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CONCENTRATION IN THE BANKING INDUSTRY AND ECONOMIC GROWTH

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Concentration in the Banking Industry and Economic Growth*

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Abstract

We present an OLG endogenous growth model in which a reduction in the level of concentration in the banking industry exterts two opposite effects on economic growth. On the one hand, it induces economies of specialisation which enhances intermediation efficiency and thereby economic growth. On the other hand, it results in duplication of fixed costs which is detrimental for efficiency and growth. The trade off between the two opposing effects is ambiguous and can vary along with the dynamic process of financial and economic development. Using cross country industry data we find that banking concentration is negatively associated with industrial growth only in low income countries while there is no such asssociation in high income countries. These empirical findings support the model's prediction that there exist a different relationship between banking concentration and growth depending on the level of economic development.

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1. Introduction

The recent theoretical literature on finance and development establishes that financial development and long run economic growth are linked phenomena. Various models within this literature predict that the development of financial intermediation services contributes to growth since, by creating liquidity and risk diversification opportunities and mitigating informational asymmetries by means of monitoring and screening technologies, it favours the allocation of financial resources toward the most productive investment projects.[1] An extensive amount of empirical work offers support for this leading view. Cross country linear econometric analyses, like for instance King and Levine (1993a, 1993b), document the existence of a strong relationship between initial financial development and subsequent growth.[2] Other studies, like for instance Rajan and Zingales (1998) confirm that financial development can have a causal role in the growth process.[3]

Comparatively less attention has been paid, so far, to the issue of whether the provision of growth inducing intermediation services is affected by structure of the credit market. The traditional argument suggests that departures from perfect competition are detrimental for growth insofar they are bound to generate inefficiencies in the allocation mechanism provided by the credit market. However, it is a well known fact that in a second best world moving toward perfect competition does not necessarily guarantee Pareto improvements. Hence, to the extent that financial intermediaries emerge as a second best response to the (informational) imperfections endemically associated with financial transactions, there is no reason to expect that an increase in the degree of competition and a reduction of concentration in the credit industry would necessarily improve the efficiency of intermediation.

On this account, Dell'Ariccia (2000) and Gehrig (1998) find that competition in the credit industry has an ambiguous effect on socially valuable screening activity by financial intermediaries.[4] Along similar lines, Petersen and Rajan

[1] Khan (2001), Boyd and Smith (1998), Acemoglu and Zilibotti (1997), Roubini and Sala-i-Martin (1995), De Gregorio (1993), King and Levine (1993b), Bencivenga and Smith (1991, 1993, 1995), Saint-Paul (1992), Levine (1991) and Greenwood and Jovanovic (1990), are key examples of this strand of literature. Comprehensive surveys on the topic are those by Levine (1997) and Pagano (1993).

[2] Other cross sectional studies are those by Jose De Gregorio and Guidotti (1995), and Roubini and Sala-i-Martin (1992).

[3] For another approach to the issue of causality between finance and growth see Levine, Loayza and Beck (2000).

[4] See also Manove, Pagano and Padilla (2000) in which monopolistic power might induce an efficient level of screening.

(1995) argue that monopolistic power facilitates the establishment of lending relationships which facilitates valuable firms' access to credit.[5] Cetorelli and Peretto (2000) elaborate further on this line of thought by proposing a model in which the type of lending relationship emerging in the context of competitive credit markets can have negative consequences for capital accumulation, while banks' market power can be beneficial for growth. The argument is that in presence of market power, banks have more incentive to undertake screening activities since they can extract a rent from the information advantage this would generate. However, associated with this rent is the typical inefficiency in quantities generated by monopolistic behaviour. Under specific conditions, the optimal trade-off between the two effects is achieved by an oligopolistic structure of the credit market.

Empirical tests of the relationship between market structure and growth offer mixed evidence. Bonaccorsi and Dell'Ariccia (2000), and Petersen and Rajan (1995) offer evidence that firms are less credit constrained and face cheaper credit the more concentrated is the credit market. On the other hand Cetorelli and Gambera (2001) find that, although some firms and industries benefit from greater banking concentration, the overall impact on industrial growth is negative. Black and Stranhan (2002) find that less concentration is associated with higher levels of newly created firms.

In this paper we abstract from the issue of lending relationships and other sources of inefficiency that perfect competition might induce in the presence of non trivial asymmetric information problems. Instead, the focus is on the trade off between economies to scale and economies to specialisation in the provision of financial intermediation services within the context of a growth model characterised by a monopolistically competitive credit market with costly financial transactions.[6] Within this set up, a reduction in the level of concentration of the banking industry has two opposite effects. On the one hand it induces duplication of fixed costs, which is detrimental for efficiency of financial transactions and thereby economic growth. On the other hand it increases specialisation which enhances efficiency and growth. One interesting feature of the model is that the trade off between the two opposite effects of concentration changes along the process of economic development. For instance, whenever the marginal effect of specialisation on intermediation costs is increasing in the level of concentration (i.e. decreasing returns to specialisation), the specialisation effect dominates at sufficiently low levels of economic development, while the net

[5] Other contributions on the subject include Shaffer (1998) and Riordan (1993).

[6] On the existence of economies of specialisation in the banking industry with reference to the US economy and their significance see Sussman and Zeira (1995).

growth-effect of the interaction between specialisation and duplication effects becomes negative at sufficiently high levels of development.

We explore the model's implications using Rajan and Zingales' (1998) cross-country industry data set, augmented recently by Cetorelli et al (2001) to include various measures of concentration of the banking sector. We split their sample into high and low income countries, and examine the relationship between concentration and industrial growth in each of the two sub-samples.. We find that concentration in the banking industry is negatively associated with growth only in low-income countries, while there is no such association in high-income countries. These results support the model's prediction that there exists a different relationship between banking concentration and industrial growth depending on the level of economic development. They also suggest that greater competition among banks is more likely to promote growth in low-income countries, while in high income countries the benefits that arise from further specialisation may not be important enough to offset the costs associated with the duplication effect.

The paper is organised as follows. Section 2 presents the model while section 3 discusses the empirical methodology and results. The last section concludes.

2. The Model

The economy is made of a continuum of firms and overlapping generations of individuals of size 1. Individuals are identical and live for two periods. They derive utility from consumption in each of the two periods according to $U = \ln c_t + \beta \ln c_{t+1}$ where c_t and c_{t+1} are consumption in the first and second period of life, respectively, for an individual born at time t, and β is the intertemporal discount factor. Each young individual is endowed with 1 unit of labour which s/he supplies inelastically to firms earning a salary w_t which is partly consumed in the first period of life and partly saved to finance consumption in the second period. With logarithmic preferences, individual savings are equal to $S_t = sw_t$ where $s = \beta/(1+\beta)$. Savings finance firms' capital accumulation, i.e. $k_{t+1} = sw_t$, where k_{t+1} is capital per head.

Firms are identical and operate in a perfectly competitive fashion. Production is based on following production function:

$$Y_t = \phi A_t K_t^{\alpha} (A_t L)^{1-\alpha}, \tag{2.1}$$

where Y_t is the level of output produced by a single firm combining capital K_t and labour, L. $A_t = K_t/L = k_t$ is the standard learning by doing externality.

Factors are paid their marginal product:

$$w_t = (1-\alpha)\phi A_t^{1-\alpha} k_t^{\alpha} \tag{2.2}$$
$$R_t = \alpha A_t k_t^{\alpha-1} A_t^{1-\alpha}. \tag{2.3}$$

We assume that financing firms' capital accumulation requires a fixed cost C plus a cost $c(z)$ per unit of lending, where z is the mass of firms being funded, both measured in terms of consumption of real resources.[7] We assume

$$\frac{dc}{dz} = c'(z) > 0 \tag{2.4}$$

which implies economies to specialisation.[8] This cost structure justifies the emergence of a credit market where intermediaries pool savings and fund firms' investments. The existence of economies to specialisation implies that the credit market can be characterised by the presence of more than one intermediary. We assume that the intermediaries operate in the context of a standard monopolistic competition framework, with no strategic interaction among players.

2.1. Intermediaries Behaviour and Equilibrium in the Credit Market

The single bank balance sheet can be written as

$$D_t = \int_0^{z_t} b_t z_t + \int_0^{z_t} c(z) b_t dz + C, \tag{2.5}$$

where D_t are deposits pooled by the bank, $\int_0^{z_t} b_t z_t$ is aggregate loans of the bank, and $\int_0^{z_t} c(z)dz$ plus C is the aggregate consumption of real resources necessary to perform the intermediation service, given the amount of per firm loan, b_t, and the mass of firms funded, z_t.

Banks act as price takers in the market for deposits. Hence they take the interest rate on deposits, R_{t+1}^d, as given. For a given level of the interest rate on loans R_{t+1} the profits of the representative bank (all banks are identical) can be written as

[7] The assumption of costly financial transactions is consistent either with a transaction costs interpretation or with the existence of informational asymmetries (not explicity modelled here) that are efficiently eliminated by incurring costs.

[8] The assumption implies that as the mass of firms funded by the bank decreases, the average cost of monitoring is reduced. We interpret this effect as economies to specialisation to the extent that the cost of monitoring a firm decreases the closer the bank is to the firm. Hence, to a higher mass of firms it corresponds a higher degree of firms' variety with respect to monitoring costs, and hence higher average variable costs. See Sussman (1993) for model which introduces a similar concept of economies of specialisation.

$$\pi_t = \int_0^{z_t} R_{t+1} b_t(R_{t+1}) dz - R_{t+1}^d D_t, \tag{2.6}$$

where

$$b_t(R_{t+1}) = \left[\frac{\alpha \phi A_{t+1}}{R_{t+1}}\right]^{\frac{1}{1-\alpha}} \tag{2.7}$$

is the demand for loans by the individual firm.[9] According to expression (2.6) bank's profits are given by total revenues $\int_0^{z_t} R_{t+1} b_t(R_t) dz$ minus costs, $R_{t+1}^d D_t$. Each bank selects the level of R_t and the level of z_t in order to maximise profits. Since banks are identical we focus on symmetric equilibria in which z_t and R_{t+1} are the same across banks. The choice of z_t is subject to a feasibility constraint $z_t \leq 1/n_t$, where n_t is number of operating banks. We assume that the individual bank takes n_t as given and also disregards other banks' actions with respect to R. The maximisation problem faced by the representative bank is

$$\begin{aligned} & \max_{\{R_t, z_t\}} \int_0^{z_t} R_{t+1} \left[\frac{\alpha \phi A_{t+1}}{R_{t+1}}\right]^{\frac{1}{1-\alpha}} dz - R_{t+1}^d D_t \qquad (2.8) \\ & s.to \\ z_t \; & \leq \; 1/n_t \\ D_t \; & = \; \int_0^{z_t} 1 + c(z) dz \left[\frac{\alpha \phi A_{t+1}}{R_{t+1}}\right]^{\frac{1}{1-\alpha}} + C. \end{aligned}$$

The set of first order conditions is

$$\begin{aligned} R_{t+1} &= \frac{R_{t+1}^d \int_0^{z_t} 1 + c(z) dz}{\alpha z_t} \qquad (2.9) \\ \lambda &= \left[\frac{\alpha \phi A_{t+1}}{R_{t+1}}\right]^{\frac{1}{1-\alpha}} \{R_{t+1} - [1 + c(z_t)]\} R_{t+1}^d, \end{aligned}$$

where $\lambda = 0$ if the optimal level of z_t satisfies $z_t < H/n_t$ as a strict inequality. In equilibrium, for any two banks j and i $z_t^i = z_t^j$. If $z_t = z_m < 1/n_t$ banks operate as local pure monopolists. Otherwise, they equally share the market, i.e. $z_t = 1/n_t$. As we are interested in movements of the market share z_t we concentrate on the latter case in which the market share constraint is binding. Given the

[9] Note that in equilibrium demand for capital at time t, $b_t(.)$, equals capital per firm at period $t+1, K_{t+1}$.

optimal level of R_{t+1} (see equation (2.9)), the value function describing the profits of the representative bank is

$$\pi_t = R_t^d \int_0^{z_t} 1 + c(z)dz(\frac{1-\alpha}{\alpha})b_t - R_t^d C. \tag{2.10}$$

2.2. Macroeconomic Equilibrium

In equilibrium, $A_t = k_t^{1-\alpha}$ holds, so that $R_t = \alpha\phi$. Hence, recalling that $k_{t+1} = sw_t$, and assuming $z_t = 1/n_t$, the set of equations describing the equilibrium is

$$\begin{aligned} R_{t+1}^d &= \frac{\alpha^2 \phi z_t}{\int_0^{z_t} 1 + c(z)dz} && (2.11) \\ w_{t+1} &= (1-\alpha)\phi k_{t+1} && (2.12) \\ k_{t+1} &= \frac{[s(1-\alpha)\phi k_t - C/z_t]}{\int_0^{z_t} 1 + c(z)dz/z_t} && (2.13) \\ \pi_t &= R_t^d \int_0^{z_t} 1 + c(z)dz(\frac{1-\alpha}{\alpha})k_{t+1} - R_t^d C && (2.14) \end{aligned}$$

Correspondingly, the equilibrium growth rate for the economy is

$$\begin{aligned} g_t &= \frac{[s(1-\alpha)\phi - C/k_t z_t]}{\int_0^{z_t} 1 + c(z)dz/z_t} - 1 = \frac{[s(1-\alpha)\phi - C/k_t z_t]}{\bar{c}(z_t)} - 1 && (2.15) \\ \text{with } z_t &= 1/n_t, \text{ and } n_t \leq n_t^{\max} \equiv \frac{(1-\alpha)^2 \phi s}{C} k_t. && (2.16) \end{aligned}$$

where $\bar{c}(z_t) = \int_0^{z_t} 1 + c(z)dz/z_t$ is average variable costs of intermediation, and $n_t^{\max}$ is the maximum number of banks which could operate in the economy given the zero profit condition, $\pi_t = 0$, associated with a perfectly contestable credit market. It can be noticed that $n_t^{\max}$ is a linear increasing function in the level of economic development. When the credit market is fully contestable, the number of operating banks in the economy is positively associated with the level of economic development, y_t, which implies that z_t would be negatively related to y_t. More generally, once we fixed a certain degree of contestability and the associated level of per bank equilibrium profits, say $\bar{\pi}$, then similarly to the case of perfect contestability, the equilibrium level of concentration would be decreasing in the level of economic development. To verify this note that starting at $\pi_t = \bar{\pi}$, as k_t increases, holding fixed the number of banks, the equilibrium level of bank profits, π_t, raises above $\bar{\pi}$ which stimulate the entrance of new banks. Therefore, the number of operating banks increase and z_t is reduced up to the point that equality $\pi_t = \bar{\pi}$ holds.

2.3. Concentration in the credit market and economic growth

The analysis of equation (2.15) reveals that the concentration level z_t affects the growth rate of the economy in two opposite ways. On one side a reduction in the level of concentration implies more specialisation, which reduces the average variable costs $\bar{c}(z_t) = \int_0^{z_t} 1 + c(z)dz/z_t$. In fact, as long as $c'(z_t) > 0$,

$$\frac{d\bar{c}(z_t)}{dz_t} = \frac{[1 - c(z_t)]z_t - \int_0^{z_t} 1 + c(z)dz]}{[\int_0^{z_t} 1 + c(z)dz]^2} > 0 \tag{2.17}$$

holds, so that if z_t decreases, this reduces $\bar{c}(z_t)$. Since $\bar{c}(z_t)$ affects growth negatively, this specialisation effect is beneficial for growth. On the other hand, a reduction in the level of concentration, which is always associated with an increase in the number of operating banks, implies an increase in total fixed costs $n_t C$. This cost duplication effect has adverse consequences for growth. In principle, the trade off between these two effects is ambiguous. This can be seen by looking at the derivative of g_t with respect to z_t which is equal to:

$$\frac{dg_t}{dz_t} = \frac{s(1-\alpha)\phi\{\int_0^{z_t} 1 + c(z)dz - [1 + c(z_t)]z_t\} + [1 + c(z_t)]C/k_t}{[\int_0^{z_t} 1 + c(z)dz]^2}, \tag{2.18}$$

which is positive if

$$\overbrace{s(1-\alpha)\phi\{\int_0^{z_t} 1 + c(z)dz - [1 + c(z_t)]z_t\}}^{A} + \overbrace{[1 + c(z_t)]C/k_t}^{B} > 0 \tag{2.19}$$

and negative otherwise. The term A is negative due to the specialisation effect, while the term B, which refers to the duplication effect, is positive.

Assume that the magnitude of the specialisation effect decreases faster than the duplication effect as z_t decreases due to new entrances in the credit market stimulated by economic development. Then, we should observe that the growth effect of an increase in concentration is negative at sufficiently low levels of economic development, and positive otherwise. For instance, if we assume $c(z_t) = az_t$ (with $a > 0$) condition (2.19) reduces to:

$$-s(1-\alpha)\phi\frac{az_t^2}{2} + \frac{[1 + az_t)]C}{k_t} > 0, \tag{2.20}$$

which implies that, for a given level of k_t, an increase in the concentration level is detrimental for growth for z_t greater than some critical value z^*. Let us assume that the credit market is perfectly contestable so that $n_t = n_t^{\max}$. Under this hypothesis, by applying expression (2.16) we get

$$z_t = \frac{C}{(1-\alpha)^2 \phi s k_t} \tag{2.21}$$

and by substituting in condition (2.20) we have

$$-\frac{aC^2}{2(1-\alpha)^3 \phi s k_t^2} + \frac{[(1-\alpha)^2 \phi s k_t + aC)]C}{(1-\alpha)^2 \phi s k_t^2} > 0, \tag{2.22}$$

so that under the assumption of a perfectly constestable credit market concentration has a positive (negative) growth effect for

$$k_t > (<) \frac{aC}{(1-\alpha)^2 \phi s} [\frac{2\alpha - 1}{2(1-\alpha)}] \equiv k^*, \tag{2.23}$$

where k^* is positive for $\alpha > 1/2$. Hence, for $k_t > k^*$, perfect contestability produces excessive proliferation of banks, i.e. too little concentration, while the opposite is true for $k_t < k^*$. By the continuity argument, for $k_t < k^*$, a reduction in the concentration level due to an increase in the degree of contestability of the credit market is surely growth inducive for $k_t < k^*$. On the other hand, for $k_t > k^*$, a reduction in the concentration forced by increased contestability is more likely to be detrimental for growth the higher is the status quo level of contestability. By the same token, the above discussion implies that we should observe a different relationship between concentration and growth at different levels of economic development.

3. Empirical Specification, Data and Results

We examine the relationship between the concentration of the banking system and industrial growth using Rajan and Zingales (1998) cross-country industry data, augmented recently by Cetorelli et al (2001) to include various measures of concentration of the banking sector. The sample includes 36 industries (all belonging to the manufacturing sector) from 41 countries, yielding a very large sample consisting of 1150 observations.[10] In order to test whether the relationship between banking concentration and growth is different depending on the level of economic development, we split the sample into high-income (mainly OECD economies) and low-income countries. [11] For each sub-sample, we esti-

[10] For a detailed description of the data set, see Rajan and Zingales (1998).

[11] We split the overall sample based on the World Bank classification. The list of countries in each of the sub-samples is reported in Table 1.

mate the empirical model adopted by Cetorelli et al (2001) in which the rate of growth of real value added for each industrial sector in each country (GTH) is regressed on industry dummies (IND), country controls (CNTRL), industry share of manufacturing value added (SHARE) and a measure of banking concentration (CONC). The growth equation for each sub-sample may be estimated via OLS, accounting for the fact that each sub-sample is a non-random sample of all available observations. This is accomplished via Heckman's selection correction model where in the first stage, a probit model is used to predict the probability of a country belonging to a certain income group and in the second stage, the appropriate inverse Mill's ratio is included as a regressor.[12] We then employ the Chow test statistic to test the null hypothesis that the coefficients on banking concentration are the same across the high-income group and low-income groups (see Hsiao, 1986).[13] Rejection of the null hypothesis would be consistent with the model's theoretical prediction that there exists a different relationship between banking concentration and industrial growth depending on the level of economic development.

3.1. Empirical Specification

The basic growth equation model estimated is

$$GTHj,k = const + a_1INDj + a_2CNTRL_k + a_3SHARC_{j,k} + a_4CONC_k + e_{j,k} \tag{3.1}$$

where $e_{j,k}$ is the error term, the subscript j indicates that the variable refers to the *j-th* industry j, a_i are vectors of coefficients to be estimated,and the subscript k indicates that the variable relates to the k-th country.

The vector of country control variables are used to control for important economic phenomena that affect economic growth. In this study, the vector of country controls ($CNTRL$) includes initial income per capita, a measure of initial human capital and a measure of banking development. We expect industries in initially richer countries to grow slower, higher initial secondary school enrollment rates to be associated with faster subsequent industrial growth, and higher levels of banking development to be associated with higher industrial growth rates. In order to compare our results with existing empirical studies,

[12] See Main and Reilly (1993) for a similar application and Maddala (1983) for a discussion of this issue. In this paper, the results with and without the Heckman's selection correction model are very similar. The results without the Heckman's selection correction are reported in Tables 3 and 4 in the appendix.

[13] The F-test is constructed without constraining the residual variance across equations. The results with constraining the residual variance across produces very similar results.

we also include a measure of stock market capitalization and the quality of accounting standards as an additional control variable. The stock market capitalization controls for the relative importance of alternative sources to banking finance and is expected to be positively correlated with industrial growth. The accounting standards measure is an index reflecting the quality of disclosure of the firm's annual reports. The stronger are these standards, the lower the information costs that banks have to incur in monitoring these firms. Thus, the expected coefficient on this variable is also positive.

The industry dummies are used to control for industry specific effects whereas the industry share of manufacturing value added ($SHARE$) is used as an additional control variable to control for industry-specific convergence effect and as such plays a role similar to that of per capita income in cross-country growth regressions. Sectors that have already witnessed very high growth rates in the past are likely to grow at slower rates in the future.

Finally, the level of banking concentration in each country $CONC$ is used to test for the effect of banking market structure on industrial growth.[14] As our theoretical discussion suggests, this effect can be different depending on the level of economic development. Hence we expect the coefficient a_4 in model (3.1) to be significantly different across the high-income and low income groups.

3.2. Data

We use Rajan and Zingales's cross country industry data set (1998) augmented recently by Cetorelli and Gambera (2001) to include concentration measures of the banking sector. The relevant growth variable is the rate of growth of real value added for each industrial sector, averaged over the 1980-1990 period. Initial human capital is measured by the average school years in the population over 25 in 1980. Initial income per capita is measured by the log of per capita income in 1980. Banking development is the ratio of private credit to GDP averaged over the 1980-1990 period. Stock market capitalization is the ratio of stock market to GDP in 1980. Finally, banking concentration is measured by the sum of market shares (in terms of total assets) of the three largest banks averaged over the 1989-1996 period.

[14] It is possible to argue that the banking market structure adjusts to a level that is optimal for a country's industrial structure which raises the issue of potential endogeneity of the market structure. This argument, however, ignores the fact that there are political and regulatory institutions that affect the natural development of the market structure of the banking system (Cetorelli et al, 2001). Despite the validity of this argument, we address the issue of endogeneity using the instrumental variable estimation approach.

3.3. Empirical Results

Table 1 reports the estimation results for the low-income and the high- income groups and for the full sample. The estimates for the full sample replicate Cetorelli and Gambera (2001) results and are reported here for the sake of comparison. The control variables are introduced once at a time to check the robustness of our results to the inclusion of control variables. For each regression, we report the Durbin-Wu-Hausamn test of over-identifying restrictions (Davidson and McKinnon, 1993), which tests the null hypothesis that the use of instrumental variables doesn't change the estimation outcome. We report the instrumental variable estimates when we reject the null hypothesis at 10% or below. For the full sample, the estimates by Cetorelli and Gambera (2001) suggest that industries in initially richer countries tend to grow slower; sectors that have witnessed high growth rates in the past are likely to grow at slower rates in the future and that higher levels of banking development are associated with higher industrial growth rates. These results are consistent with cross-country growth regressions (see Barro and Sala-i- Martin, 1992; King and Levine, 1993a,b). As to the impact of banking concentration on growth, their results suggest that banking concentration has an adverse impact on industrial growth.[15]

However, splitting the sample into high-income and low-income groups and estimating the growth equation (3.1) for each sub-sample suggest that the negative relationship between banking concentration and industrial growth found in the full sample holds only for low income countries. Specifically, Table 1 shows that the effect of banking concentration on industrial growth is different across low-income and high-income countries where the coefficient on banking concentration is negative and highly significant in the former countries, but no significant in the latter ones. We use the Chow test to test if the coefficients on all variables differ across by income group. Based on the Chow-test (Chow-Test-1 in Table 1), we reject the null hypothesis at the 1% level implying that the estimated coefficients are different across high-income and low-income countries. We also employ the Chow-test to test the null hypothesis that the coefficients on banking concentration are the same across the high-income and low income countries. Based on this test (Chow-Test-2 in Table 1), we reject the null hypothesis.

As can be seen from Table 1, these results are robust to the inclusion of human capital, stock market capitalization and accounting standards as additional control variables. In fact, the differences in the estimated coefficients on

[15] Cetorelli and Gambera's empirical study goes beyond the analysis of the average growth-effect of banking concentration, where they examine the impact of concentration on the degree of financial dependence of various categories of firms and industries.

banking concentration across the two income groups become larger as additional control variables are included. For instance, in the specification that includes all the control variables used in this study, the coefficient on banking concentration variable is much larger and retains its high significance for the low-income group, whereas it is insignificant in the high-income group. This is confirmed by the Chow-test which indicates a strong rejection of the null hypothesis that the coefficients on banking concentration are the same in the high-income and low-income countries.

Next, we use the five-bank concentration ratio suggested by Cetorelli and Gambera (2001) as an alternative measure of concentration to check that our results are robust to the arbitrary choice of focusing on the sum of the market shares of the top three banks. In addition, we use the alternative measure based on the relative position of countries in the ranking of banking concentration. This measure allows the possibility that averages over the period 1980-1989 are different from those over the period 1989-1996, but requires that countries keep their position in the ranking, which is a much less stringent condition.[16] As can be seen from Table 2, the results are very similar to those obtained previously. The negative relationship between concentration of the banking system and industrial growth found in the full sample holds only for low-income countries whereas there is no significant relationship between banking concentration and industrial growth in the high-income group.[17]

4. Concluding Remarks

Various theoretical and empirical contributions have established that the development of the banking system is positively associated with long run economic growth. An important aspect of this association, which has been subject to much less research, is whether the attributes of the banking system matter for growth. This paper focuses on one such attribute: the concentration in the banking industry. This paper presents an endogenous OLG model in which the impact of a reduction in banking concentration on economic growth depends on the trade-off between two effects. On the one hand, it enhances economic growth by inducing economies of specialisation. On the other hand, it results in higher duplication costs which is detrimental for growth. The trade-off between

[16] For a detailed description of the various measures of banking concentrations, see Cetorelli et al (2001).

[17] The results for the other specifications that include human capital, accounting standards and stock market capitalisation don't alter significantly and hence are not reported here. These results are available from authors upon request.

these two effects determines whether a more concentrated banking market structure is conducive for growth. Another insight of this study is that the trade-off between the specialization and duplication effects can vary along the process of economic development. This has important empirical implications since the model predicts that concentration may not necessarily have a uniform impact on economic growth across countries. Instead, the relationship between concentration and growth is likely to be different across countries depending on their level of economic development. The empirical results support this hypothesis where we find that banking concentration has an adverse impact on industrial growth only in low-income countries. They are also consistent with the model's prediction that, under decreasing returns to specialisation, an increase in competition is more likely to promote growth in low income countries, while in high income countries the benefits from further specialisation may not be significant enough to offset the costs of duplication, so that further competition may not be conducive for growth in these countries.

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Table 1- The Average effect of bank concentration on industrial growth

	Cons	SHARE	CONC3	BANK	LGCAP80	HUMAN80	MCAP80	ACCST	R^2	OBS	Durbin-Wu-Haus
Full sample	0.187***	-0.875***	-0.038**	0.074***	-0.016***						F(1,1046) = 0.60
	(0.028)	(0.260)	(0.0168)	(0.016)	(0.003)				0.127	1150	*p-value =0.438*
High Income	0.155***	-0.257***	-0.004	0.059***	-0.013***						F(1,536) = 0.87
	(0.066)	(0.093)	(0.009)	(0.010)	(0.006)				0.293	576	*p-value=0.35*
Low Income	0.668	-1.913***	-0.089***	0.234***	-0.075						F(1,435) = 0.02
	(0.652)	(0.370)	(0.040)	(0.050)	(0.078)				0.217	530	*p-value = 0.88*
Chow Test I	F(39,1028) = 3.94										
	p-value=0.00										
Chow Test II	F(1,1028)=4.21										
	p-value=0.04										
Full sample	0.172***	-0.890***	-0.039**	0.078***	-0.015***	0.001					F(1,1011) = 0.26
	(0.037)	(0.262)	(0.018)	(0.016)	(0.005)	(0.001)			0.128	1106	*p-value = 0.60*
High Income	0.126***	-0.276***	0.005	0.056***	-0.009	-0.002					F(1,535) = 0.76
	(0.068)	(0.091)	(0.012)	(0.010)	(0.007)	(0.001)			0.297	576	*p-value=0.38*
Low Income	2.923***	-1.915***	-0.104***	0.269***	-0.332***	-0.023***					F(1,434) = 0.12
	(0.830)	(0.368)	(0.038)	(0.054)	(0.098)	(0.005)			0.246	530	*p-value = 0.72*
Chow Test I	F(40,1026) = 4.10										
	p-value=0.00										
Chow Test II	F(1,1026) =7.33										
	p-value=0.00										
Full sample	0.198***	-0.886***	-0.055***	0.070***	-0.018***	0.001	0.036***				F(1,1010) = 0.29
	(0.036)	(0.262)	(0.019)	(0.016)	(0.004)	(0.001)	(0.006)		0.140	1106	*p-value = 0.59*
High Income	-0.032	-0.254***	-0.008	0.067***	-0.004	0.001	0.044***				F(1,534) = 1.26
	(0.067)	(0.098)	(0.010)	(0.009)	(0.006)	(0.001)	(0.005)		0.381	576	*p-value=0.26*
Low Income	2.920***	-1.917***	-0.105***	0.267***	-0.332***	-0.022***	0.002				F(1,433) = 1.12
	(0.837)	(0.371)	(0.044)	(0.061)	(0.099)	(0.005)	(0.017)		0.246	530	*p-value = 0.29*
Chow Test I	F(41,1024) = 4.37										
	p-value=0.00										
Chow Test II	F(1,1024) = 4.48										
	p-value=0.03										
Full sample	0.212***	-0.303**	-0.117***	0.058***	-0.025***	0.004**	0.029***	0.109***			F(1,908) = 8.73
	(0.036)	(0.141)	0.016	(0.014)	(0.004)	(0.002)	(0.007)	(0.026)	0.223	950	*p-value=0.00*
High Income	-0.026	-0.274***	-0.003	0.062***	0.008	0.0005	0.051***	-0.049*			F(1,533) = 0.69
	(0.066)	(0.077)	(0.011)	(0.010)	(0.008)	(0.001)	(0.007)	(0.028)	0.384	576	*p-value = 0.41*
Low Income	5.85***	-1.332***	-0.334***	0.340***	-0.644**	-0.038***	0.120***	-0.327***			F(1,331) = 6.46
	(1.047)	(0.490)	(0.090)	(0.082)	(0.119)	(0.07)	(0.036)	(0.112)	0.378	374	*p-value=0.01*
Chow Test I	F(42,866) =4.67										
	p-value=0.00										
Chow Test II	F(1,868) = 12.23										
	p-value=0.00										

*** indicates significant 1% significance level; ** indicates significance at the 5% level.

Notes to Table 1

The dependent variable is the average compounded rate of growth of real value added for each industrial sector in each country over the period 1980-1990. SHARE is industry *j's* share of manufacturing in country *k*. BANK represents banking development measured by the ratio private credit to GDP. CONC3 represents banking concentration measured by the sum of market shares (in terms of total assets) of the three largest banks averaged over the period 1989-1996. LGCAP80 is initial income per capita measured by the log of per capita income in 1980. HUMAN80 represents initial human capital measured by the average school years in the population over 25 in 1980. MCAP80 is stock market capitalization to GDP in 1980. ACCST represents the quality of accounting standards. Industry dummy variables are included in all regressions, but we don't report their coefficient estimates. Country dummy variables are not included in these regressions. Heteroskedasticity-consistent standard errors are reported in parentheses. OBS is the number of observations. The Durbin-Wu-Hausmann statistics test the null hypothesis that the use of instrumental variables doesn't change the estimation outcome. We report the IV estimates when the null hypothesis is rejected at 10% or less. The instruments used are: the rule of law, legal origin, total GDP and population. Chow test (I) tests the null hypothesis that the coefficient vectors are the same in the high-income and low-income groups. Chow test (II) tests the null hypothesis that the coefficients on CONC3 are the same in the high-income group and low-income group. Mill's ratio is included in sub-samples regressions to correct for possible sample selection bias. The Mills ratios were obtained from a probit model in which includes initial human capital and initial GDP per capita as regressors. The high income countries are: Sweden, Norway, Germany, Denmark, France, Belgium, Netherlands, Canada, Finland, Japan, Australia, UK, Austria, New Zealand, Italy, Spain, Greece, Israel, Singapore, and Portugal. The low-income countries are: Bangladesh, India, Sri Lanka, Pakistan, Kenya, Zimbabwe, Egypt, Philippines, Morocco, Peru, Turkey, Jordan, Colombia, Korea, Brazil, Malaysia, Costa Rica, Chile, Mexico, South Africa, and Venezuela.

Table 2- The Average effect of bank concentration on industrial growth

	Constant	SHARE	BANK	LGCAP80	CONC5	RANK3	R^2	OBS	Durbin-Wu-Hausman
Full sample	0.187***	-0.883***	0.073***	-0.015***	-0.031**				F(1,1046) = 0.72
	(0.028)	(0.259)	(0.016)	(0.003)	(0.014)		0.126	1150	p-value = 0.396
High Income group	0.142**	-0.264***	0.063***	-0.013***	0.001				F(1,536) =1.40
	(0.065)	(0.093)	(0.010)	(0.006)	(0.009)		0.293	576	p-value = 0.23
Low Income group			0.230***		-				
	0.699***	-1.918***	(0.051)	-0.077	0.083***				F(1,435) = 0.02
	(0.654)	(0.370)		(0.079)	(0.035)		0.213	530	p-value=0.89
Chow Test I	F(38,1028) = 3.93 p-value=0.00								
Chow Test II	F(1,1028) = 5.38 p-value=0.02								
Full sample	0.179***	-0.872***	0.074***	-0.015***		-0.05×10^{-2}***			F(1,1046) = 0.70
	(0.027)	(0.260)	(0.015)	(0.003)		(0.0002)	0.128	1150	p-value = 0.401
High Income	0.155***	-0.257***	0.059***	-0.014***		0.000			F(1,536) = 0.80
	(0.066)	(0.093)	(0.010)	(0.007)		(0.0001)	0.293	576	p-value = 0.37
Low Income	0.649***	-1.909***	0.235***	-0.075		-0.13×10^{-2}**			F(1,435) =0.00
	(0.644)	(0.369)	(0.050)	(0.077)		(0.0005)	0.216	530	p-value=0.96
Chow Test I	F(39,1072) = 3.98 p-value=0.00								
Chow Test II	F(1,1072) = 4.96 p-value=0.02								

*** indicates significant 1% significance level; ** indicates significance at the 5% level

Notes to Table 2

The dependent variable is the average compounded rate of growth of real value added for each industrial sector in each country over the period 1980-1990. SHARE is industry *j's* share of manufacturing in country *k*. BANK represents banking development measured by the ratio private credit to GDP. CONC5 represents banking concentration measured by the sum of market shares (in terms of total assets) of the five largest banks averaged over the period 1989-1996. RANK 3 is the rank of the three-bank ratio. LGCAP80 is initial income per capita measured by the log of per capita income in 1980. Industry dummy variables are included in all regressions, but we don't report their coefficient estimates. Country dummy variables are not included in these regressions. Heteroskedasticity-consistent standard errors are reported in parentheses. OBS is the number of observations. The Durbin-Wu-Hausmann statistics test the null hypothesis that the use of instrumental variables doesn't change the estimation outcome. We report the IV estimates when the null hypothesis is rejected at 10% or less. The instruments used are: the rule of law, legal origin, total GDP and population. Chow test (I) tests the null hypothesis that the coefficient vectors are the same in the high-income and low-income groups. Chow test (II) tests the null hypothesis that the coefficients on CONC3 are the same in the high-income group and low-income group. Mill's ratio is included in sub-samples regressions to correct for possible sample selection bias. The Mills ratios were obtained from a probit model in which includes initial human capital and initial GDP per capita as regressors. The high income countries are: Sweden, Norway, Germany, Denmark, France, Belgium, Netherlands, Canada, Finland, Japan, Australia, UK, Austria, New Zealand, Italy, Spain, Greece, Israel, Singapore, and Portugal. The low-income countries are: Bangladesh, India, Sri Lanka, Pakistan, Kenya, Zimbabwe, Egypt, Philippines, Morocco, Peru, Turkey, Jordan, Colombia, Korea, Brazil, Malaysia, Costa Rica, Chile, Mexico, South Africa, and Venezuela.

Table 3- The Average effect of bank concentration on industrial growth (Mill's ratio not included)

	Constant	SHARE	CONC3	BANK	LGCAP80	HUMAN80	MCAP80	ACCST	R^2	OBS	Durbin-Wu-Hausman
Full sample	0.187***	-0.875***	-0.038**	0.074***	-0.016***						F(1,1046) = 0.60
	(0.028)	(0.260)	(0.0168)	(0.016)	(0.003)				0.127	1150	*p-value =0.438*
High Income group	0.009	-0.260***	-0.001	0.063***	0.001						F(1,537) = 0.71
	(0.039)	(0.097)	(0.009)	(0.010)	(0.004)				0.282	576	*p-value=0.398*
Low Income group	0.213***	-1.809***	-0.093***	0.225***	-0.021***						F(1,470) = 0.11
	(0.061)	(0.375)	(0.038)	(0.051)	(0.006)				0.198	574	*p-value = 0.736*
Chow Test I	F(38,1074) = 3.62										
	p-value=0.000										
Chow Test II	F(1,1074)=5.37										
	p-value=0.020										
Full sample	0.172***	-0.890***	-0.039**	0.078***	-0.015***	0.001					F(1,1011) = 0.26
	(0.037)	(0.262)	(0.018)	(0.016)	(0.005)	(0.001)			0.128	1106	*p-value = 0.608*
High Income	-0.021	-0.272***	0.006	0.062***	0.005	-0.001					F(1,536) = 1.42
	(0.051)	(0.095)	(0.012)	(0.010)	(0.006)	(0.001)			0.284	576	*p-value=0.233*
Low Income	0.211***	-1.912***	-0.119***	0.281***	-0.011*	-0.013***					F(1,435) = 0.03
	(0.062)	(0.370)	(0.037)	(0.056)	(0.007)	(0.004)			0.230	530	*p-value = 0.862*
Chow Test I	F(39,1028) = 3.71										
	p-value=0.000										
Chow Test II	F(1,1028) =10.21										
	p-value=0.001										
Full sample	0.198***	-0.886***	-0.055**	0.070***	-0.018***	0.001	0.036***				F(1,1010) = 0.29
	(0.036	(0.262)	(0.019)	(0.016)	(0.005)	(0.001)	(0.006)		0.140	1106	*p-value = 0.59*
High Income	-0.028	-0.254***	0.008	0.067***	0.004	0.001	0.044***				F(1,535) = 1.27
	(0.049)	(0.075)	(0.010)	(0.010)	(0.005)	(0.001)	(0.006)		0.381	576	*p-value=0.26*
Low Income	0.214***	-1.552***	-0.092*	0.294***	-0.012*	-0.012**	0.007				F(1,434) = 6.99
	(0.079)	(0.405)	(0.060)	(0.063)	(0.007)	(0.004)	(0.017)		0.265	530	*p-value = 0.00*
Chow Test I	F(40,1028) = 4.13										
	p-value=0.00										
Chow Test II	F(1,1028) = 6.78										
	p-value=0.00										
Full sample	0.212***	-0.303**	-0.116***	0.057***	-0.025***	0.003**	0.029***	0.109***			F(1,909) = 8.73
	(0.036)	(0.140)	0.016	(0.014)	(0.004)	(0.001)	(0.007)	(0.026)	0.222	950	*p-value=0.00*
High Income	-0.054	-0.270***	-0.004	0.064***	0.010	0.001	0.051***	0.042			F(1,534) = 0.69
	(0.051)	(0.076)	(0.011)	(0.010)	(0.006)	(0.001)	(0.007)	(0.025)	0.384	576	*p-value = 0.40*
Low Income	0.436***	-1.362***	-0.410***	0.134***	-0.015**	-0.009**	0.104***	-0.080			F(1,332) = 0.14
	(0.109)	(0.446)	(0.082)	(0.062)	(0.007)	(0.004)	(0.034)	(0.089)	0.337	374	*p-value=0.70*
Chow Test I	F(41,868) =4.23										
	p-value=0.000										
Chow Test II	F(1,868) = 24.28										
	p-value=0.000										

*** indicates significant 1% significance level; ** indicates significance at the 5% level; * indicates significance at the 10% level;

Notes to Table 3

The dependent variable is the average compounded rate of growth of real value added for each industrial sector in each country over the period 1980-1990. SHARE is industry *j's* share of manufacturing in country *k*. BANK represents banking development measured by the ratio private credit to GDP. CONC3 represents banking concentration measured by the sum of market shares (in terms of total assets) of the three largest banks averaged over the period 1989-1996. LGCAP80 is initial income per capita measured by the log of per capita income in 1980. HUMAN80 represents initial human capital measured by the average school years in the population over 25 in 1980. MCAP80 is stock market capitalization to GDP in 1980. ACCST represents the quality of accounting standards. Industry dummy variables are included in all regressions, but we don't report their coefficient estimates. Country dummy variables are not included in these regressions. Heteroskedasticity-consistent standard errors are reported in parentheses. OBS is the number of observations. The Durbin-Wu-Hausmann statistics test the null hypothesis that the use of instrumental variables doesn't change the estimation outcome. We report the IV estimates when the null hypothesis is rejected at 10% or less. The instruments used are: the rule of law, legal origin, total GDP and population. Chow test (I) tests the null hypothesis that the coefficient vectors are the same in the high-income and low-income groups. Chow test (II) tests the null hypothesis that the coefficients on CONC3 are the same in the high-income group and low-income group. The high income countries are: Sweden, Norway, Germany, Denmark, France, Belgium, Netherlands, Canada, Finland, Japan, Australia, UK, Austria, New Zealand, Italy, Spain, Greece, Israel, Singapore, and Portugal. The low-income countries are: Bangladesh, India, Sri Lanka, Pakistan, Kenya, Zimbabwe, Egypt, Philippines, Morocco, Peru, Turkey, Jordan, Colombia, Korea, Brazil, Malaysia, Costa Rica, Chile, Mexico, South Africa, and Venezuela.

Table 4- The Average effect of bank concentration on industrial growth (Mills Ratio not included)

	Cons	SHARE	BANK	LGCAP80	CONC5	RANK3	R^2	OBS	Durbin-Wu-Hausman
Full sample		-0.883***	0.073***	-0.015***	-0.031**				F(1,1046) = 0.72
	0.187*** (0.028)	(0.259)	(0.016)	(0.003)	(0.014)		0.126	1150	*p-value = 0.396*
High Income group	-0.000	-0.266***	0.067***	0.001	0.004				F(1,537) =1.52
	(0.039)	(0.096)	(0.010)	(0.003)	(0.009)		0.283	576	*p-value = 0.218*
Low Income group	0.213***	-1.813***	0.221***	-0.020***	-0.080***				F(1,470) = 0.12
	(0.061)	(0.376)	(0.052)	(0.006)	(0.033)		0.195	574	*p-value=0.734*
Chow Test I	F(38,1074) = 3.53								
	p-value=0.000								
Chow Test II	F(1,1074) = 6.02								
	p-value=0.014								
Full sample			0.074***			-0.05×10^{-2}***			
	0.179***	-0.872***	(0.015)	-0.015***					F(1,1046) = 0.70
	(0.027)	(0.260)		(0.003)		(0.0002)	0.128	1150	*p-value = 0.40*
High Income	0.007	-0.261***	0.064***	0.001		-4.49×10^{-6}			F(1,537) = 0.63
	(0.038)	(0.096)	(0.010)	(0.003)		(0.0001)	0.282	576	*p-value = 0.429*
Low Income			0.226***			-0.14×10^{-2}***			
	0.197***	-1.804***	(0.050)	-0.022*					F(1,470) = 0.00
	(0.057)	(0.374)		(0.006)		(0.0005)	0.199	574	*p-value=0.986*
Chow Test I	F(38,1074) = 3.69								
	p-value=0.000								
Chow Test II	F(1,1074) = 6.45								
	p-value=0.011								

*** indicates significant 1% significance level; ** indicates significance at the 5% level; * indicates significance at the 10% level;

Notes to Table 4

The dependent variable is the average compounded rate of growth of real value added for each industrial sector in each country over the period 1980-1990. SHARE is industry *j's* share of manufacturing in country *k*. BANK represents banking development measured by the ratio private credit to GDP averaged over the period 1980-1990. CONC5 represents banking concentration measured by the sum of market shares (in terms of total assets) of the five largest banks averaged over the period 1989-1996. RANK 3 is the rank of the three-bank ratio. LGCAP80 is initial income per capita measured by the log of per capita income in 1980. Industry dummy variables are included in all regressions, but we don't report their coefficient estimates. Note that country dummy variables are not included in these regressions. Heteroskedasticity-consistent standard errors are reported in parentheses. OBS is the number of observations. The Durbin-Wu-Hausmann statistics test the null hypothesis that the use of instrumental variables doesn't change the estimation outcome. We report the IV estimates when the null hypothesis is rejected at 10% or less. The instruments used are: the rule of law, legal origin, total GDP and population. Chow test (I) tests the null hypothesis that the coefficient vectors are the same in the high-income group and low-income group. Chow test (II) tests the null hypothesis that the coefficients on CONC3 are the same in the high-income group and low-income group. The high income countries are: Sweden, Norway, Germany, Denmark, France, Belgium, Netherlands, Canada, Finland, Japan, Australia, UK, Austria, New Zealand, Italy, Spain, Greece, Israel, Singapore, and Portugal. The low-income countries are: Bangladesh, India, Sri Lanka, Pakistan, Kenya, Zimbabwe, Egypt, Philippines, Morocco, Peru, Turkey, Jordan, Colombia, Korea, Brazil, Malaysia, Costa Rica, Chile, Mexico, South Africa, and Venezuela.

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