

ARE EMPIRICAL RESULTS IN ECONOMIC GROWTH MODELS BIASED BECAUSE OF OMITTED VARIABLES? CROSS-COUNTRY EVIDENCE

Hsin-Yu Liang, Feng Chia University
Alan K. Reichert, Cleveland State University

ABSTRACT

This study examines the impact of external factors, such as law, regulation, and technology on a country's rate of economic growth. The results suggest that the technological, legal, and regulatory environment can play a major role towards enhancing the smooth functioning of the financial system and economic growth. While a growing body of evidence examines the individual impact of similar external factors, Demircuc-Kunt (2006) argues that it is crucial to consider all the relevant factors together in one model. Thus, this study first examines the individual impact of these external factors for both advanced and emerging countries. Next, we examine the joint impact of relevant factors selected by stepwise regression procedures. The findings provide evidence for both groups of countries that the best models for predicting economic growth are ones that do include all the relevant factors together in one model.

JEL: K00; G28; G21; O16; O11

KEYWORDS: Legal system, regulation, technology, financial development, economic growth.

INTRODUCTION

It appears that the technological, legal, and regulatory environment can play a major role in either enhancing or retarding the smooth functioning of a financial system. Levine (2004) summarizes the existing empirical literature and points out that various studies have examined the individual role of political, legal, regulatory, and geographic factors in shaping financial sector development (FSD) and economic growth. Moreover, Demircuc-Kunt (2006) argues that it is crucial to consider all the relevant factors together in one model. The relatively low adjusted R-squares reported by Odedokun (1996) and Liang and Reichert (2006) provide evidence that there are still important variables, which have not been included in economic growth model.

Recently, Levine (2004), Barth et al. (2004), and Demircuc-Kunt (2006) stress that whether a country's financial system can allocate resource efficiently is more important than arguing the ideal structure of the financial system. La Porta et al. (1997 and 1998) stress that a country's legal system has a crucial impact on economic growth. On the other hand, Demircuc-Kunt and Maksimovic (2002) find that introducing proper financial regulations can compensate for a weak legal system. However, previous studies do not consider the nature of the financial system in terms of regulation and corporate governance in assessing their impact on economic growth. Therefore, this study includes a comprehensive set of regulatory factors (i.e. deposit insurance scheme, measures of competitive banking environment, ownership structure, and bank freedom) in a comprehensive growth model.

Furthermore, recently researchers stress the fact that rapid advances in information and communication technology (ICT) can have profound effects on reducing transaction costs and information asymmetry. Thus, the traditional role of financial intermediations as "delegated monitors" is no longer unique and ICT has become a key factor in transforming the role of financial intermediation in a modern economy. Recent studies by Stiroh (1999) and others suggest that ICT represents a "New Economy" which can stimulate widespread growth through improved information disclosure and increased productivity. However, while Stiroh (1999) empirically examines the relationship between ICT and economic growth he fails to control for regulatory and legal factors.

As indicated in the literature review below, different researchers have employed various measures of FSD with no one measure identified as the single correct specification. King and Levine (1993) criticize the sole reliance on liquidity (M3) as an insufficient measure of FSD and suggest four alternative measures: 1) bank deposits, 2) the relative size of bank assets to total real sector assets provided by bank and central banks, 3) bank assets divided by GDP, and 4) bank private credits provided by GDP. Since these alternative FSD measures are highly correlated, we employ principal component analysis to reduce the number of variables and avoid multicollinearity problems. In addition to a narrow measure of liquidity a complementary measure of FSD is included, which considers the four alternative measures mentioned above. The complementary FSD measures are limited to banking sector development and view the existence of other sectors, such as, the equity and derivative markets as driven by exogenous regulatory factors. That is, regulation determines whether a country allows for a stock or bond market, or other non-bank types of financial institutions as complementary or substitute tools for financial resource allocation.

Therefore, the main purpose of this study is as follows. First, this study separately examines the individual impact of various relevant external factors (i.e. legal, regulatory, and ICT factors) in an expanded economic growth model which including complementary measures of FSD. Second, by selecting and retaining statistically significant external factors using stepwise regression, the final model tests their individual and collective impact. The remainder of this paper is organized as follows. Section 2 reviews the prior literature on economic growth. Section 3 discusses the methodology and the empirical model. Section 4 presents the empirical findings, while Section 5 presents the conclusions.

LITERATURE REVIEW

It has long been recognized that banks play an important role in channeling saving to their most productive use, which in turn promotes economic growth. A good deal of the empirical literature focuses on whether causality runs from FSD to economic growth (supply-leading role) or whether the demand for FSD is a derived demand (demand-following). Thus, FSD can play a leading role in economic growth or it may take a more passive role in response to expanding economics needs. In an early paper, Patrick (1966) states that in the beginning stages of economic development, causation generally runs from economic development to FSD.

This “demand-following” view is often used to explain the lack of financial institutions in underdeveloped countries where there is a low demand for financial services. As economic growth occurs the direction of causality may reverse and a “supply-leading” relationship may develop. Here the efficiency gains associated with financial intermediation stimulate continued economic growth in the later stages of a county’s economic growth cycle. Furthermore, expanded FSD can take place along a “financial sector broadening” dimension where consumers and firms, acting as both investors and borrowers, have more efficient access to basic intermediation services. Expanded access to financial services saves time and lowers transactions costs. To the extent that economies of scale exist, the development of large-scale financial intermediaries and markets drive information and transaction costs even lower.

Goldsmith (1969) is the first to examine the relationship between financial sector development and economic growth under the assumption that the size of the financial system is a proxy for the quality of financial services provided, and hence, has a positive impact on economic growth. However, Goldsmith’s work does not systematically control for other potential factors which may also influence economic growth. Both King and Levine (1993) and Odedokun (1996) address this weakness by developing a model which includes other relevant factors. Levine’s 1998 study develops a regression model to link banking sector development, as measured by loans issued by banks/GDP, and the legal environment, as measured by creditor rights and contract enforcement. However, Levine’s study does not consider the effect of deposit insurance, bank regulation, and information technology simultaneously on economic growth. For example, the presence of excessive levels of deposit insurance might diminish the positive influence of banking sector development on economic growth by increasing the risk-taking activities of

households and firms, leading to a sub-optimal allocation of resources. In the same way, excessive regulations on banking activities might also reduce bank efficiency by limiting opportunities for economies of scale and scope and risk diversification. Using the same econometric approach, Levine (1999) expands his previous work to link financial sector development (FSD) and the legal system by using four alternative measures of FSD: 1) the ratio of liquid liabilities to GDP, 2) the ratio of bank assets to total bank and central banks assets, 3) bank credits /total domestic credits, and 4) bank private credits/GDP, and four measures for legal system: a) legal tradition, b) creditor rights, c) contract enforcement, and d) financial reporting. The results are similar to his earlier paper where legal and regulatory environment has a positive impact on FSD.

Odedokun (1996) points out many existing studies suffer from a biased estimator problem due to omitting relevant variables. Odedokun (1996) proposes a theoretical model, which allows the researcher to easily expand the precise definition of FSD and/or other external factors. Most of the empirical research focuses on the direct relation between FSD and economic growth. Indicators of FSD that have been used in the literature consist of broad measures of banking activity such as the provision of private credit (lending) and measure of liquidity, such as, M2 or M3. In addition, some studies go beyond the banking system and examine the role of the stock market in FSD. For example, the potential complementary or substitutability role between the banking sector and stock markets has been studied in the empirical studies (Liang and Reichert, 2007, and Levine, 1998). As mentioned above, countries with the same level of banking sector and stock market development may not attain the same level of economic growth because of different financial, legal, and regulatory structures. Recent research attempts to control for differences in the legal and social environment but additional work is needed in terms of the bank regulatory and supervisory environment.

DATA AND METHODOLOGY

The countries included in the analysis were selected using the classification employed in the IMF's 2005 World Economic Outlook report. The IMF divides the world into two major groups: advanced countries¹ and emerging/developing countries². This study follows the World Bank definition and separates the countries into these two groups. The twenty advanced countries include: Canada, France, Japan, United States, Italy, Germany, Australia, Belgium, Denmark, Finland, Hong Kong, Iceland, Ireland, Israel, Korea, Netherlands, New Zealand, Norway, Sweden, and Switzerland. The seventy developing/emerging countries include: Algeria, Antigua and Barbuda, Argentina, Bangladesh, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Chile, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, Arab Rep., Ethiopia, Gabon, Gambia, Ghana, Grenada, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Jamaica, Jordan, Kenya, Lesotho, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Morocco, Mozambique, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Senegal, South Africa, Sri Lanka, St. Lucia, St. Vincent and the Grenadines, Swaziland, Syrian Arab Republic, Thailand, Togo, Trinidad and Tobago, Tunisia, Uganda, Uruguay, Venezuela, Zambia, and Zimbabwe.

The data for this study is obtained from the following sources: 1) 2005 World Bank Economic indicators, 2) the Beck and Levine 2002 data set, 3) the Beck et. al. 2006 data set, 3) Economic Freedom of the World Index, and 4) Index of Economic Freedom. This study starts by employing an Odedokun-type (1996) economic growth model, which employs a neo-classical aggregate production model in which financial sector development (F_{it}) is one of several inputs in the production function. Then, by adding complementary FSD measures, the authors obtain an improved economic growth model using more comprehensive and precise FSD measures.

Complementary FSD Measures

The complementary FSD measures (FSD_{it}) are obtained using principal components analysis. The candidate components for FSD are shown in Table 1. The criteria for how many components to include

are a trade-off based on the Kaiser Criterion test (e.g., eigenvalues larger than one), the Cattell Screen test (e.g., ordered eigenvalues screen plots), and the degree of variability explained by these components (e.g., >90%).

External Factors

1) Legal factors: The authors expects a direct positive impact associated with the legal environment (e.g., legal system) on economic growth since the legal environment has a positive influence on the precise terms and availability of funds for borrowers. Legal system (LEGAL2) includes measures of judicial independence, impartial courts, protection of property rights, and freedom from political intervention.

2) Regulatory factors: First, deposit insurance protection can provide a stable financial environment and thus promote economic growth. On the other hand, excessive deposit insurance protection can also cause a negative impact on economic growth by promoting undue risk-taking behavior. Therefore, this study examines the net impact of deposit insurance on economic growth. Second, while market structure theory suggests that proper regulatory restrictions on banking activity can compensate for the negative impact of deposit insurance, it also might hinder economic growth by creating a less competitive banking environment. Efficiency theory on the other hand suggests that fewer restrictions on banking activities and market entry can enhance the competitive banking environment and promote economic growth through more efficient bank management and improved resource allocation. Third, government ownership of banks often hinders efficient resource allocation and slows economic growth. Finally, bank privatization, especially foreign ownership of banks in developing countries, improves bank management and can accelerate economic growth.

The following variables are designed to proxy for regulatory factors: (1) DEPOSITINS reflects the deposit insurance coverage amount measured as a percent of per capita GDP. The DEPOSITINS variable is included in the regression model to capture the continuous impact of deposit insurance on GDP growth, (2) bank concentration (BKCONCEN), net interest margin (NIM), and overhead costs (OHCOSTS) are designed to measure the degree of competitiveness in the banking sector. Restrictions on banking activities or entry can hinder FSD and economic growth. The expected sign for BKCONCEN is unclear: if market structure theory holds, a negative sign is expected; otherwise, a positive signs hold to support the efficient theory. Negative signs for NIM and OHCOSTS are expected, which shows the negative impact of a less-competitive baking environment on economic growth. (3) Privately owned banks (BKPRIVAT1) is a proxy for good corporate governance and efficient management and a positive sign is expected. (4) Foreign-entry (FGENTRY), as measured by the percentage of foreign owned banks, is expected to have a positive sign since it signals a competitive banking environment and accelerates technology transfers across borders, (5) the index of Bank and Commerce Freedom is designed to measure the overall regulatory environment since this index includes restrictions on banking activities, entry, and ownership. A higher score represents greater bank freedom but the expected sign is unclear since greater bank freedom may lead to efficient management and investments within banks but it may also increase imprudent risk-taking.

3) Technology factors: ICTs investment promotes economic growth by increasing productivity and lowering operating costs. In addition, ICTs can also accelerate FSD through efficient bank management and broader and timelier information disclosure. TECHEXP and TECHIMP, which measure the percentage of computer and communication service exports and imports respectively, are included to capture the direct impact of ICT development on economic growth.

The next step is to examine the impact of a vector of external factors in the economic growth model (Equation 1). A unit root test is employed to examine the stationarity of each continuous variable. When a unit root test shows that a variable is non-stationary in level form, the first difference is computed and a “D” is placed in front of the variable name. Initially, individual external factors are examined by including them one at a time in the model. These individual results can subsequently be compared with the full model that simultaneously includes all of the relevant external factors.

$$\dot{Y}_{it} = b_0 + b_1 \dot{L}_{it} + b_2 (I/Y)_{it} + b_3 \dot{X}_{it} + b_4 \dot{F}_{it} + b_5 \dot{FSDPC1}_{it} + b_6 \dot{FSDPC2}_{it} + b_7 E_{it} + \mu_{it} \quad (1)$$

- \dot{Y}_{it} =Economic growth is measured as the annual growth rate of real GDP.
- \dot{L}_{it} =Labor force growth is proxied by population growth which was calculated as the annual rate of population growth.
- (I/Y) =The investment/GDP ratio is computed as gross nominal fixed capital formation divided by nominal GDP.
- \dot{X}_{it} =Real export growth is calculated as the annual rate of growth of exports of goods and services.
- \dot{F}_{it} =Liquid liability growth is calculated as the annual growth rate of liquid liabilities (M3).
- $\dot{FSDPC1}_{it}$ =Represents the first principal component of complementary FSD measures
- $\dot{FSDPC2}_{it}$ =Represents the second principal component of complementary FSD measures
- E_{it} =a vector of 10 external exogenous factors: LEGAL2, DEPOSITINS, BKCONCEN, NIM, OHCOST, BKPRIVAT, FGENTRY, BKFREE, TECHIMP, and TECHEXP.
- u_{it} =Normally distributed error term , i = a specific country, t = a specific year

Table 1: Definitions of Complementary Measure of FSD_{it} and External Factors

Variable Name	Definition /Time period/Source	Time period
<u>Panel A</u>		
DEPGDP*	Bank deposits divided by GDP /(1960-2005) Source: Beck et al. (2006)	1960-2005
BKLNCB*	Percentage of domestic non-financial real sector assets held by commercial banks (denominator: the total held by central banks and commercial banks). Source: Beck et al. (2006)	1960-2005
BKLNGBP*	Commercial banks claims on domestic non-financial real sector assets divided by GDP Source: Beck et al. (2006)	1960-2005
BKLNGBP2*	Private credits by deposit money bank to GDP Source: Beck et al. (2006)	1960-2005
<u>Panel B</u>		
LEGAL2**	Legal structure and security of property rights Source: Economic Freedom of the World	1970-2003
<u>Panel C</u>		
DEPOSITINS*	Coverage to GDP per capita ratio Source: World Bank Data	1960-2004
BKCONCEN*	The share of assets of the three largest banks in total banking system assets. Source: Beck et al. (2006)	1960-2005
NIM*	The value of a bank's <u>net</u> interest income as a share of its interesting-bearing assets Source: Beck et al. (2006)	1960-2005
OHCOSTS*	The accounting value of a bank's overhead cost as share of its total assets Source: Beck et al. (2006)	1960-2005
BKPRIVAT**	Ownership of Banks equals the percentage of deposits held in privately owned banks, measured in deciles. Source: Index of Economic Freedom	1970-2003
FGENTRY**	Foreign banks' share of total banking sector assets measured in deciles. Source: Economic Freedom of the World	1995-2003
BKFREE***	Overall regulatory environment. Source: Index of Bank and Commercial Freedom	1995-2006
<u>Panel D</u>		
TECHEXP*	Computer, communications and other services (% of commercial service exports) Source: World Bank Data	1972-2004
TECHIMP*	Computer, communications and other services (% of commercial service imports) Source: World Bank Data	1972-2004

*This table shows the definitions, time period, and sources of complementary measures of FSD and external factors. Panel A defines the complementary measures of FSD variables. Panel B defines the legal factor. Panel C defines the regulatory factors. Panel D defines the technology factors, and. * continuous variable, ** a variable which is ranged from 1-10, and *** a variable which is ranged from 1-5.*

The results of the principal component analysis are available upon request from the authors. The first component, C1BK, is interpreted as an index of general banking sector development given its large

eigenvector loadings with DEPGDP, BKLNGDP, and BKLNGDP2. DEPGDP captures the deposit services provided by the banking sector, while BKLNGDP and BKLNGDP2 capture the effects of a bank lending activities. Thus, C1BK can be viewed as a measure of banking sector “broadening” in the sense that it measures the scale of traditional intermediation services. The second component, C2BK2, has high factor loadings on BKLNCB. Thus, C2BK2 can be interpreted as measuring the level of private sector intermediation as measured by the amount of financial capital provided by commercial banks relative to that provided by public sector central banks. Thus, C2BK2 can be viewed as measuring the “deepening” of the banking sector since commercial banks may provide more sophisticated risk management services and make more efficient capital allocation decisions than government run central banks. After obtaining scores for each of these five components, a unit root test was employed to examine the stationarity of each component. Both components (C1BK and C2BK2) were non-stationary in their levels and required first differencing which is indicated by placing a “D” in front of the component name [e.g., D(C1BK)].

Joint External Factors

The first four variables in equation 1 are control variables (L, I/Y, X, and F) and are forced into the stepwise regression model. Then a vector of complementary FSD measures and external factors are considered as candidates in the stepwise model. After the final external factor regressor set is determined by the stepwise procedure, the incremental contribution of these external factors is used to measure the impact of omitting relevant variables (Equation 2).

$$\dot{Y}_{it} = b_0 + b_1 \dot{L}_{it} + b_2 (I/Y)_{it} + b_3 \dot{X}_{it} + b_4 \dot{F}_{it} + \mu_{it} \quad \begin{array}{l} \text{(Forced regressors)} \\ \text{(Stepwise candidates)} \end{array} \quad (2)$$

EMPIRICAL RESULTS

Advanced Countries

The empirical results for the advanced countries are presented in Table 2. As mentioned above, the LEGAL2 variable is designed to capture the influence of a variety of important legal factors. LEGAL2, a continuous scale variable, is obtained from Economic Freedom of the World index, where a higher score suggests a more competitive legal system. LEGAL2 has a positive and significant impact on economic growth at the 5% significance level.

In the next step, the deposit insurance protection variable (DEPOSITINS) is included in the economic growth model (Column 4). The coefficient on this variable is not statistically significant. The following three variables, BKCONCEN, NIM, and OHCOSTS, designed to measure the competitive banking environment are included sequentially in the model. BKCONCEN and NIM both have the expected negative sign but none of the three variables are statistically significant at the 10% level (Columns 5-7). On the other hand, the three model results are similar and compared to Column (1) we see an increase in adjusted R-squared to approximately 0.55, a smaller AIC number, a smaller coefficient on our traditional measure of liquidity (\dot{F}), and a weaker significant level for D(C1BK). Furthermore, the slope coefficients for the control variables I/Y and \dot{X} are increased in size. Even though none of three variables generated statistically significant results, they provide an increase in the model’s adjusted R-squared. Two variables related to ownership structure, BKPRIVAT and FGENTRY, are sequentially included in the model, but neither generates statistically significant results (Columns 8 and 9).

The coefficients of the other regressor variables remain the same after including BKPRIVAT into the model; while after including FGENTRY, the adjusted R-squared falls a little and both the size and level of statistical significance of most of the other regressors also change. This may be due to a much shorter time span for the FGENTRY variable, which only covers the period from 1995 to 2003.

Table 2: Empirical Results- Advanced Countries

Dependent Variables Y	FSD		Law	Regulation		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables:						
C	-0.024***	-0.019**	-0.047***	-0.034**	-0.019	-0.027
L	0.027	0.010	0.001	-0.011**	0.056	0.055
I/Y	0.179***	0.176***	0.198***	0.003***	0.200***	0.214**
X	0.167***	0.139***	0.136***	0.127***	0.189***	0.185***
F	0.065***	0.090***	0.077***	0.080***	0.054**	0.047*
D(CIBK)		-0.028***	-0.028***	-0.003	-0.012**	-0.013*
D(C2BK2)		0.008***	0.007**	0.027**	0.028**	0.028***
LEGAL2			0.003**			
DEPOSITINS				-0.001		
BKCONCEN					-0.012	
NIM						-0.087
OH COST						
BKRRIVAT						
FGENTRY						
BKFREE						
D(TECHEXP)						
D(TECHIMP)						
Fixed effects-C	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N
# of AR(t)terms	1	2	2	0	1	1
Adj. R Squared	0.421	0.452	0.44	0.394	0.548	0.544
AIC	-4.824	-4.638	-4.95	-5.304	-5.334	-5.328
Observations	561	498	446	197	143	142
# of countries	19	18	18	15	15	15
Period	1967-2004	1968-2004	1968-2003	1966-2003	1991-2004	1991-2004
Redundant Fixed Effect Tests (F test)						

Dependent Variables Y	Regulation			Technology		(Joint) Stepwise Regression	
	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Variables:							
C	-0.027	-0.025*	-0.025	-0.106**	-0.020*	-0.025**	-0.055*
L	0.055	-0.004	0.040	-0.270	-0.003	0.009	0.046
I/Y	0.222*	0.178***	0.234**	0.643***	0.171***	0.194***	0.384***
X	0.188*	0.141***	0.157***	0.190***	0.165***	0.188***	0.171***
F	0.047*	0.079***	0.056*	-0.005	0.063***	0.052***	0.040
D(CIBK)	-0.012**	-0.028***	-0.011	-0.009	-0.025***	-0.026***	-0.015** ₇
D(C2BK2)	0.027***	0.007**	0.016*	-0.019	0.005	0.005	0.020** ₃
LEGAL2							
DEPOSITINS							
BKCONCEN							0.018 ₄
NIM							0.361 ₈
OH COST	0.158						-0.477 ₁
BKRRIVAT		0.001					-0.003 ₂
FGENTRY			-0.001				
BKFREE				-0.004			
D(TECHEXP)					0.033**		0.152** ₆
D(TECHIMP)						-0.024	-0.170*** ₅
Fixed effects-C	Y	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N	Y
# of AR(t)terms	1	1	0	4	1	4	0
Adj. R Squared	0.546	0.426	0.418	0.802	0.445	0.490	0.571
AIC	-5.322	-4.977	-5.045	-6.048	-5.046	-5.132	-5.225
Observations	142	443	115	53	411	350	144
# of countries	15	18	15	12	18	18	15
Period	1991-200	1967-2003	1995-200	1999-2004	1972-2004	1975-2004	1990-2003
Redundant Fixed Effect							P-Value:0.0105

Table 2 shows the regression coefficients of the equation: $\dot{Y} = C + \text{Countries Dummies} + \dot{L} + I/Y + \dot{X} + \dot{F} + D(CIBK) + D(C2BK2) + \text{One External factor} + \text{error term}$ for the full sample of advanced countries. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

The BKFREE variable is designed to measure the competitiveness of the banking environment, with a higher score representing greater freedom. No statistically significant results are obtained after including BKFREE, although the adjusted R-squared is dramatically increased to 0.802. At the same time the variables, \dot{F} , D(C1BK), and D(C2BK2) are no longer significant. This may also be due to a shorter time span for the BKFREE variable, which covers the period from 1999 to 2004.

D(TECHEXP) and D(TECHIMP) are designed to measure a country's technology development, especially in the commercial services sector (e.g., computer, communication, etc.). D(TECHEXP) has a significant positive impact at the 1% significance level, while D(TECHIMP) shows a negative but statistically insignificant impact (Columns 11 and 12). The results suggest that a country with a higher percentage of commercial service exports experiences faster economic growth, since a country with sophisticated technology for export is likely to have greater productivity compared to a country which has to import technology.

Some of the external variables discussed in the previous section may have a collinear relationship with the complementary FSD measures, as well as potential collinearity among themselves. In columns (2) to (12) with individual external factors sequentially included, the complementary FSD measures (D(C1BK) and D(C2BK2) generally remain statistically significant. Thus the authors view these complementary FSD measures as relevant variables in an economic growth model. Finally, a stepwise least squares method is adopted to avoid variables selection problems where candidates for the economic growth model are the two complementary FSD measures and all the external factors. As before, the variables in economic growth model are \dot{L} , I/Y , \dot{X} , and \dot{F} are control forced into the model.

Based on the F-test results for redundant fixed effects reported at the bottom of column (13) in Table 2, both cross-sectional and time period fixed effect adjustments are necessary. The DW statistic for the model with both cross-section and time period adjustments is close to 2.0. Therefore, the best model for the advanced countries includes both cross-sectional and time-period fixed effects. The adjusted R-square has increased to 0.571 by simultaneously modeling the impact of complementary FSD measures and the external factors. Following stepwise procedures, the variables that remain in the final model are: 1) the two complementary FSD measures: D(C1BK) and D(C1BK2), 2) four regulatory factors: OHCOSTS, BKPRIVAT, BKCONCEN, and NIM, and 3) two technology factors: D(TECHIMP) and D(TECHEXP). The legal factor is not included in the final model. Note that the traditional liquidity (\dot{F}) becomes insignificant after simultaneously considering the above-mentioned factors. The regression coefficients on D(C1BK) and D(C1BK2) indicate both a negative and positive impact at the 5% significance level, respectively. Among the external factors, only the two technology factors, D(TECHEXP) and D(TECHIMP), are significant and report positive and negative impacts at the 5% and 1% significance levels, respectively.

Emerging Countries

The empirical results for the emerging countries are presented in Table 3. LEGAL2 shows a positive and statistically significant impact on economic growth at the 5% level with the regression coefficient comparable to those reported for the advanced countries. The coefficient estimates for \dot{F} , D(C1BK), and D(C2BK2) are similar regardless of the structure of the legal environment. Several interesting findings should be noted. First, based on the increased adjusted R-squared and AIC criterion, the model is improved by including DEPOSITINS (Column 4) although the variable itself is not statistically significant. Second, BKCONCEN (5) had a positive impact on economic growth and is statistically significant at the 10% significant level.

Table 3: Empirical Results-Emerging/Developing Countries

Dependent Variables Y	FSD		Law		Regulation	
Variables:	(1)	(2)	(3)	(4)	(5)	(6)
C	-0.013**	-0.008	-0.031***	-0.047***	-0.043***	0.001
L	0.619***	0.318***	0.482**	0.932*	0.316	0.428*
I/Y	0.127***	0.146***	0.164***	0.244***	0.238***	0.267***
X	0.130***	0.088***	0.090***	0.111***	0.093***	0.081***
F	0.046***	0.116***	0.099***	0.119***	0.094***	0.071***
D(CIBK)		-0.044***	-0.042***	-0.031***	-0.036***	-0.035***
D(C2BK2)		0.0032**	0.033***	0.035***	0.032***	0.031***
LEGAL2			0.003**			
DEPOSITINS				0.103		
BKCONCEN					0.025*	
NIM						-0.515***
OH COST						
BKRRIVAT						
FGENTRY						
BKFREE						
D(TECHEXP)						
D(TECHIMP)						
Fixed effects-C	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N
# of AR(t)terms	1	1	3	1	1	1
Adj. R Squared	0.237	0.315	0.364	0.382	0.327	0.374
AIC	-3.353	-3.732	-3.953	-4.214	-4.106	-4.173
Observations	2053	1584	979	252	584	615
# of countries	66	61	51	20	58	57
Period	1967-2004	1967-2004	1973-2003	1967-2003	1991-2004	1990-2004
Redundant Fixed Effect Tests (F test)						

	Regulation			Technology		(Joint) Stepwise Regression	
Variables:	(7)	(8)	(9)	(10)	(11)	(12)	(13)
C	-0.012	-0.021***	-0.056**	-0.010	-0.009	-0.002	-0.027
L	0.409*	-0.246*	0.605	0.353	0.228*	0.232*	1.196**
I/Y	0.199***	0.210***	0.434***	0.224***	0.143***	0.145***	0.289***
X	0.096***	0.097***	0.053***	0.074***	0.089***	0.089***	0.076***
F	0.089**	0.079***	0.102***	0.088***	0.109***	0.107***	0.050*
D(CIBK)	-0.031***	-0.046***	-0.051***	-0.039***	-0.040***	-0.039***	-0.030** ₃
D(C2BK2)	0.030***	0.034***	0.033***	0.031***	0.031***	0.032***	0.035*** ₂
LEGAL2							0.005 ₄
DEPOSITINS							0.010 ₁₀
BKCONCEN							
NIM							-0.415** ₁
OH COST	-0.160**						-0.444* ₉
BKRRIVAT		-0.000					0.003 ₇
FGENTRY			-0.003				
BKFREE				-0.006**			-0.002 ₈
D(TECHEXP)					0.008		-0.002 ₆
D(TECHIMP)						-0.024*	-0.008 ₅
Fixed effects-C	Y	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N	Y
# of AR(t)terms	0	1	0	0	1	1	0
Adj. R Squared	0.334	0.365	0.398	0.337	0.319	0.317	0.530
AIC	-4.140	-3.725	-3.995	-4.152	-3.821	-3.819	-4.422
Observations	628	1096	217	526	1315	1316	146
# of countries	58	51	35	57	61	61	22
Period	1990-2004	1971-2003	1995-2003	1995-2004	1971-2004	1971-2004	1995-2003
Redundant Fixed Effect Tests (F test)							P-Value: 0.0084

Table 3 shows the regression coefficients of the equation: $\dot{Y} = C + \text{Countries Dummies} + \dot{L} + I/Y + \dot{X} + \dot{F} + D(CIBK) + D(C2BK2) + \text{One External factor} + \text{error term. for the full sample of developing/emerging d countries. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.}$

The positive coefficient for BKCONCEN supports the “efficient-structure” theory that high bank concentration levels fostered by deregulation can promote increasingly competitive financial markets as only the most efficient banks remain competitive. NIM and OHCOSTS have the expected negative signs and are statistically significant at the 1% and 5% level, respectively (Columns 6 and 7). These three models are similar in terms of their adjusted R-square, AIC value, comparable coefficients on most of the control variables but somewhat smaller coefficients on \bar{F} .

The hypothesis that an enhanced competitive banking environment promotes economic growth is strongly supported by these results for the sample of emerging/developing countries. One other important result is that the coefficient on the \bar{F} variable decreased in size from 0.11 to 0.094 by including the BKCONCEN variable. Third, neither BKPRIVAT nor FGENTRY are statistically significant. Fourth, the coefficient on BKFREE has an unexpected negative sign, which is significant at the 5% level. As shown in Columns (11) and (12), D(TECHEXP) has a positive but insignificant regression coefficient, while D(TECHIMP) has a statistically significant negative impact on economic growth. The statistical significance of these results are just opposite for the advanced countries. The level of technological exports from emerging/developing countries may be relatively small and these countries are forced to import technology, which at least in the short run reduces the rate of economic growth.

The stepwise regression procedure is also employed here. Based on the F-statistic for the redundant fixed effects test, both cross-section and time-period fixed effects are required. The DW statistic for the model with both cross-section and time-period adjustments is close to 2.0. The final results of the stepwise regression procedures presented in Column 13 include the following four sets of variables: 1) the two complementary FSD measures: D(C2BK2) and D(C1BK), 2) legal factor, LEGAL2, 3) five regulatory factors: NIM, BKPRIVAT, BKFREE, OHCOSTS and DEPOSITINS, and 4) two technology factors: TECHIMP and TECHEXP. The regression coefficient on NIM and OHCOST have the expected negative sign and are significant at the 5% and 1% levels, respectively. The basic liquidity measure of the banking system, \bar{F} , continues to report a positive and highly significant coefficient although the coefficient is smaller in size after considering the direct impact of the two complementary FSD measures and external factors. The coefficients on D(C1BK) and D(C2BK2) are negative and positive and are significant at the 5% and 1% levels, respectively. Note that LEGAL2, BKPRIVAT, DEPOSITINS, BKFREE, TECHEXP, and TECHIMP are not statistically significant but remain in the model following the stepwise procedure.

CONCLUSION

Various empirical studies provide evidence that certain external factors have significant impacts on a country's rate of economic growth. Demircuc-Kunt (2006) argues that it is crucial to consider all the relevant factors altogether in one model. This study demonstrates that the technological, legal, and regulatory environment can play a major role towards enhancing or retarding the smooth of functioning of the financial system and thus impact the rate of economic growth. By employing both an individual factor model and a joint impact model, this study also concludes that omitting certain relevant external factors (i.e. law, regulation, and technology) may bias the results. For example, for advanced countries, the level of a country's technology relate exports, D(TECHEXP), carries a positive and statistically significant and larger coefficient in the model after considering all the relevant external factors. In addition, the level of technology imports, D(TECHIMP), has no significant impact in the individual factor model but carries a negative and significant impact in the joint multi-factor model. For emerging countries, BKCONCEN and FGENTRY carry significant coefficients in the individual factor models, but both become insignificant after considering other relevant variables in the multi-factor model. For both advanced and emerging countries, LEGAL2 carries a significantly positive impact in the individual factor model but becomes insignificant in the joint factor model (Note that for the advanced countries, LEGAL2 is not even included in the final stepwise regression model).

This study also provides evidence that for both advanced and emerging countries, the superior model, based on the adjusted R-squared and AIC statistic, is the one that includes all the relevant factors together in one model. In addition, using the stepwise selection process, the complementary FSD measures

(D(C1BK) and D(C2BK2)) are both included in the final joint multi-factor model for both the advanced countries and emerging countries. The impact of the traditional intermediation factor (F) also becomes insignificant in the advanced country model and weakly significant in the emerging country model. This result provides evidence that precise FSD measures are necessary in economic growth model as suggested by (Levine, 2004). Finally, missing variables for many of the external factors dramatically reduced the sample size.. Future studies can explore other types of external factors to strengthen the empirical results.

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BIOGRAPHY

Dr. Hsin-Yu Liang is an Assistant Professor of International Trade at Feng Chia University, She can be contacted at College of Business Administration, Feng Chia University, 100 Wenhwa Rd., Seatwen, Taichung, Taiwan, 40724, R.O.C. Email: lianghy@fcu.edu.tw

Dr. Alan K. Reichert is a Professor of Finance at Cleveland State University. He can be contacted at Department of Finance, College of Business, Cleveland State University, 2121 Euclid Avenue, Cleveland, Ohio 44115. Email: a.reichert@csuohio.edu