FINANCIAL INTEGRATION & GROWTH WITH IMPERFECT COMPETITION IN BANKING†

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November 2006

Abstract: We explore dynamic linkages between financial/banking sector openness, financial sector competition, and growth, highlighting analytical links between long-run economic performance and services trade, through scale economies and market and cost structures in the financial services sector. This is followed by empirics based on data for 130 countries for the 1990s. To handle the unbalanced nature of missing observations in our system, we include an estimator that lets us use the full sample given partial sample overlap. Results point to a strong positive relationship between financial sector competition /performance and financial sector openness (meaning foreign bank access to domestic markets), and between growth and financial sector competition/performance. They also point to the presence of scale economies in the sector.

Keywords: financial services trade, service trade and imperfect competition, trade in services and growth, banking sector competition

JEL codes: [F40], [C3], [F13], [F43], [G15]

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†. This paper represents our opinions, and is not meant to represent the official position or view of any organization with which we may have ever been affiliated. All remaining errors are due to confusion on the part of the authors.

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I. INTRODUCTION

In the early neoclassical growth literature, financial services played a passive role, simply funneling household savings to investors. Goldsmith [1969] and McKinnon [1973] were among the first to make a break from this mold, emphasizing a more active role for financial services in promoting growth. Since then, a considerable theoretical and empirical literature has emerged analyzing the role of finance in growth and development.

This paper explores issues that straddle two different literatures. First, they relate directly to the nascent literature on trade in services, and to the impact of services trade, in terms of foreign bank/institutional participation in domestic capital markets, on economic performance.[1] Second, they are also closely related, though not identical, to those issues found in the strand of the finance and growth literature involving capital market liberalization and financial flows restrictions.[2] The mechanisms we highlight are linked to the pro-competitive effects of openness, and come on top of those emphasized in the current literature on financial sector development.

The recent empirical literature emphasizes two ways in which domestic financial services affect growth -- capital accumulation and technical innovation. Gains in these areas can result either in temporarily higher growth rates (transitional or bounded growth effects) or in permanently higher growth rates. In general, the approach involves employing financial sector development indicators as independent variables in growth regressions. Most of this literature has looked at indicators of banking sector development and the degree of private sector involvement in financial services and the allocation of savings, together with distortion and

[1] Traditionally, the formal trade literature has focused on trade in goods, with the literature on services trade being a relatively limited and recent addition. While there is a sizable empirical literature on service sector policy and deregulation, this is largely focused on domestic deregulation. A thorough overview is provided by WTO (1998).

financial service cost measures. In addition, a few studies have examined the relationship between stock-market development and growth. Little emphasis is placed on the role of traded financial services. By this, we mean focus on identification of a possible causal chain linking financial sector openness, financial sector performance, and growth performance.

Within this growing literature[3], DeGregorio and Guidotti [1995] report a significant link between private sector credit and economic growth, while Demetriades and Hussein [1996] and Jung [1986] find that financial sector development/depth and growth have a bi-directional relationship. Roubini and Sala-i-Martin [1992] and Mattesini [1996] report a negative relationship between real interest rate distortions and lending-deposit spreads on the one hand, and growth on the other. Arestis, Demetriades and Luintel (2001, 5 countries using time-series techniques) find only weak evidence for the hypothesis that stock market activity accelerates growth. The empirical results of the latter attribute more weight to the role of banks in promoting growth. More recently sectoral and long-run vs. short run growth effects have been investigated. Fisman and Love [2004], for instance, use US data to show that in the short run financial development benefits industries with high growth potential, while it reallocates resources towards sectors with a 'natural reliance' on external finance in the long run.

While the empirical literature has moved us from assumptions of a passive financial intermediation mechanism to explicit linkages between intermediation and growth, the role of open markets in general, and financial sector openness (in a trade sense) in particular, has not been emphasized. In addition, there is apparent confusion about the different transmission channels linking international finance with growth. In general authors mean the liberalization of financial flows when they touch upon this issue. This is of particular importance, as substantial

[2] See the survey of Edison, Klein, Ricci, and Sløk (2002).
[3] See Levine [1997] and Eschenbach [2004] for surveys of the literature.

controversy exists about the question of whether capital account liberalization yields significant long-term growth effects. Its proponents argue that it may foster resource reallocation from capital abundant to capital scarce countries. On top of that it is asserted that free capital flows promote productivity growth through greater international risk diversification (Obstfeld [1994]). Its opponents, however, point out that liberalization of financial flows in the presence of pre-existing trade distortions may have immiserizing effects (see Eichengreen [2001]). Edison, Levine, et al. [2002], mention the importance of sound policies and institutions in this context. With theory giving no straightforward prediction, empirical results are no more clear-cut. While Edison, Levine et al. find no hard cross-country evidence linking capital account openness with growth, Edison, Klein, et al. [2002] summarize the empirical literature such that positive effects are found in industrialized countries. Whatever the outcome of this strand of research may be, the approach taken here is fundamentally different. We start with the definition of trade in financial service as foreign institutional participation in the domestic financial system. Accordingly the growth-promoting mechanism is different. It works through openness, market structure and competition, reducing the physical resource cost absorbed (and not invested) by financial intermediaries and ultimately giving a boost to incentives to save and invest. While the approach is relatively new in a comprehensive sense, a step in its direction is recent work linking openness with financial development and performance. For example, Claessens and Glaessner [1998] have shown that barriers to financial services trade have slowed down the development of financial markets in East Asia. In a more recent study Guiso et al. [2004] use Italian industry and firm-level data to show that financial integration accelerates growth by improving the financial infrastructure. Claessens, Demirgüç-Kunt and Huizinga [2001] have shown that greater foreign presence reduces profit margins for domestic banks in developing country financial sectors. In

our view, this suggests the first link in the causal chain explored here between financial sector openness, financial sector performance, and economic growth. It seems worth mentioning here that our approach also differs from the literature on growth effects induced by domestic financial liberalization. Andersen and Tarp [2003] for instance, argue that fostering financial sector competition in the presence of (almost) inevitable market imperfections may have detrimental growth effects. In the case of trade in financial services, however, foreign presence in the domestic financial market improves the framework within which intermediaries operate [see Levine, 2001, for instance]. In this context competition may even reduce market imperfections.

The approach followed here involves a mix of theory and empirics, and is organized as follows. First, in Section II we use an analytical model to explore possible linkages between banking/financial sector competition, scale, openness, and growth. This motivates the empirical exercise in Section III, which is based on a sample of 130 countries, covering their experience in the 1990s. These data include standard cross-country growth indicators (macroeconomic stability, inflation, etc.), along with finance sector indicators (financial openness, banking concentration, etc.). Because our data include a number of developing countries, we run into the problem of sparse data coverage, with data available for some countries for estimating some but not all equations in our system. To handle the issue of a non-square dataset while still filtering the simultaneous transmission of error terms across our system, we supplement OLS and SUR regressions with an approach similar to iterative staged estimation methods, though we actually solve the system explicitly as a simultaneous minimization problem. Basically, while using the full sample, where possible we substitute the estimated value conditional on exogenous variables within the system to then obtain least squares estimates for the entire system – partial sample overlap least squares. We are thus able to use the full, partially overlapping sample to estimate

our system of equations. These estimates are compared with the OLS and SUR estimates for the same system. Under all approaches, we find evidence for an economically and statistically significant link between financial sector openness, competition in local financial service markets, and economic growth. We summarize in Section IV.

II. THEORY

A. Basic Structure

We start by exploring linkages between competition, openness and growth analytically. This helps to motivate the empirical exercise offered in the next section. We are primarily concerned with the location of finance firms at the nexus of the savings and investment mechanism, and the implications of services trade and competition for the working of this mechanism.

We first assume a national GDP function that is Cobb-Douglas.

$$Q = AK^{a}L^{1-a} \qquad (1)$$

In equation (1), Q is GDP, K is production capital, L is labor and $0<a<1$. The composite Q also serves as the numeraire good. We assume a Ramsey-type long-run macroeconomic closure, with constant relative risk aversion (CRRA) preferences defined over consumption of the composite good Q and with consumers engaged in intertemporal optmization. This means the model has certain well-known properties. In particular, consumers strike a balance between present and deferred consumption, yielding the following modified version of the well-known steady-state condition in equation (2).

$$r = \rho + \delta + \phi \qquad (2)$$

In equation (2), r is the return earned by capital in the steady-state, ρ is the subjective rate of time discount, δ is the rate of capital stock depreciation, and ϕ is the cost of financial intermediation (i.e. the payment made in units of numeraire Q as discussed below).

The critical assumption at this juncture is that financial service firms provide a necessary bridge between savings (i.e. the creation of financial capital) and actual investment (the creation of physical capital available for investment expenditures). The theoretical literature on financial intermediation is extensive, and offers numerous alternative explanations for the observation of intermediation activities.[4] Investment projects for instance have a different size than individuals' savings. So intermediaries pool funds. There are information asymmetries and monitoring costs between savers and investors. Accordingly financial institutions screen and evaluate entrepreneurs and investment opportunities. They eventually allocate resources, monitor management and exert corporate control. Increasing sophistication of financial systems allows investors to trade, hedge, diversify and pool risk. Financial intermediaries also provide trade financing. The reasons for the emergence of financial institutions, however, are not crucial to our analysis. We expect that they exist for the range of reasons offered in the literature, and take their existence as given here. What we do require here is that in the reduced form financial intermediation involves a real resource cost that drives a wedge between the gross returns earned by physical capital and the net returns realized by financial capital owners as a basic incentive for saving and investment. Hence, changes in this incentive drive changes in the evolution of the capital stock.

To facilitate simplification of the analytics we employ several normalizations. These follow from the following assumption. While we have assumed a concave aggregate production

[4] Examples include Diamond (1984,1991), Leland and Pyle (1977), and Williamson (1987a, 1987b).

technology in terms of *K* and *L*, we also assume a Ricardian (i.e. linear) transformation technology between the composite *Q* and each of its alternative uses as (i.) consumption good *C*, (ii.) investment good (physical capital) *K* and (iii) financial services *F*. Hence we define units so that one unit of *Q* yields one unit of *C* or *K*, and we assume that financial intermediation activities are also scaled so that one unit of financial services (at price ϕ) is required per physical capital unit per period. The resource cost and pricing of financial services is discussed below.

The market for *Q* is competitive, as are factor markets. Capital and Labor both earn their value of marginal product measured in units of the numeraire *Q*. Hence, from the first order conditions, we will have $r = \alpha Q/K$. Combining this with the steady-state condition in equation [2] allows us to derive the following steady-state values (for a given price of financial services):

$$\begin{aligned} Q^* &= A\Psi^{\alpha/1-\alpha}L \\ K^* &= \Psi^{1/1-\alpha}L \\ S^* &= \delta\Psi^{1/1-\alpha}L \end{aligned} \qquad (3)$$

In equations (3) a * denotes a steady-state value while $\Psi = \alpha A/(\rho + \delta + \phi)$ and *S* denotes the level of financial savings.

To close the system we specify the competitive structure of financial markets so that ϕ is determined along with the other variables in equation (3). To do this we assume a Cournot-Nash equilibrium in the financial services sector, with constant marginal cost in the financial services sector (measured in units of Q) represented by *b*. There are *n* financial service firms. For now, assume that the value of *n* is simply set directly by regulatory authorities. These firms set quantities strategically in the sense that they are engaged in a game where they exercise market power by limiting the level of services supplied (or identically they strategically set the size of the investment basket they are willing to service). We adopt the classic Cournot assumption. Each firm believes that other firms will not adjust quantities when it does.

What does equilibrium look like in the region of the steady-state? From equations (3), we can derive the demand elasticity for financial services in the region of the steady-state:

$$\varepsilon^* = -\left[\frac{\phi}{1-\alpha}\right][\rho+\delta+\phi]^{-1} < 0 \qquad (4)$$

The Nash equilibrium conditions combined with equation [4] then give us the following relationship between n and ϕ in the region of the steady-state.

$$\phi^* = -\frac{-bn-(1-a)\rho-(1-a)\delta}{n-(1-a)} \qquad (5)$$

where $\partial\phi^* \big/ \partial n = \frac{b}{n-(1-a)} + \frac{-bn-(1-a)\rho-(1-a)\delta}{n-(1-a)} < 0$ since $\frac{b(n-(1-a))}{(n-(1-a))^2} < \frac{bn}{(n-(1-a))^2}$. Entry implies lower prices, and hence through equation (2) higher steady-state capital stocks, with related implications for the transition path from one steady-state to another. Directly lowering prices through trade will have similar effects, as would entry of foreign banks into a domestic oligopoly. We explore these issues in the next subsection.

Making a substitution into equation (3) yields the steady-state per-capita capital stock.

$$k^* = \left[\frac{n(\rho+\delta+b)}{aA(n-(1-a))}\right]^{\frac{1}{-(1-a)}} \qquad (6)$$

So far we have assumed the number of firms is set exogenously. To close the system, we are now going to add conditions sufficient to determine the number of firms n. In formal terms, we specify a limit entry condition. If unit profits are below a critical level π, firms exit, and if they are above this level, we have entry. The critical level could, for example, represent a regulatory target for long-term financial institution health. (It could also, of course, be zero). With symmetry across banks we then have:

$$\phi^* = \pi + \frac{cn}{Lk^*} + b \tag{7}$$

where *c* represents fixed costs (if any) and *b* again represents marginal costs. Together, equations (5), (6), and (7) are sufficient to define ϕ, *n*, and *k* in the region of the steady-state.

B. Trade and Market Size

There are several ways in which trade may affect long-run capital stocks (and hence transitional and long-run economic performance) in our analytical framework. The simplest approach is to assume a small country, with directly imported financial services setting a maximum price in the domestic market. Regulation and related trade barriers can be assumed to influence the import price, and hence the domestic price level, directly. From equation (3), we then have:

$$\frac{\partial k^*}{\partial \phi} = \frac{1}{-(1-a)aA}\left[\frac{\rho + \delta + \phi}{aA}\right]^{\frac{2-a}{-(1-a)}} < 0 \tag{8}$$

If cross-border services trade barriers are reduced, and this leads to a reduction in financial service prices domestically, we then expect *k** to rise as well.

Under the WTO, "trade" is actually defined as a mix of cross-border trade and local establishment (FDI) in the case of services.[5] We are therefore also interested in the case where foreign banks are allowed to enter the domestic market, where they then act like other banks in the local market. For simplicity, we assume they are subject to local cost conditions in the pure FDI case. This scenario effectively increases the size of *n*. Assuming that *n* is allowed to increase (which may require adjustment of any regulatory target for π set by the government), we then have the following effect related to entry of foreign banks from equation (6):

$$\frac{\partial k^*}{\partial n} = \left[\frac{n(\rho + \delta + c)}{(n - (1-a))aA} \right]^{\frac{1}{-(1-a)}} > 0 \qquad (9)$$

As in cross-border trade, local establishment can also be expected to have positive medium- and long-run effects related to the evolution of the capital stock.

What happens (as is often the case in developing countries) if the government sets a quantity limit for the foreign banking sector, leaving the rest of the domestic market to domestic firms? If we define $\overline{K}$ as the regulated size of the foreign banking sector, the demand elasticity for the domestic sector is directly related to the size of the foreign banking enclave:

$$\tilde{\varepsilon}^* = \varepsilon^* \frac{K^*}{K^* - \overline{K}} \qquad (10)$$

Note that $\overline{K}$ may be set under our trade or FDI scenario. In either case, working through the rest of the system as defined above, market power is weakened by an expansion of $\overline{K}$, implying lower prices and a higher value for *k**.

Next, consider market size. The reader can verify that, under constant returns (i.e. when *c*=0), the size of the market simply does not matter. However, with scale economies in the banking sector, size plays a pro-competitive role, leading to entry and an increase in the overall capital stock *k** in the steady-state. If we differentiate the system defined by equations (5), (6), and (7), we have the following:

$$\frac{\partial n^*}{\partial L}_{\delta,a,b,c,\pi,\rho} = \frac{c(n^* - (1-a))^2 n^*}{L^2[(1-a)b + (1-a)\rho + (1-a)\delta + (1-a)Lk^* + (n-(1-a))(n-(2-a))c]} > 0 \qquad (11)$$

$$\frac{\partial k^*}{\partial L}_{\delta,a,b,c,\pi,\rho} = \frac{ck^*(n-(1-a))}{L[(1-a)b + (1-a)\rho + (1-a)\delta + (1-a)Lk^* + (n-(1-a))(n-(2-a))c]} > 0 \qquad (12)$$

[5] See Hoekman (2000, 2006) for discussion of WTO-based mechanisms for services trade liberalization through a mix of FDI and cross-border trade.

As is the case with econometric industry studies, we can expect scale economies to imply a link between country size and service pricing across a sample. In the present context, this will also be manifested by an indirect linkage between country size, concentration, and k^*.

C. Transition Dynamics

The same mechanisms that link services trade in our model with long-run incomes also link financial sector openness with transitional or medium-term economic growth. Consider, for example, a constant returns world initially characterized by a closed banking sector and oligopoly pricing. Starting from the steady-state, prices are given by equation (7), and the steady-state levels of per-capita capital k^* and consumption c^* are then given by the two differential equation system:

$$\dot{k} = 0 = f(k) - (\delta)k - c \tag{13}$$

$$\dot{c} = 0 = -\Theta^{-1}[f'(k) - (\rho + \delta + \phi)] \tag{14}$$

where Θ is the coefficient of relative risk aversion, and $f(.)$ is the Cobb-Douglas production function defined in equation (1). From the $\dot{c}$ curve we can directly solve for the steady-state level of per-capita capital k^*, and obviously, if we introduce trade in services, such that the price ϕ is driven below its steady-state oligopoly value (recall the discussion of equation [8]), then we will have an increase in steady-state capital stocks. The resulting transition path will then be standard, involve rising consumption after an initial drop to seed the rise in the capital stock, and rising capital stocks k. In turn, the growth of the capital stock implies a process of medium-term transitional economic growth, as the new capital accumulated through equation [13], fed through equation [1] also then yields GDP growth.

III. EMPIRICS

Following our discussion in Section II above, we have a number of candidate relationships. First, banking sectors in smaller countries may be more concentrated due to economies of scale in the provision of financial services (equation 11). On top of that we want to test whether open financial systems tend to foster competition in the banking sector. More competition, i.e. less concentration in the banking sector, would then drive down market power as reflected in price. (equation 5). The final link in the chain is between market power and economic growth. As the financial sector becomes more efficient, we may expect to see higher rates of capital accumulation and a transition to a higher steady state capital stock per capita (equations 6, 8, 9, 13). In short, we are interested in indications of higher growth rates in the transition, all other things being equal, for countries with more open financial systems and comparable income levels.

We follow the approach of the recent empirical literature. This involves cross-country growth regressions, wherein we include a number of variables that seem to perform robustly in the literature.[6] To this mix of variables, we also add measures of financial sector openness and the degree of competition in the financial services sector. Our data are drawn from a number of sources, and provide a set of indicators for 130 countries for the decade spanning 1990-1999, including most of the transition economies. (These data are available from the authors upon request.) The variables we work with are summarized in Table 1. We are ultimately interested in economic growth, for which we take the average growth rate for per-capita income for the period 1990-99 from the IMF's World Economic Outlook dataset (*PCGDPGR*). Based on the literature, we also work with the standard deviation of inflation (*INFLATE*, also from WEO) over

this period as an indicator of macroeconomic stability, the degree of trade openness (*TRADE*, measured by the share of trade in GDP, taken from the World Bank's World Development Indicators), political stability, and a dummy for the transition economies. Our indicator of political stability (*POLSTAB*) is from a relatively new dataset provided by the World Bank, the Worldwide Governance Research Indicators. Initial per-capita GDP *(PCGDP90*) is taken from WDI and measured in 1995 US Dollars. It serves as an overall indicator of base period development. Population growth (*POPGR*, from WDI) is also the average for the 1990-99 period. Country size is measured by GDP, and scaled by world GDP (*SIZE*, from WDI). We also work with an indicator of financial stability (*FINCRIS*), which is from the IBCA Bankscope dataset and measures loan-loss provisions scaled by net interest revenue. Finding general cross-country measures of the degree of competition in banking is problematic at best. The measures we work with are rough: the share of domestic banking assets held by the three largest banks (effectively a proxy for concentration as developed in the previous section), an index of bank profitability, and a measure of bank markups (see *CONCENT*, *PROFIT*, and *NIM* in Table 1). The data are from the bankscope dataset, which, in spite of its widespread use, has been questioned because of potential underreporting of banks from developing countries. More specifically the concentration index is subject to controversy as it may be biased upward for countries where fewer small and domestic banks report. Cetorelli and Gambera [2001], however, have tested for an underreporting bias and found it to be insignificant. Regardless of this finding we introduce a correction by taking only the largest one hundred banks as a basis for the concentration index. By doing so we accommodate the assumption that in OECD countries a larger share of small banks reports compared to developing countries.

[6] The most recent literature has also explored estimation with small panel datasets, where each set of observations represents a decade in cross-section. Because many of our financial indicators only became available over the last

For financial sector openness we have three measures. One is a crude estimate of tariff-equivalents for financial services trade, based on GATS (General Agreement on Trade in Services) commitments within the WTO, labeled *TARREQ*. (For details see Hoekman 1995). A second is the Heritage Foundation's "Bank Freedom" index, that we call *BANKFREE*. It is a subindicator of the index of economic freedom. We use an average of the issues dating from 1995-1999. This is a reasonable approximation for the 1990s as each year's issue refers to a period starting a few years before its publication. Among other distortions it measures the extent to which foreign banks are allowed to operate in the domestic financial system. The third is the share of foreign banks in the domestic banking system measured by the number of foreign banks in the total number of banks for the 1990s (*FOREIGN*). This variable is also drawn from the Bankscope database. If foreign banks tend to be overrepresented for developing countries, this measure would be biased upward rather than downward. This would weaken instead of support our view so that a correction is not advisable in order to achieve conservative estimates.

Our approach is to estimate a simple simultaneous system of three equations.

$$CONCENT_{\mathrm{i}} = \mathbf{A}\mathbf{X}_{1,i} + \varepsilon_{1,i} \qquad (15.1)$$

$$NIM_{\mathrm{i}} \text{ (or } PROFIT_{\mathrm{i}}) = \mathbf{B}\mathbf{X}_{\mathbf{2},i} + \varepsilon_{2,i} \qquad (15.2)$$

$$PCGR_{\mathrm{i}} = \mathbf{C}\mathbf{X}_{3,i} + \varepsilon_{3,i} \qquad (15.3)$$

Because we are interested in the linkages between growth, competition, and openness, a system estimation approach makes sense. We then have a number of estimation options available. We offer two full sets of estimates in Tables 2, 3, and 4. We make some comparison with alternative approaches in Table 5.

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ten years, this is not possible in the present context but may be in future work.

The first set of estimates provided in Tables 2, 3, and 4 are OLS estimates. These take no account of the transmission of errors across equations. The second set, indicated as partial sample overlap least squares (PSOLS) estimates, does adjust for this issue. Our PSOLS estimates involve an approach that strips out the error component associated with endogenous right-hand variables from our estimates, as discussed below.

Given the uneven coverage for some of our indicators (especially when we work with tariff-equivalent data), if we only worked with countries that could be included in all three equations, we exclude a substantial share of the information available from the full dataset. In addition, our measures of bank markups are themselves rough, and we expect them to be prone to error as well (as implied by the structure of equation 15.2, where *CONCENT* appears on the right hand side, and equation 15.3, where *NIM* or *PROFIT* appears on the right hand side). This means we will have some correlation between right hand side variables and error terms, with transmission of error terms across equations. To handle the issue of a non-square dataset while still filtering the transmission of error terms, we employ an estimating strategy similar to iterative staged estimation methods, though we actually solve the system explicitly as a simultaneous least squares problem. Basically, where possible we substitute right hand side endogenous variables with model estimates (or more formally the estimated means conditional on exogenous variables within the system) to then obtain least squares estimates for the entire system (our PSOLS estimates in the tables). This substitution is done simultaneously across equations, with the full system solved at once. Like comparable instrument variable methods, this allows us to effectively sweep error terms transmitted from right hand side variables out of the regression equations above. At the same time, we salvage information in observations dropped under some other approaches because this approach allows the inclusion of observations

(countries) in any one equation, though they may not appear in all. Note that without the replacement of right-hand side endogenous variables by system estimates, this approach simply collapses to the ordinary least squares estimates also reported in the Tables.

Formally, to obtain our parameter estimates, the entire system defined by equations (15) is estimated simultaneously as a constrained minimization problem for the sum of the system squared errors in GAMS (a non-linear programming language used for large-scale numerical problems). [7] The constrained minimization problem is

$$\min \sum_{j=1}^{n} \sum_{i=1}^{3} \varepsilon_{i,j}^{2} \qquad s.t.\ 15.1,\ 15.2,\ 15.3 \tag{16}$$

It is because we solve the system (including right hand side substitutions) simultaneously, while mixing estimates based on (potentially) different though largely overlapping sets of observation units (countries), that we refer to these as partial sample overlap least squares or PSOLS-based estimators.

We are first interested in the relationship between financial sector openness and our competition index. These estimates (equation 15.1) are presented in Table 2. In equation 15.1, $\mathbf{X}_1$ includes *SIZE* and one of the openness indicators. *SIZE* is included because (see Section II) larger markets imply more scope for competition when scale economies are present. *TARREQ*, *BANKFREE*, and *FOREIGN* are included as our measures of financial sector openness. The *SIZE* variable emerges as consistently significant at the .01 level. Smaller economies are highly correlated with a greater degree of concentration. Critical to the present exercise, our financial sector openness variables, *TARREQ*, *BANKFREE*, and *FOREIGN*, all emerge with coefficients

[7] GAMS code is available from the authors upon request. Solutions to the problem of system estimation under such conditions can be traced to Theil (1953). SUR estimates in Table 5 have been produced with STATA.

that are significant at the .01 level as well. We will examine the policy "significance" of these coefficients, in terms of the size of this effect, after we look at growth.

Consider next the link between our competition index and financial pricing (measured by *NIM* and *PROFIT*). These are included in $\mathbf{X}_2$ above, and are reported in Table 3. They emerge, under all specifications, with significance at the .01 level. Our parameter for financial crisis is less robust, typically being generally significant at between the .01 and .15 level.

Growth results are reported in Table 4. Generally, the standard cross-country growth variables emerge with significant coefficients in the .01 to .05 range. Our measures of financial sector performance, *NIM* and *PROFIT*, all emerge with significant coefficients at the .010 level in both the OLS and PSOLS estimates. The estimated qualitative effect is highly robust to the model specification chosen (in terms of openness indicator). We do identify a stronger effect with the PSOLS estimates than is suggested by the OLS estimates, though in all cases this is significant under both approaches.

For further comparison, Table 5 takes the first system of equations, and reports results for SUR system estimates (from STATA). Because standard SUR and staged estimation procedures require a square dataset (i.e. observations appear in all 3 equations), these estimates mean we lose observations in all equations, and end up with 114 observations across all three equations. In Table 5, these are compared to OLS estimates for the same 114 observations, and PSOLS estimates for the same 114 observations. We then also report OLS and PSOLS estimates for the full sample. Comparable results follow for the SUR and PSOLS estimates, while both differ in a similar manner from the reported OLS estimates.

From the results for equations 15, we have identified the following pattern in the data. Open financial sectors appear to be more competitive, leading ultimately to lower financial

service prices and profits. Those regimes featuring more competitive financial sectors are in turn strongly linked with higher growth rates. Note also that this effect comes in addition to the effect of other financial variables, as is highlighted in the established literature. The coefficients of the standard growth regression variables including the dummy for transition economies all have the expected signs and generally emerge at high significance levels as well.

Finally we are interested in how strong the identified effects are. Within our sample, protection in the financial services sector (or identically closed financial sectors) is concentrated in the lower income countries. This is illustrated in Figures 2 and 3. The OECD countries in the sample tend to have the most open financial service sectors, so that the question of gains from liberalization can also be viewed as one particularly relevant for developing countries. Figures 1 and 2 present a picture of differences in financial openness mapping to differences in growth. However, many of these differences also follow from other factors (hence the need for an approach like the regressions above). Consider our estimates for the *BANKFREE* and *TAREQ* openness indicators. Working from these estimates, and holding all else constant, we can characterize what happens in our sample when a "typical" lower income country moves from the openness level characterizing the average lower income regime to the more liberal openness level characterizing the average higher income regime (i.e. a roughly 50% liberalization of financial services trade by these measures). Based on the coefficients in Tables 2-4, this is associated with an increased degree of competition in the financial services sector and in turn with growth rates that are then higher (in the range of 0.4 percent to 0.6 percent per year on a per capita basis). This is in line with other recent estimates of financial development and growth linkages, though the mechanism is different, being grounded in market structure and competition.

IV. SUMMARY

Recent empirical studies have applied both endogenous and bounded growth frameworks to assess the effect of financial service sector development on growth rates and per-capita income levels. In general, the approach involves employing financial sector development indicators as independent variables in growth regressions. Most of this literature has looked at indicators of banking sector development and the degree of private sector involvement in financial services and the allocation of savings, and at distortion and financial service cost measures. In addition, a few studies have examined the relationship between stock-market development and growth.

Along these lines, this paper examines the pro-competitive effects of trade in financial services. We highlight the role of financial services at the nexus of the savings and accumulation mechanism that drives economic growth. Following a brief review of the literature, we develop an analytical model in Section II characterized by Ramsey accumulation and an oligopolistic financial services sector. This model is used to highlight channels through which financial services trade may lead to dynamic, pro-competitive effects. This analytical exercise helps motivate the econometric exercise in Section III. In cross-country regressions on data for 130 countries in the 1990s, we find that there is a strong positive relationship between financial sector competition and financial sector openness, and between growth and financial sector competition.

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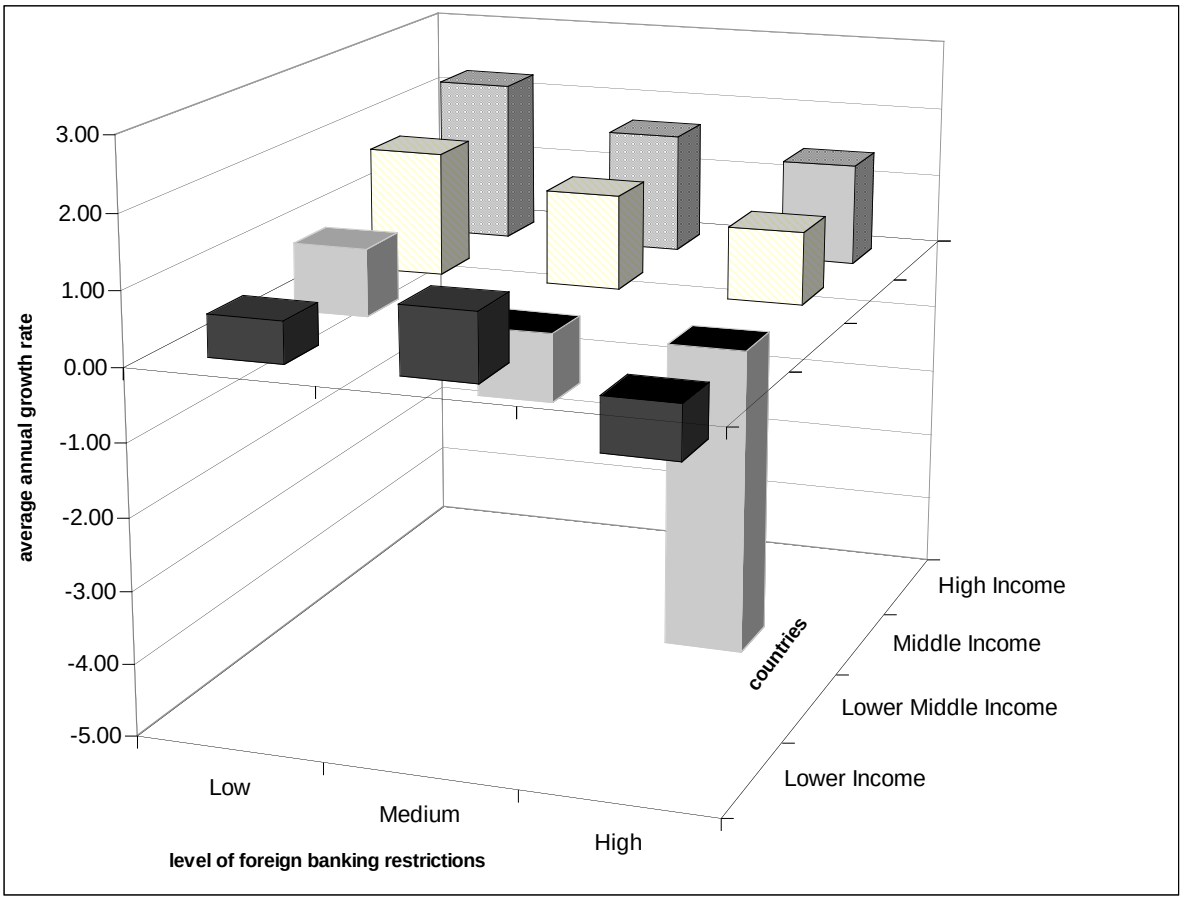
Figure 1

Foreign Banking Restrictions and Growth in the 1990s

(Bank Freedom Index as a Proxy for Restrictions on Foreign Banks)

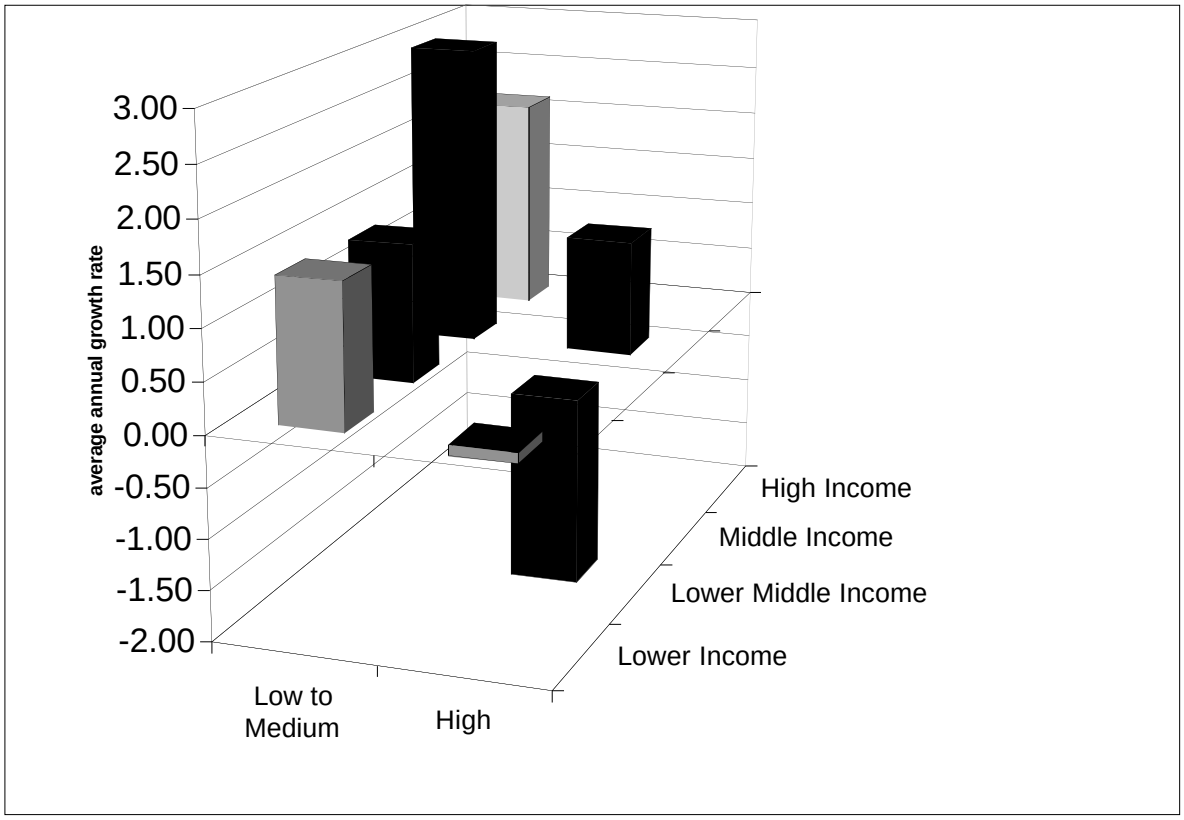


note: Growth rates are per-capita, while banking sector openness is based on the banking freedom index.
High income countries (24 in total) have 1990 GDP per capita above US $10,000 ; medium income countries (32 total) have incomes above US $2,500, lower middle income countries have incomes above US $1,000 per capita (27 in total) and lower income countries constitute the remainer (43 countries).
Low bank restrictions have an index value of 1 to 2.33, medium ranges from 2.4 to 3.66, and high ranges from 3.7 to 5. The sample of high income countries with high banking restrictions includes only Greece.

Figure 2

Foreign Banking Restrictions and Growth in the 1990s

(Tarrif Equivalents as a Proxy for Restrictions on Foreign Banks)



High income countries (23 in total) have 1990 GDP per capita above US $10,000 ; medium income countries (32 total) have incomes above US $2,500, lower middle income countries have incomes above US $1,000 per capita (27 in total) and lower income countries constitute the remainer (43 countries).
Low to medium bank restrictions have a tariff equivalent index below 35. High ranges from 35 to 50.
The OECD countries with an index below 20 include Sweden, the United States, Canada, Switzerland, Austria, Australia, New Zealand, and Finland.

Table 1: Overview of dataset

Variable	Description	Source
1. A Macroeconomie indicators		
FINCRIS	Financial crisis indicator (based on economy-wide loan loss provisions over net interest revenue	IBCA Bankscope
INFLATE	The standard deviation of the inflation rate over the 1990-99 period.	IMF WEO
PCGDP90	Per-capita GDP in 1990.	World Bank WDI
PCGDPGR	The average of per-capita growth over the 1990-99 period.	IMF WEO
POLSTAB	Political stability indicator from –2.5 to 2.5 (-2.5=most unstable, 2.5=most stable).	World Bank Worldwide Governance Research Indicators
POPGR	Average rate of population growth over the 1990-99 period.	World Bank WDI
SIZE	Total value of GDP, averaged over 1990-99, and scaled by total value of world GDP.	World Bank WDI
TRADE	Exports and imports as a share of GDP, averaged over the 1990-99 period.	World Bank WDI
TRANSEC	Transition economy (1=yes, 0=no).	26 countries
1. B Financial sector indicators		
BANKFREE	Openness of banking sector in terms of restrictions on ability of foreign banks to open branches and subsidiaries, barriers to domestic bank formation, government influence over credit allocation, government ownership of banks, government regulations like deposit insurance, and restrictions on providing all kinds of financial services from 1 to 5 (1= very low restrictions, 5=very high restrictions).	Heritage Foundation
CONCENT	Concentration in the financial sector: the assets of the largest three banks as a share of total assets in percent (corrected for income by using only largest 100 banks' assets), averaged over 1990-99 period.	IBCA Bankscope
FOREIGN	The share of the banking sector accounted for by foreign banks.	IBCA Bankscope
NIM	Net interest income over total banking assets in percent, averaged over 1990-99 period.	IBCA Bankscope
PROFIT	Commercial banks' gross operating profits over total assets in percent, averaged over 1990-99 period.	IBCA Bankscope
TARREQ	Estimated tariff equivalent of trade protection of the domestic banking and financial services sector in percent as derived from WTO Members' GATS commitments in financial services (excluding insurance); ranges from 0 (free) to 50 (most protectionist). Extended from the original set reported by Hoekman (1995) to include transition economies.	Hoekman 1995, see references

Table 2. Concentration and financial openness: Dependent variable CONCENT

Market Power Equations	OLS/ PSOLS	OLS/ PSOLS	OLS/ PSOLS
system	(1), (4)	(2), (5)	(3), (6)
SIZE	-2.71	-3.28	-1.46
	-(4.63)***	-(4.96)***	-(2.92)***
TARREQ			0.69
			(3.53)***
FOREIGN		-1.20	
		-(3.87)***	
BANKFREE	14.51		
	(8.23)***		
TRANSEC	8.94	12.00	16.57
	(2.12)**	(2.50)***	(3.07)***
OBS	128	121	77
R-squared	0.483	0.308	0.604

Systems (1) – (3) dependent variable NIM, systems (4) – (6) dependent variable PROFIT

*** denotes significance at the .01 level for a two-tailed test, ** denotes significance at the .05 level, and * denotes significance at the .10 level.

Table 3. Intermediation costs and concentration: Dependent variables NIM and PROFIT

	OLS	PSOLS			OLS	PSOLS		
system	(1),(2),(3)	(1)	(2)	(3)	(4),(5),(6)	(4)	(5)	(6)
CONCENT	0.04	0.06	0.05	0.04	0.02	0.03	0.03	0.02
	(3.19)***	(5.47)***	(4.06)***	(3.21)***	(3.60)***	(4.65)***	(5.27)***	(3.70)***
FINCRISIS	-0.02	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01	-0.01
	-(2.41)***	-(1.97)**	-(1.58)	-(1.54)	-(3.57)***	-(1.55)	-(1.61)	-(1.10)
TRANSEC	2.95	2.53	2.64	2.73	1.75	1.47	1.39	1.47
	(3.98)***	(3.32)***	(3.54)***	(3.67)***	(4.78)***	(3.91)***	(3.67)***	(3.92)***
OBS	123	123	123	123	120	120	120	120
R-squared	0.223	0.236	0.18	0.191	0.293	0.22	0.225	0.221

Systems (1) – (3) dependent variable NIM, systems (4) – (6) dependent variable PROFIT.

*** denotes significance at the .01 level for a two-tailed test, ** denotes significance at the .05 level, and * denotes significance at the .10 level.

Table 4. Per-capita GDP growth and market-power: Dependent variable PCGDPGR

	OLS	PSOLS			OLS	PSOLS		
system	(1),(2),(3)	(1)	(2)	(3)	(4),(5),(6)	(4)	(5)	(6)
PCGDP90	-9.62E-05	-1.05E-04	-1.04E-04	-1.03E-04	-9.17E-05	-1.07E-04	-1.07E-04	-1.07E-04
	-(3.11)***	-(3.16)***	-(2.93)***	-(2.75)***	-(2.97)***	-(3.09)***	-(3.19)***	-(2.79)***
POPGR	-0.64	-0.42	-0.42	-0.44	-0.42	-0.31	-0.31	-0.31
	-(2.58)***	-(1.59)	-(1.50)	-(1.47)	-(1.63)	-(1.09)	-(1.11)	-(0.97)
TRADE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(1.54)	(2.26)**	(2.10)**	(1.96)**	(1.89)*	(2.19)**	(2.27)**	(1.99)**
INFLATE	-7.16E-04	-8.34E-04	-8.33E-04	-8.32E-04	-1.00E-03	-9.41E-04	-9.42E-04	-9.43E-04
	-(2.47)***	-(2.69)***	-(2.51)**	-(2.38)**	-(4.20)***	-(3.04)***	-(3.13)***	-(2.74)***
NIM	-0.20	-0.47	-0.62	-0.71				
	-(2.12)**	-(4.61)***	-(5.72)***	-(6.22)***				
PROFIT					-0.428	-1.078	-0.97	-1.4
					-(3.16)***	-(7.10)***	-(6.58)***	-(8.31)***
POLSTAB	1.25	1.24	1.24	1.27	1.37	1.34	1.33	1.33
	(3.62)***	(3.34)***	(3.14)***	(3.04)***	(3.93)***	(3.42)***	(3.50)***	(3.06)***
TRANSEC	-4.51	-3.19	-2.76	-2.54	-4.10	-2.93	-3.14	-2.42
	-(6.06)***	-(4.00)***	-(3.22)***	-(2.82)***	-(5.13)***	-(3.27)***	-(3.62)***	-(2.44)**
OBS	115	115	115	115	112	112	112	112
R-squared	0.525	0.544	0.543	0.539	0.563	0.553	0.554	0.554

Systems (1)–(3) dependent variable NIM, systems (4)–(6) dependent variable PROFIT.

*** denotes significance at the .01 level for a two-tailed test, ** denotes significance at the .05 level, and * denotes significance at the .10 level.

Table 5. Comparison of OLS, SUR, and PSOLS, system (1).

EQUATIONS	restricted sample			unrestricted sample	
	OLS	SUR	PSOLS	OLS	PSOLS
Growth					
PCGDP90	-1.01E-04	-1.11E-04	-1.06E-04	-9.62E-05	-1.05E-04
	-(3.29)***	-(3.89)***	-(3.10)***	-(3.11)***	-(3.16)***
POPGR	-0.66	-0.49	-0.43	-0.64	-0.42
	-(2.68)***	-(2.15)**	-(1.58)	-(2.58)***	-(1.59)
TRADE	0.01	0.01	0.01	0.01	0.01
	(1.47)	(2.24)**	(2.19)**	(1.54)	(2.26)**
INFLATE	-6.68E-04	-6.35E-04	-8.34E-04	-7.16E-04	-8.34E-04
	-(2.32)**	-(2.37)**	-(2.60)***	-(2.47)**	-(2.69)***
NIM	-0.25	-0.55	-0.61	-0.20	-0.47
	-(2.52)**	-(6.00)***	-(5.56)***	-(2.12)**	-(4.61)***
POLSTAB	1.26	1.13	1.26	1.25	1.24
	(3.67)***	(3.54)***	(3.30)***	(3.62)***	(3.34)***
TRANSEC	-4.65	-3.87	-3.63	-4.51	-3.19
	-(6.26)***	-(5.35)***	-(4.39)***	-(6.06)***	-(4.00)***
Pricing					
CONCENT	0.03	0.05	0.05	0.04	0.06
	(2.90)***	(5.57)***	(5.07)***	(3.19)***	(5.47)***
FINCRISIS	-0.02	-0.02	-0.01	-0.02	-0.02
	-(2.71)***	-(2.29)**	-(1.89)*	-(2.41)**	-(1.97)**
TRANSEC	1.88	1.46	1.44	2.95	-2.53
	(3.10)***	(2.40)**	(2.31)**	(3.98)***	(3.32)***
Market Power					
SIZE	-2.47	-2.38	-2.49	-2.71	-2.71
	-(4.09)	-(4.12)	-(4.08)***	-(4.63)***	-(4.63)***
BANKFREE	13.81	13.44	13.81	14.51	14.51
	(6.62)***	(6.78)***	(6.62)***	(8.23)***	(8.23)***
TRANSEC	10.72	10.87	10.72	8.94	8.94
	(2.31)**	(2.39)**	(2.31)**	(2.12)**	(2.12)**
OBS: PCGR	114	114	114	115	115
OBS: NIM	114	114	114	123	123
OBS: CONCENT	114	114	114	128	128
R-squared: PCGR	0.536	0.480	0.536	0.525	0.544
R-squared: NIM	0.194	0.150	0.184	0.223	0.236
R-squared: CONCENT	0.421	0.421	0.421	0.483	0.483

*** denotes significance at the .01 level for a two-tailed test, ** denotes significance at the .05 level, and * denotes significance at the .10 level.