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Reserve Requirements, Currency Substitution, and Seigniorage in the Transition to European Monetary Union

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Abstract: *This article considers a transition toward European monetary union that combines increased substitution of currencies and greater monetary, financial, and fiscal policy coordination. It explores how such a transition would affect national inflation and interest rates and required reserve ratios when governments depend in part on seigniorage funding for public expenditures. We find that greater coordination of policies would lead to lower inflation and interest rates but higher reserve-requirement ratios. Because higher reserve-requirement ratios could place European banks at a competitive disadvantage, we conclude that the interaction between reserve requirements and seigniorage concerns makes it less likely that the gradualist approach of the Maastricht treaty is a sustainable means of transition to European union.*

Introduction

Under the terms of the Maastricht Treaty on European Union, most nations of Western Europe are committed to an eventual evolution toward greater harmonization of monetary and financial policies, if not toward an ultimate currency union.[1] Events of recent years have cast some doubt on how quickly European monetary and financial integration may progress, but there is clear commitment to the Treaty's basic intention on the part of participating nations. The essential thrust seems to be that participating nations gradually will undertake a transition toward increased integration, coupled with a greater degree of coordination of monetary, financial, and fiscal policies.[2]

As noted by several authors (for instance, Aizenman, 1992, Canzoneri and Rogers, 1990; Gros, 1993; Sibert, 1994, one of the key issues complicating the task of integrating and/or unifying the monetary and financial systems of Europe is balancing the goal of integration/unification with the potential need for seigniorage as a source of public revenues. All European nations have depended to some extent on seigniorage taxes to fund public

expenditures (see Gros, 1993). As Drazen (1989) has emphasized, an immediate implication is that bank reserve requirements, which influence the size of the monetary base and, consequently, the level of seigniorage, play a key role in balancing the objectives of integration/unification vis-à-vis seigniorage collection. Although there is a sizable literature assessing the proper role of reserve requirements (recent contributions include Baltensperger, 1982; Brock, 1989; Horrigan, 1988; Romer, 1985) as an instrument of monetary and financial policy, surprisingly little attention has been given to the important role that reserve requirements must play in the transition to a more integrated European monetary and financial system. One exception to this observation is Bacchetta and Caminal (1992), who extend Romer's framework to a two-country setting and conclude that a regulatory relaxation permitting cross-country deposit holdings tends to lead to increases in inflation rates and reductions in required reserve ratios.

In this article, we analyze the optimal determination of reserve requirements set by governments of interdependent nations in which there already are cross-country holdings of currencies and bank deposits and in which governments depend in part on seigniorage funding for public expenditures. The government in each nation derives seigniorage revenues from issuing high-powered money in the form of currency and bank reserves, and the magnitude of reserves is determined in part by required reserve ratios set by the nation's monetary authority. The governmental authorities also set nominal interest rates. Consequently, each government possesses two monetary policy instruments, a required reserve ratio and an interest rate, and a fiscal instrument in the form of explicit taxes. Each government can use these three instruments in an effort to maximize its nation's welfare. The governments may coordinate their settings of neither monetary instrument (pure Nash behavior), the interest rate and tax rate only (a stylized "EMS" -type environment of partial coordination), or both monetary instruments and the tax rate (full coordination).

Our key conclusions are as follows. First, policy coordination in the form of an EMS arrangement with cooperative setting of interest (and inflation) rates but without coordination of reserve requirements leads to a reduction of interest (and inflation) rates in both nations. Such coordination, however, leads to increases in the optimal required reserve ratios in each nation. The reason is that reductions in both nations' nominal interest (and inflation) rates increase welfare, and coordinated determination of interest rates internalizes this fact and induces reductions in the interest-rate choices of the governmental authorities. But interest (inflation)-rate reductions cause reductions in seigniorage revenues accruing to each nation's government. This

gives each policy maker an incentive to *increase* its reserve-requirement ratio, ceteris paribus, in an effort to offset some of the seigniorage loss caused by the lower coordinated interest-rate choices.

Second, if the choices of *both* interest rates and required reserve ratios are coordinated, then the governments together recognize the joint seigniorage loss that they experience by reducing interest rates. Hence, with coordination of both instruments, the policy makers, under most circumstances, will increase required reserve ratios even further, as compared with a situation of interest-rate coordination only, which also permits them to reduce interest (and inflation) rates by a larger amount. Indeed, an implication of our framework is that purely insular policy making yields lower reserve requirement ratios as compared with a fully coordinated regime, even if the latter environment includes fully substitutable currencies. Therefore, our overall result is that greater coordination of monetary and financial policies leads to lower interest and inflation rates but higher reserve requirements.

Of course, European nations are not symmetrically structured. They have different reserve requirement ratios, and they rely to differing extents upon seigniorage revenues as sources of funding for public spending. Nevertheless, we argue that our results indicate that, following the present evolutionary period of market and regulatory integration within Europe, any transition that is characterized by increased policy coordination is likely to witness pressures for higher average required reserve ratios. Therefore, even though interest and inflation rates may be reduced by such coordination efforts, average reserve taxes on European banks and their depositors are likely to increase during any lengthy transition period leading up to a common currency union. Consequently, increased policy coordination and monetary and financial integration could make the European banking system less competitive with others around the world. This feature of a gradualist transition toward EMU makes such an approach arguably less sustainable, as compared with the immediate adoption of full monetary union that some observers have advocated.

Our conclusions are derived from a two-country model that is described and solved in the following section. In section 3, we use the model to determine and compare the optimal instrument choices of governmental authorities in noncoordination, partial-coordination, and full-coordination settings. Then, in section 4, we interpret the meaning of our theoretical results for European countries as they contemplate further efforts to integrate their markets and coordinate their monetary policies. Section 5 concludes with a brief summary and a discussion of remaining issues.

2. A model of currency and deposit substitution with reserve requirements

The model that follows is a direct extension of Canzoneri and Diba (1992) (for an extension of the model in another interesting direction, see Canzoneri and Diba, 1993). There are two countries and a single, homogeneous good. Each country issues its own currency. In addition-and this is our key extension of the Canzoneri-Diba framework-each country has a banking system in which depository institutions issue deposits denominated in the home currency. Agents in each country can hold currency and bank deposits issued by the governments and banking systems of both nations.

2. 1. Basic structure of the model

Each nation is composed of identical, infinitely lived households with utility functions,

$$U = \sum_{t=0}^{\infty} [1/(1 + \beta)]^t [c_t + v(m_t, n_t, d_t, h_t; \sigma, \phi)], \tag{1a}$$

and

$$U^* = \sum_{t=0}^{\infty} [1/(1 + \beta)]^t [c_t^* + v(m_t^*, n_t^*, d_t^*, h_t^*; \sigma, \phi], \tag{1b}$$

where c_t, and c_t^* are home and foreign consumption, m_t and m_t^* are home and foreign holdings of home real currency balances, n_t and n_t^* are home and foreign holdings of foreign real currency balances, d_t and d_t^* are home and foreign holdings of domestic real bank deposit balances, h_t and h_t^* are home and foreign holdings of foreign bank deposit balances, and βi the households' rate of time preference. The function v denotes utility derived from using currency and deposits as media of exchange; its form and the nature of the parameters σ and ϕ are discussed in more detail below.

The budget constraints faced by home and foreign households are given by

$$\begin{aligned} c_t + m_t + n_t + d_t + h_t + b_t \leq\ & y_t - \tau_t + (p_{t-1}/p_t) m_{t-1} + (p_{t-1}^* - p_t^*)\, n_{t-1} \\ & + (1 + p_{t-1})\, d_{t-1} + (1 + p_{t-1}^*) h_{t-1} + (1 + r_{t-1}) b_{t-1}, \end{aligned} \tag{2a}$$

and

$$c_t^* + m_t^* + n_t^* + d_t^* + h_t^* + b_t^* \leq y_t^* - \tau_t^* + (p_{t-1}/p_t)m_{t-1}^* + (p_{t-1}^*/p_t^*)n_{t-1}^* + (1 + p_{t-1})d_{t-1}^* + (1 + p_{t-1}^*)h_{t-1}^* + (1 + r_{t-1}^*)b_{t-1}^*, \quad (2b)$$

where y_t and y_t^* are home and foreign income endowments, τ_t and τ_t^* are lump-sum taxes imposed by the nations' governments, r_t and r_t^* are the real returns on bonds issued by those governments, b_t and b_t^* are the real quantities of bonds: demanded, p_t and p_t^* are the home and foreign prices of the consumption good, and ρ_t and ρ_t^* are the real rates of return on deposits issued by home and foreign banks.

There is only one good, and so the home currency price of foreign exchange is equal to p_t/p_t^*. We assume throughout that this exchange rate is flexible. Because agents in both countries have identical preferences, and because governments in the model will aim to maximize welfare, the countries in this model are symmetric.[3] Consequently, in equilibrium, it will always be the case ex post that $p_t = p_t^*$, so that the exchange rate is equal to unity. This implies that in any policy regime which we might consider, the ex post equilibrium exchange rate must equal unity even though the exchange rate floats endogenously ex ante.

First-order conditions for the home country's households' constrained utility maximizations (those for foreign households are symmetric, and so we focus only on the domestic solutions below) are given by

$$v_m(m_t, n_t, d_t, h_t;\ \sigma, \phi) = (i_t/(1 + i_t)), \quad (3a)$$

$$v_d(m_t, n_t, d_t, h_t;\ \sigma, \phi) = (r_t - \rho_t/\rho_t)/(1 + r_t), \quad (3b)$$

$$v_n(m_t, n_t, d_t, h_t;\ \sigma, \phi) = i_t^*/(1 + i_t^*), \quad (3c)$$

$$v_h(m_t, n_t, d_t, h_t;\ \sigma, \phi) = (r_t^* - \rho_t^*)/(1 + r_t^*), \quad (3d)$$

and

$$r_t = \beta, \quad (3e)$$

where $i_t = \{(1 + r_t)/[1 - (p_{t+1} - p_t)/p_{t+1}]\} - 1$ is the nominal bond interest rate.

Banks operate in competitive deposit markets in which, assuming costless banking for

simplicity, the nominal interest rate on deposits δ is equal to the nominal bond rate multiplied times one minus the required reserve ratio θ_t (with $0 < \theta_t < 1$):

$$\delta_t = i_t(1 - \theta_t) \cdot \tag{4}$$

It follows that the real return on deposits is equal to $\rho_t = r_t - \theta_t i_t(1 - \pi_{t+1})$, where $\pi_{t+1} \equiv (p_{t+1} - p_t)/p_{t+1}$ is the inflation rate. In addition, given this definition for inflation and using (3e), it follows that

$$1 - \pi_{t+1} = (1 + r_t)/(1 + i_t) = (1 + \beta/(1 + i_t) \tag{5}$$

must hold at an optimum.

Following Canzoneri and Diba, the government budget constraints are given by

$$g_t + \kappa(\tau_t) + (1 + r_{t-1})bs_{t-1} = \tau_t + s_t + bs_t, \tag{6a}$$

and

$$g_t^* + \kappa(\tau_t^*) + (1 + r_{t-1}^*)bs_{t-1}^* = \tau_t^* + s_t^* + bs_t^*, \tag{6b}$$

where $\kappa(\tau_t)$ and $\kappa(\tau_t^*)$ are tax collection costs, with $0 < \kappa' < 1$ and $\kappa'' = 0$ and where bs_t and bs_t^* denote the quantities of government bonds supplied. As an analytical simplification, we assume that $g_t = g_t^*$ and that $y_t = y_t^*$, which preserves symmetry between the nations. Seigniorage revenues $s_t = s_t^*$ are defined by

$$s_t = (MB_t - MB_{t-1})/p_t = mb_t - (1 - \pi_t)mb_{t-1}, \tag{7a}$$

and

$$s_t^* = (NB_t - NB_{t-1})/p_t^* = nb_t - (1 - \pi_t^*)nb_{t-1}, \tag{7b}$$

where MB_t and NB_t are home and foreign nominal high-powered money supplies and mb_t and nb_t are real quantities of high-powered moneys.[5]

2.2. Reserve requirements, seigniorage, and currency substitution

In this model, in contrast to that of Canzoneri and Diba, high-powered money consists of both currency and required reserves. Part of the real home monetary base is held by home

residents and is equal to $m_t + \theta_t\, d_t,$ and the remainder is held by foreign residents and is equal to $m_t^* + \theta_t\, d_t^*$. Consequently, the total real monetary base is equal to $mb_t = m_t + \theta_t\, d_t + m_t^* + \theta_t d_t^*$. Likewise, the foreign real monetary base is equal to $nb_t = n_t^* + \theta_t^* h_t^* + n_t + \theta_t^* h_t$.

It follows that the discounted present values of seigniorage revenues earned by the two governments are equal to

$$s_0 = \sum_{t=0}^{\infty} [1/(1+\beta)]^t [1 - (1-\pi_{t+1})/(1+\beta)](m_t + \theta_t\, d_t + m_t^* + \theta_t d_t^*)$$
$$= \sum_{t=0}^{\infty} [1/(1+\beta)]^t [i_t/(1+i_t)](m_t + \theta_t\, d_t + m_t^* + \theta_t d_t^*), \tag{8a}$$

and

$$s_0^* = \sum_{t=0}^{\infty} [1/(1+\beta)]^t [1 - (1-\pi_{t+1}^*)/(1+\beta)](n_t^* + \theta_t^* h_t^* + n_t + \theta_t^* h_t)$$
$$= \sum_{t=0}^{\infty} [1/(1+\beta)]^t [i_t^*/(1+i_t^*)](n_t^* + \theta_t^* h_t^* + n_t + \theta_t^* h_t), \tag{8b}$$

where it has been assumed that initial (carried into time zero) real high-powered moneys are equal to zero; that is, $mb_{-1} = nb_{-1} = 0$. Ceteris paribus, real seigniorage revenues rise with increases in required reserve ratios, but higher reserve requirements increase the reserve tax on deposits and thereby can depress deposit demand.

To capture this effect, consider the following extended version of the Canzoneri-Diba parameterization of currency substitution. The function $v(m_t, n_t, d_t, h_t;\, \sigma, \phi)$ is assumed to take the form

$$v(m_t, n_t, d_t, h_t;\, \sigma, \phi) = -(1/2)[(2V - m - n) + \phi(2V - d - h)]$$
$$-[1/(2\sigma)]\{(V-m) + [\phi(V-d)] + (V-n) + [\phi(V-h)]\}, \tag{9}$$

where $0 < \phi < 1$ is a measure of ceteris paribus preferences of deposits relative to currency and $\sigma > 0$ is a measure of the degree of substitutability across national moneys. As σ increases in value, home and foreign moneys approach perfect substitutability internationally. As ϕ falls in value, deposits are more preferred to currency, holding other factors constant. The satiation level of total real money balances V represents a ridge point for the utility function.

This utility function implies that currency and deposits are imperfect substitutes both

within and between countries. Maximization of (9) yields the first-order conditions,

$$v_m \equiv (1+\sigma^{-1})(V-m) + (V-n) + \phi(V-d) + \phi(V-h) = i/(1+i), \quad (10a)$$

$$v_n \equiv (V-m) + (1+\sigma^{-1})(V-n) + \phi(V-d) + \phi(V-h) = i^*/(1+i^*), \quad (10b)$$

$$v_d \equiv \phi(V-m) + \phi(V-n) + \phi^2(1+\sigma^{-1})(V-d) + \phi^2(V-h) = \theta i/(1+i), \quad (10c)$$

and

$$v_h \equiv \phi(V-m) + \phi(V-n) + \phi^2(V-d) + \phi^2(1+\sigma^{-1})(V-h) = \theta^* i^*/(1+i^*). \quad (10d)$$

Solving this system of first-order conditions yields currency and deposit demand functions:

$$m_t = V - \phi^2\Gamma[i_t/(1+i_t)] + \phi\gamma\theta_t[i_t/(1+i_t)] + \phi(\phi+\theta_t^*)\gamma[i_t^*/(1+i_t^*)], \quad (11a)$$

$$n_t = V + \phi(\phi+\theta_t)\gamma[i_t/(1+i_t)] - \phi^2\Gamma[i_t^*/(1+i_t^*)] + \phi\gamma\theta_t^*[i_t^*/(1+i_t^*)], \quad (11b)$$

$$d_t = V + \phi\gamma[i_t/(1+i_t)] + (\phi+\theta_t^*)\gamma[i_t^*/(1+i_t^*)] - \Gamma\theta_t[i_t/(1+i_t)], \quad (11c)$$

$$h_t = V + (\phi+\theta_t^*)\gamma[i_t^*/(1+i_t^*)] + \phi\gamma[i_t^*/(1+i_t^*)] - \Gamma\theta_t^*[i_t^*/(1+i_t^*)], \quad (11d)$$

where $\gamma \equiv 1/\Delta$ and $\Gamma \equiv (3+\sigma^{-1})/\Delta$, with $\Delta \equiv \sigma^{-1}\phi(4+\sigma^{-1})$. Under this utility specification, asset demands depend negatively on their own opportunity costs and positively on the opportunity costs of all other assets. Furthermore, $m_t < d_t$ and $n_t < h_t$ for any given interest rate for $0 < \theta_t < 1$ and $0 < \phi < 1$. Thus, for these parameter values currency-deposit ratios are less than unity in each country, which is consistent with real-world observation.

3. Optimal policymaking with and without international policy coordination

The basic goal of each nation's government is to choose its interest rate, required reserve ratio, and taxes to maximize the welfare of its nation. But there are three modes of policymaker behavior that we consider. One is noncoordinated policymaking, in which each nation's government maximizes its country's welfare, taking all the instrument choices of the other government as given. Another is what we term "partial coordination," in which authorities coordinate their optimal settings of their interest rates and taxes but noncooperatively determine their reserve requirement ratios. The third is full coordination, in which both policy makers

cooperate in setting all monetary and fiscal instruments.[6]

3. 1. Noncoordinated policy making

With noncoordinated policy making, the domestic government chooses its interest rate, required reserve ratio, and taxes to maximize (1a), where the discounted present value of domestic consumption is

$$\sum_{t=0}^{\infty}[1/(1+\beta]^t c_t = \sum_{t=0}^{\infty}[1/(1+\beta]^t (y_t - \tau_t) - (1/2)(S_0 + S_0^*) \tag{12a}$$

where S_0 and S_0^* are as defined in (8). Given the form of the seigniorage relationship in (8a), the domestic intertemporal government budget constraint is, from (6a), given by

$$\sum_{t=0}^{\infty}[1/(1+\beta)]^t[g_t + \kappa(\tau_t)] = \sum_{t=0}^{\infty}[1/(1+\beta)]^t\,\tau_t + S_0. \tag{13a}$$

Therefore, the domestic authority's problem is to maximize (1a) in light of (12a), subject to (13a) and to the structure of the model.

The foreign authority behaves analogously, maximizing (1 b) given the discounted present value of foreign consumption,

$$\sum_{t=0}^{\infty}[1/(1+\beta)]^t c_t^* = \sum_{t=0}^{\infty}[1/(1+\beta)]^t (y_t^* - \tau_t^*) - (1/2)(S_0^* + S_0), \tag{12b}$$

and subject to the foreign intertemporal government budget constraint,

$$\sum_{t=0}^{\infty}[1/(1+\beta)]^t[g_t^* + \kappa(\tau_t^*)] = \sum_{t=0}^{\infty}[1/(1+\beta)]^t\,\tau_t^* + S_0^*. \tag{13b}$$

Nevertheless, because the nations are symmetric, their governments will make identical choices, and this symmetry considerably simplifies solving the constrained, noncoordinated optimal policy problems. The solutions for the required reserve ratios, interest rates, and, from (5), inflation rates are given by:[7]

$$\theta_t^n = \theta_t^{*n} = (\phi a + b)/(a + b), \tag{14a}$$

$$i_t^n/(1 + i_t^n) = i_t^{*n}/(1 + i_t^{*n}) = [(2\mu - 1)(a + b)V]/(\phi a - b), \tag{14b}$$

and

$$\pi_t^n = \pi_t^{*n} = -\beta + [(2\mu - 1)(a + b)(1 + \beta)V\,]/(\phi^2 a - b), \tag{14c}$$

where $a \equiv (4\mu - 1)\Gamma - (2\mu - 1)\gamma, b \equiv 2(3\mu - 1)\phi\gamma,$ and $\mu = 1/[1 - \kappa'(\tau_t^*)] > 1$, which implies that $\mu - 1 > 0, 2\mu - 1 > 0, 3\mu - 1 > 0,$ and $4\mu - 1 > 0.$

Substitution of the definitions of a, b, and μ into equations (14) yields $\partial\theta^n/\partial\sigma < 0$, $\partial i^n/\partial\sigma < 0,$ and $\partial\pi^n/\partial\sigma < 0$. In addition, it is straightforward to show that as $\sigma \to \infty$, $i_t^n \to 0$ and $\pi_t^n \to -\beta,$ which is the Friedman rule. Hence, as in Canzoneri and Diba, the Friedman rule arises when currencies are completely substitutable for one another: The optimal nominal interest rate approaches its minimum value of zero, so that the optimal inflation rate with competing currencies is deflation at the rate of time preference, and the nations rely on explicit taxes to fund expenditures.

At the same time, the optimal required reserve ratio falls with an increase in the degree of currency substitution. One reason for this result is that as currency substitution increases, leaving reserve requirements unchanged would place an artificial constraint on the ability to shift funds among competing assets, which would constrain utility. Another is that with greater substitutability of currencies, home agents are more willing to substitute foreign bank deposits for home deposits if the home required reserve ratio exceeds the foreign required reserve ratio. This induces competition between policymakers to reduce reserve requirements. Note, however, that governments do not eliminate reserve requirements in the limiting case of complete currency substitution; each instead sets its required reserve ratio at uncoordinated values that balance the relative preferences of home and foreign currencies and deposits so as to maximize the utility of the representative citizens of its nations.

3.2. Partial coordination

As the European Union currently is constituted, policy coordination at best could be described as "partial." The settings of reserve-requirement ratios are not coordinated. Increased "harmonization" of fiscal instruments still is largely a matter of discussion, and full fiscal coordination remains a stated goal rather than even an approximation to reality. Only through the Exchange Rate Mechanism (ERM) has any real coordination, albeit limited, been achieved. In

our model, the ERM would approximate the coordination of interest-rate choices. If fiscal coordination were added, then the resulting EMS/fiscal-coordination arrangement could be regarded as a precursor to full European monetary and fiscal union.

Therefore, we approximate such an enhanced EMS-style coordination effort by solving the following policy coordination problem. Policy makers in each nation choose their interest rates and tax rates to maximize joint welfare (the sum of U and U^*), but subject only to their own government budget constraints. At the same time, they choose reserve-requirement ratios only to maximize home welfare, and subject only to home budget constraints. Hence, the domestic authority maximizes (1a), using (12a).[8]

The solutions to this respecified policy problem are as follows:

$$\theta_t^p = \theta_t^{*p} = [(\mu-1)(a+b)b + (2\mu-1)(\bar{a}a\phi - b\bar{b})/\left[(\mu-1)(a+b)a + (2\mu-1)\left(a\bar{b} - \bar{a}b\right)\right], \quad (15a)$$

$$i_t^p/\left(1+i_t^p\right) = i_t^{*p}/\left(1+i_t^{*p}\right) = \{(2\mu-1)a^2 + 2\,[(\mu-1)ab + (2\mu-1)(a\bar{b} - \bar{a}b)]\}V/[2(\phi^2a^2 + b^2)\,\bar{a} - 4a\bar{b}b], \quad (15b)$$

and

$$\pi_t^p = \pi_t^{*p} = -\beta + (1+\beta)\{2(\mu-1)a^2 + 2[(\mu-1)ab + (2\mu-1)(a\bar{b} - \bar{a}b)]\}\,V/[2(\phi^2a^2 + b^2)\bar{a} - 4a\bar{b}b, \quad (15c)$$

where $\bar{a} \equiv (2\mu-1)\Gamma - (\mu-1)\gamma$ and $\bar{b} \equiv (3\mu-2)\phi\gamma$.

In this case of partial coordination, it can be shown that the Friedman rule continues to hold in the limit in which $\sigma \to \infty$. Consequently, even though policymakers coordinate their interest-rate choices, nominal interest rates are driven to zero. This contrasts with Canzoneri and Diba's interest-rate-coordination result, in which the Friedman rule fails to hold because the existence of marginal tax collection costs makes seigniorage part of the optimal tax package. The reason that Canzoneri and Diba's result does not hold in our partial-coordination case is that even though policymakers coordinate their interest-rate choices, they continue to compete through their required reserve ratio settings, taking into account their individual budget constraints. Therefore, in the limiting case of pure currency competition, they earn no seigniorage revenues. In addition, $\partial\theta^p/(\partial\sigma < 0, \partial i^p/\partial\sigma < 0, \text{and } \partial\pi^p/\partial\sigma < 0$, so that increased currency substitution reduces interest and inflation rates and the optimal reserve-requirement

ratios. The latter results follow for the same basic reasons discussed in the previous case.

3.3. Full coordination

As a prelude to ultimate European monetary union (EMU), the Treaty on European Union outlines a gradual movement toward coordination of monetary and fiscal policy instruments but retention of separate national currencies. At the end of such a transition phase, the Treaty specifies an umbrella European System of Central Banks and sufficient monetary/financial integration and policy coordination to permit a low-cost shift to a common currency and common reserve requirements (see Article 19 of the Treaty). While this "gradualist" approach to EMU has drawbacks (see De Grauwe, 1994), it represents the transitional framework to which the political institutions of the European union presently are committed.

To model the end result of such a transition in the period immediately *preceding* the formation of a true European common-currency union, we follow Canzoneri and Diba by considering the outcome as the solution of a "world planner's" problem of choosing all the policy instruments to maximize joint welfare, subject to both government budget constraints simultaneously. This optimization problem yields the following solutions for required reserve ratios, nominal interest rates, and inflation rates:

$$\theta_t^f = \theta_t^{*f} = (\phi a' + b')/(a' + b') \tag{16a}$$

$$\begin{aligned} i_t^f/(1+i_t^f) &= i_t^{*f}/(1+i_t^{*f}) \\ &= [(\mu-1)(a'+b')V]/\{2\mu[\phi^2(a')^2 - (b')^2]\}, \end{aligned} \tag{16b}$$

and

$$\pi_\tau^f = \pi_\tau^{*f} = -\beta + [(\mu-1)(a'+b')(1+\beta)V]/\{2\mu[(\phi^2(a')^2 - (b')^2]\}, \tag{16c}$$

where $a' \equiv \Gamma - \gamma$ and $b' \equiv 2\phi\gamma$. Again, it can be shown that $\partial\theta^f/\partial\sigma < 0$, $\partial i^f/\partial\sigma < 0$, and $\partial\pi^f/\partial\sigma < 0$, so that increased currency competition leads to lower interest and inflation rates as well as reduced required reserve ratios. In this case, however, the achievement of completely substitutable currencies does not lead to the Friedman rule for optimal inflation. The reason, as in Canzoneri and Diba, is that, in the presence of marginal tax collection costs, some reliance on seigniorage by the cooperative authorities is optimal, and so currency competition does not yield the Friedman rule in which seigniorage is driven to zero.

The result that optimal required reserve ratios decline with greater currency substitution may seem counterintuitive given that coordination removes the competition between the governments in setting their reserve-requirement ratios. As discussed in subsection 3.1, without coordination, interest and inflation rates are driven to zero, which then mitigates the ability to collect seigniorage taxes as a means of raising revenues in the presence of costs in raising explicit taxes. Then each government chooses the optimal reserve-requirement ratio solely to maximize its citizens' utilities by inducing the optimal portfolios of differentiated assets. But coordination permits the governments to internalize the tradeoff between meeting seigniorage requirements in the presence of tax collection costs and inducing optimal portfolio selection among imperfectly substitutable assets. As a result, each , government chooses positive interest and inflation rates even if there is complete currency substitution, and it can capture positive seigniorage revenues through lower required reserve ratios that provide agents incentives to balance their portfolios optimally in light of its nonzero interest-and inflation-rate choices.

3.4. Regime switching and increased European integration

What happens to policy choices and to inflation rates with increased international policy coordination? To answer this question, we begin with ceteris paribus comparisons of the solutions in (14), (15), and (16). The results of these comparisons are summarized as follows:

$$\theta_t^f > \theta_t^p > \theta_t^n, \tag{17a}$$

$$i_t^f < i_t^p < i_t^n, \tag{17b}$$

and

$$\pi_t^f < \pi_t^p < \pi_t^n, \tag{17c}$$

with ϕ, σ, and κ' assumed equal across regimes. Note that the comparison of the partial coordination case to the noncoordinated case is unambiguous for all ranges of parameter values. The indicated inequalities relating the partial coordination case to the fully coordinated case, however, require an assumption that ϕ is relatively small in value and that κ' is significantly different from zero. Therefore, as long as deposits are strongly preferred to currency and/or marginal tax collection costs are fairly large, moving from a regime of uncoordinated policy making to one in which all instruments except reserve requirements are coordinated would lead

to lower interest and inflation rates but higher reserve requirements.[9]

To understand these results, consider first the comparison between the noncoordinated and partial-coordination cases. When the policy makers coordinate their interest-rate choices, they internalize the international externalities that they ignore, when they do not cooperate, and so coordination leads to lower interest rates under partial coordination as compared with the noncooperative equilibrium (except at the limit of complete currency substitution). But reductions in interest and inflation rates reduce seigniorage, thereby requiring offsetting (noncoordinated) increases in required reserve ratios in an effort to partially offset the seigniorage loss.

If policy makers move to full coordination, then they internalize the mutual incentive to raise reserve requirements that results from reduced interest rates. Hence, as long as deposits are sufficiently preferred to currency, and/or marginal tax collection costs are sufficiently large to internalize policy makers' reliance on seigniorage, the policy makers increase reserve-requirement ratios even more when they coordinate all policy choices.

Of course, the transition to EMU, if successful, should also entail increased integration of money and financial markets in European nations. One possible outcome of increased integration could be greater currency substitution. The ceteris paribus comparisons in (17) abstract from increases in σ that might accompany regime switches that would occur under a gradualist approach to EMU. Nevertheless, higher substitutability of currencies leads to lower interest and inflation rates and lower required reserve ratios in all regimes, as discussed in the previous subsections. Would greater currency substitution–a rise in the value of σ–improve the prospects for lower required reserve ratios with coordinated policy making? To evaluate this issue, we conduct one more comparison. Under noncoordinated policy making, the optimal reserve ratio settings for a finite value of σ are given by (14a). We compare these values with the optimal reserve ratio settings under full coordination *plus* the assumption of completely substitutable currencies, $\sigma \to \infty$. Using the solutions for θ_t^f and θ_t^{*f} in (16a), we find that $\theta_t^f \big|_{\sigma\to\infty} = \theta_t^{*f} \big|_{\sigma\to\infty} = \phi$. Hence, full currency substitution constrains the policy makers to set required reserve ratios consistent with agents' allocation preferences of currency and deposits in their asset portfolios. This comparison yields $\theta_t^n < \theta_\tau^f \big|_{\sigma\to\infty}$ and $\theta_t^{n*} < \theta_t^{f*} \big|_{\sigma\to\infty}$ for all parameter values.

The implication of this result is that full policy coordination by separate national authorities generates higher reserve requirements, *even if* coordination is accomplished by increased currency substitution. The downward pressure on required reserve ratios induced by greater currency substitution is not sufficient to offset the internalization of the seigniorage motive for

raising reserve requirements that policy coordination produces. Hence, coordinating authorities unambiguously have an incentive to raise required reserve ratios, even in the face of a greater degree of currency substitution.

4. Implications for European integration/unification

Because our stylized model assumes symmetry across nations, its implications for present-day Europe must be interpreted with care. For instance, our conclusion that increased policy coordination coupled with greater currency substitution initially would lead to adoption of higher reserve requirements seems to fly in the face of recent efforts of "outlying" European nations such as Portugal to align their reserve-requirement ratios with the lower reserve-requirement ratios prevailing elsewhere in Europe.[10] But we would argue that our model's implications should be most applicable to a Europe that emerges after such fundamental harmonization efforts have been completed. That is, *after* southern nations such as Portugal have brought their degrees of dependence on seigniorage and their reserve requirements into greater general alignment, *then* the general average initial trends for Europe as a whole that our model predicts would follow in the absence of significantly greater currency substitution.

Hence, the prediction of our model is that the general trend in Europe, if the gradualist approach to an EMU transition is adopted, would be as follows. Barring shocks not accounted for by our model, the EMU transition outlined in the Treaty of Maastricht would yield lower interest rates, lower inflation rates, and higher required reserve ratios. Consequently, by the time that Europe would find itself poised for the final step of adopting a common currency and a unified banking system with common reserve requirements, its nations on average would have lower interest and inflation rates and higher reserve ratios than during the initial phases of the proposed transition.

Greater currency substitution certainly would dampen the incentive for coordination European authorities to increase reserve requirement ratios under policy coordination. There is little evidence, however, that efforts to integrate European economies have substantially increased the substitutability of European currencies (for instance, see Mizen and Pentecost's 1994 analysis of the continuing lack of substitutability of the pound for other European currencies). Our analysis indicates that even if currency substitution were to accelerate, full policy coordination among separate European nationstates would result in reserve requirements higher than those in a noncoordinated regime with a lower degree of currency substitution.

This conclusion leads naturally to arguments *against* the Treaty's gradualist approach to EMU. If a gradual transition with multiple currencies would, as our model predicts, produce higher European reserve requirements, the result could be a reduction in the ability of the European banking system to compete with other banking systems outside the European Union. Suppose that reserve ratios in existing common-currency systems of the world (for instance, in the common-currency-based banking systems of the federal polities of the United States, Japan, or even China) are lower than those that theoretically would tend to emerge by the end of a gradual EMU transition. Then the transition path that we have modeled actually may be an unstable path. It would imply a reduction of competitiveness of European banking that might not be tolerated by European policy makers.[11]

5. Conclusion

Our basic conclusion is that greater European monetary and financial integration are, when coupled with a transition to increased coordination of monetary and fiscal policymaking, likely to lead naturally to lower interest rates, lower inflation rates, and higher required reserve ratios. While lower interest and inflation rates are consistent with the expressed goals of European union, higher reserve-requirement ratios are not. Yet, to the extent that seigniorage remains a partial source for public funding in European nations and currency substitution remains low, increased reserve requirements emerge as a likely outcome along a gradual transition path to EMU, as outlined by the Maastricht Treaty on European Union. Because this could place European banking at a competitive disadvantage vis-à-vis the banking systems of other nations, this conclusion calls into question whether the gradual transition envisioned by the Maastricht Treaty is likely to be sustainable. Hence, our analysis adds weight to the argument against the "gradualist" approach to EMU specified by the Treaty.

Of course, we have not explicitly modeled the interaction of the combined European banking system with those of any other nations. Our two-country model of "Europe" takes the rest of the world as "given." A potentially interesting, albeit difficult, undertaking would be to extend our model to a three-nation setting in which there is currency substitution across the entire group but in which two nations decide to embark on a transition such as the one we have outlined in this article.[12] Such a broadened analysis would take into account feedback effects across monetary and banking systems and thereby would resolve how the interaction between one nation and a coalition of two other nations ultimately would evolve during a transition toward currency union among the coalition partners. But such an extension lies beyond the bounds of

this article.

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Notes

1. See the *Treaty on European Union* (1992) and the very helpful overview and analysis of some of its key monetary policy implications in Fratianni, von Hagen, and Waller (1992).
2. For a recent overview of the issues entailed in developing gradual versus speedy transition strategies for European union, see De Grauwe (1994).
3. This, of course, is an heroic assumption, given that reserve requirements and relative degrees of dependence upon seigniorage revenues differ considerably across European nations, as documented by Drazen (1989), Rovelli (1994), and Gros (1993). A potentially interesting, albeit difficult, direction in which to extend this framework would be to contemplate a more realistic environment with nations of different sizes and divergent public finance characteristics.
4. Our assumption of a constant proportional tax collection cost parallels a similar approach by Aizenman (1989), and it corresponds to the special case that Canzoneri and Diba (1992) adopt in their own attempt to compare across policy regimes as we do in this article.
5. This is a cash-flow measure of seigniorage. See Gros (1989, 1993), Klein and Neumann (1990), and Rovelli (1994) for useful discussions of alternative seigniorage concepts.
6. Of course, there are other iterations that could be considered, but we chose these to be of greatest interest in light of current proposals for greater unity of policy making in Europe.
7. The manner in which these solutions are obtained and in which comparisons across regimes are made is outlined in a separate appendix that is available from either author upon request.
8. Another possible version of “partial” coordination would be full coordination of both interest rates and taxes in light of both nations’ household and government budget constraints but noncoordination of reserve requirements in light of only home household and government budget constraints. This would be an alternative hybrid of the uncoordinated and fully coordinated cases that we also consider. But, in light of the incomplete nature of fiscal coordination in Europe at present, we have chosen to consider partial tax coordination as the case to emphasize in the text. This does not affect the qualitative nature of our final

conclusions.

9. The reason that an ambiguity can exist for some parameter values is that ceteris paribus, a higher required reserve ratio under full coordination, as compared to the case of partial coordination, tends to increase seigniorage while potentially worsening the agents' portfolio allocations, given the interest rate. On the one hand, if ϕ is close to unity, so that deposits and currency are nearly equally weighed assets in the utility function, then a movement from noncoordinated reserve-requirement i settings to full coordination of reserve requirements would, for a given degree of currency substitution, induce the policy makers to *reduce* reserve-requirement ratios. Coordinating policy makers would internalize the recognition that higher reserve ratios would tend to induce agents who value currency and deposits nearly equally to substitute currency for deposits. This would worsen the agents' portfolio allocations at coordinated interest-rate settings and inhibit the collection of the socially optimal level of seigniorage. On the other hand, if marginal tax collection costs are miniscule, then both policy makers internalize their reliance on explicit taxes when they coordinate fully, inducing them to reduce required reserve ratios.
10. As von Hagen and Fratianni (1993) point out, such a harmonization of reserve requirement ratios and other monetary and fiscal instruments is a necessary precursor to any attempt at a Maastricht-style transition to EMU.
11. Another possible problem of higher reserve requirement ratios is that the resulting increase in reserve taxes likely would lead to financial innovations, as agents seek to avoid such taxes. This would complicate defining monetary aggregates. In our framework, in which policy makers set interest rates, this is not difficulty for policy making, but it could become a problem if policies instead were to center around monetary aggregates (see Canzoneri and Diba for solutions of this type of model when monetary aggregates are policy instruments).
12. Such an approach might build, for instance, on the sort of stylized three-country framework considered by Canzoneri and Henderson (1991, chapter 3).

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