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The Financial Sector and Economic Growth*

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The Mankiw–Romer–Weil (1992) augmented Solow–Swan (Solow 1956; Swan 1956) model is extended to incorporate the financial sector in this study. Distinguishing between financial capital, physical capital and human capital, the research attempts to identify, in particular, the effects of financial capital on economic growth. The effects of financial sector efficiency on economic growth are also examined. The financial sector augmented model is tested on a cross-section of 35 economies. Strong support is found for the model.

I Introduction

The objective of this study is to examine the role of the financial sector in the process of economic growth by distinguishing between physical capital, financial capital and human capital. 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 *et al.* (1999a – updated in 2007). As 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 as far back as early 1900s. This view was subsequently supported by Goldsmith (1969). Since the work of McKinnon (1973) and Shaw (1973), a growing consensus regarding the positive link between financial sector development and economic growth has developed. More recently, this positive relation has been supported in the work of King and Levine (1993), Demirgüc-Kunt and Maksimovic (1996) Levine and Zervos (1998) and Beck *et al.* (1999b), among others.[2]

Despite the large literature on the financial sector and economic growth, there have been no

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[1] Mankiw *et al.* (1992) augment the Solow model with a variable for human capital. This model has subsequently been augmented by Nonneman and Vanhoudt (1996) to incorporate a variable for technological know-how, by Milbourne *et al.* (2003) to consider public and private investment, by Temple (1998) to consider equipment investment, and by Ram (2007) to cover intelligence quotient.

[2] There is a literature that develops and tests a Schumpeterian model of cross-country convergence with financial constraints (see Aghion *et al.*, 2005). According to these models, only countries with financial development above some threshold level will converge in growth rate as they are in a better position to take advantage of technology transfer. See Trew (2006) for a survey of the literature on finance and growth.

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studies that have attempted to formally incorporate a variable for the financial sector into a MRW/Solow–Swan growth model. By augmenting the MRW model with a variable for the financial sector, this study allows for estimation of the structural parameters of the model, differentiating it from previous studies. The empirical results demonstrate that the restrictions of the model are satisfied, signifying support for the financial sector augmented model.

The financial systems of many low- and middle-income economies have undergone extensive structural change as a result of 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, this study focuses primarily on the banking sector in a group of low- and middle-income economies.[3] The rest of this article 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:

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

where Y is the output, K is physical capital, H is human capital, F is financial capital, A is the level of technology and L is labour. The financial capital variable captures the value of financial assets as opposed to the physical capital variable which incorporates the value of real assets such as structures. α represents the elasticity of output with respect to physical capital, β the elasticity of output with respect to human capital and γ the elasticity of output with respect to financial capital. 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 savings rate is denoted by s_K, the accumulation of human capital by s_H and the accumulation of financial capital by s_F, the steady-state level of per capita output in logarithmic form can be expressed as:

$$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt + \frac{\alpha}{1-\alpha-\beta-\gamma}\ln s_K + \frac{\beta}{1-\alpha-\beta-\gamma}\ln s_H + \frac{\gamma}{1-\alpha-\beta-\gamma}\ln s_F - \frac{\alpha+\beta+\gamma}{1-\alpha-\beta-\gamma}\ln(n+g+\delta), \quad (2)$$

where $\ln A(0) = a_0 + \mu$, with a_0 being a constant and μ a country-specific shock.

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

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

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 Barro & Sala-i-Martin, 1992, 1999). From Equation (3), it follows that:

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

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

$$\begin{aligned}\ln y(t) - \ln y(0) &= (1-e^{-\lambda t})\frac{\alpha}{1-\alpha-\beta-\gamma}\ln s_K \\ &+ (1-e^{-\lambda t})\frac{\beta}{1-\alpha-\beta-\gamma}\ln s_H \\ &+ (1-e^{-\lambda t})\frac{\gamma}{1-\alpha-\beta-\gamma}\ln s_F \\ &- (1-e^{-\lambda t})\frac{\alpha+\beta+\gamma}{1-\alpha-\beta-\gamma}\ln(n+g+\delta) \\ &- (1-e^{-\lambda t})\ln y(0)). \quad (5)\end{aligned}$$

Equation (5) can be estimated as follows:

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

[3] Note that South Korea and Saudi Arabia are also in the sample but do not fall under the low- or middle-income categories as defined by the World Bank.

According to Equations (5) and (6), the growth rate of output per capita depends on population growth, the accumulation of physical capital, human capital and financial capital. A country that uses its financial capital more efficiently will converge to a higher level of output per capita than a country that uses it less efficiently. Accordingly, 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

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

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

III Data

The study covers the cross-section of 35 countries listed in Table 2. The data used for the empirical estimation are annual and cover the period 1992–2003. The data have been obtained from the sources listed in Table 1.

The estimations carried out in Section IV are based on the logarithms of (Y/L) for 1992 and 2003, and for all the other variables the averages over the 1992–2003 period for each country are used. The financial capital variable is proxied by three composite indices, s_{F1}, s_{F2} and s_{E1}, which are defined in the following.

Table 1
Data Sources

Variable	Source
GDP per capita (Y/L)	*World Development Reports* (World Bank, various issues, b) and *Human Development Reports* (United Nations, various issues)
Share of physical capital to GDP (s_K)	*World Development Indicators* (World Bank, various issues, a)
Annual average growth rate of the labour force (n)	*World Development Reports* (World Bank, b)
Net secondary enrolment ratio: used as proxy for human capital (s_H)	*Human Development Reports* (United Nations, various issues)
$g + \delta$	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 *et al.* (1999a – updated in 2007)

GDP, gross domestic product; MRW, Mankiw–Romer–Weil.

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 Demirgüc-Kunt and Maksimovic (1996). These three indicators are: (i) the ratio of M2/gross domestic product (GDP), which is a measure of the size and depth of the banking sector; (ii) the ratio of deposit banks' assets to GDP, which is also a measure of the size of the financial sector; and (iii) domestic credit by deposit banks to the private sector as a ratio of GDP. This final indicator measures the provision of credit by the banking sector to the private sector and is an indicator of the degree of activity of the financial intermediaries. All three indicators have been used by King and Levine (1993), Demirgüc-Kunt and Maksimovic (1996) and Levine and Zervos (1996), among others.

To measure the significance of non-bank financial intermediaries as well as the commercial banking sector, a second index is constructed, as in Demirgüc-Kunt and Maksimovic (1996). This indicator, s_{F2}, is constructed by averaging: (i) the ratio of M2/GDP; (ii) private credit by deposit banks and other financial institutions to GDP; (iii) assets of deposit banks to GDP; and (iv) assets of other financial institutions to GDP.[4] Data on the assets of other financial institutions to GDP are not available for all countries. For these countries, only the average of the first three indicators is taken into account.

Financial sector efficiency: This is measured by the indicator s_{E1}. This indicator is constructed by averaging: (i) the value of banks' net interest margin to total assets; (ii) banks' overhead costs to total assets; and (iii) a concentration measure given by the ratio of the assets of the three largest banks' to total banking assets. Increased competition in the financial sector should reduce overhead costs, interest margins and the degree

[4] Beck *et al.* (1999a) 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.

of concentration. Therefore, if these measures are low it would imply increased efficiency and vice versa.

An examination of the financial indicators in Table 2 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 percentage of GDP are high in South Africa, Peru and South Korea, whereas 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 3 presents bank concentration ratios for the countries under study. The data demonstrate that the concentration ratios have fallen in

Table 2
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 institutions 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
South 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 *et al.* (1999a – updated in 2007) and *World Development Indicators* (World Bank, a).

TABLE 3
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
South 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 *et al.* (1999a – updated in 2007).

almost all of the countries over the 1992–2003 period suggesting increased efficiency.

IV Empirical Results

This section evaluates the empirical results for the transition models.

(i) Financial Sector Size, Activity and Economic Growth

Results for the transition model, as given by Equation (6) in Section II, obtained using ordinary least squares (OLS) estimation are presented in Table 4. The growth in output per capita over the 1992–2003 period is the dependent variable in all equations. Equation (1) presents the 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 (PCR1), and Equation (5) with deposit banks' domestic assets to GDP (BA). Equations (6) and (7) incorporate the composite size and activity financial indicators.

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). These results are presented in Table 5. Four instruments are chosen on the basis of Shea's (1997) partial R^2. These are 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 to a steady state, with the coefficient on the initial level of output per head significant at the 1 per cent level and negative in all OLS and GMM regression equations. The values of $\bar{R}^2$ in the financial sector augmented models are in the range of 0.61–0.67 in Tables 4 and 5, suggesting high explanatory power of these models. The OLS estimates indicate that the financial sector variables are statistically significant at the 5 and 1 per cent levels and the GMM estimates indicate that they are significant at the 5 and 10 per cent levels, respectively. The composite financial sector index is significant at the 5 and 1 per cent levels under the two estimation methods. The human capital variable is significant at the 5 and 1 per cent levels in all equations. A Durbin–Wu–Hausman[5] test is carried out to examine if there are any statistically significant differences between the OLS and GMM estimates (see Table 5). There is no evidence of any significant difference between the OLS and GMM estimates. The *J*-statistic of Hansen *et al.* (1996) suggests that the instruments are valid and that the model is correctly specified.

The implied output elasticities are reported in the bottom panel of Table 4. The implied output elasticities of physical capital (α) in the financial capital augmented model are slightly

[5] See Durbin (1954), Wu (1973) and Hausman (1978).

TABLE 4

Financial Sector Size and Activity and Tests of Conditional Convergence in the Transition Model: Ordinary Least Squares (OLS) Estimation
Dependent variable: $ln(Y/L)_{2003} - ln(Y/L)_{1992}$

	MRW	MRW augmented					
Independent variable	(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)	0.15 (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(PCR1)	—	—	—	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)
$\bar{R}^2$	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: MRW, Mankiw–Romer–Weil; M2, M2/gross domestic product (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 banks' 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 banks' assets to GDP and other financial institutions' assets to GDP (in countries for which other financial institutions' assets to GDP data are not available, only the average of the first three variables is taken into account). Standard errors are reported within parentheses. *, ** and *** indicate significances at the 10, 5 and 1 per cent levels, respectively. Equations (6) and (7) were re-estimated with regional dummies using OLS. Equation (6) yielded a coefficient of 0.19 for Asia and 0.20 for Africa and the Middle East. Equation (7) yielded a coefficient of 0.16 for Asia and 0.20 for Africa and the Middle East. The coefficients were not statistically significant.

TABLE 5

Financial Sector Size and Activity and Tests of Conditional Convergence in the Transition Model: General Method of Moments 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(PCR1)	—	—	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)***
$\bar{R}^2$	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 *et al.*, $\chi^2(3)$	0.08	0.19	0.12	0.08	0.19	0.13
Shea's 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: Definitions of financial sector variables are same as for Table 4. Standard errors are reported within parentheses. *, ** and *** indicate significances at the 10, 5 and 1 per cent levels, respectively. The 5 per cent critical value for the Durbin–Wu–Hausman test, $\chi^2(5)_{0.05}$, is 11.07. The 5 per cent critical value for the *J*-statistic of Hansen *et al.*'s test, $\chi^2(3)_{0.05}$, is 7.81.

lower than in the MRW estimates (1992, Table VI). However, in Equation (1) – Table 4, 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 of reasonable magnitude and the rate of convergence is in the range of 0.018–0.022, which is consistent with the MRW estimate of 0.018 for the intermediate sample (1992, Table VI).

(ii) Financial Sector Size, Activity, Efficiency and Economic Growth

The effects of banking sector size, activity and efficiency on economic growth are examined in this sub-section. Estimation is carried out using both OLS and the GMM. Banking sector efficiency is, as mentioned before, measured by the banks' overhead costs as a share of total assets, banks' net interest revenue as a share of total assets and the concentration ratio. The results are presented in Table 6. The instruments for the GMM technique are chosen on the basis of Shea's (1997) partial R^2 and are the same as in the previous sub-section. Again there is significant evidence of convergence to a steady state, with the coefficient on the initial level of income being significant and negative.

The composite banking size and efficiency indicators are statistically significant under both estimation techniques. Consistent with expectations, the negative coefficients on the interest margin and overhead cost variables suggest that higher interest margins and overhead costs are associated with lower growth. Concentration ratios are significant at the 10 per cent level under the GMM method. The composite efficiency index is significant at the 10 per cent level in Equations (5)–(8). Human capital has a significant positive effect on economic growth. The inclusion of the financial sector efficiency variables in the size and efficiency models leads to a significant increase in the explanatory power of the regression models.

(iii) Interaction between Financial Sector Size, Activity and Efficiency and Economic Growth

As efficiency can be related to the size and activity of the financial sector, this sub-section examines interaction effects between banking sector size and activity and efficiency and their effects on economic growth. Table 7 reports the regression estimates.

The interaction terms are significant at the 10 per cent level, suggesting that size and activity are related to efficiency in that increased financial capital translates into greater efficiency and/or that greater efficiency leads to the productive use of a country's financial capital.

(iv) Robustness Checks

A number of tests have been carried out to ensure the robustness of the results.

GMM estimation

The models have been estimated using the GMM technique – see Tables 5 and 6 – in addition to OLS, to correct for any potential endogenity bias (explained before) that may be present in the models. 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 *et al.* suggests that the instruments are valid and that the model is correctly specified. It can be concluded that endogenity is not a problem and that the results are robust to the estimation technique.

Alternative regressors

A number of different financial variables are used as proxies for financial capital and efficiency (Tables 4–6). It can be concluded that the results are robust to the choice of the financial variable.

Dummy variables

The composite models were re-estimated with dummy variables to see if the results were driven by regional differences (see note 3 to Table 4). Selecting South America and West Indies as the benchmark group, two regional dummies were defined for: (i) Asia, and (ii) Africa and the Middle East. The regional dummies were positive but insignificant, suggesting that regional disparities are not the main drivers of economic growth. The inclusion of the regional dummies did not change the overall results.

Table 6
Financial Sector Size, Activity, Efficiency and Growth in the Transition Model Dependent variable: $ln(Y/L)_{2003} - ln(Y/L)_{1992}$

Variable	(1) OLS	(2) GMM	(3) OLS	(4) GMM	(5) OLS	(6) GMM	(7) OLS	(8) GMM
$\ln(Y/L)_{1992}$	−0.36 (0.05)***	−0.36 (0.04)***	−0.38 (0.05)***	−0.38 (0.04)***	−0.37 (0.04)***	−0.38 (0.05)***	−0.40 (0.05)***	−0.39 (0.04)***
$\ln(s_K)$	0.11 (0.15)	0.12 (0.12)	0.13 (0.14)	0.01 (0.08)	0.10 (0.13)	0.04 (0.11)	0.13 (0.14)	0.05 (0.10)
$\ln(n+g+\delta)$	−0.04 (0.04)	−0.36 (0.23)*	−0.05 (0.04)*	−0.33 (0.22)*	−0.07 (0.04)*	−0.19 (0.18)	−0.07 (0.04)**	−0.19 (0.16)
$\ln(s_H)$	0.28 (0.10)***	0.30 (0.08)***	0.29 (0.10)***	0.32 (0.08)***	0.25 (0.10)***	0.25 (0.09)***	0.26 (0.09)***	0.26 (0.08)***
$\ln(s_{F1})$	0.18 (0.10)**	0.15 (0.08)**	—		0.17 (0.11)*	0.11 (0.07)*	—	—
$\ln(s_{F2})$	—	—	0.24 (0.11)**	0.18 (0.08)**	—	—	0.24 (0.11)**	0.17 (0.12)*
ln(IM)	−0.28 (0.16)**	−0.40 (0.12)**	−0.23 (0.15)*	−0.35 (0.12)***	—	—	—	—
ln(OC)	−0.23 (0.16)*	−0.29 (0.13)**	−0.24 (0.16)*	−0.26 (0.12)**	—		—	—
ln(concentration)	0.17 (0.16)	0.25 (0.18)*	0.20 (0.16)	0.28 (0.17)*	—		—	—
$\ln(s_{E1})$	—	—	—	—	−0.02 (0.015)*	−0.04 (0.03)*	0.04 (0.03)*	−0.03 (0.02)*
Constant	1.40 (1.06)*	1.86 (0.91)**	1.03 (1.04)	1.57 (0.94)**	1.50 (1.04)*	1.60 (1.80)	1.95 (0.84)**	1.34 (1.52)
$\bar{R}^2$	0.63	0.76	0.66	0.77	0.69	0.70	0.65	0.72
Durbin–Wu–Hausman test, $\chi^2(5)$		1.68		1.73		1.16		1.94
J-statistic of Hansen *et al.*, $\chi^2(3)$		1.81		3.21		2.32		1.51
Shea's R^2								
$\ln(s_{F1})$	—	0.80	—	—	—	0.80	—	—
$\ln(s_{F2})$	—	—	—	0.84	—	—	—	0.84

Notes: The definitions of financial sector size and activity variables are the same as for Table 4. OLS, ordinary least squares; GMM, General Method of Moments; IM, net interest margin, which is the accounting value of a bank's net interest revenue as a share of its total assets; OC is the accounting value of a bank's overhead costs as share of its total assets; concentration is the ratio of the assets of the three largest banks' to total banking sector assets; s_{E1} is the average of the ratios of IM to total assets, overhead costs to total assets and bank concentration to total assets. Standard errors are reported within parentheses. *, ** and *** indicate significances at the 10, 5 and 1 per cent levels, respectively. The 5 per cent critical value for the Durbin–Wu–Hausman test, $\chi^2(5)_{0.05}$, is 11.07. The 5 per cent critical value for the *J*-statistic of Hansen *et al.*'s test, $\chi^2(3)_{0.05}$, is 7.81.

TABLE 7
Interaction between Financial Sector Size, Activity, Efficiency and Economic Growth in the Transition Model
Dependent variable: $ln(Y/L)_{2003} - ln(Y/L)_{1992}$

Independent variable	(1) OLS	(2) GMM	(3) OLS	(4) GMM
$\ln(Y/L)_{1992}$	−0.37 (0.05)***	−0.36 (0.05)***	−0.38 (0.04)***	−0.37 (0.05)
$\ln(s_K)$	0.12 (0.13)	0.07 (0.11)	0.16 (0.12)*	0.12 (0.09)
$\ln(n+g+\delta)$	−0.06 (0.04)*	−0.18 (0.19)	−0.06 (0.04)*	−0.15 (0.19)
$\ln(s_H)$	0.22 (0.11)**	0.24 (0.08)***	0.23 (0.10)**	0.23 (0.08)***
$\ln(s_{F1})$	0.20 (0.10)**	0.34 (0.24)*	—	—
$\ln(s_{F2})$	—	—	0.38 (0.24)*	0.39 (0.23)**
$\ln(s_{E1})$	−0.29 (0.22)*	−0.48 (0.36)*	−0.28 (0.20)*	−0.40 (0.26)*
$\ln(s_{F1})*\ln(s_{E1})$	0.07 (0.05)*	0.13 (0.10)*	—	—
$\ln(s_{F2})*\ln(s_{E1})$	—	—	0.08 (0.06)*	0.14 (0.09)*
Constant	1.38 (0.92)*	1.65 (0.80)**	1.34 (0.98)*	1.67 (0.82)**
$\bar{R}^2$	0.70	0.71	0.72	0.73
Durbin–Wu–Hausman test, $\chi^2(5)$	—	2.03	—	1.13
J-statistic of Hansen *et al.*, $\chi^2(3)$	—	1.18	—	1.02
Shea's 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 4 and 6. Standard errors are reported within parentheses. *, ** and *** indicate significances at the 10, 5 and 1 per cenr levels, respectively. The 5 per cent critical value for the Durbin–Wu–Hausman test, $\chi^2(5)_{0.05}$, is 11.07. The 5 per cent critical value for the *J*-statistic of Hansen *et al.*'s test, $\chi^2(3)_{0.05}$, is 7.81.

Robust regression

According to Temple (1998), outliers that arise from measurement error or omitted variables can bias the results of growth models. Therefore, to address the issue of influential outliers, the equations were re-estimated using the robust regression technique which gives less weight to outlying observations. The results are reported in Table 8. These results are consistent with the OLS and GMM findings, suggesting that the estimates are not unduly influenced by outliers.

V Conclusions

This study augments the MRW structural model with a variable for 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. An examination of the effects of financial sector size, activity and efficiency on economic growth shows that size, activity and efficiency are important for economic growth. The evidence suggests that further broadening of 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 banking 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 country's financial capital, leading to higher growth. Similarly, countries with larger and more active financial sectors may use 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 (1993), Demirgüc-Kunt and Maksimovic (1996), Levine and Zervos (1998)

Table 8
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)*	—
$\ln(s_{F2}) * \ln(s_{F2})$	—	—	—	—	—	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)*
$\bar{R}^2$	0.60	0.63	0.60	0.61	0.69	0.70

Notes: Definitions of financial sector variables are same as for Tables 4 and 6. Standard errors are reported within parentheses. *, ** and *** indicate significances at the 10, 5 and 1 per cent levels, respectively.

and Beck *et al.* (1999b), in that there exists a positive relation between economic growth and financial sector development. In addition, relative to the previous literature on the financial sector and economic growth, the present study demonstrates that the restrictions of the model are met. It can be argued, therefore, that this is a superior means of estimating the model relative to the previous literature.

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