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FINANCIAL INTEGRATION WITH AND WITHOUT INTERNATIONAL POLICY COORDINATION

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FINANCIAL INTEGRATION WITH AND WITHOUT INTERNATIONAL POLICY COORDINATION*

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Abstract

This paper studies an economy in which financial integration increases world welfare in the presence of international policy coordination but decreases welfare in its absence. This happens because financial integration enhances the impact of domestic government financial policies on foreigners, which increases the welfare losses from noncooperative policymaking. The policy message is that financial integration, of the type attempted by European countries, can be successful if and only if governments agree to coordinate their macroeconomic policies.

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I. Introduction

A central development in recent times is the increased integration of financial markets across countries. Most governments have welcomed this process and tried to speed it up by eliminating legal barriers to international financial flows. The most prominent example is, of course, that of the European Economic Community [1]. In this case, an unresolved issue is whether member governments will surrender their sovereign power over fiscal and monetary policy to a central "European" authority. Some governments, particularly the British, agree on financial liberalization but refuse to give up their independence in the day to day management of macroeconomic policy.

In this paper I argue that international policy cooperation is necessary for the success of financial integration. More precisely, I show a world in which increased financial capital mobility improves world welfare provided that governments coordinate their macroeconomic policies, but reduces welfare if coordination is absent.

This possibility stems from the fact that financial integration increases the interdependence of macroeconomic policies and, in particular, of government financial policies. For instance, the international effects of the United States budget deficit are greater the stronger the links between American and foreign financial markets. If the United States government acts independently of foreign governments it is likely to ignore the international effects of its budget deficit and to underestimate its social costs.

Since financial integration increases the international effects of domestic policies, it may increase the welfare losses due to "beggar thy neighbor" policy making. These increased losses may (and, in the model below, do) exceed the benefits from financial integration.

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[1] For an overview of the recent process of financial integration, see Bryant (1987). A review of the European process is found in Key (1989)

The policy message of this paper is straightforward. If governments retain sovereignty in macroeconomic policy making, financial integration may make all countries worse off even if it would be beneficial under cooperation.

I develop these ideas in the context of a two country overlapping generations model (Samuelson (1958)). I assume that the resources of each country fluctuate over time, but the world resources do not fluctuate. Governments have a mandate to ameliorate the effects of country specific fluctuations by choosing a transfer policy financed with debt issue. Each government maximizes a social welfare function that weights the utility of current and future domestic generations.

There is free trade in consumption goods. With respect to international capital markets, I consider two possibilities: a Portfolio Autarky regime (PA) in which international borrowing or lending is ruled out, and a perfect Capital Mobility (CM) regime in which residents of both countries can freely borrow or lend to citizens abroad.

In a PA regime, fiscal deficits have no international effects, and international policy coordination is irrelevant. I describe optimal deficit policies in PA and show that, given these policies, interest rates and debt fluctuate in each country; fiscal policy cannot eliminate fluctuations because countries cannot run trade imbalances.

In a CM regime, arbitrage ensures that domestic and foreign interest rates are equal to each other, and equal to the "world" interest rate. The fiscal deficit of one country affects, through its effect on the world interest rate, real allocations and welfare in the other country. Thus fiscal deficits have international effects and policy coordination matters.

Accordingly, I study a cooperative CM regime in which governments delegate fiscal policy to a world planner that is instructed to maximize total world welfare. I find the optimal cooperative deficit policies, and show that they eliminate fluctuations in interest rates and world debt. This is possible because the world fundamentals do not fluctuate, and in a CM regime countries can smooth consumption by borrowing and lending in the international markets. As a result, world welfare (as measured both by total welfare and, provided governments do not discount the future too heavily, by the two countries' welfare functions) in a cooperative CM regime is higher than in PA.

Finally, I study a noncooperative CM regime in which each government chooses its fiscal policy independently in order to maximize its own country's welfare function. This regime takes the form of a dynamic game in which governments are the players and their fiscal deficits are strategies. I show that this dynamic game has a Markov Nash equilibrium. The fiscal policies chosen in this Nash equilibrium imply a constant world interest rate and debt quantity, as in the cooperative CM regime. However, the resulting world interest rate is larger than under cooperation, a reflection of the fact that governments underestimate the world cost of their deficits.

Not surprisingly, world welfare is lower in a noncooperative CM regime than in a cooperative CM regime. The novel result of my analysis is that world welfare in a noncooperative CM regime is lower than in PA. This result is surprising because one could have expected there to be a tradeoff between the benefits of capital mobility and the losses from noncooperative behavior. In the model below no such tradeoff exists, and portfolio autarky is always superior to capital mobility if governments behave noncooperatively.

This paper is a direct descendant of my previous work (Chang (1987,1990)) on the links between international policy coordination and the structure of international capital markets. In particular, it differs from Chang (1990) in allowing for aggregate gains from financial integration and comparing capital mobility against portfolio autarky. These papers belong to an emerging literature that emphasizes the public finance aspects of international policy coordination, as in the contributions of Kehoe (1987), Canzoneri and Rogers (1990), and Casella and Feinstein (1989).

This paper is also related to recent studies on the welfare gains from financial integration. Feldstein and Horioka (1982) and Cole and Obstfeld (1991) have raised the question of whether the welfare gains from financial integration are big or small. My results show that such issue may be irrelevant if countries do not coordinate fiscal policy: in the model below, the potential gains from financial integration are positive but the realized gains are actually negative.

The plan of the paper is the following: Section II presents the model. Section III discusses optimal policies in Portfolio Autarky. Section IV derives optimal policies in a symmetric cooperative CM regime, and compares the outcomes with the PA outcomes. Section V discusses the noncooperative CM regime, and compares its properties with those of the PA and the cooperative CM regime. Section VI concludes. Some technical details are deferred to two Appendices.

II. The Model

I will discuss an overlapping generations world of two countries, "home" and "foreign", denoted by $i = 1,2$. At the beginning of each period $t = 1,2,\ldots$ a new agent, called (i,t), is born in country i . Each agent lives for two consecutive periods, "youth" and "old age". The only exception to this rule is "generation zero", composed of two agents, one domestic and one foreign, who live only in period one and will be indexed by $(i,0)$. Thus, there are four agents alive in each period, two young and two old, two "domestic" and two foreign.

There is only one homogeneous, nonstorable consumption good which is freely traded in the world market. There is no physical capital, only "financial" capital. The consumption good can be produced in each period with only the labor of young people: if agent (i,t) works n_{it} hours his output is n_{it} units of consumption. In addition, agent (i,t) is endowed in old age with $e_{i,t+1} > 0$ units of consumption which cannot be traded nor taxed. The endowment sequences $\{e_{it}\}$, $i = 1,2$, are exogenously given by a process described below.

Agent (i,t) consumes only in old age [2]. His decision problem is to choose labor effort n_{it} and old age consumption $c_{i,t+1}$ to maximize his lifetime utility subject to the following budget constraint:

$$c_{i,t+1} = e_{i,t+1} + R_{it}n_{it} + \tau_{i,t+1}, \quad n_{it} \in [0, N], \quad c_{i,t+1} \geq 0 \tag{2.1}$$

In (2.1), R_{it} denotes the gross interest rate prevailing in country i for one period loans between t and t+1 [3]. Also, $\tau_{i,t+1}$ denotes a transfer (tax, if negative) from government i to agent (i,t) in his old age, and N is a (large) bound on labor effort. Agent (i,t) has perfect foresight and takes R_{it} and $\tau_{i,t+1}$ as given.

I shall assume that agent (i,t)'s preferences over labor and old age consumption are given by:

$$u(e_{i,t+1}) + K_{i,t+1}\,(c_{i,t+1} - e_{i,t+1}) - n_{it}^2/2 \tag{2.2}$$

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[2] Assuming that agents consume only when old is not essential for our results. By a change in notation, one can rewrite this model as a pure exchange model in which agents receive endowments and consume in both periods. See Grandmont (1985), for example.

[3] Thus, agent (i,t) invests all of its labor income in one period loans, the value of which in period (t+1) is $R_{it}n_{it}$.

where u(.) is a strictly increasing, differentiable, and strictly concave function, and $K_{i,t+1} = u'(e_{i,t+1})$. Note that (2.2) implies that poorer agents (those with small $e_{i,t+1}$) value government transfers more strongly than wealthier ones (see (2.4) below).

The justification for the form of the utility function (2.2) is twofold. One may simply postulate (2.2) on the basis of analytical convenience. Alternatively, (2.2) can be interpreted as an approximation to a more general utility function of the form $u(c_{i,t+1}) - v(n_{it})$; in such case, $u(e_{i,t+1}) + K_{i,t+1}(c_{i,t+1} - e_{i,t+1})$ can be seen as a first order approximation of $u(c_{i,t+1})$. Most optimizing nonlinear dynamic models do not admit closed form solutions and require some kind of approximation anyway, so readers may wish to interpret the solutions below as approximations to the solutions with the more general utility function.

The maximization of (2.2) subject to (2.1) yields:

$$n_{it} = K_{i,t+1} R_t \tag{2.3a}$$

$$c_{i,t+1} = e_{i,t+1} + K_{i,t+1} R_t^2 + \tau_{i,t+1} \tag{2.3b}$$

provided $R_t \in [0, \frac{N}{K_{i,t+1}}]$, which turns out to be the case in equilibrium. Note that (i,t)'s labor effort and savings increase with the interest rate and decrease with his old age endowment.

For future reference, note that the maximized utility of agent (i,t) is given by the <u>indirect utility function:</u>

$$w_{it}(R_{it}, \tau_{i,t+1}) = \frac{1}{2} K_{i,t+1}^2 R_t^2 + K_{i,t+1} \tau_{i,t+1} + u(e_{i,t+1}) \tag{2.4}$$

Agent (i,0) simply consumes his endowment e_{i1} plus the value of the transfer τ_{i1} that he receives from the government. His utility is then $K_{i1}\tau_{i1} + u(e_{i0})$.

The government of each country i = 1,2 chooses a <u>transfer policy</u> $\tau^{i} \equiv (\tau_{i1},\tau_{i2},\ldots)$. Aside from these transfers and debt repayments, governments have no other expenditures. Each period, the government of country i issues a number b_{it} of one period bonds to finance the transfer τ_{it} and to repay bonds issued the period before. Government bonds pay the market interest rate. For simplicity, I assume that there is no government debt due in period one [4]. Thus, the evolution of government i's debt is given by:

$$b_{it} = R_{i,t-1}b_{i,t-1} + \tau_{it} \tag{2.5}$$

where $b_{i0} = 0$.

By definition, τ_{it} is the <u>(primary) fiscal deficit</u> of country i in period t. Thus, a policy τ^{i} is a sequence of fiscal deficits of government i. A pair $\tau = (\tau^{1},\tau^{2})$ will be called a <u>joint policy</u>.

Where each government can sell its debt depends on the international regime. I will consider two possibilities. In a <u>Portfolio Autarky regime</u> (PA) [5], private agents are not allowed to borrow from or lend to foreigners. In an opposite regime, called <u>Perfect Capital Mobility</u> (CM), private agents can freely borrow and lend internationally. The international regime is given at the beginning of time and remains in place forever [6]. The rest of this paper

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[4] This is for simplicity only. It will become clear that initial conditions do not matter if governments do not discount the future too heavily. In any event, it is easy to alter the model to include initial government obligations.

[5] The term "Portfolio Autarky" belongs to Kareken and Wallace (1981)

[6] Thus the existence or absence of capital controls is taken as given. Alternatively, one could ask how capital controls are chosen by governments.

analyzes the merits of CM relative to PA.

I assume that old age endowments in each country follow a <u>two period deterministic cycle</u> which is perfectly and negatively correlated with that of the other country. That is, I assume that, for some $h > \ell > 0$, $e_{1t} = \ell$ and $e_{2t} = h$ if t is odd, while $e_{1t} = h$ and $e_{2t} = \ell$ if t is even. Thus, if t is odd then the home old generation is "poor" and the foreign old is "rich", and the opposite happens if t is even. This is probably the easiest way to allow for gains from financial integration without resorting to uncertainty, which would greatly complicate matters.

Since old age endowments fluctuate, the marginal utilities of government transfers fluctuate as well. Denoting $u'(\ell) = H$, and $u'(h) = L$, it follows that $H > L > 0$ and:

$$K_{it} = H \quad \text{if } i = 1 \text{ and t is odd or if } i = 2 \text{ and t is even} \qquad (2.6a)$$

$$K_{it} = L \quad \text{if } i = 1 \text{ and t is even of if } i = 2 \text{ and t is odd} \qquad (2.6b)$$

Assumption (2.6) implies that from the viewpoint of each country both the marginal benefit of τ_{it} and national savings functions fluctuate over time. However, the <u>world</u> fundamentals are the same in every period, and it is technologically feasible for both countries to smooth consumption and production over time.

I assume that consumption smoothing over time is desirable, and that governments have a mandate to use their fiscal deficit policies to ameliorate the effects of fluctuations. Formally, each government will be assumed to maximize a weighted discounted sum of the utilities of all current and future domestic generations:

For an attempt in this direction, see Chang (1987).

$$P_i(\tau_1,\tau_2) = (1-\beta)\left[\frac{K_{i1}\tau_{i1} + u(e_{i0})}{\beta} + \sum_{t=1}^{\infty} \beta^{t-1} w_{it}(R_{it},\tau_{i,t+1})\right] \qquad (2.7)$$

where $P_i(\tau^1,\tau^2)$ is the value of government i's social welfare function when the joint policy $\tau = (\tau^1,\tau^2)$ is chosen. The social welfare function (2.7) is just the sum, discounted by β, of the marginal utility of the transfer to generation (i,0) and the indirect utility function of all generations born in country i. The discount factor β is assumed to be between zero and one. Governments are assumed to be totally benevolent in the sense that their objectives depend only on private welfare. On the other hand, they are assumed to be nationalistic in the sense that the objective function (7) does not include the welfare of foreigners.

The social welfare function (2.7) can be expressed as a discounted sum of a function of contemporaneous variables, as:

$$P_i(\tau_1,\tau_2) = \omega_i + \sum_{t=1}^{\infty} \beta^{t-1} (1-\beta)\left(\frac{K_{it}\tau_{it}}{\beta} + \frac{1}{2} K^2_{i,t+1} R^2_{it}\right) \qquad (2.8)$$

where $\omega_1 = (u(\ell)/\beta + u(h))/(1+\beta)$ and $\omega_2 = (u(h)/\beta + u(\ell))/(1+\beta)$ denote the discounted utility of the consumption of old age endowments in countries 1 and 2 respectively.

Note that the two countries differ because of discounting and of initial conditions. However, it can be easily seen that if discounting is small the two countries are almost symmetric: as β goes to one the effect of initial conditions vanishes (ω_1 and ω_2 converge to the same number) and the social welfare function (2.7) converges to an average criterion (see Abel (1987)).

The social welfare function (2.7) is defined in terms of interest rates and therefore makes sense only for joint policies that result in a competitive equilibrium. In order to extend the definition of $P_i(\tau^1,\tau^2)$ for all policies, I shall assume that $P_i(\tau^1,\tau^2) = -\infty$ for all τ for which there is no competitive equilibrium. If fiscal deficits are so large that there is no equilibrium, financial markets break down, and in that case I assume that governments suffer large political costs.

Given the social welfare functions defined by (2.7), we can see that fiscal policies may affect social objectives both directly and indirectly through equilibrium interest rates. Since the latter are determined in financial markets, the effects of government deficits depend on the degree of international financial integration. This is the issue discussed below.

III. Optimal Fiscal Deficits In Portfolio Autarky

This section describes optimal deficit policies and equilibrium interest rates and allocations in a Portfolio Autarky regime. In a PA world, capital markets are segmented across countries and interest rates in the two countries may be different. Even with free trade in consumption goods [7], a consequence of this separation is that fiscal deficits have no international effects: interest rates and real allocations in country i depend only on government i's fiscal deficit policy τ^i, and not on the other government's policy. Thus, in a PA regime government policies are not interdependent, and there is no need for international policy coordination.

As we shall see, Portfolio Autarky implies a cost relative to Perfect Capital Mobility. Our assumptions about social welfare in country i (eq.

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[7] In fact, because there is only one consumption good in this model, Portfolio Autarky effectively reduces each country to total autarky. But this is not essential. One can assume that there are two traded goods; as long as the relative price of the two goods is constant, the model effectively reduces to one with a single composite good.

(2.7)) imply that government i would like to smooth consumption across generations, giving transfers to poor old generations and taxing rich old agents. However, international borrowing is not possible in PA, and trade must be balanced in all periods. As a result, Portfolio Autarky implies that consumption smoothing is limited, as will be expressed by the fact that optimal policies imply that interest rates fluctuate in each country.

Given a policy pair $\tau = (\tau^1, \tau^2)$ a PA competitive equilibrium is a collection of sequences of nonnegative consumption and labor effort $\{(n_{it}, c_{it})\}_{t=1}^{\infty}$, interest rates $\{R_{it}\}_{t=1}^{\infty}$, and debt quantities $\{b_{it}\}_{t=1}^{\infty}$ such that for all $t \geq 1$ and $i = 1, 2$:

[PA1] $\{b_{it}\}$ and τ^i satisfy (2.5), given $\{R_{it}\}$ and $b_{i0} = 0$.

[PA2] $(n_{it}, c_{i,t+1})$ maximizes (2.2) given $R_{it}, \tau_{i,t+1}$, (2.1), and (2.6)

[PA3] $n_{it} = b_{it}$

[PA1] requires each government budget constraint to be always satisfied. [PA2] implies that private agents act optimally. [PA3] is the market clearing condition in PA: it states that the demand for assets equals the supply for assets in each period, in each country. By Walras' Law, the world market for the consumption good also clears in each period.

The problem of government i = 1,2 is to choose a policy τ^i to maximize P_i, given by (2.7), subject to feasibility conditions which ensure that τ^i is consistent with the existence of a PA competitive equilibrium. Such problem is a standard dynamic programming problem that is fully analyzed in a previous version of this paper (Chang (1989)) [8]. To preserve space, I just describe the main results below.

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[8] Chang (1989) shows that the problem of government i is recursive, so that the optimal deficits below are time consistent.

It is useful to define a "state" variable (z_{it}, K_{it}), where $K_{it} = u'(e_{it})$ as before, and $z_{it} = R_{i,t-1}b_{i,t-1}$ is the debt service of government i due at t. Because there is no debt at the beginning of time, $z_{i0} = 0$. Then the optimal deficit policy of government i is given recursively by:

$$\tau_{it} = \tau_{PA}(x_{it}, K_{it}) = \frac{K_{it}}{\beta} - z_{it} \tag{3.1}$$

which implies that government i's debt service evolves according to:

$$z_{i,t+1} = \frac{K_{it}}{\beta^2 K_{i,t+1}} \tag{3.2}$$

The following remarks will provide some intuition about the optimal solution (3.1). First, we must notice that (given z_{it}) the deficit of government i at t, τ_{it}, is larger when $K_{it} = H$ than when $K_{it} = L$. The intuition is, of course, that the optimal policy prescribes larger transfers to agents that are "poor" in old age, which are precisely the ones for which $K_{it} = H = u'(\ell)$.

Second, it can be shown that (3.1) implies that interest rates in country i are given by:

$$R_{it} = \frac{K_{it}}{\beta K_{i,t+1}} \tag{3.3}$$

That is, the interest rate in country i fluctuates over time. In country 1, for instance, the interest rate is high (equal to $H/\beta L$) in odd periods and low (equal to $L/\beta H$) in even periods. Correspondingly, consumption, production, savings, and debt service fluctuate in both countries.

The fact that the optimal deficit policies cannot eliminate fluctuations is due to the impossibility of international borrowing and lending under PA. In this model, country specific resources fluctuate but countries cannot poll their resources to smooth consumption over time because trade must be balanced in each period.

The value of the social welfare function (2.7) evaluated at the optimal policy will be called the <u>value of PA</u> for country i, and denoted by v_i^{PA}. In Chang (1989) it is shown that:

$$v_1^{PA} = \omega_1 + (H^2 + \beta L^2)[2\beta^2(1+\beta)]^{-1} \tag{3.4a}$$

$$v_2^{PA} = \omega_2 + (L^2 + \beta H^2)[2\beta^2(1+\beta)]^{-1} \tag{3.4b}$$

The value of PA differs for the two countries because of the differences in initial conditions. Note, however, that as the discount factor β goes to one the effect of initial conditions vanishes, and both v_1^{PA} and v_2^{PA} converge to the same value, $(u(\ell)+u(h))/2 + (H^2+L^2)/4$.

IV. <u>The Gains From Financial Integration Under International Cooperation</u>

In the next two sections we discuss a world of <u>Perfect Capital Mobility (CM)</u>, that is, a world in which residents of both countries can freely borrow from or lend to residents of other countries. We will compare equilibrium allocations and welfare under CM *vis a vis* PA in order to gain understanding of the welfare gains from financial integration.

In contrast with PA, international capital mobility implies that interest rates must be linked across countries. Indeed, in our deterministic model interest rates must be equal to each other, and thus one can properly define "the" world interest rate $R_t \equiv R_{1t} = R_{2t}$.

In addition, under CM the equilibrium sequence of world interest rates depends on both fiscal deficit policies τ^1 and τ^2. The fiscal deficits of government 1 affect, through their effect on the world interest rate, real allocations and welfare in country 2 and vice versa. As a consequence, the optimal choices of deficit policies depend on whether or not the two governments act cooperatively.

This section starts with a brief discussion of competitive equilibrium under CM. Then it describes optimal policies in a CM regime when the two governments agree on a symmetric cooperative scheme. This case will be called a cooperative CM regime. I show that, not surprisingly, world welfare is strictly greater in a cooperative CM regime than under PA. This provides a justification of financial integration on welfare grounds.

IV.a. Competitive Equilibrium and Feasible Policies in CM

Given a pair of policies $\tau = (\tau^1, \tau^2)$, a world competitive equilibrium under CM is a sequence of world interest rates $\{R_t\}$, debt quantities $\{b_{1t}, b_{2t}\}$, and nonnegative labor effort and old age consumption for each agent $\{(n_{it}, c_{i,t+1})\}$, such that for all $t \geq 1$ and $i = 1,2$:

(CM1) Given $R_{it} = R_t$ and $\tau_{i,t+1}$, $(n_{it}, c_{i,t+1})$ maximizes (2.2) subject to (2.1)

(CM2) Given $b_{i0} = 0$ and $\{R_t\}$, (b_{it}, τ_{it}) satisfies (2.6)

(CM3) $b_{1t} + b_{2t} = n_{1t} + n_{2t}$ for all $t \geq 1$

Condition (CM1) states that given interest rates and government transfers, each individual is maximizing utility. Condition (CM2) states that governments budget constraints are always satisfied. Finally, condition (CM3) is the market clearing condition under CM: it states that the world supply of assets equals the world demand for assets in each period.

The set of feasible policies under CM, that is, the set of joint policies for which there is a competitive equilibrium under CM, can be characterized recursively as follows. Let x_{it} denote the value in period t of agent (i,t-1)'s savings. Given (x_{1t}, x_{2t}), a pair of deficits (τ_{1t}, τ_{2t}) is feasible at t under two conditions. First, total debt supply must be no greater than the maximum possible world savings, which requires:

$$x_{1t} + x_{2t} + \tau_{1t} + \tau_{2t} \leq 2N \qquad (4.1)$$

The second condition is that τ_{it} must assign nonnegative consumption to (i,t-1). This condition can be expressed by:

$$x_{it} + \tau_{it} \geq 0, \ i = 1,2 \qquad (4.2)$$

If (τ_{1t}, τ_{2t}) satisfies (4.1-4.2), then (2.3a), (2.5) and (CM3) imply that the following world interest rate clears the world asset market:

$$R_t = \frac{1}{H+L}(x_{1t} + x_{2t} + \tau_{1t} + \tau_{2t}) \qquad (4.3)$$

and the value in period (t+1) of agent (i,t)'s savings is, from (2.3a) and (4.3):

$$x_{i,t+1} = \frac{K_{i,t+1}}{(H + L)^2}(x_{1t} + x_{2t} + \tau_{1t} + \tau_{2t})^2 \qquad (4.4)$$

A joint policy $\tau = (\tau^1, \tau^2)$ is feasible, i.e., is consistent with a CM competitive equilibrium if and only if (4.1) and (4.2) are satisfied for all t, given that $x_{11} = x_{12} = 0$ and that x_{it} evolve according to (4.4). We shall denote by Γ the set of all feasible policies.

Given a feasible policy, the equilibrium sequence of interest rates is given recursively by (4.3) and (4.4). Then production, consumption and private welfare in both countries are determined by (2.3) and (2.4). Thus a feasible policy determines a whole dynamic equilibrium path for the world economy. Note that competitive equilibrium under CM depends on <u>both</u> fiscal deficit policies τ^1 and τ^2. This is the source of losses if cooperation is missing.

IV.b. <u>Optimal Fiscal Deficits and Welfare Under Cooperation</u>

What fiscal deficits will governments choose if there is international cooperation? An answer will be obtained in this section by assuming that both governments delegate their national power to a "world planner" that is instructed to maximize a "world welfare function". This case will be called a <u>"cooperative CM" regime</u>.

Which world welfare function the planner is supposed to maximize is a crucial question in the cooperative case. I will assume that the planner is instructed to choose a feasible policy in order to maximize the sum of government payoffs $P_1 + P_2$, where P_i is given by (2.7). One may object to this welfare criterion because it treats both countries symmetrically while countries are not exactly symmetric. My answer to this objection is twofold. First, the symmetric case is important because, in practice, international cooperation is defined not only by economic factors but also by equity factors. A second justification is that, as argued in Section II, for low discount rates (β close to one) the two countries become "almost" symmetric. Indeed, we will pay particular attention to the outcomes when β goes to one.

Under the above assumption, the world planner's problem is to choose a feasible policy $\tau = (\tau^1, \tau^2) \in \Gamma$ to maximize $P_1(\tau^1, \tau^2) + P_2(\tau^1, \tau^2)$, where $P_i(.,.)$ is defined in (2.7). This is a recursive discounted dynamic programming problem that can be handled with standard methods, as sketched in Appendix A; I present the results next.

The planner's optimal deficit (τ_{1t}, τ_{2t}) is given recursively by:

$$\tau_{it} = - x_{it} \qquad \text{if } K_{it} = L \tag{4.5}$$

$$= \frac{H\ (H+L)^2}{\beta\ (H^2+L^2)} - x_{it} \qquad \text{if } K_{it} = H \tag{4.6}$$

which implies that the "state" variable x_{it} evolves according to:

$$x_{i,t+1} = \frac{H(H+L)}{\beta(H^2+L^2)} K_{i,t+1} \tag{4.7}$$

The intuition of the optimal cooperative policy (4.5)-(4.7) is simple: the world planner partially equalizes the consumption of rich and poor old agents. One can verify that (4.5)-(4.7) imply that the consumption of an old agent equals h if he is rich and $\ell + H(H+L)^2/\beta(H^2+L^2)$ if he is poor.

The cooperative policy (4.5)-(4.7) also manages to stabilize the world economy in the sense that the resulting world interest rate and therefore world production are constant over time. To see this, notice that (4.3), and (4.5)-(4.7) imply that for all $t \geq 1$:

$$R_t = \frac{H\ (H+L)}{\beta\ (H^2 + L^2)} \tag{4.8}$$

The planner can stabilize the world economy because, although country specific savings fluctuate, the world fundamentals do not. In contrast with PA, CM allows for consumption smoothing across countries. It can be checked that the optimal cooperative policies result in current account surpluses and deficits for each country.

The value of the world's welfare function $P_1 + P_2$ under the cooperative policies (4.5)-(4.7) will be called the <u>world value of cooperation</u>, and denoted by v_c. One can easily show that:

$$v_c = \left\{ H^2(H+L)^2/2\beta^2(H^2+L^2) \right\} + \omega_1 + \omega_2. \tag{4.9}$$

The <u>value of cooperation for government i</u>, that is, the value of P_i under the cooperative policy (4.5)-(4.7), will be denoted by v_i^c . One can easily show that:

$$v_1^c = \lambda(v_c - (\omega_1+\omega_2)) + \omega_1 \tag{4.10}$$

$$v_2^c = (1-\lambda)(v_c - (\omega_1+\omega_2)) + \omega_2, \tag{4.11}$$

where $\lambda = \{L^2 + (2-\beta)H^2\}/(1+\beta)(H^2+L^2)$.

Comparing these results with those in PA (equation (3.4)) we obtain that:

(i) Total world welfare, as measured by the sum $P_1 + P_2$, is larger in a cooperative CM regime than under PA. Under PA, total world welfare is equal to $v_1^{PA} + v_2^{PA} = \omega_1 + \omega_2 + (H^2+L^2)/2\beta^2$, which is always lower than v_c. Thus, from an "international" perspective, cooperation improves welfare.

(ii) At least one of the two countries obtains higher welfare, measured by P_i, in a cooperative CM regime than under PA. Moreover, if β is sufficiently close to one, both countries must benefit from the cooperative CM regime. The latter point can be seen by noting that $\lim_{\beta\to 1} v_i^c = (u(\ell)+u(h))/2 + H^2(H+L)^2/4(H^2+L^2) > (u(\ell)+u(h))/2 + (H^2+L^2)/4 = \lim_{\beta\to 1} v_i^{PA}$ for both i = 1,2. Thus, if discounting is sufficiently small, a switch from PA to a cooperative CM world makes both countries better off.

V. Financial Integration Without International Policy Coordination

This section studies a noncooperative CM world, in which there is perfect capital mobility but no intergovernmental cooperation. In the absence of cooperation, CM implies an externality that may result in welfare losses relative to PA. Ricardian equivalence does not hold in our model, and fiscal deficits may distort interest rates and intertemporal allocations. If there is portfolio autarky, these dynamic distortions are taken into account by the governments in choosing deficits optimally. But in a noncooperative CM world each government ignores the distortions caused by its own deficit on the welfare of foreigners, therefore understating the cost of its deficit. This implies that each government has an incentive to choose excessively large fiscal deficits. When both governments try to exploit each other in this way, deficits turn out to be too large. This implies a welfare loss that, in our model, more than outweighs the benefits from consumption smoothing.

This section analyzes the noncooperative CM regime as a dynamic game which possesses a Nash equilibrium in which fiscal deficits are larger, the world interest rate larger, and world welfare lower than under cooperation. Our main result is that a noncooperative CM regime results in lower welfare for both countries than portfolio autarky, provided discounting is small. The policy message of this section is, therefore, that financial integration can be counterproductive if governments do not coordinate their fiscal deficit policies.

V.a. Optimal Fiscal Policies in a Noncooperative CM World

I will characterize the outcomes of a noncooperative CM regime by the noncooperative equilibria of a dynamic game. In this game, governments 1 and 2 are the players. The fiscal policy chosen by each government is its strategy. Given a joint strategy, the payoff for government i is the value of the social welfare function defined by (2.7).

I will focus on the Nash equilibria of the game. A Nash equilibrium (NE) is a pair of strategies, one for each player, such that each player's strategy maximizes its payoff given the other government's strategy.

Strategies can be, in principle, functions of the whole history of the game. Given the recursive structure of the model, I shall restrict attention to Markov Nash Equilibria (MNE), that is, Nash equilibria in Markov strategies. A Markov strategy for player i is a real valued function $\tau_{it} = \tau_i(x_{1t}, x_{2t}, K_{1t}, K_{2t})$. Thus, a Markov strategy for i is such that the deficit actually chosen by government i at t is a function of the "state" at t. Focusing on MNE is natural because the best response to a Markov strategy is also Markov, as shown in Appendix B, and because a MNE is subgame perfect.

The calculation of MNE is cumbersome. I delay technical details to Appendix B and collect the results below. I assume that the parameters of the model satisfy the following technical assumption [9]:

$$(H+L)^2(H^2+L^2)^2 \geq 4\beta \text{ HL } N^2 \ (H^3-L^3) \text{ and } \ 2(H+L)(H^2+L^2) \leq \beta \text{ HL N}. \qquad \text{(AS)}$$

[9] Assumption (AS) is a sufficient but by no means a necessary condition for the MNE. The Appendix shows that the role of (AS) is to ensure that the solutions of the maximization problems of both governments are always interior and characterized by first order conditions. Thus, I make the assumption (AS) for simplicity: without (AS), MNE policies may require corner solutions for some values of x, and MNE would become much more complicated. Notice also that (AS) can always be satisfied if (H^3-L^3) is sufficiently small.

Then the dynamic game has a MNE in which deficits are of the form:

$$\tau_{it} = \tau_i(x_{1t},x_{2t},K_{1t},K_{2t}) = \gamma + \mu_i(K_{1t},K_{2t})(x_{1t} + x_{2t}), \quad i = 1,2 \tag{5.1}$$

where $\mu_i(.,.)$ and γ are given in Appendix B. These policies imply that the evolution of x_{it} is given by:

$$x_{i,t+1} = K_{i,t+1} \left(\frac{H^2 + L^2}{\beta HL} \right)^2 \tag{5.2}$$

and that the world interest rate is constant and given by:

$$R_t = \frac{H^2 + L^2}{\beta HL} \tag{5.3}$$

As in a cooperative CM regime, the MNE strategies result on the complete stabilization of the world economy, in the sense that the world interest rate, world production, and the total amount of debt service is constant for all periods. These facts could suggest that the MNE policies are similar to cooperative ones. However, a comparison of (4.8) and (5.3) reveals that world interest rates are larger in a MNE than in a cooperative regime, which reflects that the MNE deficits are larger on average than the cooperative deficits [10].

The intuition, as stated at the beginning of this section, is that the

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[10] It must be noticed, incidentally, that the absence of interest rate or production fluctuations is no evidence of cooperation. Both the cooperative CM and noncooperative CM regimes result in constant interest rates and world production. Likewise, equality of interest rates across countries is not necessarily welfare improving.

fiscal deficits of government 1 affect R_t and therefore welfare in country 2. In the absence of cooperation, government 1 ignores this international effect of its deficit. As government 2 does the same, the outcome is that fiscal deficits tend to be too large.

V.b. The Welfare Losses from A Noncooperative CM World

The payoff that government i receives in the MNE will be called the value of noncooperation and denoted by v_i^N. The results in the Appendix imply that:

$$v_1^N = \omega_1 + \alpha, \quad v_2^N = \omega_2 - \alpha \tag{5.4}$$

where α is a constant described in the Appendix.

Comparing (5.4) with our results in previous sections we find that:

(i) Not surprisingly, total world welfare, measured by the sum $P_1 + P_2$, is lower in a noncooperative CM regime than in a cooperative CM regime. From (5.4), a noncooperative CM regime results in a world welfare level of $v_1^N + v_2^N = \omega_1 + \omega_2$, which is less than v^c. This also implies that at least one country is worse off in a noncooperative CM regime than in a cooperative CM one . If discounting is small enough, we obtain the stronger result that, under CM, absence of cooperation makes both countries worse off.

(ii) A more surprising result is that world welfare turns out to be lower in a noncooperative CM regime than under Portfolio Autarky. Total world welfare, measured by $P_1 + P_2$, is lower in a noncooperative CM regime than under PA [11]. This also implies that at least one country is worse off in a

[11] From (3.4) and (5.4), $v_1^{PA} + v_2^{PA} = \omega_1 + \omega_2 + (H^2 + L^2)/2\beta^2 > \omega_1 + \omega_2 = v_1^N + v_2^N$.

noncooperative CM regime. Finally, $v_i^{PA} > v_i^N$ for both i when β is sufficiently close to one [12]; that is, if discounting is small enough <u>both</u> countries would rather live in a Portfolio Autarky World than in a noncooperative CM world.

Some intuition for this result can be obtained by looking at the MNE policies (5.1). The <u>potential</u> gains from international capital mobility are due to the possibility of transferring resources to poor old agents, smoothing consumption. Noncooperative behavior prevents this smoothing, which is reflected in the fact that the MNE transfers (5.1) have no clear link to endowment fluctuations. Thus, in the absence of cooperation the <u>realized</u> gains from international capital mobility are small. In addition, in a noncooperative CM regime fiscal deficits always tend to be inefficiently large. The latter effect dominates, and financial integration reduces welfare in the absence of international cooperation.

VI. Final Remarks

This paper has studied a model with and without international capital mobility and with and without international policy coordination. The main result is that, while financial integration may be beneficial under international cooperation, it may reduce welfare if governments do not coordinate their fiscal deficits.

The main qualification to these results is that the symmetric MNE discussed in Section V may not be the unique subgame perfect NE of the noncooperative CM regime. Indeed, there may be a NE in which cooperative policies are supported by noncooperative strategies based on threats and reputation (as in Benhabib and Radner (forthcoming) and Chang (1990)). Short

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[12] This follows because, from (3.4) and (5.4), $\lim_{\beta \to 1} v_i^N = (u(\ell)+u(h))/2 < \lim_{\beta \to 1} v_i^{PA}$.

of a theory of how a particular NE will be selected, our main result can be restated as follows: if governments do not cooperate implicitly or explicitly, then financial integration may make all countries worse off.

The main intuition of the paper is that financial integration increases the international effects of domestic financial policies (such as deficit policies), which tends to decrease welfare if governments act noncooperatively. The increased losses from noncooperative behavior may outweigh the benefits from financial integration. Then one can be sure that financial integration improves welfare if and only if there is international cooperation.

In view of my results, an important issue is to determine if financial integration is actually beneficial in models that better approximate actual economies than the model of this paper. A second issue is, why would rational governments choose to eliminate restrictions to capital flows if they are not planning to coordinate fiscal policy? I leave these questions for future work.

Appendix A

The purpose of this Appendix is to supply the details underlying the claims in Section IV.b. The problem of the world planner is to maximize P_1+P_2, given by (2.8), subject to (4.1)-(4.4). Since ω_1 and ω_2 are constant, this is equivalent to maximizing $P_1+P_2-\omega_1-\omega_2$ subject to the same constraints. Thus reformulated, the planner's problem is a standard dynamic programming problem. Let $v(s_t)$ denote the associated value function in period t, which depends on the state $s_t = (x_{1t},x_{2t},K_{1t},K_{2t})$. Then v is the only solution of the Bellman equation:

$$v(s_t) =$$

$$\underset{\tau_{1t},\tau_{2t}}{\text{Max}} \quad (1-\beta) \left\{ \frac{K_1\tau_{1t}+ K_2\tau_{2t}}{\beta} + \frac{H^2+L^2}{2(H+L)^2} (x_{1t}+x_{2t}+\tau_{1t}+\tau_{2t})^2 \right\} + \beta\, v(s_{t+1})$$

subject to (4.1)-(4.4), and $K_{1,t+1} = K_{2t}$, $K_{2,t+1} = K_{1t}$.

One can check directly that the solution of this equation is:

$$v(s_t) = \frac{H^2(H+L)^2}{2\beta^2(H^2+L^2)} - \frac{H^2+L^2}{H+L}\,\frac{1-\beta}{\beta}\,(x_{1t}+x_{2t})$$

and that the associated policy function is given by (4.5)-(4.6). Finally, equation (4.9) is implied by $P_1 + P_2 = \omega_1+\omega_2 + v(s_1)$ and $s_1 = (0,0,H,L)$.

Appendix B

The purpose of this Appendix is to show that the dynamic game described in section V.a. has a Markov Nash equilibrium of the form (5.1), in which:

$$\gamma = \frac{(H+L)\ (H^2+L^2)}{2\beta HL} \tag{A1}$$

$$\mu_1(K_1,K_2) = -\ \frac{K_1^3 - K_2^3 + 2K_2^2\ (H+L)}{2(H+L)\ (H^2+ L^2)} \tag{A2}$$

$$\mu_2(K_1,K_2) = -\ \frac{K_2^3 - K_1^3 + 2K_1^2\ (H+L)}{2(H+L)\ (H^2+ L^2)} \tag{A3}$$

and that implies the outcomes given in (5.2), (5.3), and (5.4).

Assume that government 2's policy is given by $\tau_{2t} = \gamma_2 + \mu_2(K_{1t},K_{2t})(x_{1t}+x_{2t})$. The problem of government 1 is to maximize (2.8) subject to this policy and (4.1)-(4.4). We will ignore the constant ω_1 for the time being. Government 1's problem is a standard dynamic programming problem. Let $v_1(x_1,x_2,K_1,K_2)$ be the value function of government 1's problem if the starting state is (x_1,x_2,K_1,K_2). Then v_1 is the only solution of:

$$v_1(x_1,x_2,K_1,K_2) = \underset{\tau}{\text{Max}}\ \ W_1(x_1,x_2,K_1,K_2,\tau) + \beta\ v_1(x_1',x_2',K_2,K_1) \tag{A4}$$

subject to:

$$x_1 + \tau \geq 0 \tag{A5}$$

$$x_1 + x_2 + \tau + \tau_2(x_1,x_2,K_1,K_2) \leq 2N \tag{A6}$$

$$x_i' = \frac{K_i'}{(H+L)^2}\ (x_1+ x_2+ \tau + \tau_2(x_1,x_2,K_1,K_2))^2 \tag{A7}$$

where primes denote next period values and:

$$W_1(x_1,x_2,K_1,K_2) = (1-\beta) \left\{ \frac{K_1\tau}{\beta} + \frac{K_2^2}{2(H+L)^2}\ (x_1+x_2+\tau+\tau_2(x_1,x_2,K_1,K_2))^2 \right\}$$

The first order condition for the maximization in (A4) is given by:

$$(1-\beta)\left[\frac{K_1}{\beta}+\frac{K_2^2}{(H+L)^2}(x_1+x_2+\tau+\tau_2)\right]$$

$$+\frac{2\beta\,(x_1+x_2+\tau+\tau_2)}{(H+L)^2}\left[K_2\frac{\partial v_1}{\partial x_1}+K_1\frac{\partial v_1}{\partial x_2}\right]=0 \tag{A8}$$

where $\partial v_1/\partial x_i$ is evaluated at (x_1',x_2',K_2,K_1).

The Benveniste-Scheinkman Lemma together with (A8) now imply that: $\frac{\partial v_1}{\partial x_i}(x_1,x_2,K_1,K_2) = -(1-\beta)\frac{K_1}{\beta}(1+\mu_2(K_1,K_2))$, for i = 1,2. Inserting this expression in (A8) and simplifying we obtain the optimal choice of τ for government 1. One can check that, as claimed, government 1's best response has the form (5.1) with:

$$\gamma_1=\frac{K_1}{\beta}\left[\frac{2K_2\,(1+\mu_2(K_2,K_1))}{H+L}-\frac{K_2^2}{(H+L)^2}\right]^{-1}-\gamma_2 \tag{A9}$$

and:

$$\mu_1(K_1,K_2) = -(1+\mu_2(K_1,K_2)) \tag{A10}$$

Now, we need to find coefficients γ_i and functions $\mu_i(K_1,K_2)$, i= 1,2 that solve (A9),(A10), and the corresponding equations for government 2. We will search for a solution that is symmetric in the sense that $\mu_1(K_1,K_2) = \mu_2(K_2,K_1)$ and $\gamma_1 = \gamma_2 = \gamma$. In this solution, the policy of government 2 in odd periods is the same as that of government 1 in even periods and viceversa.

We proceed as follows: (A9) implies that if γ is going to be independent of (K_1,K_2) it must be the case that:

$$\frac{K_1}{\beta}\left[\frac{2\ K_2\ (1+\mu_2(K_2,K_1))}{H+L} - \frac{K_2^2}{(H+L)^2}\right]^{-1} =$$

$$\frac{K_2}{\beta}\left[\frac{2\ K_1\ (1+\mu_2(K_1,K_2))}{H+L} - \frac{K_1^2}{(H+L)^2}\right]^{-1} \tag{A11}$$

Using (A10) in (A11) and simplifying we obtain the solution for $\mu_1(K_1,K_2)$ as given by equation (A2). Since we assumed symmetry, $\mu_2(K_1,K_2) = \mu_1(K_2,K_1)$, which together with (A10) implies (A3). Inserting (A2) in (A9) and assuming $\gamma_1 = \gamma_2 = \gamma$ gives the solution for γ in (A1).

These MNE policies imply that $(x_{1t}+x_{2t}+\tau_{1t}+\tau_{2t}) = (H+L)(H^2+L^2)/\beta HL$ for all t, independently of the state. This fact and (4.3)-(4.4) imply (5.2) and (5.3) of the text.

Reintroducing the constant ω_i, one now can check that the value function for government i = 1,2 is given by:

$$v_i(x_1,x_2,\ K_1,K_2) = \omega_i + A_i(K_1,K_2) + \frac{(1-\beta)\ K_i}{\beta}\ \mu_i(K_1,K_2)\ (x_1+x_2) \tag{A12}$$

where $A_1(H,L) = A_2(L,H) = \alpha$, $A_1(L,H) = A_2(H,L) = -\alpha$, and α is given by:

$$(1+\beta)\alpha = \left[\frac{H}{\beta} + L\right]\gamma +$$

$$\left(\frac{H^2+L^2}{\beta HL}\right)^2 \left[\frac{L^2+\beta H^2}{2} + (H+L)\ (L\mu_1(L,H) + \beta\ H\mu_1(H,L))\right] \tag{A13}$$

Note that (A2),(A3), and (A13) imply that $\alpha \to 0$ as $\beta \to 1$, as claimed in the text. Equation (5.4) now follows from (A12) by evaluating $v_i(x_1,x_2,H,L)$ at the starting state (0,0,H,L).

To finish the proof, one must show that the MNE policies defined by (5.1), (A1)-(A.3) are always feasible. This requires showing that for all feasible (x_{1t},x_{2t}):

$$x_{it} + \tau_i(x_{1t},x_{2t},K_{1t},K_{2t}) \geq 0 \tag{A14}$$

$$x_{1t} + x_{2t} + \tau_1(x_{1t},x_{2t},K_{1t},K_{2t}) + \tau_2(x_{1t},x_{2t},K_{1t},K_{2t}) \leq 2N \tag{A15}$$

The set of feasible values of (x_{1t},x_{2t}), which has been implicit in our discussion, is $X = \{ (x_1,x_2) |\ 0 \leq x_i \leq 4HN^2/(H+L)^2$ and $0 \leq x_1+x_2 \leq 4N^2/(H+L) \}$. Using this fact and (A1)-(A3) it follows that the condition $(H+L)^2(H^2+L^2)^2 \geq 4\,\beta\,HL\,N^2\,(H^3 - L^3)$ is sufficient (although not necessary) for (A14) to be satisfied. On the other hand, (A1)-(A3) implies that (A15) is satisfied for all $(x_{1t},x_{2t}) \in X$ if $2(H+L)(H^2+L^2) \leq \beta HLN$. These are the conditions stated in (AS). The proof is complete. ▮

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