FEDERAL RESERVE BANK OF ST. LOUIS

REVIEW

JULY/AUGUST 2003 | VOLUME 85, NUMBER 4

Finance and Real Economic Activity

Proceedings of the Twenty-Seventh Annual Economic Policy Conference of the Federal Reserve Bank of St. Louis

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Editor's Introduction

R. Alton Gilbert

The Twenty-Seventh Economic Policy Conference, held November 7 and 8, 2002, focused on research that examines the influence of financial markets and institutions on real economic activity. While some economists trace this literature back to Schumpeter (1949, first published in 1912), Gurley and Shaw (1955), and Goldsmith (1969), published research on this topic has grown rapidly in recent years. This conference volume is designed to examine various facets of this literature through six articles by authors who have published their research on finance and real economic activity, as well as through the comments of their discussants.

THEORETICAL FOUNDATION

Most of the recent research on the influence of finance on real economic activity is empirical. Major challenges for contributors to this empirical literature include measuring the development of financial systems and devising statistical tests that imply causality running from the development of financial systems to real economic activity, rather than the development of financial systems in response to growth in real economic activity. Another strand of the literature on finance and real economic activity, however, examines the theoretical foundation for an influence of financial markets and institutions on real economic activity. Bruce Smith was a major contributor to this theoretical literature. In fall 2001, Bruce agreed to write a theoretical paper for the conference, jointly with his wife and co-author, Valerie Bencivenga. Bruce died in the summer of 2002, but Valerie presented the paper at the conference and edited the paper for this conference volume.

Theirs is the first article in this conference volume. In the article, they develop a theoretical model in which monetary policy affects the incentives of individuals to use banking services. In their model, the use of banking services influences economic growth. Their results suggest that monetary policy can exert an important influence on both the development of national financial systems and real economic development.

Franklin Allen, as discussant of the Smith-Bencivenga article, raises a series of questions about the influence of monetary policy on the development of financial systems and economic growth under alternative assumptions about their theoretical model. In addition, Allen asks for empirical evidence that monetary policy influences the development of financial systems. He notes that they cite the rapid development of financial systems in various South American nations in the 1980s and 1990s after these nations achieved substantial reductions in inflation rates. Allen asks whether there is evidence to separate the influence of transactions costs on the development of financial systems from the influence of monetary policy.

DEVELOPMENT OF FINANCIAL SYSTEMS AND ECONOMIC GROWTH

Ross Levine surveys the empirical literature on the development of national financial systems and economic growth. He focuses on studies that use three methods: first, cross-country regressions in which the dependent variable is a measure of long-run economic growth in each nation in the study and the independent variables include a measure of the development of the financial system in each nation; second, panel studies that combine cross-section and time-series data on measures of development in financial systems and measures of economic growth; and third, micro studies of the association between access to funds and growth at the industry or firm level. Levine notes that these studies lead to three conclusions:

1. Countries with better-developed financial systems tend to grow faster.
2. This association does not appear to reflect simultaneity between finance and growth.

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3. Better-functioning financial systems ease the external financing constraint that impedes expansion at the firm or industry level.

Levine also concludes that the empirical research on the development of financial systems and growth is developing a wide array of evidence about the laws, regulations, and policies that promote the development of national financial systems and economic growth.

In his comment on Levine, Luigi Zingales acknowledges that in recent years there has been a great deal of effort devoted to understanding the influence of financial system development on economic growth. He chooses to focus on reasons why it continues to be difficult to draw policy conclusions from this literature. He identifies six weak links in the development of this literature for purposes of making recommendations to government policymakers:

1. Measures of development of national financial systems are highly correlated with measures of good government institutions, including facets such as enforcement of property rights. It is difficult to determine which aspects of government institutions or development of financial systems are singularly important as determinants of economic growth. Possibilities of omitted variables in other studies raise questions about the use of the studies for policy recommendations.
2. A good measure of financial development would reflect the ease with which entrepreneurs can gain access to funds to finance sound projects. The measures of development of financial systems are not designed to reflect this aspect of the performance of financial systems.
3. For purposes of establishing policies to promote growth, it is important to understand the channels through which financial development influences growth.
4. With national financial markets increasingly integrated with the financial markets of other nations, why is the development of domestic financial institutions important?
5. The literature focuses primarily on aggregate economic growth. There are other features of economic activity that are of interest when we consider the effects of the development of financial systems, including the degree of competition among firms in the economy, social mobility, and the distribution of income among households.
6. The literature gives limited guidance on the nature of government policies that promote the development of financial systems.

DATING THE LIBERALIZATION OF EQUITY MARKETS IN EMERGING-MARKET ECONOMIES

One approach to estimating the effects of financial market development on real economic activity is to estimate the effects of important changes in the regulation of national financial institutions. The authors of the third article in the conference volume, Geert Bekaert, Campbell R. Harvey, and Christian T. Lundblad, make the case that equity market liberalizations are important changes in national financial regulation. Equity market liberalizations give foreign investors the opportunity to invest in domestic equity securities and give domestic investors the right to transact in foreign equity securities. To estimate the effects of equity market liberalizations on real economic activity, it is necessary to identify the appropriate dates of the liberalizations. This article presents some of the work of the authors in an ongoing research agenda on the real economic impacts of equity market liberalizations. In many emerging-market nations, equity market liberalizations have occurred in various stages. The primary contribution of the authors to this conference volume involves an analysis of the nature of market liberalizations on various dates for a large number of emerging-market nations. The authors also present some of their empirical results that indicate positive effects of equity market liberalizations on economic growth in emerging-market nations.

Peter Blair Henry, the discussant of the Bekaert, Harvey, and Lundblad article, has been an active contributor to the literature on the effects of equity market liberalizations in emerging-market nations. His comments focus on the magnitude of the estimated effect of equity market liberalizations on economic growth in the article. Their evidence indicates that the decline in the cost of capital that results from equity market liberalization is large enough to increase the growth rate of gross domestic product per capita by 1 percentage point per annum. Henry concludes, on the basis of growth theory, that given the estimates of the effects of liberalization on the cost of capital in the emerging-market economies,

the estimated effects of liberalizations on economic growth are too large. Henry concludes that equity market liberalizations in emerging-market nations tend to occur around the same time as other policy changes that raise total factor productivity. His comments imply that to some extent the changes in national economic growth that Bekaert, Harvey, and Lundblad attribute to equity market liberalizations actually reflect additional reforms in the emerging-market nations that tended to occur around the time of the equity market liberalizations.

LESSONS FROM ECONOMIC HISTORY

Peter Rousseau finds that, while economic historians and macroeconomists have studied the influence of finance on economic growth, their assumptions and methods have been different. Studies of the history of economic development in individual countries have convinced economic historians that the development of financial systems has tended to lead to faster economic growth. Economic historians tend to ask questions about the *means* through which the development of financial systems promoted faster growth and the *magnitude* of the effect. Macroeconomists, in contrast, tend to ask *whether* the development of financial systems promoted faster economic growth, using cross-country and time-series regressions designed to test the hypothesis that finance *causes* growth.

Rousseau attempts to narrow this gap between the assumptions and methods of economic historians and macroeconomists by applying the statistical methods used by macroeconomists to historical data on finance and growth for several nations. He finds evidence that is consistent with the hypothesis that the development of national financial systems led to faster economic growth.

In discussing Rousseau's article, Eugene White raises questions about bias and missing variables. This issue of bias involves the choice of countries for the econometric analysis. White maintains that Rousseau has selected some of the success stories. The relationship between finance and growth might be substantially different for other nations during periods in which they did not achieve rapid economic development.

The issue of missing variables involves the idea that national financial systems tended to develop rapidly during periods in which other types of changes in national economies made the conditions for faster economic growth more likely. White emphasizes this point in comments on the changes in England that facilitated the Industrial Revolution. This comment by White is similar to the comment by Henry on the article by Bekaert, Harvey, and Lundblad: Major changes in national financial systems tend occur around the same time as other changes in government policy that have the potential to affect total factor productivity and, therefore, the pace of economic growth. The challenge for estimating the effects of finance on growth includes isolating the partial effect of changes in national financial systems, holding constant other determinants of growth.

BANKING STRUCTURE AND REAL ECONOMIC ACTIVITY

In his discussion of the Levine article, Zingales emphasizes the value of evidence about the effects of finance on growth derived from "natural experiments." He cites research by Jayaratne and Strahan (1996) as an example of analysis based on natural experiments, which involved the lifting of restrictions on bank branching by U.S. states at various points in time.

In the fifth article in the conference volume, Philip Strahan summarizes the results of his research agenda on quantifying the real economic impacts of a major change in banking regulation in the United States: relaxation of restrictions at the state level on bank branching. States lifted restrictions on branching at various points in time beginning in the early 1980s. The fact that these changes occurred at different points in time makes it possible for Strahan to estimate the effects of eliminating branching restrictions on measures of real economic activity at the state level using pooled time-series, cross-section analysis.

Strahan finds that the rate of state economic growth increased after states lifted their restrictions on branch banking. He finds that these effects of deregulation are especially pronounced for entrepreneurial activity. In addition, the variability of state income declined after states lifted restrictions on interstate banking. Strahan interprets these results as evidence that interstate banking tended to reduce the sensitivity of state income to shocks to the capital of banks headquartered in the individual states.

David Wheelock, discussant of Strahan's article, uses his background as an economic historian to relate the analysis of Strahan to analysis of the effects of bank branching restrictions on economic

activity during periods prior to the sample period of Strahan's analysis. Wheelock also considers factors that might account for the large estimated impact of branching restrictions on state economic growth in Strahan's analysis. His empirical results indicate that removing restrictions on statewide branching increased the average growth rate of state real per capita income by 33 percent, and this effect on growth persisted for five years after deregulation. Wheelock notes a regional pattern in state branching deregulation. One possible explanation for the pattern of the timing of banking deregulation and economic growth is that states tended to lift restrictions on branch banking when the growth in state per capita income was below trend. The increase in economic growth after banking deregulation might reflect a return of state per capita growth to trend after deregulation. In the version of the article published in this conference volume, Strahan says that he adjusted for such influences, and his results remain unchanged.

In the sixth article of this conference volume, Nicola Cetorelli examines the influence of banking competition on the growth of employment in industrial firms in the start-up phase and in more mature firms. His work is based on the framework of Petersen and Rajan (1995). While he characterizes the article in this conference volume as exploratory, Cetorelli is able to draw some tentative conclusions from the empirical results. Greater banking competition appears to promote job creation among industrial firms at the start-up stage and permit these start-up firms to prosper in the immediate wake of their entry. Greater competition among banks, however, accelerates the exit of the more mature industrial firms. This finding involving the rate of exit of mature firms is consistent with the theory that bank market power can create a financial barrier to entry in product markets.

In his remarks as discussant of the Cetorelli article, Raghuram Rajan discusses the challenges that researchers face in measuring the effects of banking competition on entry into nonfinancial industries, and he surveys the literature on methods of dealing with these challenges. Rajan describes Cetorelli's approach as promising.

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Monetary Policy and Financial Market Evolution

Valerie R. Bencivenga and Bruce D. Smith†

I. INTRODUCTION

In the 1950s and 1960s, Gurley and Shaw (1955, 1960, 1967) advanced a particular view of the joint evolution of per capita income and the financial system. They observed that at low levels of development, most investment is self-financed. As per capita income rises, bilateral borrowing and lending becomes more important. With further increases in per capita income, banks and similar financial intermediaries become prominent in financing investment. Eventually, more sophisticated financial markets, such as equity markets, arise. In the Gurley and Shaw view, rising per capita income and increasing financial depth reinforce each other. Therefore, a model of the joint evolution of per capita income and the banking system must allow usage of banks to be endogenous, and the level of per capita income and usage of banks must be determined simultaneously.

Many poor countries have relatively poorly developed financial systems. Why might this be the case? One possibility is that at low levels of development, the costs of financial intermediation are too high relative to the benefits. There is ample evidence that costs of accessing the banking system are high in developing countries.[1] In developing countries, penetration of the formal banking system into rural areas is limited; the high costs to the rural poor of accessing banks, such as the costs of traveling to a town with a bank branch and foregone income, are frequently cited as a reason for low utilization rates of banks. Even in the United States, about 13 percent of families do not have a checking account, and when asked why not, about half cited high service charges or other reasons related to the costs of banking.[2]

However, another possibility is that monetary policy also influences the choice between self-financed and intermediated investment. Many developing countries have relatively high nominal interest rates and relatively low measures of financial depth, as measured, for example, by the ratio of M2 to gross domestic product (GDP).[3] Because the nominal interest rate represents the opportunity cost of holding currency, the relatively low rates at which banks are used in many developing countries with high nominal interest rates may seem puzzling. But banks also hold reserves of currency to provide liquidity to their depositors, and the rates of return banks offer to their depositors—the degree to which banks insure against depositors' liquidity needs—are influenced by the nominal interest rate. Therefore, a model of the joint evolution of per capita income and the banking system must also allow monetary policy to affect the benefits of financial intermediation—rates of return on deposits and to what degree banks insure depositors against the need for liquidity.

This paper considers a model in which both of these factors—the resource cost of saving through intermediaries and monetary policy, specifically the money growth rate—are important determinants of (i) whether banks are used and (ii) the level of per capita income. Our model incorporates a fixed resource cost of intermediation, similar to that in Bencivenga and Smith (1998). It also incorporates a role for monetary policy, by creating a role for government-supplied fiat money.

We consider an overlapping-generations model of capital accumulation with currency as a second primary asset. Young agents can save their wage income as currency or by investing in capital formation; or young agents can deposit their saving in banks, which hold the primary assets (currency and capital investment) on behalf of their depositors. The model generates a transactions demand for

[1] See, for example, Gine (2001), who estimates the magnitude of transactions costs of accessing banks in rural Thailand.

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[2] Kennickell, Starr-McCluer, and Surette (2000).

[3] For example, see Levine (1996).

currency by subjecting each agent to a random shock whose realization determines whether or not the agent will be relocated across spatially separated locations. In the event of relocation, an agent needs currency to purchase consumption after relocation. Also, any investment in capital formation undertaken directly by a young agent who subsequently is relocated is lost (both to the investor and socially).

Banks insure their depositors against the risk of an adverse realization of the relocation shock, by holding currency to pay a return to depositors who end up being relocated. Also, since no capital investment undertaken by banks is ever lost, a depositor's expected return (per unit deposited) is higher than the expected return of a young agent who holds the primary assets directly. However, in this model, it is costly for agents to utilize banks; specifically, agents incur a fixed resource cost when they deposit their saving in a bank. This implies that the returns on bank deposits must be sufficiently high relative to the return on currency, and the insurance that banks provide against the need for liquidity arising from the risk of relocation must be sufficiently good, for agents to be induced to utilize banks. Agents may find it optimal to bear the fixed costs of financial intermediation, or they may find it optimal to avoid these costs by holding the primary assets directly.

In this model, the money growth rate plays an important role in agents' decisions about whether to utilize banks. The nominal interest rate represents the opportunity cost of holding currency, and for this reason, the degree of insurance optimally provided by banks against the need for liquidity falls as the nominal interest rate rises. The model simultaneously determines the capital-labor ratio, the real interest rate, per capita income, and the nominal interest rate, as well as whether or not banks will be used, as a function of the money growth rate.

The main results we obtain about the utilization of banks, and the impact of monetary policy on the utilization of banks, are as follows. Agents do not use banks—they self-insure against the risk of relocation by holding currency directly and self-finance capital formation—for low values of the nominal interest rate or (possibly, depending on parameter values) for high values of the nominal interest rate. At low nominal interest rates, capital is not much better an asset than currency; the costs of holding currency to self-insure against the risk of relocation and of losing capital in the event of relocation are relatively low, so agents avoid the fixed costs of saving through banks. Higher money growth rates shrink the range of low nominal interest rates for which autarkic saving is optimal, but do not eliminate it. Agents may also reject the use of banks (depending on parameter values) at high nominal interest rates. The higher the nominal interest rate, the less insurance banks offer against the risk of an adverse realization of the relocation shock. For sufficiently high nominal interest rates, the value of the insurance offered by banks is less than the value of the resource cost of using banks. Higher money growth rates exacerbate this effect, in that they expand the range of high nominal interest rates for which autarkic saving is optimal. Thus, a high inflation rate can deter development of a banking system.

The remainder of the paper proceeds as follows. Sections II and III lay out the environment and trade in factor markets. Sections IV through VII derive the optimal saving behavior of agents who save autarkically, and analyze the steady-state equilibrium and stability properties of this equilibrium. In these sections it is assumed that agents do not have access to a banking system. Sections VIII through XII assume that agents incur the transactions costs associated with access to the banking system and that all saving is intermediated. The optimal behavior of banks and the laws of motion of the capital stock and nominal interest rate are derived. Existence and stability of steady-state equilibrium (or equilibria) are analyzed. The comparative static effects of an increase in the money growth rate are also analyzed. Finally, Section XIII asks when agents will find it optimal to save autarkically as opposed to utilizing banks and discusses the impact of a change in the money growth rate on that decision. Section XIV concludes.

II. THE ENVIRONMENT

We consider a discrete time model, with time indexed by $t = 1,2,\ldots$ The economy consists of an infinite sequence of two-period-lived, overlapping generations. We ignore the initial old generation. The model features two locations, or islands, across which agents are distributed. At each date a continuum of ex ante identical young agents with unit mass is born in each location. Our assumptions will guarantee that the locations are always symmetric, and the description that follows applies to each location.

In each location in each period a single final good is produced, using capital and labor as inputs

into a constant return to scale technology. Letting K_t be the aggregate time t capital stock and letting L_t be aggregate time t employment, output of the final good is $F(K_t,L_t)$. Defining $k_t \equiv K_t/L_t$ to be the time t capital-labor ratio, let $f(k_t) \equiv F(K_t/L_t,1)$ denote the intensive production function. For simplicity, we assume that the production function has the Cobb-Douglas form $f(k) = Ak^{\alpha}$, with $\alpha \in (0,1)$. In addition, we assume that capital depreciates 100 percent in the production process.

Each young agent is endowed with one unit of labor, which is supplied inelastically. Again, to attain maximum simplicity, we assume that agents derive utility from consumption only when old. Let c_t denote the second period consumption of an agent born at t. Then the agent has the lifetime utility level $u(c_t)$, where $u(c_t) = c_t^{1-\rho}/(1-\rho)$. We assume throughout that $\rho \in (0,1)$. This assumption implies that a higher opportunity cost of holding currency induces agents to economize on their balances of currency.[4]

In order to introduce a transactions role for money, we follow Townsend (1980, 1987) and emphasize the importance of limited communication between the two locations in the economy. In particular, we assume that at each date an agent can trade only with agents who inhabit his current location and that there is no communication between islands. Communication and record keeping within any island pose no problems. However, between dates t and $t+1$, each agent faces the probability $\pi \in (0,1)$ that he will be relocated to the other island. When agents are relocated, they lose contact with agents in their original location. Moreover, the absence of communication between locations implies that agents in their new location do not know the asset position of relocated agents. Hence, relocated agents will require currency to purchase goods. On the other hand, agents who are not relocated can purchase goods with credit instruments; they do not require currency to make purchases. Stochastic relocation, then, is a physical story about which transactions do and do not require the use of currency.

In addition to providing a framework that requires currency to be used in some exchanges, the presence of stochastic relocation implies that agents face the risk of having to convert potentially higher-yielding assets into currency. This risk represents an analog of the liquidity preference shock in the Diamond and Dybvig (1983) model. Agents will wish to be insured against this shock. We will describe situations under which they either self-insure or are insured by banks.

This economy has two primary assets—currency and physical capital. One unit of the final good invested at t becomes one unit of capital at $t+1$. Capital investment cannot be transported between locations. As we have emphasized, spatial separation and limited communication imply that relocated agents require currency to consume. The economy's primary assets can be held directly by agents, or they can be held by intermediaries. We now describe the access of agents to intermediation.

We assume that each young agent can choose to deposit his saving in a bank. However, utilization of a bank is costly; saving in the form of bank deposits involves a fixed cost of $\phi > 0$ units of the final good. In other words, resources are "used up" (lost to society) each time an agent saves through a bank.[5] Agents who use a bank will deposit all of their saving (net of the fixed costs incurred in accessing banks). Then, once agents' relocation shocks are realized, agents who must relocate contact their banks again (in a decentralized manner) and withdraw cash that is taken to the agents' new location. Agents who are not relocated will not require cash to purchase the consumption good; they can use checks, credit cards, or other credit instruments. There is, of course, an alternative to using intermediaries. Agents can hold the economy's primary assets directly, thereby avoiding the incurrence of the fixed cost, ϕ. However, avoiding the fixed cost requires that an agent invest autarkically, which prevents the sharing of relocation risk. We describe below the circumstances under which agents will and will not choose to use banks.

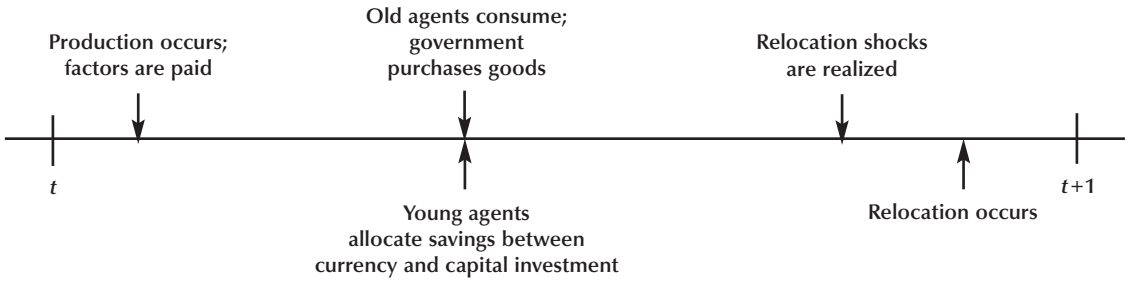
As is typical in models of spatial separation and limited communication, the timing of events within a period is of considerable importance. In this economy, the timing of events is as follows. At the beginning of a period, production of the final good occurs and factors are paid. Each young agent supplies his labor inelastically, earning the prevailing real wage. All of this wage income is saved. At this point, each young agent decides whether to hold the primary assets directly (i.e., to allocate his saving between holdings of currency and the investment technology) or to save in the form of bank deposits. If saving is

[4] See Schreft and Smith (1998).

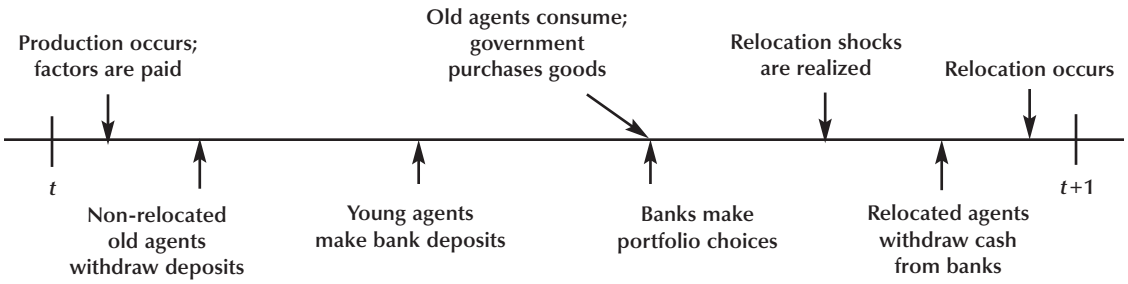
[5] The notion that utilizing a bank involves a fixed cost has a long tradition in macroeconomics, a tradition that is reflected, for instance, in Baumol (1952) and Tobin (1956).

Figure 1

A. Timing of Economic Activity within a Period (Autarky)



B. Timing of Economic Activity within a Period (Banks)



intermediated, banks make their portfolio decisions. The goods market clears, with output of the final good going to investment in capital formation, government purchases (described below), and consumption on the part of old agents. Later in the same period, each young agent learns the realization of his relocation shock. By assumption, young agents do not meet after their relocation status is realized (unless saving is intermediated, in which case they may contact their banks). Therefore, relocated agents who save and invest autarkically lose the value of their investment in the technology to produce physical capital, because capital investment cannot be transported between locations. On the other hand, if saving is intermediated, relocated agents return to their banks and withdraw currency. Relocated agents carry currency to their new location, using it to purchase consumption when old. Agents who are not relocated take no action until the beginning of the next period, at which point they consume the gross return on their asset holdings (currency and capital, if saving and investment is autarkic, or bank deposits, if saving is intermediated). The timing of events is depicted in Figure 1.[6] Figure 1A describes the case of autarkic saving, and Figure 1B the case of intermediated saving.

In addition to the old and young agents and (potentially) banks in each location, this economy has a government. The government prints money and purchases the final good. Let M_t be the nominal money supply, per young agent, at t. M_t evolves according to $M_{t+1} = \sigma M_t$, with σ being chosen once and for all at the beginning of time. If p_t denotes the time t price level, then seigniorage revenue of the government at t is

$$\left(\frac{\sigma - 1}{\sigma}\right)\frac{M_t}{p_t}.$$

We assume that the government uses this revenue to purchase the final good. Government purchases of the final good do not affect agents' saving behavior or portfolio allocations. Note that this way of inject-

[6] Notice that we have compressed all the events against which agents want to be insured into one period. This convention follows Champ, Smith, and Williamson (1996) and Schreft and Smith (1997, 1998). It implies that there are no opportunities for intergenerational interactions through the banking system.

ing money restricts us to the case $\sigma \geq 1$; that is, there can be no contraction of the money supply. This restriction is not particularly important here. As we will see, with this restriction certain commonly considered contractionary policies, such as the Friedman rule, are infeasible in a nontrivial equilibrium of this model.

III. TRADE IN FACTOR MARKETS

At the beginning of period t, firms hire labor and rent capital. These trades take place in competitive factor markets in each location. Let w_t denote the time t real wage rate, and let r_t denote the time t capital rental rate. Then the following standard factor pricing relationships obtain in each location:

$$r_t = f'(k_t) = \alpha A k_t^{\alpha-1} \tag{1}$$

$$w_t = f(k_t) - k_t f'(k_t) \equiv w(k_t) = (1-\alpha) A k_t^{\alpha}. \tag{2}$$

IV. BEHAVIOR OF AGENTS WHO SAVE AUTARKICALLY

From this point, we will proceed by describing (i) how agents behave if they save by holding the primary assets of the economy directly and (ii) how agents and banks behave if agents save in the form of bank deposits. Then we will discuss conditions under which young agents will choose to incur the fixed cost necessary for saving to be intermediated. We begin with the behavior of agents who save autarkically.

A young agent at t earns the real wage w_t, all of which is saved. If he saves autarkically, he divides his saving between holdings of currency and investment in physical capital. Let γ_{at} denote the fraction of saving held in the form of real money balances by a young agent at t; then $1-\gamma_{at}$ is the fraction held in the form of capital investment. The gross real return on holdings of currency between t and $t+1$ is p_t/p_{t+1}, and the gross real return on capital investment held from t to $t+1$ is r_{t+1} (since capital depreciates 100 percent). Agents behave competitively in asset markets, taking these returns as unaffected by their own saving behavior. Lifetime expected utility of a young agent is given by the expression

$$\pi u\left[\gamma_{at}\left(\frac{p_t}{p_{t+1}}\right)\right] + (1-\pi)\, u\left[\gamma_{at}\left(\frac{p_t}{p_{t+1}}\right) + (1-\gamma_{at}) r_{t+1}\right],$$

which he maximizes by choice of γ_{at}. Notice that the young agent's expected utility is the probability of being relocated multiplied by utility generated by the consumption that can be purchased when old with the agent's real balances, plus the probability of not being relocated multiplied by utility generated by consumption of the proceeds of the agent's capital, as well as purchases with his real balances, when old. To emphasize, relocated agents cannot move or trade claims to their capital investment, which is simply lost.

The solution to the problem of an autarkic young agent sets

$$\gamma_{at} = \min\left\{\frac{I_t}{I_t - 1 + \left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I_t-1)^{1/\rho}}, 1\right\} \equiv \gamma_a(I_t),$$

where $I_t \equiv r_{t+1}(p_{t+1}/p_t)$ is the gross nominal rate of interest. The nominal interest rate, of course, represents the opportunity cost of holding currency. Several properties of the function $\gamma_a(I_t)$ will be useful in the subsequent analysis. These properties are stated in the following lemma. Its proof appears in Appendix A.

Lemma 1.

(a) $\gamma_a(I_t) = 1$ holds for all $I_t \in \left[1, \frac{1}{1-\pi}\right]$. $\gamma_a(I_t) < 1$ holds for all $I_t > \frac{1}{1-\pi}$.

(b) $\lim_{I_t \to \infty} \gamma_a(I_t) = 0$.

(c) For $I_t > \frac{1}{1-\pi}$, $\frac{I_t \gamma_a'(I_t)}{\gamma_a(I_t)}$ satisfies

$$\frac{I_t \gamma_a'(I_t)}{\gamma_a(I_t)} = 1 - \gamma_a(I_t)\left[1 + \left(\frac{1}{\rho}\right)\left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I_t-1)^{(1-\rho)/\rho}\right] < 0.$$

V. GENERAL EQUILIBRIUM WITH AUTARKIC SAVING

Young agents at t earn the real wage $w(k_t)$, all of which is saved. The fraction $\gamma_a(I_t)$ of their saving is held in the form of real balances, and the fraction $1-\gamma_a(I_t)$ is held as capital investment. Hence, if $m_t \equiv (M_t/p_t)$ denotes the outstanding per capita supply of real balances at t, the money market clears if

$$m_t = \gamma_a(I_t) w(k_t). \tag{3}$$

In addition, the time $t+1$ per capita capital stock, k_{t+1}, is given by

$$k_{t+1}=(1-\pi)\left[1-\gamma_a(I_t)\right]w(k_t). \tag{4}$$

Equation (4) obtains because a fraction $1-\gamma_a(I_t)$ of saving is invested in capital formation and the fraction π of capital investment is lost due to relocation of some agents.[7]

The gross nominal rate of interest at t is given by

$$I_t = r_{t+1}\left(\frac{p_{t+1}}{p_t}\right) = r_{t+1}\sigma\left(\frac{m_t}{m_{t+1}}\right). \tag{5}$$

Substituting (1) and (3) into (5) yields the equilibrium law of motion for I_t when agents save autarkically:

$$I_t = \sigma f'(k_{t+1})\frac{\gamma_a(I_t)w(k_t)}{\gamma_a(I_{t+1})w(k_{t+1})} = \frac{\sigma k_{t+1}f'(k_{t+1})\gamma_a(I_t)w(k_t)}{w(k_{t+1})\gamma_a(I_{t+1})k_{t+1}}.$$

Upon substituting (4) into this law of motion, we obtain

$$\gamma_a(I_{t+1}) = \frac{\sigma\alpha}{(1-\alpha)(1-\pi)}\left\{\left(\frac{1}{I_t}\right)\left[\frac{\gamma_a(I_t)}{1-\gamma_a(I_t)}\right]\right\}. \tag{6}$$

VI. STEADY STATE UNDER AUTARKIC SAVING

Imposing $I_t = I_{t+1}$ in equation (6) yields the following steady-state equilibrium condition:

$$I\left[1-\gamma_a(I)\right] = \left(\frac{\sigma}{1-\pi}\right)\left(\frac{\alpha}{1-\alpha}\right). \tag{7}$$

Lemma 1 implies that (7) has a unique solution with $I > (1/1-\pi)$. Clearly, the steady-state value of the gross nominal rate of interest is an increasing function of the money growth rate. It is also straightforward to show that, in a steady state,

$$\frac{\partial(I/\sigma)}{\partial\sigma} = \frac{1}{\sigma}\left[\frac{I\gamma_a'(I)}{1-\gamma_a(I)}\right] < 0.$$

Therefore, as the money growth rate increases, the steady-state real interest rate, $I/\sigma = f'(k)$, declines. To sum up, when agents save autarkically, a higher rate of money creation leads to a higher steady-state nominal rate of interest, a lower real rate of interest, and a higher steady-state capital stock. Intuitively, this occurs because a higher nominal rate of interest implies a higher opportunity cost of holding currency. As a result, young agents substitute away from real balances and into capital investment. This leads to a higher steady-state capital stock and clearly constitutes a version of the Mundell-Tobin effect.

Notice that it is impossible for this economy to have a nontrivial equilibrium under the Friedman rule (that is, setting $I_t = 1$). This is because the Friedman rule makes currency such a good asset that agents will hold it to the exclusion of any other, and no capital investment will ever occur.[8]

Example: Assume the following parameter values: $\phi = 0.1$, $\alpha = 0.35$, $\rho = 0.95$, $\sigma = 1.05$, $A = 1$, and $\pi = 0.3$. The (gross) nominal interest rate in an autarkic steady state is 1.97, and γ_a, the share of saving held as currency, is 0.59.

VII. DYNAMICS UNDER AUTARKIC SAVING

The equilibrium law of motion for I_t given in equation (6) is depicted in Figure 2. It is easy to show that (6) gives I_{t+1} as an increasing function of I_t and that the steady state is unstable. This means that the steady state is the unique equilibrium.

VIII. AN ECONOMY WITH INTERMEDIATED SAVING

We now turn our attention to an economy where saving is intermediated. For the present, we simply assume that all saving is intermediated. Later, we provide conditions under which this is the optimal choice for young agents.

When young agents save through banks, they incur the fixed transactions cost, ϕ. They then deposit all remaining saving (each young agent deposits $w_t - \phi$ at date t) in banks.[9] Banks promise a gross real return of d_t^m to young agents who are relocated between t and $t+1$, and a gross real return of d_t to those who are not, per unit of the final good

[7] It is not essential to our analysis that all capital held by relocated agents is abandoned. The model easily could be modified so that ownership of capital held by relocated agents is transferred to non-relocated agents in a post-relocation shock asset market where some transactions costs are incurred. The term $1-\pi$ in equation (4) would then be replaced by a term that reflects the transactions costs associated with transferring ownership of capital investment. This change would have little effect on our analysis. The central point is that ownership of capital investment does not need to be transferred between agents when capital investment is intermediated.

[8] See Smith (2002), who makes a similar point in a model without capital accumulation. In his economy it is feasible to follow the Friedman rule in a nontrivial equilibrium, but it is not optimal to do so.

[9] As in Diamond and Dybvig (1983), all savings will be deposited in banks if agents strictly prefer intermediated to autarkic savings.

deposited at t. Banks allocate deposits between reserves of currency and investment in capital, prior to realization of agents' relocation shocks. After banks allocate their portfolios, agents who must relocate contact their banks in a decentralized manner and withdraw their deposits, with interest, in the form of currency. Banks must give these agents adequate quantities of currency for them to be able to consume at the promised level in their new location at $t+1$. Agents who are not relocated can make purchases with checks or other credit instruments at $t+1$. Let γ_{bt} denote the fraction of a bank's assets that are held in the form of currency and $1-\gamma_{bt}$ denote the fraction held as investment in capital.

As in Diamond and Dybvig (1983), a bank can be thought of as a coalition of ex ante identical young agents. A bank will then choose real rates of return on deposits and a reserve-to-deposit ratio (γ_{bt}) to maximize the expected utility of a representative depositor, subject to the following constraints. First, young agents who must relocate must be given enough currency to deliver the promised gross real return, d_t^m, between t and $t+1$. Since the gross real return on currency carried between t and $t+1$ is p_t/p_{t+1}, this constraint requires that

$$\pi d_t^m \le \gamma_{bt}\left(p_t/p_{t+1}\right). \tag{8}$$

If currency is dominated in rate of return,[10] then agents who remain in their original location will be paid out of the returns on the bank's investment in capital. This return is simply the capital rental rate in $t+1$ (since capital depreciates 100 percent). Therefore, the second constraint requires that

$$(1-\pi)d_t \le (1-\gamma_{bt})r_{t+1}. \tag{9}$$

Banks take the gross real returns on the primary assets, p_t/p_{t+1} and r_{t+1}, as given. Then a bank at t chooses d_t^m, d_t, and γ_{bt} to maximize the expected utility of a representative depositor

$$\frac{(w_t-\phi)^{1-\rho}}{1-\rho}\left[\pi\left(d_t^m\right)^{1-\rho}+(1-\pi)\left(d_t\right)^{1-\rho}\right],$$

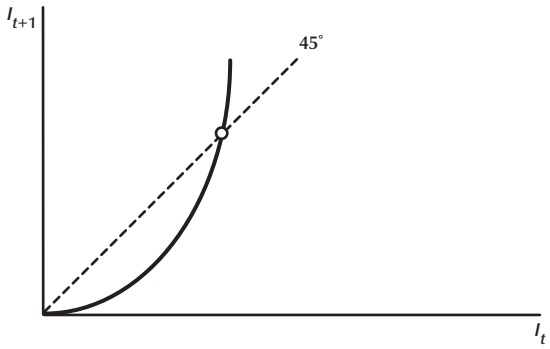
subject to the constraints (8) and (9) and nonnegativity.

The optimal reserve-to-deposit ratio of a bank at t is given by

[10] As we have noted, currency will be dominated in rate of return ($I_t > 1$ will hold) in any nontrivial equilibrium. When currency is dominated in rate of return, banks will not carry reserves of currency between periods.

Figure 2

Steady State in Autarky



$$\gamma_{bt} = \frac{1}{1+\left(\frac{1-\pi}{\pi}\right)I_t^{(1-\rho)/\rho}} \equiv \gamma_b\left(I_t\right). \tag{10}$$

Using (10), a bank's optimal deposit return schedule can be recovered from (8) and (9). It is easy to show that $d_t = I_t^{1/\rho} d_t^m$ holds at an optimum. With positive nominal rates of interest ($I_t > 1$), banks do not provide complete insurance against the risk of relocation. This is because they must hold currency to provide insurance against the risk of relocation, and holding currency involves an opportunity cost that is reflected in the nominal rate of interest. As this opportunity cost rises, banks provide less insurance.

Various properties of the function $\gamma_b(I)$ will be important in the analysis that follows. We now state these properties.[11]

Lemma 2.

(a) $\gamma_b(I) = \pi$.

(b) $\lim_{I\to\infty} \gamma_b(I) = 0$.

(c) $\dfrac{I\gamma_b'(I)}{\gamma_b(I)} = -\left(\dfrac{1-\rho}{\rho}\right)\left[1-\gamma_b(I)\right] < 0$.

Notice that, when saving is intermediated, setting the gross nominal interest rate equal to unity does not induce agents to save exclusively in the form of real balances. This contrasts with the situation of autarkic saving. When saving is intermediated, withdrawal demand is completely predictable, so there is

[11] For a proof of lemma 2, see Schreft and Smith (1998).

no reason for banks to hold precautionary reserves. For autarkic savers, only currency can provide complete insurance against relocation risk, and agents will hold only currency if $I_t = 1$. As we will see, if $I_t = 1$, autarkic saving will be optimal, but part (a) of lemma 2 will prove useful nonetheless. Finally, part (c) of the lemma indicates that, with $\rho < 1$, an increase in the nominal rate of interest induces banks to economize on their holdings of reserves. This is clearly the intuitively appealing (and empirically supported) case.[12]

IX. GENERAL EQUILIBRIUM WITH INTERMEDIATED SAVING

When all saving is intermediated, all beginning-of-period demand for currency derives from banks. Each young agent deposits his saving, net of the transactions cost ($w_t - \phi$), and each bank holds the fraction $\gamma_b(I_t)$ of deposits in the form of reserves of currency. Hence, at date t, the money market clears if

$$m_t = \gamma_b(I_t)\left[w(k_t) - \phi\right]. \tag{11}$$

Banks invest $1-\gamma_{bt}$ of deposits in capital formation. In contrast to the situation of autarkic saving, capital investment is not lost when agents relocate (since capital investment is undertaken by banks). Therefore, the per capita capital stock evolves according to

$$k_{t+1} = \left[1 - \gamma_b(I_t)\right]\left[w(k_t) - \phi\right]. \tag{12}$$

The condition that determines the evolution of the gross nominal rate of interest remains to be stated. By definition,

$$I_t = r_{t+1}\left(\frac{p_{t+1}}{p_t}\right) = r_{t+1}\sigma\left(\frac{m_t}{m_{t+1}}\right). \tag{13}$$

Substituting (1) and (11) into (13) yields

$$I_t = \frac{\sigma f'(k_{t+1})\gamma_b(I_t)\left[w(k_t) - \phi\right]}{\gamma_b(I_{t+1})\left[w(k_{t+1}) - \phi\right]} \tag{14}$$

or, upon rearranging terms,

$$\gamma_b(I_{t+1}) = \frac{\sigma f'(k_{t+1})\gamma_b(I_t)\left[w(k_t) - \phi\right]}{I_t\left[w(k_{t+1}) - \phi\right]} \equiv G(k_{t+1}, k_t, I_t). \tag{15}$$

[12] Goldfeld (1966) reports an interest elasticity of excess reserves (all reserves here are excess reserves) of –0.3. Schreft and Smith (2002) report that this figure continues to be widely used in policy circles.

Equations (12) and (15) constitute the equilibrium laws of motion for k_t and I_t. We begin with a consideration of steady states.

X. STEADY-STATE EQUILIBRIA UNDER INTERMEDIATED SAVING

Imposing $I_t = I_{t+1} = I$ and $k_{t+1} = k_t = k$ in equation (14) yields one of the steady-state equilibrium conditions:

$$I = \sigma f'(k). \tag{16}$$

Under our assumption of Cobb-Douglas production, equation (16) implies that

$$k = \left(\sigma\alpha A/I\right)^{1/(1-\alpha)} \tag{17}$$

and, consequently, that $w(k) - \phi = (1-\alpha)A(\sigma\alpha A/I)^{\alpha/(1-\alpha)} - \phi$. Substituting this condition into (12), rearranging terms, and making use of (17) gives a condition that determines the steady-state value(s) of I:

$$\frac{1}{1-\gamma_b(I)} = \left(\frac{1-\alpha}{\alpha}\right)\left(\frac{I}{\sigma}\right) - \mu\left(\frac{I}{\sigma}\right)^{1/(1-\alpha)} \equiv H(I), \tag{18}$$

with $\mu \equiv \phi(\alpha A)^{1/(\alpha-1)}$. Some properties of the function $H(I)$ are stated in the following lemma. Its proof appears in Appendix B.

Lemma 3.

(a) $H'(I) \geq 0$ holds if and only if

$$I \leq \sigma\left[\frac{(1-\alpha)^2}{\alpha\mu}\right]^{(1-\alpha)/\alpha} \equiv \hat{I}.$$

(b) $H(I) \geq 0$ holds if and only if $\left(\frac{1-\alpha}{\alpha}\right)^{(1-\alpha)/\alpha} \geq I$.

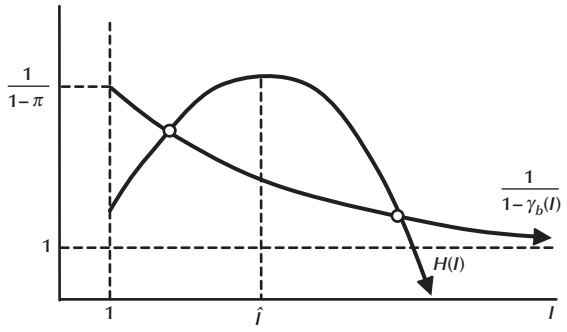
(c) $H(I)$ is a concave function of I.

Lemma 3 implies that there are three possibilities concerning the existence of steady-state equilibria with intermediated saving. These are depicted in Figure 3.

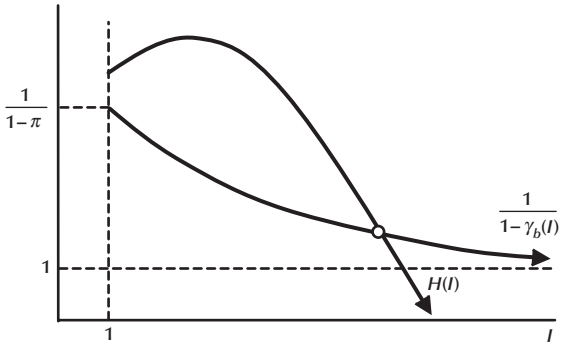
Case 1. If $H(1) < \frac{1}{1-\pi}$, $\hat{I} > 1$, and $H(\hat{I}) > 1 - \gamma_b(\hat{I})$ hold, we have the situation depicted in Figure 3A. Since $H(I)$ is concave, and since it is easy to verify that $\frac{1}{1-\gamma_b(I)}$ is a convex function of I, equation (18)

Figure 3

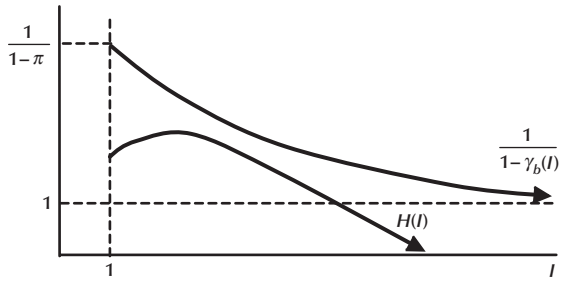
A. Two Steady States with Banks



B. One Steady State with Banks



C. No Steady State with Banks

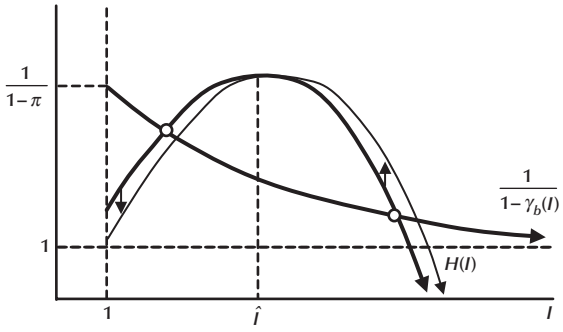


has two solutions. These are the candidate steady states when all saving is intermediated.

Case 2. If $H(1) > \frac{1}{1-\pi}$, we have the situation depicted in Figure 3B. Equation (18) has only one solution with $I > 1$, which is the candidate steady-state equilibrium.

Figure 4

Effect of an Increase in σ on Steady States with Banks



Case 3. It is possible that equation (18) has no solutions. This can happen if the fixed cost of contacting a bank is too large, for example. In this case, depicted in Figure 3C, there are no steady-state equilibria where all saving is intermediated.

XI. COMPARATIVE STATICS OF A CHANGE IN MONETARY POLICY

We now indicate how a change in the money growth rate, σ, affects the nominal rate of interest and the capital stock in a steady-state equilibrium with intermediation. We focus on case 1; from that it will be apparent what effects a change in σ has in case 2.

Figure 4 depicts the consequences of an increase in σ, which shifts the function $H(I)$ down (up) if $H'(I) > (<)0$. Notice that, in each candidate steady state, an increase in the rate of money creation has the effect of increasing I, the gross nominal rate of interest. The consequences of higher money growth rates for the steady-state capital stock, however, depend on which of the two steady states obtains. The relevant result is reported in proposition 1, which is proved in Appendix C.

Proposition 1. $\partial k/\partial\sigma > (<)0$ holds in the steady state with the low (high) nominal interest rate.

Proposition 1 says that at the steady state where $H'(I) > (<)0$, an increase in the rate of money creation raises (lowers) the steady-state capital stock (as well as steady-state output). Thus, the long-run real effects of a higher rate of money growth depend on which steady state obtains.

Of course, in a case 2 economy, there is a single steady state with $H'(I) < 0$. In a case 2 economy, a higher rate of money creation (a higher steady-state rate of inflation) reduces the per capita capital stock and per capita output.

XII. DYNAMICS WITH INTERMEDIATED SAVING

The dynamic system governing the evolution of $\{k_t, I_t\}$ consists of equations (12) and (15). In this section, we analyze local dynamics in a neighborhood of a steady-state equilibrium. The stability properties of a steady-state equilibrium depend on the number of steady states and their configuration. For this reason, we consider case 1 and case 2 economies separately.

Case 1. Here there are two candidate steady-state equilibria. Appendix D establishes the following result.

Proposition 2. In a case 1 economy, the low (high) nominal interest rate steady state is a saddle (source).

Because it is a source, the high nominal interest rate steady state cannot be approached from any nearby point. There is a unique path converging to the low nominal interest rate steady state, which is a saddle. In addition, it is easy to verify that dynamics in a neighborhood of the low nominal interest rate steady state are monotone.

Case 2. In a case 2 economy, there is a unique steady state. In Appendix E we prove the following claim.

Proposition 3. The steady state is a source.

It is therefore unclear what happens in a case 2 economy asymptotically, even if initial conditions put the economy in a neighborhood of the steady state. An analysis of global dynamics would be necessary; however, such an analysis is beyond the scope of the present paper.

Example: The parameter values are the same as in the example in Section VI. With intermediation of saving, these parameter values produce a case 1 economy. The two steady-state nominal interest rates are 1.12039 and 10.2615. For both steady states, the Jacobian matrix of partial derivatives of (12) and (15), evaluated at the steady state, has real eigenvalues. The low nominal interest rate steady state is a saddle, and the high nominal interest rate steady state is a source.

XIII. WHEN IS SAVING INTERMEDIATED?

To this point we have imposed either that agents save autarkically, or that agents' saving is intermediated, and we examined the potential equilibria emerging in each case. In this section we turn our attention to conditions under which agents will find it optimal to incur the fixed cost associated with intermediated saving.

We begin by considering the lifetime expected utility of an agent who saves autarkically. This (maximized) utility level is given by the expression

$$V_a(w_t, I_t) \equiv \frac{w_t^{1-\rho}}{1-\rho}\left\{\pi\left[\left(\frac{p_t}{p_{t+1}}\right)\gamma_a(I_t)\right]^{1-\rho} + (1-\pi)\left[\left(\frac{p_t}{p_{t+1}}\right)\gamma_a(I_t) + r_{t+1}\left(1-\gamma_a(I_t)\right)\right]^{1-\rho}\right\}$$

$$= \frac{w_t^{1-\rho}}{(1-\rho)}\left(\frac{p_t}{p_{t+1}}\right)^{1-\rho} \gamma_a(I_t)^{1-\rho}\left\{\pi + (1-\pi)\left[\frac{\gamma_a(I_t) + I_t\left(1-\gamma_a(I_t)\right)}{\gamma_a(I_t)}\right]^{1-\rho}\right\}.$$

It is easily verified that

$$\pi + (1-\pi)\left[\frac{\gamma_a(I_t) + I_t\left(1-\gamma_a(I_t)\right)}{\gamma_a(I_t)}\right]^{1-\rho} = \pi\left[\frac{1}{\gamma_a(I_t)}\right]\left(\frac{I_t}{I_t - 1}\right).$$

Therefore,

$$V_a(w_t, I_t) = \pi\left(\frac{w_t^{1-\rho}}{1-\rho}\right)\left(\frac{p_t}{p_{t+1}}\right)^{1-\rho}\left[\frac{1}{\gamma_a(I_t)}\right]^{\rho}\left(\frac{I_t}{I_t - 1}\right).$$

The (maximized) lifetime expected utility of agents whose saving is intermediated is given by

$$V_b(w_t, I_t) \equiv \left[\frac{(w_t - \phi)^{1-\rho}}{1-\rho}\right]\left\{\pi\left[\left(\frac{p_t}{p_{t+1}}\right)\frac{\gamma_b(I_t)}{\pi}\right]^{1-\rho} + (1-\pi)\left[\frac{r_{t+1}\left(1-\gamma_b(I_t)\right)}{1-\pi}\right]^{1-\rho}\right\}$$

$$= \left[\frac{(w_t-\phi)^{1-\rho}}{1-\rho}\right]\left(\frac{p_t}{p_{t+1}}\right)^{1-\rho}\left[\frac{\gamma_b(I_t)}{\pi}\right]^{1-\rho}\left[\pi+(1-\pi)I_t^{(1-\rho)/\rho}\right]$$

$$= \pi^{\rho}\left[\frac{(w_t-\phi)^{1-\rho}}{1-\rho}\right]\left(\frac{p_t}{p_{t+1}}\right)^{1-\rho}\left[\frac{1}{\gamma_b(I_t)}\right]^{\rho}.$$

Agents will save autarkically at date t if and only if

(19) $$V_a(w_t, I_t) \geq V_b(w_t, I_t).$$

Based on our previous observations, the condition (19) is equivalent to

(20)

$$\frac{w_t-\phi}{w_t} \leq \pi\left[\frac{\gamma_b(I_t)}{\gamma_a(I_t)}\right]^{\rho/(1-\rho)}\left(\frac{I_t}{I_t-1}\right)^{1/(1-\rho)} \equiv \pi Q(I_t)^{1/(1-\rho)}.$$

If the autarkic candidate equilibrium real wage and nominal rate of interest at t satisfy (20), then there exists an equilibrium in which agents save autarkically at t.

Clearly the properties of the function $Q(I)$ will be important in the subsequent analysis. These properties are stated in the following lemma, whose proof appears in Appendix F.

Lemma 4.

(a) $\lim_{I\downarrow 1} Q(I) = \infty$.

(b) $\lim_{I\to\infty} Q(I) = \left[\frac{1-\pi}{\pi}\right]^{1-\rho}$.

(c) $\frac{IQ'(I)}{Q(I)} = (1-\rho)\left[\gamma_b(I) - \gamma_a(I_t)\right]$.

(d) $Q'(I) \leq 0$ holds for all $I \in \left(1, \frac{1}{1-\pi}\right)$. For $I > \frac{1}{1-\pi}$, $Q'(I) < 0$ holds if $\pi \geq 1/2$. If $\pi < 1/2$, then $Q'(I) \leq (>) 0$ if and only if $I \leq (>) \tilde{I}$, where $\tilde{I}$ is the unique solution to

(21) $$1 + \left(\frac{1-\pi}{\pi}\right)I^{1/\rho} = \left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I-1)^{1/\rho}$$

and $\tilde{I} > \frac{1}{1-\pi}$ holds.

Equation (20) is equivalent to

(22)

$$1 \leq \left[\frac{\phi}{(1-\alpha)A(\alpha A)^{\alpha/(1-\alpha)}}\right]\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)} + \pi Q(I)^{1/(1-\rho)}.$$

In autarky

$$\frac{I}{\sigma} = \left[\frac{\alpha}{(1-\alpha)(1-\pi)}\right]\left[\frac{1}{1-\gamma_a(I)}\right];$$

and therefore, in autarky, (22) becomes

(23) $$1 \leq \Phi\left[1-\gamma_a(I)\right]^{\alpha/(\alpha-1)} + \pi Q(I)^{1/(1-\rho)} \equiv T(I),$$

where $\Phi \equiv \frac{\phi}{\left[(1-\alpha)A\right]^{1/(1-\alpha)}(1-\pi)^{\alpha/(1-\alpha)}}$.

The relevant properties of the function $T(I)$ are summarized in the following lemma, which is proved in Appendix G.

Lemma 5.

(a) $\lim_{I\downarrow 1} T(I) = \infty$.

(b) $\lim_{I\to\infty} T(I) = \Phi + (1-\pi)$.

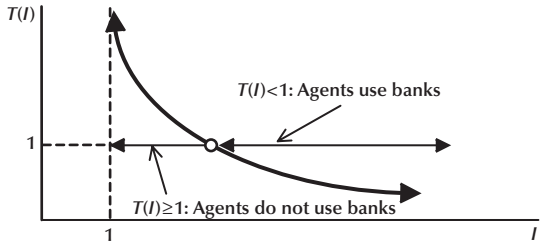
(c) If $Q'(I) \leq 0$, $T'(I) < 0$ holds.

(d) $T(I) = 1$ holds at (at most) two points.

Lemma 5 implies that the locus of nominal interest rates for which agents prefer autarky, described by (23), has the possible configurations depicted in Figure 5. In Figure 5A, (23) holds only for low values of the nominal interest rate. The intuition behind Figure 5A is straightforward; when the nominal interest rate is low, currency is a relatively good asset and the resource cost to an agent of saving through a bank exceeds the value of the insurance against an adverse realization of the relocation shock provided by the bank. In Figure 5B, (23) holds for two disjoint ranges of values of the nominal interest rate, implying that agents save autarkically for either low or high values of the nominal interest rate. The intuition behind the range of low values for which (23) holds is the same as in Figure 5A. The intuition behind the possibility that (23) holds for a range of high values of the nominal interest rate is as follows. As the nominal interest rate increases, banks provide less insurance against an adverse realization of the relocation shock. (Recall that banks

Figure 5

A. Agents Choose Autarky at a Low Nominal Interest Rate



B. Agents Choose Autarky at a Low or a High Nominal Interest Rate

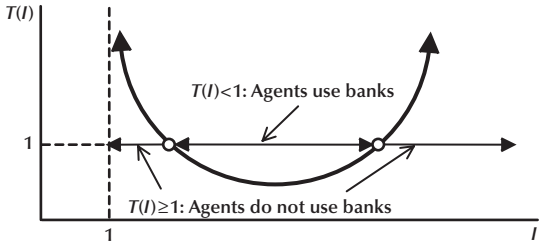
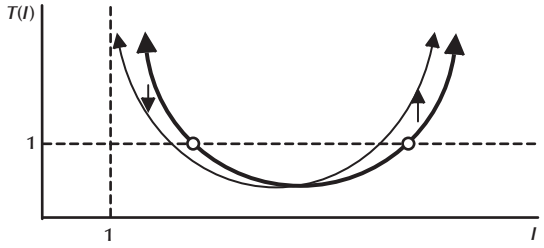
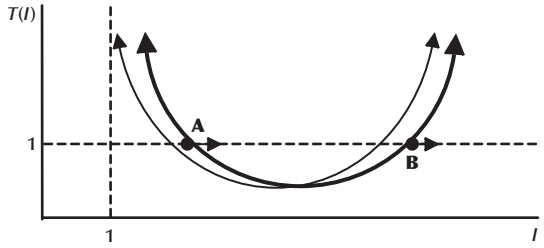


Figure 6

A. Effect of an Increase in σ on $T(I)$



B. An Increase in σ May Change Whether Intermediation Is Optimal



optimally offer $d = I^{1/\rho}d^m$, implying that the wedge between the rates of return offered by banks to non-relocated and relocated agents increases as I increases.) For parameter values leading to the configuration of $T(I)$ in Figure 5B, there is some value of I above which the insurance provided by banks deteriorates to the point where an agent values this insurance less than the agent values the resources it would cost to access a bank.

Note that the rate of money growth, σ, is held constant along $T(I)$; along $T(I)$, the steady-state nominal interest rate changes due to an underlying change in the capital-labor ratio, with (i) low capital-labor ratios corresponding to high values of the marginal product of capital and (ii) high nominal interest rates (given the rate of money growth). In Figure 5B, the upper range of values of I for which a steady state will be autarkic corresponds to low capital-labor ratios and low wages. For a steady state in this range, the insurance against relocation provided by banks is relatively poor, while the fixed cost of accessing banks is high relative to the wage; as a result, agents optimally engage in autarkic saving.

How does monetary policy—a change in the money growth rate—affect the choice between autarkic saving and saving through banks? Here, too, the range of high values of the nominal interest rate for which autarky will be chosen in Figure 5B generates an interesting possibility. To see this, we must establish the comparative static effects of an increase in the money growth rate on $T(I)$, which are summarized in the following proposition and illustrated in Figure 6A.

Proposition 4. In response to an increase in σ, $T(I)$ shifts down (up) if $T'(I) < (>)0$ at $T(I) = 1$. (Proposition 4 is proved in Appendix H.)

In Figure 6A, the economy may exhibit an autarkic steady state if the nominal interest rate is either low or high. Starting from an autarkic steady state, an increase in the money growth rate will raise the nominal interest rate (despite lowering the steady-state marginal product of capital). Proposition 4 implies the following: Starting from an autarkic steady state with a low nominal interest rate and raising that rate (by increasing the money growth rate) may move the steady state into one in which saving optimally is intermediated. This possibility is illustrated in Figure 6B: Point A, which is initially an autarkic steady state, moves to the right as a result of an increase in σ, while $T(I)$ shifts to

the left. However, starting from an autarkic steady state in which the nominal interest rate is high, an increase in σ will leave the economy with an autarkic steady state; see point B in Figure 6B.

For an economy with parameter values leading to the configuration of $T(I)$ in Figure 5B, a higher money growth rate lowers the threshold for the upper range of nominal interest rates at which agents save autarkically. A higher money growth rate therefore increases the range of nominal interest rates for which banks will be unable to provide sufficiently good insurance against agents' liquidity needs to make utilization of banks worthwhile.

There are a number of historical episodes in which a sudden, substantial reduction in the inflation rate, due to fiscal reform and correspondingly reduced reliance on seigniorage, was followed by rapid development of the banking system. For example, in Argentina, the ratio of deposit money bank assets to GDP, which is a measure of the size of the banking system, increased from an average of 0.178 for 1983-91 to an average of 0.216 for 1992-97.[13] During most of the earlier period, Argentina's money supply expanded very rapidly due to large government budget deficits that were being monetized, and the adoption of a currency board in 1991 removed any possibility of reliance on seigniorage. Similarly, Brazil's fiscal reforms of 1994 caused an increase from an average of 0.227 for 1980-93 to an average of 0.361 for 1994-97. Bolivia's fiscal reforms at the end of 1985, which ended a period of government budget deficits and rapid money growth culminating in a short but severe hyperinflation, provides a dramatic example. The ratio of deposit money bank assets to GDP increased from an average of 0.08 for 1975-85 to an average of 0.28 for 1986-97, and it experienced a strong trend during this latter period, increasing from 0.063 in 1986 to 0.497 in 1997. These episodes are consistent with the model here, in which a reduction in the money growth rate may change the steady-state equilibrium from one without banks to one with banks, by increasing the degree to which the structure of bank deposit rates offered by banks insure depositors against liquidity shocks.

XIV. CONCLUSION

In the world, we see countries with low levels of per capita income, low utilization rates of banks, apparently high costs of utilizing banks, and, in some cases, high inflation rates and high nominal interest rates. Here, we have explored the implications of a model in which both the resource costs associated with banking and monetary policy are important factors determining whether or not banks are utilized, and in which this decision is analyzed jointly with the determination of per capita income and the nominal interest rate. Our results suggest that monetary policy exerts an important influence over both financial and real development. By altering the opportunity cost of holding currency, a change in the money growth rate affects—in quite complex ways—the relative costs and benefits of self-financed investment and self-insurance against liquidity needs, on the one hand, and financial intermediation, on the other hand.

One result that we believe to be especially interesting is the possibility that banks will not be used for high values of the nominal interest rate. As mentioned earlier, many developing countries have relatively high nominal interest rates and relatively low utilization rates of banks. Since the nominal interest rate represents the cost of holding currency, this observation seems puzzling at first glance. Our model suggests that this observation might be explained by the negative impact of high money growth rates and high inflation rates on the degree to which banks insure depositors against liquidity shocks.

There are several directions in which this analysis could be extended. One would be to investigate a more sophisticated model of the resource costs of banking. For example, the average cost of intermediation (per unit deposited) may be a decreasing function of the volume of saving through the banking system. The impact of subsidizing the costs of banking also could be studied. Another possible line of inquiry would involve the alternative ways in which the government's purchases of the final good are used and alternative methods for injecting base money into the economy.

[13] These data on the ratio of deposit money bank assets to GDP are from the financial structures database accompanying Beck, Demirgüç-Kunt, and Levine (2000).

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Appendix

A. PROOF OF LEMMA 1.

Parts (a) and (b) of the lemma follow from the definition of γ_a. For part (c), differentiation yields

$$\frac{I\gamma_a'(I)}{\gamma_a(I)} = \frac{-1+\left[(1-\pi)/\pi\right]^{1/\rho}(I-1)^{1/\rho}\left[1-\rho^{-1}\left[I/(I-1)\right]\right]}{I-1+\left[(1-\pi)/\pi\right]^{1/\rho}(I-1)^{1/\rho}}$$

$$= 1-\gamma_a(I)-\gamma_a(I)\left[\frac{(1-\pi)^{1/\rho}(I-1)^{(1-\rho)/\rho}}{\rho\pi^{1/\rho}}\right].$$

B. PROOF OF LEMMA 3.

Differentiating $H(I)$ yields

$$H'(I) = \left[\left(\frac{1-\alpha}{\alpha}\right)-\left(\frac{1}{1-\alpha}\right)\mu\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}\right]\left(\frac{1}{\sigma}\right).$$

Part (a) of the lemma follows immediately. Part (b) follows immediately from the definition of $H(I)$. For part (c), we have

$$H''(I) = -\left\{\left[\frac{\alpha}{(1-\alpha)^2}\right]\mu\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}\right\}\left(\frac{1}{\sigma I}\right) < 0.$$

C. PROOF OF PROPOSITION 1.

Differentiation of equation (18) with respect to σ yields

(A.1)
$$\frac{\partial I}{\partial\sigma}\left\{\frac{\gamma_b'(I)}{\left[1-\gamma_b(I)\right]^2}-\left(\frac{1-\alpha}{\sigma\alpha}\right)\right\}+\left[\frac{\mu}{\sigma(1-\alpha)}\right]\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}$$

$$= -\left(\frac{I}{\sigma^2}\right)\left[\left(\frac{1-\alpha}{\alpha}\right)-\left(\frac{\mu}{1-\alpha}\right)\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}\right].$$

Rearranging terms in (A.1), one obtains

$$\frac{\sigma}{I}\frac{\partial I}{\partial\sigma} = \frac{\left(\frac{1-\alpha}{\alpha}\right)-\left(\frac{\mu}{1-\alpha}\right)\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}}{\left(\frac{1-\alpha}{\alpha}\right)-\left(\frac{\mu}{1-\alpha}\right)\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}-\left(\frac{\sigma\gamma_b'(I)}{\left(1-\gamma_b(I)\right)^2}\right)}.$$

From part (a) of lemma 3, it is then apparent that $\frac{\sigma}{I}\frac{\partial I}{\partial\sigma}\in(0,1)$ if $H'(I)>0$ holds and that $\frac{\sigma}{I}\frac{\partial I}{\partial\sigma}>1$ if $H'(I)<0$ holds.

Now note that $f'(k) = I/\sigma$, so that $f''(k)(\partial k/\partial\sigma) = \left(\frac{I}{\sigma^2}\right)\left[\left(\frac{\sigma}{I}\right)\left(\frac{\partial I}{\partial\sigma}\right)-1\right]$. Thus $\partial k/\partial\sigma >(<) 0$ holds if $H'(I) >(<) 0$.

Appendix cont'd

D. PROOF OF PROPOSITION 2.

We begin by linearizing equations (12) and (15) in a neighborhood of a steady state. Doing so yields the linear approximation $(k_t - k, I_t - I)' = J(k_{t-1} - k, I_{t-1} - I)'$, where k and I denote steady-state values and where J is the standard Jacobian matrix with partial derivatives evaluated at the appropriate steady state. To derive some properties of J, we begin with the following observations.

First, differentiation of equation (12) implies that

$$\frac{\partial k_{t+1}}{\partial k_t} = \frac{k\,w'(k)}{w(k)-\phi} = \frac{k\,w'(k)}{w(k)}\frac{w(k)}{w(k)-\phi} = \alpha\frac{w(k)}{w(k)-\phi}$$

and

$$\frac{I}{k}\frac{\partial k_{t+1}}{\partial I_t} = -\left[\frac{I\,\gamma_b'(I)}{\gamma_b(I)}\right]\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right].$$

Second, from the definition of the function $G(k_{t+1}, k_t, I_t)$,

(A.2) $$\frac{k_{t+1}G_1(k_{t+1},k_t,I_t)}{G(k_{t+1},k_t,I_t)} = \frac{k\,f''(k)}{f'(k)} - \left[\frac{k\,w'(k)}{w(k)}\right]\left[\frac{w(k)}{w(k)-\phi}\right] = -(1-\alpha) - \alpha\left[\frac{w(k)}{w(k)-\phi}\right],$$

(A.3) $$\frac{k_tG_2(k_{t+1},k_t,I_t)}{G(k_{t+1},k_t,I_t)} = \left[\frac{k_tw'(k_t)}{w(k_t)}\right]\left[\frac{w(k_t)}{w(k_t)-\phi}\right] = \alpha\left[\frac{w(k_t)}{w(k_t)-\phi}\right],$$

and

(A.4) $$\frac{I_tG_3(k_{t+1},k_t,I_t)}{G(k_{t+1},k_t,I_t)} = \frac{I_t\gamma_b'(I_t)}{\gamma_b(I_t)} - 1.$$

Third, differentiation of equation (15) yields

(A.5) $$\left[\frac{I\gamma_b'(I)}{\gamma_b(I)}\right]\left[\frac{k}{I}\frac{\partial I_{t+1}}{\partial k_t}\right] = \left[\frac{k\,G_1(k_{t+1},k_t,I_t)}{G(k_{t+1},k_t,I_t)}\right]\frac{\partial k_{t+1}}{\partial k_t} + \frac{k\,G_2(k_{t+1},k_t,I_t)}{G(k_{t+1},k_t,I_t)}$$

$$= -\phi\alpha^2\left[\frac{\phi\,w(k)}{(w(k)-\phi)^2}\right],$$

where the second equality follows from (A.2), (A.3), and the expression for $\partial k_{t+1}/\partial k_t$. In addition,

(A.6) $$\left[\frac{I\gamma_b'(I)}{\gamma_b(I)}\right]\left[\frac{\partial I_{t+1}}{\partial I_t}\right] = \left[\frac{k\,G_1}{G}\right]\left[\frac{I}{k}\frac{\partial k_{t+1}}{\partial I_t}\right] + \frac{I\,G_3}{G}$$

$$= \frac{I\gamma_b'(I)}{\gamma_b(I)} - 1 - \left\{1-\alpha+\alpha\left[\frac{w(k)}{w(k)-\phi}\right]\frac{I}{k}\frac{\partial k_{t+1}}{\partial I_t}\right\},$$

where the second equality follows from (A.2) and (A.4).

Appendix cont'd

Now let T denote the trace of J and D denote the determinant of J. From the preceding expressions it is straightforward to verify that

(A.7) $$T = 1 + (1-\alpha)\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right] - \left[\frac{\gamma_b(I)}{I\gamma_b'(I)}\right] + \alpha\left[\frac{w(k)}{w(k)-\phi}\right]\left[\frac{1}{1-\gamma_b(I)}\right] > 0$$

and

(A.8) $$D = \alpha\left[\frac{w(k)}{w(k)-\phi}\right]\left[1 - \frac{\gamma_b(I)}{I\gamma_b'(I)}\right] + \alpha\left[\frac{w(k)}{w(k)-\phi}\right]\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right]$$

$$= \left(\frac{\alpha}{1-\rho}\right)\left[\frac{w(k)}{w(k)-\phi}\right]\left[\frac{1}{1-\gamma_b(I)}\right] = \left(\frac{1-\alpha}{1-\rho}\right)\frac{I}{\sigma} > 0,$$

where the last equality follows from

(A.9) $$\left[\frac{w(k)}{w(k)-\phi}\right]\left[\frac{1}{1-\gamma_b(I)}\right] = \frac{w(k)}{k} = \left(\frac{1-\alpha}{\alpha}\right)f'(k) = \left(\frac{1-\alpha}{\alpha}\right)\frac{I}{\sigma}.$$

Equations (A.7) and (A.8) imply that either J has two positive real eigenvalues or the eigenvalues of J are complex conjugates. Also, clearly

(A.10) $$T = 1 + D + (1-\alpha)\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right] + \alpha\left[\frac{w(k)}{w(k)-\phi}\right]\left[\frac{\gamma_b(I)}{I\gamma_b'(I)}\right] - \frac{\gamma_b(I)}{I\gamma_b'(I)}.$$

We now make two observations. One is that equation (A.9) implies that

$$\left[\frac{w(k)}{w(k)-\phi}\right] = \left(\frac{1-\alpha}{\alpha}\right)\left(\frac{I}{\sigma}\right)\left[1-\gamma_b(I)\right].$$

The second is that, from (18),

$$\left(\frac{1-\alpha}{\alpha}\right)\left(\frac{I}{\sigma}\right)\left[1-\gamma_b(I)\right] = \frac{1}{1-\mu\left(\frac{\alpha}{1-\alpha}\right)\left(\frac{I}{\sigma}\right)^{\alpha/(1-\alpha)}} \equiv \frac{\left(\frac{1-\alpha}{\alpha}\right)\left(\frac{I}{\sigma}\right)}{H(I)}.$$

From these observations, it follows that

$$T = 1 + D + (1-\alpha)\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right] - \left(\frac{\rho}{1-\rho}\right)\left[\frac{1}{1-\gamma_b(I)}\right]\left\{(1-\alpha)\left[\frac{I/\sigma}{H(I)}\right] - 1\right\}.$$

It therefore follows that $T > (<) 1 + D$ holds if and only if

(A.11) $$\left(\frac{1-\rho}{\rho}\right)(1-\alpha)\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right] > (<)\left[\frac{1}{1-\gamma_b(I)}\right]\left\{(1-\alpha)\left[\frac{I/\sigma}{H(I)}\right] - 1\right\}$$

$$= (1-\alpha)(I/\sigma) - H(I) = -(1-\alpha)\,I\,H'(I).$$

Appendix cont'd

We now note that

$$\frac{\partial\left[1-\gamma_b(I)\right]^{-1}}{\partial I}=-\left(\frac{1}{I}\right)\left(\frac{1-\rho}{\rho}\right)\left[\frac{\gamma_b(I)}{1-\gamma_b(I)}\right].$$

Thus, from (A.11), $T>(<)1+D$ holds if and only if

$$\frac{\partial\left[1-\gamma_b(I)\right]^{-1}}{\partial I}<(>)H'(I).$$

Thus $T>(<)1+D$ is satisfied at steady states where $H'(I)>(<)0$. It follows that the low nominal interest rate steady state is a saddle and that dynamics in a neighborhood of it are monotone. The high nominal interest rate steady state is a source if $D>1$ holds (Azariadis, 1993). It is straightforward to show that the condition $T<1+D$ is equivalent to

$$D>\frac{(1-\alpha)\gamma_b(I)}{\rho\left[1-\gamma_b(I)\right]}+\frac{1}{(1-\rho)\left[1-\gamma_b(I)\right]}.$$

Since the second term on the right exceeds 1, then, clearly, satisfaction of the condition $T<1+D$ implies $D>1$. This establishes the proposition.

E. PROOF OF PROPOSITION 3.

The proposition follows immediately from the fact that the only steady state has $H'(I)<0$ and from the observations in the proof of proposition 2.

F. PROOF OF LEMMA 4.

Part (a) of the lemma is obvious from the definition of $Q(I)$. For part (b), L'Hopital's rule implies that $\lim_{I\to\infty}\left[\gamma_b(I)/\gamma_a(I)\right]^{\rho}=\left[(1-\pi)/\pi\right]^{(1-\rho)/\rho}$. Part (b) of the lemma then follows from continuity.

To establish part (c), differentiate the definition of $Q(I)$ to obtain

(A.12)
$$\frac{IQ'(I)}{Q(I)}=-\left(\frac{1}{I-1}\right)+\rho\left[\frac{I\gamma_b'(I)}{\gamma_b(I)}\right]-\rho\left[\frac{I\gamma_a'(I)}{\gamma_a(I)}\right]$$
$$=-\left(\frac{1}{I-1}\right)-(1-\rho)\left[1-\gamma_b(I)\right]-\rho\left[1-\gamma_a(I)\right]+\gamma_a(I)\left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I-1)^{(1-\rho)/\rho},$$

where the second equality follows from applying lemmas 1 and 2. Moreover,

(A.13)
$$\gamma_a(I)\left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I-1)^{(1-\rho)/\rho}-\left(\frac{1}{I-1}\right)=1-\gamma_a(I)$$

holds. Substituting (A.13) into (A.12) yields the expression in part (c) of the lemma.

Clearly $Q'(I)\le 0$ holds if and only if $\gamma_a(I)\ge\gamma_b(I)$. For $I\le\frac{1}{1-\pi}$, $\gamma_a(I)=1>\gamma_b(I)$ is satisfied. For $I>\frac{1}{1-\pi}$, $\gamma_a(I)\ge\gamma_b(I)$ is easily shown to hold if and only if

(A.14)
$$1+\left(\frac{1-\pi}{\pi}\right)I^{1/\rho}\ge\left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I-1)^{1/\rho}.$$

Appendix cont'd

It is straightforward to show that (A.14) holds for all $I \geq 1$ if $\pi \geq 1/2$. If $\pi < 1/2$, then it is easily shown that (A.14) has a unique solution, $\tilde{I}$, with $\tilde{I} > \frac{1}{1-\pi}$. This completes the proof.

G. PROOF OF LEMMA 5.

Part (a) of the lemma follows from part (a) of lemma 1 and part (a) of lemma 4. Part (b) follows from part (b) of lemma 1 and part (b) of lemma 4. To obtain part (c), note that

$$T'(I) = \Phi\left(\frac{\alpha}{1-\alpha}\right)\left[1-\gamma_a(I)\right]^{1/(\alpha-1)}\gamma_a'(I) + \pi\left(\frac{1}{1-\rho}\right)Q(I)^{\rho/(1-\rho)}Q'(I).$$

Since $0 \leq \gamma_a(I) \leq 1$, $\gamma_a'(I) \leq 0$, and $Q(I) \geq 0$, it is clear that $Q'(I) < 0$ implies $T'(I) < 0$.

To prove part (d) of the lemma, suppose that $T'(I) \geq 0$ holds at some value of I that satisfies (23) at equality. At that value of I

$$\left(\frac{1}{\rho}\right)\left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I-1)^{(1-\rho)/\rho}\left[\frac{\gamma_a(I)}{1-\gamma_a(I)}\right]-1 \leq \left(\frac{1-\alpha}{\alpha}\right)\left[\frac{1}{\gamma_a(I)}\right]\left[\frac{\pi Q(I)^{1/(1-\rho)}}{1-\pi Q(I)^{1/(1-\rho)}}\right]\left[\gamma_b(I)-\gamma_a(I)\right]. \quad \text{(A.15)}$$

Note that if $T'(I) \geq 0$, then necessarily $Q'(I) > 0$, $\gamma_b(I) \geq \gamma_a(I)$, and $\frac{\gamma_b(I)}{\gamma_a(I)}$ is increasing in I, so the right-hand side of (A.15) is increasing in I. Also, the left-hand side of (A.15) equals

$$\left(\frac{1}{\rho}\right)\left(\frac{I}{I-1}\right)\left[\frac{\left(\frac{1-\pi}{\pi}\right)^{1/\rho}(I-1)^{1/\rho}}{\left(\frac{1-\pi}{\pi}\right)(I-1)^{1/\rho}-1}\right]-1,$$

which is decreasing in I.

Therefore, if $T'(I_1) \geq 0$ for some I_1 satisfying (23) with equality, then for any $I_2 > I_1$ satisfying (23) with equality, $T'(I_2) \geq 0$ also must hold. This is a contradiction. This establishes that there is at most one value of I at which $T(I) = 1$, for which $T'(I) \geq 0$. This completes the proof.

H. PROOF OF PROPOSITION 4.

Differentiation of equation (7) yields

$$\frac{I}{\sigma} + I\left[1-\gamma_a(I)\right]^{-1}\gamma_a'(I)\frac{\partial I}{\partial \sigma} - \frac{\partial I}{\partial \sigma} = 0,$$

which implies that

$$\frac{\partial I}{\partial \sigma} = -\frac{I}{\sigma}\left\{\frac{I\gamma_a'(I)}{1-\gamma_a(I)} - 1\right\}^{-1} > 0$$

since $\gamma_a'(I) < 0$. Obviously $\frac{\partial T(I)}{\partial \sigma} = T'(I)\frac{\partial I}{\partial \sigma}$, and therefore the sign of $\frac{\partial T(I)}{\partial \sigma}$ depends on the sign of $T'(I)$. This completes the proof.

Commentary

Franklin Allen

The conventional wisdom concerning the interaction between economic development and financial system structure is that there are three stages (see, e.g., Gurley and Shaw, 1960, Goldsmith, 1969, and Allen and Gale, 2000). In this process of historical development, increasing per capita income and financial depth reinforce each other, and the transaction costs of establishing financial institutions and markets play a key role. In the first stage, where the level of development is low, investment is self-financed. The only financial instrument is money. At moderate levels of development, the second stage, banks and other financial institutions start to play a role. These financial institutions transfer resources from agents with excess funds to agents that need funds to invest and consume. They also provide liquidity insurance and a range of other services. At the third stage, formalized markets develop for agents (including financial institutions) to trade in. These markets improve the efficiency of the allocation from surplus units to deficit units and allow risk sharing.

This interesting paper contributes to the literature on financial system structure and growth by showing that it is not just transactions costs that matter for the development of banking systems. Monetary policy is also an important determinant of the extent of intermediation. The paper develops a model based on the interaction of the transactions costs of intermediation and monetary policy. The main result is that some low-income countries that have high inflation and a poorly developed banking system may be able to improve the banking sector by lowering the rate of inflation. They give the examples of Argentina in the 1980s and early 1990s, Brazil in the 1990s, and Bolivia in the 1980s. In all these countries a reduction in inflation was accompanied by a significant growth in the financial sector.

The model assumes an overlapping generations framework with two-period-lived individuals. These people are endowed with 1 unit of labor when they are young, which provides their income. They save their labor income for their old age, which is when they consume. The individuals have constant relative risk aversion utility functions with a degree of risk aversion between 0 and 1.

An important role is played by liquidity shocks. These are modeled by assuming there are two islands with limited communication between them but perfect communication within each one. After they have made their saving decisions, individuals find out whether they have to relocate to the other island. Initially, the proportion that relocates is known but the identities of who has to relocate are not.

Production takes place on each island using capital and labor. The production function is Cobb-Douglas and displays constant returns to scale. The assets available for saving are physical capital and money. Physical capital cannot be moved between the islands but money can be.

If there are no banks, you have to abandon your capital if you are relocated and the capital is lost to you and to society as a whole. In contrast, if there is a bank, a person who is forced to relocate can withdraw money from the bank before moving and take it with her. There is no private or social loss of capital. Banks thus provide liquidity insurance.

Money is printed by the government in order to purchase the final good. Government expenditure does not have any direct effect on people's behavior.

In the first case analyzed, there are no banks and people save using direct holdings of physical capital and money. Physical capital has a higher return but cannot be relocated and is wasted if relocation occurs. Currency has the advantage that it can be transported. It has an opportunity cost that depends on the rate of inflation and the marginal product of capital. The optimal portfolio of physical capital and money depends on the trade-off between the opportunity cost of holding currency and the probability of relocation. The main result is that there is a unique steady state for the economy. This is a fairly simple case, so the result is not particularly surprising.

In the second case, individuals put their savings

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in banks. Each bank chooses a portfolio of physical capital and money. If a person is relocated she can withdraw the currency and take it with her. The banks thus provide liquidity insurance. On the other hand, banks are costly because of fixed transaction costs. In this case, two steady states exist, one with a high nominal interest rate and one with a low nominal interest rate.

The main result of the paper is to show that whether agents choose autarky or intermediated saving depends on monetary policy. General equilibrium effects are complex because the bank has to make a decision about how much liquidity to hold. There are two possible situations. In the first, for low nominal interest rates, currency has a low opportunity cost, so autarky prevails and banks are not used; for high nominal interest rates, currency has a high opportunity cost and banks are used.

In the second situation, for low and high nominal interest rates autarky prevails and banks are not used; for intermediate rates banks are used. The intuition for the second situation is the same as the first. The difference between the two situations is that, in the second, at high nominal rates less liquidity insurance would be offered by banks. As a result, it becomes unattractive to pay the fixed cost to use the bank, so people save on their own. This second case shows that a lack of banks may be due to monetary policy that causes high inflation and high nominal rates. A change in monetary policy may lead to the establishment of banks.

This is an interesting paper on an important topic that is well worth reading. It is quite thought provoking and opens up many interesting questions for future research.

1. Is there any historical or other evidence that can determine the validity of the conventional wisdom that transaction costs alone, rather than monetary policy, lead to the absence of banks? For example, in the 19th century, did adopting the gold standard help the financial systems of some countries?
2. How important to the results is the loss of self-financed capital in the autarkic system when relocation occurs? If the interpretation is that people are self-financed entrepreneurs, then this is a reasonable assumption. Another possible interpretation is that there are partnerships or firms with multiple owners. In this case, the output from the capital would not be lost but would be transferred to the other owners. It would be interesting to see whether this made any difference to the results.
3. What precisely is the role of liquidity insurance provided by banks versus the loss of output from relocation under autarky? An interesting special case might involve log utility. In the Diamond and Dybvig (1983) framework, liquidity insurance does not provide any benefit in this case. Is this true here? A good benchmark model might be log utility, no social loss of output under relocation, and no fixed costs of setting up a bank. Autarky and banking might be equivalent here. It could then be seen which assumptions are most important for the results obtained.
4. What is happening to government expenditure in the comparison of autarky and banks? If government expenditure is higher in the high nominal rate autarkic equilibrium, then it may be that the inflation tax is an efficient tax.
5. Is a welfare analysis of any kind possible? Can the steady states be compared? Are welfare comparisons possible in the numerical examples?
6. What would happen with equity markets? Would this eliminate liquidity insurance and be worse than the banking system in the same way as in Jacklin (1987)? When would equity markets occur in equilibrium? This might provide an interesting contrast to the conventional wisdom discussed initially.
7. If aggregate uncertainty could be introduced, the interaction of monetary policy, financial structure, and financial stability could be investigated. This is a crucial issue that has had relatively little research devoted to it. It deserves much more attention.

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More on Finance and Growth: More Finance, More Growth?

Ross Levine

Nobel Prize winners disagree about the impact of the financial sector on economic growth. Some do not even consider finance worth discussing. A collection of essays by the "pioneers of development economics"—including three winners of the Nobel Prize in Economics—does not discuss finance (Meier and Seers, 1984). At the other extreme, Nobel Prize winner Merton Miller (1998, p. 14) recently remarked "that financial markets contribute to economic growth is a proposition almost too obvious for serious discussion." As a third view, Nobel Laureate Robert Lucas (1988) holds that the role of finance in economic growth has been "over-stressed" by the growth literature. Resolving the debate about the importance of financial development for economic growth is important for distinguishing among theoretical models. More importantly, information on the importance of finance for growth will affect the intensity with which researchers and policymakers attempt to identify and construct appropriate financial sector reforms around the world.

This paper selectively discusses recent empirical work on the controversial issue of whether financial systems play a critical role in determining long-run rates of economic growth. Building on work by Bagehot (1873), Schumpeter (1912), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973), recent research has employed different econometric methodologies and data sets to assess the role of the financial sector in stimulating economic growth. I will focus on three classes of empirical studies: (i) pure cross-country growth regressions, (ii) panel techniques that exploit both the cross-country and time-series dimensions of the data, and (iii) microeconomic-based studies that examine the mechanisms through which finance may influence economic growth. Thus, I will largely ignore country case studies and purely time-series investigations, which generally confirm the conclusions from the cross-country, panel, and microeconomic-based studies. Also, this paper does not discuss the theory surrounding the role of financial contracts, markets, and intermediaries in economic growth.[1]

The growing body of empirical research, using different statistical procedures and data sets, produces remarkably consistent results. First, countries with better-developed financial systems tend to grow faster—specifically, those with (i) large, privately owned banks that funnel credit to private enterprises and (ii) liquid stock exchanges. The levels of banking development and stock market liquidity each exert a positive influence on economic growth. Second, simultaneity bias does not seem to be the cause of this result. Third, better-functioning financial systems ease the external financing constraints that impede firm and industrial expansion. Thus, access to external capital is one channel through which financial development matters for growth because it allows financially constrained firms to expand.

Each of the different statistical procedures that have been brought to bear on the finance-growth debate has methodological shortcomings, which emphasizes the need for additional research to clarify the relationship between finance and growth. Moreover, data problems plague the study of finance and growth in general. Perhaps the biggest data problem involves the empirical proxies of "financial development," because it is difficult to construct accurate, consistent measures of financial development for a broad cross-section of countries. Thus, more microeconomic-based studies that explore the possible channels through which finance influences growth will foster a keener understanding of the finance-growth nexus. Without ignoring the weaknesses of existing work and the need for future research, the consistency of existing empirical results across different data sets and statistical procedures suggests that finance plays an important role in the process of economic growth.

The body of existing work motivates research

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[1] For a review of the theory of finance and growth and a discussion of the time-series and case-study literature, see Levine (1997 and 2002a).

Table 1

Growth and Financial Intermediary Development, 1960-89

	Dependent variables		
	Real per capita GDP growth	Real per capita capital growth	Productivity growth
DEPTH	2.4**	2.2**	1.8**
	(0.007)	(0.006)	(0.026)
R^2	0.50	0.65	0.42

NOTE: Observations: 77.

**Indicates significance at the 5 percent level; p-values are in parentheses.

Variable definitions: DEPTH = liquid liabilities/GDP; productivity growth = real per capita GDP growth – (0.3)*(real per capita capital growth). Other explanatory variables included in each of the nine regression results reported above: logarithm of intial income, logarithm of initial secondary school enrollment, ratio of government consumption expenditures to GDP, inflation rate, and ratio of exports plus imports to GDP.

King and Levine (1993b) define 2 percent growth as 0.02. For comparability with subsequent tables, we have redefined 2 percent growth as 2.00 and adjusted the coefficients by a factor of 100.

SOURCE: King and Levine (1993b, Table VII).

into the determinants of financial development. If financial development is crucial for growth, how can countries develop well-functioning financial systems? What legal, regulatory, and policy changes would foster the emergence of growth-enhancing financial markets and intermediaries? While I do not discuss this emerging literature, I point to some recent work on this question in the conclusion.

The remainder of the paper proceeds as follows. The next section discusses cross-country studies of growth. The third section reviews panel studies of growth, and the fourth section analyzes industry- and firm-level research on the finance-growth nexus.

CROSS-COUNTRY STUDIES

Financial Intermediaries and Growth

I first examine the application of broad cross-country growth regressions to the study of finance and growth. These studies aggregate economic growth over long periods, a decade or more, and assess the relationship between long-run growth and measures of financial development. King and Levine (1993a,b,c) build on earlier cross-country work by Goldsmith (1969). In particular, King and Levine (1993a,b,c) more than double Goldsmith's (1969) sample of countries, study growth over a 30-year horizon, and systematically control for many possible determinants of economic growth such as initial income, educational attainment, inflation, black market exchange rate premia, government spending, openness to trade, and political instability. Furthermore, they examine whether financial development is associated with productivity growth and capital accumulation, which are two channels through which finance may influence economic growth.

King and Levine (1993b) (henceforth KL) study 77 countries over the period 1960-89. To measure financial development, KL focus on DEPTH, which equals the size of the financial intermediary sector. It equals the liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries) divided by gross domestic product (GDP). An important weakness of this measure of financial development is that DEPTH measures the size of the financial intermediary sector. It may not, however, represent an accurate proxy for the functioning of the financial system. It may not proxy for how well bank research firms exert corporate control or provide risk management services to clients. KL experiment with alternative measures of financial development that are designed to gauge who is conducting credit allocation, i.e., whether it is banks or the government, and to where the credit is flowing, i.e., to the private sector or to the government and state-owned enterprises. They obtain similar results with these alternative indicators of financial development (also see La Porta, Lopez-de-Silanes, and Shleifer, 2002).

Table 2

Growth and Initial Financial Depth, 1960-89

	Dependent variables		
	Real per capita GDP growth	Real per capita capital growth	Productivity growth
DEPTH	2.8**	1.9**	2.2**
	(0.001)	(0.001)	(0.001)
R^2	0.61	0.63	0.58

NOTE: Observations: 57.

**Indicates significance at the 5 percent level; p-values are in parentheses.

Variable definitions: DEPTH = liquid liabilities/GDP; productivity growth = real per capita GDP growth – (0.3)*(real per capita capital growth). Other explanatory variables included in each of the nine regression results reported above: logarithm of intial income, logarithm of initial secondary school enrollment, ratio of government consumption expenditures to GDP, inflation rate, and ratio of exports plus imports to GDP.

King and Levine (1993b) define 2 percent growth as 0.02. For comparability with subsequent tables, we have redefined 2 percent growth as 2.00 and adjusted the coefficients by a factor of 100.

SOURCE: King and Levine (1993b, Table VII) and Levine (1997, Table 3).

KL assess the strength of the empirical relationship between DEPTH averaged over the 1960-89 period and three growth indicators also averaged over the same period, *G*. The three growth indicators are as follows: (i) the average rate of real per capita GDP growth, (ii) the average rate of growth in the capital stock per person, and (iii) total productivity growth, which is a "Solow residual" defined as real per capita GDP growth minus (0.3) times the growth rate of the capital stock per person. The analyses include a matrix of conditioning information, *X*, that controls for other factors associated with economic growth (e.g., income per capita, education, political stability, indicators of exchange rate, trade, fiscal, and monetary policy). KL estimated the following regressions:

$$G_j = a + b\text{DEPTH} + cX + u.$$

Adapted from KL, Table 1 indicates that there is a statistically significant and economically large relationship between DEPTH and (i) long-run real per capita growth, (ii) capital accumulation, and (iii) productivity growth. The coefficient on DEPTH implies that a country that increased DEPTH from the mean of the slowest growing quartile of countries (0.2) to the mean of the fastest growing quartile of countries (0.6) would have increased its per capita growth rate by almost 1 percent per year. This is large. The difference between the slowest growing 25 percent of countries and the fastest growing 25 percent of countries is about 5 percent per annum over this 30-year period. Thus, the rise in DEPTH alone eliminates 20 percent of this growth difference. The illustrative example, however, ignores causality and the issue of how to increase DEPTH.

KL also examine whether the value of financial depth in 1960 *predicts* the rate of economic growth, capital accumulation, and productivity growth over the next 30 years. As shown in Table 2, the regressions indicate that financial depth in 1960 is a good predictor of subsequent rates of economic growth, physical capital accumulation, and economic efficiency improvements over the next 30 years, even after controlling for income, education, and measures of monetary, trade, and fiscal policy. Thus, finance does not simply follow growth; financial development predicts long-run growth.

While improving on past work, there are problems with methodology and interpretation in the KL analyses. As noted in the introduction, the proxy measures for financial development, DEPTH and the alternative measures, do not directly measure the ability of the financial system to (i) overcome information asymmetries and funnel credit to worthy firms, (ii) monitor managers effectively and exert corporate governance efficiently, (iii) provide risk management services, or (iv) facilitate exchange and the pooling of savings. This lowers the confidence one has in interpreting the results as establishing a link running from financial development to econ-

omic growth. Also, while KL show that finance predicts growth, they do not deal formally with the issue of causality. Finally, KL focus on only one segment of the financial system—banks. They do not incorporate measures of other components of national financial systems.

Stock Markets, Banks, and Economic Growth

Following Atje and Jovanovic (1993), Levine and Zervos (1998) (henceforth LZ) add measures of stock market and banking development to cross-country studies of growth. Thus, they simultaneously examine two components of the financial system: banks and equity markets. This provides information on the independent impact of stock markets and banks on economic growth. Thus, these analyses help policymakers set reform priorities and influence debates on the comparative importance of different segments of the financial sector (Demirgüç-Kunt and Levine, 2001).

LZ construct numerous measures of stock market development to assess the relationship between stock market development and economic growth, capital accumulation, and productivity. In this paper, I focus on one of the LZ liquidity indicators: the turnover ratio. This equals the total value of shares traded on a country's stock exchanges divided by stock market capitalization (the value of listed shares on the country's exchanges). The turnover ratio measures trading relative to the size of the market. All else equal, therefore, differences in trading frictions will influence the turnover ratio. LZ confirm their results using an assortment of stock market development indicators.[2]

There are difficulties in measuring liquidity, however. First, LZ do not measure the direct costs of conducting equity transactions. LZ simply measure trading, which may reflect differences in the arrival of news and how heterogeneous agents interpret this information. Thus, while we would like a proxy of the ease of trading at posted prices, the data provide only a measure of actual transactions. Second, stock markets may do more than provide liquidity. For instance, stock markets may provide mechanisms for hedging and trading the idiosyncratic risk associated with individual projects, firms, industries, sectors, and countries. Thus, focusing on liquidity may omit important services provided by equity markets and, therefore, mis-measure stock market development. Third, the turnover ratio measures domestic stock transactions on a country's national stock exchanges. The physical location of the stock market, however, may not necessarily matter for the provision of liquidity. This measurement problem will increase if economies become more financially integrated and firms list and issue shares on foreign exchanges.

Recent evidence, however, suggests that focusing on domestic financial markets is relevant. Guiso, Sapienza, and Zingales (2002) study the effects of differences in local financial development within an integrated financial market, Italy. They find that local financial development (i) enhances the probability an individual starts his own business, (ii) increases competition, and (iii) promotes the growth of firms. As predicted by theory, these effects are weaker for larger firms, which can more easily raise funds outside of the local area. Thus, the authors' results suggest that local financial development is an important determinant of the economic success of an area even in an environment where there are no frictions to capital movements.

The turnover ratio exhibits substantial cross-country variability. Very active markets such as Japan and the United States had turnover ratios of almost 0.5 during the period 1976-93. Markets that are less liquid, such as Bangladesh, Chile, and Egypt, had turnover ratios of 0.06 or less.

As summarized in Table 3, LZ find that the initial level of stock market liquidity and the initial level of banking development (bank credit) are positively and significantly correlated with future rates of economic growth, capital accumulation, and productivity growth over the next 18 years, even after controlling for initial income, schooling, inflation, government spending, the black market exchange rate premium, and political stability. To measure banking sector development, LZ use bank credit, which they define as bank credit to the private sector as a share of GDP. This measure of banking development excludes credit issued by the government and the central bank and excludes credits issued to the

[2] LZ (1998) examine three additional measures of liquidity. First, the value-traded ratio equals the total value of domestic stocks traded on domestic exchanges as a share of GDP. This measures trading relative to the size of the economy. The next two measures of liquidity measure trading relative to stock price movements: (i) the value-traded ratio divided by stock return volatility and (ii) the turnover ratio divided by stock return volatility. They also examine a measure of stock market integration. While a vast literature examines the pricing of risk, there exists very little empirical evidence that directly links risk diversification services with long-run economic growth. LZ do not find a strong link between economic growth and the ability of investors to diversify risk internationally.

Table 3

Stock Market and Bank Development Predict Growth, 1976-93

	Independent variables (1976)		
Dependent variables (1976-93)	Bank credit	Turnover	R^2
Real per capita GDP growth	1.31**	2.69**	0.50
	(0.022)	(0.005)	
Real per capita capital growth	1.48**	2.22**	0.51
	(0.025)	(0.024)	
Productivity growth	1.11**	2.01**	0.40
	(0.020)	(0.029)	

NOTE: Observations: 42 for the real per capita GDP growth regression and 41 for the others.

**Indicates significance at the 5 percent level; p-values are in parentheses.

Variable definitions: Bank credit = bank credit to the private sector as a share of GDP in 1976 or the closest date with data; turnover = value of the trades of domestic shares on domestic exchanges as a share of market capitalization of domestic shares in 1976 or the closest date with data; productivity growth = real per capita GDP growth – (0.3)*(real per capita capital growth). Other explanatory variables included in each of the regression results reported above: logarithm of intial income, logarithm of initial secondary school enrollment, ratio of government consumption expenditures to GDP, inflation rate, black market exchange rate premium, and frequency of revolutions and coups.

Levine and Zervos (1998) define 2 percent growth as 0.02. For comparability with subsequent tables, we have redefined 2 percent growth as 2.00 and adjusted the coefficients by a factor of 100.

SOURCE: Levine and Zervos (1998, Table 3).

government and public enterprises. LZ argue that their banking development indicator is better than KL's because nongovernmental financial intermediaries that are allocating credit to private firms are more likely to improve the efficiency of credit allocation and the monitoring of firms than intermediaries that allocate money to the government and public enterprises.

These results are consistent with models that emphasize that stock market liquidity facilitates long-run growth (Levine, 1991; Bencivenga, Smith, and Starr, 1995) and are not supportive of models that emphasize the negative aspects of stock market liquidity (Bhide, 1993). Furthermore, the results do lend much support to models that emphasize the tensions between bank-based and market-based systems. The results suggest that stock markets provide different financial functions from those provided by banks, or else they would not both enter the growth regression significantly.

The sizes of the coefficients are economically meaningful. For example, the estimated coefficient implies that a one-standard-deviation increase in initial stock market liquidity (0.30) would increase per capita GDP growth by 0.80 percentage points per year (2.7*0.3). Accumulating over 18 years, this implies real GDP per capita would have been over 15 percentage points higher by the end of the sample. Similarly, the estimated coefficient on bank credit implies a correspondingly large growth effect. That is, a one-standard-deviation increase in bank credit (0.5) would increase growth by 0.7 percentage points per year (1.3*0.5). Taken together, the results imply that if a country had increased both stock market liquidity and bank development by one standard deviation, then by the end of the 18-year sample period, real per capita GDP would have been almost 30 percent higher and productivity would have been almost 25 percent higher.[3]

Critically for policymakers, LZ do not find that stock market size, as measured by market capitalization divided by GDP, is robustly correlated with growth. Simply listing on the national stock exchange does not necessarily foster resource allocation. Rather, it is the ability to trade ownership of the economy's productive technologies that influences resource allocation and growth.

While LZ incorporate stock markets into the analysis of economic growth, there are problems.

[3] As emphasized throughout, these conceptual experiments do not consider the question of causality or how to change the operation of the financial sector.

First, they do not deal formally with the issue of causality. Second, while LZ (1998) include stock markets, they exclude other components of the financial sector, e.g., bond markets and the financial services provided by nonfinancial firms. Third, as discussed above, the turnover ratio may not accurately measure the ability to trade shares and may miss other important services provided by equity markets.

Using Instrumental Variables To Deal with Simultaneity Bias

To assess whether the finance-growth relationship is driven by simultaneity bias, recent research uses instrumental variables to extract the exogenous component of financial development. To do this, one needs instrumental variables that explain cross-country differences in financial development but are uncorrelated with economic growth beyond their link with financial development. Then, one can use standard instrumental variable procedures to examine the finance-growth relationship while formally controlling for endogeneity.

Levine (1998, 1999) and Levine, Loayza, and Beck (2000) use the La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) (henceforth LLSV) measures of legal origin as instrumental variables. In particular, LLSV show that legal origin—whether a country's commercial/company law derives from British, French, German, or Scandinavian law—importantly shapes national approaches to laws concerning creditors and the efficiency with which those laws are enforced. Since finance is based on contracts, legal origins that produce laws that protect the rights of external investors and enforce those rights effectively will do a correspondingly better job at promoting financial development. Indeed, LLSV trace the effect of legal origin to laws and enforcement and then to the development of financial intermediaries. Since most countries obtained their legal systems through occupation and colonization, the legal origin variables may be plausibly treated as exogenous.

Formally, consider the generalized method of moments (GMM) regression:

$$G_j = a + bF_i + cX + u.$$

G_j is real per capita GDP growth over the 1960-95 period. The legal origin indicators are used as instrumental variables for the measures of financial development, F_i. X is treated as an included exogenous variable.

The validity of the instrumental variables, the *legal origin* dummy variables, requires that they are uncorrelated with the error term, u, i.e., they may affect growth only through the financial development indicators *and* the variables in the conditioning information set, X. I test the null hypothesis that the instrumental variables are uncorrelated with the error term using Hansen's (1982) test of the over-identifying restrictions (OIR-test). If the regression specification "passes" the test, then we cannot reject the statistical and economic significance of the estimated coefficient on financial intermediary development as indicating an effect running from financial development to per capita GDP growth.

In using instrumental variables, Levine, Loayza, and Beck (2000) and Beck, Levine, and Loayza (2000) also develop a new measure of overall financial development. The new measure, private credit, equals the value of credits by financial intermediaries to the private sector divided by GDP. The measure (i) isolates credit issued to the private sector, (ii) excludes credit issued to governments, government agencies, and public enterprises, and (iii) excludes credits issued by central banks. Unlike the LZ bank credit measure, private credit includes credits issued by financial intermediaries that are not classified as deposit money banks by the International Monetary Fund.

As shown in Table 4 (IV cross-country), Beck, Levine, and Loayza (2000) find a very strong connection between the exogenous component of financial intermediary development and long-run economic growth when using cross-country instrumental variables. They also show that the exogenous component of financial development is linked with both capital accumulation and productivity growth. Using various conditioning information sets, i.e., different X's, the results still hold. Furthermore, the data do not reject Hansen's (1982) test of the over-identifying restrictions. Thus, the exogenous component of privately owned banks is positively associated with economic growth

These results suggest an economically large impact of financial development on growth. For example, India's value of private credit over the period 1960-95 was 19.5 percent of GDP, while the mean value for developing countries was 25 percent of GDP. The estimated coefficient suggests that an exogenous improvement in private credit in India

Table 4

Growth, Productivity Growth, and Capital Accumulation, Panel GMM and OLS, 1960-95

Estimation procedure	Private credit	Countries	Observations	OIR test[1]	Sargan test[2] (p-value)	Serial correlation test[3] (p-value)
A. Dependent variable: real per capita GDP growth						
IV cross-country	2.22** (0.003)	63	63	0.577		
GMM panel	2.40** (0.001)	77	365		0.183	0.516
B. Dependent variable: productivity growth						
IV cross-country	1.50** (0.004)	63	63	2.036		
GMM panel	1.33** (0.001)	77	365		0.205	0.772
C. Dependent variable: capital per capita growth						
IV cross-country	2.83** (0.006)	63	63	6.750		
GMM panel	3.44** (0.001)	77	365		0.166	0.014

NOTE: **Indicates significance at the 5 percent level; p-values are in parentheses.

[1]The null hypothesis is that the instruments used are not correlated with the residuals from the respective regression. Critical values for OIR test (2 d.f.): 10 percent = 4.61; 5 percent = 5.99.

[2]The null hypothesis is that the instruments used are not correlated with the residuals from the respective regression.

[3]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

IV cross-country = cross-country instrumental variables with legal origin as instruments, estimated using GMM; GMM panel = dynamic panel (5-year averages) generalized method of moments using system estimator; private credit = logarithm (credit by deposit money banks and other financial institutions to the private sector divided by GDP). Other explanatory variables: logarithm of initial income per capita, average years of schooling.

SOURCE: Beck, Levine, and Loayza (2000).

that would have pushed it to the sample mean for developing countries would have accelerated real per capita GDP growth by an additional 0.6 percentage points per year. These types of conceptual experiments must be treated as illustrative because they do not account for *how* to increase financial intermediary development.

While these analyses confront the causality issue, problems remain. In addition to the previously noted problems of constructing accurate measures of financial development, these cross-country instrumental variable analyses consider only the endogenous determination of the financial development. They treat the other explanatory variables as exogenous. Furthermore, the cross-country instrumental variable studies do not simultaneously consider the independent role of equity markets.

PANEL STUDIES OF FINANCE AND GROWTH

Why Use Panel Techniques?

In light of the problems associated with purely cross-country growth regressions, Levine, Loayza, and Beck (2000) (henceforth LLB) use a GMM estimator developed for panel data (Arellano and Bond, 1991, and Arellano and Bover, 1995). Compared with purely cross-country approaches, the panel

approach has three important advantages and one particular disadvantage. To see these, consider the panel regression specified as follows:

$$y_{i,t} = aX^1_{i,t} + bX^2_{i,t} + C_i + T_t + u_{i,t},$$

where y represents growth, X^1 represents a set of lagged explanatory variables, and X^2 represents a set of contemporaneous explanatory variables, C is an unobserved country-specific effect, T is a time-specific effect, u is the time-varying error term, and i and t represent country and (five-year) time period, respectively.

The first benefit from moving to a panel is the ability to exploit the time-series and cross-sectional variation in the data. LLB construct a panel that consists of data for 77 countries over the period 1960-95. The data are averaged over seven non-overlapping five-year periods. Moving to a panel incorporates the variability of the time-series dimension, exploiting substantial additional variability.

A second benefit from moving to a panel is that in the purely cross-sectional regression, the unobserved country-specific effect is part of the error term so that correlation between C_i and the explanatory variables results in biased coefficient estimates.[4] To control for the presence of unobserved country-specific effects, Arellano and Bond (1991) propose to "first-difference" the regression equation to eliminate the country-specific effect and then use instrumental variables to control for endogeneity. This approach eliminates biases due to country-specific omitted variables.

The third benefit from using a panel is that it overcomes the following problem: the pure cross-country instrumental variable does not control for the potential endogeneity of all the regressors. This problem can lead to inappropriate inferences on the coefficient on financial development. The panel estimator uses instruments based on previous realizations of the explanatory variables to consider the potential endogeneity of the other regressors.

An important disadvantage caused by moving to panel data is that it means employing data averaged over five-year periods. Yet, we are seeking to assess the connection between financial development and long-run growth. To the extent that five years does not adequately proxy for long-run growth, the panel methods may be less precise in assessing the finance-growth relationship than methods based on lower-frequency data.

Results with Financial Intermediation

LLB use panel techniques to study the relationship between financial intermediary development and growth, while Beck, Levine, and Loayza (2000) extend this work to evaluate the relationship between financial development and the sources of growth, i.e., productivity growth and physical capital accumulation. They use many indicators of financial intermediary development and various conditioning information sets to assess robustness (Levine and Renelt, 1992). Table 4 summarizes these results using the private credit measure of financial development described above.

Table 4 indicates a positive relationship between the exogenous component of financial development and economic growth, productivity growth, and capital accumulation. The regressions pass the standard specification tests for panel regressions. Remarkably, the coefficient estimates for the panel estimates are very similar to those obtained using pure cross-sectional instrumental variables. Thus, the large, positive relationship between economic growth and private credit does not appear to be driven by simultaneity bias, omitted country-specific effects, or other problems plaguing cross-country growth regressions.[5]

Stock Markets, Banks, and Growth Revisited

Rousseau and Wachtel (2000) extend the LZ study of stock markets, banks, and growth to a panel context. They use annual data and the panel difference estimator proposed by Arellano and Bond (1991). Thus, they jointly study the impact of bank and equity markets on economic growth.

Beck and Levine (forthcoming) build on Rousseau and Wachtel (2000). Beck and Levine (i) use data averaged over five-year periods to abstract from business-cycle fluctuations, (ii) employ more recent panel procedures that avoid biases associated with difference, and (iii) extend the sample through 1998, which mitigates the potential effect of the Asian stock market boom in the 1990s on the results.

[4] Furthermore, if the lagged dependent variable is included in X^1 (which is the norm in cross-country regressions), then the country-specific effect is certainly correlated with X^1.

[5] Beck, Levine, and Loayza (2000) go on to argue that the finance-capital accumulation link is not robust to alternative specifications, but financial development is robustly linked with both economic growth and productivity growth.

Table 5

Stock Markets, Banks, and Growth: Panel GMM and OLS, 1975-98

Estimation procedure	Bank credit	Turnover	Countries	Observations	Sargan test[1] (p-value)	Serial correlation test[2] (p-value)
OLS cross-country	1.47** (0.001)	0.79** (0.025)	40			
GMM panel	1.76** (0.001)	0.96** (0.001)	40	146	0.488	0.60

NOTE: **Indicates significance at the 5 percent level; p-values are in parentheses.

[1]The null hypothesis is that the instruments used are not correlated with the residuals.

[2]The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

OLS = ordinary least squares with heteroskedasticity-consistent standard errors; GMM = dynamic panel generalized method of moments using system estimator; bank credit = logarithm (credit by deposit money banks to the private sector as a share of GDP); turnover = logarithm (value of the trades of domestic shares on domestic exchanges as a share of market capitalization of domestic shares). Other explanatory variables: logarithm of initial income, logarithm of initial secondary school enrollment.

SOURCE: Beck and Levine (forthcoming, Tables 2 and 3).

Table 5 indicates that the exogenous components of both stock market development and bank development help predict economic growth. Based on Beck and Levine (forthcoming), Table 5 also presents simple ordinary least-squares (OLS) regressions. As shown, the coefficient estimates from the two methods are very similar. The panel procedure passes the standard specification tests, which increases confidence in the assumptions underlying the econometric methodology. While not shown, Beck and Levine (forthcoming) find that stock market capitalization is not closely associated with growth, which confirms the earlier results by LZ. Thus, it is not listing, per se, that is important for growth; rather, it is the ability of agents to exchange ownership claims on an economy's productive technologies that matters.

The Table 5 estimates are economically meaningful and consistent with magnitudes obtained using different methods. If Mexico's turnover ratio had been at the average of the Organisation for Economic Cooperation and Development (OECD) countries (68 percent) instead of the actual 36 percent during the period 1996-98, it would have grown 0.6 percentage points faster per year. Similarly, if its bank credit had been at the average of all OECD countries (71 percent) instead of the actual 16 percent, it would have grown 0.6 percentage points faster per year. These results suggest that the exogenous components of both bank and stock market development have an economically large impact on economic growth. Note, however, using quarterly data and vector autoregressive techniques, Arestis, Demetriades, and Luintel (2001) find that the economic effect of stock market liquidity on growth is positive and significant, but smaller economically than that found in LZ, Rousseau and Wachtel (2000), and Beck and Levine (forthcoming). While differences in data frequency, country coverage, sample period, and econometric technique may account for the differences, future work needs to clarify the economic impact of stock market development on economic growth.

MICROECONOMIC STUDIES OF FINANCE AND GROWTH

Industry-level and firm-level data have also been brought to bear on the question of whether financial development promotes economic growth. By circumventing weaknesses with cross-country and panel studies, the microeconomic research seeks to resolve causality issues and to document in greater detail the mechanisms, if any, through which finance influences economic growth.

Industry-Level Studies

In a very influential study, Rajan and Zingales (1998) (henceforth RZ) use industry-level data to study the mechanisms through which financial development may influence economic growth and to deal rigorously with causality issues. They argue

that better-developed financial systems ameliorate market frictions that make it difficult for firms to obtain external finance. Thus, industries that are naturally heavy users of external finance should benefit disproportionately more from greater financial development than industries that are not naturally heavy users of external finance. If researchers can identify those industries that rely heavily on external finance in an economy with few market frictions—i.e., "naturally heavy users" of external finance—then this establishes a natural test: Do industries that are naturally heavy users of external finance grow faster in economies with better developed financial systems? If they do, then this supports the view that financial development spurs growth by facilitating the flow of external finance.

RZ work under three maintained assumptions: (i) financial markets in the United States are relatively frictionless, (ii) in a frictionless financial system, technological factors influence the degree to which an industry uses external finance, and (iii) the technological factors influencing external finance are reasonably constant across countries. RZ use the external financing of industries in the United States as a benchmark of the external financing needs of industries in a comparatively frictionless financial system. They then develop methods to assess whether industries that are naturally heavy users of external finance grow comparatively faster in countries that are more financially developed.

Consider the equation

$$Growth_{i,k} = aC + bI + cShare_{i,k} + d[External_k * FD_i] + u_{i,k}.$$

$Growth_{i,k}$ is the average annual growth rate of value added in industry k and country i over the period 1980-90. C and I are matrices of country and industry dummies for all countries and industries, respectively. $Share_{i,k}$ is the share of industry k in manufacturing in country i in 1980. $External_k$ is the fraction of capital expenditures not financed with internal funds for U.S. firms in industry k between 1980-90. FD_i is an indicator of financial development for country i. RZ interact the external dependence of an industry (*External*) with financial development (*FD*), where the estimated coefficient on the interaction, d, is the focus of their analysis. Thus, if d is significant and positive, then this implies that an increase in financial development (*FD*) will induce a *bigger* impact on industrial growth ($Growth_{i,k}$) if this industry relies heavily on external finance ($External_k$) than if this industry is not a naturally heavy user of external finance.[6]

This approach allows RZ (i) to study a particular mechanism, external finance, through which finance operates rather than simply assess links between finance and growth and (ii) to exploit within-country differences concerning industries.

RZ use data on 36 industries across 41 countries. To measure financial development, RZ examine (i) total capitalization, which equals the summation of stock market capitalization and domestic credit as a share of GDP, and (ii) accounting standards. As RZ discuss, there are problems with these measures. Stock market capitalization does not capture the actual amount of capital raised in equity markets.[7] RZ use the accounting standards measure as a positive signal of the ease with which firms can raise external funds, while noting that it is not a direct measure of external financing. Beck and Levine (2002) confirm the RZ findings by using alternative measures of financial development.

As summarized in Table 6, RZ find that the coefficient estimate for the interaction between external dependence and total capitalization measure, $External_k * Total\ Capitalization_i$, is positive and statistically significant at the 1 percent level. This implies that an increase in financial development disproportionately boosts the growth of industries that are naturally heavy users of external finance.

RZ note that the economic magnitude is large. Compare the machinery industry with the beverage industry. The former is an industry with a dependence of 0.45 and is at the 75th percentile of the sample; the latter has low dependence, 0.08, and is at the 25th percentile. Now, consider Italy, which has high total capitalization (0.98) and is at the 75th percentile, and the Philippines, which has a capitalization value of 0.46 and is at the 25th percentile of

[6] They do not include financial development independently because they focus on within-country, within-industry growth rates. The dummy variables for industries and countries correct for country- and industry-specific characteristics that might determine industry growth patterns. RZ thus isolate the effect that the interaction of external dependence and financial development/structure has on industry growth rates relative to country and industry means. By including the initial share of an industry, this controls for a convergence effect: industries with a large share might grow more slowly. RZ include the share in manufacturing, rather than the level, to focus on within-country, within-industry growth rates.

[7] Indeed, some countries provide tax incentives for firms to list, which artificially boosts stock market capitalization without indicating greater external financing or stock market development. Also, as discussed above, stock market capitalization does not necessarily reflect how well the market facilitates exchange.

Table 6

Industry Growth and Financial Development
Dependent variable: growth of value added of industy *k* in country *i*, 1980-90

$Share_{i,k}$ of industry *k* in country *i* in 1980	$External_k$ * *total capitalization*$_i$	$External_k$* *accounting* standards$_i$	R^2	Observations
–0.912	0.069		0.29	1217
(0.246)	(0.023)			
–0.643		0.155	0.35	1067
(0.204)		(0.034)		

NOTE: The table above reports the results from the regression: $Growth_{i,k} = aC + bI + cShare_{i,k} + d[External_k*FD_i] + u_{i,k}$. Two regressions are reported corresponding to two values of FD_i, total capitalization, and account standards, respectively; heteroskedasticity-robust standard errors are in parentheses.

$External_k$ = the fraction of capital expenditures not financed with internal funds for U.S. firms in industry *k* between 1980-90; total capitalization = stock market capitalization plus domestic credit; accounting standards = an index of the quality of corporate financial reports.

SOURCE: Rajan and Zingales (1998, Table 4).

total capitalization. Due to differences in financial development, the coefficient estimates predict the following about faster growth in the machinery industry compared with the beverages industry: This difference in growth between the two industries is predicted to be 1.3 percent faster in Italy than in the Philippines. The actual difference is 3.4, so the estimated value of 1.3 is substantial. Thus, financial development has a big impact on industrial growth by facilitating external finance.

Firm-Level Studies

Demirgüç-Kunt and Maksimovic (1998) (henceforth DM) use firm-level data and test whether financial development influences the degree to which firms are constrained from investing in profitable growth opportunities. They focus on the use of long-term debt and external equity in funding firm growth. As in RZ, DM focus on a particular mechanism through which finance influences growth: Does greater financial development remove impediments to firm growth? In contrast to RZ, DM estimate the external financing needs of each individual firm in the sample.

Questioning the assumptions underlying RZ, DM argue that it is important to allow for differences among countries in the amount of external financing needed by firms in the same industry. These differences may arise because firms in different countries employ different technologies, because profit rates may differ across countries, or because investment opportunities and demand may differ.

To control for differences in the need for external finance at the firm level, DM calculate the rate at which each firm can grow using (i) only its internal funds and (ii) only its internal funds and short-term borrowing. They then compute the percentage of firms that grow at rates that exceed each of these two estimated rates. This yields estimates of the proportion of firms in each economy that rely on external financing to grow.

For the largest publicly traded manufacturing firms in 26 countries, DM estimate a firm's potential growth rate using the textbook "percentage of sales" financial planning model.[8] This approach relates a firm's growth rate of sales to its need for investment funds, based on three simplifying assumptions. First, the ratio of assets used in production to sales is constant. Second, the firm's profits per unit of sales are constant. Finally, the economic depreciation rate equals the accounting depreciation rate.

Based on these important maintained assumptions, DM compute the short-term financed growth rate, $STFG_t$, as the maximum growth rate that can be obtained if the firm reinvests all its earnings and obtains enough short-term external resources to maintain the ratio of its short-term liabilities to assets.

Then, DM calculate the proportion of firms whose growth rates exceed the estimate of the maximum growth rate that can be financed by relying only on internal and short-term financing,

[8] Beck, Demirgüç-Kunt, and Levine (2001) confirm the findings using an extended sample.

Table 7

Excess Growth of Firms and External Financing
Dependent variable: proportion of firms that grow faster than their predicted growth rate[1]

Market capitalization/GDP	Turnover	Bank assets/GDP	Adjusted R^2	Countries
–0.106	0.311***	0.162***	0.48	26
(0.058)	(0.072)	(0.050)		

NOTE: ***Indicates significance at the 1 percent level; White's heteroskedasticity-consistent standard errors are in parentheses.

[1]The proportion of firms whose growth rates exceed the estimate of the maximum growth rate that can be financed by relying only on internal and short-term financing.

Market capitalization/GDP = value of domestic equities listed on domestic exchanges as a share of GDP; turnover = total value of trades of domestic shares on domestic exchanges as a share of market capitalization. Other regressors: rate of inflation; the law and order tradition of the economy, i.e., the extent to which citizens utilize existing legal system to mediate disputes and enforce contracts; growth rate of real GDP per capita; real GDP per capita; government subsidies to private industires and public enterprises as a share of GDP; and net fixes assets divided by total assets.

Time period: The dependent variable is averaged over the 1986-91 period. All regressors are averaged over the 1980-85 period, data permitting.

SOURCE: Demirgüç-Kunt and Maksimovic (1998, Table V).

PROPORTION_FASTER. There is quite a bit of cross-country variation in PROPORTION_FASTER. For instance, in Turkey, South Africa, and Pakistan, less than 30 percent of the firms have growth rates that exceed the estimate of the maximum growth rate that can be financed by relying only on internal and short-term financing. In contrast, in Japan, Korea, Singapore, and Thailand, PROPORTION_FASTER is greater than 50 percent. Put differently, in these latter countries, more than half the firms require long-term financing to finance their growth according to the "percentage of sales" financial planning model.

To analyze whether financial development spurs firm growth, DM run the following cross-country regressions:

$$\text{PROPORTION\_FASTER} = a + bFD_{i,t} + cCV_{i,t} + u_{i,t},$$

where *FD* is a variety of measures of financial development, *CV* is a set of control variables, and *u* is the error term. To measure financial development, DM use (i) the ratio of market capitalization to GDP (market capitalization/GDP), (ii) turnover, which equals the total value of shares traded divided by market capitalization, and (iii) bank assets/GDP, which equals the ratio of domestic assets of deposit banks divided by GDP. Thus, DM include all domestic assets of deposit banks, not just credit to the private sector. As control variables, DM experiment with different combinations of control variables, including economic growth, inflation, the average market to book value of firms in the economy, government subsidies to firms in the economy, the net fixed assets divided by total assets of firms in the economy, the level of real per capita GDP, and the law-and-order tradition of the economy.

As summarized in Table 7, DM (1998) find that both banking system development and stock market liquidity are positively associated with the excess growth of firms. Thus, in countries with high turnover and high bank assets/GDP, a larger proportion of firms is growing at a level that requires access to external sources of long-term capital, holding other things constant.[9] Note, consistent with LZ, the size of the domestic stock markets is not related to the excess growth of firms. After conducting a wide array of robustness checks, DM conclude that the proportion of firms that grow at rates exceeding the rate at which each firm can grow with only retained earnings and short-term borrowing is positively associated with stock market liquidity and banking system size.

CONCLUSION

This paper selectively reviews recent empirical work on the relationship between financial development and economic growth. In particular, I discuss cross-country, panel, and microeconomic studies

[9] Recent work examines whether bank-based or market-based financial systems are most conducive for growth (Beck, Demirgüç-Kunt, and Levine, 2001; Beck and Levine, 2002; and Levine, 2002b). While financial development boosts growth, the evidence does not favor either bank-based or market-based systems.

of the finance-growth nexus. As noted in the introduction, I have largely ignored purely time-series studies and detailed country investigations that are reviewed in Levine (2002a).

There are strengths and weaknesses associated with each methodology used to examine the relationship between finance and economic growth. The cross-country work examines a broad number of countries and aggregates over long time periods and thereby focuses on long-run growth. The panel work ameliorates many statistical shortcomings associated with the cross-country work and exploits the time-series dimension of the data. In using higher-frequency data, however, the panel work is less directly linked to long-run growth and may not fully abstract from business-cycle and shorter-run influences. The microeconomic evidence examines particular channels through which finance may influence economic activity and deals with causality concerns. However, the microeconomic studies operate under a number of maintained hypotheses, the validity of which are difficult to ascertain. Finally, one problem plaguing the entire study of finance and growth pertains to the proxies for financial development. While theory suggests that financial systems influence growth by easing information and transactions costs and thereby improving the allocation of capital, corporate governance, risk management, and financial exchanges, the empirical measures do not directly measure these financial functions.

While the different methodologies have distinct strengths and weaknesses, they produce remarkably consistent results. The main conclusions that I garner from recent empirical work are as follows:

- Countries with better-developed financial systems tend to grow faster. Specifically, both financial intermediaries and markets matter for growth. The size of the banking system and the liquidity of stock markets are each positively linked with economic growth.
- Simultaneity bias does not seem to be the cause of this result.
- Better-functioning financial systems ease the external financing constraints that impede firm and industrial expansion. Thus, one channel through which financial development matters for growth is access to external capital, which enables industries and firms to expand.

I state these conclusions simply, but stress that I hold them with a significant degree of skepticism. These findings may certainly be refuted, qualified, and clarified by future work, and I have listed various avenues for future research in the text. Nevertheless, my assessment for now is that a large—albeit not unanimous—body of evidence supports these three conclusions.

To the extent that financial systems exert a first-order influence on economic growth, this motivates research into the determinants of well-functioning financial systems. A new and exciting literature researches this question. Some focus on the direct laws and regulations shaping the operation of financial systems, while complementary work examines the broader political, historical, and institutional determinants of financial development.

In terms of direct laws and regulations, a growing body of work examines how the law and enforcement mechanisms protecting outside investors influence stock markets, banks, and economic growth (LLSV; Beck, Demirgüç-Kunt, and Levine, forthcoming). In other work, La Porta, Lopez-de-Silanes, and Shleifer (2002) argue that government ownership of banks hurt the efficient functioning of the banking system and hence economic growth. Barth, Caprio, and Levine (forthcoming) and others examine the role of bank regulations and supervisory practices on the operation of banks and, hence economic growth (Jayaratne and Strahan, 1996; Demirgüç-Kunt, Laeven, and Levine, 2002; Beck, Demirgüç-Kunt, and Levine, forthcoming). In terms of international issues, Levine (2002c) finds that regulatory restrictions on foreign bank entry hurt the efficiency of bank operations. Furthermore, Bekaert, Harvey, and Lundblad (2001) show that international financial liberalization improves the operations of financial systems with positive effects on economic growth. But, Levine and Schmukler (2002) find that international cross-listing by emerging market firms can hurt the operation of the emerging market itself, with adverse implications for economic development (Guiso, Sapienza, and Zingales, 2002). As a final example of work examining specific policies, some research highlights the importance of inflation on the functioning of stock markets and banks (Boyd, Levine, and Smith, 2001).

More broadly, some research studies the underlying forces shaping the laws, regulations, and institutions that form the "rules of the game" governing financial arrangements. Rajan and Zingales (2002 and 2003a,b) and Pagano (2001) focus on how political-economy forces induce governments to

repress or encourage financial development, while Guiso, Sapienza, and Zingales (2000) examine the role of social capital in shaping financial systems. Finally, some scholars stress the role of geographical endowments on the formation of long-lasting institutions that shape financial systems (Engerman and Sokoloff, 1997; Acemoglu, Johnson, and Robinson, 2001; Beck, Demirgüç-Kunt, and Levine, 2002; Easterly and Levine, 2003). This work is building a wide-array of evidence on which laws, regulations, and policies work best to promote growth-enhancing financial systems and on the political and historical determinants of financial systems.

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Commentary

Luigi Zingales

THE WEAK LINKS

Ten years ago the literature on the relation between finance and growth was set on its modern course by the publication of King and Levine's (1993) influential paper. Much of the following work in this area was done by Ross Levine and his coauthors. Thus, none better than Levine himself could summarize the progress over the past decade, in the struggle to move from a correlation between financial development and economic development (Goldsmith, 1969) to establishing a causal relation between finance and growth.

Levine emphasizes advances along two dimensions. First, in the measures of financial development. Goldsmith (1969) relied on the ratio of the value of financial intermediary assets to gross domestic product (GDP) as his only measure of financial development. Levine and coauthors have used many different variables, e.g., the liquid liability to GDP ratio, the credit in the private sector to GDP ratio, and the level of stock market turnover. Rajan and Zingales (1998) have even used the quality of accounting standards as a measure of a firm's ability to raise funds. Nevertheless, as I will discuss momentarily, this first area is probably where less progress has been made.

The second and more important dimension emphasized by Levine's survey is in the attempt to establish causality. This is the area where most innovations have taken place. Their first step was to use the time dimension to identify the cause-effect relation (King and Levine, 1993), relying on the old "post hoc ergo propter hoc" argument. Levine and coauthors have subsequently enriched this approach using dynamic panel estimation, and further progress has been made in the use of instrumental variables (Rajan and Zingales, 1998, and Levine, 1998 and 1999). In both cases they use the La Porta et al. (1998) measures of legal origin as instrumental variables. I will discuss later whether and when these can be considered good instruments.

A third step in trying to establish causality, which is not adequately surveyed by Levine, is the "natural experiment" approach. In a very clever paper, Jayaratne and Strahan (1996) use the banking deregulation across U.S. states as an exogenous change in financial development. This omission, justified on the basis of a decision not to focus on within-country studies, is the only shortcoming in Levine's survey. Personally, I trust much more the natural experiment approach than the more sophisticated, but less robust, dynamic panel estimation techniques.

The final step in the quest for a causal link, amply summarized by Levine, is to look in more detail at the mechanism through which finance spurs growth (see, e.g., Rajan and Zingales, 1998, and Demirgüç-Kunt and Maksimovic, 1998).

In spite of this minor quibble, Levine's survey does an excellent job of summarizing the progress made in the past decade. In 1993 many people doubted that there was a relation between finance and growth; now very few do. Since Levine has documented so well what has been done, my role as a discussant is to describe what remains to be done. I will focus, thus, on the weak links in the quest for a reliable relation between finance and growth that policymakers can use in their decisions. I focus on six such weak links.

Good Institutions vs. Finance

As La Porta et al. (1999 and 2002) document, there is a set of countries that seem to be doing "the right thing" in many dimensions: Their legal enforcement is better, their level of generalized trust higher, their judicial system more efficient and independent; they have less corruption, less regulation, more respect for property rights, and better-developed financial markets. Each institution taken individually has a positive effect on economic growth. Yet there are too many (highly correlated)

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variables and too few countries to be able to reliably identify the effect that one institution has compared with another.

To make the problem worse, all these variables are measured with errors. Thus, a multiple regression may fail to identify which of these variables really matter.

Finally, these characteristics seem to be very persistent. In fact, all are highly correlated with the country from which their legal system originated. Thus, neither dynamic panel estimation techniques nor instrumental variables (when the instrument is correlated with the omitted factor) can help us separate the effect of financial development from the effect of other good institutions.

One could argue that the natural experiment approach followed by Jayaratne and Strahan (1996) or the more micro approach followed by Rajan and Zingales (1998) and Demirgüç-Kunt and Maksimovic (1998) can address this issue. In part, this is true. If I had to convince a policymaker of the importance of this relation, I would start from this evidence.

Nevertheless, not even this evidence is bullet proof. In the natural experiment approach, there is always a possibility that unobserved factors caused both the deregulation and the higher growth of some states. For example, Kroszner and Strahan (1999) show that one of the factors driving deregulation was the diffusion of automated teller machines (ATMs). This diffusion was not homogenous. ATMs arrived sooner in California than in Arkansas. This is not uncorrelated with California being better than Arkansas at capturing the growth opportunities provided by new technologies.

An omitted variable is even more of a problem in Demirgüç-Kunt and Maksimovic's (1998) approach. After computing a firm-based measure of financial constraints, they collapse it into a country-level indicator. In so doing, they fall back into a traditional country-level regression, which prevents them from controlling for country-specific factors, as Jayaratne and Strahan (1996) and Rajan and Zingales (1998) do.

By exploiting the channel through which finance should have an effect, Rajan and Zingales (1998) make it more difficult for spurious correlation to drive their results. For such correlation to exist, both their measure of external financial dependence and their instrumented measure of financial development would need to be spuriously correlated in the "right" direction. Potentially, the most serious source of trouble could be that external financial dependence acts as proxy for growth opportunities in the more technologically advanced sectors, which have better opportunities for growth in economically developed countries (which tend to be also more financially developed). Rajan and Zingales (1998), however, consider this possibility and add to their specification an interaction between their measure of external dependence and the per capita GDP, as a proxy for the state's economic development. While this addition reduces the size of the coefficient of financial development, the coefficient remains both economically and statistically significant. Nevertheless, the possibility remains that financial development (instrumented by the legal origin variables) is a better proxy for technological sophistication than per capita GDP.

In sum, while enormous progress has been made in the last decade toward establishing a causal link between finance and growth, we still do not have the smoking gun.

Measures of Financial Development

For the relation between finance and growth to be used as a policy tool, we need to improve our measure of financial development. Thus far, the literature has mostly relied on the measures that were easily available, with few links to what theory suggests the measure should be.

More problematically, some of these measures can be misleading from a policy point of view. Consider, for instance, the proxy of financial market development employed by Levine and Zervos (1998): volume of stock traded relative to their market capitalization. There is no question that—as the authors say—improvement in liquidity should be beneficial to the economy and that liquidity is positively correlated with trading volume. Nevertheless, more stock trading is not necessarily beneficial. More volume can increase stock volatility, as shown in a clever paper by French and Roll (1986). And nobody would dare argue that the diffusion of day trading has been beneficial to the economy. Nevertheless, an unsophisticated policymaker, who took the Levine and Zervos (1998) evidence seriously, would conclude that donating a computer and an E*Trade® account to every household in Africa would benefit the economic growth of that continent!

Thus, one dimension in which this literature must progress is in its measure of financial development. From this point of view, it would be useful to go back to fundamentals. From a theoretical point of view, the right measure would capture the ease with which any entrepreneur or company with a

sound project could obtain finance and the price at which this finance could be obtained. A developed financial system should provide broader access to finance at a lower cost.

All measures currently used are only vaguely related to this notion. For example, most papers use the credit to GDP ratio, but Jayaratne and Strahan (1996) show that after banking deregulation, when the efficiency of the financial system most likely went up, the level of bank debt to GDP did not go up. It was only the percentage of bad loans that went down.

Rajan and Zingales (1998) attempt to devise a measure of financial development that is more linked to theory. They use the quality of the accounting standards, which is more likely to be correlated with the ease of raising external funds than with any of the previous measures.

More recently, Guiso, Sapienza, and Zingales (2002) (GSZ) tried to develop a more theory-based measure of financial development. Since the right theoretical measure should capture the ease with which entrepreneurs with sound projects can obtain finance, they compute the local variation in households' access to credit. By using a rich data set of Italian households, which includes their answer to the question "Have you been denied credit or been discouraged from applying for credit in the past year?" they can identify where, ceteris paribus, households have easier access to credit. To distinguish between overlending and efficient provision of funds, they control for the percentage of bad loans in the area. Not only is this a measure related to the theoretical notion of financial development, it is also a variable that policymakers can target in hopes of obtaining the desired final effect.

One potential problem with this approach is that the measure of financial development may capture local variation that is correlated with access to credit. To guard against this potential problem, GSZ instrument their measure of financial development by using some historical constraints present in the Italian banking system. This specificity, however, limits the applicability of this method to other environments. Hence, more work is needed on this dimension.

Mechanisms Through Which Finance Works

Much of the literature has focused on proving that the observed correlation between finance and growth is causal. Less attention has been focused on understanding the channels through which finance works. Establishing the main channel is important not only for instilling confidence in the theory of a causal link, but also from a policy point of view. Only by understanding the channel through which this relation works can we help policymakers design effective policies to promote growth.

Identifying the most important channels will also help us settle the question of which aspects of the financial system are more important. Most studies agree that having a more developed banking sector is better than having an underdeveloped one. But there is still a lot of uncertainty about whether a developed equity market provides an additional benefit, even more so if the development of the equity market occurs at the expense of the development of the banking system.

One approach in establishing the main channels is to derive some cross-sectional implications about which firms or industries would benefit the most from financial development. This is the approach followed by Rajan and Zingales (1998).

Another approach is to trace the effects of financial development from the micro evidence to the macro. For example, Rajan and Zingales (1998) show that financial development provides greater benefit to the growth in the number of establishments than to the growth in the average size of the establishment. This would suggest that one of the channels through which finance affects growth is by promoting entrepreneurship. Not only do GSZ find such evidence in their Italian micro data set, but they also show how this effect translates into a higher growth of firms in more financially developed areas and ultimately in higher GDP growth. More evidence of this kind is needed.

Does Domestic Financial Development Matter?

All the evidence on the impact of finance on growth has measured the development of finance at the country level and ignored the possibility that financial institutions and markets from a neighboring country could substitute for deficiencies in the domestic financial system. In the past, this was not such a strong assumption. International capital movements were extremely limited. In recent years, however, private capital flows have grown dramatically. International listings also grew dramatically over the 1990s. Now, more Israeli companies are

listed in Nasdaq than in Tel Aviv. It is legitimate to ask, then, whether Israel needs a local capital market. This question is extremely important from a policy point of view. Do emerging markets need to develop their domestic financial institutions and markets or, in the current scenario with high capital mobility, can they piggyback on the financial systems of developed countries?

Unfortunately, this is a difficult question to answer empirically. The integration of national financial markets is so recent that we lack a sufficiently long time series to estimate its impact in the data. At the same time, the pace of integration is so fast that, if we were to establish that national financial development mattered for national growth during the past decade, we could not confidently extrapolate this result to the current decade.

To try to assess the relevance for growth of national financial institutions and markets in an increasingly integrated capital market, GSZ follow a different approach. Rather than study the effect of financial development across countries, they study the effect of local financial development within a single country—one that has been unified for the past 140 years—Italy. The level of integration achieved in Italy probably represents an upper bound for the level of integration that international financial markets can reach. The authors find that local financial development matters for growth within Italy. Hence, one can safely conclude that national financial development will continue to matter for national growth in the foreseeable future.

It still remains to be established, however, to what extent foreign institutions can substitute domestic ones. Consistent with Petersen and Rajan (2002), GSZ's evidence suggests that small firms encounter barriers to distance lending. They do not find these barriers for large firms. Thus, domestic financial development might be an issue for small firms only.

Other Effects of Financial Development

Thus far, the literature has focused on the effects of finance on GDP growth, with occasional reference to investment and total factor productivity growth. Not only is this single-minded focus unwarranted—because there are several aspects we care about besides economic growth—but it is also harmful. These are conditions of the economic system that might impact the long-run ability to grow, such as competition, firm size, and industry concentration, but also aspects we care about directly, such as social mobility and income distribution. There are sound theoretical reasons why financial development might impact these variables. Greater access to funds, for instance, facilitates new entry of firms, which breeds competition. At the same time, it makes it easier for poor individuals to exploit their talents, promoting social mobility but also, possibly, worsening the income distribution. Thus, there is no justification for ignoring these aspects.

To be fair, there is already evidence on some of these effects. Haber (1991) presents an interesting case study of the effects of financial development in promoting competition. Similarly, GSZ show that, in more financially developed areas, firms' mark-ups are lower, indicating more intense competition. Finally, Cetorelli (2001) shows that a more concentrated financial sector is associated with larger firms.

Not only are these effects interesting, per se, they might also shed light on the political support (or lack thereof) for financial development. If finance breeds competition, then incumbent firms might not be so thrilled to see finance develop. I will return to this issue momentarily.

In this search for the additional effects of financial development, it is important to acknowledge the possible negative effects. While the overwhelming evidence at this point suggests a positive overall effect of finance, it is well possible that financial development also has negative consequences. For example, are financially developed systems more prone to financial crisis or bubbles? The possibility exists. Kaminsky and Reinhart (1999), for instance, show that in 18 of 26 banking crises in the past two decades, the financial sector was liberalized in the preceding 5 years. More research is needed on this issue as well.

What Causes Financial Development?

Thus far, all the literature points to financial development as being beneficial. So then, if finance is indeed so good, why don't we see more of it? What does cause financial development (or lack thereof)? This question is important from the perspective of both theory and policy. From a theoretical point of view, as stated earlier, only by understanding the real causes of financial development can we devise the appropriate instruments to identify the causal relation between finance and growth.

From a policy perspective, this is probably the most important question. It is of little use to know that a relation between finance and growth exists

if policymakers do not know how to promote financial development. What do we know on this count?

La Porta et al. (1997) show a strong correlation between financial development (and, in particular, financial markets development) and the presence of a legal and regulatory infrastructure. Their conjecture is that, for external finance to develop, investors need to be protected by laws and regulations. This conjecture is supported by further work. Dyck and Zingales (2002), for instance, show that private benefits of control are lower in countries with better laws and regulations, suggesting that outside investors are indeed better protected there. They also show that markets with a lower level of private benefits are more developed.

This evidence, however, compels the question of why these better laws and regulations are not introduced in all countries. La Porta et al. (1998) claim that there is something specific to common-law tradition that makes a common-law country more protective of property rights and in particular more attentive to investors' property rights. In La Porta et al. (1998) they identify a number of statutes that protect investors, and they show that these statutes are more often present in common-law countries than in civil-law countries.

The source of the difference, however, cannot be so simplistic. If there is political will, civil-law countries can easily copy common-law statutes. Hence, either those statutes are not the source of the difference or the problem resides in the lack of political will. In several papers, Andrei Shleifer and coauthors have explored alternative reasons why common-law countries protect investors more. They have focused on the three aspects that differentiate them: the general stance of government, i.e., their degree of interventionism; the structure of the legal system, in particular the politicization of judges; and the strength of common-law principles, such as "smell tests." Of these three, only the last is intrinsically linked to the essence of the common-law tradition, making it hard to export in civil-law counties. The other two compel the same question: If there is political will, why don't civil-law countries imitate the more successful institutions of common-law countries?

As suggested, a possible answer is that these countries lack political will. In fact, Rajan and Zingales (2001, 2003) point out that reforms to promote financial development can be opposed by the dominant elite, who benefit from oligopolistic and nontransparent markets. Since these elites are wealthy and well connected, they could easily shape political action even in well-established democracies. But their power is reduced when a country is open to foreign goods and capital. Consistent with this interpretation, they find evidence that financial markets develop the most in countries and in periods of free capital and goods mobility.

An additional explanation is that better laws and regulations simply reflect a more fundamental trait of some countries or communities, where people vote, obey the law, and cooperate with each other and whose leaders are honest and committed to the public good (Putnam, 1993 and 1995). As Guiso, Sapienza, and Zingales (2000) show, these characteristics, often labeled "social capital," are highly correlated with the use and the availability of financial instruments at the local level and with financial development across countries. Unfortunately, we still know very little about what causes social capital to use these findings as an effective policy tool.

In sum, the debate on the causes of financial development is still in its infancy and a lot more remains to be learned.

CONCLUSION

In his survey, Levine emphasizes how much we have learned in the past decade about the relation between finance and growth. Here, I have stressed how much we still need to know before this relation can be confidently used for policy purposes. In this area, the next decade promises to be as exciting as the past one.

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Equity Market Liberalization in Emerging Markets

Geert Bekaert, Campbell R. Harvey, and Christian T. Lundblad

One of the most important national policy decisions of the past 25 years has been the financial liberalization of equity markets across the world. Equity market liberalizations give foreign investors the opportunity to invest in domestic equity securities and domestic investors the right to transact in foreign equity securities.

It is important to distinguish between the concepts of liberalization and integration. For example, a country might pass a law that seemingly drops all barriers to foreign participation in local capital markets. This is a liberalization—but it might not be an effective liberalization that results in market integration. Indeed, there are two possibilities in this example. First, the market might have been integrated before the regulatory liberalization. That is, foreigners might have had the ability to access the market through other means, such as country funds and depository receipts. Second, the liberalization might have little or no effect because either foreign investors do not believe the regulatory reforms will be long lasting or other market imperfections exist.

Liberalizations must be dated to be studied, but pinpointing specific dates is difficult because countries have pursued varied liberalization strategies. Our paper begins by analyzing the progress that has been made on dating liberalizations. We examine regulatory changes, the ability of investors to access the local market via proxies such as country funds, and the behavior of foreign portfolio holdings.

If liberalization is effective, it leads to market integration, which has a fundamental impact on both the financial and real sectors of developing countries. Our paper also summarizes some recent research on the impact of liberalization on the real sector.

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FINANCIAL LIBERALIZATION

Official Equity Market Liberalization

As a start, Bekaert and Harvey (2000) (BH) provide a detailed examination of the key economic events that could potentially impact the financial liberalization and reform process in a large number of emerging countries.[1] Further, to explore the effects of foreign access to domestic equity markets, BH date an "official equity market liberalization" for each country—that is, a date of formal regulatory change giving foreign investors the opportunity to invest in domestic equity securities and domestic investors the right to transact in foreign equity securities. For example, Brazil rewrote its foreign investment law in May 1991. Resolution 1832 Annex IV stipulated that foreign institutions can own up to 49 percent of voting stock and 100 percent of nonvoting stock. Similarly, January 1992 signified a partial opening of the Korean stock market to foreigners, after which foreign investors could own up to 10 percent of domestically listed firms. In Table 1, we present the BH official liberalization dates for 30 emerging equity markets. As can be observed, many liberalizations are clustered in the late 1980s or early 1990s. Based upon the chronologies presented in BH, Table 2 provides a more detailed analysis describing the particular regulatory changes that occurred at the BH official liberalization date. Generally, as in the examples provided above, these reforms involved (for the first time) the removal of restrictions on foreigners holding domestic equities. Further, these dates generally correspond to the liberalization dates provided by the International Finance Corporation (IFC); however, there are other "equity market liberalization" dates provided in this literature which, employing somewhat different

[1] Detailed BH chronologies for each of the emerging market countries presented here are available in the country risk analysis at < http://www.duke.edu/~charvey/Country_risk/couindex.htm > .

Table 1

Equity Market Opening in Emerging Countries

Country	Official liberalization date	First ADR introduction	First country fund introduction	Estimate of increase in net U.S. capital flows
Argentina (ARG)	11/89	08/91	10/91	04/93
Bangladesh (BGD)	06/91	NA	NA	NA
Brazil (BRA)	05/91	01/92	10/87	06/88
Chile (CHL)	01/92	03/90	09/89	01/88
Colombia (COL)	02/91	12/92	05/92	08/93
Côte d'Ivoire (CIV)	95	NA	NA	NA
Egypt (EGY)	92	11/96*	NA	NA
Greece (GRC)	12/87	08/88	09/88	12/86
India (IND)	11/92	02/92	06/86	04/93
Indonesia (IDN)	09/89	04/91	01/89	06/93
Israel (ISR)	11/93	08/87*	10/92	NA
Jamaica (JAM)	09/91	06/93*	NA	NA
Jordan (JOR)	12/95	12/97*	NA	NA
Kenya (KEN)	01/95	NA	NA	NA
Korea (KOR)	01/92	11/90	08/84	03/93
Malaysia (MYS)	12/88	08/92	12/87	04/92
Mexico (MEX)	05/89	01/89	06/81	05/90
Morocco (MAR)	06/88	04/96*	NA	NA
Nigeria (NGA)	08/95	05/98*	NA	NA
Pakistan (PAK)	02/91	09/94*	07/91	04/93
Philippines (PHL)	06/91	03/91	05/87	01/90
Portugal (PRT)	07/86	06/90	08/87	08/94
South Africa (ZAF)	96	06/94*	03/94	NA
Sri Lanka (LKA)	05/91	03/94*	NA	NA
Taiwan (TWN)	01/91	12/91	05/86	08/92
Thailand (THA)	09/87	01/91	07/85	07/88
Trinidad & Tobago (TTO)	04/97	NA	NA	NA
Tunisia (TUN)	06/95	02/98*	NA	NA
Turkey (TUR)	08/89	07/90	12/89	12/89
Venezuela (VEN)	01/90	08/91	NA	02/94
Zimbabwe (ZWE)	06/93	NA	NA	NA

NOTE: The official liberalization dates, date of first ADR issuance, and first country fund are based on Bekaert and Harvey (2000), augmented here to include ten additional emerging markets. The estimate of the break point in U.S. equity portfolio holdings is obtained from Bekaert and Harvey (2000), using the algorithm in Bai, Lumsdaine, and Stock (1998). The asterisks denote that we obtained "effective dates" from the Bank of New York (<http://www.adrbny.com>). The other "announcement" dates are from Miller (1999); however, he notes that the announcement usually preceeds the issue by only 40 days, on average. For South Africa, the first ADR introduction date is associated with the post-apartheid period; there were many ADRs in the early 1980s, which we ignore. NA represents not available.

criteria, do differ significantly from those provided by BH for certain countries (see Henry, 2000a, Kim and Singal, 2000, and Levine and Zervos, 1998b).

To illustrate the difficulty associated with dating market integration, Table 3 presents chronologies of major economic events for two countries, Brazil and Korea. For example, over the 20-year period presented, Brazil (shown in panel A) introduced insider trading laws, undertook macroeconomic reforms, employed several different exchange rate regimes, and gradually allowed increased foreign direct and portfolio investment. Additionally, these events were not one-directional, as exchange rate and trade restrictions were reintroduced over the reform time-line. Taken together, this multifaceted reform effort makes the dating of economic and financial integration a matter of judgment, particularly as this and previous work are interested in isolating the financial and economic effects of an equity market liberalization (see Bekaert, Harvey, and Lundblad, 2001 and 2002). Further, Brazil is by no means unique or unusual; in panel B, we display the comparable chronology for Korea, which exhibits the same challenging features. For example, Korea was admitted into the United Nations and initiated a political rapprochement with the Democratic People's Republic of Korea in 1991, the same year to which BH ascribe the equity market liberalization. This complete series of events makes the analysis somewhat challenging. Unfortunately, the simultaneity of macroeconomic, political, and financial reform is not the only factor potentially confounding an examination of a single reform's key economic effects. In practice, there are additional factors that may cloud the importance of the particular regulatory changes that BH (and others) document. First, it is possible that the investment restrictions were not binding prior to the reform. Second, the official regulatory changes permitting foreign investment are often implemented gradually. For instance, as can be observed in Table 3, the restrictions foreigners faced when investing in Korean securities were lifted only gradually throughout the 1990s. Hence, dating the "official liberalization" is not unambiguous. Third, although countries might undertake official regulatory reform efforts, foreign investors may still face significant liquidity costs; Chuhan (1994), for example, reports that market participants in many industrialized countries mentioned liquidity concerns as one of the major impediments to investing in emerging markets.

Alternative Entry: Country Funds and American Depository Receipts

Another challenge when dating an equity market liberalization is that many of these emerging markets were already indirectly open to foreign investment prior to official reform by way of country funds and American depository receipts (ADRs). A closed-end country fund is an investment company that invests in a portfolio of assets in a foreign country but issues a fixed number of shares domestically. Closed-end mutual funds were the original vehicles for foreign investment in emerging financial markets. For example, the Korea Fund partially opened up the Korean equity market to foreign investors in 1984, long before the capital market liberalizations of 1991. In contrast, ADRs are rights to foreign shares that trade in dollars on a U.S. exchange or over the counter. Further, since ADRs are treated as U.S. securities in most legal situations, they enable mutual funds, pension funds, and other U.S. institutions to hold securities that are fungible with foreign shares. Table 1 details the earliest country fund and ADR introduction for the emerging markets in our sample.

The Intensity of Liberalization

Market integration is usually a gradual process, and the speed of the process is determined by the particular situation in each individual country. When one starts from the segmented state, the barriers to investment are often numerous. Bekaert (1995) details three different categories of barriers to emerging market investment: (i) legal barriers; (ii) indirect barriers that arise because of information asymmetry, accounting standards, and investor protection; and (iii) risks that are especially important in emerging markets such as liquidity, political, economic policy, and currency risk. These barriers discourage foreign investment, and it is unlikely that any/all of these barriers disappear at a single point in time. Since reform is usually a gradual process, the usual 0/1 indicators variables are perhaps too coarse, failing to capture the intensity or comprehensiveness of the liberalization.

Empirical models have been developed that allow the degree of market integration to change through time (see Bekaert and Harvey, 1995). This moves us away from the static segmented/integrated paradigm to a dynamic partial segmentation/partial integration setting. Whereas these models are indirect, relying on a model and econometric estimation to infer changes in the degree of integration, there are more direct measures available. Bekaert (1995)

Table 2

Classifying an Official Equity Market Liberalization

Country	Official liberalization date	
Argentina (ARG)	11/89	Free repatriation of capital, remittance of dividends, and capital gains.
Bangladesh (BGD)	06/91	Purchases of Bangladesh shares and securities by nonresidents, including nonresident Bangladeshis, in stock exchange in Bangladesh allowed, subject to meeting procedural requirements.
Brazil (BRA)	05/91	Foreign investment law changed. Resolution 1832 Annex IV stipulates that foreign institutions can now own up to 49% of voting stock and 100% of nonvoting stock. Economic ministers approve rules allowing direct foreign investments; 15% tax on distributed earnings and dividends but no tax on capital gains. Foreign investment capital must remain in country for 6 years (was 12 years). Bank debt restructuring agreement.
Chile (CHL)	01/92	Liberalization of foreign investment, reducing the minimum holding period and tax on investment income.
Colombia (COL)	02/91	Foreigners have the same rights as domestic investors.
Côte d'Ivoire (CIV)	95	National Assembly approves a new Ivoirian Investment Code. For all practical purposes, there are no significant limits on foreign investment—or differences in the treatment of foreign and national investors—either in terms of levels of foreign ownership or sector of investment.
Egypt (EGY)	92	Capital Market Law 95 grants foreign investors full access to capital markets. There are no restrictions on foreign investment in the stock exchange.
Greece (GRC)	12/87	Liberalization of currency controls allows foreigners to participate in the equity market and to repatriate their capital gains.
India (IND)	11/92	Government announces that foreign portfolio investors will be able to invest directly in listed Indian securities
Indonesia (IDN)	09/89	Minister of Finance allows foreigners to purchase up to 49% of all companies listing shares on the domestic exchange, excluding financial firms.
Israel (ISR)	11/93	Nonresidents allowed to deposit into nonresident accounts all incomes received from Israeli securities and real estate, even if these were purchased from sources other than nonresident accounts.
Jamaica (JAM)	09/91	All inward and outward capital transfers permitted, except that financial institutions must match their Jamaican dollar liabilities to their clients with Jamaican dollar assets.
Jordan (JOR)	12/95	Foreign investment bylaws passed, allowing foreign investors to purchase shares without government approval.
Kenya (KEN)	01/95	Restrictions on investment by foreigners in shares and government securities removed. The Capital Market Authority Act amended to allow foreign equity participation of up to 40% of listed companies, while individuals are allowed to own up to 5% of listed companies.
Korea (KOR)	01/92	Partial opening of the stock market to foreigners. Foreigners can now own up to 10% of domestically listed firms; 565 foreign investors registered with the Securities Supervisory Board.

Table 2 cont'd

Classifying an Official Equity Market Liberalization

Country	Official liberalization date	
Malaysia (MYS)	12/88	Budget calls for liberalization of foreign ownership policies to attract more foreign investors.
Mexico (MEX)	05/89	Restrictions on foreign capital participation in new direct foreign investments liberalized substantially.
Morocco (MAR)	06/88	Foreigners permitted to subscribe to two Treasury bond issues of June 1988; repatriation of capital and income from the investment granted.
Nigeria (NGA)	08/95	Nigerian market open to foreign portfolio investment.
Pakistan (PAK)	02/91	Restrictions removed on foreigners or nonresident Pakistanis purchasing shares of a listed company or subscribing to public offerings of shares, subject to some approvals.
Philippines (PHL)	06/91	Foreign Investment Act signed into law. The Act removes, over a period of three years, all restrictions on foreign investments.
Portugal (PRT)	07/86	All restrictions on foreign investment removed except for arms-sector investments.
South Africa (ZAF)	96	Restrictions on foreign membership in the Johannesburgh Stock Exchange lifted.
Sri Lanka (LKA)	1/90	Companies incorporated abroad permitted to invest in securities traded at the Colombo Stock Exchange, subject to the same terms and conditions as those applicable to such investments by approved national funds, approved regional funds, and nonresident individuals.
Taiwan (TWN)	01/91	Implementation date of phase two of liberalization plan. Eligible foreign institutional investors may now invest directly in Taiwan securities, subject to approval.
Thailand (THA)	09/87	Inauguration of the Alien Board on Thailand's Stock Exchange. The Alien Board allows foreigners to trade stocks of those companies that have reached their foreign investment limits.
Trinidad & Tobago (TTO)	04/97	Companies Act in force. Under the Companies Ordinance and the Foreign Investment Act, a foreign investor may purchase shares in a local corporation. However, foreign investors must obtain a license before they can legally acquire more than 30% of a publicly held company.
Tunisia (TUN)	06/95	Inward portfolio investment partially liberalized.
Turkey (TUR)	08/89	Foreign investors permitted to trade in listed securities with no restrictions at all and pay no withholding or capital gains tax provided they are registered with the Capital Markets Board and the Treasury.
Venezuela (VEN)	01/90	Decree 727 opens foreign direct investment for all stocks except bank stocks.
Zimbabwe (ZWE)	06/93	Zimbabwe Stock Exchange opened to foreign portfolio investment, subject to certain conditions.

Table 3

Most Important Events

Panel A: Brazil

Date	
76	Introduction of insider trading laws.
78	First prosecution under insider trading laws.
02/86	Cruzado plan (price and wage controls).
09/86	Fixed nominal exchange rate abandoned.
01/87	Major provisions of Cruzado plan abandoned.
03/87	CVM Resolution 1289 Annex II limits foreign direct investment through special conditions.
89	Deposit rates fully liberalized. Mehrez and Kaufmann liberalization date.
03/90	Collor Plan introduces a new currency and taxes stock-market transactions heavily.
91	Elimination of exclusive broker system. Creation of NYSE-like system.
05/91	Foreign investment law changed. Resolution 1832 Annex IV stipulates that foreign institutions can now own up to 49% of voting stock and 100% of non-voting stock. Economic ministers approve rules allowing direct foreign investments; 15% tax on distributed earnings and dividends but no tax on capital gains. Foreign investment capital must remain in country for 6 years (was 12 years). Bank debt restructuring agreement.
05/91	**Bekaert/Harvey official liberalization date.**
06/30/92	Foreign investors authorized to operate in the options and futures markets related to securities, exchange, and interest rates.
94	Banking crises (1994-95).
10/94	New 15% tax on all consumer loans and installment payments by banks and businesses.
03/06/95	New exchange-rate system based on bands introduced. Band set at R$0.86 to R$0.90 per U.S. dollar until May 2, when it changed to R$0.86 to R$0.98 per U.S. dollar.
05/95	Trade policy turns inward as import quotas introduced and tariffs increased.
10/97	Brazil stock market suffers from the domino effect caused by Hong Kong market crash; $5 billion of reserves used to defend the currency.
11/97	Brazil's legislature approves austerity package.

and Edison and Warnock (2001) propose a continuous measure of equity market "openness" designed to reflect the foreign "investability" of these markets. The measure is based on the ratio of the market capitalization of the constituent firms comprising the IFC investable index to those that comprise the IFC global index for each country. The IFC global index, subject to some exclusion restrictions,[2] is designed to represent the overall market portfolio for each country, whereas the IFC investable index is designed to better represent a portfolio of domestic equities that are available to foreign investors. Hence, a ratio of 1 means that all of the stocks are available to foreign investors.

We present the "investability" measure in Figure 1 for two of the markets we consider, Brazil and Korea. As can be seen, for these countries, this measure increases over time, potentially reflecting the intensity of the liberalization. Indeed, the investability measure for Korea begins at 0 in 1989 and increases to just below 1 by 2001. For comparison, we also note for each country the BH official liberalization date. In each case, the (first) major regulatory reform is indeed associated with a significant increase in the investability measure; however, the move certainly does not suggest full foreign access subsequent to the official date. Rather, the official liberalization date is generally associated with the first big jump in this measure, but large moves in the investability index may follow. For instance, foreign access to the Korean equity market increased

[2] For a more complete description of the methodology behind the construction of the SP/IFC indices, see Standard & Poor's (2000).

Table 3 cont'd

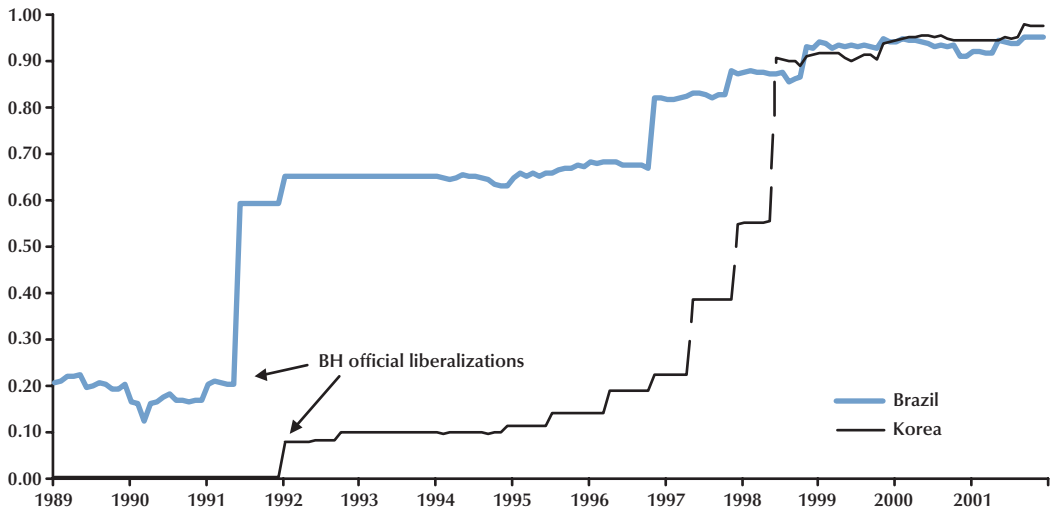
Most Important Events

Panel B: Korea

Date	
04/87	Trade liberalization measures announced.
07/01/87	Certain tax privileges granted to attract FDI reduced, and after-investment controls relaxed to put foreign-invested companies and local companies on the same basis.
12/28/87	Overseas investments by Korean residents of less than US$1 million automatically approved, and the upper limit on investment free from government screening increased from US$3 million to US$5 million, regardless of purposes of investment.
89	Foreign exchange controls phased out.
11/90	First ADR announced.
01/03/91	Market opening to foreign investors. Notification system makes authorization of foreign investment subject to approval or notification. Foreign participation easier under new law. Repatriation of capital freely permitted.
09/91	Korea admitted into the United Nations. Announcement that stock market will open to investors in January 1992.
01/92	Partial opening of the stock market to foreigners. Foreigners can now own up to 10% of domestically listed firms; 565 foreign investors registered with the Securities Supervisory Board.
01/92	**Bekaert/Harvey official liberalization date.**
12/94	Limit of foreign ownership of domestically listed firms raised from 10% to 12%. Government announces intention to raise the overall limit from 12% to 15% in 1995.
05/95	International financial institutions permitted to issue won-denominated bonds in the domestic financial market.
07/95	Government raises foreign stock ownership limit from 12% to 15% and the limit for single investors from 3% to 5%. Registration period for foreign investment decreased from 14 to 5 days.
09/95	Government announces foreign firms will be able to list on the Korean Stock Exchange as of 1996.
04/01/96	Ceilings on securities investments by residents abolished.
05/96	Limit of foreign ownership of domestically listed firms raised from 15% to 18%.
09/96	Government relaxes foreign ownership restrictions from 18% to 20% and from 12% to 15% for state-owned enterprises.
05/97	Government raises foreign ownership restriction from 20% to 23%.
11/97	Government raises the foreign share-holding limit from 23% to 26%; state-run firms' limits raised to 21% from 18%.
12/97	Government announces new 50% foreign investment ceiling.
05/98	Foreign investment limit on Korean securities raised to 55%. Foreign investment limit on state-run corporations boosted from 25% to 30%.
05/25/98	Controls on capital and money market instruments: Foreigners free to purchase domestic collective investment securities without restriction. Controls on direct investment: Foreign investors allowed to take over corporations, except defense-related companies, and the ceiling on the amount of stock foreigners may acquire in all companies without the approval of the board of directors is abolished.

Figure 1

Equity Market Liberalization Intensity



SOURCE: Edison and Warnock (2001).

significantly in 1997 and 1998 (see Table 3) and is associated with large jumps in the investability index. The corresponding intensity measures for other countries are very similar (see Edison and Warnock, 2001, for a more detailed analysis of this measure across a large collection of emerging markets).

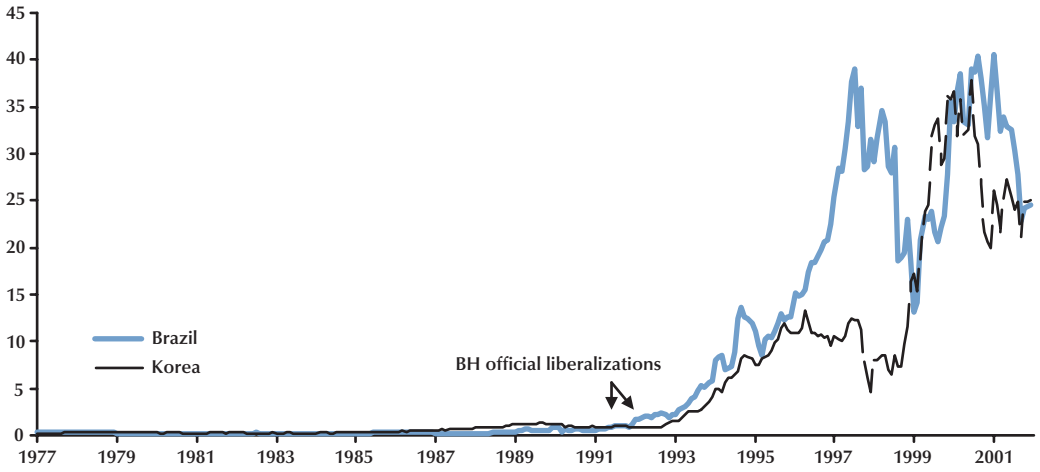
Foreign Equity Portfolio Holdings

A second alternative designed to measure the intensity or quality of reforms is to directly investigate changes in the level of foreign equity portfolio holdings in these countries. It makes sense that as barriers to entry decrease in emerging equity markets, foreign capital flows in. One would like to document the observable points at which foreign investors are significantly changing their portfolio holdings in these markets, but, unfortunately, the data are somewhat limited along this dimension. The only high-frequency data available are U.S. net capital flows to emerging markets, published monthly in the *U.S. Treasury Bulletin*. If one is willing to take the U.S. transactions as a proxy for more general foreign equity market activity in these countries, then an estimate of U.S. ownership can be obtained by cumulating the net equity flow data (adjusting for local equity market appreciation). The United States' presence in these markets is likely to be highly correlated with the aggregate foreign presence.

Nevertheless, U.S. holdings estimates based upon the net portfolio flow data are not without problems. First, foreign investors may not hold the precise equity portfolio employed to account for the value appreciation in the cumulation of the net flows. Second, the U.S. data on cross-border purchases and sales of securities indicate where U.S. investors are purchasing foreign securities, but not the bona fide residence of the issuer of the foreign security. Hence, large observed net flows to financial centers may actually reflect emerging equity market investment through these intermediaries that one is unable to track, and so estimates of U.S. portfolio holdings may be consequently understated. The Bureau of Economic Analysis (BEA) conducted benchmark surveys of actual U.S. holdings of foreign securities in March 1994 and December 1997 and 2000. Warnock and Cleaver (2002) show that estimated U.S. equity portfolio holdings based upon the cumulated U.S. net equity flows starting in 1994 differ significantly in many cases from the benchmark survey amounts as of 1997. They find that U.S. holdings of foreign securities are indeed substantially underestimated, suggesting many U.S. transactions in foreign securities are going through intermediaries in other countries, particularly the United Kingdom.

Figure 2

Estimated U.S. Equity Portfolio Holdings (US$ Billions)



SOURCE: Thomas and Warnock (2002).

To deal with this shortcoming, Thomas and Warnock (2002) provide modified estimates of U.S. equity portfolio holdings that employ the monthly net equity flow data, but are also anchored at the BEA survey of U.S. holdings amounts in 1994 and 1997. This methodology exploits the high-frequency feature of the U.S. net flow data, but corrects for the documented underestimation by also employing the infrequent but high-quality, survey-based U.S. holdings data. Similar to BH and Bekaert, Harvey, and Lumsdaine (2002a,b), they form baseline holdings estimates, denoted $Own_{i,t}$, at the end of a month by adjusting the previous month's holdings for estimated price and exchange rate changes and then add the current month's net purchases:

$$(1) \qquad Own_{i,t} = Own_{i,t-1} * (1 + R_{i,t}) + Flow_{i,t},$$

where $Own_{i,t}$ is the estimated U.S. holdings of country i's securities at the end of month t; $Flow_{i,t}$ is the net U.S. purchases of country i's securities during month t; and $R_{i,t}$ is an appropriate equity return (with dividends) required to revalue last period's holdings. They also correct for transaction costs and stock swaps. Recall that these unadjusted U.S. holdings amounts will be understated. According to the December 1997 data, for example, this methodology resulted in a holdings estimate $Own_{i,12/1997}$ that differed significantly from the benchmark survey. Thomas and Warnock (2002) also employ a grid search methodology to adjust the net equity flows in each inter-survey month by an amount that will equate $Own_{i,12/1997}$ to its benchmark survey level.[3] For many countries, the estimates extend back to 1977, but some begin later as the equity price data necessary for the valuation adjustment are not uniformly available. In Figure 2, we display the estimated U.S. holdings of Brazilian and Korean equities, along with the associated BH official equity market liberalization dates. As can be seen, the estimated holdings are effectively zero in dollar terms prior to the official liberalization; but they subsequently explode, reaching $24.3 and $24.8 billion (U.S.), respectively, by the end of 2001.

Estimated Breaks in U.S. Equity Portfolio Holdings. BH and Bekaert, Harvey, and Lumsdaine (2002a) employ similar estimates of U.S. equity portfolio holdings to test for a structural break in the ownership series to econometrically identify the point at which the foreign presence in these markets increases significantly. The idea is that a structural shift in the foreign presence in the markets may be a better indicator of the quality of equity market liberalization; however, it should be noted that foreign capital will also be attracted by strong growth opportunities in addition to consid-

[3] For 16 of the emerging markets considered in this paper, Thomas and Warnock were kind enough to share their adjusted estimates of U.S. equity holdings.

erations such as the comprehensiveness, quality, and stability of capital market reforms. Note, the holdings data reflect both increased U.S. net transactions as well as the significant (and well documented) equity appreciation observed for these markets over the post-liberalization period (see BH and Henry, 2000a). Consequently, to control for the valuation component, they divide these figures by the domestic equity market capitalization. BH and Bekaert, Harvey, and Lumsdaine (2002a) employ the endogenous break point tests detailed in Bai, Lumsdaine, and Stock (1998), which search for a break in the mean within the context of an autoregressive model for the U.S. ownership series. Additionally, the procedure yields a break date with a 90 percent confidence interval. We report the BH estimated portfolio holdings break dates in the last column of Table 1. As can be seen, there are several countries for which the official liberalization date and estimated break date are within a year or two of one another; see, for example, Turkey which has an official liberalization in August 1989 and an estimate of the portfolio holding break date in December of that same year. In contrast, there are several countries for which the dates are quite different (see, for example, Argentina, Portugal, and Venezuela). Taken together, the lack of uniformity across these dates presents a challenge to researchers in this area. For this reason, it is important to evaluate the robustness of any estimated liberalization effects to alternative dating schemes.

In Figure 3 (panels A through P), we present the ratio of the estimated U.S. equity portfolio holdings (from Thomas and Warnock, 2002) to the market capitalization of the Morgan Stanley Capital International (MSCI) (2001) indices for each country (which they use to make valuation adjustments). Below each estimate, we provide the BH official liberalization date, the date associated with either the first country fund or ADR, and the estimated break date. Additionally, we highlight key macroeconomic, trade, legal, and financial reforms that may impact foreign interest and/or access. As can be seen, across almost all of the countries considered, estimated U.S. holdings of domestic equities in these countries comprised almost none of the domestic market capitalization at the start dates; in contrast, by the end of 2001, the U.S. equity holdings exceeded 25 percent, on average, of the MSCI index capitalization across these markets, with several countries exceeding 50 percent. It is important to realize that these holdings do not reflect the percent of total market capitalization held by U.S. residents because the MSCI indices represent only between 50 percent and 70 percent of the total market capitalization. Hence, a 25 percent holding translates approximately into a (0.25 times 0.6 =) 15 percent U.S. holding. These figures, showing a strong upward trend in almost every case, demonstrate a dramatic change in the importance of foreign investors to the domestic equity markets in each of these countries over the past two decades. The more important question, however, is whether this increased foreign presence has significantly altered or improved (i) the level of financial development and (ii) real economic development through growth. These questions are the subject of our recent work (see Bekaert, Harvey, and Lundblad, 2001 and 2002).

ECONOMIC EFFECTS OF FINANCIAL LIBERALIZATION

There are a number of channels through which financial liberalization may affect the real economy. First, once they are allowed access, foreign investors, exploiting the benefits of diversification, will drive up domestic equity market values; BH and Henry (2000a) demonstrate that the cost of capital falls subsequent to major regulatory reforms that permit foreign investors access to domestic equity markets. Second, Henry (2000b) and Bekaert, Harvey, and Lundblad (2002) document that aggregate domestic investment increases significantly after liberalization, potentially stimulating economic growth. There is also a booming literature (see, for example, Atje and Jovanovic, 1993, King and Levine, 1993, and Levine and Zervos, 1998a) that associates enhanced economic growth with deeper financial markets and banking sectors. Because equity market liberalization promotes financial development and liquidity (see Bekaert, Harvey, and Lundblad, 2002), this may provide an additional channel through which liberalization stimulates growth. Finally, as foreign investors may demand improved corporate governance and transparency in these countries, liberalization may reduce the wedge between costs of external and internal financing at the firm level, stimulating corporate investment (see Love, 2000). In this paper, we summarize some recent evidence on the liberalization effects on real gross domestic product (GDP) and investment growth for a collection of developing economies that house emerging equity markets.

For a collection of emerging and frontier markets

Figure 3A

U.S. Share of MSCI Market Capitalization in Argentina

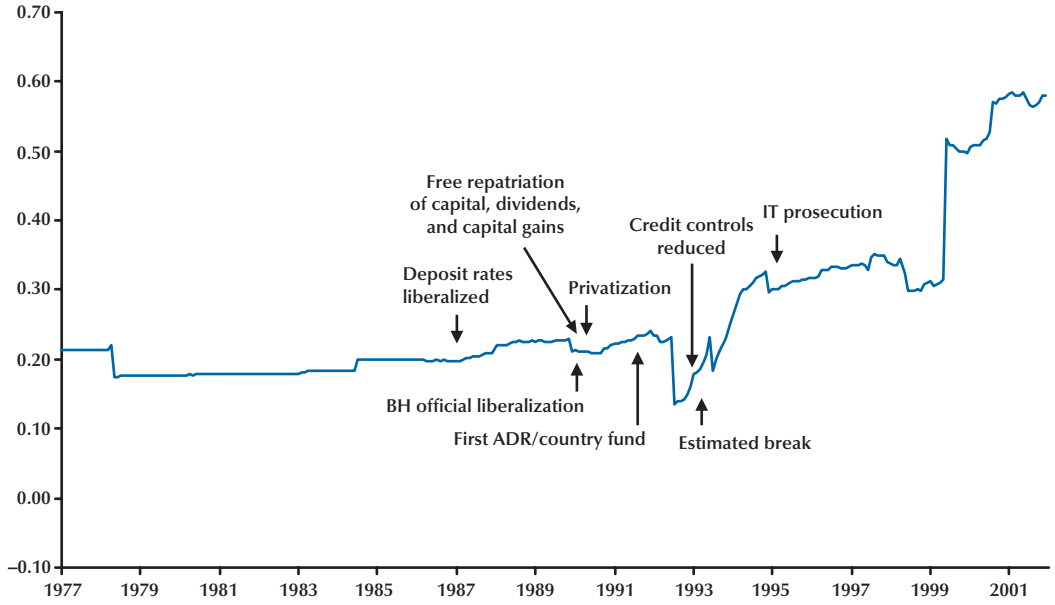


Figure 3B

U.S. Share of MSCI Market Capitalization in Brazil

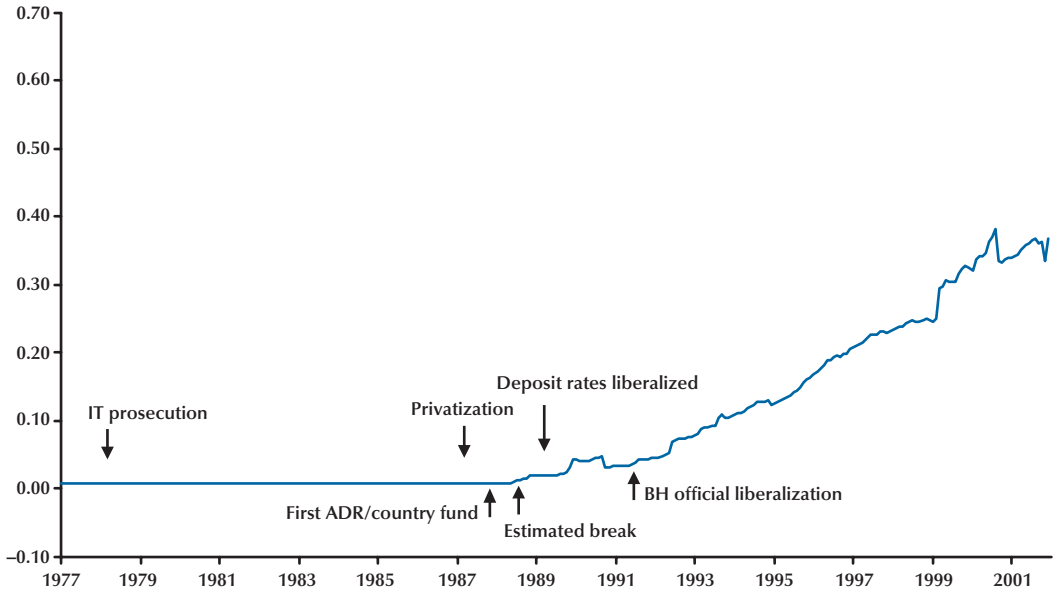


Figure 3C

U.S. Share of MSCI Market Capitalization in Chile

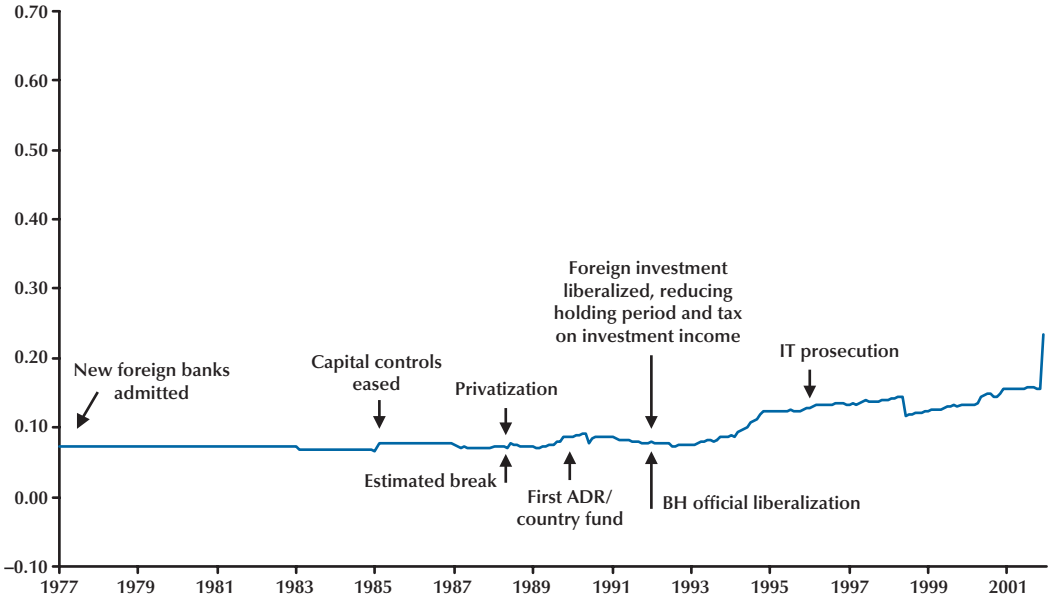


Figure 3D

U.S. Share of MSCI Market Capitalization in Colombia

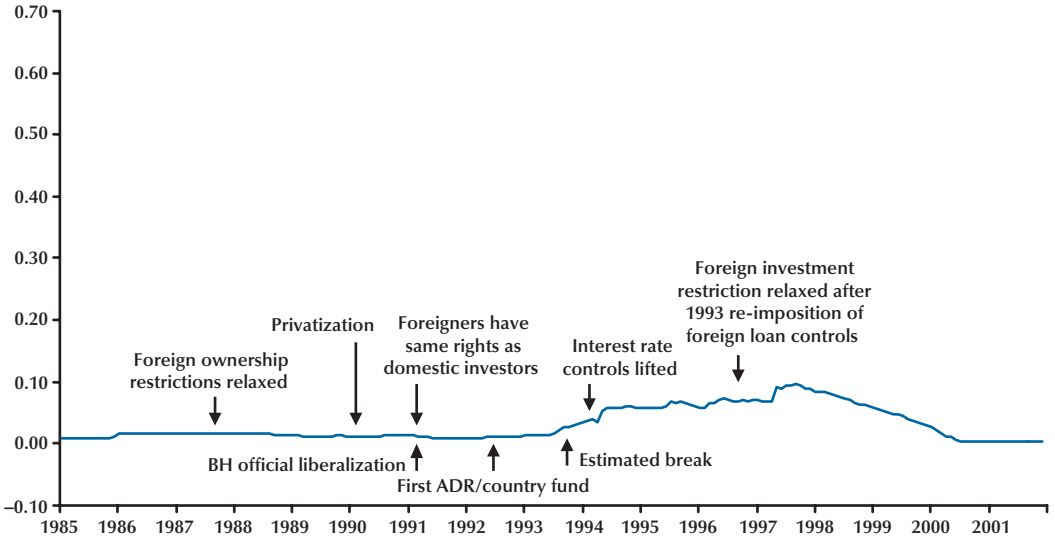


Figure 3E

U.S. Share of MSCI Market Capitalization in Greece

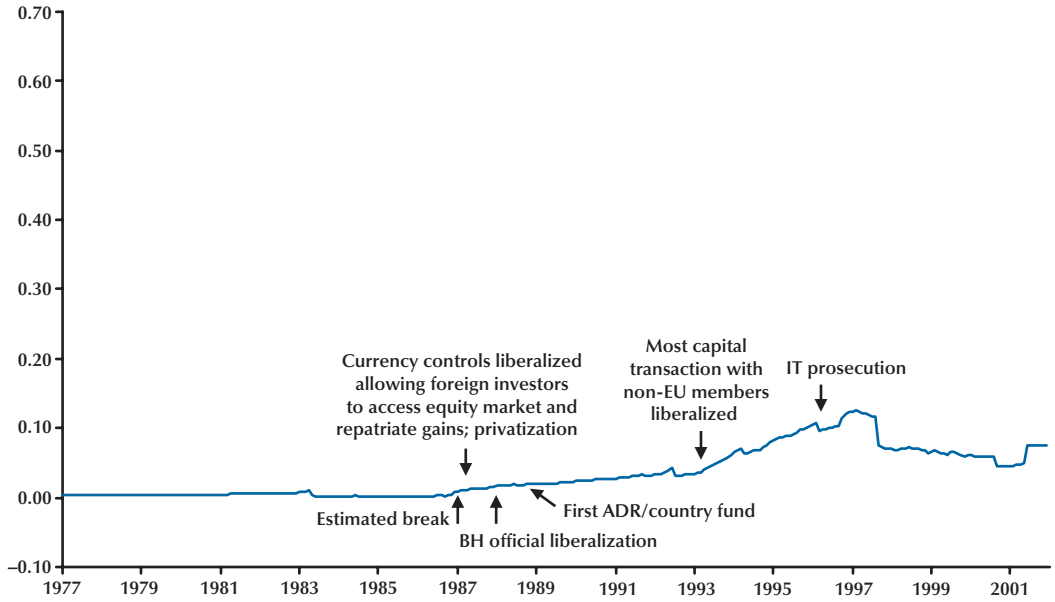


Figure 3F

U.S. Share of MSCI Market Capitalization in India

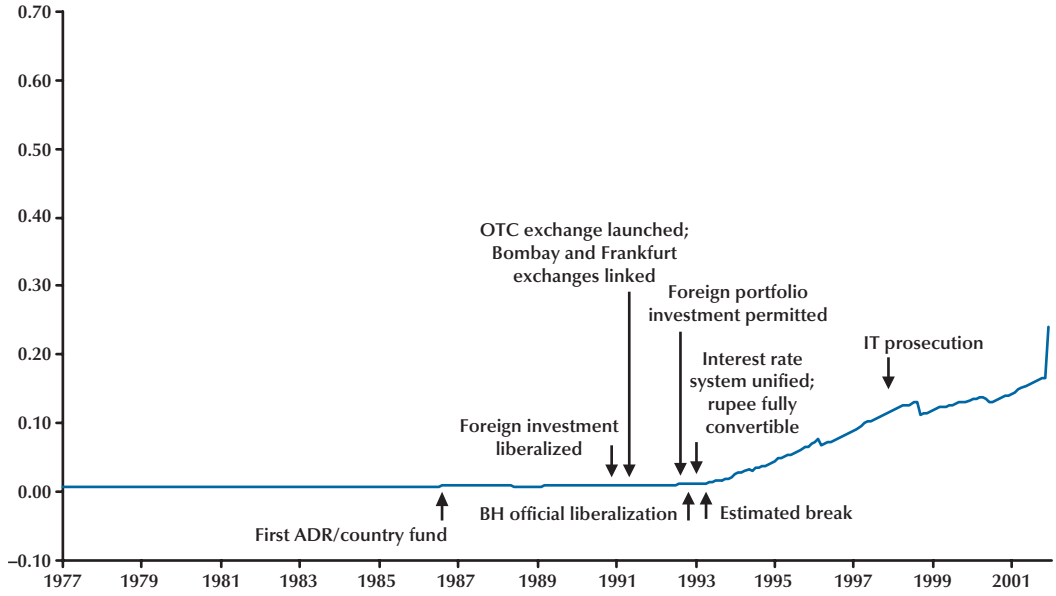


Figure 3G

U.S. Share of MSCI Market Capitalization in Indonesia

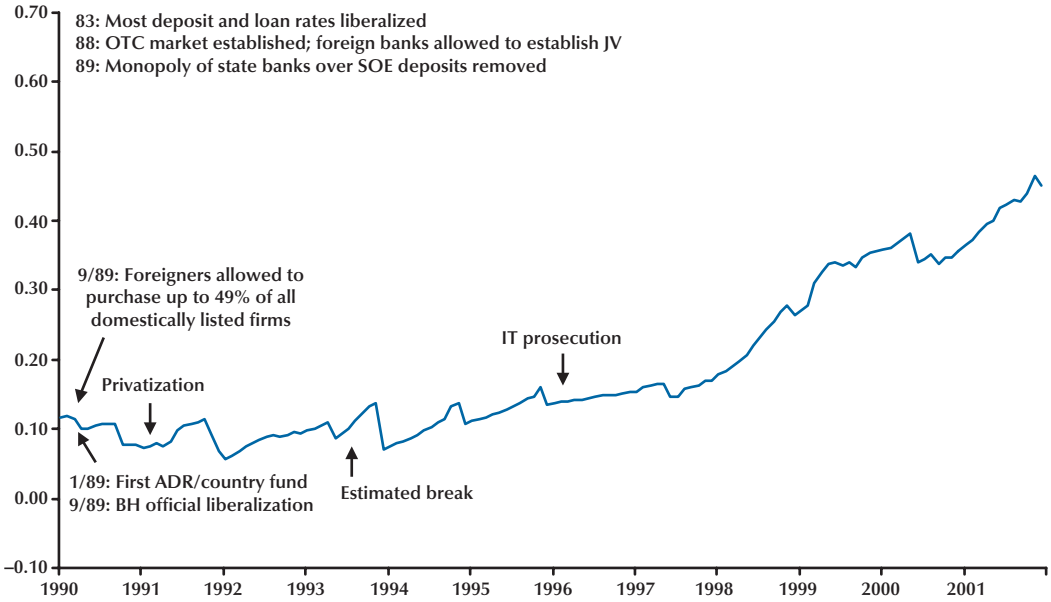


Figure 3H

U.S. Share of MSCI Market Capitalization in Korea

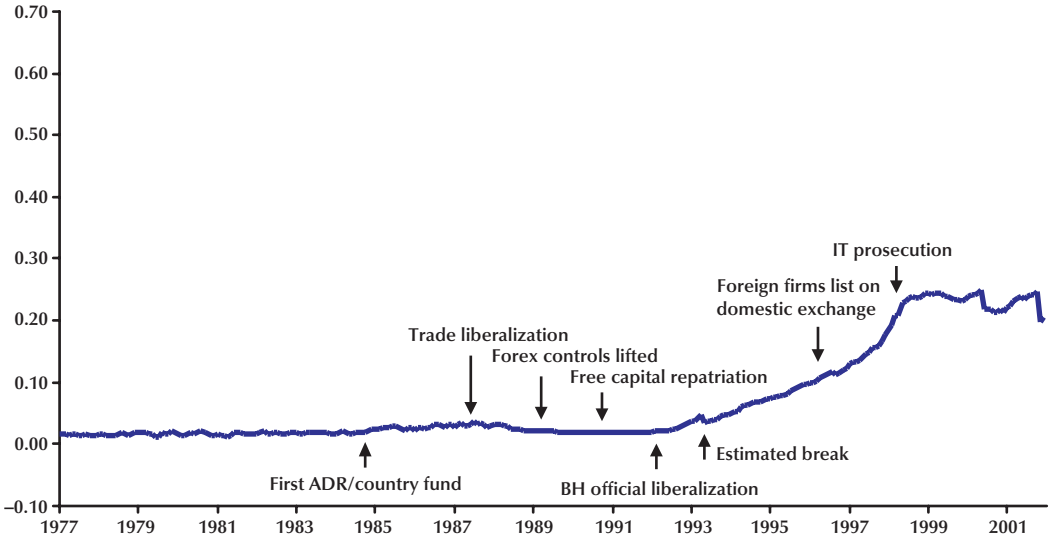


Figure 3I

U.S. Share of MSCI Market Capitalization in Malaysia

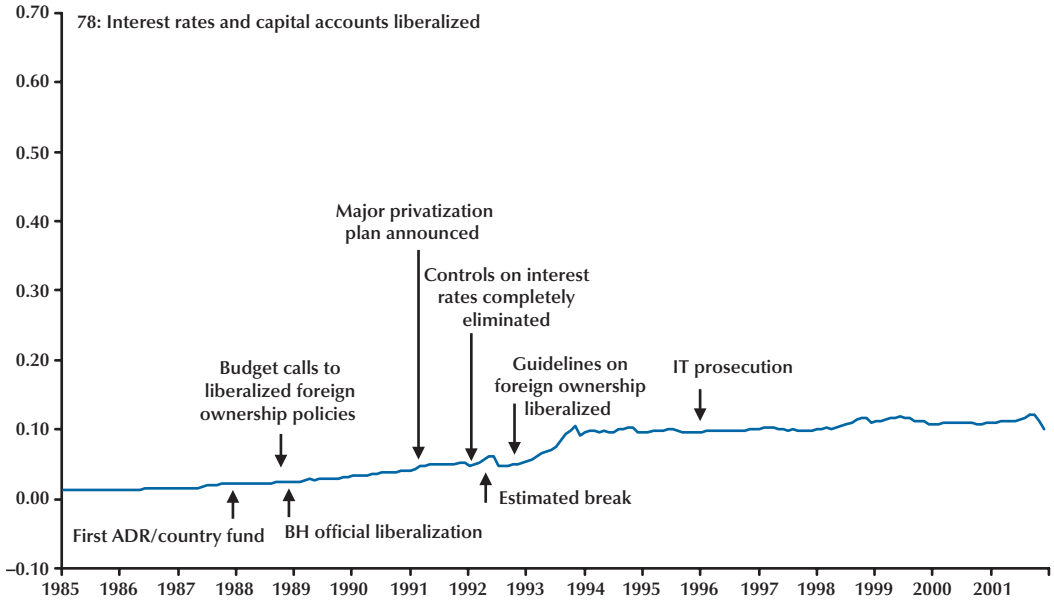


Figure 3J

U.S. Share of MSCI Market Capitalization in Mexico

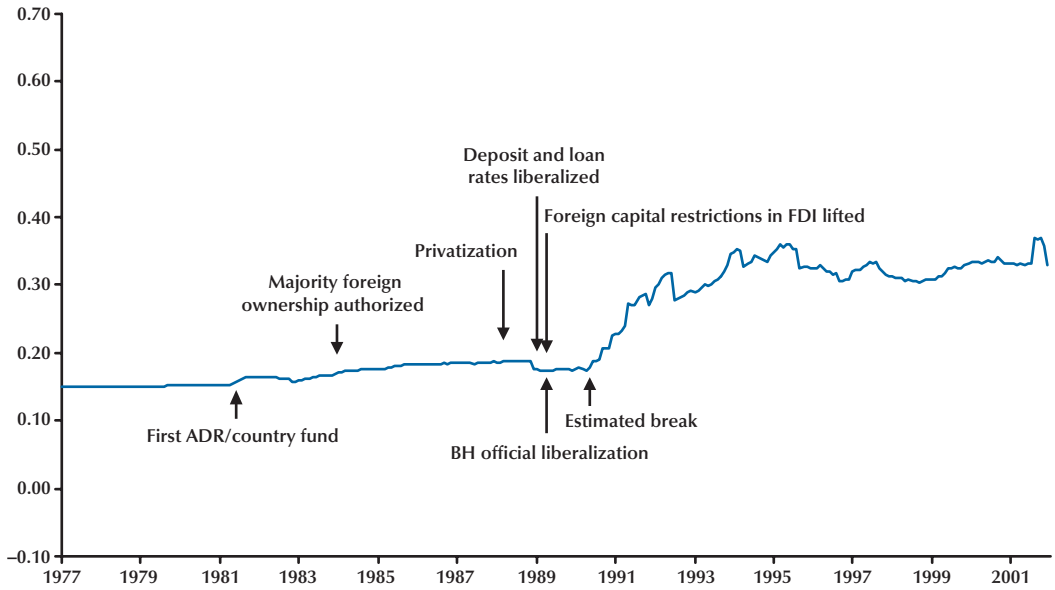


Figure 3K

U.S. Share of MSCI Market Capitalization in Philippines

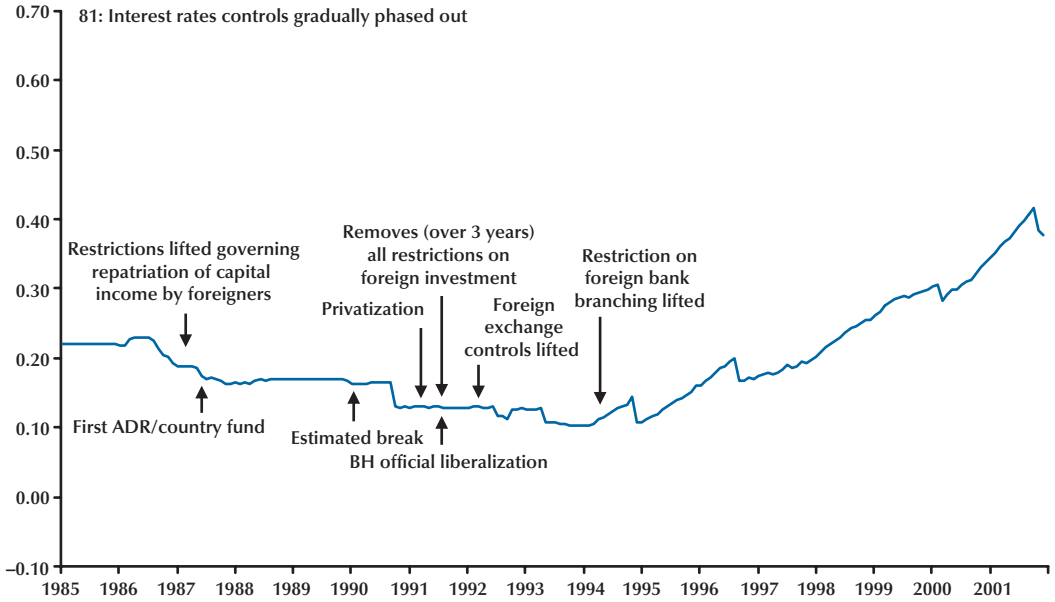


Figure 3L

U.S. Share of MSCI Market Capitalization in Portugal

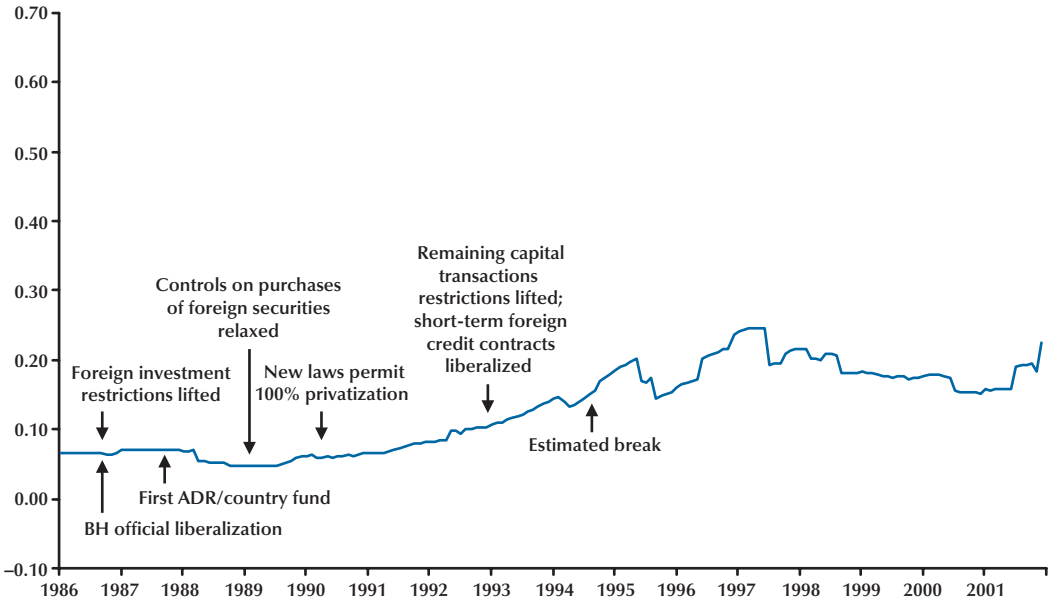


Figure 3M

U.S. Share of MSCI Market Capitalization in Taiwan

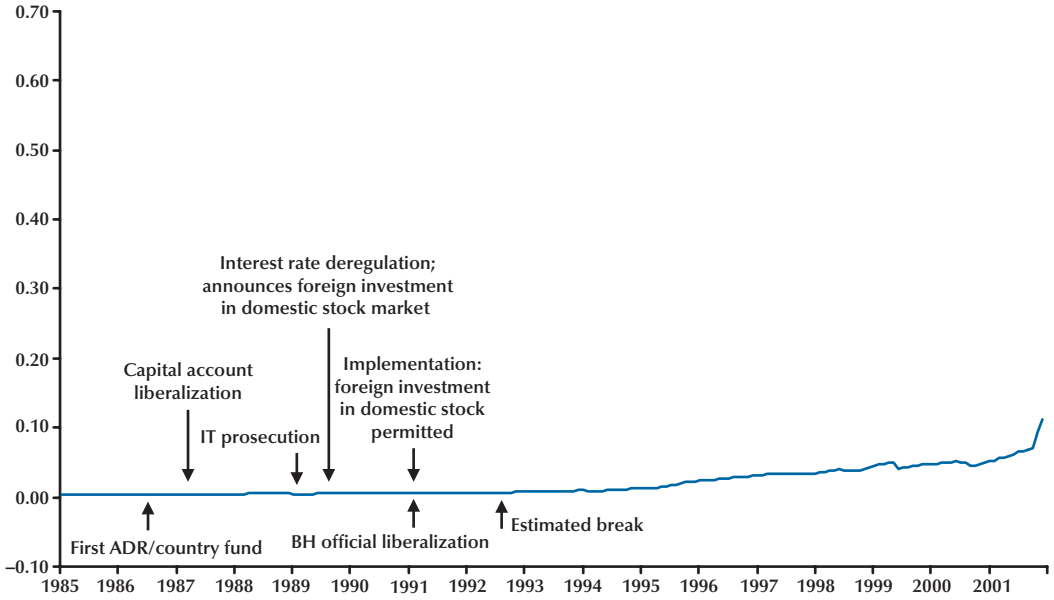


Figure 3N

U.S. Share of MSCI Market Capitalization in Thailand

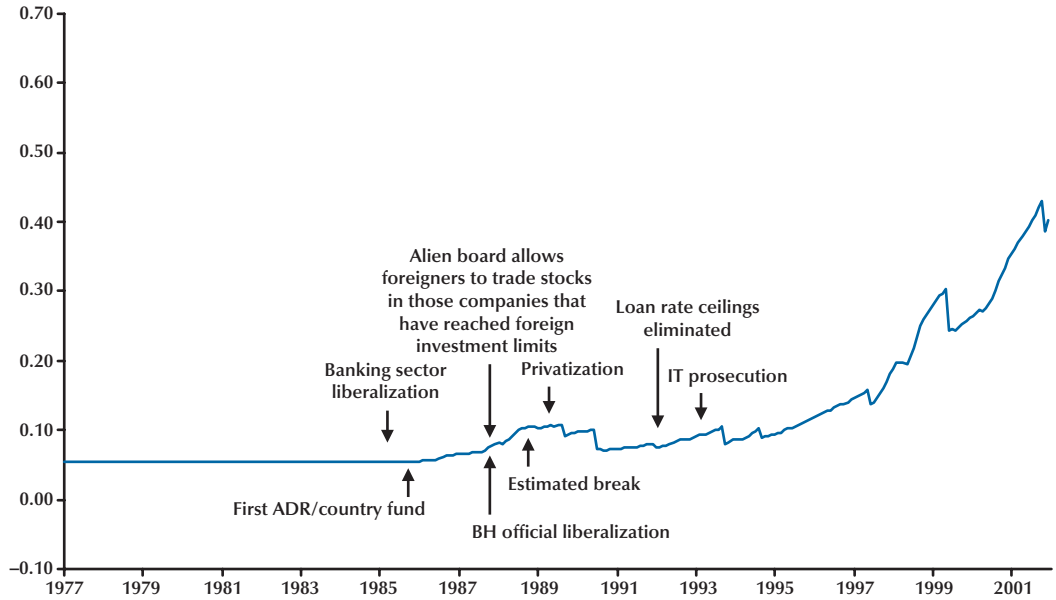


Figure 3O

U.S. Share of MSCI Market Capitalization in Turkey

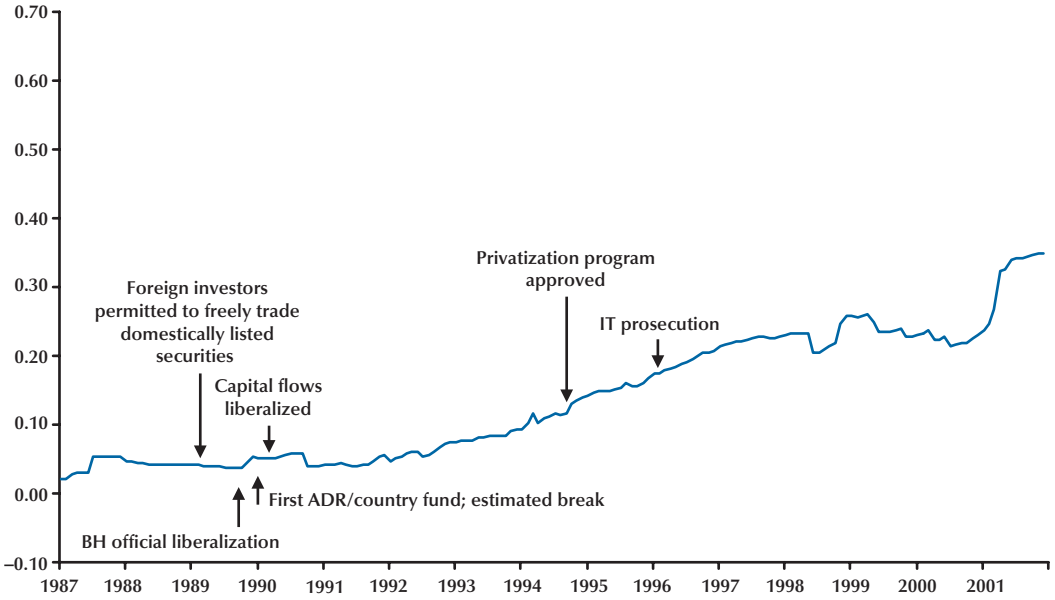


Figure 3P

U.S. Share of MSCI Market Capitalization in Venezuela

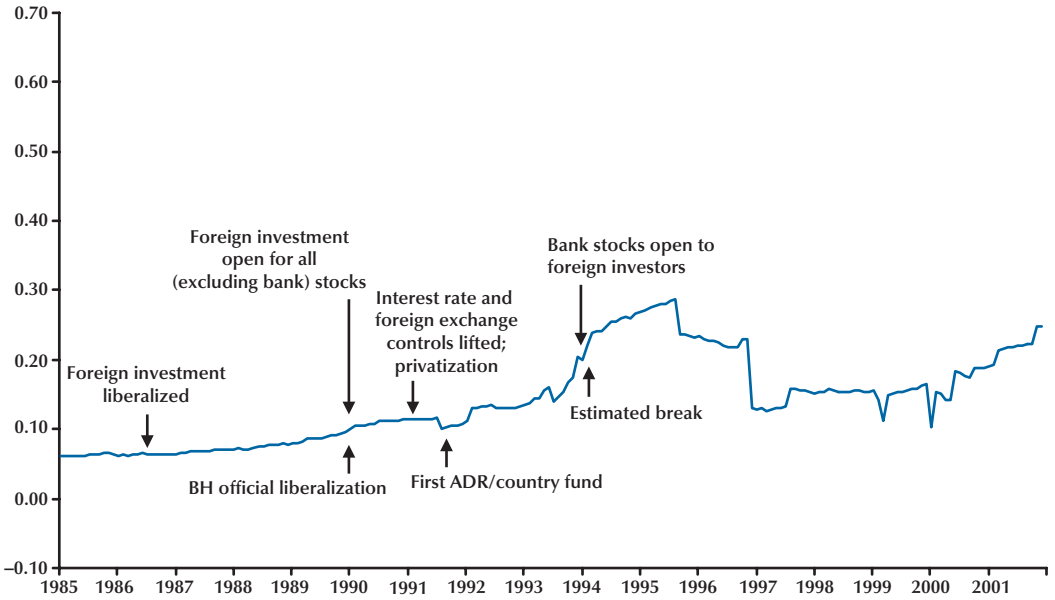
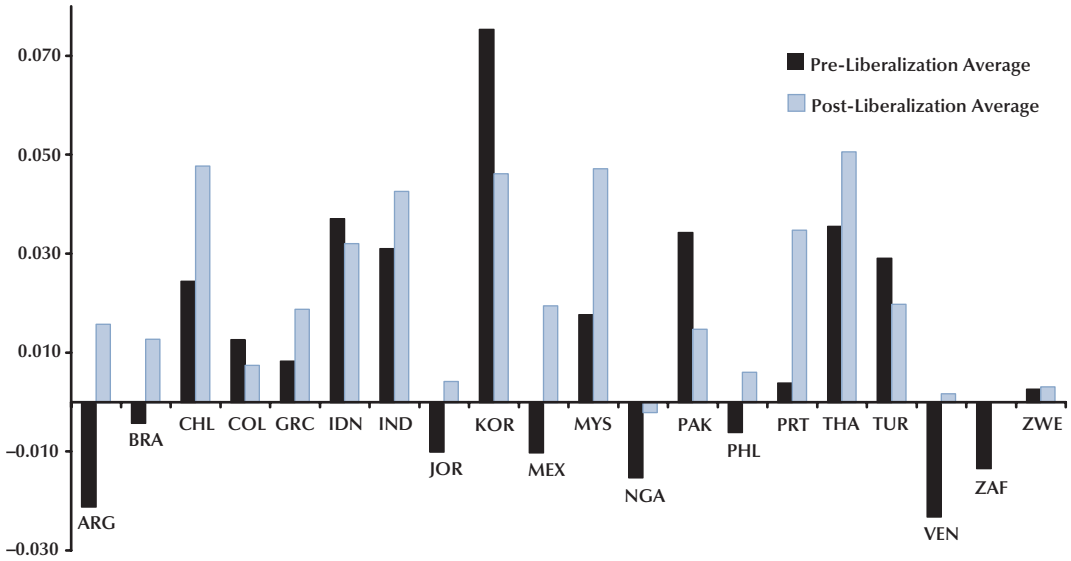


Figure 4

Real GDP Growth Before and After Financial Liberalization



NOTE: For country abbreviations, see Table 1.
SOURCE: Liberalization dates: Bekaert and Harvey (2000).

over the 1980-97 period, Bekaert, Harvey, and Lundblad (2001) document that an "official equity market liberalization" leads to an increase in average annual per capita GDP of around 1 percent, controlling for other macroeconomic, demographic, and financial factors that have been shown to predict cross-sectional variation in economic growth. We explore GDP and investment growth across a similar set of countries here, updating our data set to include the highly influential South East Asian crises, for which several countries in that region actually contracted by more than 10 percent. For example, according to the World Bank, real per capita GDP growth in 1998 was –12.1 percent in Thailand, –15.7 percent in Indonesia, and –7.8 percent in Korea.

Summary Statistics

For the 30 emerging markets (excluding Taiwan due to World Bank data limitations) that we consider above, we collect annual data on real per capita GDP and investment extending from 1980 to 2000 from the World Bank Development Indicators CD-ROM (<www.worldbank.org>). Figures 4 and 5 present evidence on annually observed rates of economic and investment growth, respectively, both before and after the BH official liberalization dates presented in Table 1. As can be seen from the graphs, the majority of these countries exhibit larger average economic growth after financial liberalization, even when the crisis years are included. With that in mind, the observed average difference across liberalization regimes is a remarkably robust feature of the data. Investment growth is similarly larger, on average, for most countries; however, Zimbabwe has a very large negative average investment rate after liberalization. This is due to an extremely large investment contraction in 2000. (GDP also contracts, but by a considerably smaller margin.) This drop in investment is likely due to the extensive political turbulence in that country at the end of our sample.[4] Nevertheless, investment growth is, on average, higher for liberalized countries.

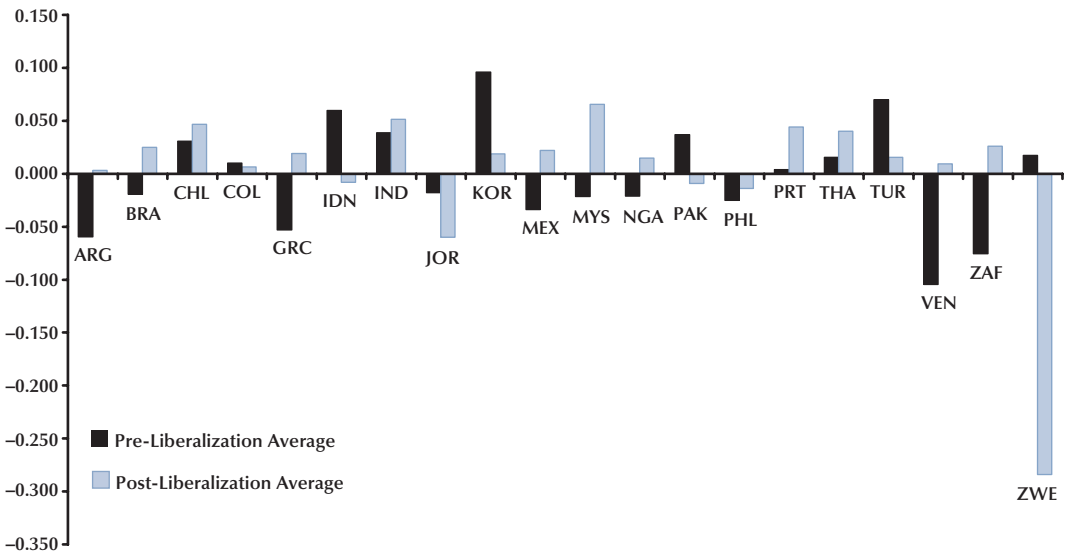
Emerging Economies and Liberalization

Following Bekaert, Harvey, and Lundblad (2001 and 2002), we exploit the following regression specification:

[4] Zimbabwe faced its worst economic crisis since independence, with unemployment, interest rates, and inflation all soaring to record highs in 2000.

Figure 5

Real Investment Growth Before and After Financial Liberalization



NOTE: For country abbreviations, see Table 1.
SOURCE: Liberalization dates: Bekaert and Harvey (2000).

(2) $$y_{i,t+1} = \beta_{i,0} + \beta_1 \cdot \mathbf{Lib_{i,t}} + \varepsilon_{i,t+1},$$

where $y_{i,t}$ is the one-year growth rate in either real per capita GDP or investment and $\mathbf{Lib_{i,t}}$ denotes a liberalization indicator variable that takes a value of 1 when the equity market is officially liberalized and 0 otherwise. BH official liberalization dates are presented in Table 1. We estimate the pooled time-series cross-sectional regression by GMM (see Hansen, 1982), correcting for groupwise heteroskedasticity and SUR effects. We also employ a simple fixed-effects estimator to directly soak up other country-specific factors that might affect economic and investment growth. To conserve space, we do not present the fixed effects.

In Table 4, we present estimates of the relation between real economic growth rates and the BH official equity market liberalization indicator. Consistent with the evidence on the pre- and post-liberalization average growth rates presented in Figures 4 and 5, these estimates demonstrate a positive and statistically significant relation between the BH official equity market liberalization and both GDP and investment growth. Specifically, consistent with Bekaert, Harvey, and Lundblad (2001), the evidence implies that real GDP per capita growth rates increase by 0.84 percent (standard error 0.16 percent), on average, across the countries considered here following financial liberalization. Similarly, consistent with Henry (2000b), real investment growth increases by 2.2 percent (standard error 0.73 percent), on average. These differences suggest a significant economic affect associated with the introduction of foreign investors to the domestic equity market.

As emphasized above, the dating of an equity market liberalization is not a clear-cut empirical exercise. Hence, when exploring the economic affects associated with the official regulatory reform, an examination of the robustness of these effects to alternative dating schemes is required. For this reason, as in Bekaert, Harvey, and Lundblad (2002), we reestimate the regressions presented above, using two alternative sets of equity market liberalizations. The first set of dates is what they refer to as "first sign" dates—that is, the earliest of the three dates presented in Table 1: official liberalizations, first ADR announcement, and first country fund launch. The second line of Table 4 suggests that the liberalization coefficients are robust to using the "first sign" dates, as the estimated effects for both GDP and investment growth are virtually identical.

Second, given the limitation of the 0/1 liberaliza-

Table 4

Real Economy Effects of an Equity Market Liberalization
Sample: 30 Countries

	Panel A: One-year GDP growth fixed effects (not reported)		Panel B: One-year investment fixed effects (not reported)	
	Estimate	Standard error	Estimate	Standard error
Official liberalization	0.0083	*0.0013*	0.0232	*0.0057*
First sign	0.0082	*0.0014*	0.0264	*0.0057*
Investability	0.0108	*0.0022*	0.0325	*0.0111*

NOTE: The regression we perform includes observations on 30 countries from 1980 through 2000. The dependent variable is either the one-year average growth rate of real per capita GDP (Panel A) or real per capita domestic investment (Panel B). We include in the regressions, but do not report, country-specific intercepts (fixed effects). We report the coefficient on the official liberalization variable that takes a value of 1 when the equity market is liberalized and 0 otherwise. The first sign liberalization indicator takes the value of 1 after the first of the following events: the official liberalization date, the introduction of an ADR, or the introduction of a country fund. The intensity measure is the ratio of IFC investables to global market capitalization from Edison and Warnock (2001). The weighting matrix we employ in our GMM estimation provides a correction for cross-sectional heteroskedasticity.

tion indicator employed above, we also reestimate the regressions above, employing the continuous investability measure from Edison and Warnock (2001). Recall, a ratio of 1 indicates that all of the domestic stocks are available to foreign investors. In Table 4, we call this the "investability" measure. The estimates reported in Table 4 can be interpreted as the liberalization effect for countries which are fully open. The effect is, not surprisingly, stronger than the "coarse" liberalization effect. For example, the GDP and investment growth effects of a full equity market liberalization are 1.1 percent and 3.3 percent, respectively, and both are highly significant. For a more elaborate analysis, including the growth effects for various horizons, the effect of control variables, and an exploration of the channels of growth, see Bekaert, Harvey, and Lundblad (2002).

CONCLUSION

The integration of emerging equity markets into world capital markets is best thought of as a structural change. Integration impacts the functioning of the equity market, the cost of capital, the diversification ability of local participants, the level of prices, the business focus of local companies, and foreign capital flows. The financial changes spill over into the real economy. It makes sense that a lower cost of capital is associated with increased investment and better prospects for GDP growth.

Our paper has focused on the different routes that a country can take to liberalize its equity market. We explored the methods by which researchers can date the integration of world equity markets. The dating is a critical exercise. Only when dates are established can research begin to measure the impact of liberalizations. Given the considerable variation in liberalization initiatives, a closer analysis of the sequencing of liberalizations is an important focus of future research.

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Commentary

Peter Blair Henry

Bekaert, Harvey, and Lundblad (BHL) are to be congratulated for producing another paper on equity market liberalizations in emerging markets, and it is a pleasure to discuss their work. Yet, there are three reasons why I may not be an impartial discussant: (i) Having devoted most of my fledgling career to the study of capital account liberalization in emerging markets, I am favorably disposed to the research topic; (ii) my published work contains extensive citations to the authors' papers; and (iii) I am in broad agreement with the lion's share of the authors' conclusions about the effects of equity market liberalization on the cost of capital.

The BHL paper has three central themes. First, liberalization reduces the cost of capital. Second, dating liberalizations is difficult and we should try to do a better job of pinning down precise liberalization dates. Third, and most importantly, the liberalization-induced fall in the cost of capital increases the growth rate of gross domestic product (GDP) per capita by 1 percentage point per annum.

I believe the first message. There is broad consensus that liberalization reduces the cost of capital by up to 100 basis points, depending on how you date the liberalization (Bekaert and Harvey, 2000; Henry, 2000a; Martell and Stulz, 2003; Stulz, 1999). All of the evidence we have supports this qualitative conclusion and suggests that the effects are economically significant, even if we can't precisely pin down the magnitude of the effects (Henry 2000b, 2003).

I also believe the second message. Liberalizations are difficult to date. While there is broad agreement that liberalization reduces the cost of capital, there is some disagreement about the exact timing of liberalizations. This matters, in principle, because the size of the effect depends on what liberalization date one chooses. On the other hand, changing liberalization dates has virtually no effect on the qualitative conclusion that liberalization reduces the cost of capital. Because more precise dates are likely to strengthen our previous conclusions about the financial effects of liberalization, and because this is a conference on the real effects of finance, most of my comments will be directed toward the third message, which is summarized in Table 4 of BHL's paper—equity market liberalization increases the growth rate of GDP per capita by 1 percent per annum.

I don't believe the third message. The claim that stock liberalizations increase the growth rate of GDP per capita by 1 percent per annum is inconsistent with the assumptions of the neoclassical growth model on which the analysis is based. The rest of my comments will be devoted to developing this thought in detail, but, first, a small digression.

The paper uses the terms "equity market liberalization" and "financial liberalization" interchangeably. Doing so is potentially confusing. Financial liberalization refers to the removal of domestic financial repression—government-imposed interest rate ceilings, restricted use of savings for consumer credit purposes, and the like (McKinnon, 1973; Shaw, 1973). The McKinnon-Shaw literature studies the effects of financial liberalization on interest rates and growth, but financial liberalization, per se, has nothing to do with granting foreigners access to domestic capital markets.

In contrast, the BHL paper summarizes the empirical effects of equity market liberalization, a decision by a country's government to allow foreigners to purchase shares in the domestic equity market. Strictly speaking, equity market liberalization is a specific type of capital account liberalization, which is a decision to allow capital in all forms to move freely in and out of the domestic market. In other words, the distinction between financial liberalization and capital account liberalization is worth making because the two terms mean very different things in the literature and none of the BHL results have anything to do with financial liberalization in the traditional sense. For the sake of clarity, I would hold to the traditional nomenclature.

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FINANCIAL EFFECTS OF LIBERALIZATION: COST OF CAPITAL

Back to the main issues. An emerging economy's cost of capital should fall when it liberalizes its equity market. The following partial-equilibrium, mean variance arguments based on Stulz (1999) make the central points most succinctly.

Assume a small country whose equity market is completely segmented from world equity markets. Also assume that all investors in the world have the same constant relative risk aversion and care about only the expected return and variance of their investment. Let $E[\tilde{R}_M]$ denote the equilibrium required rate of return on the aggregate domestic stock market before liberalization, and let r_f denote the domestic risk-free interest rate. Define the price of risk as follows: the aggregate risk premium, $E[\tilde{R}_M]-r_f$, divided by the variance of the aggregate return on the market, $VAR(\tilde{R}_M)$. Under our assumptions, the price of risk in the small country before liberalization is a constant, T. It follows that

$$E[\tilde{R}_M] = r_f + \mathrm{T}Var(\tilde{R}_M). \tag{1}$$

Now consider what happens to the required rate of return when the country opens its stock market to the rest of the world and also allows its residents to invest abroad. Assume that the mean and variance of domestic dividends are unaltered by the liberalization. Let $E[\tilde{R}^*_M]$ denote the required rate of return on the market after liberalization and let $E[\tilde{R}_W]$ be the required rate of return on the world equity market. With completely open capital markets, the world risk-free rate, r^*_f, becomes the relevant interest rate. The risk premium on the domestic stock market will now depend on the following two factors: (i) the beta of the domestic stock market with the world stock market, β_{MW}, and (ii) the world risk premium, $E[\tilde{R}_W]-r^*_f$. Following liberalization it must be the case that

$$E[\tilde{R}^*_M] = r^*_f + \beta_{MW}(E[\tilde{R}_W]-r^*_f). \tag{2}$$

Since the liberalizing country is small, adding its stock market to the world market portfolio has a negligible effect on the variance (and hence the risk premium) of the world market portfolio. It follows that $(E[\tilde{R}_W]-r^*_f) = \mathrm{T}VAR(\tilde{R}_W)$. Using this fact, the definition of β_{MW}, and a little bit of algebra, one can show that after liberalization the required rate of return on the domestic stock market is given by

$$E[\tilde{R}^*_M] = r^*_f + \mathrm{T}Cov(\tilde{R}_M, \tilde{R}_W). \tag{3}$$

Subtracting equation (1) from equation (3) gives the difference in the post- and pre-liberalization required rates of return:

$$\Delta E[\tilde{R}_M] = (r^*_f - r_f) + \mathrm{T}[Cov(\tilde{R}_M, \tilde{R}_W) - Var(\tilde{R}_M)]. \tag{4}$$

Since poor countries have lower capital-to-labor ratios than rich countries, we would expect that $r_f > r^*_f$. Hence the first term on the right-hand side of (4) is negative. Next, consider the change in the equity premium. For every country in the sample, the covariance of the local market with the world market, $Cov(\tilde{R}_M, \tilde{R}_W)$, is less than the variance of the local market, $Var(\tilde{R}_M)$ (Stulz, 1999). Hence the second term is also negative. The central result follows: Liberalization reduces the cost of capital.

REAL EFFECTS OF LIBERALIZATION: INVESTMENT AND GROWTH

Since liberalization reduces the cost of capital, firms should engage in arbitrage between equities and physical assets, as described by Fischer and Merton (1984) and Tobin and Brainard (1977). The Solow growth model illustrates the point (Solow, 1956). Before liberalization, the economy is in steady state: The marginal product of capital equals the cost of capital; the capital stock and the labor force are growing at the same rate. Liberalization occurs and the cost of capital falls. Firms respond by driving down the marginal product of capital to its new lower cost. But marginal products and costs can be equalized only if the capital stock temporarily grows faster than the labor force. Hence, there must be an increase in the growth rate of the capital stock (investment). Once the marginal product of capital falls to the post-liberalization cost of capital, the growth rate of the capital stock will return to its pre-liberalization rate (i.e., the same rate as the labor force).

Since the growth rate of the capital stock increases, the growth rate of output per worker should also rise in accordance with the standard growth accounting equation:

$$\hat{Y} = \hat{A} + \alpha\hat{K} + (1-\alpha)\hat{L}, \tag{5}$$

where a circumflex over a variable denotes the change in the natural log of that variable.

Figure 1

Investment Increases Following Equity Market Liberalizations

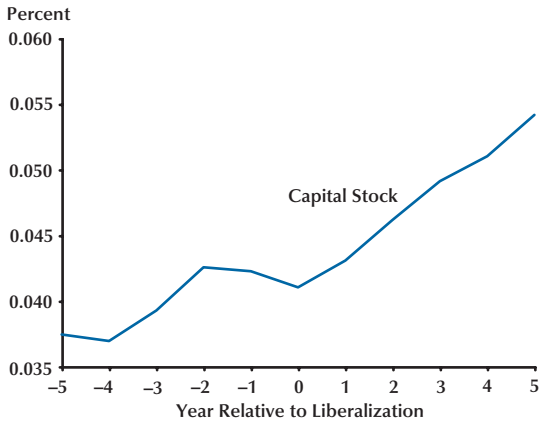
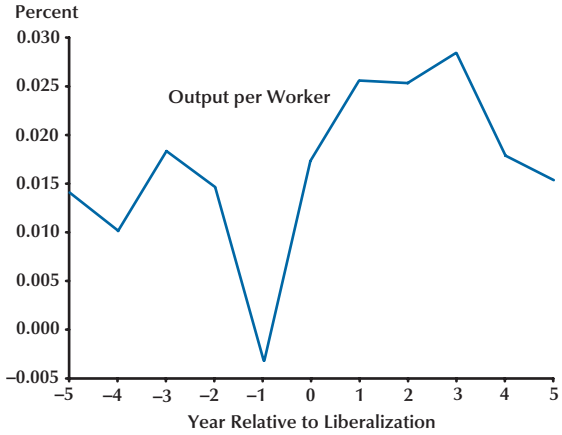


Figure 2

The Increase in Growth Following Equity Market Liberalizations Is Too Large To Be Explained by the Increase in Investment



EVIDENCE AND CONCERNS ABOUT THE BHL FINDINGS ON LIBERALIZATION AND GROWTH

With all of the theoretical pieces in place for understanding the effects of liberalization, I now turn to the raw data that form the basis of the central BHL results. The sample of countries that I use in my analysis consists of the countries and liberalization dates reported in Table 1 of the BHL paper. Figures 1 through 4 produce the basic evidence.

Consistent with firms increasing investment in response to a liberalization-induced fall in the cost of capital, Figure 1 shows that the growth rate of the capital stock rises in the aftermath of liberalizations. To give a rough sense of magnitudes, I use the data presented in Figure 1 to calculate the average growth rate in the five-year period preceding the liberalization (years –5 through –1) and the average growth rate in the five-year period following the liberalization (years 1 through 5).[1] This calculation reveals that the growth rate of the capital stock increases by 0.9 percentage points—from an average of 4.0 percent per year in the pre-liberalization period to an average of 4.9 percent in the post-liberalization period.

Figure 2 confirms that the growth rate of output per worker rises by 1.0 percentage points—from an average of 1.2 percent per year in the pre-liberalization period to an average of 2.2 percent per year in the post-liberalization period. On the one hand, there is nothing surprising about Figure 2. Whereas Figure 1 documents a behavioral response of the quantity of capital to liberalization, Figure 2 simply provides a mechanical check of the standard growth accounting equation (5).

On the other hand, Figure 2 is interesting in that the increase in the growth rate of output per worker is too large to be explained by the increase in the growth rate of the capital stock. A few simple calculations illustrate the point. The elasticity of output with respect to capital, α, is typically around 0.33. So, based on Figure 1, we would expect the growth rate of output per worker in the post-liberalization period to be about 0.297 (0.33 times 0.9) percentage points higher. But Figure 2 displays a 1.0-percentage-point increase in the growth rate of output per worker.

All else equal, a 0.9-percentage-point increase in the growth rate of the capital stock can produce a 1.0-percentage-point increase in the growth rate of output per worker only if the elasticity of output with respect to capital is slightly larger than 1! In their NBER working paper on liberalization and growth, the authors find that the increase in growth due to liberalization is slightly larger than 1 percentage point, even after controlling for a number of variables (Bekaert, Harvey, and Lundblad, 2001).

There are two possible explanations of such a result. Either (i) capital accumulation in emerging markets is characterized by increasing returns or

[1] All before-and-after growth rates quoted for Figures 2 through 4 are based on analogous calculations.

(ii) the BHL estimates of the effect of liberalization on growth are overstated. I think the BHL estimates of the effect of liberalization on growth are overstated because they fail to properly account for the effect of increases in total factor productivity (TFP) growth that closely coincide with stock market liberalizations, but are not a result of the stock market liberalizations per se. Let me explain.

Equation (5) shows that any increase in the rate of growth of output that is not accounted for by an increase in the growth rate of capital and labor must be the result of an increase in $\hat{A}$, the growth rate of TFP. So, one way to rationalize the BHL results is to claim that, in addition to increasing investment, stock market liberalizations also drive up TFP growth. However, it is important to remember that the theory of capital account liberalization focuses exclusively on capital accumulation. Technological change and TFP growth do not enter into the story. Therefore, one cannot automatically claim that liberalization is also responsible for the increase in TFP growth.

Now, it is true that if liberalization increases the allocative efficiency of domestic investment, it will also raise TFP growth without any need for technological change. However, it is not obvious why capital account liberalization, a policy change directed at increasing international allocative efficiency, would have any effect on domestic allocative efficiency (Henry, 2003). But if equity market liberalization is not responsible for the increase in TFP growth, what is?

The simple answer is that other economic reforms are at work. Indeed, stock market liberalizations are part of a general process that involves substantial macroeconomic reforms such as inflation stabilization and trade liberalization. While we typically interpret $\hat{A}$ as the growth rate of technological progress, any economic reform that raises the efficiency of a given stock of capital and labor will also increase $\hat{A}$, even in the absence of technological change. In other words, holding the productivity of capital constant, liberalization reduces the cost of capital and encourages more rapid investment; holding capital account policy constant, economic reforms raise the marginal product of capital. Because liberalizations do not occur in isolation, it is important to think carefully about how to interpret the data.

Now the authors certainly acknowledge the importance of other economic reforms. The paper contains a lot of tables and lists of reforms and discusses the importance of thinking about those reforms. But those events are not employed in their analysis of liberalization on growth (BHL, 2001).

The authors perform panel regressions of country growth rates on a liberalization dummy (Table 4 of the paper summarizes the results), but they do not include dummy variables for the other reforms, which they so painstakingly list in Table 3. For example, in place of a discrete dummy variable for trade reform that would tell us whether growth increases following trade reforms, they use a continuous proxy variable—trade as a fraction of GDP. They follow a similar approach with respect to inflation stabilization. I do not understand this asymmetric treatment of the economic reforms. If you are performing a before-and-after experiment of equity market liberalizations on growth, it seems natural to perform a before-and-after experiment for the other reforms on growth as well.

Since the other economic reforms never enter the empirical specifications in the same manner as the equity market liberalizations, it is not clear how much confidence we can place in the authors' claim that their estimated effect of equity market liberalization on growth—1 percentage point per annum—is robust to other reforms. I have already argued that this claim is inconsistent with standard production theory. I have also argued that this inconsistency cannot be easily reconciled by claiming that liberalization increases TFP growth. Therefore, the sensible conclusion is, contrary to the authors' claim, that their estimate is not robust to the inclusion of other reforms. Let me now illustrate the point empirically with a few simple pictures.

Standard trade theory predicts that trade liberalization will increase TFP. As countries tilt production toward their comparative advantage, they will experience an increase in output, for a given stock of capital and labor. Figure 3 plots the average growth rate of output per worker across all of the countries in the BHL sample following trade liberalizations. The trade liberalization dates are taken from Sachs and Warner (1995). The figure shows that the average growth rate of output per worker rises by 1.5 percentage points following trade liberalizations—from an average of 0.6 percent per year in the five years preceding trade liberalization to an average of 2.1 percent per year in the five years after.

Stabilizing inflation may also increase TFP, because high inflation generates incentives for workers and producers to divert resources away

Figure 3

Growth Also Increases Following Trade Liberalizations

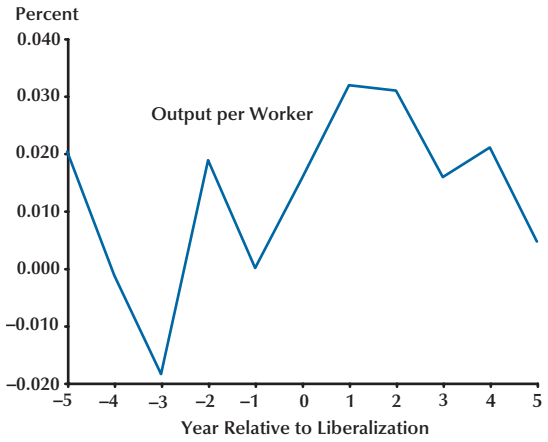
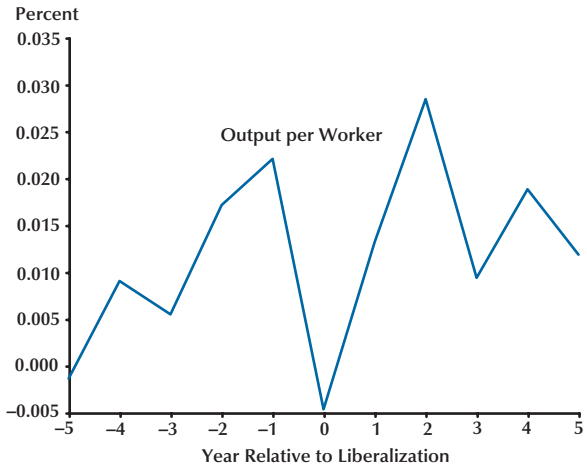


Figure 4

Growth Also Increases Following Inflation Stabilization Programs



from productive activities that increase output and toward activities that help them avoid the costs of high inflation. There is an extensive literature that demonstrates that stabilizing high inflation is good for asset prices, investment, and output (Henry 2000b, 2002; Fischer, Sahay, and Végh, 2002; Calvo and Végh, 1999; Easterly, 1996).

Figure 4 plots the average growth rate of output per worker across all of the countries in the BHL sample following inflation stabilization programs. The inflation stabilization dates are taken from Henry (2002). In countries where there are multiple stabilization dates, the last stabilization date was chosen. Figure 4 shows that the growth rate of output per worker rises by 0.8 percentage points following stabilization programs—from an average of 0.8 percent per year in the five years preceding stabilization to an average of 1.6 percent per year in the five-year post-liberalization period.

Pictures are of course not conclusive. One would also want to conduct some serious econometric exercise that attempts to disentangle the effects of these and other reforms on growth. My only point is that there are strong a priori theoretical reasons to expect reforms other than equity market liberalization to have a significant effect on economic growth. The raw data do no harm to this view and provide strong prima facie evidence that the BHL analysis significantly overstates the effect of equity market liberalization on growth.

CONCLUDING THOUGHTS

The problems with the BHL findings on equity market liberalization and growth are not unique. Interpretation problems are endemic to cross-country growth regressions. Whatever growth in output is not explained by growth in inputs is, by definition, a result of TFP growth. Without a clean theoretical link between TFP growth and equity market liberalization, however, it is not clear how to interpret the results. Nevertheless, the authors deserve credit for tackling an important question. We certainly need a better understanding of the ways in which the effects of liberalization are transmitted to the real economy, but the results on equity market liberalization and growth are difficult to believe. I look forward to reading their future efforts at sorting out these difficult but important issues.

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Historical Perspectives on Financial Development and Economic Growth

Peter L. Rousseau

The link between financial development and economic growth is not a recent discovery. And though Bagehot (1873), Schumpeter (1911), and Gurley and Shaw (1955) motivated this relationship decades, and indeed, over a century ago, it remained for economic historians such as Davis (1965), Cameron (1967), and Sylla (1969), among others, to give empirical content to the idea. These scholars primarily used the historical experiences of England and the United States to illustrate the role of the financial system in paving the way to market leadership. Since then, macro and development economists have studied the link more formally with theoretical models in which countries achieve rapid growth through well-developed financial systems that reduce credit market frictions (e.g., Greenwood and Jovanovic, 1990, Greenwood and Smith, 1997, and Rousseau, 1998) and with cross-country and time-series statistical studies that uncover significant effects of financial sector size on macroeconomic outcomes (e.g., King and Levine, 1993, and Rousseau and Wachtel, 1998).[1]

Interestingly, economic historians and macroeconomists studying finance and growth seem for the most part content to continue pursuing their closely related agendas independently. Perhaps this is because macroeconomists usually ask whether financial factors *do indeed* matter for growth, while most economic historians see the answer to this question as more obvious and ask instead *how* and *how much* they matter. The economic historian's prior is understandable—older single-country studies have made strong cases for finance-led growth with the sporadic data observations that are usually available. For the macroeconomist, however, the lack of an explicit role for financial factors in the baseline neoclassical growth model combines with a recognition of the statistical and conceptual problems of establishing causation in cross-country and time-series regressions to yield a more cautious perspective. This article attempts to narrow the gap between these views by illustrating with standard macroeconometric techniques that the historical time series that are available for Amsterdam (1640-1794), England (1720-1850), the United States (1790-1850), and Meiji Japan (1880-1913) are consistent with the "finance-led" growth hypothesis.

The approach is decidedly macroeconomic. This is because I believe that the empirical growth literature has underemphasized a key mechanism through which finance matters in the early stages of economic development—resource mobilization. This is not to say that banks and financial markets do not also promote growth by directing resources to productive uses, but that their ability to overcome project indivisibilities and to encourage investors to accept longer time horizons for payoffs widens the first bottleneck through which a young economy must pass. This turns out to be important for the four countries that I consider in this study, and especially for the Dutch Republic, England, and the United States, whose financial sectors emerged during their "pre-industrial" epochs. Is it no coincidence that England, with the key components of a financial system in place by 1750, was poised to tackle industrialization next? The main findings suggest that banks and financial markets did indeed promote investment and commercial activities by generating information, pooling funds, facilitating payments, and providing working capital for the largest companies that traded on the world's earliest "stock exchanges," at least in the modern sense of the term.

The article proceeds on a case-by-case basis, but will, to the degree that it is practical, offer a consistent empirical framework throughout. At the end, I summarize some of my recent findings with Richard Sylla for a larger group of countries after 1850. It seems only appropriate to begin the analysis with the city of Amsterdam, the site where the action begins.

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[1] The empirical literature on the so-called "finance-growth nexus" has expanded rapidly in recent years, making an exhaustive list of references impractical to provide here. Levine (1997) offers a useful survey.

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AMSTERDAM

The World's First Financial Revolution?

Amsterdam rose to prominence as a commercial city in the late 16th century. Its strategic position in the North Sea for intra-European and Baltic trade made it a logical heir to the inheritance of Antwerp, which had been the center of European commerce over the preceding century (van der Wee, 1963). As the largest city in the newly formed United Provinces, Amsterdam's reputation for ethnic tolerance also drew immigrants and their capital from the rest of Europe and the Eastern Mediterranean. These factors combined by the early 17th century to produce a bustling commercial community. As the potential for speculation and profit in trading with the East Indies became clear, Amsterdam merchants began pooling resources to equip individual voyages, with the profits distributed upon sale of the incoming cargoes. These arrangements were formalized in 1602 with the chartering of the United East India Company (or VOC, short for Vereenigde Oostindische Compagnie). The charter called for a combine from six cities, or chambers, of which Amsterdam was by far the largest and most important. The VOC was capitalized with 2,167 shares at a par value of 3,000 florins each, and the owners could liquidate their stakes through the VOC once every ten years (Glamann, 1958, pp. 7-8). But when the Directors repudiated this provision at the end of the first decade, those wishing to liquidate needed a secondary market. It was in this climate that shares and futures began to trade on the Amsterdam bourse—the world's first modern securities market if we are to believe the engaging anecdotes of Josef de la Vega (1688).

The VOC was Amsterdam's largest trading company and held a monopoly by statute and in practice on Asiatic trade east of the Cape of Good Hope, but other forms of commerce, especially intra-European, also flourished in Amsterdam throughout the 17th century. It was decided early on that the city would need a clearinghouse for exchange, and the Bank of Amsterdam (BA) got started in 1609 to perform this function. And though the innovations of a clearing bank and exchange bills did not originate in Amsterdam, having existed previously in Venice and Antwerp, never before had either form been used so successfully.

The BA was not a bank of issue, but instead accepted bullion and coin from merchants and held them for safekeeping, issuing receipts for "drawing accounts" that could be used for exchanging wealth as needed in the course of trade. The BA also made large loans to the VOC and to the government over the next two centuries (to the latter for waging wars). According to de la Vega (1957, pp. 23-24), however, the BA did not only support commodity trades, but was also used to effect payments. For example, stocks traded on the bourse were often said to be "payable at the Bank," and "time accounts" organized by the BA were used as quasi-official records of futures agreements—records in which sellers could attest that they actually held the security that they had agreed to deliver and in which borrowers could record their intention to borrow when the time came to settle or purchase.[2] It was in this manner that the BA and its drawing accounts became a key component of the stock exchange.

Data and Methodology

To explore quantitatively the relationship between finance and growth in pre-industrial Amsterdam, some measures of commercial investment and of financial size and efficiency are needed. And though there are few continuous time series from the period, there are enough to conduct a preliminary statistical investigation. For example, van Dillen (1934, pp. 117-23) published annual figures for the BA's activities from 1610 through 1820, including the balances in its "drawing" accounts and loans to the VOC. To the extent that the BA supported the stock market and commerce in Amsterdam during this period, the size of its drawing accounts may be a reasonable measure of the city's financial development. Further, Neal (1990) has improved upon van Dillen's (1931) share price series for the VOC from 1723 through 1794.[3] I will use these data to explore the efficiency of the Amsterdam market and the importance of any financing constraints that the VOC might have faced. Measures of aggregate investment in the city are not generally available, but the VOC archives do include the number of voyages that the company sent to the East Indies

[2] See also Hermann Kellenbenz's introduction to the English translation of de la Vega (1957, p. 18).

[3] To build the annual series, I use the final price observation for year VOC share from Neal's reading of the *Amsterdam Courant*. These observations are usually from the last week in December. I use the final price observations from van Dillen (1931) for years that are unavailable in Neal's data. The VOC prices and other stock market data from Neal (1990) are available on the World Wide Web from the Inter-University Consortium for Political and Social Research (ICPSR) at the address < http://www.icpsr.umich.edu > .

in each year from 1641 to 1794; the amounts of gold, silver, and coins that left with these voyages; and the market values of their incoming cargoes.[4] If investment and trading activity in the VOC reflect commercial activity in Amsterdam more broadly, testing for statistical links between drawing balances at the BA and VOC investment might shed some light on how finance affected real activity at the time. Figure 1 shows the evolution of the florin-denominated real quantities as three-year moving averages.[5] Even casual examination of Figure 1 indicates that the market value of VOC trade, hard money exports by the VOC, and the size of drawing account balances at the BA all saw dramatic increases following the financial crisis of 1672 until the mid-1720s—increases that were sustained until the decline of the VOC after 1780.

The vector autoregressive (VAR) approach facilitates investigation of dynamic interactions in stationary multivariate systems without imposing a priori structural restrictions. This type of exploration seems most appropriate for historical studies of finance and growth, given the limitations of the available data. For example, to investigate the relationship between, say, the market value of VOC trade, drawing balances at the BA, and the value of money shipments to the East, a VAR would include a separate regression for each variable in the system on its own lags and those of the other variables:

(1a,b,c)

$$x_{1,t} = a_{1,0} + \sum_{i=1}^{k} a_{1,i} X_{1,t-i} + \sum_{i=1}^{k} b_{1,i} X_{2,t-i} + \sum_{i=1}^{k} c_{1,i} X_{3,t-i} + u_{1,t}$$

$$x_{2,t} = a_{2,0} + \sum_{i=1}^{k} a_{2,i} X_{1,t-i} + \sum_{i=1}^{k} b_{2,i} X_{2,t-i} + \sum_{i=1}^{k} c_{2,i} X_{3,t-i} + u_{2,t}$$

$$x_{3,t} = a_{3,0} + \sum_{i=1}^{k} a_{3,i} X_{1,t-i} + \sum_{i=1}^{k} b_{3,i} X_{2,t-i} + \sum_{i=1}^{k} c_{3,i} X_{3,t-i} + u_{3,t},$$

where x_1 is trade, x_2 is drawing balances, x_3 is money shipments, and k is the number of lags.

Stationarity of a VAR is important in interpreting tests for Granger noncausality, that is, the hypothesis that past values of a variable do not jointly improve one-step-ahead forecasts of another. Specifically, the null hypothesis implies the following joint restrictions on the coefficients in (1):

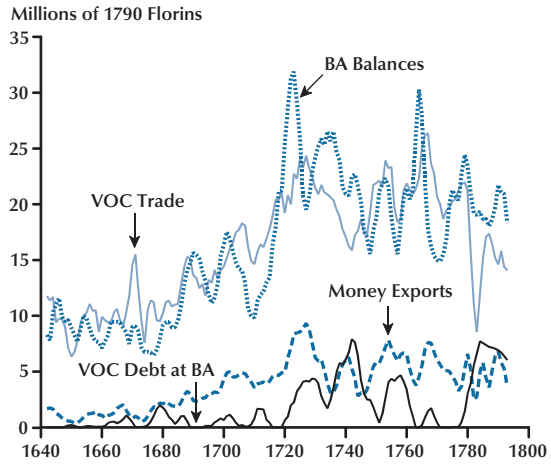
(2) $\hat{l}_{j,i} = \hat{l}_{j,i+1} = \ldots = \hat{l}_{j,k} = 0 \qquad l = \text{a,b,c};\ j = 1,2,3.$

In general, the distributions of these tests are nonstandard when a VAR contains variables with unit roots, and differencing is usually required to ensure stationarity. Sims, Stock, and Watson (1990) show, however, that Granger tests conform to standard distributions in trivariate VARs with unit roots, so long as a cointegrating relationship exists among the variables. I apply this result in the eight trivariate systems for Amsterdam because the null hypothesis of a unit root is not rejected with standard tests for any of the variables and there appears to be a cointegrating relationship in each system.[6] Running a VAR in levels is advantageous because it allows joint evaluation of short- and long-term effects of movements in one variable upon others in the system.

Granger-causality tests must be interpreted cautiously since rejection of the block exclusion restrictions does not necessarily imply that there is "economic causality." This is because the validity of the test is predicated on the inclusion of the full information set in the VAR. Since this condition is violated in any finite regression framework, especially when the data at hand are only proxies for the

Figure 1

Finance and Trade Quantities for Amsterdam, 1641-1794



[4] The number of outgoing VOC voyages is from the Netherlands Historical Data Archive's (NHDA) data set D0100 titled "Dutch-Asiatic shipping, 1602-1795." The data are similar but not identical to those presented in Bruijn, Gaastra, and Schoffer (1987). Eastbound money shipments are from NHDA data set F3503 titled "Total amounts of money, 1603-1795." The market value of VOC trade is from NHDA data set F3505 titled "Returning ships and products, 1641-1796."

[5] The long-run movement of VOC voyages tracks VOC trade closely with a correlation coefficient of 0.69. The price index used to deflate all florin-denominated quantitites is van Zanden's (2000) consumption price index for the western Netherlands.

[6] See the appendix for details and results of tests of unit roots and cointegration.

Table 1

VAR Models of Financial Quantities and VOC Activity for Amsterdam, 1641-1794

Equation	Dependent variable	Market value VOC trade	BA drawing balances	VOC money exports	Adjusted R^2	Dependent variable	No. of VOC voyages	BA drawing balances	VOC money exports	Adjusted R^2
1a	Market value VOC trade	0.402 (0.000)	0.204 (0.007)	0.134 (0.061)	0.663	No. of VOC voyages	0.405 (0.003)	0.245 (0.082)	0.011 (0.228)	0.340
1b	BA drawing balances	0.041 (0.662)	0.799 (0.000)	0.061 (0.373)	0.806	BA drawing balances	0.097 (0.268)	0.778 (0.000)	0.062 (0.303)	0.809
1c	VOC money exports	–0.032 (0.551)	0.318 (0.010)	0.795 (0.000)	0.693	VOC money exports	0.438 (0.119)	0.163 (0.043)	0.733 (0.000)	0.701

Equation	Dependent variable	Market value VOC trade	BA drawing balances	VOC debt at BA	Adjusted R^2	Dependent variable	No. of VOC voyages	BA drawing balances	VOC debt at BA	Adjusted R^2
1a	Market value VOC trade	0.691 (0.000)	0.195 (0.000)	–0.054 (0.463)	0.718	No. of VOC voyages	0.420 (0.008)	0.397 (0.021)	0.046 (0.466)	0.315
1b	BA drawing balances	0.218 (0.094)	0.729 (0.000)	0.185 (0.046)	0.791	BA drawing balances	0.132 (0.037)	0.791 (0.000)	0.019 (0.271)	0.794
1c	VOC debt at BA	–0.031 (0.141)	0.059 (0.056)	0.840 (0.000)	0.868	VOC debt at BA	–0.006 (0.012)	0.040 (0.118)	0.866 (0.000)	0.873

NOTE: Equation numbers correspond to those in the text. Each VAR uses three lags. The VARs in the upper panel are in real log levels; in the lower panel they are in real levels due to zero values for VOC debt in some years. The table reports the sum of the regression coefficients for each variable block, with the significance level of the F-test for Granger noncausality in parentheses beneath the coeffcient sums.

desired theoretical constructs, the results presented below are suggestive of the nature of linkages between finance and investment in pre-industrial Amsterdam but cannot be taken as conclusive.

When an investigator can specify a reasonable causal ordering for the variables in a VAR system (based on economic theory and perhaps the results of Granger tests), the nonlinear responses of each variable to one-time shocks in the others can be traced through time. This facilitates an evaluation of the economic importance (i.e., size) of the estimated effects, and for this reason I augment the results of Granger-causality tests with an examination of selected impulse responses.

Finance and VOC Investment

Table 1 presents estimates from four VARs that cover the period from 1641 to 1794. The starting year is that in which all data become continuously available, and the end date was chosen to capture the decline of the United Provinces but not the period of political upheaval that surrounded the French invasion of 1795. Nested likelihood ratio tests select three lags.[7] For each system, I report the sum of the regression coefficients on the variable blocks listed in the column headings in equations (1a) through (1c) along with the significance level of the F-test for block exclusion. In the upper left panel, for example, the results for equation (1a) indicate that the log of real drawing balances at the BA Granger-cause the real market value of VOC trade at the 1 percent level, while real money exports Granger-cause trade at the 6 percent level. The coefficients on the lag variables sum to a positive number for each of these blocks. Equation (1b) shows that neither VOC trade nor money exports Granger-cause BA drawing balances, while equation (1c) shows that BA balances Granger-cause money exports.

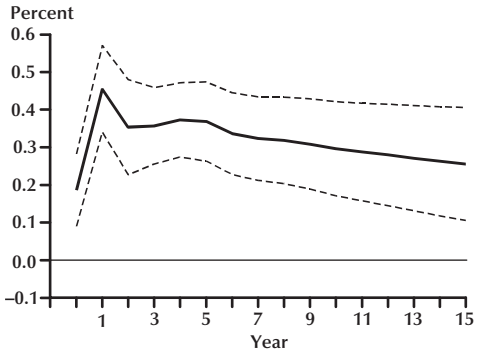
The results are qualitatively similar in the upper-right panel of Table 1, where the log of outgoing VOC voyages replaces VOC trade as the measure of

[7] This method starts with a sufficiently large lag length and then tests successively that the coefficients on the final lag are zero, stopping when the restrictions are rejected.

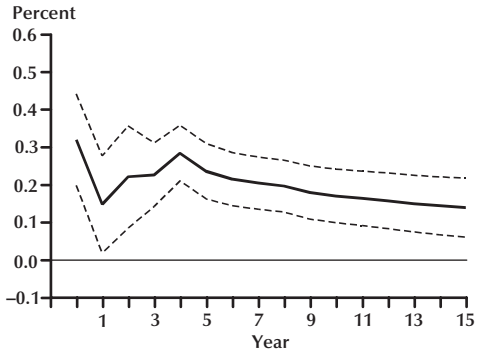
Figure 2

Selected Impulse Responses from VARs for Amsterdam, 1641-1794

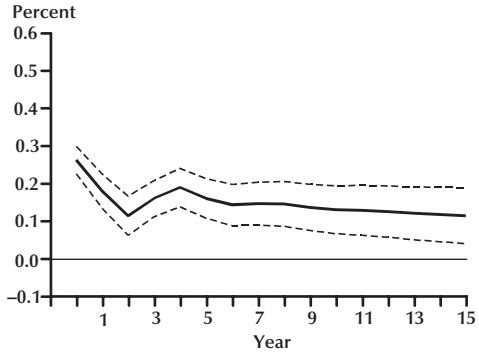
A. Effect of BA Balances on VOC Trade



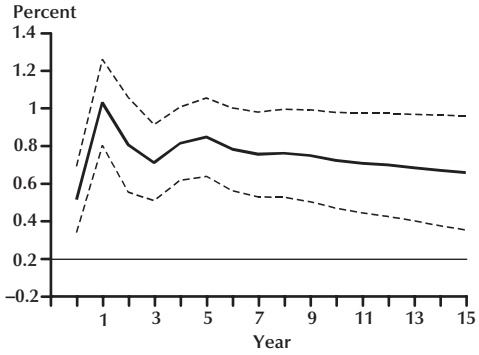
B. Effect of BA Balances on VOC Voyages



C. Effect of Money Exports on VOC Trade



D. Effect of BA Balances on Money Exports



NOTE: The impulse responses are taken from the VARs reported in the upper panels of Table 1. Each plot traces the percent change in the affected variable that results over a 15-year horizon from a 1 percent change in the orthogonalized innovation to the potentially causal variable. The ordering is BA balances first, VOC hard money exports second, and either the market value of VOC trade or the number of VOC voyages third. Using Monte Carlo integration, the solid lines are the mean responses that result from 10,000 random draws from the distribution of the estimated VAR coefficients. The dotted lines are one-standard-error bands.

investment, though money exports are no longer statistically significant in equation (1a). These findings suggest that increases in the size of the BA's drawing account balances did indeed have a positive effect on commercial activity. Further, larger balances increased the amount of hard money that was used in conducting VOC business. This seems reasonable, as more resources at the disposal of the Bank would make it easier to meet demands for bullion prior to ship departures. There is no evidence of feedback from either VOC trade or the number of voyages to drawing account balances or money exports. Thus, the effects of the financial variables appear to be unidirectional.

Figure 2 shows the impulse responses. The Granger-causality tests in Table 1 imply that placing drawing account balances first, money exports second, and either VOC voyages or trade third would move from the most statistically "exogenous" to the least. In panels A and B of Figure 2, a 1 percent change in BA balances is related to an increase in VOC trade of about 0.45 percent after two years and a sharp increase in VOC voyages of about 0.3 percent. Both effects decay slowly. Evaluated at the sample means, the responses imply that increasing BA balances by 1.6 million florins (10 percent) would increase VOC trade by 2.8 million florins and lead to 3.7 additional voyages over the next five years.

Table 2

VAR Models of Q and Investment for the Dutch East India Company, 1723-94

Equation	Dependent variable	Market value VOC trade	BA drawing balances	VOC Q	Adjusted R^2	Dependent variable	No. of VOC voyages	BA drawing balances	VOC Q	Adjusted R^2
1a	Market value VOC trade	0.399 (0.001)	–0.211 (0.178)	0.062 (0.004)	0.467	No. of VOC voyages	0.111 (0.786)	–0.103 (0.812)	0.050 (0.098)	0.032
1b	BA drawing balances	–0.088 (0.826)	0.413 (0.000)	0.029 (0.438)	0.296	BA drawing balances	0.054 (0.642)	0.477 (0.000)	0.015 (0.549)	0.323
1c	VOC Q	–0.004 (0.590)	–0.285 (0.661)	0.972 (0.000)	0.892	VOC Q	0.114 (0.638)	–0.080 (0.583)	0.964 (0.000)	0.897

Equation	Dependent variable	Market value VOC trade	VOC debt at BA	VOC Q	Adjusted R^2	Dependent variable	No. of VOC voyages	VOC debt at BA	VOC Q	Adjusted R^2
1a	Market value VOC trade	0.303 (0.013)	–0.399 (0.126)	0.748 (0.000)	0.550	No. of VOC voyages	0.060 (0.942)	0.343 (0.532)	1.680 (0.055)	0.055
1b	VOC debt at BA	–0.103 (0.135)	0.782 (0.000)	0.097 (0.760)	0.827	VOC debt at BA	0.015 (0.027)	0.866 (0.000)	–0.045 (0.884)	0.829
1c	VOC Q	–0.021 (0.517)	–0.032 (0.709)	0.973 (0.000)	0.891	VOC Q	0.009 (0.335)	–0.021 (0.335)	0.938 (0.000)	0.899

NOTE: See note for Table 1.

These increases would have been substantial given that drawing balances at the BA were used to support all types of commercial activity in the city, not just that of the VOC. Panel C shows that a 1 percent change in the amount of gold, silver, and coin sent East by the VOC led to return cargoes that were about 0.26 percent larger. Evaluated at the sample means, this implies that for every florin in precious metals sent out, incoming cargoes over the next five years were worth 3.7 florins more. The VOC seems to have deployed its metallic resources efficiently in the East Indies. In panel D, a 1 percent change in BA balances is associated with a 3.4 percent increase in VOC money exports over a 5-year period.

In the lower panels of Table 1, I switch to a specification in real levels (i.e., without taking logs) to allow the outstanding debt of the VOC at the BA, which contains zero values in several years, to enter the systems in place of money exports. I did this as an initial test of whether the VOC faced financing constraints in its operations. Interestingly, VOC debt does not Granger-cause the number of voyages in either system, though it does respond negatively to increased trade and voyages. This might mean that, when the company needed to get voyages underway the BA did not stand in the way of providing working capital and that, once equipped, the VOC's demand for debt fell off. This is not the type of behavior that one would expect from a company that was having trouble raising cash in the local financial market.

Finance and the Q-Theory of Investment

The Q-theory of investment as first described by Brainard and Tobin (1968) predicts that a firm's investment rate will rise with its Q (the ratio of market value to the replacement cost of capital). Fazzari, Hubbard, and Petersen's (1998, FHP) study of financing behavior among U.S. firms in the 1980s, however, casts doubt on a single-factor Q-theory in favor of one in which access to the capital market figures prominently. Indeed, FHP's firm-level regressions show that cash flow explains investment more effectively than a host of alternatives and that Q loses some of its explanatory power when cash is included in the model. This is especially true for firms with low dividend payout ratios, where in some specifications Q loses statistical significance altogether. This effect probably occurs because

firms with low payout ratios are often small firms that have limited access to external capital, which makes financing constraints bind more sharply when borrowing channels dry up. Since the VOC was a large company, one would not expect it to face financing constraints in today's relatively efficient U.S. capital market, but it certainly might face them in a less developed market due to the effects of the business cycle on the availability of loanable funds.

The VARs reported in Table 2 examine whether such constraints were active between 1723 and 1794, which is the period when continuous annual prices of VOC shares become available (see footnote 3). Like their counterparts in Table 1, these systems include either the market value of VOC trade or the number of outgoing voyages as measures of investment; but now they also include the VOC's Q at the end of each year.[8] By then adding either drawing account balances or VOC debt at the BA, I can examine whether Q is indeed the only determinant of investment, as the theory would suggest, or whether, as in FHP, the other financing variables come in strongly and lower the estimated coefficients on Q. The results in Table 2 are striking in that Q matters for explaining VOC investment (equation (1a)) in all four VARs, while neither drawing balances nor VOC debt are significant determinants. Taken alongside Table 1, this suggests that VOC investment did not only grow with the capital market, but that temporary fluctuations in credit conditions within the BA did not alter capital budgeting decisions being made by the company directors. Rather, the Amsterdam capital market was liquid enough for the VOC to secure the funds needed for investment based on its shadow price and did not rely on the official bank of exchange. This seems to reflect financial development in a most fundamental sense.

ENGLAND

Finance, Trade, and the Industrial Revolution

England's "financial revolution" can be traced to Dutch innovation that accompanied William III as he crossed the North Sea to accept the British throne in 1688, but the event really involved two phases—the first being pre-industrial and the second being industrial. It is fortunate that the financial institutions that arose to facilitate both internal and external trade and to stabilize the monetary system in the half century after the Glorious Revolution left the nation poised to overcome the political and social obstacles of financing their Industrial Revolution.

British finance got a strong start with the founding of the Bank of England (BE) in 1694. Over its first 50 years, the BE would become, to quote R.D. Richards (1934, p. 272), "a credit institution, an organ of State Finance, a discount and issuing house, a bullion warehouse, and a safe repository." Shortly after its founding, the government had the nation's metallic currency recoined and the BE engaged in various note-issuing experiments, both of which promoted monetization of the economy and brought some order to a disheveled monetary system. And while the BE's integral relationship with the state has received the most attention among its scholars, the BE's support of London's merchant and trading communities through its clearing and discounting facilities was too large to be overlooked (see Clapham, 1941). Indeed, it is the monetization and the private business roles of the BE that I will focus upon in this section.

Before 1750, the BE coexisted only with a group of private bankers in London who dealt primarily in deposits and bills of exchange. This gave rise to an active money market to finance trade and working capital for the fledgling manufacturing sector, and the BE played a key role in its smooth operation. A stock exchange emerged by the 1690s to facilitate transactions in public debt securities and shares of the large trading companies, including the British East and West India Companies, the South Sea Company, and the Royal African Company. In short, England quickly achieved what Richard Sylla and I have listed as four of the five elements of a "good" financial system: (i) sound public finance, (ii) stable money, (iii) a central bank, and (iv) well-functioning securities markets (Rousseau and Sylla, 2001, pp. 2-3).

With a reasonably "good" system in place by 1750, it remained for the financial sector to develop the final feature: (v) a variety of banks. Indeed, country banks did not spring up until the second half of the 18th century, but made up for lost time by multiplying rapidly, issuing their own notes to facilitate transactions outside of London and fostering correspondent relationships with London's pri-

[8] The VOC did not change its share capital over the 71-year period that I consider, so the Q of VOC equity is the ratio of price to par value of the shares.

vate bankers.[9] Savings banks started up after 1817 to provide a vehicle for the surpluses of less-wealthy individuals, but were never large enough to be a very important part of the financial landscape. Major legislation enacted in 1826 ended the BE's long-standing monopoly in the joint-stock banking business, and though institutions (perhaps surprisingly) did not form immediately in response, by 1840 there were more than 600 joint-stock banks.

Amidst such important financial advances, England was also undergoing a commercial and industrial revolution. Figure 3 shows that the real value of international trade, defined as the sum of imports, domestic exports, and re-exports, rose by 50 percent between 1720 and 1760, and another 50 percent between 1760 and 1805.[10] When viewed alongside earlier data for the English East India Company that indicates a more-than-sixfold increase in Asian exports between 1660 and 1710, the rapid commercialization of the British economy comes into clear focus. Hoffman's index of industrial production (Mitchell, 1988, Table 8.21.A, pp. 431-32, including building), also shown in Figure 3, progresses less rapidly than the trade series at first, but accelerates after 1780 and once again around 1818; thus, it seems to share the rhythm of the later part of the trade boom.

Figure 3 also shows the "best guess" index of industrial production from Crafts, Leybourne, and Mills (1989, p. 58). This index corrects some of the sectoral weightings in Hoffman's index to reflect more accurately the composition of the British economy in the latter part of the 18th century. The more variable series does not show the rapid acceleration in industrial production after 1780 that appears in the Hoffman index and suggests that the Industrial Revolution did not get into full swing until the early part of the 19th century. This new information has generated debate among economic historians as to the timing of the Industrial Revolution, which is to some extent beyond the scope of this paper. Since all of the available macroeconomic time series, however, seem consistent with the initial development of a commercial sector that later nurtured and was complemented by a growing manufacturing sector by the end of the 18th century, I examine econometric models using both indices but focus on results obtained with the more recent Crafts, Leybourne, and Mills index.

Finance as a Leading Sector

Did England's financial system promote the coevolution of trade and industry? To address this question quantitatively and in a macroeconomic sense, it is necessary to construct a measure of monetization. This is easier for the period before 1775 because London's private bankers had stopped issuing notes, which had always been a small part of their business, years earlier due to competition from the BE (Cameron, 1967, p. 22). It is thus fair to say that coin and BE notes made up the circulating medium used in London before 1750 and a large part of what circulated outside of the city as well. This is useful because time series for the circulation and deposit liabilities of the BE are available almost from its inception. The rise of deposit banking in the countryside after 1775 and a lack of reliable information about net specie imports, however, doom any attempt to build a continuous series for an M2 aggregate. Nevertheless, Figure 4 shows a strong long-term relationship between the BE's deposit and circulation liabilities and Cameron's (1967, p. 42) sporadic estimates of the broad money supply.[11] Further, Huffman and Lothian's (1980) estimates of high-powered money for the 1833-50 period (not shown) track BE liabilities closely from 1840 to 1850, which is the period when the issues of the joint-stock banks make the trend of the BE series first begin to diverge from the pattern in Cameron's estimates. These observations offer reason to believe that the BE's deposit and circulation

[9] Relatively little is known about the extent of country banking in 18th century England and its contribution to the money supply beyond the information contained in Pressnell (1956). We do know, however, that country banks were generally small and grew rapidly in number after 1750. Cameron (1967, pp. 23-24), for example, reports that "about a dozen" existed in 1750, more than 100 in the early 1780s, more than 300 by 1800, and 783 in 1810.

[10] The trade data are from Mitchell (1988), Table 10.1.A, pp. 448-49, for England and Wales, 1720-91; Table 10.1.B, p. 450, for Great Britain, 1792-1804; and Table 10.2, pp. 451-52, for the U.K., 1805-50. I start with the earlier and more narrow trade figures for England and Wales and then successively join the broader aggregates to form a single trade series. I form the price deflator using Mitchell (1988) by joining the Schumpeter-Gilboy index for consumer goods for 1720-1819 (Table 14.1.B, pp. 719-20) with Rousseaux's overall index for 1820-45 (Table 14.3, pp. 722) and the Sauerbeck-Statist index for 1847-50 (Table 14.4, p. 725).

[11] The circulation and deposit liabilities of the BE are from Mitchell (1988, Table 12.2.A, pp. 655-58). I reconstructed a series for the Bank's private advances as the income from discounting bills and notes and making private loans (Clapham, 1945, Vol. I, Appendix E, pp. 301-02, and Vol. II, Appendix C, p. 433) divided by the Bank rate over the previous year (Clapham, 1945, Vol. I, Appendix D, p. 299, discount rates for inland bills, and Vol. II, Appendix B, pp. 429). This assumes that the BE's loans were primarily short term, which is consistent with Clapham's reading of the loan records.

Figure 3

Industrial Production and International Trade for England, 1720-1850

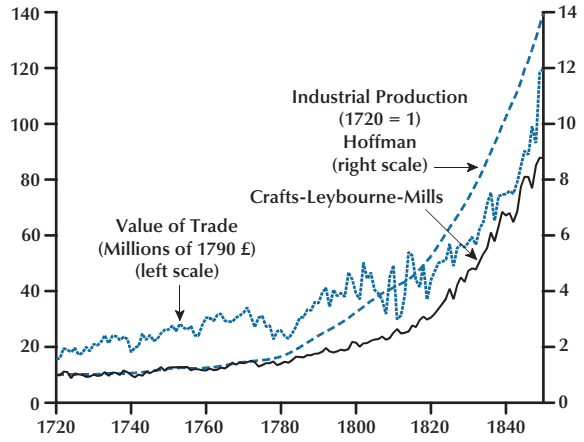
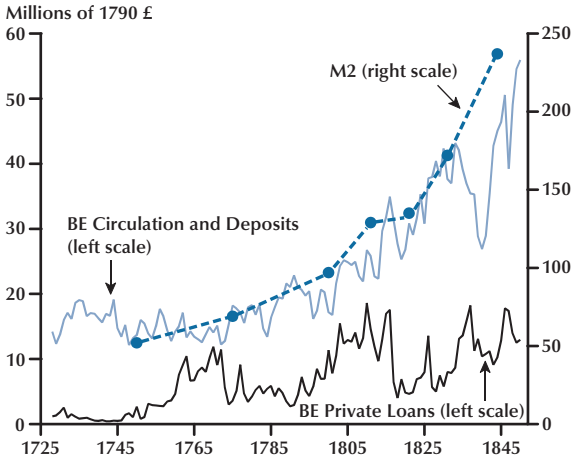


Figure 4

Monetary Aggregates for England, 1728-1850



liabilities are useful as a proxy for long-term fluctuations in narrowly defined money, and perhaps even as a more general measure of monetization.

Part of the BE's business was in making advances to merchants with drawing accounts, though not all those with accounts were entitled to discount (Clapham, 1941). The BE also made over 90 loans to the East India Company between 1709 and 1744, but these direct loans, though exceeding bill and note discounts in the BE's early days, did not become an important component of the asset portfolio until the 1750s (see Figure 4). The BE's private operations grew rapidly after that and even approached the size of its deposit and circulation liabilities during the 1760s and again around 1800. Evidence from the Bank archives shows that loans and discounts were spread across a wide range of commercial activities and that discounts below the statutory limit of £50 were not unusual. Since advances were also used to facilitate trade, fluctuations in their availability may have also affected the course of trade. This is among the possibilities that I examine below.

Quantitative Results with the Aggregate Data

The empirical analysis proceeds as in Section 1, but the two VARs that I consider first capture economic activity in a more general sense than was possible for the Dutch Republic. The first system explores dynamic interactions between industrial production, trade, and monetization as measured by the BE's deposit and circulation liabilities. In the second, I replace the measure of monetization with the quantity of private loans and discounts at the BE, which should reflect the stringency of credit conditions in the London money market.

Table 3 reports the findings.[12] Given the limitations of early British data, it is striking that BE liabilities do indeed Granger-cause industrial production at the 15 percent level in the upper panel and that this effect is unidirectional. If BE liabilities reflect monetization as I have suggested, this means that finance moved before output in England's modern sector and may have played a leading role in its development. Interestingly, neither monetization nor industrial production appear to affect trade quantities. In the lower panel of the table, BE private lending does not Granger-cause industrial production or trade, but trade does Granger-cause BE lending. Since periods of high demand for trade credit are likely to coincide with surges in real trading activity, this relationship would be expected.[13]

[12] As in the analysis for the Dutch Republic, the unit root hypothesis cannot be rejected for any of the variables considered in this section using ADF tests with three lags, and Johansen tests indicate that the systems are cointegrated. See appendix for details.

[13] I also estimated the VARs using Hoffman's index of industrial production in place of the Crafts, Leybourne, and Mills index. The results for the analogue of the upper panel in Table 3 were similar, though BE liabilities in this case Granger-caused industrial production at the 10 percent level. This stronger result might be expected given the rise in BE liabilities after 1770 and the (earlier) 1780 start of the Industrial Revolution that Hoffman's data imply. BE private loans also Granger-cause trade at the 15 percent level when using Hoffman's index.

Table 3

VARs of Financial and Real Activity for England, 1728-1850

Equation	Dependent variable	Industrial production index	Market value trade	BE liabilities	Adjusted R^2
1a	Industrial production index	0.980 (0.000)	–0.025 (0.111)	0.102 (0.136)	0.976
1b	Market value trade	0.054 (0.335)	0.924 (0.000)	0.041 (0.346)	0.938
1c	BE liabilities	–0.010 (0.995)	0.125 (0.091)	0.888 (0.000)	0.921

Equation	Dependent variable	Industrial production index	Market value trade	BE private loans	Adjusted R^2
1a	Industrial production index	0.988 (0.000)	0.066 (0.039)	–0.009 (0.280)	0.976
1b	Market value trade	0.075 (0.204)	0.918 (0.000)	0.009 (0.389)	0.938
1c	BE private loans	–0.152 (0.346)	0.386 (0.005)	0.877 (0.000)	0.886

NOTE: See note for Table 1. The VARs use four lags that were selected with nested likelihood ratio tests. Data are in real log levels.

Figure 5 displays selected impulse responses. In the upper-left panel, a 1 percent increase in "monetization" is associated with persistent increases in industrial production that cumulate to nearly 2 percent after five years. In the upper-right panel, a 1 percent increase in industrial production increases trade by about 0.42 percent over the same period. The response of trade to a 1 percent rise in BE loans, though not significant in the Granger tests, is "significantly" positive (i.e., the lower one-standard-error band rises above the zero line) three years after the shock but cumulates to only 0.11 percent after five years. Interestingly, the effect of a 1 percent increase in monetization on trade, though also not statistically significant in the Granger tests, adds up to nearly 1 percent after five years. Thus, the impulse responses offer a richer interpretation than that obtained with standard block exogeneity tests. Indeed, a pattern emerges in which finance affects output, and to a lesser extent trade, while increases in output encourage more trade.

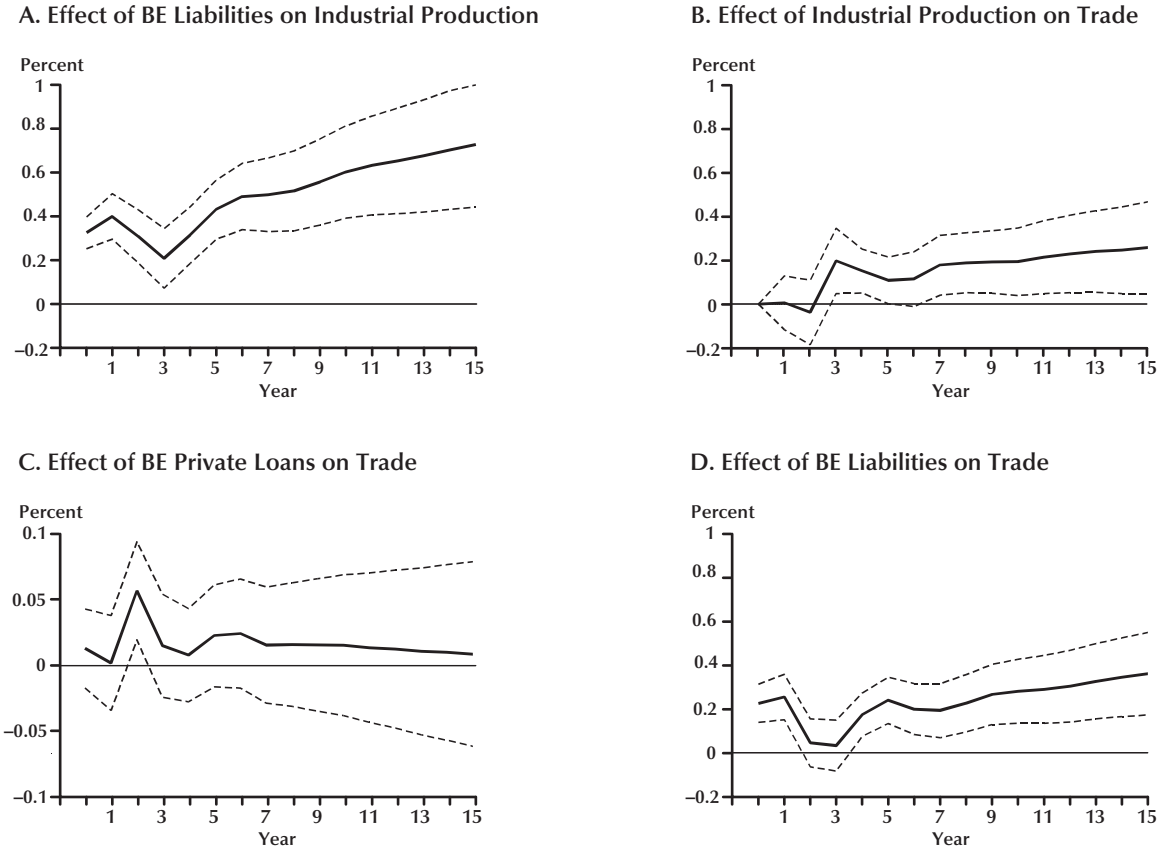
Financing Constraints and the English East India Company

The British version of the Asiatic trade behemoth, the English East India Company (EIC), formed at about the same time as its Dutch counterpart (1601), but remained a loosely knit group of merchants operating in the shadow of its North Sea rival for decades before creating a permanent capital of £369,891 in 1657 (Chaudhuri, 1978, p. 7). The Company's early operations were limited by an inability to garner recently mined American silver in quantities that the Dutch VOC could command. The presence of more developed financial and trading institutions in Amsterdam to handle specie flows is a likely explanation for the early preeminence of the Dutch, but the English company managed to expand operations early in the 18th century following a merger in 1708 with a competing English trading company.

The EIC's capital was small compared with the turnover of its operations, and as such it depended heavily on short-term debt and internally generated funds to get voyages out to sea. If financing were a problem for the Company in the 17th century, as much anecdotal evidence suggests that it was, yet became a less binding constraint as the English financial system developed, we should observe the availability of cash or debt financing as a less important determinant of the Company's investment activities than something more fundamental such as the quality of investment opportunities, at least for the first half of the 18th century. Because the

Figure 5

Selected Impulse Responses from VAR Systems for England, 1728-1850



NOTE: The impulse responses are taken from the VAR systems reported in Table 3. The ordering places BE deposit and circulation liabilities or BE private loans first, the real market value of trade second, and real industrial producion third. Using Monte Carlo integration, the solid lines are the mean impulse responses that result from 10,000 random draws from the posterior distribution of the estimated VAR coefficients. The dotted lines are one-standard-error bands.

available data cover the heyday of the EIC, the Q-theory analysis that follows is even more telling for the efficiency of English finance than that presented in the previous section for the VOC, which covered the period of gradual decline for the Dutch enterprise.

By 1710 a number of government securities traded on the London Stock Exchange beside shares of the main trading companies, and Castaing's *Course of the Exchange* (the *Wall Street Journal* of its day) carried the share prices. Due to the painstaking work of Larry Neal (1990, pp. 231-57), we now have a nearly complete picture of EIC share prices from this point onward. Balance sheet data, including cash balances, debt levels, and trading values are available for 1710-45 from Chaudhuri (1978).[14] The econometric specifications that I consider are similar to those estimated for the VOC (see Table 2), where Q controls for the quality of the EIC's investment opportunities as perceived by the stock market, exports proxy for actual investment, and the firm's cash balances and total debt alternately enter the model to capture the dependence of the Company's investment on the availability of cash resources.

The results, displayed in Table 4, offer evidence that financing constraints did not bind for the EIC over this period. In the upper panel, Q Granger-causes EIC trade at the 5 percent level, while the firm's total debt levels do not approach statistical significance. The effects are also unidirectional in a

[14] Asian exports of the EIC are from Chaudhuri (1978), Table C.1, p. 507. The EIC's cash balances and total bond debt are from Table A.26, col 3, p. 440.

Table 4

VAR Models of Q and Trade for the British East India Company, 1710-45

Equation	Dependent variable	Market value EIC trade	EIC total debt	EIC Q	Adjusted R^2
1a	Market value EIC trade	0.979 (0.090)	–0.804 (0.386)	0.382 (0.042)	0.591
1b	EIC total debt	0.423 (0.004)	0.077 (0.636)	–0.089 (0.131)	0.770
1c	EIC Q	–0.069 (0.149)	0.117 (0.254)	0.449 (0.000)	0.653

Equation	Dependent variable	Market value EIC trade	EIC cash balance	EIC Q	Adjusted R^2
1a	Market value EIC trade	0.344 (0.388)	–0.241 (0.783)	0.399 (0.073)	0.550
1b	EIC cash balance	–0.590 (0.198)	–0.335 (0.441)	0.057 (0.965)	0.012
1c	EIC Q	–0.513 (0.151)	–0.491 (0.191)	0.567 (0.000)	0.891

NOTE: See note for Table 1. The VARs use three lags. EIC trade and debt are in real log levels in the upper panel. Due to negative observations for cash, EIC trade and cash balances enter the VAR in the lower panel as real levels.

statistical sense, as evidenced by a lack of Granger-causality from either EIC exports or debt to Q. The results are similar in the lower panel when the EIC's cash balances replace external debt as the financial variable. These results suggest that the EIC may have been constrained by the quality of its investment opportunities, but that the availability of finance did not enter into investment decisions. This is, as in the Dutch case, characteristic of a capital market that could mobilize the resources needed for economic development. And though the VAR systems are silent on whether such unconstrained access to capital was available for smaller merchants and manufacturers, "good" institutional arrangements seem to have been in place for firms that had achieved some degree of public reputation.

THE UNITED STATES

A "Federalist Financial Revolution"?

Any skeptic of the importance of finance in promoting economic development must come to grips with the powerful case of the United States after adoption of the federal Constitution in 1788. At no other point in history did the five elements of a "good" financial system develop so rapidly. Much of the credit for what Richard Sylla (1998) has termed the "Federalist financial revolution" seems appropriate to bestow upon the nation's first secretary of the Treasury, Alexander Hamilton, though the impact of Hamilton's reforms on the real side of the economy were perhaps not fully felt for another quarter century, when the "modern" sector finally emerged.

By any standards, the U.S. economy experienced a near-miraculous turnaround in the last decade of the 18th century, when it made the transition from a defaulting debtor awash in obligations left over from the war of independence to a magnet for international capital flows. The chartering of a national bank, the First Bank of the United States, and Hamilton's ingenious idea of allowing federal debt securities to be tendered for shares therein, quickly raised the restructured U.S. debt, which had been trading at pennies on the dollar through informal channels, to par and above by 1791. Securities markets in New York, Philadelphia, and Boston quickly sprang up to trade these securities and others associated directly with internal improvements.

Hamilton also established a federal mint, bringing order to the collection of foreign coins and various issues of fiat paper that had previously

Figure 6

Private Investment and Foreign Trade for the United States, 1790-1850

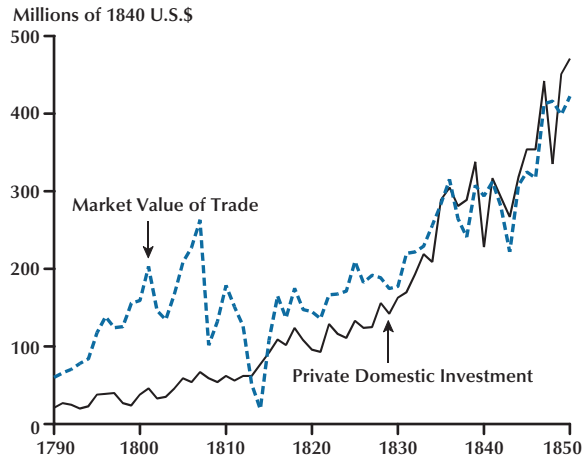
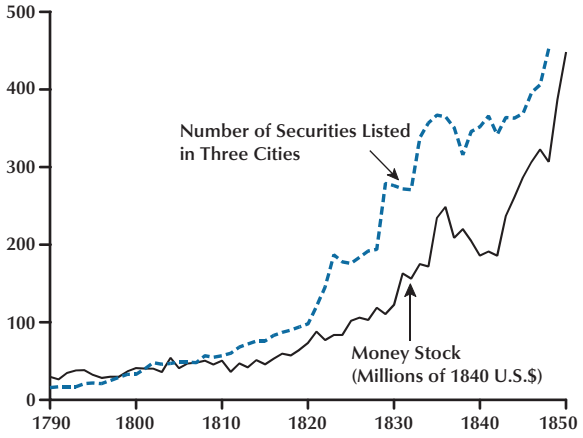


Figure 7

Monetary and Financial Aggregates for the United States, 1790-1850



comprised the nation's money stock under a bi-metallic standard. Over the next 50 years, the number of banks would rise from 3 in 1791 to more than 800, and the paid-in capital of the banking system would increase by more than 100-fold!

Given the speed with which a sophisticated financial sector emerged in the United States, it is surprising that economic historians have only recently begun to consider seriously its implications for the nation's early growth. This is probably because agriculture remained dominant for most of the 19th century, preventing measures of early gross national product (GNP), such as those of David (1967) or Berry (1988), from reflecting growth in the "modern" sector very well—that is, the part of the economy that would have relied most on the types of financing arrangements that were available in the U.S. markets of the time.

Measures of Financial and Real Sector Development

As in the analyses of the Dutch Republic and England noted previously, it is the development of a "modern" sector, as measured by foreign trade and investment activity, that I will focus upon in the empirical analysis.[15] Figure 6 presents the series. Both foreign trade and private domestic investment rise slowly in real terms until 1815, when they begin to accelerate, which is consistent with the rise of a modern sector at about this time.

On the financial side, a measure of monetization is again needed. And though it is difficult to measure the quantity of specie in the hands of the public—the most important component of the money stock in the early national period—with any degree of confidence, Rousseau and Sylla (1999) use the available data to extend Peter Temin's (1969) series, which begins in 1820, back to 1790 by replicating Temin's method as closely as possible.[16] The resulting series includes obligations of banks to the public and specie outside of banks, and thus represent assets that are either acceptable or quickly convertible for use in market transactions. Increases in the real value of these assets reflect more widespread use of the market economy and might be plausibly linked to trade and investment.

It is also for the United States that I can first introduce securities markets explicitly into the empirics. Rousseau and Sylla (1999, pp. 7-12), in tandem with Sylla, Wilson, and Wright (1997), collected the total number of securities listed in the financial press for three major cities (New York, Philadelphia, and Boston) around the end of each calendar year from 1790 to 1850, and I will use this

[15] Foreign trade is the sum of total exports and imports (U.S. Bureau of the Census, *Historical Statistics of the United States*, 1975, Series U1 and U8, pp. 865-66). Gross domestic investment is from Berry (1988).

[16] The data and methods used to construct the annual series for the U.S. money stock are described in detail in Appendix A of Rousseau and Sylla (1999, pp. 48-50), and the series will appear in the forthcoming millennial edition of the *Historical Statistics of the United States*.

Table 5

VARs of Financial and Real Activity for the United States, 1790-1850

Equation	Dependent variable	Investment	Market value trade	Money stock	Adjusted R^2
1a	Investment	0.717 (0.000)	–0.266 (0.094)	0.423 (0.018)	0.964
1b	Market value trade	–0.239 (0.799)	0.377 (0.001)	0.549 (0.010)	0.663
1c	Money stock	0.154 (0.075)	0.037 (0.958)	0.840 (0.000)	0.973

Equation	Dependent variable	Investment	Market value trade	Money stock	No. of listed securities	Adjusted R^2
1a	Investment	0.245 (0.570)	–0.253 (0.025)	0.281 (0.009)	0.470 (0.005)	0.972
1b	Market value trade	–0.050 (0.918)	0.373 (0.001)	0.597 (0.004)	–0.185 (0.391)	0.664
1c	Money stock	0.089 (0.168)	0.032 (0.961)	0.823 (0.000)	0.074 (0.669)	0.971
1d	No. of listed securities	–0.053 (0.772)	–0.013 (0.879)	–0.015 (0.662)	1.042 (0.000)	0.991

NOTE: See note for Table 1. The VARs use four lags that were selected with nested likelihood ratio tests. Data are in real log levels. The lower panel reports results from a four-dimensional system, which requires an extra equation (1d) in the VAR.

as a robust measure of the size (and perhaps the sophistication) of the securities market.

Figure 7 displays financial series. Both money and securities listings grow slowly until about 1815 when they begin to rise quickly. Overall, both series grow at an average rate of about 4.5 percent per year, which is higher than the 1.9 percent growth rate of GDP (Berry 1988) and implies rapid financial deepening.

Time-Series Findings

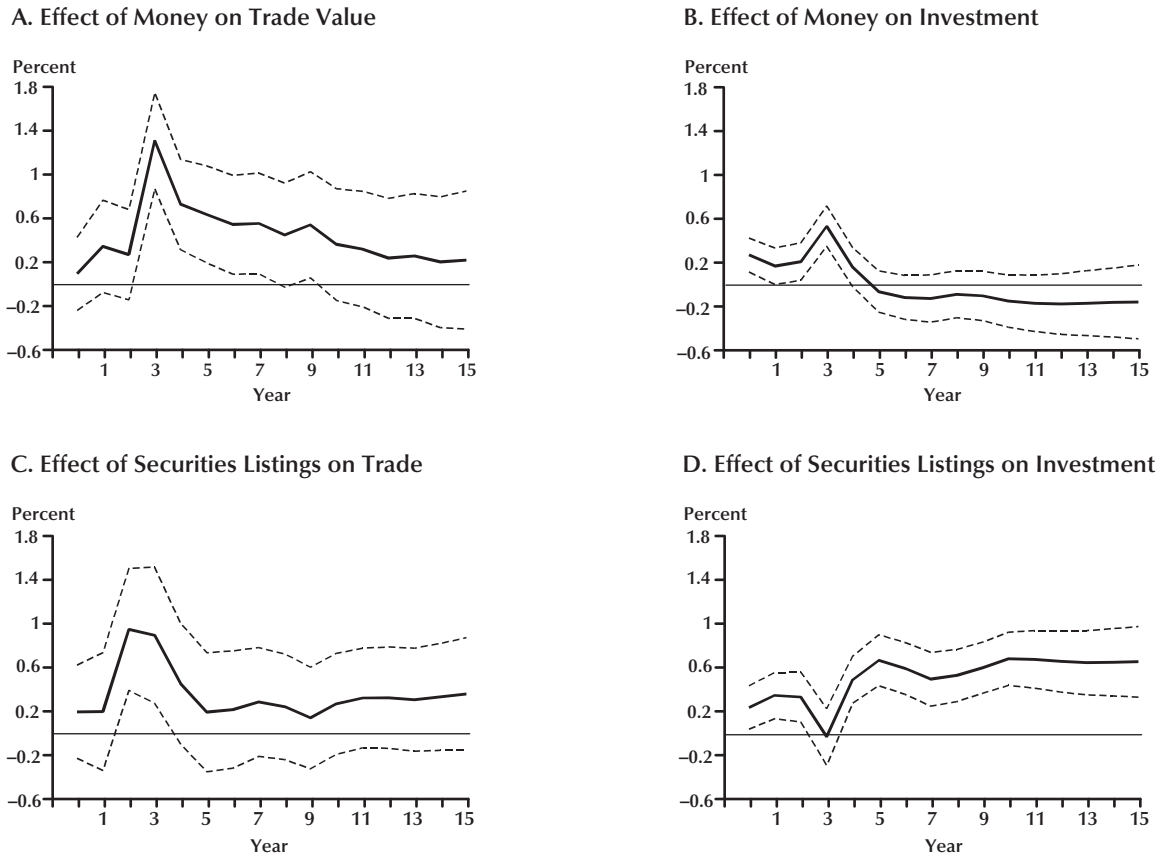
To explore possible links between the financial and real variables described above, I start with a VAR specification that includes measures of investment, trade, and monetization. I will then add the number of listed securities to this system to measure their additional impact. The method of bringing securities markets into the analysis incrementally is consistent with Levine and Zervos (1998) and Rousseau and Wachtel (2000), who keep a measure of liquid liabilities in their baseline models to allow for complementarities between banks and stock markets in the growth process. All data are transformed into logs before analysis. Table A1 in the Appendix shows that the four series that I use are statistically indistinguishable from unit root processes, and Table A2 shows that the two systems are cointegrated, which justifies running the VARs in levels form.

Table 5 presents the results. In the upper panel, the findings for the three-variable system show that the money stock Granger-causes both real investment (top line, third column) at the 2 percent level, and the value of real trade (second line, second column) at the 1 percent level. Trade Granger-causes investment at the 10 percent level, but has a negative overall effect, which suggests that increases in the import component of trade may have to some degree crowded out investment in the early United States. In the lower panel, the results for the four-variable system are similar to the three-variable results insofar as the monetary effects are concerned, yet the size of the securities market also exerted a positive and independent effect on investment. Listed securities do not Granger-cause trade, however, which suggests that the rise of securities markets had their largest effects in the domestic capital market.

Figure 8 presents selected impulse responses from the four-variable system in Table 5. In panels A and B, respectively, 1 percent increases in the

Figure 8

Selected Impulse Responses from a Four-Variable VAR for the United States, 1728-1850



NOTE: The impulse responses are taken from the VAR systems reported in the lower panel of Table 5. The variable ordering places the number of listed securities first, the real money stock second, the real market value of trade third, and real investment last. Using Monte Carlo integration, the solid lines plot the mean impulse responses that result from 10,000 random draws from the posterior distribution of the estimated VAR coefficients. The dotted lines are one-standard-error bands.

real stock of money are associated with increases in trade of 2.78 percent and in investment of 1.35 percent after five years. Panels C and D indicate that 1 percent increases in the number of listed securities increase trade by 2.70 percent and investment by 1.37 percent after five years. The result for the effect of listed securities on trade is striking because the Granger tests did not show a significant effect, which once again is an important reason to consider the nonlinear and interactive impulse responses when evaluating VAR systems. The effects of both the money stock and the number of listed securities on trade and investment are of about the same order of magnitude once they have had an opportunity to work their way through the VAR for five years.

There is no doubt that the data available for the United States in the early national period are sketchy, yet they have been generated using the best practices available to the economic historian. And the relative strength of the results with these data reveal that the nascent "finance-led growth" hypothesis for the United States at the very least requires much more investigation among macroeconomists and economic historians alike.

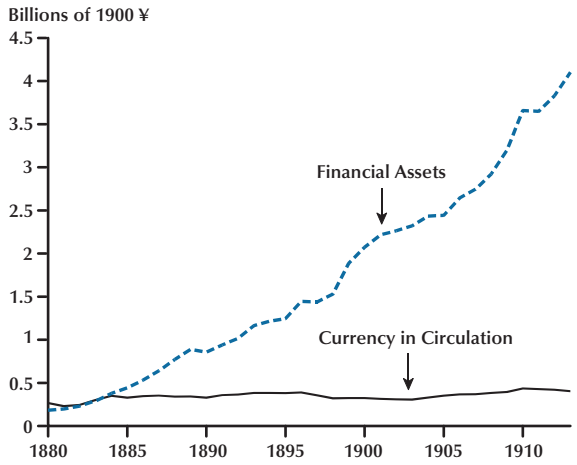
JAPAN

Financial Developments in the Meiji Period

In the decade that followed the restoration of the Meiji regime in 1868, Japan made a quantum

Figure 9

Monetary and Financial Aggregates for Japan, 1880-1913



leap in the development of financial markets and foreign trade and quickened the pace of its industrialization. Scholars of the period such as Ott (1962) and Lockwood (1968) have remarked that the financial sector was instrumental in promoting the adoption of new agricultural and machine-based industrial technologies that allowed Japan to achieve modern rates of economic growth after 1885. This section reviews the empirical evidence for this proposition using available historical statistics and drawing from the more extended analysis in Rousseau (1999).

Among the financial innovations of the 1870s, the most important was the commutation of rice payments (i.e., taxes) that were normally made to the feudal nobility through an issue of long-term government bonds, which were redeemable only at heavy discounts. In an action reminiscent of Alexander Hamilton, an 1876 revision of the National Bank Act then allowed these bonds to be used as banking capital. Like its U.S. predecessor, stock markets emerged in Tokyo and Osaka shortly thereafter for trading the fresh securities. A rapid expansion in the number of national banks from 5 in 1876 to 151 in 1879 ensued (Bank of Japan, 1966, p. 196). Among the new banks was the Yokahoma Specie Bank, which started up in 1880 to meet the foreign exchange needs of merchants who were active in the nation's growing foreign trade and spurred by the low tariff rates that remained in effect until 1895. As the economy opened more and more to the West, it was able to import industrial technologies, such as the power loom that had been available in Europe and the United States for decades, and was able to do so at relatively low cost.

Japan's financial development was briefly short-circuited in 1880 when note issues of the newly formed banks flooded the market and caused an episode of sharp inflation, but this experience led to a consolidation of note issuance under the nation's first central bank, which formed in 1882. In short, by 1885 Japan had achieved all five elements of a "good" financial system and did so almost as quickly as the United States had 80 years earlier.

Evidence of Finance-Led Growth in Meiji Japan

The statistical analysis uses a broad measure of financial development that encompasses the total assets of Japan's most important intermediaries and the book values of corporate debt and equity in the hands of the public. The intermediaries include commercial banks (national, private, and ordinary), special banks, savings banks, agricultural cooperatives, and insurance companies, but do not include quasi-banks, small credit cooperatives, and country pawnbrokers (who, according to Goldsmith, 1983, p. 27, accounted for as much as 18 percent of all intermediary assets).[17] Figure 9 shows the remarkable growth of the broad financial aggregate from 1880 to 1913 and contrasts it with the relative flatness of the amount of currency in circulation. GNP and private domestic fixed investment serve as measures of real sector performance.

The trivariate VAR specifications that I consider include currency in circulation, the broad financial aggregate, and either output or private fixed investment, with all variables converted to logs of real 1900 quantities prior to analysis. The unit root and cointegration tests for these systems, reported in Tables A1 and A2 of the appendix, suggest that estimation in levels is appropriate. Table 6 presents the results. In the upper panel, financial assets Granger-cause GNP at the 1 percent level, currency Granger-causes GNP at the 10 percent level, and there is no feedback from GNP to either currency or financial

[17] The source data used to build the financial and real aggregates are from the Bank of Japan (1966), Ott (1962), and a five-volume series edited by Ohkawa, Shinohara, and Umemura, titled *Estimates of the Long-Term Economic Statistics of Japan Since 1868*. See Rousseau (1999, pp. 196-97) for details.

Table 6

VARs of Financial and Real Activity for Japan, 1880-1913

Equation	Dependent variable	GNP	Currency in circulation	Financial assets	Adjusted R^2
1a	GNP	–0.163 (0.582)	0.097 (0.088)	0.360 (0.001)	0.988
1b	Currency in circulation	–0.287 (0.576)	0.800 (0.000)	0.075 (0.286)	0.833
1c	Financial assets	–0.170 (0.959)	–0.041 (0.875)	0.999 (0.000)	0.994
Equation	**Dependent variable**	**Private investment**	**Currency in circulation**	**Financial assets**	**Adjusted R^2**
1a	Private Investment	0.236 (0.074)	1.895 (0.055)	0.457 (0.036)	0.957
1b	Currency in circulation	–0.138 (0.010)	1.060 (0.000)	0.087 (0.014)	0.872
1d	Financial assets	–0.080 (0.616)	0.143 (0.585)	1.007 (0.000)	0.993

NOTE: See note for Table 1. The VAR with GNP uses three lags of each variable, and the VAR with private investment uses four, with the lag orders selected with nested likelihood ratio tests.

assets. The lower panel reports qualitatively similar findings when private fixed investment replaces GNP as the measure of real sector activity, except that investment and financial assets now Granger-cause currency. This result reflects a complementarity between cash and real investment, which is consistent with the developing-economy model introduced by McKinnon (1973, esp. Chap. 6). There is again no feedback from investment or currency to financial assets.

The impulse responses in Figure 10 indicate that the effects of real financial assets on real output and investment are large, with a 1 percent increase in financial assets associated with a 1.38 percent increase in GNP (panel B) and a 1.37 percent increase in investment after five years (panel D). It is the effect of currency on investment (panel C) that is truly striking, with a 1 percent increase in currency raising investment by 7.6 percent after five years. Though strong inferences should surely be avoided given the sheer size of the response and the fact that it was derived from a VAR system with only 34 usable time series observations, the result nonetheless emphasizes that all economic actors did not necessarily have access to the formal financial sector and may have used cash as a vehicle for saving to overcome investment indivisibilities.

Overall, the findings for Meiji Japan suggest that the financial system played a key role in promoting output and investment and offer strong support for the hypothesis of "finance-led" growth.

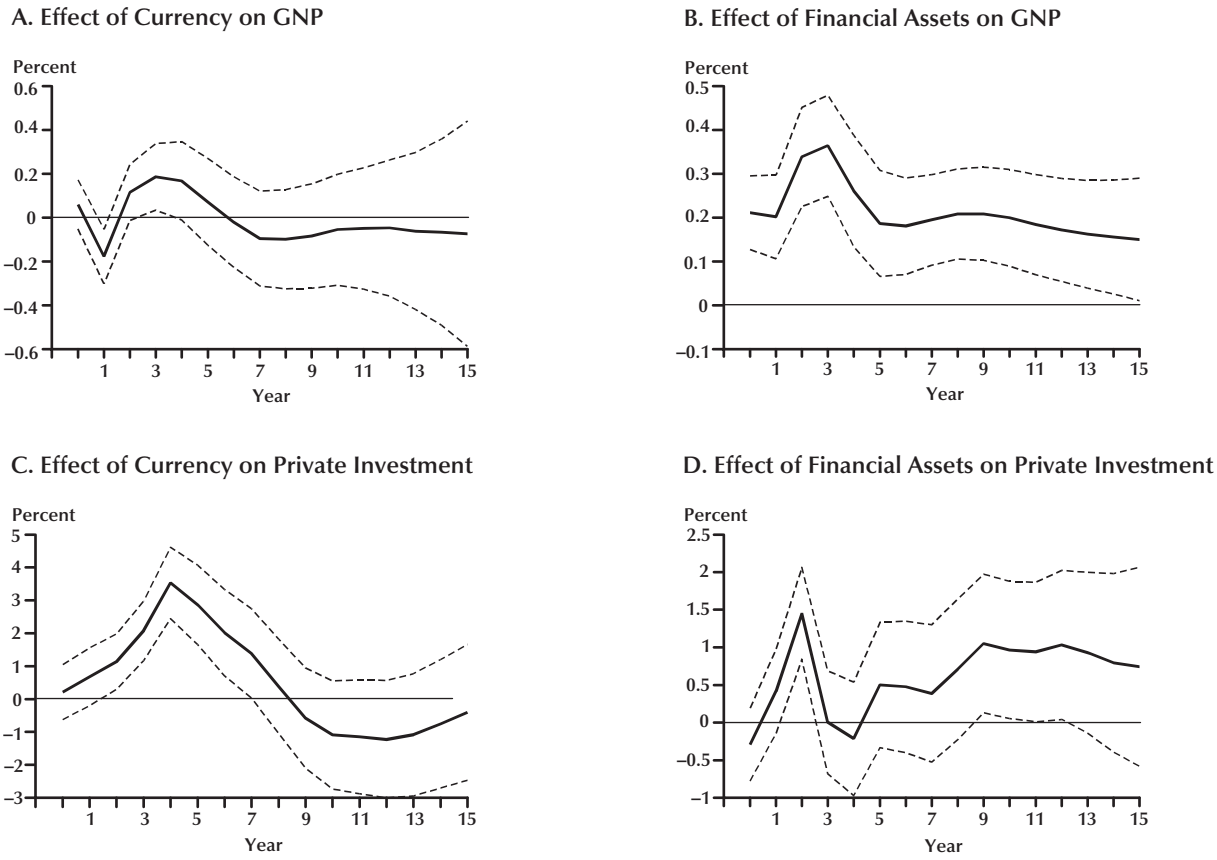
FROM 1850 TO THE PRESENT

The case approach taken in the previous sections facilitated the statistical investigation of four of history's "financial revolutions" and their impact on real activity, but is indeed limited to countries that achieved some degree of what might be called economic "success." This means that there are elements of selection bias in the cases considered here, not the least of which involves the very availability of early economic data for countries where financial institutions emerged in conjunction with modernization.

This problem is present but less severe after 1850, however, because economic data become available for an increasing number of countries. From 1850 to 1929, for example, continuous measures of real output and monetization can be assembled for a set of 17 countries that are often referred to as the "Atlantic" economies, even though Australia

Figure 10

Selected Impulse Responses from VARs for Japan, 1880-1913



NOTE: The impulse responses are taken from the VARs reported in Table 6. The variable ordering places financial assets first, currency second, and either GNP or private domestic investment third. Using Monte Carlo integration, the solid lines plot the mean impulse responses that result from 10,000 random draws from the distribution of the estimated VAR coefficients. The dotted lines are one-standard-error bands.

and Japan are usually included in the group.[18] This sample is broad enough to consider a cross-section analysis of the relationship between financial deepening and economic growth with the techniques used so successfully for the post-World War II period by Ross Levine and his collaborators (e.g., King and Levine, 1993). In this section, I present a few cross-sectional results for the Atlantic economies over the 1850-1997 period, and then compare the findings with those obtained for the subperiod 1850-1930.[19]

The data are from four main sources. From 1960, it is the World Bank's *World Development Indicators* database. Data for earlier years are from worksheets underlying Bordo and Jonung (2001) and Obstfeld and Taylor (2003), and Mitchell (1998a,b,c).[20]

To examine the partial correlations between the size of the financial sector and economic growth from 1850 while retaining the widest cross section possible, it is necessary to choose a broad aggregate, such as the ratio of the liquid liabilities to output, as the measure of financial development. Liquid liabilities is, of course, an imprecise measure because of nonbank intermediaries such as insurance and

[18] The 17 countries are Argentina, Australia, Brazil, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States.

[19] The results draw primarily from Rousseau and Sylla (2001). Interested readers should see this earlier paper for a more extended analysis.

[20] Rousseau and Sylla (2001, pp. 39-45) include a complete description of the data sources and methods used in constructing this panel.

Table 7

Cross-country Growth Regressions, 1850-1997 and 1850-1929

	Dependent variable: % growth of per capita real GDP			
	1850-1997		1850-1929	
	OLS	IV	OLS	IV
Constant	7.463**	6.776**	6.206**	6.308**
	(1.500)	(1.477)	(2.034)	(2.050)
Log of initial real per capita GDP	–0.706**	–0.603**	–0.710**	–0.731**
	(0.179)	(0.179)	(0.307)	(0.305)
Initial ratio of broad money to GDP	0.949*	0.956*	2.251**	2.186**
	(0.541)	(0.540)	(1.075)	(1.039)
Initial ratio of government expenditure to GDP	–5.280**	–5.915**	–6.229	–6.397
	(2.299)	(2.583)	(3.848)	(4.150)
R^2	0.339	0.372	0.137	0.147
No. of observations	211	197	186	185

NOTE: The table reports coefficients from OLS and IV regressions, with standard errors in parentheses. The dependent variable is the growth rate of real per capita GDP averaged for each decade for the regressions that cover 1850 to 1997 and averaged over 5-year periods for the regressions that cover 1850 to 1929. Initial values are taken from the first year of each period. Period dummies are included in the regression but are not reported. * and ** denote statistical significance at the 10 percent and 5 percent levels, respectively.

investment companies whose liabilities do not wind up in the aggregate. These omissions are probably not that important in the prewar period, but quite substantial in recent years. Further, the broadly defined money stock does not include securities markets. Growth in real income per head, despite its inability to reflect the distribution of wealth and its implications for welfare, is a common measure of economic performance and is readily available for all 17 countries back into the mid-19th century.

Following the now-standard cross-country growth specification of Barro (1991) as supplemented by King and Levine (1993), Table 7 presents regressions in which the average growth rate of real per capita GDP is the dependent variable. Averaging is done across decades for the 1850-1997 period and across five-year periods for 1850-1929. The baseline regression also conditions on the level of per capita income (in 1960 U.S. dollars) at the start of each period to capture a convergence or "catching up" effect. The ratio of government expenditure to GDP also appears because the resource requirements that are often associated with large public expenditures are likely to "crowd out" private investment and lead to less efficient resource allocations than the private sector might provide. Finally, the ratio of the broad money stock to GDP is included to capture the effects of financial development. The specification also includes dummy variables for each time period to control for time trends in the levels variables and for business cycle effects.

In the ordinary least-squares (OLS) regressions, the first observations for each period are used as the regressors to ameliorate the impact of possible reverse causality from growth to additional finance. This technique cannot fully eliminate the simultaneity problem due to autocorrelation in the time series for financial depth, but it does ensure that all regressors are predetermined and thus plausible determinants of *subsequent* growth. The instrumental variables (IV) specifications use contemporaneous averages of the data as regressors and control for simultaneity by instrumenting in each period with the initial values of the complete set of regressors, initial inflation, and the ratio of initial trade (exports plus imports) to GDP.

A strong convergence effect, as indicated by negative coefficients on initial income that are statistically significant at the 5 percent level, is common to all four regressions reported in Table 7. Government expenditure has the expected negative sign and is significant at the 5 percent level for the full 1850-1997 period, but is not quite significant at the 10 percent level for the pre-Depression period, though the coefficients are about the same size throughout. The coefficient sizes are robust to the

choice of the initial value OLS or IV estimation technique. It is the differences across subperiods in the coefficients on the ratio of the broad money stock, however, that are particularly interesting. For 1850-1997, the coefficients are about 1 and significant at only the 10 percent level. Evaluated at the sample mean of 50.6 percent, this implies that an increase in financial depth of 10 percentage points would increase the annual growth rate of GDP by about 0.1 percent, which is not particularly large. For the 1850-1929 period, the coefficients are significant at the 5 percent level and more than double the size, implying an increase in GDP growth of 0.22 percent per year for a 10-percentage-point increase in financial depth from the sample mean of 42.8 percent.

The sharper increase in output for a given change in financial depth in the pre-1930 period is consistent with the view that financial factors matter most emphatically in the early stages of economic development by mobilizing and allocating resources and make smaller contributions to the efficiency of resource allocation in more mature economies. The sample of "Atlantic" economies makes this point clear, since many were relatively "immature" in the 19th century yet nearly all could be termed "mature" today. King and Levine (1993) obtain results using a similar specification for the post-1960 period that are similar to mine for 1850-1929, and now we can posit at least one reason for this: the King and Levine sample, due to its inclusion of 80 or more countries, captures many of them in their emerging phases and is thus closer in composition, at least insofar as phases of economic development are concerned, to the earlier sample of Atlantic economies.

CONCLUSION

The case studies considered in this article offer statistical evidence that the development of banking and securities markets mattered for industrialization and the expansion of commerce in four economies that are generally considered to have experienced "financial revolutions" over the past 400 years. The data are more limited than those at the disposal of the modern macroeconomist, and this means that results must be interpreted as more suggestive than definitive, yet the consistency of the evidence with the historical narrative that can be obtained by letting the data speak is unmistakable. Cross-country evidence for the period from 1850 to the present indicates that the results obtained in the case studies are not just a result of biases imposed by the availability of historical data.

Surely other factors, particularly the adoption of new technologies, are also at the center of commercial and industrial revolutions. In 17th century Amsterdam, that innovation was the ability to build seaworthy vessels quickly and cheaply enough to exploit the trade opportunities associated with circumventing the Cape of Good Hope. For early 19th century England, it was steam, the power loom, and a host of other machines that raised productivity. Even in these cases, however, the new technologies needed financing to get off the ground, and the emerging financial markets in these nations seem to have provided it. And the very availability of financing would have encouraged other potential entrepreneurs to formulate new business ideas.

It is in this way that I believe the financial sector mobilized the resources needed to start large projects in the pre-industrial period and had incentive effects in the real sector that extended beyond those firms that actually received financing. It remained for the later industrial phases, at least in England and the United States, for the financial sector to develop the sophisticated screening and monitoring functions required to affect economic growth through the quality of resource allocations, but the expansion of deposit banking in these countries ultimately did this as well. The process of market emergence and expansion prepared each of the four nations for world economic leadership over the next century—positions that Amsterdam and England were able to retain until new technologies, both real and financial, displaced them in classic episodes of Schumpeterian creative destruction. Will today's information technology revolution hasten the emergence of a "world" financial market in which the United States will assume the role of partner among equals rather than the leadership position to which we have grown accustomed over the past century or so?

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Appendix

TIME-SERIES PROPERTIES OF DATA USED IN THE EMPIRICAL ANALYSIS

This appendix presents Augmented Dickey-Fuller (ADF) tests for unit roots and Johansen (1991) tests for cointegration in the series and VAR systems used in the analysis. If ADF tests are unable to reject the unit root for a series in levels, yet reject after differencing, there is some justification for treating the series as I(1) in subsequent modeling. The univariate representations for the ADF tests include four lags. The trending nature of the series make both constant and trend terms necessary in the levels tests, while a constant-only regression is used for the first differences. The log transformation is applied to series that enter VAR systems as such. Table A1 reports the test statistics and significance levels.

A VAR system with nonstationary variables is classified as cointegrated if a linear combination exists that yields a stationary series when applied to the data. In the trivariate case, a cointegrating relationship also implies that the error terms of the system are stationary. The technique developed by Johansen (1991) provides a regression-based test for determining both the presence of cointegration and the number of linear stationary combinations that span the space. Each system is modeled as a VAR of the form

$$\text{(A.1)} \qquad \Delta x_t = \mu + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-1} + \mathbf{\Pi} x_{t-k} = e_t,$$

where x_t is a vector containing the potentially endogenous variables and k is adequately large both to capture the short-run dynamics of the underlying VAR and to generate residuals that approximate the normal distribution. The lag order for each system is chosen with a series of nested likelihood ratio tests. The presence of trends in the data suggests the inclusion of an unrestricted intercept. The Johansen methodology tests whether the $\mathbf{\Pi}$ matrix in (A.1) is of less than full rank via the trace and maximum eigenvalue statistics. Table A2 includes the results and significance levels for the four countries in the study.

Table A1

ADF Tests for Series Used in the Empirical Analysis

	Levels	1st Difference
Amsterdam, 1641-1794		
Market value of VOC trade	–2.38	–8.60**
No. of outbound VOC voyages	–3.46*	–8.46**
VOC hard money exports	–1.89	–6.48**
BA drawing balances	–2.85	–6.36**
VOC debt at the BA	–3.41	–5.29**
England, 1728-1850		
Industrial production	–0.10	–6.85**
Market value of trade	–0.86	–5.94**
BE circulation and deposits	–2.15	–6.09**
BE private loans	–1.41	–5.35**
EIC exports (1710-45)	–2.93	–3.19*
EIC debt (1710-45)	–2.14	–2.48
EIC cash balances (1710-45)	–2.52	–3.23**
EIC Q (1710-45)	–3.10	–2.88
United States, 1790-1850		
Domestic investment	–2.50	–4.32**
Foreign trade	–2.14	–4.39*
Money stock	–2.38	–3.65*
No. of listed securities	–1.58	–3.61*
Japan, 1880-1913		
Gross national product	–2.27	–6.39**
Private domestic investment	–1.94	–5.42**
Currency in circulation	–2.68	–4.67**
Financial assets	–3.80**	–3.68**

NOTE: * and ** denote rejection of the unit root hypothesis at the 10 and 5 percent levels, respectively.

Table A2

Johansen Tests for Cointegration

	Trace			Maximum eigenvalue		
	r = 0	r ≤ 1	r ≤ 2	r = 0	r ≤ 1	r ≤ 2
Amsterdam (K = 3)						
Trade, BA balances, money exports	49.19**	21.38**	3.22*	27.81**	18.16**	3.22*
Trade, BA balances, VOC debt	49.03**	11.68	2.64	37.35**	9.04	2.64
Voyages, BA balances, money exports	55.74**	27.05**	2.58	28.69**	24.20**	2.58
Voyages, BA balances, VOC debt	46.90**	21.12**	3.08*	25.78**	18.04**	3.08*
Trade, BA balances, VOC Q	38.22**	12.17	1.05	26.05**	11.12	1.05
Trade, VOC debt, VOC Q	33.63**	8.37	1.26	25.26**	7.11	1.26
Voyages, BA balances, VOC Q	35.53**	14.89*	0.94	18.63*	15.95**	0.94
Voyages, VOC debt, VOC Q	26.92*	8.64	1.27	16.29	7.36	1.27
England (K = 4)						
Industrial prod., trade, BE liabilities	33.53**	14.05*	4.29*	19.48*	9.76	4.29*
Industrial prod., trade, BE loans	23.93	7.38	3.22	16.55	4.16	3.22
EIC trade, EIC debt, EIC Q (K = 3)	45.01**	19.37**	5.45**	25.63**	13.92*	5.45**
EIC trade, EIC cash, EIC Q (K = 3)	41.84**	20.19**	5.81**	21.65**	14.39**	5.81**
United States (K = 4)						
Investment, trade, money	34.24**	6.05	0.25	28.19**	5.80	0.25
Investment, trade, money, no. of listed securities	60.23**	20.93	8.76	39.30**	12.17 r ≤ 3	7.83 0.93
Japan (K = 4)						
GNP, currency, financial assets	37.77**	9.01	2.70	25.76	6.31	2.70
Investment, currency, financial assets	48.52**	9.45	2.70	39.07**	6.20	2.70

NOTE: K is the lag at which the levels terms enter the test regressions. The columns labeled r = 0 test a null hypothesis of no cointegration, while the r ≤ 1 (r ≤ 2) columns test a null of at most one (two) cointegrating vector(s). * and ** denote rejections of the null at the 10 and 5 percent levels, respectively, with critical values from Osterwald-Lenum (1992, Table 1).

Commentary

Eugene N. White

Seeking to narrow the gap between two parallel literatures, Peter Rousseau makes a welcome addition to studies searching for links between financial development and growth. One approach, employed by macroeconomists, uses cross-sectional and panel data on the contemporary world to identify the existence of a relationship between financial development and growth. Economic historians have taken a different approach, concentrating on historical case studies and endeavoring to find the pathways and magnitude of the relationship. Rousseau combines the historian's case study approach with the macroeconomist's techniques. His case studies of the first modernizing economies are valuable because it is widely held that the greatest financial impulse to growth came in the early stages of development. The first success stories of modern economic growth have the benefit of large mature literatures.

Although modern financial markets first took shape in the Netherlands, Rousseau's first case, the most important one is Great Britain, his second case. Economic historians have long wrestled with the question of why Britain was first to industrialize. In the vast literature spawned by this question, there is considerable attention to the role of finance in creating the 19th century's "workshop of the world." But, before considering this relatively narrow issue, it is important to remember that Britain was not simply the first country to industrialize and achieve high rates of growth in its leading sectors. It was also the first country to modernize its government, changing how taxes were collected and forming a modern capital market for government debt (Brewer, 1990; Neal, 1990; White, 2001). Its tax-smoothing fiscal policy from the early 18th century onward left continental powers in envy and earned the admiration of today's macroeconomists (Barro, 1987). Furthermore, in addition to having a dynamic economy and an efficient macroeconomic policy regime, it became a military powerhouse—thanks, in part, to the carefully designed incentives for the operation of its navy (Allen, 2002).

Thus, Britain was the first modern nation in not one, but many dimensions. This astonishing achievement led contemporaries and later historians to make comparisons with Britain's continental rivals, principally France. French observers in the late 18th century found it difficult to believe that France's centuries-long rival had bypassed her. It was all the more shocking because, at the beginning of the 18th century, France looked good by most comparisons. A population of 19 million (vs. Britain's 7 million), a per capita gross domestic product (GDP) comparable with Britain's, a thriving manufacturing sector, and a substantially lower average per capita tax burden gave France a good position initially (White, 2001). Britain's quick success appears puzzling until one looks carefully at the preconditions for economic growth.

As contemporary research on the connection between finance and growth has discovered, many of the clues to growth are not found in the statistics but in the laws, regulations, and customs that govern economic activity. Looking at output, labor, natural resources, technology, and capital, we can see whether the markets were competitive (allowing for price flexibility and freedom of entry and exit) and whether there were well-protected property and contract rights. By the middle of the 18th century, Britain was not perfect but was well ahead of France by most of these measures, with the rest of the continent much further behind. Simply put, Britain was much closer to its production possibilities frontier and more able to exploit technological change because it had created markets and incentive structures for its pre-industrial economy. It had accomplished many of the institutional changes that the International Monetary Fund and World Bank might recommend to a developing country today. The main effects of these institutional characteristics point in the same direction as the newer research on financial development and growth.

The point here is that the conditions that allow capital markets to grease the wheels of economic

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growth are also the conditions that ensure that other markets work. What we know from history is that, if one market meets the preconditions, it is likely others will, because these changes are part of an economywide overhaul. Rousseau's statement—that it was no coincidence that England, with the key components of a financial system in place by 1750, was poised to tackle industrialization next—is too modest an assessment. Britain had its other factor, goods, and services markets set up for growth, too.

To return to Rousseau's first case, the Netherlands, we are confronted with a country that had become the center of world capital markets, well before industrialization. Financial innovation and market integration helped build many of the standard features of financial systems—from banking to stock exchanges. This development was accomplished at a time when Europe and the Netherlands were embarked on what is known as a "commercial revolution," linking and expanding markets for goods and services within Europe and around the world. The question here is whether financial development in the Netherlands helped to spur on the commercial revolution of the 17th century.

There is a problem in using contemporary macroeconomic techniques to examine the links between financial development and the industrial revolution or the commercial revolution, namely, the absence of macroeconomic time series for the 17th and 18th centuries, well before the advent of national income accounting. What Rousseau has found are data for the monopoly international trading companies, the Dutch East India Company (VOC) and the British East India Company (EIC), and for the privileged banks, the Bank of Amsterdam and the Bank of England. These four companies were the giant chartered corporations of their day and trading in their securities dominated the exchanges (Neal, 1990). Whether studying the connection between these trading companies and banks helps us to gain some insight into the influence of finance on economic growth depends first on the importance of foreign trade in economic growth at the time and second on whether the relationship between a monopoly trading company and a highly privileged bank tells us much about the financing of growth.

In the case of Britain, the current wisdom among economic historians is that foreign trade was not central to the country's move to a higher growth path in the first industrial revolution (Crouzet, 2001; Cameron and Neal, 2003). Furthermore, the early stages of the industrial revolution were not centered in London or southern England, where the EIC and Bank of England operated, but in northern areas, where cotton mills and iron foundries were located. From company and family records, scrutinized by historians, we find that much of the financing for these enterprises—which were small in comparison with the EIC and the Bank of England—came from informal networks and local bankers. The potential link between financial development and the commercial revolution appears stronger because Amsterdam, the home of the Bank of Amsterdam, was also the trading base for the VOC.

As far as the second question is concerned, Rousseau needs to provide a stronger argument for why the relationship between highly privileged financial and non-financial companies should be of interest. The activities of the VOC and the Dutch bank could well have been closely linked for reasons other than some inherent relationship between finance and growth. The Dutch economic elite had influence in both institutions and there appears to have been a considerable overlap between the two in terms of stockholders and directors. Both institutions were intended to serve their commercial interests and the state. It is hard to believe that a privileged trading company created by the state could be capital constrained when the state also created the privileged bank.

By selecting Britain and the Netherlands, Rousseau has perhaps introduced some bias into his study, as those two nations were the success stories. In addition to the British and Dutch East India companies, there was a French East India Company, which was a notable failure in spite of the privileges that it enjoyed. Was this failure due to the failure of French entrepreneurship, or to the French navy to safeguard the seas, or perhaps to the absence of adequate financing? The Bank of England was founded in 1697 and the Bank of Amsterdam in 1602. During John Law's effort to reform royal finances, the French finally created the Banque Royale in 1716; but the collapse of the Mississippi bubble left the country with a profound distaste for banks (White, 2001). In the next half-century, private banks and informal networks, including the notaries, were the only sources of finance. An institution parallel to the Dutch and British banks only reappeared with the establishment of the Discount Bank in 1776. But this bank, primarily serving private bankers rather than commerce or industry, dissolved during the French Revolution; a permanent institu-

tion was put in place only with the creation of the Bank of France in 1800. French money and capital markets at the time have been generally and correctly characterized as inferior to their British counterparts. Using government financial development as a yardstick, there was no equivalent of standard short-term British instruments, such as Navy bills or Treasury notes. Instead, the French government was forced to rely on privately contracted tax farmers for advances against taxes. Long-term government markets were also limited. The broad deep market for the British consol did not exist in France, which attempted to use heterogeneous and complicated life annuities for long-term financing. Although it may not be testable because of a lack of data, the absence of a well-developed financial system suggests that French trade could have been potentially weakened, offering support for Rousseau's conjecture about the role of finance in British and Dutch commercial development.

Turning to the empirical evidence for the Netherlands, Rousseau finds that neither trade nor money Granger-cause bank credit and that bank credit Granger-causes money shipments, suggesting that more credit had a positive effect on the VOC's commercial activity. Bank of Amsterdam credit appears to drive VOC voyages but not the other way around. In addition, Rousseau finds that Tobin's Q explains VOC investment, and neither bank credit nor VOC debt adds significantly to explaining VOC investment. He concludes that temporary credit conditions at the bank did not alter the capital budgeting decisions and that the Amsterdam market was deep enough for the VOC to secure funds based on its shadow price. Yet, as already noted, this relationship may not be so surprising for two interconnected privileged firms. The other issue, well beyond the scope of this paper, is why, if the financial markets in the Netherlands were so brilliant and the country was economically sophisticated in many other aspects, did the first industrial surge occur in Britain and not the Netherlands?

For Britain, Rousseau obtains similar results for 1710-45, showing that financing constraints did not bind the EIC and that Tobin's Q Granger-causes investment. He concludes that the EIC was not limited by the availability of finance and there was a preexisting well-developed financial market. The same caveats apply here except that the EIC played a much smaller role in the British economy than the VOC played in the Dutch economy.

For Britain, Rousseau also has annual data on industrial production, international trade (the sum of imports and exports), and the Bank of England liabilities for 1728-1850. He finds some econometric evidence that the bank's liabilities Granger-cause industrial production—or in his words that "finance moved before output." However, there is a problem with this interpretation because industrial production may cause trade and trade may cause bank lending. Perhaps the biggest omission from this exercise is the factor that causes the biggest fluctuations in the financial markets and the whole economy: war. The huge increases in financial aggregates are not related to growth of the private sector but to war finance and the needs of the government (Bordo and White, 1991).

For the 19th century, more modern data are available. Rousseau breaks his study into two periods—before and after 1850, reflecting the quality and availability of data. For the earlier period in the United States, the data for 1790-1850 look more like a modern economy. It appears here that the money stock and the number of listed securities cause investment but not the other way around. The impulse response results show that they are also important for trade. Rousseau concludes that for the United States "finance-led" growth has some credibility. He finds similar results for Japan in the period 1880-1913, with financial assets driving private investment. For the second period, 1850-1929, Rousseau has a data set of 17 countries, enough to allow a cross-section analysis. The results are very similar to those found by King and Levine (1994) for the post-World War II period. The most interesting finding is that output is more responsive in the pre-1930 period, suggesting that financial factors matter more in the early stages of economic development.

While using nontraditional data for the Netherlands and Britain raises some potential problems, Rousseau's analysis of newly assembled data sets strengthens the view that finance is important for economic growth, providing evidence of larger effects for earlier stages of growth. Yet, the development of financial markets was the product of broader trends that established well-functioning markets for goods and factors across the economy. Explaining this change is a much greater challenge.

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The Real Effects of U.S. Banking Deregulation

Philip E. Strahan

In the 1970s, commercial banks in the United States faced restrictions on interest rates, both on the deposit and lending sides of their business. They were restricted for the most part to classic financial intermediation—deposit-taking and lending—to the exclusion, for example, of underwriting many corporate securities and insurance products. And banks were limited in the geographical scope of their operations. No state permitted banks headquartered in other states either to open branches or to buy their banks, and many states prohibited or restricted intrastate branching.

Today, almost all of these restrictions have been lifted: Interest rate ceilings on deposits were phased out in the early 1980s; state usury laws have been weakened because banks may now lend anywhere; and limits to banks' ability to engage in other financial activities have been almost completely eliminated, as have restrictions on the geographical scope of banking. As a result, our banking system is now more competitive and more consolidated than ever—both vertically and horizontally.

This paper focuses on how one dimension of this broad-based deregulation—the removal of limits on bank entry and expansion—affected economic performance. In a nutshell, the results suggest that this regulatory change was followed by better performance of the real economy. State economies grew faster and had higher rates of new business formation after this deregulation. At the same time, macroeconomic stability improved. By opening up markets and allowing the banking system to integrate across the nation, deregulation made local economies less sensitive to the fortunes of their local banks.

First, I explain how relaxation of geographical restrictions on bank expansion proceeded historically and why our somewhat unusual history of state-level regulation and deregulation presents an attractive setting to study how the financial system affects the real economy. I then present evidence that banking deregulation led to substantial and beneficial real effects on our economy. The findings are important for at least two reasons. First, they demonstrate the tight link between "Wall Street" and "Main Street." Finance is not only affected by the fortunes of the industrial sector, but the reverse holds true as well. This mutual dependence highlights the importance of financial regulation not only here in the United States but, perhaps even more critically, in emerging economies without a well-developed set of financial markets and institutions. Second, the results support the idea that competition and openness in financial markets are beneficial. This finding is accepted when applied to industrial firms—for most economists, free trade and competition are akin to motherhood—but it is much less accepted when applied to the financial sector.

BANK DEREGULATION AS AN EMPIRICAL LABORATORY

The evolutionary history of banking regulations in the United States offers researchers a unique opportunity to study the effects of deregulation, particularly those related to restrictions on banks' ability to expand within and across state lines, because regulations were imposed at the state level and because states changed their regulatory restrictions on expansion at different times. Although there was some deregulation of branching restrictions in the 1930s, most states continued to enforce these policies into the 1970s. In 1970, only 12 states allowed unrestricted statewide branching. Between 1970 and 1994, however, 38 states deregulated their restrictions on branching.[1]

In addition to branching limitations within a state, until the 1980s states effectively prohibited cross-state ownership of banks by applying the Douglas Amendment to the 1956 Bank Holding Company (BHC) Act. This amendment prohibited a BHC from acquiring banks outside the state where

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[1] Although branching was generally restricted, banking companies could expand in some states by forming multi-bank holding companies.

Table 1

Year of State-Level Deregulation of Restrictions on Geographical Expansion

State	Intrastate branching via M&A	Unrestricted intrastate branching permitted	Interstate banking permitted
Alabama	1981	1990	1987
Alaska	<1970	<1970	1982
Arizona	<1970	<1970	1986
Arkansas	1994	*	1989
California	<1970	<1970	1987
Colorado	1991	*	1988
Connecticut	1980	1988	1983
Delaware	<1970	<1970	1988
Washington, DC	<1970	<1970	1985
Florida	1988	1988	1985
Georgia	1983	*	1985
Hawaii	1986	1986	*
Idaho	<1970	<1970	1985
Illinois	1988	1993	1986
Indiana	1989	1991	1986
Iowa	*	*	1991
Kansas	1987	1990	1992
Kentucky	1990	*	1984
Louisiana	1988	1988	1987
Maine	1975	1975	1978
Maryland	<1970	<1970	1985
Massachusetts	1984	1984	1983
Michigan	1987	1988	1986
Minnesota	1993	*	1986
Mississippi	1986	1989	1988
Missouri	1990	1990	1986

it was headquartered unless the target bank's state permitted such acquisitions. Since states chose to bar such transactions, the amendment effectively prevented interstate banking. Change began in 1978, when Maine passed a law allowing entry by out-of-state BHCs if, in return, banks from Maine were allowed to enter those states. (Entry in the case means the ability to buy incumbent banks.) No state reciprocated, however, so the deregulation process remained stalled until 1982, when Alaska and New York passed laws similar to Maine's. State deregulation was nearly complete by 1992, by which time all states but Hawaii had passed similar laws.

Table 1 notes the years each state relaxed these restrictions on bank branching and interstate banking. The first column presents the year in which each state permitted branching by means of merger and acquisition (M&A) only. With this form of deregulation, an expansion-minded bank could enter a new market, either by buying an existing bank in that market and folding its operations into the acquirer's existing operations or by buying individual branches of existing banks. The second column reports the year in which each state first permitted unrestricted branching, thereby allowing banks to enter new markets by opening new branches. In most cases, branching by M&A occurred first, then unrestricted branching deregulation occurred soon

Table 1 cont'd

Year of State-Level Deregulation of Restrictions on Geographical Expansion

State	Intrastate branching via M&A	Unrestricted intrastate branching permitted	Interstate banking permitted
Montana	1990	*	1993
Nebraska	1985	*	1990
Nevada	<1970	<1970	1985
New Hampshire	1987	1987	1987
New Jersey	1977	*	1986
New Mexico	1991	1991	1989
New York	1976	1976	1982
North Carolina	<1970	<1970	1985
North Dakota	1987	*	1991
Ohio	1979	1989	1985
Oklahoma	1988	*	1987
Oregon	1985	1985	1986
Pennsylvania	1982	1990	1986
Rhode Island	<1970	<1970	1984
South Carolina	<1970	<1970	1986
South Dakota	<1970	<1970	1988
Tennessee	1985	1990	1985
Texas	1988	1988	1987
Utah	1981	1981	1984
Vermont	1970	1970	1988
Virginia	1978	1987	1985
Washington	1985	1985	1987
West Virginia	1987	1987	1988
Wisconsin	1990	1990	1987
Wyoming	1988	*	1987

NOTE: *States not yet fully deregulated by 1996. M&A is merger and acquisition.

SOURCE: Amel (1993) and Kroszner and Strahan (1999).

thereafter. Because these changes usually occurred in quick succession, it is hard to isolate the impact of M&A branching from the impact of permitting new branches; moreover, it turns out that most banks enter new markets by buying existing banks or branches rather than by building new ones. So, in the empirical analysis I construct a single branching indicator based on the date a state first permitted branching by M&A.

The third column reports the year in which states first entered into an interstate banking agreement with other states. With interstate deregulation, it became possible for an outside banking organization to acquire a state's incumbent banks. This form of deregulation, however, did not permit these newly acquired banking assets to be folded into the acquirer's banking operations outside the state. State-level progress toward interstate banking, therefore, did not lead to interstate *branching*. In 1994, though, the deregulatory process was completed with passage of the Interstate Banking and Branching Efficiency Act of 1994 (IBBEA), federal legislation that mandated complete interstate banking as of 1997 and encouraged states to permit interstate branching. IBBEA permitted states to opt out of interstate branching, but only Texas and Montana chose to do so. Most

other states protected their banks by forcing out-of-state entrants to buy existing branches rather than open new ones.

The staggered timing of state-level action to deregulate both branching and interstate banking restrictions provides an ideal laboratory to explore empirically how these regulatory changes affected banking and the real economy. Because of the cross-state and over-time variation in the regulatory status of different states, both unobserved state differences and aggregate shocks (and any trends) can be fully absorbed with the inclusion of fixed effects, while leaving sufficient variation in the regulatory variables to estimate their effects on state-level financial and real variables. Moreover, by using the state as the relevant unit, the resulting panel data set is balanced because states do not enter or exit the sample. Thus, there is no need to worry about (or attempt to correct for) survivorship biases that can plague attempts to draw inferences from bank-level or firm-level data.[2]

To be concrete, the research method boils down to estimating a regression using observations from a given state and year (state-year) in the following structure:

$$(1) \qquad y_{st} = \alpha_t + \beta_s + \gamma_1 Branch_{st} + \gamma_2 Bank_{st} + OtherControls_{st} + \varepsilon_{st},$$

where s indexes states, t indexes time, y_{st} is the dependent variable of interest, α_t is a year-specific fixed effect (estimated by including year indicator variables), β_s is a state-specific fixed effect (estimated by including state indicator variables), $Branch_{st}$ is an indicator set to 1 after a state permits branching (by means of M&A), and $Bank_{st}$ is an indicator set to 1 after a state permits interstate banking. Thus, the deregulation indicators equal 1 in all state-years following deregulation, and they equal 0 in all state-years prior to deregulation.[3]

Endogenous Deregulation?

Before describing the results, it is worth considering briefly why banking regulations remained static from the 1930s to the mid-1970s and why they began to change across all states from the 1970s to the early 1990s. Several developments probably contributed. In the mid-1980s, for instance, the Office of the Comptroller of the Currency took advantage of a clause in the 1864 National Bank Act to allow nationally chartered banks to branch freely in those states where savings institutions (savings and loans and savings banks) did not face branching restrictions. The Comptroller's action was instrumental in introducing statewide branching in several southern states. Another impetus behind deregulation may have been the rash of bank and thrift failures in the 1980s, which increased public awareness of the advantages of large, well-diversified banks. As part of the 1982 Garn–St. Germain Act, for example, federal legislators amended the Bank Holding Company Act to allow failed banks and thrifts to be acquired by any BHC, regardless of state laws (Kane, 1996).

More broadly, Economides, Hubbard, and Palia (1996) show that small banks lobbied successfully in the 1930s for both generous deposit insurance and tight limits on branching, despite the objections of large banks. White (1998) shows that the small bank lobby continued its success over the subsequent 40 years by gaining increased levels of deposit insurance coverage all the way up until 1980, when this limit was last raised (to $100,000).[4] Thus, the influence of small banks may explain the relative stability of these regulatory institutions from the 1930s through the 1970s.

Kroszner and Strahan (1999) suggest that the emergence of new technologies in both deposit-taking and lending that began in the 1970s tipped the balance in the political arena from the traditional beneficiaries of geographical restrictions—small banks—toward more expansion-minded large banks. As evidence, we show that deregulation occurred earlier in states (i) with fewer small banks, (ii) where small banks were financially weak, and (iii) with more small and bank-dependent firms. We also find that where the insurance industry was large, deregulation tended to occur later, particularly when banks could compete in the sale of insurance products. The relative strength of potential winners (large banks and small firms) and losers (small banks and the rival insurance firms) from deregulation can

[2] These issues are especially important for studies of entry regulations because the competitive shakeout that occurs after regulatory change increases the odds that some banks will not survive.

[3] I drop observations during the year of deregulation. In addition, I do not include Delaware and South Dakota in any of the analyses because these states had a unique history due to the growth of the credit card business there.

[4] As of this writing, an increase in FDIC insurance coverage to $130,000 is under debate in Congress at the urging of advocacy groups representing the interests of small, community banks.

therefore explain the timing of branching reform across states.[5]

Given these political economy explanations for banking reform, can we interpret the results from equation (1)? The results in Kroszner and Strahan (1999) suggest that aggregate forces such as technological change affected all financial services firms and created increasingly strong pressures for regulatory regime change; however, interest group factors determined the exact *timing* of when a particular state changed its laws. Thus, a cross-state comparison of state growth or business cycle volatility might be misleading, or at least difficult to interpret. For example, consider comparing states in a single year, say, 1987. If states permitting interstate banking had more large banks than states that did not yet permit interstate banking, it could be that regulation led to structural changes favoring large banks (i.e., regulation caused the structural change). Or it could be that states with more large banks deregulated before states with fewer large banks (i.e., regulation was caused by the cross-state differences in structure).

The estimators reported here are not likely to be affected by the political economy factors. By including the state fixed effects (β_s) in the model, all of the cross-sectional variation (such as when a state deregulates) gets removed; coefficients are driven by *changes* in variables after a state alters its regulations. Persistent differences across states (e.g., those dominated by large vs. small banks) do not affect the results. Instead, we look at how a state's banking structure changes after it deregulates; how its growth performance changes relative to its level before deregulation; and how the volatility of its business cycle changes, again, relative to its volatility prior to regulatory change.

HOW BANKING CHANGED AFTER DEREGULATION

We can expect deregulation to have had large effects on the real economy only if there were important changes in the structure and efficiency of the banking industry resulting from the reforms. Briefly, the key changes are as follows: Relaxing restrictions on bank expansion led to larger banks operating across a wider geographical area. Increases in *local* market concentration, however, did not occur. This makes sense because the restrictions on branching and interstate banking generally did not apply to local markets, with the exception of a few unit banking states that did not permit branching in any form. Thus, deregulation led banks to enter new markets, but it did not spur banks to consolidate within a local market.[6]

Table 2 documents very briefly the magnitude of some of these changes, including the estimated coefficients on the intrastate branching indicator ($Branch_{st}$) and the interstate banking indicator ($Bank_{st}$) from the fixed-effects model described in equation (1). In column 1, the dependent variable equals the acquisition rate in a state-year (defined as the total dollar value of assets in banks acquired in a state-year, divided by total banking assets in the state at the beginning of the year).[7] The results suggest, as expected, that acquisitions increased sharply following interstate banking deregulation. The coefficient implies that the annual acquisition rate rose by 1.64 percentage points after interstate reform—quite a large jump relative to the unconditional mean of 2.77 percent. In contrast, there was no significant increase in bank acquisitions following branching deregulation. Banks tended to expand by purchasing branches of existing banks rather than by acquiring all of the branches and other assets of whole banks, so the acquisition rate of whole banks did not rise. (For details, see Stiroh and Strahan, forthcoming.)

The second column of Table 2 shows that local market concentration did *not* increase following deregulation despite the increased acquisition activity; if anything, there was a slight drop following interstate banking reform.[8] Local market concentration equals the deposit Herfindahl-Hirschman Index (HHI), calculated as the deposit-weighted average of the HHIs of the metropolitan statistical areas (MSAs) in a state-year. The HHI for each local market is defined as the sum of squared market shares, where market shares are based on branch-level deposit data from the Federal Deposit Insurance Corporation's *Summary of Deposits* data set. To illustrate how this variable is computed, consider a bank (or banking company) that owned 10 branches

[5] We also find that the same interest group variables also can explain the voting patterns of legislators in the U.S. House of Representatives on interstate banking deregulation and deposit insurance reform. (See Kroszner and Strahan, 2001.)

[6] For a comprehensive survey of the literature on financial consolidation, see Berger, Demsetz, and Strahan (1999).

[7] An "acquisition" here occurs when ownership of banking assets changes. So, if a BHC buys a bank, or if two unaffiliated banks merge, both would contribute to total assets in acquisitions. But if two banks owned by the same holding company merged, these assets would not be counted.

[8] Concentration at the state and national levels has increased substantially, however, in part because of these regulatory changes.

Table 2

Structural Changes in the Banking Industry Following Deregulation (1994 dollars)

			Share of assets in banks with assets		
	Acquisition rate	Local deposit HHI	Less than $50 million	$50 to $100 million	$100 to $500 million
Post-branching	0.0031	–9.85	–0.016*	–0.020*	–0.022*
	(0.0062)	(34.34)	(0.002)	(0.003)	(0.006)
Post-interstate banking	0.0164*	–76.87*	–0.013*	–0.005	0.004
	(0.0078)	(43.13)	(0.003)	(0.003)	(0.007)
N	849	824	849	849	849
Within R^2	0.1229	0.0290	0.4644	0.3888	0.1707
Dependent-variable mean	0.0277	1,913	0.089	0.103	0.232

NOTE: Standard errors in parentheses. The acquisition rate is the dollar value of assets acquired during the state-year divided by beginning-of-period assets in the state-year. The local deposit HHI is the sum of squared market shares for all banking organizations operating within a local market, defined as an MSA. For states with multiple MSAs, we average the HHI across MSAs within the state, weighted by the amount of deposits in the MSA. The model is estimated using a fixed-effects model with both year and state effects. The year of deregulation is dropped. Also, South Dakota and Delaware are dropped. *Statistically significant at the 10 percent level.

within an MSA. This bank's market share (measured in percentage terms) would equal the sum of all of its deposits in those 10 branches, divided by the total deposits held by all bank branches within that MSA, multiplied by 100. For a market with a single bank owning all of the branches, the HHI would equal 10,000, whereas in a perfectly atomistic market the HHI would approach 0.

The last three columns of Table 2 show that the market share of small banks declined following both branching and interstate banking reform. The declines were most pronounced following branching deregulation. For example, the share of assets held by banks with less than $50 million in assets (in 1994 dollars) fell by 1.6 percentage points (relative to a mean of 8.9 percent), the share of assets held by banks with assets of $50 to $100 million fell by 2.0 percentage points (relative to a mean of 10.3 percent), and the share held by banks with assets of $100 to $500 million fell by 2.2 percentage points (relative to a mean of 23.2 percent). After interstate banking the share of the smallest banks declined while the share of other banks did not change significantly.

Did these structural changes cause meaningful changes in the efficiency of a state's banking industry? In earlier research, Jayaratne and Strahan (1998) report that the banking industry became significantly more efficient following reform. They find that noninterest costs fell, wages fell, and loan losses fell after states deregulated branching. These cost reductions led, in turn, to lower prices on loans (although not on deposits). The mechanism for this better performance seems to be changes in the market shares of banks following deregulation. Prior to regulatory reform, well-run banks faced binding constraints on the markets in which they could operate. When these constraints were lifted, however, assets moved toward the better-run banks as they gained the opportunity to acquire market share.[9]

The beneficial dynamic effects of competition following deregulation can be seen graphically in Figures 1 through 3.[10] Figure 1 simply plots the correlation between a bank's profit rate (return on equity [ROE]) and its subsequent asset growth. We find that this correlation is low during the late 1970s, when the better banks were constrained by regulations, then rose sharply during the period of regulatory change—the period when better banks were gobbling up market share—and fell back during the 1990s. The figure illustrates, somewhat crudely, the dynamic effects of deregulation.

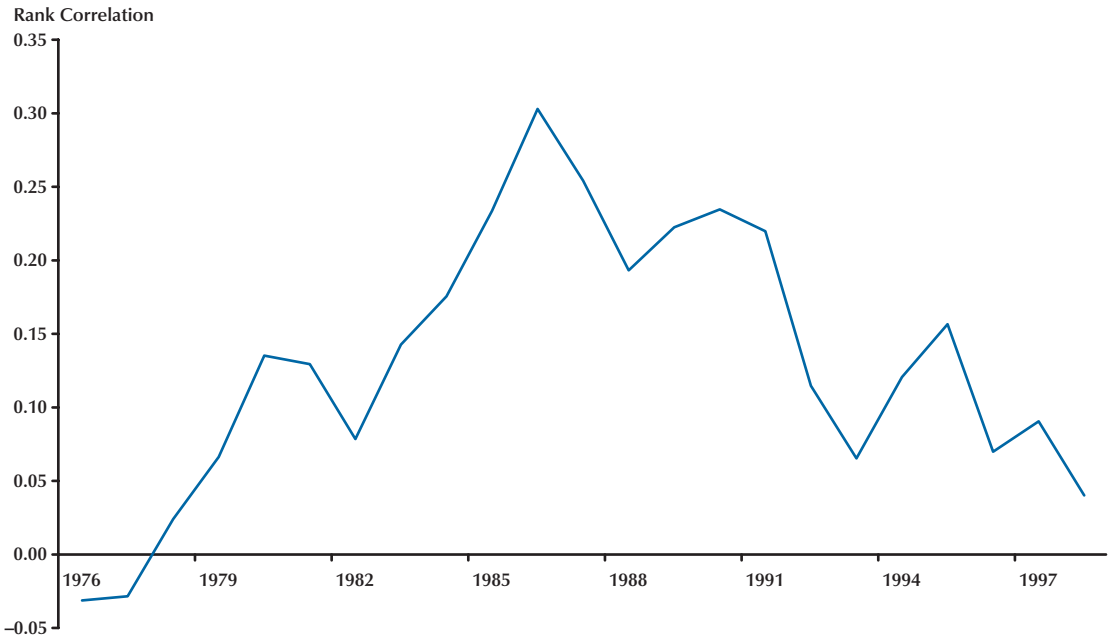
Figures 2 and 3 show the outcome of these dynamics by plotting the average market share of banks with above-median profits, averaged across states, after first separating them into three groups:

[9] Hubbard and Palia (1995) also show that management compensation became more sensitive to performance after deregulation.

[10] These figures are taken from Stiroh and Strahan (forthcoming).

Figure 1

Correlation of Performance and Asset Growth



NOTE: Plot of the Spearman rank correlation for each year between a bank's ROE in year $^{t-1}$ (normalized relative to the economy average) and the change in the economywide share of the bank's assets from year $^{t-1}$ to ^{t}. Correlations include only banks that survive for two consecutive years.

(i) states that have permitted branching since the 1930s or before (12 states); (ii) states that limited branching (23 states); and (iii) the unit banking states that did not permit any form of branching (16 states). The figures illustrate the detrimental effects of these constraining regulations. For example, in unit banking states, the higher-profit banks typically held 50 percent or less of the assets in a state; after those states relaxed their regulations, however, these better banks' share rose to 65 to 75 percent of the state's assets. States that limited but did not prohibit branching experienced qualitatively similar effects following deregulation, although these effects were somewhat smaller.

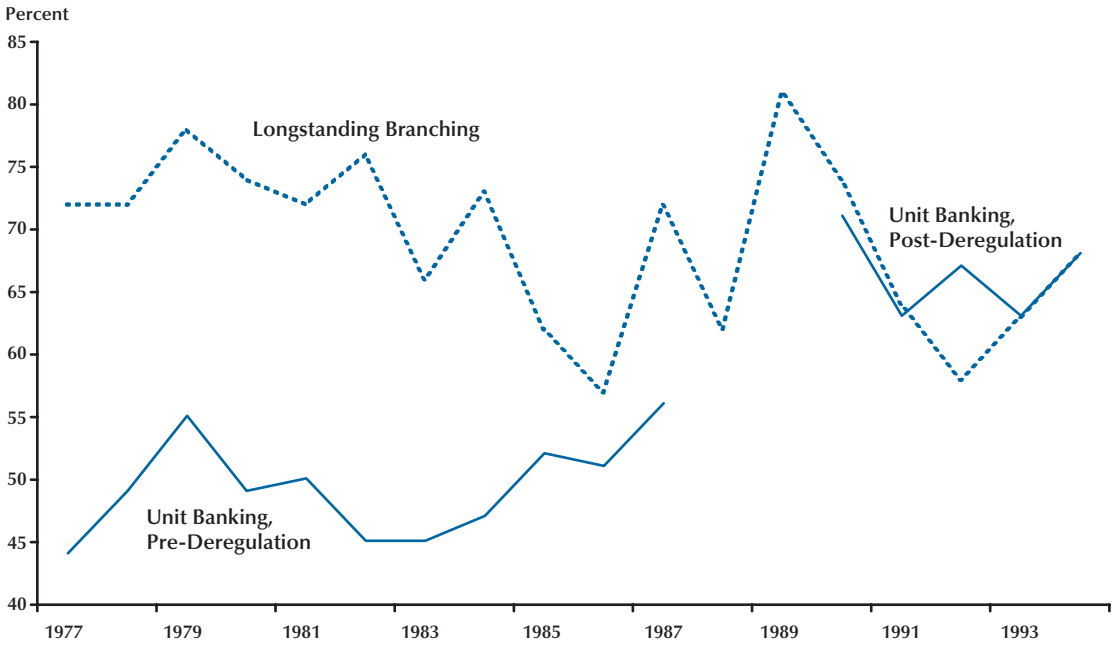
THE REAL EFFECTS OF DEREGULATION

Did the beneficial changes in banking have quantitatively important effects on the real economy? The answer to this question is important not only for helping us gain an understanding of what has happened in the United States, but also for considering how banking systems across the world ought to be structured and regulated. In recent years, a growing number of researchers have studied how different financial regulatory regimes across countries affected financial stability and economic performance. For example, Rajan and Zingales (1998) and Cetorelli and Gambera (2001) test how differences in financial development and banking structure affected growth across different industries. Demirgüç-Kunt, Levine, and Min (1998) find that banks perform better in countries that are open to foreign entry. Most recently, Barth, Caprio, and Levine (2002) document how various dimensions of banking laws and regulations—e.g., restrictions on bank activities, restrictions on entry, capital adequacy regulations, deposit insurance, supervision and regulation of banks, and government ownership of banks—vary across the world and relate these differences to measures of economic performance and stability.

While the cross-country approach has much to teach us, one of the difficulties inherent in such studies is that many kinds of policy regimes tend to go together. For example, La Porta, Lopez-de-Silanes, and Shleifer (2002) find that government ownership of banks tends to occur in countries with substantial corruption and poor long-run growth performance.

Figure 2

Market Share of High-ROE Banks: Unit Banking States vs. Longstanding Branching States



NOTE: Each line represents the market share of banks with above-median ROE, averaged across each type of state. If there are fewer than 10 states for a particular type in a given year, we do not report the result.

Similarly, Djankov et al. (2002) find that entry regulations also tend to be most prevalent in countries with corrupt political institutions. Thus, it becomes difficult in cross-country studies to determine what specific factor matters; for example, is entry regulation bad, or does it simply proxy for other sorts of government constraints that can be overcome only through bribery?

As noted above, our focus is on the U.S. experience; the relative homogeneity in the economic and legal infrastructure across states presents a strong advantage from an empirical standpoint because the many "invisible" barriers to effective contracting and economic performance are either not present or do not vary substantially across states. Having said that, the hope of this researcher is that the conclusions drawn for the U.S. states will carry over to other environments, such as emerging economies. I will focus specifically on three questions. First, what were the effects of banking reform on states' growth performance? Second, what were the effects of reform on entrepreneurial activity? Third, how did reform affect state-level business cycle stability?

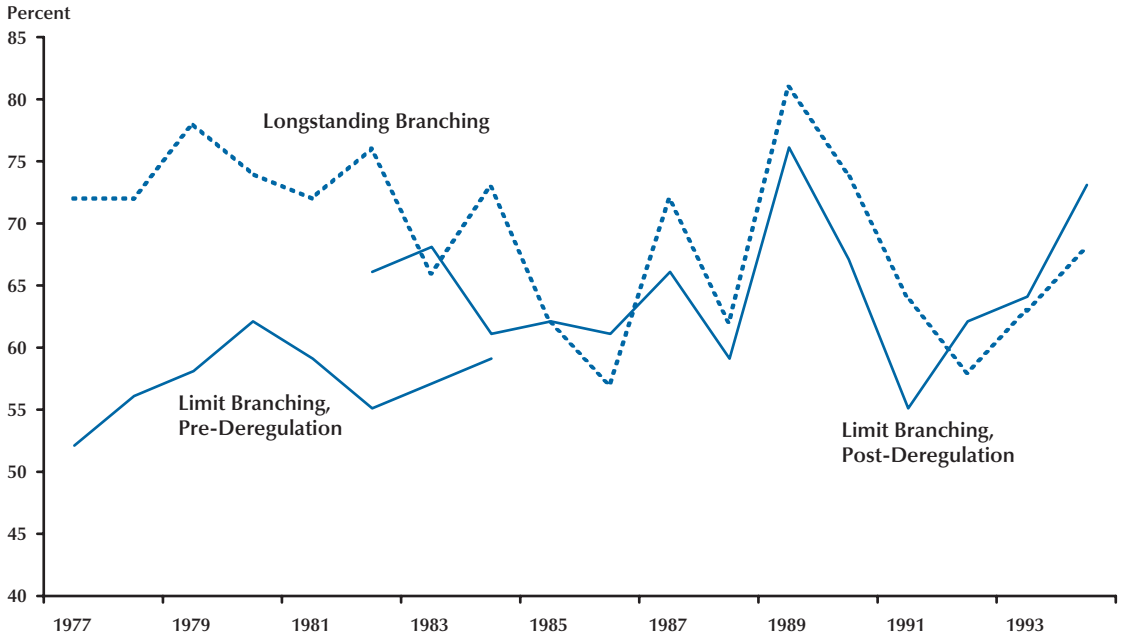
Growth Effects

Joseph Schumpeter (1969) argued in the early part of the 20th century that efficient financial systems promote innovations; hence, better finance leads to faster growth. On the other hand, Joan Robinson (1952) believed that the causality was reversed; economies with good growth prospects develop institutions to provide the funds necessary to support those good prospects. In other words, the economy leads and finance follows. Recent theoretical developments have fleshed out two potential causal links from financial systems to growth. Financial markets can matter either by affecting the volume of savings available to finance investment or by increasing the productivity (or quality) of that investment. These theories show that an improvement in financial market efficiency can act as a lubricant to the engine of economic growth, allowing that engine to run faster.

Empirical research in recent years has increasingly provided support for the Schumpterian view that financial market development can play an important causal role in driving long-run growth.

Figure 3

Market Share of High-ROE Banks: Limited Branching States vs. Longstanding Branching States



NOTE: Each line represents the market share of banks with above-median ROE, averaged across each type of state. If there are fewer than 10 states for a particular type in a given year, we do not report the result.

For example, King and Levine (1993) demonstrated that the size and depth of an economy's financial system is positively correlated with its future growth in per capita, real income. While this evidence is appealing, it can not rule out the possibility that financial development and growth are simultaneously driven by a common factor not controlled in the empirical analysis. Rajan and Zingales (1998) and Cetorelli and Gambera (2001) attempt to answer this criticism by exploiting cross-industry differences in financial dependence. They show that in countries with well-developed financial markets, industries that require more external finance grow faster than "cash cow" industries that can finance investment with internally generated funds.[11] Levine, Loayza, and Beck (2000) attempt to establish a causal link from finance to growth by using preexisting legal differences across countries as instruments for the development of the banking system; they show that the exogenous component of banking development is positively related to growth performance.

Another way to establish that better finance (or, specifically, better banking) can lead to faster growth is to find policy changes that lead to more efficient finance (banking) and see how the economy responds.[12] Bekaert, Harvey, and Lundblad (2003) do this for equity markets, showing that economic growth sped up after liberalization. In our earlier work, Jayaratne and Strahan (1996), we study state-level branching deregulation and find that this improvement in banking market openness spurred faster economic growth.[13] Using data from 1972 to 1992, we estimated the change in economic performance before and after deregulation and found that

[11] Cetorelli (2001, 2003) attempts to gain a better understanding of the channels through which better finance can affect economic performance. He shows that countries with concentrated banking sectors tend to have more concentrated industrial sectors, particularly in those sectors where external finance is important. Petersen and Rajan (1995) find that small U.S. firms in concentrated local banking markets borrow on better terms than small firms in less-concentrated markets, and Bonaccorsi di Patti and Dell'Ariccia (2001) find that banking concentration in Italy helps foster creation of new firms.

[12] For a comprehensive review, see Levine (2003).

[13] More recently, Collender and Shaffer (2002) explore how other aspects of banking structure affect economic growth.

Table 3

Summary Statistics for State-Level Characteristics

	Mean	Standard deviation
Real per capita income growth	0.0144	0.0279
New incorporations per 1000 people living in the state	2.50	1.41
Growth in new incorporations per capita	0.0206	0.1093
Volatility of real per capita growth	0.0126	0.0138
Volatility of growth in new incorporations	0.0656	0.0732
Growth in bank capital	0.0897	0.0842
Share of employment in mining	0.0128	0.0177
Share of employment in construction	0.0478	0.0146
Share of employment in manufacturing	0.1946	0.1124
Share of employment in transportation	0.0549	0.0119
Share of employment in trade	0.2288	0.0377
Share of employment in finance	0.0533	0.0131
Share of employment in services	0.2192	0.0600

NOTE: These statistics are calculated using state-year observations. All data except bank capital growth are from the Bureau of Economic Analysis, U.S. Department of Commerce. Bank capital growth equals the change in all capital at banks headquartered in a given state-year (from the Reports of Income and Condition).

annual growth rates accelerated by 1/2 to 1 percentage point. In that study, we worked hard to rule out other interpretations of the finding. For example, we showed that states did not deregulate their economies in anticipation of future good growth prospects. We also found no other concomitant policy changes that could account for the result and no consistent political changes, such as a change in the party controlling the state government, around the time of deregulation.

Below, I reestimate this growth model using a slightly different sample period (1976 to 1996) and include some additional control variables. Table 3 reports summary statistics for the growth measure, which equals the real annual growth rate in per capita state-level personal income.[14] The personal income data are reported by the Bureau of Economic Analysis and converted to constant dollars using the consumer price index. Over the sample period, real personal income grew at an annual rate of slightly less than 1.5 percent. The standard deviation of the growth rates equals 2.79 percent, with a minimum of about –15 percent (in North Dakota in 1980) and a maximum of about +17 percent (again in North Dakota in 1978). Overall there is clearly more variability in year-to-year growth rates for small states such as North Dakota, but in Jayaratne and Strahan (1996) we were careful to rule out the possibility that the growth increases were driven by a few of these small states. In the interest of brevity, I will not report these tests here.[15]

Table 4 reports the results of the growth regressions, which include the two banking reform indicator variables, the state and time fixed effects, and a set of variables controlling for the share of employment in each state coming from eight one-digit SIC industries. These share variables account for the possibility that different sectors exhibit different levels of average growth.[16]

[14] Jayaratne and Strahan (1996) also considered the growth in gross state product, which treats income from capital in a slightly different way from the personal income series. The results, however, were very similar across these two dependent variables.

[15] Specifically, we showed that the results remain significant using a weighted least-squares model, where the weights were proportional to state size. In addition, we showed that among the 35 states that deregulated their branching restrictions after 1972, all but 6 experienced an increase in growth after the regulatory changes.

[16] In the regressions the shares sum to 1, so one of the eight groups must be omitted. In all regressions, the omitted category is the share of employment in the government sector. Hence, all of the coefficients measure the effect of increasing the employment share in the sector relative to the government sector.

Table 4

Panel Regression of State Growth in Real, Per Capita Income on Banking Deregulation and Employment Share Variables

	Dependent variable: growth in real per capita state income			
Post-branching	0.0056*	0.0051*	0.0068*	0.0066*
	(0.0024)	(0.0028)	(0.0025)	(0.0025)
Indicator for 5+ years after branching	—	–0.0029	—	0.0007
		(0.0025)		(0.0025)
Indicator for 5 years leading up to branching	—	–0.0016	—	–0.0001
		(0.0026)		(0.0027)
Post-interstate banking	0.0048	0.0049	0.0015	0.0014
	(0.0031)	(0.0031)	(0.0033)	(0.0033)
Share of employment in mining	—	—	0.40*	0.40*
			(0.13)	(0.13)
Share of employment in construction	—	—	0.48*	0.48*
			(0.10)	(0.10)
Share of employment in manufacturing	—	—	0.33*	0.33*
			(0.10)	(0.10)
Share of employment in transportation	—	—	0.63	0.63*
			(0.29)	(0.29)
Share of employment in trade	—	—	0.04	0.04
			(0.15)	(0.15)
Share of employment in finance	—	—	–0.88*	–0.88*
			(0.29)	(0.29)
Share of employment in services	—	—	0.15	0.14
			(0.12)	(0.12)
N	949	949	890	890
Within R^2	0.5016	0.5025	0.5485	0.5486

NOTE: Standard errors in parentheses. These regressions are estimated using a fixed-effects model with both year and state effects. The year of deregulation is dropped. Also, South Dakota and Delaware are dropped. *Statistically significant at the 10 percent level.

The results in column 1 suggest that average growth accelerated by about 0.56 percentage points following branching reform; following interstate banking reform the point estimate is only slightly lower (0.48 percentage points), but it loses statistical significance.[17] In columns 2 and 4 of Table 4, I test whether these growth effects reflect either a temporary growth surge just after deregulation or a temporary growth recession just before deregulation. In these specifications, I add two additional indicator variables; the first equals 1 starting five years after branching reform, and the second equals 1 during the five-year period leading up to branching reform. The first additional indicator allows us to test whether the growth increases were temporary, since this additional indicator would have a negative and statistically significant coefficient under this hypothesis. (The long-run effect is estimated by summing the two coefficients.) Since this additional variable does not enter the regression with a significant effect, the evidence suggests that the growth effects are permanent. Of course, the amount of time that has elapsed since the end of the deregulatory phase has

[17] Because most states permitted interstate banking during the middle of the 1980s, there is much less variation to exploit in the regressions once state and year fixed effects are included. Hence, the standard error of the interstate banking indicator tends to be larger than the standard error on the branching reform indicator.

not been long—less than ten years in this data set—so these conclusions must be made cautiously.

Freeman (2002) suggests that states deregulated their restrictions on branching during periods following abnormally low (below trend) economic growth. He finds that *dropping* the observations just prior to deregulation substantially reduces the measured impact of branching reform on growth. Dropping these observations, however, reduces the power of the test by making it harder to pin down the annual business cycle shocks (the year fixed effects). The specifications in columns 2 and 4 of Table 4, with the pre- and post-deregulation indicators, effectively leave these observations in the sample but allow the growth rates to vary systematically during the years surrounding regulatory change. These results provide very weak evidence that growth was lower leading up to deregulation; the coefficient equals –0.16 percent (not statistically significant) in column 2 of Table 4 (and, effectively, 0 in column 4). Moreover, including these indicators does not lead to a substantively important change in the estimated growth effect of branching reform.

In the last two columns of Table 4, I introduce the employment share variables. These results suggest that mining, construction, manufacturing, and transportation are associated with relatively faster growth than the other sectors. Most important for the purposes here, however, is that the conclusions remain the same. The effect of branching deregulation gets somewhat *larger* when the share variables are added to the model. Moreover, the indicator equal to 1 during the years starting five years after reform becomes *positive*, although as before we cannot reject the hypothesis that its coefficient equals 0.[18]

Effects on Entrepreneurs

The results so far suggest that growth accelerated after deregulation. But following the logic of Rajan and Zingales, just as cash-constrained firms benefited most from financial development, bank-dependent firms ought to have benefited the most from the banking deregulation and associated improvements in finance. Entrepreneurs or potential entrepreneurs are likely to be highly dependent on banks and other financial markets because they have not had the opportunity (yet) to generate cash flow that can support investment. Indeed, Schumpeter (1969) himself emphasized the role of financial markets in getting funds to young firms as a key channel through which finance can affect long-run growth. To test this idea, I now explore how the *level* and *growth* in new business formation changes following banking reform.[19]

To measure business formation, I use new business incorporations in each state and year from 1976 to 1996. This series comes from the individual states, as reported and compiled by Dun & Bradstreet. Business incorporations is not a perfect measure of the rate of business formation in a state, but it offers the best proxy available that is compiled on a consistent basis over a relatively long period. Dun & Bradstreet also report a series on business "starts" that is an offshoot of their credit database. Since this series goes back only to 1985, it is not helpful in exploring how the changes in banking that began in the mid-1970s affected entrepreneurship and business formation.[20] Nevertheless, the starts data can help verify that business incorporations closely tracks the rate of business formation in a state. It turns out that new incorporations per capita and business starts per capita are consistently positively correlated with each other; the cross-state correlation ranged from a low of 0.58 in 1994 to a high of 0.72 in 1988. There is one important exception, however. The number of incorporations in Delaware is about 20 times the average number of incorporations in the other states (per capita), while the number of starts in Delaware is very close to the average. This difference reflects favorable legal treatment of incorporations in that state. In addition, measures of banking structure in both Delaware and South Dakota are skewed by the presence of credit card banks in those states. We therefore drop both of these states from all of our regressions.

As a further check on the data, incorporations per capita and starts per capita can be compared with the number of new establishments per capita,

[18] A quick look at Table 1 suggests that the timing of state deregulation was clustered by region. Thus, one concern with the growth acceleration may be that it is picking up a regional business cycle effect, rather than an increase in growth that can be tied to state-level branching reform. To rule out this possibility, Jayaratne and Strahan (1996) introduce four sets of year indicators, one for each of four broad regions, to control for potential regional business cycles. Introducing these additional controls reduces the growth acceleration by about one third (i.e., the coefficient on the branching deregulation indicator), but it remains statistically significant at the 5 percent level.

[19] In Black and Strahan (2002), we explore how differences in banking structure across states affect new business formation.

[20] Moreover, the starts series depends on a firm's actively seeking to raise funds, because it is based on Dun & Bradstreet's credit database.

Table 5

Panel Regression of the Level and Growth in New Incorporations on Banking Deregulation and Employment Share Variables

	Log of new incorporations per capita		Growth of new incorporations per capita	
Post-branching	0.0279	0.0981*	0.0312*	0.0390*
	(0.0186)	(0.0175)	(0.0128)	(0.0138)
Post-interstate banking	0.1169*	0.0572*	–0.0057	–0.0133
	(0.0243)	(0.0229)	(0.0164)	(0.0178)
Share of employment in mining	—	6.30*	—	0.75
		(0.92)		(0.75)
Share of employment in construction	—	9.59*	—	0.42
		(0.70)		(0.63)
Share of employment in manufacturing	—	2.89*	—	0.52
		(0.69)		(0.57)
Share of employment in transportation	—	6.00*	—	1.41
		(1.99)		(1.59)
Share of employment in trade	—	6.11*	—	0.09
		(1.03)		(0.83)
Share of employment in finance	—	6.04*	—	–2.87*
		(1.98)		(1.58)
Share of employment in services	—	2.68*	—	–0.64
		(0.82)		(0.67)
N	949	890	901	850
Within R^2	0.3554	0.5166	0.1933	0.2259

NOTE: Standard errors in parentheses. These regressions are estimated using a fixed-effects model with both year and state effects. The year of deregulation is dropped. Also, South Dakota and Delaware are dropped. *Statistically significant at the 10 percent level.

which is available from the Small Business Administration starting in 1989.[21] An establishment is not a firm; rather, it is an economic unit such as a plant, a factory, or a restaurant that employs people. Nevertheless, we think that the number of new establishments ought to be highly correlated with the economic quantity that we are trying to observe—the rate of creation of new businesses. Again, it is highly correlated with both incorporations and starts. From 1989 to 1994, the cross-state correlation between incorporations and new establishments ranges from 0.52 to 0.57, and cross-state correlation between starts and new establishments ranges from 0.41 to 0.65. Thus, new incorporations in a state seems to be a good proxy for new business formation.

Table 3 reports summary statistics for both the level of new incorporations per capita and its annual growth rate. In a typical state and year, there are about 2.5 new incorporations formed for every 1000 people living in a state. The mean growth rate is 2.06 percent per year, slightly higher than the growth in real per capita income. Notice that the variation in the growth of new incorporations is about four times higher than the variation of overall income.

Using the new incorporations data, Table 5 reports how entrepreneurial activity changed following banking deregulation. (Note that in the levels regression, I use the logarithm of the rate of new

[21] Again, since the new establishments series goes back only to 1989, it is not useful in exploring the effects of banking deregulation, which was nearing completion by this time.

businesses per capita so that the coefficient may be interpreted in percentage terms.) Consistent with the Schumpterian logic, both the level and growth of entrepreneurial activity increased following banking deregulation. The regression coefficients suggest, for example, that the annual level of new incorporations per capita increased by 9.8 percent after branching deregulation and by 5.7 percent after interstate banking reform (column 2). In the specifications using the growth rate, the increase occurred only after branching deregulation. Thus, the effects on entrepreneurial activity of branching deregulation appear to be larger and more persistent than the effects of interstate banking, consistent with the effects of the two reforms on personal income growth. It is also worth noting that the *magnitude* of the increase in the growth of new incorporations is substantially larger than the increase in personal income growth following reform, although the standard errors are also substantially larger due to the greater variation in this series.

Business Cycle Effects

The evidence so far points to substantial benefits of opening up banking markets to potential entry and greater competition. Entrepreneurs appear better able to start businesses and, perhaps through their efforts, economic growth accelerates. Cross-country evidence that is beginning to emerge suggests that opening up financial markets to foreign entry can also create benefits associated with macroeconomic stability (Barth, Caprio, and Levine, 2002). There is some evidence from studies at the bank level, however, that risk-taking may increase with the reductions in franchise value that come following banking deregulation (Keeley, 1990; Demsetz, Saidenberg, and Strahan, 1996; Hellman, Murdock, and Stiglitz, 2000; Bergstresser, 2001).

How did banking reform in the U.S. affect macroeconomic stability? In a recent paper, Morgan, Rime, and Strahan (2002) analyze this question from both a theoretical and an empirical standpoint. They show first that following interstate banking deregulation in the United States, the banking system became substantially better integrated nationally. Prior to deregulation, the U.S. had a balkanized system composed effectively of 50 little banking systems, one for each state. After interstate deregulation, however, an average of about 60 percent of a state's banking assets were owned by a multi-state (or sometimes multinational) banking company. The theoretical effect of this banking integration on business cycles, however, is ambiguous. Morgan, Rime, and Strahan start with a banking model in which bankers can *prevent* moral hazard—by monitoring firms—as well as *commit* moral hazard—by neglecting to monitor. These hazards make the equilibrium rate of investment in the economy depend on the level of firm collateral and bank capital; these state variables give firms and bankers a stake in future investment outcomes, but shocks to either variable cause equilibrium investment to fall, i.e., collateral crunches and bank capital crunches are both contractionary.

Morgan, Rime, and Strahan then show how integration of banking—that is, linking up the banking systems of two formerly separate economies—changes the effects of these two kinds of shocks. They show that both collateral and capital shocks remain contractionary after integration, but their magnitudes change: Bank capital shocks become less important after integration, but the effect of collateral shocks gets bigger. The intuition for this result is straightforward and general. A banking company that is diversified across two economies can import capital if lending opportunities in one economy are strong relative to the availability of local bank capital. In contrast, a collateral shock in one economy will lead the integrated bank to *export* their capital and lending, thus worsening the resulting downturn.

Table 6 quantifies empirically how both branching and interstate banking deregulation affected the magnitude of state business cycles. The dependent variable in these regressions equals the absolute value of the residuals from the personal income growth regressions (Table 4, columns 1 and 3) and the growth in new incorporations regressions (Table 5, columns 3 and 4). Thus, the dependent variables in Table 6 can be thought of as the *magnitude* of the deviation from expected growth in state personal income and new businesses, conditional on the employment shares in a state, the state's average growth rate (the state fixed effect), and shocks to the U.S. economy as a whole (the year fixed effects).

The results suggest that overall state-level business cycle volatility fell after interstate banking and the associated financial integration. The coefficients suggest a decline of 0.31 to 0.47 percentage points, which is large relative to the unconditional mean of 1.26 percent (columns 1 and 2). The effects of branching deregulation are not significant, although this should perhaps not be too surprising because branching deregulation allowed integration

Table 6

Panel Regression of Volatility of Growth in Real, Per Capita Income and New Incorporations on Banking Deregulation and Employment Share Variables

	Volatility in growth in real, per capita state income		Volatility in growth in new incorporations per capita	
Post-branching	–0.0001	–0.0004	–0.0136	–0.0090
	(0.0014)	(0.0015)	(0.0080)	(0.0088)
Post-interstate banking	–0.0031*	–0.0047*	–0.0072	–0.0116
	(0.0028)	(0.0020)	(0.0107)	(0.0114)
Share of employment in mining	—	0.01	—	1.86*
		(0.08)		(0.48)
Share of employment in construction	—	0.20*	—	0.25
		(0.06)		(0.41)
Share of employment in manufacturing	—	–0.01	—	0.24
		(0.06)		(0.36)
Share of employment in transportation	—	0.02	—	–2.24*
		(0.17)		(1.02)
Share of employment in trade	—	0.08	—	0.27
		(0.09)		(0.53)
Share of employment in finance	—	0.20	—	1.35
		(0.17)		(1.01)
Share of employment in services	—	0.07	—	0.31
		(0.07)		(0.43)
N	949	890	901	850
Within R^2	0.0650	0.0932	0.0604	0.0987

NOTE: Standard errors in parentheses. The volatility equals the absolute deviation in the growth rate from its expected value—that is, the absolute value of the residuals from the models reported in Tables 4 and 5. These regressions are estimated using a fixed-effects model with both year and state effects. The year of deregulation is dropped. Also, South Dakota and Delaware are dropped.
*Statistically significant at the 10 percent level.

within a state rather than *across* state lines.[22] The results for the volatility of the growth of new incorporations also point in the same direction—toward less volatility following deregulation—although the coefficients on both deregulation indicators are not significant at conventional levels (columns 3 and 4).

The theoretical analysis suggests that the explanation for better macroeconomic stability following deregulation is due to better insulation of a state's economy against shocks to its own banking system. In a disintegrated banking system, such as the one we had in the 1970s and early 1980s, shocks to bank capital lead to reductions in lending, thereby worsening the downturn. In contrast, with integration a state can import bank capital from abroad (i.e., from other states) when its banks are down. If this explanation really holds, then the correlation between economic performance and banking performance ought to weaken with deregulation and integration.

Table 7 puts this notion to the test by adding the growth rate of local bank capital to the personal income and incorporations growth regressions reported in Tables 4 and 5, along with interactions between bank capital growth and the deregulation indicator variables. The results provide strong support for the idea that interstate banking deregulation

[22] Perhaps a better test of the potential stabilizing effects of branching reform would be to use local economic performance, such as from a county or city. Integration of banks within a state might help localities share risks just as integration across state lines help states share risks.

Table 7

Panel Regression of Growth Variables on Banking Deregulation, Bank Capital Growth, and Employment Share Variables

	Growth in real, per capita state income		Growth in new incorporations per capita	
Post-branching	0.0028	0.0031	0.0238	0.0292
	(0.0037)	(0.0038)	(0.0202)	(0.0203)
Post-interstate banking	0.0099*	0.0094*	0.0189	0.0244
	(0.0041)	(0.0043)	(0.0217)	(0.0226)
Growth in local bank capital	0.1416*	0.1244*	0.4535*	0.5388*
	(0.0234)	(0.0268)	(0.1286)	(0.1431)
Growth in local bank capital × post-branching	0.0226	0.0322	0.1086	0.1028
	(0.0330)	(0.0348)	(0.1852)	(0.1886)
Growth in local bank capital × post-interstate banking	–0.1267*	–0.1266*	–0.4794*	–0.5840*
	(0.0312)	(0.0341)	(0.1770)	(0.1831)
Employment share variables included?	No	Yes	No	Yes
N	851	794	803	754
Within R^2	0.5533	0.5881	0.2293	0.2762

NOTE: Standard errors in parentheses. These regressions are estimated using a fixed-effects model with both year and state effects. The year of deregulation is dropped. Also, South Dakota and Delaware are dropped. *Statistically significant at the 10 percent level. The sample ends in 1994 because the capital growth variable cannot be constructed at the state level accurately after that time.

severed the link between local economic performance and local bank performance.[23] According to the estimated coefficients, a 10-percentage-point reduction in the growth of bank capital held by local banks would be associated with a decline in personal income growth of 1.2 to 1.4 percent prior to interstate banking reform. After reform, however, this correlation becomes indistinguishable (statistically) from 0 (columns 1 and 2).

Table 7 also shows that the link between local bank capital and the growth of new incorporations is much stronger prior to deregulation, compared with its link with overall income growth, consistent with the premise that banks are especially important for small and young firms. The regression coefficients, for instance, suggest that a 10-percentage-point reduction in the growth of local bank capital would be associated with a decline in the growth rate of new incorporations of 4.5 to 5.4 percent, again prior to interstate banking reform. After reform, however, this correlation also becomes indistinguishable (statistically) from 0 (columns 3 and 4). So, integration has salutary effects on business cycles by insulating the local economy from the ups and downs of the local banking system. Of course, the kind of cross-state integration that we experienced following interstate deregulation would not be expected to insulate states from shocks to *all* banks in the United States.

CONCLUSIONS

Banking deregulation of restrictions on branching and interstate banking lifted a set of constraints that had prevented better-run banks from gaining ground over their less-efficient rivals. Big changes in the banking industry followed deregulation: many acquisitions and consolidations, integration across state lines, and a decline in the market share of small banks. These changes allowed banks to offer better services to their customers at lower prices. As a result, the real economy—"Main Street" as it were—seems to have benefited. Overall economic growth accelerated following deregulation, and this faster growth seems to have been concentrated among new businesses. Sometimes we think that higher returns necessarily come at the cost of greater

[23] Local banks here means banks headquartered within the state.

risk, but in the case of U.S. banking deregulation, volatility of the economy *declined* as growth went up.

Will these beneficial results on both mean economic growth and business cycle volatility translate over to small economies opening their financial markets? Using a broad panel of countries, Morgan and Strahan (2002) report evidence that foreign bank entry seemed to be followed by more—or certainly no less—economic volatility. But these conclusions are made tentatively; more research is clearly needed. Given the strong statistical results reported here for the United States, it would seem that additional country "case studies" would be particularly valuable.

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Commentary

David C. Wheelock

Phil Strahan and various coauthors have written a series of significant papers on the impact of interstate banking and intrastate branching deregulation. His present paper summarizes and extends much of that research.[1]

I suspect that most economists would agree that draconian restrictions on branch banking or on the ability of bank holding companies to cross state lines make no sense. Geographic restrictions historically left the U.S. banking system vulnerable to regional economic shocks, limited banks' ability to exploit economies of scale and scope, sheltered weak banks from competition, and imposed costs on the consumers of banking services. Strahan's work attempts to *quantify* the impact of the removal of such restrictions on economic growth and entrepreneurial activity at the state level. His estimates are striking—for example, the removal of restrictions on branching appears to have increased the growth rate of state per capita incomes by about one-third, and the effect is persistent. He also estimates a marked increase in the rate of new business incorporations following deregulation, as well as a large decline in the volatility of state-level business cycles after interstate banking was permitted.

Economists and economic historians have long debated the effects of a country's financial system on its economic development. This commentary relates Strahan (2003) to other studies on the effects of geographic restrictions on banks, with a focus on historical comparisons. In addition, I raise some specific questions about Strahan's empirical analysis in the traditional discussant's role as devil's advocate.

DOES FINANCIAL STRUCTURE MATTER?

Richard Sylla (1998) argues that, between 1780 and 1820, the emergence of a financial system characterized by strong commercial banks, a deep capital market, and a sound currency set the United States apart from its Western Hemisphere neighbors and helps explain why the United States experienced rapid economic growth when other countries did not. Although commercial banks and securities markets did not arise or develop independently of one another, the degree of separation between the two and the importance of securities markets in the United States was unlike the financial systems of continental European countries, where banks dominated and securities markets were bit players.

The failure of powerful universal banks to emerge in the United States—and by extension, the reason why the U.S. capital market became so important—was the result, Calomiris (1995) argues, of restrictions on the ability of commercial banks to operate branches.[2] Calomiris argues that universal banks enjoy economies of scope by combining deposit-taking, trust services, lending, equity-holding, and underwriting. Hence, universal banks are uniquely able to meet the changing financial needs of corporations as they mature and, thus, provide an efficient means of financing a nation's economic development. In the United States, Calomiris claims, branching restrictions made it difficult for commercial banks to grow sufficiently in size to meet the financial needs of large-scale enterprises, and, consequently, he argues that the cost of capital was higher in the United States than it would have been with a system of universal banks with nationwide offices (such as in the German banking system).

[1] See Strahan (2003) for references.

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[2] With the exceptions of the First and Second Bank of the United States, which were federally chartered and operated offices throughout the country, before the Civil War all U.S. banks were chartered by state governments. A few southern states permitted banks to branch, but most states did not; furthermore, state-chartered banks were never permitted to operate branches across state lines. The charters of both the First and Second Banks were both allowed to expire after 20 years of operation, and no bank operated interstate branches after 1836. The National Bank Act of 1863, which established the Office of the Comptroller of the Currency and provided for federal bank chartering, was interpreted as prohibiting interstate branching. The McFadden Act of 1927 further restricted branching by national banks.

ARE BRANCHING BANKS MORE STABLE?

Calomiris's (1995) contention—that branching restrictions increased the cost of capital in the United States and, presumably, held back the rate of economic growth—is difficult to test and not universally agreed upon (e.g., see Fohlin, 1998). Much more widely accepted is the view that branching restrictions were an important cause of instability in the U.S. banking system. Friedman and Schwartz (1963) contend that branching restrictions left the U.S. banking system especially vulnerable to banking panics, such as those occurring during the Great Depression. Canada, by contrast, had a banking system consisting of a small number of large banks with nationwide branches and suffered no banking panics during the Depression. Grossman (1994) also finds that panics were less likely to occur during the Depression in countries that had nationwide branch banking.

Within the United States, Wheelock (1995) and Mitchener (2002) find that during the Depression bank failure rates were lower in states that permitted some branching. Interestingly, Calomiris and Mason (2000) and Carlson (2001) find that branching *increased* the probability of failure for individual banks, controlling for bank size and other specific characteristics. Both Calomiris and Mason (2000) and Carlson and Mitchener (2002) suggest that prior acquisitions by branching banks might explain why branching seems to have increased the probability of failure for individual banks while average failure rates were lower in states that permitted branching. Calomiris and Mason (2000) note that some branching banks had engaged aggressively in acquisitions during the late 1920s, and the estimated positive effect of branching on the probability of failure for individual banks during the 1930s might reflect the costs of acquiring distressed banks in prior years.

Carlson and Mitchener (2002) conclude that the expansion of branching during the 1920s increased competition and drove out of existence many weak banks in formerly protected markets either by failure, voluntary liquidation, or merger. Hence, once the Depression hit, the average bank—regardless of whether it had branches—was stronger in states that permitted branching than in other states, resulting in a lower state bank failure rate. Carlson (2001) finds that branching banks tended to maintain lower reserve ratios than other banks, however, which might explain why branching appears to have increased the probability of failure for individual banks.

THE EFFICIENCY OF BRANCH BANKING SYSTEMS

Although banking systems that consist of a small number of large banks with nationwide branches have been more stable historically, the question arises whether such systems are efficient. Although Strahan (2003) finds that deregulation has not increased bank market concentration in the United States, many countries that permit nationwide branching have highly concentrated banking systems. Cetorelli and Gambera (2001) find that increasing market concentration raises the cost of bank loans for firms and retards economic growth. Bordo, Redish, and Rockhoff (1995), however, find that interest rates on loans between 1920 and 1980 were not higher in Canada, which has a highly concentrated banking system, than in the United States. They also find that interest rates paid on deposits were higher in Canada. Although Canadian banks had a higher average rate of return on equity than U.S. banks, Bordo, Redish, and Rockhoff (1995) attribute this to scale economies and the Canadian system's stability rather than to the exercise of monopoly power.

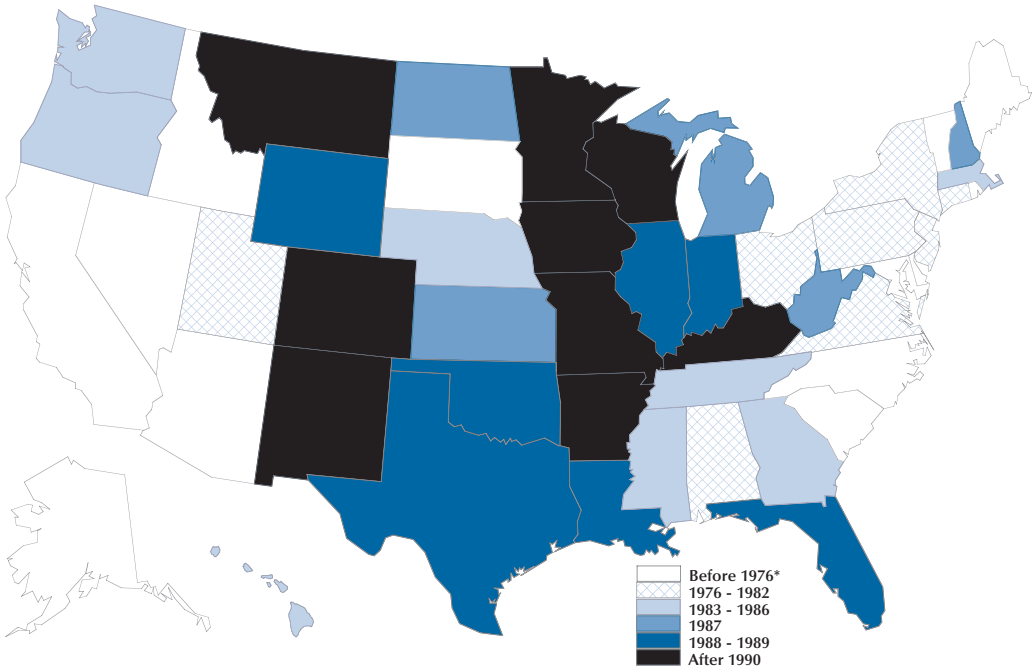
Although Cetorelli and Gambera (2001) and other studies have investigated the effects of bank market concentration on economic growth, I am not aware of any studies other than Strahan's work that directly test the effects that branching, per se, or changes in branching laws have on growth. Friedman and Schwartz (1963) note that, although Canada had no banking panics, the percentage declines in Canadian and U.S. gross domestic product (GDP) during the Depression were similar. Moreover, U.S. states that permitted branch banking seem not to have fared any better during the Depression than did other states. These studies focus on a short and unusual period, however, and provide little evidence of the impact of branching in general. Strahan's studies of the real economic effects of intrastate branching and interstate banking deregulation are thus unique and important.

SPECIFIC COMMENTS ON STRAHAN (2003)

Strahan's (2003) estimates of the impact of deregulation on economic growth are large: He finds that removing restrictions on statewide branching increased the average growth rate of state real per

Figure 1

When Banks Permitted Intrastate Branching



NOTE: *Delaware and South Dakota are excluded.

capita income by 33 percent and that the effect on growth remained as high five years after deregulation. Kroszner and Strahan (1999) investigate the determinants of deregulation and conclude that technological changes created strong pressure for deregulation, while the timing of deregulation in specific states was determined by the relative strengths of pro- and anti-deregulation constituents. Importantly, they find no evidence that deregulation occurred in anticipation of future economic growth. Freeman (2002), however, shows that states tended to deregulate when they were growing below trend, suggesting that the choice of branching regime was not independent of income growth. Freeman shows further that when three- or five-year intervals surrounding the year of deregulation are eliminated from the estimation of Strahan's model, the estimated impact of the removal of intrastate branching restrictions on growth is smaller than what Strahan reports.

A correlation between deregulation and state per capita income growth is evident in Figures 1 through 3. Figures 1 and 2 show the dates when states removed restrictions on intrastate branching and interstate banking. In Figure 1, states that are not shaded include those permitting statewide branching before 1976 (the first year in Strahan's, 2003, empirical analysis), plus Delaware and South Dakota, which Strahan excludes.[3] Other states are shaded in groups according to when they enabled statewide branching. In Figure 3, states are shaded according to annual average growth in state per capita income during 1976-96, the years encompassed by Strahan's empirical work. By comparing the three maps, one notes that average growth tended to be higher in states that deregulated earlier. One also notes regional patterns in the timing of deregulation and average growth rates. States in the South and New England tended to deregulate earlier than Midwestern states, and several of these had among the highest average annual growth rates.

The regional patterns in the timing of deregulation and growth rates suggest possible spatial correlation among either or both variables. Spatial

[3] Delaware and South Dakota are are omitted because the presence of several large credit-card banks in each state distorts banking and growth data. These states are not shaded in Figure 2 for the same reason.

Figure 2

When Banks Permitted Interstate Banking

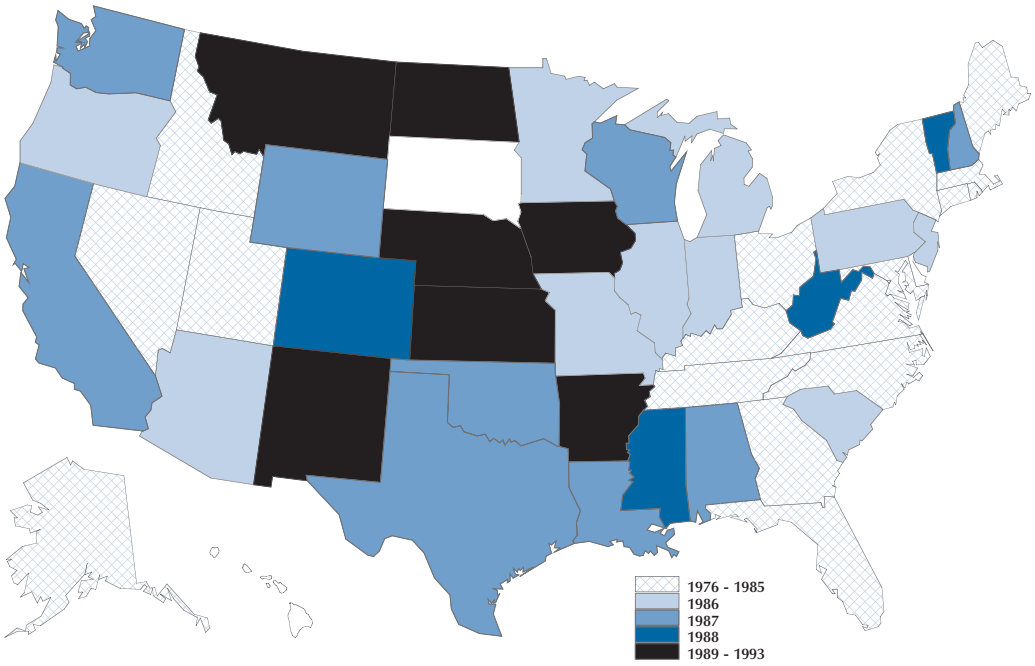
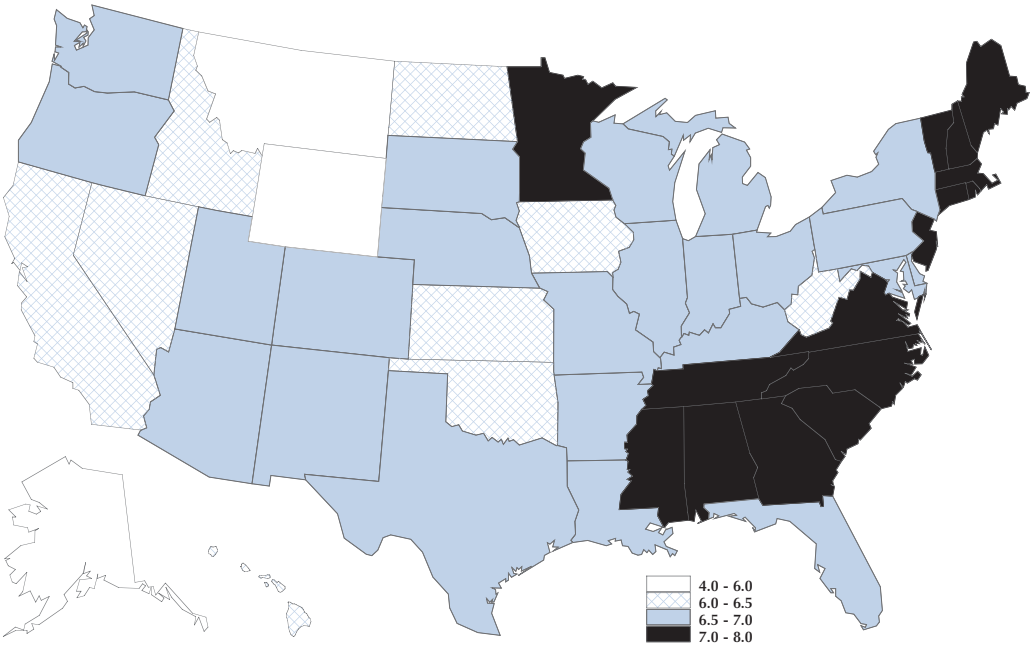


Figure 3

Average Per Capita Income Growth Rate, 1976-96



correlation arises if, say, the decision of one state to adopt a particular branching law is affected by another state's choice. Or, it would arise if the growth rate of one state is affected by the growth rate of another state. In the former case, an independent variable in Strahan's (2003) model would exhibit spatial correlation. In the latter case, the dependent variable would exhibit spatial correlation. Failure to account for spatial correlation in an independent variable will result in inefficient coefficient estimates. Failure to account for spatial correlation in a dependent variable, however, can lead to biased estimates.[4] Observed regional patterns do not necessarily mean that variables are spatially correlated, but do suggest the need for additional testing.

The removal of intrastate branching and interstate banking restrictions in the United States provided a natural experiment of the effects of changes in banking market structure on real economic activity. Strahan's comprehensive analysis shows that deregulation had significant positive effects on economic activity. Although additional econometric work might reduce the magnitude of the effects he finds, Strahan's work will remain important as a comprehensive analysis of the causes and effects of banking deregulation.

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[4] See Anselin (1988).

Life-Cycle Dynamics in Industrial Sectors: The Role of Banking Market Structure

Nicola Cetorelli

A theoretical debate has emerged recently on the role of bank competition for economic activity in industrial sectors. In their seminal work on this issue, Petersen and Rajan (1995) have argued that young and unknown firms have easier access to credit if banks have market power. In their reasoning, banks with market power fund young firms with the expectation that they will be capable of extracting future rents once those firms become profitable. Petersen and Rajan's argument has immediate implications for predicting the role of bank competition on entry conditions in industrial sectors. Following their goal of profit maximization, banks with market power should be observed always to favor new entrants. This is because new entrants are potentially endowed with higher-return projects and more innovative technologies that would guarantee ever-increasing profit-sharing opportunities for the banks. Therefore, bank market power should continuously foster industry entry.

There is empirical evidence providing support for this argument. In addition to the aforementioned Petersen and Rajan (1995), Bonaccorsi di Patti and Dell'Ariccia (forthcoming) show that growth rates in the number of new enterprises are higher in markets with higher bank concentration. Cetorelli and Gambera (2001), although not focusing on entry, show that growth of industries where young firms are especially dependent on external finance is disproportionately higher in countries with higher bank concentration. There is also empirical evidence pointing in the opposite direction. Black and Strahan (2002), for example, show that business starts became more numerous in U.S. states after the relaxation of restrictions to entry in banking markets; they also show a higher level of business starts in markets with lower bank concentration. Similar results are also found in Cetorelli (2001, 2003) and in Cetorelli and Strahan (2002).

The lack of univocal evidence may indicate the existence of a more elaborate mechanism through which bank competition affects economic activity in industrial sectors. The basic argument in Petersen and Rajan relies on the formation of long-time lending relationships and on the inherent value of such relationships for the bank. The latter is represented in their work by the present value of the future stream of profits of those firms the bank originally helped start up, firms that eventually become the industry incumbents. A possible theoretical "tension" embedded in this argument lies in the fact that the profitability of the older bank clients (and thus the bank's own profitability) will be affected by the entry of new firms. The bank may therefore face a potential trade-off: On the one hand, the bank could restrict access to credit for new entrants and continue its ongoing relationship with the industry incumbents; on the other hand, it could allow credit access to new firms, thus establishing new and possibly even more valuable relationships with them at the expense of the older clients. In recent papers, Cestone and White (forthcoming) and Spagnolo (2000) present theoretical frameworks in which existing lending relationships do indeed affect the behavior of lenders vis-à-vis potential new borrowers. The less competitive the conditions in the credit market, the lower the incentive for lenders to finance newcomers. Hence, financial market competition can represent a form of *barrier to entry* in *product* markets.[1]

What emerges from this discussion is that the effect of banking market structure and competition may have heterogeneous effects across firms within an industrial sector. More precisely, the effect may be different for start-ups and incumbents, thus implying that bank competition may have an impact on the *entire* life-cycle dynamics of industrial sectors,

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[1] This work is itself based on contributions to the issue of product market competition, such as Brander and Lewis (1986), Chevalier (1995), Kovenock and Phillips (1995, 1997), and Maksimovic (1988).

and not just on entry. More or less bank competition affects not only entry but also the likelihood that young firms will survive and expand after entry. Once again, in keeping with the theoretical arguments illustrated above, more or less bank competition will also have an impact on the ability of the more mature firms (the incumbents) to prosper and, eventually, on the pace at which they will exit the industry.

This paper reflects a first attempt to examine the effect of bank competition on the life-cycle dynamics of industrial sectors. More precisely, I measure the effect of bank competition on the rates of job creation and destruction in U.S. manufacturing plants belonging to different age groups. If bank market power enhances the access to credit of young firms and accelerates exit of the more mature ones, then we should expect—all else being equal—higher rates of job creation and/or lower rates of job destruction among young firms, and lower rates of job creation and higher rates of job destruction among older firms. The opposite should be true if, instead, banks with market power tend to maintain close ties with incumbent firms and to create a financial barrier to entry in product markets.

The following section illustrates the data sets I have used for this study. Next, I describe the methodology for identifying the effects of bank competition and present the results of the empirical analysis. A summary of the results, highlighting caveats and unresolved issues, is presented in the conclusion.

DATA SET

The empirical testing of these propositions calls for a data set with information on industry dynamics, including specific details on the real activity of both start-ups and mature firms. The Davis, Haltiwanger, and Schuh (1996) data set on job creation and destruction in U.S. manufacturing sectors is a good example of a data set with these characteristics, one which to the best of my knowledge has yet to be used to analyze the potential effects of credit market characteristics on the life-cycle dynamics of industrial sectors.

This data set collects information on establishments' rates of job creation and destruction elaborated from the Longitudinal Research Database of the Census Bureau's Center for Economic Studies. The database contains information on individual U.S. manufacturing plants with five or more employees, collected through the quinquennial Census of Manufactures and the Annual Surveys of Manufactures. The publicly available version of the data set, at its finest level of detail, contains information aggregated across establishments belonging to the same two-digit standard industrial classification (SIC) manufacturing sectors; it comprises nine census regions (New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, Pacific) from 1973 to 1988.[2] Data is presented at this level of disaggregation on the rates of job creation and destruction among both "start-ups" and "continuing" establishments. An establishment is defined as a start-up in a given year if it shows up in the survey for the first time in that year. An establishment is defined as a continuing one in a given year if it was already present in the survey the previous year.[3] Note, however, that the rates of job creation for the two age groups (start-ups and continuing establishments) are reported only as *components* of the total rate of job creation.[4] In other words,

$$(1) \qquad g_t^T = g_t^B \cdot empshare_t^B + g_t^C \cdot empshare_t^C,$$

where g_t^T is total job creation rate, g_t^B the growth rate for start-ups, $empshare_t^B$ the employment share of start-ups, g_t^C the growth rate for continuing establishments, and $empshare_t^C$ their employment share. The data set contains information for the two products on the right-hand side but not for the growth rates separately, or for relative employment shares. Hence, the data on job creation for each of the two age categories is somewhat interdependent, which implies that these data on job creation can be used only to estimate the *relative* effect of bank competition on one group with respect to the other.

There exists, however, an alternative format of the Davis, Haltiwanger, and Schuh (1996) data set that is also publicly available. This data set has a coarser level of disaggregation, with information available only over time and across census regions but aggregated across industrial sectors. While lacking the industry dimension, this alternative data set has the important advantage of providing the rates of job creation and destruction for three different age categories: establishments up to one year old (observed only in the current year), those between

[2] Data through 1993 are available to the public, but at a higher level of aggregation—which is not relevant for this study.

[3] For complete classification criteria of start-ups and continuing establishments, see Davis, Haltiwanger, and Schuh (1996, Table A3, p. 202).

[4] This comment does not apply to the rates of job destruction.

Table 1

Job Flows by Establishment Age

Age categories	Job creation	Job destruction	Employment share
Start-ups	48.70	11.00	2.70
Middle-aged	12.20	13.70	17.50
Mature	7.09	9.30	79.70

NOTE: Start-ups are establishments up to one year old, middle-aged establishments are those between two and ten years old, and mature establishments are more than ten years old. The statistics are averages across regions and industrial sectors for the period 1977-88.

two and ten years old, and those older than ten years.[5] Davis, Haltiwanger, and Schuh define the first group, again, as start-ups, the second as "middle-aged," and the third as "mature."

In addition to a finer level of detail on the age profile of industrial establishments, the rates of job creation and destruction in this alternative data set are reported as actual growth rates for each age category, rather than components of the total job creation rate across categories. Thus, the first data set includes a third (cross-industry) dimension but does not provide independent information on job creation rates between start-ups and the complementary age group of the continuing establishments. The second data set lacks the cross-industry dimension but has superior information related to the age profile of manufacturing establishments. Gathering evidence from both data sets should allow me to draw as complete a picture as possible of the effect of bank competition on job creation rates. Table 1 presents year averages for the rates of job creation and job destruction and employment share for the three age categories of start-ups, middle-aged, and mature establishments.

The data on industry structure was matched with information from the FDIC Summary of Deposits, from Jayaratne and Strahan (1996), and from Compustat. From the Summary of Deposits, I have calculated Herfindhal-Hirschman indices of market concentration, measures of total bank assets, and total bank loans for each of the nine census regions. Jayaratne and Strahan (1996) used dummy variables to describe the process of banking deregulation occurring across U.S. states. Both intrastate and interstate restrictions on branching and on the creation of *de novo* banks existed to differing degrees in all U.S. states in previous decades. This meant substantial restrictions to entry in local markets and, consequently, a significant impact on the degree of banking competition. Starting in the 1970s, states began a process of relaxing such restrictions that continued throughout the early 1990s. Jayaratne and Strahan (1996) have shown that, as a result of increased competition, state economic growth accelerated after deregulation. Based on their indicator variables constructed at the state level, I have constructed an equivalent indicator for each region, using state income levels as weights, which captures the process of relaxation of restrictions to interstate bank branching. Figures 1 and 2 illustrate the time path of bank concentration and of the deregulation indicators constructed for the nine regions.

Taking advantage of the first data set's availability of establishment information from a cross-section of industrial sectors, I have augmented the estimations according to the differences-in-differences approach first suggested by Rajan and Zingales (1998). As these authors highlight, industrial sectors differ from one another, for technological reasons, in terms of their degree of dependence on external sources of finance. It must therefore be the case that, whatever the effect of bank concentration and bank deregulation on the life-cycle dynamics of a sector, this effect must be especially strong for those sectors that rely more heavily on external finance for their investment needs. For this reason, and following Rajan and Zingales, I constructed data on external financial dependence for each two-digit sector using information available in Compustat.

Data from the Summary of Deposits was available only from 1977, so the merged data, in its most

[5] The classification of the age categories varies slightly over time. At one extreme, in some years the ranges are less than 2 years old, 2 to 8, and older than 8. At the other extreme, for some years the ranges were less than 3, 3 to 12, and older than 12.

Figure 1

Banking Deregulation by Census Region

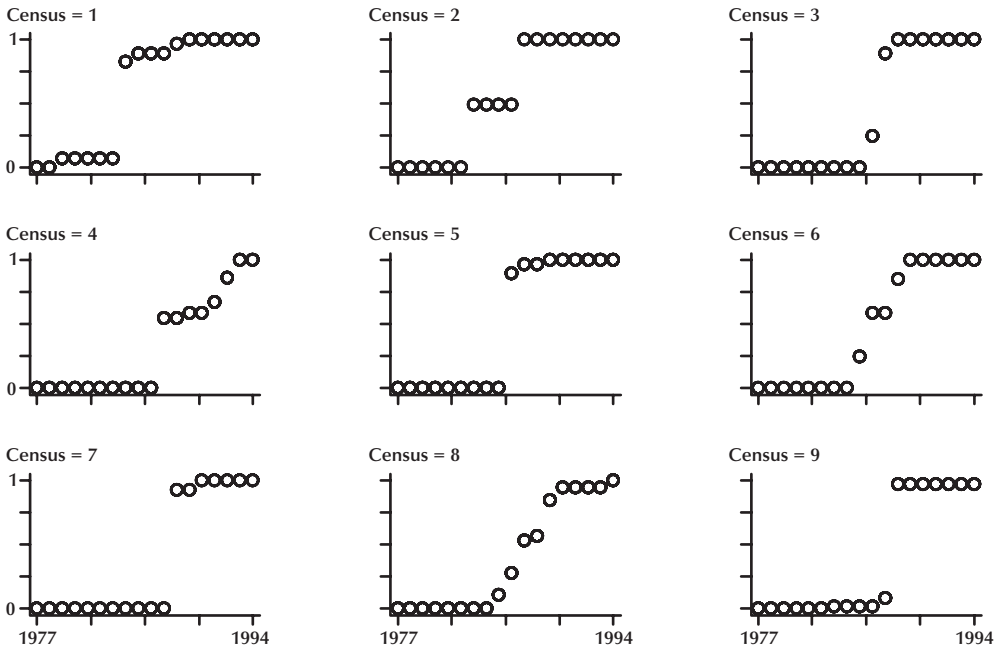
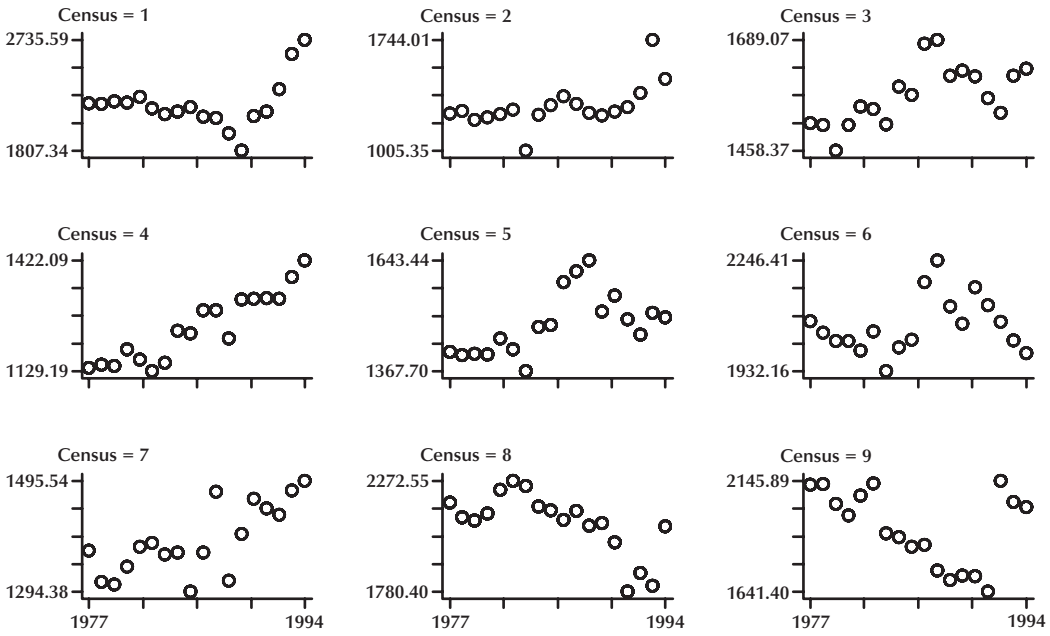


Figure 2

Bank Concentration by Census Region



extensive format, runs from 1977 through 1988, with information for 9 regions and 20 manufacturing sectors.

EMPIRICAL TESTING

Because the information on real economic activity for establishments in different age categories is so detailed, it is possible to test hypotheses about the specific mechanisms through which bank concentration and banking deregulation may impact the life-cycle dynamics of industrial sectors. Evidently, industries' employment dynamics, and what they imply in terms of industry entry and exit, are the results of many more factors, possibly even of a higher order of importance than the prevailing characteristics of the credit market. Such factors may be specific to each industrial sector, or they may be common across sectors for firms operating in a certain geographical area, or they may have a temporal component. The richness of a data set with multiple dimensions makes it possible to identify the effect of the bank competition variables, which vary across both region and time, while still controlling with vectors of dummy variables for effects that are specific to a given geographical region, are related to time passing, or are industry specific. This approach should substantially reduce the risk of a bias in the estimations due to the omission of relevant variables. As mentioned above, I also use information on the financial needs of each industrial sector; where possible, I also augment the estimation of the effects of the bank competition variables by using terms of interaction of such variables with the indicator of external financial dependence constructed from Compustat data.

Details of the methodology are more easily understood by looking directly at the models used for the estimation analysis. The basic strategy is to analyze the effect of the bank competition variables on establishments in the different age groups. I begin by focusing on the possible effect of bank competition on start-up plants. If bank market power enhances credit access to the youngest firms, then we should find that, all else equal, the rates of job creation of start-ups should be higher if bank concentration is higher and if banks face tighter regulatory restrictions. The opposite is true if, instead, one argues that banking market power may in fact represent a financial barrier to entry in product markets.

Using the second data set, I first estimate the following model:

(2)
$$\textit{Job creation of start-ups}_{rt} = \alpha_r \textit{Regional dummies}_r + \alpha_t \textit{Year dummies}_t + \beta \textit{Deregulation}_{rt} + \gamma \textit{Bank concentration}_{rt} + \eta \textit{Controls}_{rt} + \textit{Error}_{rt},$$

where the dependent variable is the actual rate of job creation of start-up establishments in region r and in year t. The vectors of indicator variables absorb region-specific and time-specific effects. The deregulation and bank concentration variables contain both a time and a geographic dimension and are therefore identifiable. If bank market power enhances entry, then we should expect β to be negative and significant and γ to be positive and significant. The opposite is true under the more traditional hypothesis that bank competition has a positive effect on the real economic activity of start-ups.

Subsequently, I look for confirmation of any result obtained with this first model specification by using the richer three-dimensional panel. As explained above, since this data set presents rates of job creation for start-ups and continuing establishments only as *components* of the total job creation rate, I can only test how either job creation rates for each age group contribute to the total. More precisely, I estimate the following alternative model specification:

(3)
$$(\textit{Job creation of start-ups/Total job creation})_{rst} = \Delta_r \textit{Regional dummies}_r + \Delta_s \textit{Industry dummies}_s + \Delta_t \textit{Year dummies}_t + \beta \textit{Deregulation}_{rt} + \gamma \textit{Bank concentration}_{rt} + \delta(\textit{Deregulation}_{rt} \cdot \textit{External financial dependence}_s) + \varphi(\textit{Bank concentration}_{rt} \cdot \textit{External financial dependence}_s) + \eta \textit{Controls}_{rtv} + \lambda(\textit{Controls}_{rt} \cdot \textit{External financial dependence}_s) + \textit{Error}_{rst}.$$

The dependent variable is the rate of job creation of start-ups in each industry s in region r in year t, relative to the total job creation rate. Note that, necessarily, any effect identified through this model specification implies a mirror image effect (of the same magnitude but opposite sign) on mature establishments. The three vectors of indicator variables absorb the sector-specific, region-specific, and time-specific effects. As above, the deregulation and bank concentration variables contain both time and geographic dimensions and are therefore identifiable. As mentioned earlier, this data set may also be exploited to disaggregate sector-specific characteristics, such as the needs for external funding.

Following the methodological approach of Rajan and Zingales (1998), whatever the effect of the variables of bank competition, such an effect will be especially strong in sectors that are relatively more dependent on external sources of finance. The interaction terms with the external financial dependence variable capture these effects. If bank market power enhances entry, then δ will be negative and significant and φ positive and significant.

Next, I focus on what happens to start-ups once they receive funding and begin to grow. Does bank competition help relatively young firms to thrive? To explore this issue I have analyzed the effect of bank competition on the persistence rates of start-ups. The finer details on age present in the second data set allow me to do that by looking at both the job creation rates and the job destruction rates for the middle-aged establishments. These are plants that in relatively recent times were start-ups but are not yet considered mature. The analysis of this age group is performed using the following model specifications:

(4)
$$\textit{Job creation of middle-aged establishments}_{rt} = \alpha_r \textit{Regional dummies}_r + \alpha_t \textit{Year dummies}_t + \beta \textit{Deregulation}_{rt} + \gamma \textit{Bank concentration}_{rt} + \eta \textit{Controls}_{rt} + \textit{Error}_{rt}$$

and

(5)
$$\textit{Job destruction of middle-aged establishments}_{rt} = \alpha_r \textit{Regional dummies}_r + \alpha_t \textit{Year dummies}_t + \beta \textit{Deregulation}_{rt} + \gamma \textit{Bank concentration}_{rt} + \eta \textit{Controls}_{rt} + \textit{Error}_{rt}.$$

Finally, I analyze the effect of bank competition on the mature establishments. Given the dependence between the rates of job creation in the first data set, some indirect information on the role of bank competition for continuing establishments comes from the analysis of model (3). Analysis similar to those of models (1) and (4) can, however, be replicated by focusing on the job creation rates of the third cohort, that of the mature establishments:

(6)
$$\textit{Job creation of mature establishments}_{rt} = \Delta_r \textit{Regional dummies}_r + \Delta_t \textit{Year dummies}_t + \beta \textit{Deregulation}_{rt} + \gamma \textit{Bank concentration}_{rt} + \eta \textit{Controls}_{rt} + \textit{Error}_{rt}.$$

Similarly, I analyze the potential effect of bank competition on the persistence rates of industry incumbents, thereby testing whether bank competition accelerates or slows down industry exit. To this end, I estimate the following model specification:

(7)
$$\textit{Job destruction of mature establishments}_{rt} = \Delta_r \textit{Regional dummies}_r + \Delta_t \textit{Year dummies}_t + \beta \textit{Deregulation}_{rt} + \gamma \textit{Bank concentration}_{rt} + \eta \textit{Controls}_{rt} + \textit{Error}_{rt}.$$

RESULTS

This section presents the results obtained during this first exploration of the data set. While the robustness of the results varies, they are nevertheless quite consistent across the various model specifications and allow us to form a coherent picture of the potential effects of bank competition on the life-cycle dynamics of nonfinancial industries.

Effect on Entry (Start-ups)

Table 2 presents the results of regressions based on model specification (2). The dependent variable is the actual growth rate of job creation among start-ups. As mentioned earlier, this second data set is characterized by information across regions and years only, but it has a finer level of detail on the age profile of establishments. Region and year indicator variables are included in the regressions though their estimates are not reported in the table. The regression results show that bank concentration is not significant, while the bank deregulation variable is positive and significant (at the 10 percent level) in three of four regressions. Employment share measures the relative size of all start-up establishments in a given region and year. Bank size, total loans, and total loans per capita are additional controls for characteristics of the banking industry.

The results from this set of regressions offer a first indication that bank competition, rather than bank market power, may provide better opportunity for entry in industrial sectors. Additional evidence of the potential effects on industry entry is extrapolated using the first data set. Table 3 displays regression results based on estimation of specification (3). Recall that the dependent variable is the rate of job creation of start-up establishments (in sector *s*, region *r*, and year *t*) *relative* to the total rate of job creation in each sector, region, and year. With this

Table 2

The Effect of Bank Competition on Start-ups

	1	2	3	4
Bank concentration$_{rt}$	–97.279 (136.514)	–191.597 (158.453)	–136.169 (138.778)	–93.899 (138.366)
Bank deregulation$_{rt}$	10.480* (6.425)	8.424 (6.500)	11.423* (6.230)	10.600* (6.468)
Employment share$_{rt}$	–27.673*** (10.227)	–30.153*** (10.649)	–37.041*** (11.290)	–28.167*** (10.360)
Bank size$_{rt}$		10.214 (6.590)		
Total loans$_{rt}$			–0.136** (0.059)	
Total loans per capita$_{rt}$				–4.518 (15.610)
Observations	108	108	108	108
R^2	0.82	0.83	0.83	0.82

NOTE: The dependent variable is the rate of job creation of start-ups in each region *r* and year *t*. Start-ups are defined as plants up to one year old. The time period is 1977-88. *Bank concentration* is the Herfindahl-Hirschman index calculated on bank deposits, aggregated across markets in each of the nine census regions *r* over time. *Bank deregulation* is an indicator variable capturing the process of relaxation of bank entry restrictions in each region *r* over time. *Employment share* measures the relative size of all start-up plants in region *r* and year *t*. *Bank size* is an aggregate of bank total assets for banks in region *r* and year *t*. *Total loans* is an aggregate of bank total loans for banks in region *r* and year *t*. *Total loans per capita* is total loans divided by total region population. Region and year dummy variables are included in all regressions, but the coefficient estimates are not reported. Robust standard errors are in parentheses. */**/*** denote significance at the 10/5/1 percent levels, respectively.

dependent variable we can thus test if the contribution of start-ups to the total job creation rate increases or decreases depending on the competitive conditions in banking. Industry, region, and year indicator variables are included in the regressions though their estimates are not reported in the table. The results in the different specifications of the model indicate a negative and significant effect of bank concentration on the relative rate of job creation of start-ups. Consistent with this first result, the bank deregulation indicator is positive and significant (in two of four regressions) when interacted with external financial dependence. Both results thus indicate that the job creation rates of start-ups become relatively more important for the job creation rate of the industry as a whole as a result of improvements in bank competition.

Taken all together, the results from these first two models suggest that bank competition plays a positive role for start-ups, and that, in fact, bank market power may represent a form of barrier to entry in nonfinancial sectors.

Persistence Rates of Start-ups

The next step was to analyze the impact of bank competition on the "persistence" rates of start-ups: Once they are helped in the earliest stages of the life cycle, will the youngest establishments thrive under more or less competitive conditions in the banking industry? The results displayed in Tables 4 and 5 provide some indication that, if bank competition enhances industry entry, it also enhances their likelihood of survival in the first years of the life cycle. As Table 4 indicates, there is only tenuous evidence of a significant effect on the job creation of middle-aged establishments (those between two and ten years old); however, there is stronger evidence, reported in Table 5, that the rate of job destruction among middle-aged establishments is significantly lower in regions after states began the process of banking deregulation. Hence, this second set of results suggests that bank competition contributes to the success of newcomers. This is true at least in the sense that once they pass the start-up stage there is a decreasing likelihood of shrinking

Table 3

The Effect of Bank Competition on Start-ups (Relative Effect)

	1	2	3	4
Bank concentration$_{rt}$	–0.740**	–1.367***	–0.909***	–0.757**
	(0.328)	(0.382)	(0.339)	(0.330)
Bank deregulation$_{rt}$	0.005	–0.013	0.011	–0.001
	(0.015)	(0.016)	(0.016)	(0.016)
Bank concentration$_{rt}$ · *External dependence*$_{s}$	–0.044	–0.047	–0.057	–0.119
	(0.141)	(0.140)	(0.150)	(0.157)
Bank deregulation$_{rt}$ · *External dependence*$_{s}$	0.023*	0.027*	0.024*	0.026*
	(0.014)	(0.014)	(0.015)	(0.014)
Employment share$_{rst}$	–0.010*	–0.010*	–0.010**	–0.009*
	(0.005)	(0.005)	(0.005)	(0.005)
Bank size$_{rt}$		0.070***		
		(0.018)		
Bank size$_{rt}$ · *External dependence*$_{s}$		–0.000		
		(0.000)		
Total loans$_{rt}$			–0.0004***	
			(0.0001)	
Total loans$_{rt}$ · *External dependence*$_{s}$			–0.0002	
			(0.0004)	
Total loans per capita$_{rt}$				0.087*
				(0.052)
Total loans per capita$_{rt}$ · *External dependence*$_{s}$				–0.042
				(0.029)
Observations	2157	2157	2157	2157
R^2	0.28	0.28	0.28	0.28

NOTE: The dependent variable is the rate of job creation of start-ups in each region *r*, sector *s*, and year *t*, relative to total job creation—that is, the sum of job creation rates for start-ups and continuing establishments in each region *r*, sector *s*, and year *t*. Start-ups are defined as plants up to one year old; continuing establishments are a complementary group to start-ups. *External dependence* measures for each sector *s* the degree of financial dependence on external sources of funding. *Employment share* measures the relative size of all plants in region *r* and year *t*. See note for Table 2 for further explanations.

and shutting down in more competitive banking markets.

Expansion of Incumbents

The results of model specification (2) already pointed out, indirectly, that bank competition has a negative impact on the ability of older establishments to expand. Indeed, given the dependent variable in that model, any effect of bank competition on start-ups would be equal but with an opposite sign for the older plants. Using the second data set, we can look for confirmation of the negative role of bank competition on the ability of incumbents to expand, and focus specifically on the job creation rates of mature plants. The results of regressions from specification (6), as displayed in Table 6, indicate that job creation rates of mature plants are indeed higher in markets characterized by *higher* bank concentration. Hence, the continuing expansion of establishments, once they reach a mature age and attain the status of industry incumbents, seems to be enhanced by the presence of less competitive conditions in the banking industry.

Persistence Rates of Incumbents

The evidence gathered so far suggests that bank competition has an overall positive effect on the expansion and survival of younger establishments

Table 4

The Effect of Bank Competition on the Persistence Rates of Start-ups: Effect on the Job Creation Rates of Middle-aged Establishments

	1	2	3	4
Bank concentration$_{rt}$	–4.704	–44.565*	–13.334	–3.213
	(23.205)	(27.002)	(23.163)	(23.540)
Bank deregulation$_{rt}$	0.252	–0.614	0.224	0.312
	(0.910)	(0.867)	(0.907)	(0.911)
Employment share$_{rt}$	–0.824	–0.792	–1.247	–0.796
	(0.771)	(0.727)	(0.775)	(0.776)
Bank size$_{rt}$		4.217***		
		(1.196)		
Total loans$_{rt}$			–0.020**	
			(0.010)	
Total loans per capita$_{rt}$				–2.185
				(2.855)
Observations	108	108	108	108
R^2	0.63	0.67	0.64	0.63

NOTE: The dependent variable is the rate of job creation of middle-aged establishments in each region *r* and year *t*. Middle-aged establishments are defined as plants between two and ten years old. *Employment share* measures the relative size of all plants in the middle-aged group in region *r* and year *t*. See note for Table 2 for further explanations.

Table 5

The Effect of Bank Competition on the Persistence Rates of Start-ups: Effect on the Job Destruction Rates of Middle-aged Establishments

	1	2	3	4
Bank concentration$_{rt}$	–7.883	–0.643	0.631	–13.023
	(25.459)	(34.921)	(26.384)	(25.490)
Bank deregulation$_{rt}$	–2.748**	–2.602**	–2.868**	–2.911**
	(1.172)	(1.238)	(1.181)	(1.170)
Employment share$_{rt}$	0.136	0.159	0.225	0.098
	(0.249)	(0.260)	(0.254)	(0.261)
Bank size$_{rt}$		–0.725		
		(1.552)		
Total loans$_{rt}$			0.020	
			(0.013)	
Total loans per capita$_{rt}$				7.113
				(4.909)
Observations	108	108	108	108
R^2	0.85	0.85	0.85	0.85

NOTE: The dependent variable is the rate of job destruction of middle-aged establishments in each region *r* and year *t*. Middle-aged establishments are defined as plants between two and ten years old. *Employment share* measures the relative size of all plants in the middle-aged group in region *r* and year *t*. See note for Table 2 for further explanations.

Table 6

The Effect of Bank Competition on Incumbents' Expansion

	1	2	3	4
Bank concentration$_{rt}$	22.086**	10.433	21.393**	23.907***
	(9.056)	(11.416)	(9.604)	(8.393)
Bank deregulation$_{rt}$	0.389	0.154	0.399	0.447
	(0.365)	(0.386)	(0.365)	(0.355)
Employment share$_{rt}$	–0.050	–0.087	–0.057	–0.037
	(0.144)	(0.141)	(0.150)	(0.143)
Bank size$_{rt}$		1.167**		
		(0.573)		
Total loans$_{rt}$			–0.002	
			(0.004)	
Total loans per capita$_{rt}$				–2.520*
				(1.321)
Observations	108	108	108	108
R^2	0.82	0.82	0.82	0.82

NOTE: The dependent variable is the rate of job creation of mature establishments in each region *r* and year *t*. Mature establishments are defined as plants more than ten years old. *Employment share* measures the relative size of all mature plants in region *r* and year *t*. See note for Table 2 for further explanations.

and a negative effect on the expansion of mature ones. Table 7 shows evidence of the effect of bank competition on the persistence rates of incumbents. The dependent variable is the rate of job destruction of continuing establishments. The effect is picked up by the terms of interaction of bank concentration and bank deregulation with external financial dependence. The first term is negative and significant, while the second one is positive and significant in all four alternative model specifications. This result is confirmed, at least partially, from the results presented in Table 8, based on the alternative data set. In two of four specifications, bank concentration is negative and significant. Taken together, these results suggest that incumbent establishments do better in less competitive banking markets.

CONCLUSIONS

This paper has explored a new dimension of the economic role of bank competition. The empirical evidence shows that bank competition can have a significant impact on the entire life-cycle dynamics of nonfinancial industries. Some caveats remain present at this preliminary stage of analysis. As interesting as the data sets on job flows are, they still suffer from potentially relevant limitations in the width of the available information. Gaining access to the data at higher levels of disaggregation would certainly allow a more careful identification of the effects under study. The incorporation of additional control variables would also permit a higher degree of reliability.

These reservations notwithstanding, the data suggest important trajectories for further analysis. More competition in banking appears to promote job creation among industrial establishments at the start-up stage and to permit them to prosper in the immediate wake of their entry into the market. At the same time, more bank competition accelerates the exit of more mature establishments from the market. These results are consistent with theories suggesting that banking market power may represent a financial barrier to entry in product markets.

Another way to express the results is to say that bank competition has an effect on the age distribution of establishments within an industry. Let us refer to the statistics reported in Table 1, which describe job flows and employment share for each of the three age categories of industrial establishments over the period under analysis (1977-88). It is a stylized fact that, as the table indicates, on average start-ups have the highest rates of job creation and mature establishments the lowest; but the relative size of start-ups is very small compared with

Table 7

The Effect of Bank Competition on Incumbents' Persistence Rates

	1	2	3	4
Bank concentration$_{rt}$	1.826	3.803	2.996	1.499
	(5.548)	(6.997)	(5.656)	(5.586)
Bank deregulation$_{rt}$	–0.228	–0.176	–0.280	–0.277
	(0.231)	(0.231)	(0.234)	(0.231)
Bank concentration$_{rt}$ · *External dependence*$_{s}$	–5.659**	–5.670**	–6.439***	–5.842**
	(2.381)	(2.389)	(2.463)	(2.700)
Bank deregulation$_{rt}$ · *External dependence*$_{s}$	0.526**	0.539**	0.591**	0.535**
	(0.220)	(0.226)	(0.231)	(0.229)
Total job destruction$_{rst}$	0.612***	0.612***	0.611***	0.612***
	(0.044)	(0.044)	(0.044)	(0.044)
Bank size$_{rt}$		–0.204		
		(0.336)		
Bank size$_{rt}$ · *External dependence*$_{s}$		–0.000		
		(0.000)		
Total loans$_{rt}$			0.003	
			(0.002)	
Total loans$_{rt}$ · *External dependence*$_{s}$			–0.002	
			(0.001)	
Total loans per capita$_{rt}$				0.731
				(0.811)
Total loans per capita$_{rt}$ · *External dependence*$_{s}$				–0.103
				(0.436)
Observations	2157	2157	2157	2157
R^2	0.75	0.75	0.75	0.75

NOTE: The dependent variable is the rate of job destruction of continuing establishments in each region *r*, sector *s*, and year *t*. Continuing establishments are a complementary age group to start-ups. *External dependence* measures for each sector *s* the degree of financial dependence on external sources of funding. *Total job destruction* is the sum of job destruction rates for establishments shutting down and establishments surviving in each region *r*, sector *s*, and year *t*. See note for Table 2 for further explanations.

older establishments. The results of the paper suggest that changes in bank competition may modify such distributions in nonfinancial sectors. More precisely, increases in bank competition should be associated with a shift of mass in the age distribution of job flows and size toward the younger establishments.

Much theoretical and empirical work has analyzed the relationship between establishments' age and job flows and, more generally, the determinants of the industrial life cycle.[6] This paper makes a contribution to this literature by arguing that certain characteristics of the credit market—namely, its degree of competition—constitute one such determinant. It is worth exploring further what the findings of this analysis imply about the broad relationship of bank competition to industry structure, though here I will simply mention two possible implications. First, if concentration of market power in banking creates a barrier to entry in other industries, then we are suggesting that bank competition has a potential impact on the competitive conduct of nonfinancial markets. In addition, banking markets' role in delaying or accelerating processes of industry entry and exit may in turn be expected to impact the pace of adoption of technological innovations in industrial sectors. Thus, the dynamics explored in this analysis may ultimately have implications for economic growth.

[6] See, e.g., Jovanovic (1982), Hopenhayn (1992), Evans (1987), Dunne, Roberts, and Samuelson (1989), and Davis and Haltiwanger (1992).

Table 8

More on the Effect of Bank Competition on Incumbents' Persistence Rates

	1	2	3	4
Bank concentration$_{rt}$	–23.266*	–25.994	–17.483	–29.076**
	(13.645)	(17.462)	(14.569)	(11.546)
Bank deregulation$_{rt}$	–0.238	–0.293	–0.319	–0.422
	(0.625)	(0.653)	(0.628)	(0.582)
Employment share$_{rt}$	–0.264	–0.273	–0.203	–0.307
	(0.211)	(0.213)	(0.231)	(0.224)
Bank size$_{rt}$		0.273		
		(0.834)		
Total loans$_{rt}$			0.014*	
			(0.007)	
Total loans per capita$_{rt}$				8.041**
				(3.611)
Observations	108	108	108	108
R^2	0.84	0.84	0.85	0.85

NOTE: The dependent variable is the rate of job destruction of mature establishments in each region *r* and year *t*. Mature establishments are defined as plants more than ten years old. See note for Table 2 for further explanations.

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Commentary

Raghuram G. Rajan

Does credit market competition aid or hinder the formation of firm-creditor relationships? Economists have offered contradictory answers. In an insightful analysis, Mayer (1988) argued that in a world where contracts are incomplete, limited competition in the credit markets might allow creditors to take the long-term view. Intuitively, a certain degree of monopoly power can create the kind of rents ex post that allow the monopolist creditor to invest in nurturing young firms. Put another way, if the borrower cannot commit to stay with the lender via long-term contracts, but it is optimal for him to commit, he may be better off when the creditor is a monopolist because commitment is achieved de facto.

A number of assumptions are necessary for this result. First, for the relationship to start up, the lender has to make a fixed investment up front, regardless of whether he is a monopolist. Second, once the relationship starts up, there is little ongoing relationship-specific investment by either party during the course of the relationship. These two assumptions ensure the lender will have more of an incentive to make the required investment when he is faced with little competition ex post and that competition ex ante does not spur more investment.

Petersen and Rajan (1995) formalize this intuition in a model and take it to the data. One measure of a creditor's up-front investment in a relationship is his willingness to offer lower-than-market rates to start-up firms. They find that loan rates are indeed lower for young firms and higher for older firms in concentrated banking markets than for comparable firms in competitive banking markets. They also find a greater availability of credit for firms in concentrated markets.

Of course, if the upfront investment is discretionary, the potential monopolistic lender will have less of an incentive to make that investment if he knows that the borrower will be captive anyway. (This assumes, of course, that the lender cannot appropriate all the surplus the borrower generates.) Similarly, if the relationship demands ongoing investment by the borrower, he may have less of an incentive to commit to that investment if he knows the lender will enjoy a monopoly regardless. A marriage where there is no possibility of divorce is one where neither party has the incentive to work very hard at keeping the marriage exciting. Thus the traditional effect of monopolies, that they distort the incentive to invest, can imply that firm-creditor relationships can be shallow and unsatisfying. (See, for example, Dinc, 2000, for a nice development of this point.)

This means that one cannot make a blanket assertion about whether credit market competition is good or bad for firm-creditor relationships—it depends, at the very least, on the nature of the investments that are required by either party. To test the theory, we have to go deeper into the data and look at the details of the theory—for example, the intertemporal loan rate smoothing observed by Petersen and Rajan (1995).

However, work has moved beyond testing the detailed implications of the theory to testing whether some of its predictions hold up. In particular, if firm-creditor relationships are stronger in more concentrated areas and if they especially benefit small and young firms who would otherwise have limited access to credit, we should see more entry by industrial firms in areas where there is more credit market concentration. (See Cetorelli's paper, as well as Black and Strahan, 2002.)

While exploring a link between credit market competition and entry is interesting, I am not sure we can attribute any finding solely to stronger (or weaker) firm-creditor relationships. There are at least two other explanations that have to be ruled out.

The first is a selection bias. For example, it could be that areas where there is little entry into banking (so that the banking sector is concentrated) are also areas where entry into industry is difficult. A correlation would then be seen between limited industrial entry and banking sector concentration; the cause would not be weak relationships, however, but a

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common explanatory omitted variable—poor incentives to enter industry or finance.

The omitted variable could also be political: Perhaps access to finance is used as an entry barrier. (See the negative correlation between the size of entry barriers in a country and the development of financial markets documented in Rajan and Zingales, forthcoming.) In areas with more concentrated finance, such barriers are easier to coordinate. Or, equivalently, concentrated finance might reflect the ascendancy of a small group of incumbents who prevent finance from becoming widely accessible.

These possibilities suggest that one has to be cautious about examining the relationship between entry and credit market competition and drawing strong conclusions about how the availability of finance to small- and medium-sized firms varies with credit market competition. For instance, a liberalization of credit markets is likely to occur in concert with a removal of other entry barriers for a variety of reasons.

This suggests that we need to move away from the broad implications of the theory (the correlation between competition and access to credit) to the more detailed implications of the theory in order to test it. One way that Cetorelli's paper suggests is to look at the differential impact of credit market competition on firms of different ages or on firms at various stages of distress. I think this is promising, and if the predictions can be tied more closely to the theory (that is, what is the nature of the investment required at each stage), we will make progress.

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