OPTIMAL CENTRAL BANK AREAS, FINANCIAL INTERMEDIATION, AND MEXICAN DOLLARIZATION

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very preliminary and incomplete

Abstract

(to be added)

1. Introduction

The question of whether Mexico should adopt the U.S. dollar involves a broad range of questions, ranging from the effects of details of a conversion process[1], through the standard questions of monetary policy, to much broader questions of political spillovers and overall relations between people (and their governments) in the two countries.[2] This paper will focus on an important but neglected issue in the midrange of this spectrum – the economic effects of the range of the central bank's authority. In other words, what are the effects on financial intermediation and economic growth of having a *single central bank* for two countries rather than separate central banks in each country?

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[1] Conversion issues include procedures for negotiations on one-time or ongoing payments of seigniorage from the United States, procedures tying any ongoing payments to total real dollar balances held in Mexico and procedures for measuring that total; choice of an exchange rate for conversion of nominal contracts denominated in pesos, education programs to create familiarity with dollars and associated U.S. coins, changes in accounting procedures and rules for tax collections; procedures for physical conversion and distribution of dollars to people and businesses, etc.

[2] These issues include effects of dollarization on political pressures from Mexico to the Federal Reserve, Mexican nationalism the chance that blame would center on the United States for various future economic problems in Mexico, as spillovers from differences in opinion on monetary policies (broadly defined) for other issues such as immigration, drug laws and enforcement, free trade and various forms of protectionism (including environmental, health, and safety laws and regulations), and issues of human rights and procedures of democracy.

2. Common Currencies: Common and Uncommon Considerations

To appreciate the impact of the issue of central banking areas, it is useful to begin by contrasting the issues that typically take precedence in considerations of optimal currency areas and choices of exchange-rate systems. The theory of optimal currency areas has emphasized the importance of factors such as the relative sizes of domestic money-demand shocks versus foreign monetary shocks and real shocks, the correlations of shocks across countries, and economic flexibility (such as the mobility of labor). When domestic money-demand shocks dominate foreign nominal shocks and nation-specific real shocks (as opposed to common real shocks), that theory implies that a common currency (or a fixed exchange-rate system) has an advantage over separate currencies with flexible exchange rates, because the domestic money supply automatically adjusts to changes in domestic to money demand under a common currency (or a true fixed-rate system), without requiring changes in interest rates or the price level that may otherwise result from the money-demand shocks.[3] Consequently, with a sticky nominal price level, a common currency or system of truly fixed exchange rates helps reduce the short-run fluctuations in real GDP and employment that would otherwise result from those shocks. In contrast, when foreign nominal shocks or nation-specific real shocks dominate money-demand shocks, the theory implies that separate currencies operating under a flexible exchange-rate system has an advantage over a common currency or true fixed-exchange-rate system, because the exchange rate can adjust to help absorb the shocks and reduce the magnitude of required price-level changes and the associated short-run fluctuations in real GDP and employment. This reasoning is similar to Milton Friedman's "daylight savings time" argument for flexible exchange rates: Why require adjustments in all nominal prices when a change in the nominal exchange rate can accomplish much of that adjustment without the same disruptions in real GDP and employment? In each case, the magnitude of the advantage of

[3] Included under “nation-specific real shocks” are asymmetric responses to common real shocks, due to national differences in economic structures.

one system over the other rises as the economy becomes less flexible in its responses to shocks.

Many factors can alter these conclusions. For example, a central bank can respond to domestic money-demand shocks automatically by policies that target a domestic nominal interest rate or price level rather than a monetary aggregate. Many central banks, including the Federal Reserve, routinely follow such policies. The ability to follow these policies reduces the advantage of a common currency (or true fixed exchange-rate system) even in the presence of dominant domestic money-demand shocks.

A similar caveat applies to the argument that a fixed exchange-rate system provides monetary discipline, and that a common currency enhances this discipline by eliminating the option of devaluation. While a common currency or fixed exchange-rate system can provide discipline, other mechanisms can also provide discipline, as illustrated by cross-sectional studies of the effects of central bank independence and by the monetary experience of New Zealand. Perhaps the political will that is necessary for adoption of a fixed exchange rate or common currency would be sufficient for adoption of alternative mechanisms of monetary discipline (while retaining some measure of monetary independence).[4]

Little research has focused on the political economy of a common currency, particularly in the presence of differences in real shocks across countries. Regional factors within the United States -- such as the decline of the "rustbelt," or the different regional effects of a shock to world oil prices, or the different regional effects of changes in international competition (such as in automobiles) – have created regional political battles within the Federal Reserve over monetary policies. Two countries with different real shocks, or that respond differently to the same real shocks, would also experience political battles over monetary policy. Would adoption of a common currency reduce or raise the real

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4 The flip-side of this argument is that flexible exchange rates are desirable because they provide the option for a nation to pursue its own monetary policies. Whether that option is a benefit or curse depends on factors such as how political forces operate within the nation's institutions to affect its policies. Perhaps the political forces necessary for adoption of a common currency could instead be channeled to adoption of institutional arrangements that would permit wiser choices of future monetary policies by a domestic agency.

resource costs of such political battles? Would it affect the outcomes of such battles? If Mexico used the U.S. dollar, would Mexico benefit from a reduction in political forces on monetary policy? Or would Mexico lose because the political forces on the monetary policies that affect its economy now flow mainly from the 50 states to its north? Would the United States gain or lose from the changes in political forces affecting monetary policy if Mexico used the dollar? Or, more precisely, which regions and sectors in the United States would gain and which would lose from these changes in the political balance? Would political battles on monetary policy remain isolated from other economic issues (or other political issues)? What would be the consequences?

Analogous issues arise for the alleged advantage of multiple currencies with floating exchange rates (over a common currency or a true fixed-exchange-rate system) in the presence of dominant (and asymmetric) real shocks. This advantage is reduced if distortions in the economy (including those resulting from nominal price stickiness) cause exchange-rate movements to have real resource-allocation costs, or merely to postpone the real resource costs associated with changes in domestic nominal prices.

Similarly, the usual case for floating exchange rates over a common currency ignores any real-resource costs of changes in exchange rates. The main objection to floating exchange rates is that we don't know if the market will respond "correctly" to exogenous shocks (with the exchange rate adjusting to its new equilibrium level) and that speculative factors won't create changes in exchange rates that create "new" shocks. Economists currently lack a well-corroborated theory of exchange rates. However, if a significant fraction of movements in exchange rates result from speculative factors (as many economists suspect), and if these movements have real resource costs, then the presence of these shocks may provide an additional advantage for a common currency over multiple currencies with floating exchange rates.[5] While existing studies show little differences in the

5 I take it for granted here that a system of pegged (imperfectly fixed) exchange rates is the worst of all systems, based on the real costs of speculative attacks, exchange-rate crises, associated banking crises, and the distortions from government policies that are adopted to forestall devaluation and its consequences.

behavior of real GDP, employment, or international trade across exchange-rate systems (with the *only* obvious difference appearing in the variability of the real exchange rate), and little connection between these exchange-rate changes and the behavior of fundamental variables, existing evidence does not preclude the possibility of substantial real resource costs from exchange-rate variability.[6] Evidence does not suggest a strong effect of exchange-rate variability on the magnitude of international trade.[7] However, Duarte (1999) shows – in a model that captures these main features of the data, with only the exchange rate showing greater variability under a floating-rate system -- that the exchange-rate system nevertheless affects welfare.

A separate argument for a common currency (or true fixed exchange-rate system) over multiple currencies involves the transactions costs of changing currencies, and associated information-processing costs of translating prices from unfamiliar to familiar terms. However, the size of these costs is fairly small and declining over time. The cost of translating prices between dollars and pesos, for example, involves a multiplication or division problem which involves a conversion factor remains constant (even under floating rates) across different products bought at the same date, and that remains at least approximately constant over short periods of time under a floating exchange-rate system. In contrast, people deal everyday with multiplication or division problems that involve a different conversion factors across products. For example, does a 12-pack at $6.99 represent a better bargain than a 6-pack at $2.99? Does the 36-oz size of a product at $4.79 represent a better bargain than a 22-oz size at $2.79? Because most people face currency conversion problems less frequently than the latter problems (in which factors of multiplication or division differ for each problem), the total real costs associated with currency conversion problems is probably much smaller. Moreover, currency-conversion costs have fallen with

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6 See Baxter and Stockman (1989) and Flood and Rose (1995).

7 See $$$

technological advances (such as those that led to development of calculators and reductions in their prices) and will continue to fall with further technological advances.

A related argument for a common currency (of truly fixed exchange rate) asserts that floating exchange rates among multiple currencies create uncertainty and risk. Speculative factors that affect floating exchange rates may create uncertainty, at least in the exchange rates themselves. As noted above, however, whether this translates into uncertainty about real allocations remains an unresolved question.[8] Moreover, this uncertainty need not create aggregate risk if individual firms and consumers can use financial instruments to hedge, and thereby avoid real effects of, movements in exchange rates. Of course, floating exchange rates show substantially variability in practice; but international financial markets have developed instruments that allow firms to hedge many of the associated risks.

An important but neglected channel through which a common currency is likely to affect economic performance operates through the policies of central banks that affect financial intermediation. Adoption of a common currency implies far more than reduced transactions costs and monetary discipline; it implies a change in an institution that plays a central role in the governance and operation of the nation's system of financial intermediaries, and a change in the intricate connections between the nation's *monetary* system and *credit* (intermediation) system. Because financial intermediation plays keys role in long-term economic growth and (perhaps) in business cycles, the question of whether to adopt a common currency involves the issue of optimal central bank areas. Based on recent developments in the theory of financial markets and evidence that financial intermediation plays a key role in long-term economic growth, the long-run impact of this issue may dominate the other costs and benefits associated with adoption of a common currency.

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[8] Another unresolved question is whether this currency speculation is "extra" speculation that would not affect the economy if it were to adopt a common currency, or whether the (limited) time and resources of speculators and noise traders that impact the exchange rate under a floating-rate system would find other outlets under a common currency, resulting in greater speculative effects on *other* financial variables (such as stock markets, derivative financial instruments, etc.).

Levine (1997) surveys the literature connecting financial development with economic growth. Financial intermediation may enhance economic growth by channeling savings into the most productive investments, assisting in diversification to reduce risks and raise investment, raise the rate of technological growth by facilitating investments in research and development, channeling investments from less productive but more liquid investments into more productive (though less liquid) projects, and through other channels. Each of these channels may be affected by the institutional change in central banks that would accompany adoption of a common currency.

The relevant issues include not only the purely economic costs and benefits of a single central bank (versus multiple central banks) for a banking system that spans across diverse regions and nations, but also the economic consequences of the changes in political forces that would impinge on a single central bank (as opposed to separate central banks). Economists too often neglect these political-economy aspects of central bank policies, though clearly a substantial amount of financial-market (and institution) regulation in the United States has been implemented as a way to provide subsidized services or credit to various special groups (think of the U.S. Community Reinvestment Act or the "window guidance" practiced at the Bank of Japan, as well as entry restrictions and geographical restrictions on financial institutions) to protect certain groups from competition (think of regulations that protect entrenched management by impeding hostile takeovers). It is for reasons like these that the financial services sector is the largest single source of political action committee (PAC) money in the United States (Kroszner and Stratmann, 1998). Mexico, like the United States, clearly sees the results of such political pressures – Umlauf (1993) found that when Mexico temporarily switched from auctioning its treasury bills with a multiple-price auction (in which each winning bidder pays his bid) to a single-price auction (in which all winners pay the same price), the profits of bidders – financial institutions, mainly –

fell; apparently buyers had less success at collusion and manipulation of the latter auctions, and (probably due to political pressures) Mexico switched back to the former system.[9]

These issues -- of political pressures on policies and the effects of changes in institutional arrangements on the political equilibrium -- become particularly important when one of the nations has a particularly fragile banking system. Much evidence (as well as economic theory) indicates that banking crises and currency crises are intertwined, each contributing to the other. Consequently, one might be tempted to advocate a common currency to eliminate the possibility of a currency crisis. However, the change in central bank institutions and policies that accompanies adoption of a common currency could raise rather than reduce the economic problems associated with banking crises, or adversely affect the functions of financial intermediaries, reducing investment and economic growth.

King and Levine (1993) provide evidence that financial development helps predict subsequent growth (over the next one to three decades). However, because prediction does not imply causality, their evidence may admit other interpretations than the conclusion that financial intermediation causes economic growth. (These alternative interpretations might include arguments that both result from a third variable, such as shocks to saving or technology; or that financial development results from people's predictions of future economic growth – because those predictions lead people to invest in developing financial markets and institutions to be ready for that later growth.)

Rajan and Zingales (1998), however, present evidence that financial development *causes* growth (though some effects may also operate in the reverse direction) and the size of the effect is significant. Their methodology avoids the *post hoc* arguments by showing that financial development disproportionately helps firms and industries that are typically dependent on external finance. Their data show that, in a panel of 43 countries for 1980-1990, measures of financial development (domestic credit plus stock market capitalization

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[9] Changes in political forces from financial institutions, brought about by financial crises, played important roles in the initial abolition of deposit insurance in Argentina, followed by its reinstatement in a different form (Kroszner, 1999).

relative to GDP, and an index of accounting standards in firms' annual reports) significantly predict growth of real industry value-added, with industries that are more dependent on outside finance (measured by their dependence in the United States) showing significantly greater growth in value-added.

These issues are relevant not just for long-term growth but also for business cycles. Some evidence in the past decade has supported the argument of Bernanke and Gertler (1987) that reductions in bank capital cause reductions in bank lending, which reduce investment, and that this mechanism plays an important role in business cycles.

The difference in the effects on financial intermediation of a *common* central bank versus *separate* central banks can operate through a variety of channels, including supervision and regulation of banks, normal lending of reserves as part of monetary policy, lender-of-last-resort policies, and (implicit) subsidies to banks by lending at below-market interest rates to insolvent institutions . For example, with two separate currencies and central banks, Mexico and United States each have separate lenders of last resort. Considerable confusion has arisen in many recent discussions of lender-of-last-resort policies because of differences in the use of that term. For purposes of this paper, define *lender-of-last-resort* policy as lending to *illiquid* but *solvent* financial institutions – with sufficient collateral for the loan in the absence of a liquidity problem – to prevent a fall in the nominal money supply (measured by some broad monetary aggregate) that would otherwise result from disintermediation, whether occurring through a rise in the currency-deposit ratio or a rise in the reserve-to-loan ratio of intermediaries. Lender-of-last-resort policy becomes relevant only in a system-wide banking crisis. When an isolated bank has a liquidity problem, it can borrow on financial markets and does not require a loan from a lender of last resort (unless the central bank knows more about the isolated bank's condition than does the market, or some other problems hinder the normal operation of financial markets). If an isolated bank becomes insolvent, a lender of last resort would not lend to it (at least in the

presence of deposit insurance).[10] However, if a sufficiently large group of banks develops a liquidity problem, that group can borrow on financial markets only if there is a sufficiently large set of lenders available (with sufficient funds for short-term loans) and willing to lend at some interest rate that does not create new problems of insolvency. In a closed economy, a system-wide liquidity problem among banks may require a lender of last resort (meaning that, in its absence, a fall of the money supply and associated disintermediation would impose large costs on the economy).

Consider an economy consisting of two countries, Mexico and the United States, with local lending and locally correlated real shocks that affect financial intermediation (such as shocks that affect the value of collateral that firms have pledged on bank loans, or total savings available to banks for loans, or total bank "capital" available for banks to invest. With two separate central banks, a Mexican-specific shock requires its central bank to take lender of last resort actions; with a single, common, central bank, US banks can lend to Mexican banks without any lender of last resort actions. Essentially, a law of large numbers helps reduce the need for central bank actions.

Reducing the likelihood of central bank lender-of-last-resort actions is important because those actions have costs, including problems of moral hazard that lead banks to take excessive risks, as well as the cost of possible collusion between the central bank and the banking system (or some subset of it) to disguise distortionary subsidies to banks as lender-of-last--resort actions. In addition, of course, these central bank actions have direct costs of administration, information-collection, and monitoring. Consequently, nations benefit from institutions that reduce the chance of lender-of-last-resort actions.

Unlike standard Mundellian analysis, this argument suggests that *the more asymmetric certain real shocks, the* <u>*greater the benefits*</u> *of a common currency and central bank*. (With similar real shocks, the chance is smaller that one country, but not the other, will

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[10] Distinguish lender of last resort policy from a policy of subsidizing an insolvent bank because it is "too big to fail."

experience a system-wide banking crisis that requires a lender of last resort response under separate central banks that could be avoided under a single central bank.) To determine *which* kinds of differences and similarities in real shocks favor a single central bank and which favor different central banks, one needs a model that incorporates a banking system with a variety of such shocks. While the argument above applies to shocks that affect bank liquidity, the standard Mundellian argument applies to shocks that create macroeconomic inefficiencies that can be reduced by monetary policy. A full model would also incorporate the political forces operating on central banks and the political equilibrium that results from competition among groups, comparing the resulting policies with the socially optimal policies.) For example, central banks may follow policies, as a lender of last resort, that err on the side of bailouts of insolvent banks (as well as solvent, liquid, but politically-powerful banks) than to fail to lend to solvent but illiquid banks.

With two central banks, each "captured" by the local banking industry through its political influence, each has an incentive to help cartelize, separately, the local banks under their jurisdictions. The resulting equilibrium is likely to be inefficient as these competing cartels overexploit common resources – such as the rents to be gained from the acquisition and use of investors' funds. In contrast, a single central bank prevents this overexploitation by internalizing the effects of policies on the entire banking system (weighted by its political influence on policy). However, although a common central bank creates more efficient use of investor funds, it also redistributes more aggregate rents to members of the cartel and away from other parties (depositors, investors, and firms that borrow to finance investments). These issues are not unique to central banks, of course – the same issues arise with inefficiences from competition among state and local governments within a country in setting tax rates, regulations, and subsidies to attract new businesses. The offsetting benefit in that case, which perhaps also applies to central banks (to the extent that financial institutions are free to move their operations across countries and thereby to choose, to some extent, the

central bank that will have jurisdiction over them), involves the benefits of competition between governments (as in Tiebout, 19$$, and the large literature it has spawned).

Similarly, even if central banks operate in the "national interest" rather than the private interests of financial institutions, each of two separate central banks has an incentive to set rules to cartelize – separately – the local banks to increase rent extraction from *foreign* investors and borrowers. A common central bank, in contrast, would have different incentives – based on the relative political powers of financial institutions from the two different countries. While the resulting equilibrium is likely to be more efficient in an aggregate sense, it is also likely to involve a different distribution of rents across financial institutions. This occurs for two reasons. First, a common central bank removes the incentives of competing cartels each with incentives to extract rents from foreigners; second, a common central bank alters the balance of political influences among those financial institutions. Mexican dollarization, for example, is likely to result in a fall in the political power of Mexican banks relative to U.S. banks, and an associated redistribution of rents.

3. A Simple Intermediation Model With Moral Hazard

Begin, for simplicity, with a model that focuses on moral hazard problems associated with bank lending but that *ignores* the bargaining power over rents that has become a central feature of recent work in corporate finance (e.g. Rajan, 19$$$). Consider a 3-nation world with (a) a large "rest-or-world" nation that will not be analyzed, and (b) two *ex ante* identical countries, each with three types of agents: firms, investors, and banks. These agents live 2 periods, making financial, investment, and effort decisions in the first period, that, together with random events, lead to real and financial outcomes in the second period.

The description of each national economy is similar to that in Holmstrom and Tirole (1997). All agents are risk neutral. There is a continuum of firms, each with its own *ex ante* identical investment project, and firms differ only in the internal funds they have available, A, to finance their own investment projects. The cumulative distribution functions G(A) in

the “home” country, and G*(A*) in the “foreign” country, summarize their *ex ante* differences. As in Holmstrom and Tirole, it is useful to assume initially that the scales of investment projects are fixed at I >0. If a firm has assets $A < I$, then it requires $I - A$ in external funds to finance its investment project. Investment generates a verifiable return of either 0 or $R > 0$ at t=2. Three situations are possible for each investment project: (1) a “good” situation in which the firm exerts a high level of (unobserved and unverifiable) effort, resulting in a probability p_H of a “good:” investment outcome (a return of R); (2) a “bad” situation in which the firm exerts a low level of (unobserved and unverifiable) effort, resulting in a probability $p_L < p_H$ of a “good” investment outcome, but with a private return to the firm (from the reduced effort level) of $\Pi > p > 0$, and (3) a “very bad” situation in which the firm exerts a medium level of (unobserved and unverifiable) effort, resulting in a probability $p_L < p_H$ of a “good” investment outcome (the same probability as if the firm exerted low effort), but with a private return to the firm (from the reduced effort level) of $p \in (0, \Pi)$. The table below summarizes these possible situations.

	“Good”	**“Bad” with high private return**	**“Bad” with low private return**
probability that investment returns R>0 (rather than 0)	p_H	p_L	p_L
private benefit to firm	0	$\Pi > p > 0$	$p \in (0, \Pi)$

Let g be the (gross) real interest rate available, *without* monitoring, to investors in the “home” and “foreign” countries. Assume that the good situation provides an expected return that exceeds g, while the other situations provide expected returns below g, i.e. $p_H R > g\, I > p_L R + \Pi$.

As in Holmstrom and Tirole, an optimal contract occurs when each firm invests A, investors provide $I - A$, with each getting zero if project fails, while if project succeeds the

firm gets $R_f > 0$ and investors get $R_I > 0$, where $R_f + R_I = R$. The return paid to the firm is sufficient to exert high effort if $p_H R_f > p_L R_f + \Pi$, or $\Delta p R_f \geq \Pi$ where $\Delta p \equiv p_H - p_L$. This leaves at most $R_I = \Pi / \Delta p$ to be paid to investors, so the highest expected income that investors can extract from the firm, while providing the firm with an incentive to exert high effort, is $p_H (R - \frac{\Pi}{\Delta p})$. Investors will choose to invest in this project if and only if this return exceeds $g(I - A)$. Consequently, there is a cutoff level of A, $\overline{A}$, such that only firms with capital exceeding this cutoff, $A \geq \overline{A}$, can attract investors. Consider the nontrivial case in which $I - \overline{A} > 0$.

Banks can raise intermediation and investment. Assume there is a continuum of banks in each country. Each bank can monitor only one project at a fixed cost $C > 0$. With banks, $R_f + R_I + R_B = R$. Assume, with Holmstrom and Tirole, that bank monitoring can prevent low effort, so the firm's incentive constraint becomes $\Delta p R_f \geq p$, leaving at most $R - \frac{p}{\Delta p}$ for investors and the bank.

The bank has an incentive to monitor if $\Delta p R_B \geq C$. As Holmstrom and Tirole note, this, along with $p_L > 0$, implies $p_H R_B - C > 0$, so that banks would earn rents if they did not provide funds for the firms' investments. Consequently, banks actively invest in the projects that they monitor. Consequently, there remains at most $R - \frac{p + C}{\Delta p}$ for investors (other than the bank). As before, investors will choose to invest in this project if and only if this return exceeds $g(I - A)$.

Letting ϕ denote the bank's investment in the project, its gross expected rate of return is $b = \frac{p_H R_B}{f}$. Since it pays the monitoring cost C, $\beta > \gamma$ when banks earn

nonnegative rents. Consequently, firms have incentive to economize on bank investment and maximize investment by other investors. Therefore $b = \frac{p_H C}{f \Delta p}$. Summarizing, firms obtain finance from banks and investors if and only if

$$A \geq \overline{A}(g) \equiv I - f(b) - \frac{p_H}{g}(R - \frac{p + C}{\Delta p})$$

where $f(b) = \frac{p_H C}{b \Delta p}$

Note that $\overline{A}$ is increasing in γ and β.

The aggregate demand for bank capital in the home country is $\mathrm{K}_B^d = If(\overline{\overline{A}} - \overline{A})$ where $\overline{\overline{A}}$ is the level of the firm's assets at which the firm does not need bank intermediation (because the firm has sufficient equity interest in its project that it will exert high effort without monitoring, so it can directly raise funds from investors). As Holmstrom and Tirole show, an increase in g has an ambiguous effect on K_B^d because it raises both $\overline{A}$ and $\overline{\overline{A}}$. However, an increase in b unambiguously reduces K_B^d. *Without* an international capital market,

$$K_B^d(g, b) = \int_{\overline{A}(g,b)}^{\overline{\overline{A}}(g)} [I - A - f(b)] dG(A) + \int_{\overline{\overline{A}}(g)}^{\infty} [I - A] dG(A)$$

and equilibrium in each country requires this quantity demanded equal that country's quantity of bank capital supplied. Central bank policies, such as bank supervision and regulation, can affect the equilibrium quantity of bank capital and the resulting equilibrium rate of return in the banking industry, b, which can exceed the rate of return in other industries (due to entry restrictions).

With free international capital movements between the home and foreign counties, but with *imperfect* capital movements between this block and the rest of the world, the demand for bank capital within the 2-nation block is

$$K_B^d(g,b)+K_B^{d^*}(g,b^*) \quad =$$

$$\int_{\bar{A}(g,b)}^{\bar{\bar{A}}(g)} [I-A-f(b)]dG(A) \quad + \int_{\bar{\bar{A}}(g)}^{\infty} [I-A]dG(A)$$

$$+ \quad \int_{\bar{A}^*(g,b^*)}^{\bar{\bar{A}}^*(g)} [I-A-f^*(b^*)]dG^*(A) \quad + \int_{\bar{\bar{A}}^*(g)}^{\infty} [I-A]dG^*(A)$$

Equilibrium requires that this quantity demanded equal the aggregate quantity of bank capital within the 2-nation block. That equation then determines the equilibrium rate of return in the banking industry. With separate central banks in the home and foreign countries, this equilibrium rate of return may differ across countries. (The equilibrium condition along with a constraint imposed by policy would determine the two equilibrium rates of return.) Similarly, the aggregate level of bank assets and their distribution across banks may differ across countries. One could also allow the scale of projects to differ across countries, although the expression above does not do so.

Following Holmstrom and Tirole, we can generalize the setup to include variable scales of investment projects to eliminate ambiguous effects resulting from discontinuities. A firm with initial assets A_0 chooses {I, A, R_F, R_B, R_I, ϕ_B, ϕ_I} to:[11]

$$\max V(A_0) \equiv p_H RI - p_H R_B - p_H R_I + g\,(A_0 - A)$$

$$\textit{subject to}$$

$$A \le A_0$$

$$A + f_B + f_I \ge I$$

$$p_H R_B \ge b f_B$$

$$p_H R_I \ge g f_I$$

$$R_B \ge CI \big/ \Delta p$$

$$R_f \ge p\,I \big/ \Delta p$$

$$R_F + R_B + R_I \le RI$$

[11] Setting up the problem in this way implicitly assumes that banks have value as monitors.

Because the inequalities in the problem will all hold as equalities at the optimum, we can combine them to get:

$$A_0 + {Ip_H C}\big/{b\Delta p} + I\left({p_H}\big/{g}\right)\left[R - \frac{(p+C)}{\Delta p}\right]$$

Solving for the maximum level of investment, we get

$$I(A_0) = \frac{A_0}{1 - \frac{p_H C}{b\Delta p} - \left({p_H}\big/{g}\right)\left[R - \frac{(p+C)}{\Delta p}\right]}$$

and

$$V(A_0) \quad = \quad \frac{p_H p\, I(A_0)}{\Delta p}$$

as the maximized value of the firm's objective function. Note that all firms are identical *ex ante* except for scale, A_0, and location Define k_F, k_B, and k_I as the aggregate quantities of capital of firms, banks, and investors in the home country, and k_F^*, k_B^*, and k_I^* as the analogous foreign quantities. Define within-nation aggregates as $k \equiv k_F + k_B + k_I$, $k^* \equiv k_F^* + k_B^* + k_I^*$, and world aggregates as $\bar{k} \equiv k + k^*$, $\bar{k}_F \equiv k_F + k_F^*$, $\bar{k}_B \equiv k_B + k_B^*$, and $\bar{k}_I \equiv k_I + k_I^*$. Treating $\bar{k}_F$ and $\bar{k}_B$ as exogenous, solve for equilibrium in the market for $\bar{k}_I$:

$$\frac{p_H \bar{k}\,(R - \frac{p+C}{\Delta p})}{g(\bar{k}_I)} \quad = \quad \bar{k}_I$$

where $g(\bar{k}_I)$ is the supply function of investor funds. The right-hand-side of this equation shows the quantity supplied; the left-hand-side shows the quantity demanded,

which equals the discounted present value (at the gross interest rate γ) of the total expected income that investors can extract. Consequently, the equilibrium interest rate on investor funds is

$$g^* = p_H k (R - \frac{p + C}{\Delta p}) \Big/ k_I$$

and the rate of return to bank capital is

$$b^* = p_H C k \Big/ \Delta p k_B$$

4. Results on the Optimal Domain of Central Banks

Now consider the effects of exogenous shocks and central bank policies, and the question of how a decision to combine the two central banks into one would affect aggregate investment. Holmstrom and Tirole, in their closed-economy model, show that a fall in k_F (a reduction in collateral available to firms) reduces total investment k and the funds provided by investors k_I along with both rates of return g^* and b^*. They also show that a fall in bank capital k_B reduces total investment k as well as the funds provided by investors k_I and both rates of return, g^* and b^*, and that a fall in savings, reducing the funds supplied by investors, $k_I(g)$, reduces total investment k while it raises the equilibrium rate of return to investment, g^*, and lowers the rate of return to banks, b^*. Clearly, a rise in outside investment opportunities operates like a fall in savings. If monitoring is a continuous choice variable, so that monitoring at level *m* eliminates all projects with private opportunity cost equal to or greater than *p(m)* , then an increase in bank capital raises monitoring intensity, which in turn attracts more investment. If investment projects at firms are continuous rather than discrete, and have diminishing returns, then (denoting the total return by $R(I)$ and assuming that $R'(I) > 0$ and $R''(I) < 0$) the firm's net utility is

$$p_H R(I) - g\,I - (b - g) I_B \quad = \quad p_H R(I) - g\,I - (b - g) \frac{p_H C}{b \Delta p} I$$

which depends on its asset level A_0 only through how that level affects the amount that the firm can borrow. Investment therefore depends positively on a firm's initial assets.

Central bank policies can affect several of the parameters in this model. Monetary policy may affect γ in a model with sticky prices or limited participation. Bank supervision and regulation can affect β and C. Central bank policies might respond differently across countries to the same shocks if bank assets A_0 and/or its distribution across firms differs across countries, or if π, C, R(I), Δp, or p_H differ across countries. Clearly, one also needs to explain why central banks would be involved *at all* in choosing policies to affect these parameters. After all, the equilibrium in the model outlined above is efficient subject to information and enforcement constraints, and does not leave any clear room for government or central bank policies to enhance efficiency. However, as noted above, two separate central banks in the two countries are unlikely to have aggregate efficiency as their goals; instead, each is likely to follow policies to maximize an objective function that puts disproportionate weight on interest groups (or the mythical representative household) within its own country. Alternatively, one can imagine a role for the police power of the state – the central bank might make public the (otherwise private and unverifiable) level of bank investment, $f^*(b)$. As a bank regulator, it may have access to information that could not as easily be provided through market outcomes of contractual arrangements between banks and investors.

If each central bank responds to political pressures that help banks as a whole within the country, or certain segments of those banks, then it may restrict entry to help keep k_B low and β high, or choose regulatory/supervision policies for that same purpose. Similarly, it could choose those policies to respond to disproportionate political pressures from subclasses of financial intermediaries, such as large banks, to reduce competition from other subclasses, such as small banks (or vice-versa, as in the creation of deposit insurance in the United States, which helped protect small banks from competition of larger New York banks). The central bank might choose regulatory/supervision policies that limit the risks of loans in portfolios of banks, e.g. requiring diversification. Such policies could prevent small

banks from taking sufficiently large investment positions in any *one* project that they can profitably monitor projects. If the central bank is performing an efficient function, such as information provision or verification (and can do so at lower cost than the private sector), and if a single central bank must treat all financial intermediaries in its jurisdiction similarly, and if regions experience asymmetric real shocks that call for different policy responses, then there can be an efficiency advantage to having two separate central banks.

Next, consider the different results, under a single central bank and two central banks, of a fall in bank capital in the aggregate or in a single country; a fall in the collateral (value) available to firms, a fall in aggregate savings, a fall in outside investment opportunities, an increase in moral hazard problems causing a a rise in investment risk (a rise in Δp), a central bank policy of bailing out banks that are "too big to fail."

RESULTS TO BE ADDED

5. The Beginnings of a Model with Bargaining

Diamond and Rajan (1997, 1999) have made bargaining over rents a centerpiece of their theory of banking. Their corporate-finance approach integrates the bank-depositor interactions analyzed in Diamond and Dybvig (19$$$) with the *delegated monitoring* model of Diamond (19$$$). the model of the previous section ignored this issue for simplicity and to make clearer the contributions of these key corporate-finance elements to the effects of central bank policies and the question of optimal central bank areas.

This section modifies the model to add those elements, though it requires simplifying the model in certain dimensions. In particular, suppose that banking is a perfectly competitive industry. That assumption allows us to proceed along the lines of the banking model developed by Diamond and Rajan (1997, 1999). Again assume a three-period economy, but add the assumptions of risk-neutrality and no discounting. Each entrepreneur has one idea for an investment project in which he has specific human capital. These

projects provide (unverifiable except to the firm) returns y_2^s in state s in period 2, and $y_3^{s'}$ in state s' in period 3, per dollar invested at t=1, providing that the entrepreneur contributes effort to the project. Without that entrepreneur's effort, the project has liquidation value x_2^s in state s in period 2, and $x_3^{s'}$ in state s' in period 3 (after paying y_2^s in state s in period 2), per dollar invested at t=1. Assume that $x_3^{s'}$ is nonstochastic as of t=2. Each project has a maximum scale that supports up to $1 of investment. However, entrepreneurs have no money; nor do they have the ability to commit to provide effort to their projects. Instead, they rely on a set of savers, who have money but no investment ideas.

Each saver can invest in a riskless asset that pays a zero return, or an investment project. However, each saver's available funds are small relative to the scale of a typical firm's investment project. Assume that up to *n* savers can jointly lend to finance a single project, and that *n* are required for a project to be funded to maximal scale. Assume that the expected value of the return from each investment project exceeds zero at each date, regardless of the realization of the liquidation value at t=2:

Denoting $y_1 \equiv y_2^s + y_3^{s'}$,

$$\min\{Ey_1, E[y_1 / x_2^s \mid x_2^s]\} > 1 \quad \forall x_2^s.$$

Assume also that $y_3^{s'} > x_3^{s'}$., which says that entrepreneurs can always pay more than the liquidation value at t = 3.

Suppose monitoring a borrower takes time, so savers rely on "banks" as intermediaries to lend to entrepreneurs and monitor them, and that each bank can only monitor one entrepreneur. Assume that educating a lender about a project takes time, so each entrepreneur can borrow from at most one bank, and only banks -- not savers -- can obtain the liquidation value of the project . Finally, assume that to obtain the full liquidation value of a project, a bank must supply its expertise (gained in the process of monitoring) to that project. Savers themselves (lacking such expertise) can collect only a fraction α of this liquidation value. However, banks cannot credibly commit to provide their expertise

following the liquidation of a project. Courts will enforce debt contracts and transfers of collateral to the lender in the event of default. Each entrepreneur promises to make payments z_t to the bank at dates t. If the entrepreneur failed to make a payment, he defaults and loses the project to the bank. (There are no partial defaults.)

A key insight is this: because entrepreneurs cannot commit effort in advance, they may attempt to renegotiate any previously signed contract. If an entrepreneur attempts to renegotiate a previously-signed contract by offering payments $\{\tilde{z}\}$ in place of payments {z} (and simultaneously committing to some current level of effort), then the lender can accept the offer, or reject it and seize the project, or reject it and but not seize the project (at least, not at the current date), or reject it and sell his the loan. Diamond and Rajan show that because banks cannot commit to provide their expertise to a liquidated project, they can threaten to pay only α of the liquidation value to lenders. Such renegotiation allows banks to capture a portion of the rent from their expertise, which is $x(1-\alpha)$, (conditional upon a liquidation).

If bargaining between banks and savers results in banks retaining half the rent, or -- conditional on liquidation -- $x(1-\alpha)/2$, then savers then get $ax + \frac{(1-a)x}{2} = \frac{(1+a)x}{2}$.

Consequently, the market value of the bank loan is $(1+a)x/2$.

Assuming that banks cannot negotiate with only a subset of savers or distinguish between them in such negotiations, the bank can commit *not* to renegotiate with savers. The idea is that the bank can offer demand deposits with a sequential service constraint as in Diamond and Dybvig (1983). With these deposits, a run on the bank would occur if there were a chance that it would try to renegotiate with savers. Assume that if a bank experiences a run, then depositors acquire claims to its loan, and the entrepreneur can make depositors an offer, which (like the bank) they can either accept or reject. The depositors also have the option of hiring the bank to obtain the full liquidation value of the loan (which they can do for half the banks rent, as above). Diamond and Rajan prove that the entrepreneur can make a (weakly) better offer to depositors than can the bank, keeping

the bank's rent to zero. Consequently, demand deposits help the bank to create "liquidity," i.e. the bank can borrow more from depositors than the market value of the loan.

In contrast to the previous section, we now turn to the separation of monitoring and investment *within* a bank. Assume, in contrast to the previous section, that “banks” have *no funds of their own*. Bank capital does not belong to the banker himself, but to investors who provide funds and with whom the banker must negotiate a contractual arrangement. Assume that depositors provide $d_t < z_t$ of the funds that the bank lends to the firm, and that these other residual-claim-holders provide the remaining assets. In that case, a bank can collect rent on its expertise. The residual-claim-holders need the bank to provide its expertise (gained in the process of monitoring), just as the bank needs their money. So they bargain to share the rent. Assume that in these negotiations between banks and residual-claim-holders, they split rents equally.

Consider the final-period results, at date t=3. Let $\tilde{z}$ = payment promised by entrepreneur at t=1 to be made to the bank at t=3. Diamond and Rajan prove that if deposits were chosen (in the previous period) to be sufficiently high, then a run occurs at t=3 and the bank earns no rent. With a sufficiently low level of deposits (and high level of investment from residual claim holders), there is no run and the division of rents between the bank and investors depends on parameters of the model. The middle case, with a medium level of deposits, leads to no bank run with banks and investors sharing the rent. Assuming that bank runs have a real cost, this result implies a tradeoff in which the economy can have greater levels of intermediation and real investment, but at the cost of greater financial-market fragility and enhanced chance of bank runs (with their attendant costs).

INCOMPLETE – equilibrium to be added

6. Results

This section considers the effects of randomness in collateral values at firms – in the

liquidation value of a project that banks can attain by providing their (limited) expertise, and/or the liquidation value that investors can achieve (without such expertise). We also consider the effects of shocks to available savings, and of central bank policies of (a) acting as a lender of last resort, and (b) instituting a state-contingent subsidy on banks that are "too big to fail." We then turn to the benefits and costs of a single central bank rather than two separate central banks.

RESULTS TO BE ADDED

7. Remarks (Incomplete)

In contrast to the standard literature on optimal currency areas, the tradeoffs involved in optimal central bank areas are more complex. On the one hand, there is a tradeoff between the gains from a *common* central bank that follow from reliance on the law of large numbers and the gains from *separate* central banks that follow from the standard optimal-currency-area arguments. The gains from *each* rise with asymmetries across countries in certain real shocks. Consequently, although standard statements have been taken to imply that losses from fixed exchange rates rise (gains from floating) rise with increases in different real shocks across countries, those different real shocks also raise the size of the gains from a common central bank. The analysis is complicated by the political-economy issues – central bank policies respond to political pressures.

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