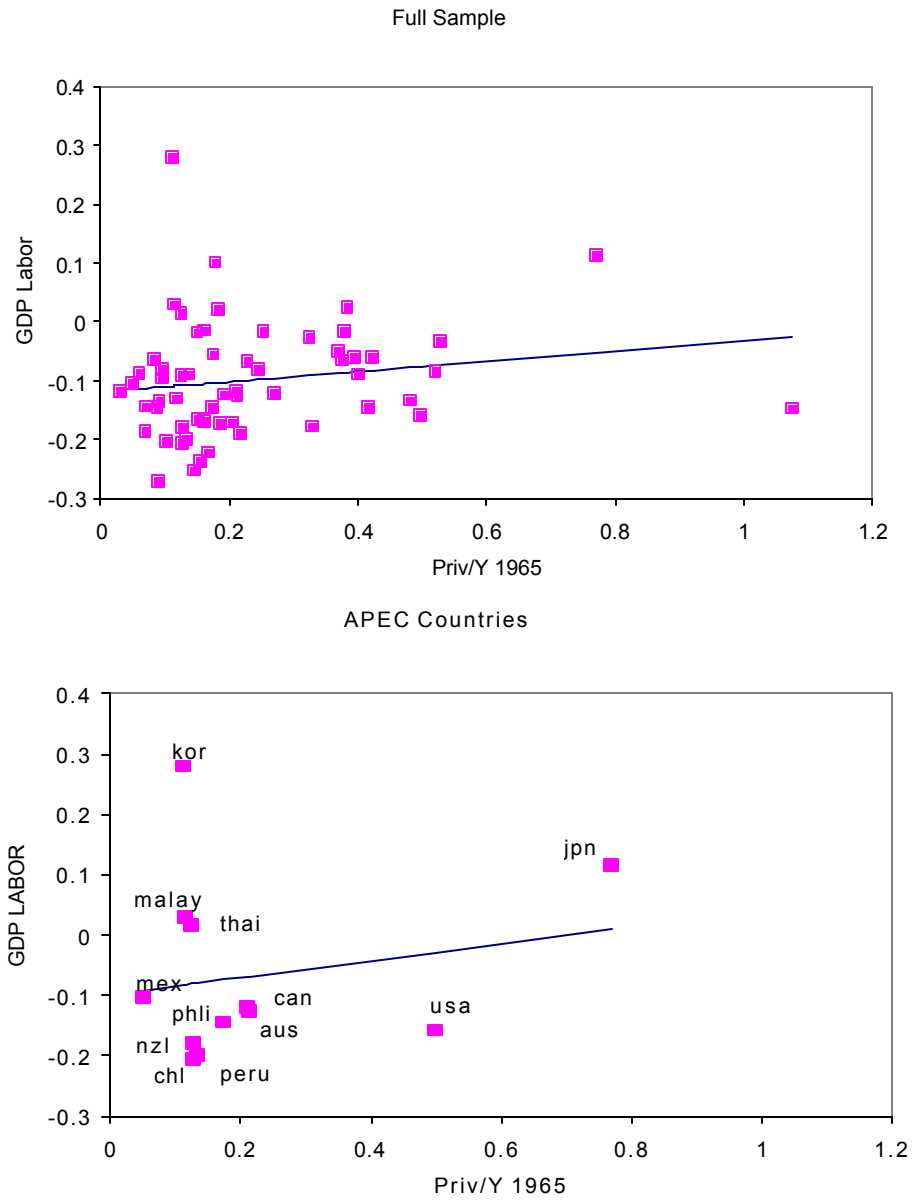
[1] Financial Depth is M2/GDP.

Figure 2: Growth in GDP/LABOR 1965-1985 and 1965 Bank level[2]



[2] Bank is deposit money bank domestic assets divided by deposit money bank domestic asets plus central bank domestic assets. Source: IFS lines 12a-f/(lines 12a-f + lines 22a-f)

Figure 3: Growth GDP/LABOR 1965-1985 and 1965 PRIV/Y level[3]



[3] PRIV/Y is credit issued to private businesses divided by GDP.