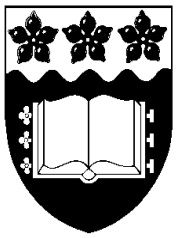

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THE FINANCIAL SECTOR AND ECONOMIC GROWTH

Arusha Cooray
School of Economics

University of Wollongong
Wollongong, NSW 2522

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Arusha Cooray*

ABSTRACT: The Mankiw-Romer-Weil (1992) augmented Solow-Swan model is extended to incorporate the financial sector in this study. Distinguishing between financial capital, physical capital and human capital, this study attempts to identify in particular, the effects of financial capital on economic growth. The study is also examines the effects of financial sector efficiency on economic growth. The financial sector augmented model is tested on 35 low and middle income economies. Strong support is found for the financial sector augmented model.

JEL Codes: O42, O43, O47

Keywords: Mankiw-Romer-Weil model, economic growth, financial capital, banking sector, convergence

* Corresponding author: Arusha Cooray, School of Economics, University of Wollongong, Northfields Avenue, NSW 2522, Australia, Tel: 61-2-4221-4017; E-mail: arusha@uow.edu.au. This paper was presented at the 37th Australian Conference of Economists, Gold Coast, Australia. I wish to thank the conference participants and Paul Blacklow, Amnon Levy, Ranjan Ray, Peter Siminski, Simon Ville, Graeme Wells and Ed Wilson for helpful comments.

1. INTRODUCTION

The objective of this study is to examine specifically, the role of the financial sector in the process of economic growth by distinguishing between physical capital, financial capital and human capital. In order to realise this objective, the Mankiw-Romer-Weil (MRW) augmented Solow-Swan model is further extended to incorporate the financial sector by means of a separate variable proxying for financial capital.[1] The effects of the efficiency of the financial sector on economic growth are also considered, given that increased efficiency can lead to enhanced growth through the productive use of a country's stock of financial capital. Three financial sector indicators are constructed by using the data set compiled by Beck, Demirguc-Kunt and Levine (1999 – updated in 2007). Since a financial system channels funds from savers to borrowers, it plays a vital role in an economy's growth process. Schumpeter (1911) recognised the importance of finance in economic development in as far back as 1911. This view was subsequently supported by Goldsmith (1969). Since the work of McKinnon (1973) and Shaw (1973) there has developed a growing consensus regarding the positive link between financial sector development and economic growth. More recently, this positive relation has been supported in the work of King and Levine (1993a), Levine and Zervos (1998), Beck, Levine and Loayza (1999), Demirguc-Kunt and Maksimovic (1996) among others. The present study differs from the previous literature in that it extends the MRW structural framework for testing the impact of the financial sector on economic growth.

The size and degree of the efficiency of the financial systems of many developing economies have undergone extensive structural change due to regulatory reform.

Despite the significant expansion of the stock markets in these economies in the recent past, the banking sector still remains the main financial intermediary. Therefore in constructing the financial sector indices, this paper focuses on the banking sector in 35 low and middle income economies. The rest of this paper is structured as follows: Section II presents the financial sector augmented model. Section III examines the data. Section IV evaluates the empirical results and Section V summarises the conclusions.

II. THE FINANCIAL SECTOR AUGMENTED MODEL

Aggregate production is characterised by a constant returns to scale Cobb-Douglas production function with physical capital, human capital, financial capital and the labour force:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} F(t)^{\gamma} (A(t)L(t))^{1-\alpha-\beta-\gamma} \qquad (1)$$

where Y = output, K = physical capital, H = human capital, F = financial capital, A = the level of technology and L = labour. The financial capital variable captures the value of financial assets as opposed to physical capital which incorporates the value of real assets such as structures. It is assumed that *L(t)* grows exogenously at a rate n and *A(t)* grows exogenously at a rate g. The rate of depreciation of the capital stock is denoted by δ. As in the MRW model, g and δ are assumed to be the same across countries. If the fraction of income devoted to physical capital is denoted by s_K, the fraction of income devoted to human capital is s_H and the fraction of income devoted to the financial sector is s_F, the steady state level of per capita output in logarithmic form can be expressed as:

$$\ln\left[\frac{Y(t)}{L(t)}\right]^{*} = \ln A(0) + gt + \frac{\alpha}{1-\alpha-\beta-\gamma}\ln s_K + \frac{\beta}{1-\alpha-\beta-\gamma}\ln s_H + \frac{\gamma}{1-\alpha-\beta-\gamma}\ln s_F$$

$$-\frac{\alpha+\beta+\gamma}{1-\alpha-\beta-\gamma}\ln(n+g+\delta) \qquad (2)$$

Let $\ln A(0) = a_0 + \mu$ where a_0 is a constant and μ is a country specific shock.

Relaxing the assumption of steady state, the speed of convergence is expressed by:

$$\frac{d\ln y(t)}{dt} = (1-\alpha-\beta-\gamma)(n+g+\delta)(\ln y^{*} - \ln y(t)) \qquad (3)$$

where y is the level of output per effective worker and y^{*} is the steady state level of output per effective worker. If $\lambda = (1-\alpha-\beta-\gamma)(n+g+\delta)$ then λ can be defined as the speed of convergence of the economy (see Barrro and Sala-i-Martin 1992, 1999). From equation (3) it follows that:

$$\ln y(t) = (1-e^{-\lambda t})\ln(y^{*}) + e^{-\lambda t}\ln y(0) \qquad (4)$$

Subtracting $y(0)$ from both sides and substituting for y^{*} gives:

$$\ln y(t) - \ln y(0) = (1-e^{-\lambda t})\frac{\alpha}{1-\alpha-\beta-\gamma}\ln s_K + (1-e^{-\lambda t})\frac{\beta}{1-\alpha-\beta-\gamma}\ln s_H$$

$$+(1-e^{-\lambda t})\frac{\gamma}{1-\alpha-\beta-\gamma}\ln s_F - (1-e^{-\lambda t})\frac{\alpha+\beta+\gamma}{1-\alpha-\beta-\gamma}\ln(n+g+\delta)$$

$$-(1-e^{-\lambda t})\ln y(0) \qquad (5)$$

Equation (5) can be estimated as follows,

$$\ln y(t) - \ln y(0) = a_0 + a_1\ln s_K + a_2\ln s_H + a_3\ln s_F + a_4\ln(n+g+\delta) + a_5\ln y(0) + \mu \qquad (6)$$

According to equations (5) and (6), the growth rate of income per capita depends on population growth, the accumulation of physical capital, human capital and financial capital. The model is also tested by taking into account the efficiency of the financial sector. When efficiency is incorporated into the model, equation (6) becomes,

$$\ln y(t) - \ln y(0) = a_0 + a_1 \ln s_K + a_2 \ln s_H + a_3 \ln s_F + a_4 \ln(n + g + \delta) + a_5 \ln y(0) + a_6 \ln \theta + \mu \quad (7)$$

where θ measures banking efficiency. Equations (6) and (7), are tested in Section IV.

III. DATA

The study comprises the 35 low and middle income economies (as defined by the World Bank) listed in Table 1. The data used for the empirical estimation are annual and cover the period 1992-2003. The data have been obtained from the following sources:

Variable	Source
GDP per Capita (Y/L)	World Development Reports and Human Development Reports.
Share of Physical Capital to GDP (s_K)	World Development Indicators.
Annual Average Growth Rate of the Labour Force (n)	World Development Reports.
Net Secondary Enrolment Ratio: used as proxy for human capital (s_H)	Human Development Reports.
$g + \delta$	The sum of the growth rate of technology, g, and the rate of depreciation, δ, are assumed to be 0.05 as in MRW.
Financial Sector Variables	All financial sector variables have been taken from the database compiled by Beck, Demirguc-Kunt and Levine (1999 updated in 2007).

The estimation carried out in Section IV is based on the logarithms of (Y/L) for 1992 and 2003, and for all other variable the averages are computed for the 1992-2003 period. The financial capital variable is proxied by three composite indices s_{F1}, s_{F2} and s_{E1} which are defined below.

Financial Sector Size and Activity: Two composite indicators s_{F1} and s_{F2} are used to measure financial sector size and activity. The indicator s_{F1} is constructed by taking the average of three commercial banking indicators as used by Demirguc-Kunt and Maksimovic (1996). These three indicators are: one, the ratio of M2/GDP which is a measure of the size and depth of the banking sector. Two, the ratio of deposit banks assets to GDP which is also a measure of the size of the financial sector. Three, domestic credit by deposit banks to the private sector as a ratio of GDP. This measures the provision of credit by the banking sector to the private sector and is an indicator of the degree of activity of financial intermediaries. All three indicators have been used by Demirguc-Kunt and Maksimovic (1996), King and Levine (1993), Levine and Zervos (1996) among others.

To measure the significance of not only the commercial banking sector, but also, non-bank financial intermediaries, a second index is constructed as in Demirguc-Kunt and Maksimovic (1996). The indicator s_{F2} is constructed by averaging: one, the ratio of M2/GDP; two, private credit by deposit banks and other financial institutions to GDP; three, assets of deposit banks to GDP; and four, assets of other financial institutions to GDP. [2] Assets of other financial institutions to GDP is not available for all countries. For these countries only the average of the first three indicators is taken into account.

Financial Sector Efficiency: is measured by the indicator s_{E1}. This is constructed by averaging (1) the value of banks' net interest margin to total assets, (2) banks' overhead costs to total assets and (3) a concentration measure which is the ratio of the three largest banks' assets to total banking assets. Increased competition in the

financial sector should reduce overhead costs, interest margins and the degree of concentration.

(Table 1, about here)

An examination of the financial indicators on Table 1 show that the size and depth of the banking sector as measured by M2/GDP and domestic assets of deposit banks to GDP are relatively large in Jordan, Mauritius, Malaysia, Thailand, Morocco and South Africa. Banking sector activity as measured by the provision of credit to the private sector is high in Jordan, South Korea, Malaysia and Thailand. The assets held by non-bank financial institutions as a % of GDP are high in South Africa, Peru and South Korea, while in the provision of credit to the private sector, non-bank financial institutions play a relatively large role in Jordan, South Korea, Malaysia, South Africa, Thailand and Tunisia.

(Table 2, about here)

Table 2 presents the bank concentration ratios for the countries under study. The data reveal that the concentration ratios have fallen in almost all of the countries over the 1992 to 2003 period. As greater banking concentration is associated with reduced efficiency, the data presented in Table 2 suggest increased efficiency. See Beck et al. (1999) who point out that a highly concentrated banking sector leads to lack of competitive pressure in attracting savings and channelling them to their most productive uses.

IV. EMPIRICAL RESULTS

This section evaluates the empirical results for the transition models.

Financial Sector Size, Activity and Economic Growth

The OLS results for the transition model as given by equation (6) in Section II, are presented in Table 3A. The growth in per capita income over 1992 to 2003 is the dependent variable in all equations. Equation (1) presents results for the MRW model. The MRW model is augmented with the financial variables in equations (2) – (7). Equation (2) augments the MRW model with the ratio of M2/GDP (M2), equation (3) with domestic credit to the private sector to GDP (PCR), equation (4) with private credit by deposit banks and other financial institutions to GDP (PCR_1), equation (5) with deposit bank domestic assets to GDP (BA). Equations (6) and (7) incorporate the composite size and activity financial indicators.

(Table 3A-3B, about here)

The OLS estimates will be biased and inconsistent if financial sector growth were also a function of economic growth. Therefore, in order to correct for any endogeneity bias that may be present in the models, the equations are also estimated using the (General Method of Moments) GMM. See Table 3B. Four instruments were chosen on the basis of Shea's (1996) partial R^2. These were the primary enrolment ratio, the stock market turnover ratio, the stock market capitalisation ratio and the stock market liquidity ratio. There is strong evidence of convergence with the coefficient on the initial level of income per head significant at the 1% level and negative in all regression equations. The values of $\bar{R}^2$ in the financial sector augmented models in Tables 3A and 3B are in the range of 0.61 – 0.67 suggesting high explanatory power in the models. The OLS estimates indicate that the financial sector variables are statistically significant at the 5% and 1% levels and the GMM estimates that they are significant at the 5% and 10% levels. The composite financial sector index is

significant at the 5% and 1% levels under the two estimation methods. The human capital variable is significant at the 5% and 1% levels in all equations. A Durbin-Wu-Hausman (1954, 1973, 1978) test is performed to test for any statistically significant difference between the OLS and GMM estimates (see Table 3B). There is no evidence of any significant difference between the OLS and GMM estimates. Therefore it can be concluded that the OLS estimates are reliable. The J Statistic of Hansen (1996) suggests that over-identifying restrictions are not rejected.

The implied output elasticities are reported in the bottom panel of Table 3A. The implied output elasticities of physical capital (α) in the financial capital augmented model are slightly lower than in the MRW estimates (1992, Table VI). However, in equation (1), the MRW model in the present study, the estimate is 0.40 which is consistent with the MRW estimates (1992, Table VI). The implied output elasticities of human capital, β, in the present study range from 0.21-0.25 which are consistent with MRW whose β estimates are 0.23 (1992, Table VI). The implied output elasticities of financial capital, γ, are in the range of 0.13-0.21 and are 0.17 in the composite size and activity augmented models. The implied output elasticities of the different forms of capital are reasonable and the rate of convergence is in the range of 0.018-0.022 consistent with the MRW estimate of 0.018 for the intermediate sample (1992, Table VI).

Financial Sector Size, Activity, Efficiency and Economic Growth

Next, the effects of banking sector size, activity and efficiency on economic growth are examined. Estimation is carried out using both OLS and the GMM. Banking sector efficiency as mentioned above is measured by taking into account banks'

overhead costs as a share of its total assets, banks' net interest revenue as a share of its total assets and the concentration ratio. The results are presented in Table 4. The instruments for the GMM technique were chosen on the basis of Shea's (1996) partial R^2 and are the same as in the previous section. Again there is significant evidence of convergence with the coefficient on the initial level of income being significant and negative.

(Table 4, about here)

The composite banking size and efficiency indicators are statistically significant under both estimation techniques. Consistent with expectations, the negative values on the interest margin and overhead cost coefficients suggest that higher interest margins and overhead costs are associated with lower growth. Concentration ratios are significant at the 10% level under the GMM method. The composite efficiency index is significant at the 10% level in equations (3) and (4). Human capital has a positive significant effect on economic growth. The inclusion of the financial sector efficiency variables to the size and efficiency models, lead to a significant increase in the explanatory power of the regression models to the range of 0.63-0.77.

Interaction between Financial Sector Size, Activity and Efficiency and Economic Growth

Since efficiency can be related to the size and activity of the financial sector, this section examines the interaction between banking size and activity and efficiency and their effects on economic growth. Table 5 reports the regression estimates.

(Table 5, about here)

The interaction terms are significant at the 10% level suggesting that size and activity are related to efficiency in that increased financial capital could translate into greater

efficiency and/or greater efficiency can lead to the productive use of a country's financial capital.

Robustness Checks

A number of tests have been carried out to ensure that the results are robust.

GMM Estimation

The study has been carried out using GMM estimation in addition to OLS to correct for the potential endogenity bias (explained above) associated with growth models. It can be concluded that endogenity is not a problem and that the results are robust to the estimation technique. The Durbin-Wu-Hausman test suggests the absence of any statistically significant difference between the OLS and GMM estimates and the J statistic of Hansen suggests that the instruments are valid.

Alternative Regressors

A number of different financial variables are used as proxies for financial capital and efficiency (Tables 3 and 4). It can be concluded therefore that the results are robust to the choice of the financial variable.

Dummy Variables

The composite models were re-estimated with dummy variables in order to account for any regional disparities (see footnote to Table 3). Selecting Europe and Central Asia as the benchmark group, four regional dummies were defined for: (1) Asia, (2) South America and the West Indies, (3) the Middle East and (4) Africa. All of the regional dummies were positive and insignificant suggesting that regional disparities are not the main driver of economic growth. The inclusion of the regional dummies do not change the overall results.

Robust Regression

According to Temple (1998), outliers that arise from measurement error and omitted variables can bias the results of growth models. Therefore in order to address the issue of influential outliers, the equations are re-estimated using the robust regression technique which gives minimum weight to outlying observations. The results are reported in Table 6. The estimates are consistent with the OLS and GMM estimates suggesting that the estimates do not appear to be unduly influenced by outliers.

(Table 6, about here)

V. CONCLUSIONS

This study distinguishes between physical capital, human capital and financial capital. Using the financial sector to proxy for financial capital, the study focuses specifically on the effects of financial sector development on economic growth. Strong support is found for the financial sector augmented model with significant evidence of a positive impact of financial capital on economic growth. An examination of the effects of financial sector size, activity, and efficiency on economic growth show that size, activity and efficiency are important for economic growth. Therefore the evidence suggests that further broadening the banking system in the countries under study to channel resources to their most productive uses can enhance growth. Measures could also be taken to increase the efficiency of the banking system by reducing concentration, interest margins and overhead costs. There is evidence of interaction between the size and activity of the financial sector and efficiency suggesting that greater efficiency of the financial sector contributes to the productive use of a countries financial capital leading to higher growth. Similarly, countries with larger and more active financial sectors could use their financial capital more efficiently.

Consistent with the findings of MRW, the results of the present study show that human capital is a significant variable in influencing growth. As education is the most important means of increasing the level of income of a society, the skill levels of the population and education opportunities can be increased to promote economic growth and also reduce the growth in population.

The results are consistent with the findings of King and Levine (1993a), Levine and Zervos (1998), Beck, Levine and Loayza (1999), Demirguc-Kunt and Maksimovic (1996) in there exists a positive relation between economic growth and financial sector development.

REFERENCES

Barro R and Sala-i-Martin X (1992) 'Convergence' *Journal of Political Economy*, 100, 1992, 223-251

Barro R and Sala-i-Martin X (1999) 'Economic Growth' Cambridge, MA: MIT Press.

Beck T, Demirgüc-Kunt A and Levine R (1999) 'A New Database on Financial Development and Structure (updated in 2007)' *World Bank Policy Research Working Paper* 2146, World Bank, Washington

Beck T, Levine R and Loayza N (1999) 'Finance and the Sources of Growth' World Bank Policy Research Working Paper 2057, World Bank, Washington

Demirgüc-Kunt A and Maksimovic V (1996) 'Stock Market Development and Financing Choices of Firms' *World Bank Economic Review*, 10, 341-369

Durbin J (1954) 'Errors in Variables' *Review of the International Statistical Institute*, 22, 23-32

Goldsmith R (1969) 'Financial Structure and Development' Yale University Press, New Haven, CT

Hansen L, Heaton J and Yaron A (1996) 'Finite Sample Properties of Some Alternative GMM Estimators' *Journal of Business and Economic Statistics*, 14, 262 – 280

Hausman J (1978) 'Specification Tests in Econometrics' *Econometrica*, 46, 1251

King R and Levine R (1993a) 'Finance and Growth: Schumpeter Might be Right' *Quarterly Journal of Economics*, 108, 717-738

Levine R and Zervos S (1996) 'Stock Market Development and Long Run Growth' *World Bank Economic Review*, 10, 323-339

Levine R and Zervos S (1998) 'Stock Markets, Banks and Economic Growth'

American Economic Review, 26, 1169-1183

Mankiw N G, Romer D and Weil D (1992) 'A Contribution to the Empirics of Economic Growth' *Quarterly Journal of Economics*, 2, 407-437

McKinnon R (1973) 'Money and Capital in Economic Development, Brookings Institution, Washington

Milburne R, Otto G and Voss G (2003) 'Public Investment and Economic Growth' *Applied Economics*, 35, 527-540

Nonneman W and Vanhoudt P (1996) 'A Further Augmentation of the Solow Model and the Empirics of Economic Growth for OECD Countries' *Quarterly Journal of Economics*, 3, 943-953

Ram R (2007) 'IQ and Economic Growth: Further Augmentation of Mankiw-Romer-Weil Model' *Economics Letters*, 94, 7-11

Schumpeter J 'The Theory of Economic Development' Harvard University Press, Cambridge, MA

Shaw E (1973) 'Financial Deepening in Economic Development' Oxford University Press, NY

Shea J (1997) 'Instrument Relevance in Multivariate Linear Models: A Simple Measure' *Review of Economics and Statistics*, 79, 348 - 352

Swan T (1956) 'Economic Growth and Capital Accumulation' *Economic Record*, 32, 334-361

Temple J (1998) 'Robustness Tests of the Augmented Solow Model' *Journal of Applied Econometrics*, 13, 361-375

United Nations, *Human Development Reports*, Various Issues, NY

World Bank, *World Development Indicators*, World Bank, Washington

World Bank, *World Development Reports*, Various Issues, World Bank, Washington

Wu D (1973) ‘Alternative Tests of Independence between Stochastic Regressors and Disturbances’ *Econometrics*, 41, 733 - 750

TABLE 1

Banking Indicators

	Ratio of M2 to GDP	Domestic Credit by Banks to Private Sector / GDP	Deposit Banks Domestic Assets to GDP	Assets of Other Financial Institutions to GDP	Private Credit by Deposit Banks and Other Financial Ins to GDP
Bangladesh	0.30	0.23	0.30	-	0.23
Botswana	0.24	0.10	0.11	-	0.10
Brazil	0.25	0.27	0.42	0.14	0.33
Chilie	0.39	0.51	0.52	0.12	0.62
Columbia	0.21	0.17	0.21	0.14	0.29
Cote d'Ivoir	0.24	0.19	0.25	-	0.19
Ecuador	0.22	0.25	0.26	0.04	0.26
Ghana	0.21	0.08	0.14	-	0.08
India	0.48	0.25	0.38	-	0.25
Indonesia	0.46	0.37	0.48	-	0.37
Iran	0.36	0.19	0.20	0.07	0.26
Jamaica	0.38	0.19	0.31	0.04	0.22
Jordan	1.05	0.65	0.74	0.06	0.70
Kenya	0.34	0.25	0.35	0.08	0.31
S Korea	-	0.63	0.65	0.59	1.20
Malaysia	0.86	0.87	0.93	0.41	1.25
Mauritius	0.76	0.48	0.63	-	0.48
Morocco	0.71	0.39	0.56	0.19	0.46
Namibia	0.34	0.33	0.37	0.09	0.42
Nigeria	0.18	0.12	0.16	0.02	0.12
Pakistan	0.41	0.22	0.36	-	0.22
Panama	0.64	0.73	0.74	-	0.73
Peru	0.25	0.19	0.21	0.69	0.19
Philippines	0.51	0.34	0.46	0.05	0.39
Russia	0.19	0.37	0.44	0.08	0.43
Saudi Arabia	0.46	0.23	0.39	0.31	0.54
South Africa	0.51	0.62	0.68	0.77	1.23
Sri Lanka	0.34	0.22	0.29	-	0.22
Swaziland	0.24	0.17	0.17	-	0.17
Thailand	0.88	0.89	0.95	0.36	1.20
Trinidad and Tobago	0.43	0.25	0.37	0.15	0.42
Tunisia	0.48	0.52	0.56	0.10	0.63
Turkey	0.32	0.15	0.29	0.01	0.16
Venezuela	0.19	0.10	0.13	0.03	0.13
Zimbabwe	0.21	0.19	0.25	0.13	0.27

Source: the average for the 1992-2003 period calculated from Beck, Demirguc-Kunt and Levine (1999 updated in 2007) and World Development Indicators.

TABLE 2

Bank Concentration Ratios

	1992	2003
Bangladesh	0.74	0.45
Botswana	0.97	0.77
Brazil	0.98	0.47
Chilie	0.63	0.59
Columbia	0.48	0.35
Cote d'Ivoir	1.00	0.74
Ecuador	0.50	0.50
Ghana	1.00	0.71
India	0.46	0.33
Indonesia	0.69	0.54
Iran	1.00	0.80
Jamaica	0.82	0.86
Jordan	0.92	0.90
Kenya	0.62	0.58
S Korea	0.51	0.47
Malaysia	0.51	0.41
Mauritius	0.97	0.73
Morocco	0.83	0.64
Namibia	1.00	0.86
Nigeria	0.96	0.41
Pakistan	0.79	0.52
Panama	0.74	0.34
Peru	0.87	0.72
Philippines	0.89	0.40
Russia	0.80	0.25
Saudi Arabia	0.62	0.59
South Africa	0.74	0.76
Sri Lanka	0.84	0.64
Swaziland	1.00	0.76
Thailand	0.63	0.52
Trinidad and Tobago	0.79	0.83
Tunisia	0.54	0.46
Turkey	0.98	0.51
Venezuela	0.66	0.46
Zimbabwe	0.74	0.73

Source: Beck, Demirguc-Kunt and Levine (1999 updated in 2007)

TABLE 3A

Financial Sector Size and Activity and Tests of Conditional Convergence in the Transition

Model: OLS Estimation

Dependent Variable: $\ln(Y/L)_{2003} - \ln(Y/L)_{1992}$

Independent Variable	MRW	MRW Augmented					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln(Y/L)_{1992}$	-0.37 (0.05)***	-0.38 (0.05)***	-0.38 (0.05)***	-0.40 (0.05)***	-0.38 (0.05)***	-0.41 (0.05)***	-0.42 (0.05)***
$\ln S_K$	0.43 (0.23)**	0.16 (0.27)	.15 (0.23)	0.22 (0.23)	0.19 (0.24)	0.31 (0.23)	0.32 (0.21)
$\ln(n+g+\delta)$	-0.04 (0.04)	-0.07 (0.04)	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.04)	-0.07 (0.04)**
$\ln(S_H)$	0.23 (0.11)**	0.28 (0.11)***	0.24 (0.10)**	0.24 (0.10)**	0.24 (0.10)**	0.27 (0.10)***	0.28 (0.10)***
$\ln(M2)$	-	0.23 (0.10)**	-	-	-	-	-
$\ln(PCR)$	-	-	0.17 (0.07)***	-	-	-	-
$\ln(PCR_1)$	-	-	-	0.14 (0.06)**	-	-	-
$\ln(BA)$	-	-	-	-	0.17 (0.07)**	-	-
$\ln(S_{F1})$	-	-	-	-	-	0.21 (0.09)**	-
$\ln(S_{F2})$	-	-	-	-	-	-	0.22 (0.08)***
Constant	1.81 (0.73)***	1.78 (0.76)**	2.17 (0.68)***	2.16 (0.69)***	1.99 (0.69)***	1.62 (0.68)**	1.62 (0.65)
$\overline{R^2}$	0.58	0.65	0.62	0.61	0.67	0.66	0.67
Implied Output Elasticities							
α	0.40	0.14	0.15	0.21	0.18	0.25	0.24
β	0.21	0.25	0.24	0.23	0.23	0.22	0.21
γ	-	0.21	0.17	0.13	0.17	0.17	0.17
Convergence Rate							
λ	0.020	0.02	0.022	0.022	0.021	0.020	0.021

Notes:

(1) M2 = M2/ GDP; PCR = private credit by deposit banks to GDP; PCR1 = private credit by deposit banks and other financial institutions to GDP; BA = deposit banks assets to GDP; S_{F1} is the average of the ratio of M2/GDP, domestic credit to the private sector to GDP and deposit bank domestic assets to GDP; S_{F2} is the average of the ratio of M2/GDP, private credit by deposit banks and other financial institutions to GDP, deposit bank assets to GDP, and other financial institutions assets to GDP (countries for which other financial institutions assets to GDP data are not available, only the average of the first three variables are taken into account).

(2) Standard errors reported within parenthesis. *, **, ***, significant at the 10%, 5% and 1% levels.

(3) Equations (6) and (7) using OLS were re-estimated with regional dummies. The coefficients for equation (6) were 0.20 for Asia, 0.23 for South America and the West Indies, 0.22 for the Middle East and 0.24 for Africa. The coefficients for equation (7) were 0.22 for Asia, 0.23 for South America and the West Indies, 0.24 for the Middle East and 0.24 for Africa. None of the coefficients were statistically significant.

TABLE 3B

Financial Sector Size and Activity and Tests of Conditional Convergence in the Transition

Model: GMM Estimation

Dependent Variable: $\ln(Y/L)_{2003} - \ln(Y/L)_{1992}$

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(Y/L)_{1992}$	-0.36 (0.06)***	-0.38 (0.05)***	-0.40 (0.06)***	-0.37 (0.05)***	-0.37 (0.05)***	-0.39 (0.05)***
$\ln S_K$	0.03 (0.26)	0.10 (0.26)	0.16 (0.25)	0.11 (0.26)	0.07 (0.25)	0.09 (0.24)
$\ln(n+g+\delta)$	-0.29 (0.21)*	-0.20 (0.19)	-0.18 (0.20)	-0.20 (0.20)	-0.23 (0.20)	-0.20 (0.19)
$\ln(S_H)$	0.32 (0.12)***	0.28 (0.11)***	0.28 (0.11)***	0.28 (0.11)***	0.29 (0.11)***	0.30 (0.11)***
$\ln(M2)$	0.26 (0.16)*	-	-	-	-	-
$\ln(PCR)$	-	0.16 (0.09)**	-	-	-	-
$\ln(PCR_1)$	-	-	0.16 (0.10)*	-	-	-
$\ln(BA)$	-	-	-	0.19 (0.11)*	-	-
$\ln(S_{F1})$	-	-	-	-	0.20 (0.07)**	-
$\ln(S_{F2})$	-	-	-	-	-	0.21 (0.09)**
Constant	2.19 (0.87)***	2.34 (0.81)***	2.27 (0.81)***	2.11 (0.81)***	2.17 (0.78)***	2.13 (0.76)***
$\overline{R^2}$	0.63	0.64	0.62	0.63	0.65	0.67
Durbin-Wu-Hausman Test $\chi^2(5)$	3.63	2.20	1.84	2.37	4.49	3.69
J Statistic of Hansen $\chi^2(3)$	0.08	0.19	0.12	0.08	0.19	0.13
Shea R^2						
$\ln(M2)$	0.62	-	-	-	-	-
$\ln(PCR)$	-	0.60	-	-	-	-
$\ln(PCR1)$	-	-	0.58	-	-	-
$\ln(BA)$	-	-	-	0.57	-	-
$\ln(S_{F1})$	-	-	-	-	0.58	-
$\ln(S_{F2})$	-	-	-	-	-	0.64

Notes:

(1) Definitions of financial sector variables same as for Table 3.

(2) Standard errors reported within parenthesis. *, **, ***, significant at the 10%, 5% and 1% levels.

(3) The 5% critical value for the Durbin-Wu-Hausman test is , $\chi^2(5)_{.05}$ is 11.07. The 5% critical value for the J Statistic of Hansen test, $\chi^2(3)_{.05}$ is 7.81.

TABLE 4

Financial Sector Size, Activity, Efficiency and Growth in the Transition Model

Dependent Variable: $\ln(Y/L)_{2003} - \ln(Y/L)_{1992}$

Variable	(1)		(2)		(3)		(4)	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
$\ln(Y/L)_{1992}$	-0.36	-0.36	-0.38	-0.38	-0.37	-0.38	-0.40	-0.39
	(0.05)***	(0.04)***	(0.05)***	(0.04)***	(0.04)***	(0.05)***	(0.05)***	(0.04)***
$\ln(s_K)$	0.11	0.12	0.13	0.01	0.10	0.04	0.13	0.05
	(0.15)	(0.12)	(0.14)	(0.08)	(0.13)	(0.11)	(0.14)	(0.10)
$\ln(n+g+\delta)$	-0.04	-0.36	-0.05	-0.33	-0.07	-0.19	-0.07	-0.19
	(0.04)	(0.23)*	(0.04)*	(0.22)*	(0.04)*	(0.18)	(0.04)**	(0.16)
$\ln(s_H)$	0.28	0.30	0.29	0.32	0.25	0.25	0.26	0.26
	(0.10)***	(0.08)***	(0.10)***	(0.08)***	(0.10)***	(0.09)***	(0.09)***	(0.08)***
$\ln(s_{F1})$	0.18	0.15	-		0.17	0.11	-	-
	(0.10)**	(0.08)**			(0.11)*	(0.07)*		
$\ln(s_{F2})$	-	-	0.24	0.18	-		0.24	0.17
			(0.11)**	(0.08)**			(0.11)**	(0.12)*
ln(IM)	-0.28	-0.40	-0.23	-0.35	-		-	-
	(0.16)**	(0.12)**	(0.15)*	(0.12)***				
ln(OC)	-0.23	-0.29	-0.24	-0.26	-		-	-
	(0.16)*	(0.13)**	(0.16)*	(0.12)**				
ln(concentration)	0.17	0.25	0.20	0.28	-		-	-
	(0.16)	(0.18)*	(0.16)	(0.17)*				
$\ln(s_{E1})$	-	-	-	-	-0.02	-0.04	0.04	-0.03
					(0.015)*	(0.03)*	(0.03)*	(0.02)*
Constant	1.40	1.86	1.03	1.57	1.50	1.60	1.95	1.34
	(1.06)*	(0.91)**	(1.04)	(0.94)**	(1.04)*	(1.80)	(0.84)**	(1.52)
$\overline{R^2}$	0.63	0.76	0.66	0.77	0.69	0.70	0.65	0.72
Durbin-Wu-Hausman Test χ^2		1.68		1.73		1.16		1.94
J Statistic of Hansen χ^2		1.81		3.21		2.32		1.51
She R^2 -								
$\ln(s_{F1})$	-	0.80	-	-	-	0.80	-	-
$\ln(s_{F2})$	-	-	-	0.84	-	-	-	0.84

Notes: The definitions of financial sector variables are the same as for Table 3.

IM- net interest margin = the accounting value of a bank's net interest revenue as a share of its total assets; OC = the accounting value of a bank's overhead costs as share of its total assets; Concentration = the ratio of the three largest banks' assets to total banking sector assets.

s_{E1} is the average of the ratios of net interest margin to total assets, overhead costs to total assets and bank concentration to total assets.

Standard errors reported within parenthesis. *, **, ***, significant at the 10%, 5% and 1% levels.

The 5% critical value for the Durbin-Wu-Hausman test, $\chi^2(5)_{.05}$ is 11.07. The 5% critical value for the J Statistisc of Hansen test, $\chi^2(3)_{.05}$ is 7.81.

TABLE 5

Interaction between Financial Sector Size, Activity, Efficiency and Economic Growth

in the Transition Model

Dependent Variable: $\ln(Y/L)_{2003} - \ln(Y/L)_{1992}$

Variable	(1)	(2)	(3)	(4)
	OLS	GMM	OLS	GMM
$\ln(Y/L)_{1992}$	-0.37	-0.36	-0.38	-0.37
	(0.05)***	(0.05)***	(0.04)***	(0.05)
$\ln(s_K)$	0.12	0.07	0.16	0.12
	(0.13)	(0.11)	(0.12)*	(0.09)
$\ln(n+g+\delta)$	-0.06	-0.18	-0.06	-0.15
	(0.04)*	(0.19)	(0.04)*	(0.19)
$\ln(s_H)$	0.22	0.24	0.23	0.23
	(0.11)**	(0.08)***	(0.10)**	(0.08)***
$\ln(s_{F1})$	0.20	0.34	-	-
	(0.10)**	(0.24)*		
$\ln(s_{F2})$	-	-	0.38	0.39
			(0.24)*	(0.23)**
$\ln(s_{E1})$	-0.29	-0.48	-0.28	-0.40
	(0.22)*	(0.36)*	(0.20)*	(0.26)*
$\ln(s_{F1})*\ln(s_{E1})$	0.07	0.13	-	-
	(0.05)*	(0.10)*		
$\ln(s_{F2})*\ln(s_{E1})$	-	-	0.08	0.14
			(0.06)*	(0.09)*
Constant	1.38	1.65	1.34	1.67
	(0.92)*	(0.80)**	(0.98)*	(0.82)**
$\overline{R^2}$	0.70	0.71	0.72	0.73
Durbin-Wu-Hausman Test χ^2	-	2.03	-	1.13
J Statistic of Hansen χ^2	-	1.18	-	1.02
She R^2 -				
$\ln(s_{F1})$	-	0.90	-	-
$\ln(s_{F2})$	-	-	-	0.92

Notes: Definitions of financial sector size and activity and efficiency are the same as for Tables 3A and 4.

Standard errors reported within parenthesis. *, **, ***, significant at the 10%, 5% and 1% levels.

The 5% critical value for the Durbin-Wu-Hausman test, $\chi^2(5)_{.05}$ is 11.07. The 5% critical value for the J Statistisc of Hansen test, $\chi^2(3)_{.05}$ is 7.81. Instruments are the same as those for the above models chosen on the basis of She's R^2.

TABLE 6

Estimation of the Composite Models using Robust Regression

Dependent Variable: $\ln(Y/L)_{2003} - \ln(Y/L)_{1992}$

Variable	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(Y/L)_{1992}$	-0.39 (0.05)***	-0.41 (0.05)***	-0.39 (0.06)***	-0.41 (0.06)***	-0.36 (0.06)***	-0.36 (0.06)***
$\ln(S_K)$	0.11 (0.15)	0.11 (0.14)	0.10 (0.16)	0.12 (0.15)	0.18 (0.17)	0.21 (0.16)
$\ln(n+g+\delta)$	-0.07 (0.05)*	-0.07 (0.04)**	-0.07 (0.05)*	-0.07 (0.04)	-0.04 (0.05)	-0.05 (0.04)
$\ln(S_H)$	0.23 (0.11)**	0.24 (0.11)**	0.23 (0.11)**	0.24 (0.11)**	0.49 (0.31)*	0.44 (0.30)*
$\ln(S_{F1})$	0.20 (0.09)**	-	0.16 (0.12)*	-	0.34 (0.24)*	-
$\ln(S_{F2})$	-	0.22 (0.08)***	-	0.25 (0.12)**	-	-0.42 (0.27)*
$\ln(S_{E1})$	-	-	-0.04 (0.02)*	-0.05 (0.01)**	-0.47 (0.30)*	-
$\ln(S_{F1})*\ln(S_{E1})$	-	-	-	-	0.12 (0.08)*	-
$\ln(S_{F2})*\ln(S_{E1})$	-	-	-	-	-	0.13 (0.08)**
Constant	1.12 (0.81)	1.35 (0.76)**	1.40 (0.82)**	1.38 (0.87)*	1.03 (0.82)	1.34 (0.86)*
$\overline{R^2}$	0.60	0.63	0.60	0.61	0.69	0.70

Notes: Definitions of financial sector variables same as for Tables 3-5.
Standard errors reported within parenthesis. *, **, ***, significant at the 10%, 5% and 1% levels.

Endnotes

[1] Mankiw, Romer and Weil (1992) augment the Solow model with a variable for human capital. The *Mankiw et al.* model has subsequently been augmented by Nonneman and Vanhoudt (1996) to incorporate a variable for technological know-how; Milbourne, Otto and Voss (2003) - public and private investment; Temple (1998) – equipment investment; Ram (2007) - IQ.

[2] Beck, Demirguc-Kunt and Levine define other financial institutions as savings banks, cooperative banks, mortgage banks, building societies, finance companies, insurance companies, private pensions and provident funds, pooled investment schemes and development banks.