WELFARE AND MACROECONOMIC
INTERDEPENDENCE*

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We develop a baseline model of monetary and fiscal transmission in interdependent economies. The welfare effects of expansionary policies are related to monopolistic supply in production and monopoly power of a country in trade. An unanticipated exchange rate depreciation can be *beggar-thyself* rather than *beggar-thy-neighbor,* as gains in domestic output are offset by deteriorating terms of trade. Smaller and more open economies are more prone to suffer from inflationary shocks. Larger economies benefit from moderate demand-led expansions, but may be worse off if policy-makers attempt to close the output gap. Fiscal shocks are generally *beggar-thy-neighbor* in the long run; in the short run they raise domestic demand at given terms of trade, thus reducing the welfare benefits from monetary expansions. Analytical tractability makes our model uniquely suitable as a starting point to approach the recent "new open-economy macroeconomic" literature.

I. Introduction

How are policy shocks transmitted in open economies? How do they affect national residents' welfare? This paper is part of the ongoing research program aimed at building a modern theoretical paradigm for international policy evaluation—based on micro-founded models of imperfect competition with nominal rigidities—to address such questions. In the new literature, as in the traditional Mundell-Fleming-Dornbusch model, nominal shocks increase domestic output and employment and depreciate the real exchange rate. In contrast to the traditional approach, policy analysis based on the new models can rely on an index of

social welfare that is logically consistent with the behavioral analysis of the international transmission mechanism.

The first generation of contributions to the new literature[1] has emphasized the welfare and policy implications of monopoly distortions in production, extending to an open-economy setting the key conclusions of influential closed-economy models such as Blanchard and Kiyotaki [1987] and Ball and Romer [1990].[2] In such models wages and prices are suboptimally high, while output and consumption are suboptimally low. Given nominal rigidities, a small demand shock that raises output toward its efficient levels also improves national welfare. Consistently, in the benchmark open-economy model by Obstfeld and Rogoff [1995], a small unanticipated monetary expansion raises consumption and welfare everywhere in the world economy, no matter whether the shock originates at home or abroad. Only if one considers other internal inefficiencies in addition to monopolistic supply (such as nonlump-sum income taxes) do money shocks have asymmetric effects on domestic and foreign residents.

In open economies, however, there exists an economic distortion that is *directly* associated with openness, namely, a country's power to affect its terms of trade by influencing the supply of its products. The literature still lacks a comprehensive exploration of the interplay between internal and external sources of economic distortion (that is, monopolistic supply in production and monopoly power of a country in trade) that lies at the very core of the "new open-economy macroeconomics." This paper attempts to fill this gap by providing a baseline choice-theoretic analysis of monetary and fiscal transmission in interdependent economies.

When we account for both internal and external distortions, the analogies of policy analysis in open- and closed-economy models break down in several crucial dimensions. Consider, for instance, the effects of unanticipated money shocks. In both closed and open economies with nominal rigidities, monetary surprises raise output toward its efficient level. In open economies, however, they also reduce domestic consumers' purchasing power in the global markets. Because of the latter effect, expansionary policies can be *beggar-thyself.* Smaller and more open

economies are more likely to suffer from domestic nominal shocks that worsen their terms of trade. Larger economies, that could benefit from moderate output and employment gains, are actually worse off if policy-makers engineer large monetary expansions in an attempt to close the gap between actual and potential output.

Our analysis has rather unorthodox policy implications. In contrast with the popular model of competitive devaluations, exchange rate shocks are not *beggar-thy-neighbor*: due to deteriorating terms of trade, the benefits from a domestic monetary expansion accrue primarily to foreigners. Also in contrast with the conventional wisdom, domestic fiscal expansions hurt the trading partners: fiscal linkages are in general *beggar-thy-neighbor* in the long run. In the short run, fiscal shocks modify the trade-off between employment and domestic inflation by raising domestic demand at unchanged terms of trade, thus reducing the welfare benefits from a monetary expansion.

While complementing and expanding the findings of the "first-generation" new open-economy macroeconomics, these novel results do not come at the price of introducing additional technical difficulties: if anything, our setting can be viewed as a useful simplification of the models epitomized by Obstfeld and Rogoff [1996, Ch. 10]. Our two-country, general-equilibrium model can be solved in closed form without imposing symmetry upon the economic structures of the two countries and without resorting to local log-linear approximations—a quantum leap over alternative specifications in terms of analytical tractability. While somewhat restrictive, a modeling strategy leading to a closed-form solution makes our analytical framework uniquely suitable to "inspect the mechanism" of international policy transmission and assess its welfare implications in both deterministic and stochastic settings. Because of this, our contribution provides a good starting point to approach the recent fast-growing micro-founded theory of macroeconomic interdependence.

The paper is structured as follows. Sections II introduces the model. Section III describes its structural form and solution in an application to the case of permanent monetary and fiscal shocks. Section IV studies the welfare effects of domestic monetary shocks, contrasting results in closed- and open-economy policy analysis. Sections V and VI delve into the analysis of monetary and fiscal interdependence. Section VII provides a synthesis of our results. Section VIII concludes.

II. THE MODEL

A. Preferences and Consumption Indexes

Our theoretical framework consists of a general equilibrium two-country model. Two key features of our framework, i.e., nominal rigidities and monopolistic competition, are standard in the new open-economy macroeconomic literature. The introduction of short-run nominal rigidities is motivated in terms of empirical plausibility and realism. Characterizing economywide distortions in terms of monopoly power is logically coherent with the assumption that output is demand-determined when prices are fixed. The main departure of our framework from the previous literature is a specification according to which the substitutability among nationally produced goods is higher than between domestic goods and foreign goods as a group. It is this very feature that allows us to examine the macroeconomic and welfare implications of terms of trade externalities.

The model includes two countries, Home and Foreign, each specialized in the production of a traded good. In each country there is a continuum of economic agents, with population size normalized to 1.

The lifetime utility of Home agent $j \in [0, 1]$ is given by

(1) $U_t(j)$

$$= E_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \left[\frac{C_\tau(j)^{1-\rho}}{1 - \rho} + \chi \ln \frac{M_\tau(j)}{P_\tau} + V(G_\tau) - \frac{\kappa}{2} l_\tau(j)^2 \right]$$

$$\beta, \rho, \chi, \kappa > 0.$$

Here β is the discount rate, equal to $1/(1 + \delta)$, where $\delta > 0$ is the rate of time preference, and $1/\rho$ is the elasticity of intertemporal substitution. The consumption index for the Home agent, C, is defined as

(2) $C_t(j) \equiv (C_{H,t}(j))^\gamma (C_{F,t}(j))^{1-\gamma}$ $0 < \gamma < 1$,

where $C_H(j)$ and $C_F(j)$ are, respectively, consumption of the Home good and consumption of the Foreign good by individual j. Domestic real money holdings, M/P, provide liquidity services that enter the utility function. The function V is individual utility from public goods G, while l is the amount of labor supplied by the agent.

The utility of Foreign agent j*—foreign variables are indexed

by asterisks—is similar to (1). Preferences over consumption goods are symmetric both within and across countries: the elasticity of substitution $1/\rho$ and the rate of time preference δ of Foreign agents are identical to those of Home agents. The weight γ in agent $j*$'s consumption index is the same as in (2):

$$(3) \qquad C_t^*(j^*) \equiv (C_{H,t}^*(j^*))^\gamma (C_{F,t}^*(j^*))^{1-\gamma}.$$

Yet, there are two notable differences between the two countries. First, the weight of the Home good in preferences can be different from the weight of the Foreign good ($\gamma \neq \frac{1}{2}$). Second, domestic and foreign agents are dissimilar as far as preferences toward liquidity, leisure, and public goods are concerned: the Home parameters χ and κ need not be equal to the corresponding Foreign parameters χ^* and κ^*, and V can be different from V^*.

The consumption-based price indexes that correspond to the above preference specification[3] are

$$(4) \qquad P_t \equiv \frac{1}{\gamma_W}(P_{H,t})^\gamma (P_{F,t})^{1-\gamma} \qquad P_t^* \equiv \frac{1}{\gamma_W}(P_{H,t}^*)^\gamma (P_{F,t}^*)^{1-\gamma},$$

where $\gamma_W \equiv \gamma^\gamma (1 - \gamma)^{(1-\gamma)}$. In equations (4), P_H and P_F are the prices of Home and Foreign goods in Home currency, P_H^* and P_F^* the prices of Home and Foreign goods in Foreign currency.

B. Technology and Production

In each country output is produced with a continuum of differentiated labor inputs that are provided by domestic agents. Technology is described by a linear-homogeneous CES production function—for the Home country, we have

$$(5) \qquad Y_t = \left(\int_0^1 l_t(j)^{(\phi-1)/\phi} \, dj \right)^{\phi/(\phi-1)} \qquad \phi > 1,$$

where Y denotes output. Each agent is a monopolistic supplier of one specific input. The elasticity of input substitution ϕ is therefore a (decreasing) index of imperfect competition: the smaller the degree of substitutability among inputs, the higher the market power of agents. Note that, unlike first-generation "new open-economy macroeconomic" models, we do not restrict the degree of monopolistic competition to vary with the elasticity of substitu-

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3. The consumption-based price index P is defined as the minimum expenditure required to buy one unit of the composite good C, given the prices of the Home and Foreign goods.

tion between foreign and domestic goods, which in our model is constant and equal to one.[4]

Firms act competitively.[5] From the Home firms' profit maximization problem, we derive the labor demand for each type of labor:

(6) $l_t(j) = (W_t(j)/P_{\mathrm{H},t})^{-\phi}Y_t,$

where $W(j)$ is the nominal wage rate. Similar relations hold for the Foreign country, noting that the elasticity ϕ^* can be different from ϕ. As firms are price-takers both domestically and abroad, the law of one price holds: goods prices expressed in the same currency are equal across countries. Denoting by $\mathscr{E}$ the nominal exchange rate (domestic currency per unit of foreign currency), we have

(7) $P_{\mathrm{F},t} = P_{\mathrm{F},t}^*\mathscr{E}_t \quad P_{\mathrm{H},t}^* = P_{\mathrm{H},t}/\mathscr{E}_t.$

While the terms of trade $(P_{\mathrm{H}}/\mathscr{E}P_{\mathrm{F}}^*)$ move in response to shocks in the global economy, consumption-based purchasing power parity $(P = \mathscr{E}P^*)$ always holds in our model as a straightforward implication of the law of one price and the assumptions on preferences.

C. Budget and Resource Constraints

Agents hold two assets, national money and an international bond B. Without loss of generality, this bond is denominated in the Home country currency. Its nominal yield (paid at the beginning of period t) is denoted i_t, while its rate of return in terms of consumption units is denoted r_t, with $1 + r_t = (1 + i_t)P_{t-1}/P_t$.

In the Home country, the individual budget constraint is

(8) $B_{t+1}(j) + M_t(j) \leq (1 + i_t)B_t(j) + M_{t-1}(j) + W_t(j)l_t(j)$

$$- P_tT_t(j) - P_{\mathrm{H},t}C_{\mathrm{H},t}(j) - P_{\mathrm{F},t}C_{\mathrm{F},t}(j),$$

where T are nondistortionary (lump-sum) net taxes, denominated

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4. For instance, in Obstfeld and Rogoff [1995] the consumption indexes are defined over a continuum of differentiated goods, which enter the index with a common elasticity of intratemporal substitution. A single parameter thus plays the double role of elasticity of substitution between foreign and domestic goods and index of monopolistic distortion.

5. The assumption that goods markets are perfectly competitive but labor markets are not, is by no means essential for our results. One could derive the same analytical solution of Section III below within an alternative setup in which firms are imperfectly competitive, while labor markets are competitive. This alternative specification allows for a continuum of differentiated goods, both domestically produced and imported.

in composite consumption units.[6] Similarly, agent $j*$'s budget constraint is

$$(9) \quad \frac{B_{t+1}^*(j^*)}{\mathscr{E}_t} + M_t^*(j^*) \le (1 + i_t) \frac{B_t^*(j^*)}{\mathscr{E}_t} + M_{t-1}^*(j^*)$$

$$+ W_t^*(j^*)l_t^*(j^*) - P_t^* T_t^*(j) - P_{H,t}^* C_{H,t}^*(j^*) - P_{F,t}^* C_{F,t}^*(j^*),$$

where we observe that the realized Foreign-currency return on the international bond at the beginning of time t is $(1 + i_t)\mathscr{E}_{t-1}/\mathscr{E}_t$.

Realistically, we assume that each national government spends exclusively on domestically produced goods. At any point in time the Home government sets public spending G_t, individual net taxes $T_t(j)$, and money M_t such that

$$(10) \quad M_t - M_{t-1} + P_t \int_0^1 T_t(j) \, dj \ge P_{H,t} G_t,$$

where

$$(11) \quad M_t = \int_0^1 M_t(j) \, dj.$$

Similar constraints characterize the Foreign economy.

At the world level the international bond is in zero-net supply:

$$(12) \quad \int_0^1 B_t(j) \, dj + \int_0^1 B_t^*(j^*) \, dj^* = 0.$$

Last, we write the worldwide resource constraints for the two goods:

$$(13) \quad Y_t \ge G_t + \int_0^1 C_{H,t}(j) \, dj + \int_0^1 C_{H,t}^*(j^*) \, dj^*$$

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6. We adopt the notation of Obstfeld and Rogoff [1996, Ch. 10]. Specifically, our timing convention has $M_t(j)$ as agent j's nominal balances accumulated during period t and carried over into period $t + 1$, while $B_t(j)$ denotes agent j's bonds accumulated during period $t - 1$ and carried over into period t with nominal return i_t.

$$(14) \qquad Y_t^* \geq G_t^* + \int_0^1 C_{\mathrm{F},t}(j)\,dj + \int_0^1 C_{\mathrm{F},t}^*(j^*)\,dj^*.$$

D. Nominal Rigidities and Participation Constraints

In both countries there are nominal rigidities that we introduce in the form of one-period nominal wage contracts. Nominal wages in period t are predetermined with contracts signed at time $t-1$. When setting her wage $W(j)$, each Home agent acts as a monopolistic supplier of her productive input, i.e., takes into account firms' demand (6) in her utility maximization problem. From the first-order conditions, the optimal preset wage then satisfies

$$(15) \qquad E_{t-1}[\kappa l_t^2(j)] = \frac{\phi - 1}{\phi}\, W_t(j)\, E_{t-1}\left[\frac{1}{P_t}\frac{l_t(j)}{C_t(j)^\rho}\right].$$

The lower the wage rate $W(j)$, the higher the demand for agent j's labor and her labor income (since $\phi > 1$). At the margin, the expected disutility from an increase in labor effort (left-hand side) is equal to the expected utility from higher revenue (right-hand side).

Ex post—once nominal wages are set—agents are willing to meet any unanticipated changes in firms' labor demand, provided that the real wage does not fall below the marginal rate of substitution between consumption and leisure:

$$(16) \qquad \kappa l_t^2(j) \leq W_t(j)\,\frac{1}{P_t}\frac{l_t}{C_t(j)^\rho} \quad \text{or} \quad \frac{W_t(j)}{P_t} \geq \kappa l_t(j) C_t(j)^\rho.$$

If, due to a large demand shock, the above inequality did not hold at the predetermined wage rate, Home agents would be better off by refusing to supply the additional labor requested by firms. In our model, we restrict the set of policy shocks so that the "participation constraint" (16) and its Foreign analog are never violated.

E. Equilibrium

Given an initial allocation of $B_{t_0}, B_{t_0}^*, M_{t_0-1}$, and $M_{t_0-1}^*$, and the processes for $G_t, G_t^*, M_t, M_t^*, T_t(j)$, and $T_t^*(j^*)$ for all $t \geq t_0$, an equilibrium is a set of processes for $C_{\mathrm{H},t}(j), C_{\mathrm{F},t}(j), B_{t+1}(j),$ $M_t(j), l_t(j), C_{\mathrm{H},t}^*(j^*), C_{\mathrm{F},t}^*(j^*), B_{t+1}^*(j^*), M_t^*(j^*), l_t^*(j^*), Y_t, Y_t^*, W_t(j),$ $W_t^*(j^*), P_{\mathrm{H},t}, P_{\mathrm{F},t}, P_{\mathrm{H},t}^*, P_{\mathrm{F},t}^*, \mathscr{E}_t,$ and i_{t+1} such that, for all $t \geq t_0$, (i) the government budget constraint (10) and its Foreign analog are

satisfied; (ii) given prices $P_{\mathrm{H},t}, P_{\mathrm{F},t}, \mathscr{E}_t$, and i_{t+1} Home agents maximize (1) subject to (2), (4), (8), and the no-Ponzi game constraint, and set wages $W_t(j)$ according to (15); (iii) given prices $P_{\mathrm{H},t}^*, P_{\mathrm{F},t}^*, \mathscr{E}_t$, and i_{t+1} Foreign agents solve the analog optimization problem; (iv) firms choose $l_t(j)$ and $l_t^*(j^*)$ according to (6) and its Foreign analog; output levels Y_t and Y_t^* are determined according to (5) and its Foreign analog; (v) the Home and Foreign markets for Home and Foreign goods, Home and Foreign monies, and the international bond clear; that is, conditions (7), (11), and its Foreign analog, (12), (13), and (14) hold.

The rest of the paper considers an equilibrium in which agents are symmetric within each country, dropping the indexes j and j^* and interpreting all variables in per-capita terms. Note that, according to (5), in an equilibrium where $l_t(j) = l_t$ and $l_t^*(j^*) = l_t^*$ output is a linear function of labor: $Y_t = l_t$ and $Y_t^* = l_t^*$. Condition (6) then implies that product prices are always equal to nominal wages ($P_{\mathrm{H},t} = W_t$, $P_{\mathrm{F},t}^* = W_t^*$).

III. UNDERSTANDING INTERDEPENDENCE

A. Methodology and Notation

Focusing on the analysis of policy interdependence, in what follows we restrict our attention to the effects of once-and-for-all unanticipated changes in domestic or foreign money and government spending—the same perfect-foresight exercise as in the Dornbusch [1976] "overshooting" model and the Obstfeld and Rogoff [1995] "redux" model. In addition to facilitating the comparison with this literature, the application proposed below provides an intuitive yardstick to approach the stochastic versions of our model.

Throughout our exercise, we assume that the economy starts off in a steady-state equilibrium in which neither country is a net debtor. To save on unnecessary notation, we hereafter drop time subscripts: variables in the initial (preshock) steady state are indexed by the subscript 0, variables in the new (postshock) steady state are indexed by upperbars, while short-run variables are not indexed. The short run coincides with the length of the wage contracts, and therefore lasts one period only. As all policy changes in our exercise are unanticipated, wages in the short run are set at a level consistent with the initial steady-state equilibrium (so that $W_0 = P_{\mathrm{H}_0} = W$ and $W_0^* = P_{\mathrm{F}_0}^* = W^*$).

In our analysis of monetary policy, shocks are defined as unexpected changes in the long-run money stocks, $\bar{M} \geq M_0$ and $\bar{M}^* \geq M_0^*$. Since these changes are permanent, short-run and long-run stocks coincide: $M = \bar{M}$ and $M^* = \bar{M}^*$.

Fiscal policy is expressed by an index of government spending, defined as the ratio of total output to output net of spending. In the Home country we have $g \equiv Y/(Y - G)$ for the short run, and $\bar{g} \equiv \bar{Y}/(\bar{Y} - \bar{G})$ for the long run; g^* and $\bar{g}^*$ are similarly defined. Note that these indexes are equal to one when government spending is zero, and are increasing functions of the spending to output ratios. Using these indexes, we define fiscal shocks as unexpected changes in the long-run spending to output ratios; that is, $\bar{g} \geq g_0$ and $\bar{g}^* \geq g_0^*$. The corresponding long-run levels of government spending, namely $\bar{G}$ and $\bar{G}^*$, are determined endogenously. When we analyze permanent fiscal shocks implemented by the Home authorities, we simply set the level of short-run spending equal to its long-run value: $G = \bar{G}$. When we analyze Home monetary shocks, as well as Foreign fiscal and monetary shocks, we treat the short-run level of Home spending G as parametric. The analytical advantages of this specification will be evident below.

B. The Model in its Structural Form

The structural form of the model is summarized in Table I.[7] In this table expressions (17) are the Euler equations that describe the optimal intertemporal allocation of consumption.[8] Equations (18) and (19) describe equilibrium in the money markets in the short and the long run, respectively: demand for real balances is positively related to consumption and negatively related to the domestic nominal interest rate. Note that the steady-state real and nominal interest rate is equal to δ.

Equations (20) describe the short-run current account identities. The right-hand side is output minus absorption, both measured in national currency units. Given our assumption that neither country is a net lender in the initial equilibrium, i.e., $B_0 = B_0^*/\mathcal{E}_0 = 0$, the short-run current account in the

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7. For the analytical details of the optimization problem and a graphical analysis, see the working paper version of the model [Corsetti and Pesenti 1997].
8. In the Foreign country the real rate of return in Foreign consumption units is r_t, the same rate as in the Home country. Under consumption-based purchasing power parity, real returns in local consumption units are equalized across countries regardless of the currency denomination of the internationally traded bond.

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TABLE I

STRUCTURAL FORM OF THE MODEL

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$$(17) \quad C^{-\rho} = \beta(1+r)\bar{C}^{-\rho} \qquad\qquad (C^*)^{-\rho} = \beta(1+r)(\bar{C}^*)^{-\rho}$$

$$(18) \quad \frac{\bar{M}}{P} = \chi\,\frac{1+i}{i}\,C^{\rho} \qquad\qquad \frac{\bar{M}^*}{P^*} = \chi^*\,\frac{(1+i)\mathscr{E}}{(1+i)\mathscr{E}-\bar{\mathscr{E}}}\,(C^*)^{\rho}$$

$$(19) \quad \frac{\bar{M}}{\bar{P}} = \chi\,\frac{1+\delta}{\delta}\,\bar{C}^{\rho} \qquad\qquad \frac{\bar{M}^*}{\bar{P}^*} = \chi^*\,\frac{1+\delta}{\delta}\,(\bar{C}^*)^{\rho}$$

$$(20) \quad B = P_H\frac{Y}{g} - PC \qquad\qquad -\frac{B}{\mathscr{E}} = P_F^*\,\frac{Y^*}{g^*} - P^*C^*$$

$$(21) \quad \bar{P}\bar{C} = \bar{P}_H\,\frac{\bar{Y}}{\bar{g}} + \delta\bar{B} \qquad\qquad \bar{P}^*\bar{C}^* = \bar{P}_F^*\,\frac{\bar{Y}^*}{\bar{g}^*} - \delta\,\frac{\bar{B}}{\bar{\mathscr{E}}}$$

$$(22) \quad \frac{P_H Y}{Pg} = \gamma(C + C^*) \qquad\qquad \frac{P_F^* Y^*}{P^* g^*} = (1-\gamma)(C + C^*)$$

$$(23) \quad \frac{\bar{P}_H\bar{Y}}{\bar{P}\bar{g}} = \gamma(\bar{C} + \bar{C}^*) \qquad\qquad \frac{\bar{P}_F^*\bar{Y}^*}{\bar{P}^*\bar{g}^*} = (1-\gamma)(\bar{C} + \bar{C}^*)$$

$$(24) \quad \bar{Y} = \Phi\,\frac{\bar{P}_H}{\bar{P}}\,\bar{C}^{-\rho} \qquad\qquad \bar{Y}^* = \Phi^*\,\frac{\bar{P}_F^*}{\bar{P}^*}\,(\bar{C}^*)^{-\rho}$$

$$\Phi \equiv \frac{\phi-1}{\kappa\phi} \qquad\qquad \Phi^* \equiv \frac{\phi^*-1}{\kappa^*\phi^*}$$

Home country is equivalent to the end-of-period net asset position B (if B is positive, Home is a net lender, and Foreign is a net borrower). In the long run, steady-state consumption (21) is equal to output net of government spending plus net interest payments from (or to) the rest of the world. The net asset positions of the Home and Foreign country are $\bar{B}$ and $-\bar{B}/\bar{\mathscr{E}}$, respectively. Equations (22) and (23) are the short-run and long-run aggregate equilibrium conditions in the goods markets, showing that real net income in each country is a constant share of real world consumption spending.

The last equilibrium conditions (24) describe the trade-off

between labor and leisure in a steady state.[9] At the margin the utility cost of forgoing leisure is equal to the benefit from consumption financed with the income generated by supplying additional labor. In the long run, labor supply and output are negatively related to consumption and positively related to the real wage $\bar{W}/\bar{P} = \bar{P}_\mathrm{H}/\bar{P}$ and $\bar{W}^*/\bar{P}^* = \bar{P}_\mathrm{F}^*/\bar{P}^*$. Equations (24) also show that labor supply and output depend on domestic market distortions associated with monopolistic competition, as captured by the terms Φ and Φ^* defined in Table I.

C. The Solution of the Model

The key step in solving our model is to show that policy shocks do not lead to international redistribution of wealth through current account changes. We rearrange the current account equations in the short and the long run (20) and (21), using the equilibrium conditions in the goods markets (22) and (23):

$$(25) \qquad \frac{C + B/P}{C^* - B/P} = \frac{\gamma}{1 - \gamma} \qquad \frac{\bar{C} - \delta\bar{B}/\bar{P}}{\bar{C}^* + \delta\bar{B}/\bar{P}} = \frac{\gamma}{1 - \gamma}.$$

Now, the Home and Foreign Euler equations (17) imply that there cannot be anticipated changes in the ratio of Home to Foreign consumption:

$$(26) \qquad\qquad C/C^* = \bar{C}/\bar{C}^*.$$

Observing that $(1 + i)B = (1 + \delta)\bar{B}^{10}$ and combining (25) and (26) above, we conclude that $B = \bar{B} = 0$. In equilibrium, the ratio of Home to Foreign consumption is constant at $\gamma/(1 - \gamma)$: the mechanism of adjustment to shocks in the world economy hinges exclusively upon variations of the terms of trade, without changes in national net-asset positions.[11]

To gain intuition, note that in our setup the elasticity of relative net output demand $((Y - G)/(Y^* - G^*))$ with respect to relative prices $(P_\mathrm{H}/\mathscr{E}P_\mathrm{F}^*)$ is equal to one, which is also the elasticity of intratemporal substitution in our consumption

9. Conditions (24) only hold in the long run, when wages and goods prices fully adjust to their equilibrium levels. In the short run nominal wages are predetermined (implying that P_H and P_F^* are also fixed) and workers adjust their labor supply as to meet labor demand.

10. The link between short-run and long-run asset positions can be determined by comparing (21) with the current account equation in the first period after the shock, namely $\bar{B} - B = iB + \bar{P}_\mathrm{H}\bar{Y}/\bar{g} - \bar{P}\bar{C}$.

11. On the role of terms of trade movements in the international transmission mechanism, see, for instance, Stockman [1987] and Cole and Obstfeld [1991].

TABLE II

SOLUTION OF THE MODEL

Determinants of Home welfare	
$C = a_1(\bar{M}_W)^{1/\rho}$	Short-run consumption
$Y = a_2(\bar{M}_R)^{1-\gamma}(\bar{M}_W)^{1/\rho} + G$	Short-run output
$\bar{M}/P = a_3\bar{M}_W$	Short-run real balances
$\bar{C} = a_4(\bar{g}_W)^{-1/(1+\rho)}$	Long-run consumption
$\bar{Y} = a_5\bar{g}^{1/2}(\bar{g}_W)^{-(1-\rho)/(2(1+\rho))}$	Long-run output
$\bar{M}/\bar{P} = a_6(\bar{g}_W)^{-\rho/(1+\rho)}$	Long-run real balances

Prices	
$1 + r = a_7(\bar{M}_W)^{-1}(\bar{g}_W)^{-\rho/(1+\rho)}$	Short-run real interest rate
$\mathscr{E}P^*_F/P_H = a_8\bar{M}_R$	Short-run terms of trade
$\mathscr{E} = \bar{\mathscr{E}} = a_9\bar{M}_R$	Nominal exchange rate
$\bar{\mathscr{E}}\bar{P}^*_F/\bar{P}_H = a_{10}(\bar{g}_R)^{-1/2}$	Long-run terms of trade
$\bar{P}_H = a_{11}\bar{M}(\bar{g}_W)^{-(1-\rho)/(2(1+\rho))}\bar{g}^{1/2}$	Long-run Home good price

The index R refers to ratios of Home to Foreign variables. The index W refers to geometric averages of Home and Foreign variables with weights γ and $1 - \gamma$. The constants are defined below, where the subscript 0 indexes preshock levels.

$a_1 = \gamma(\gamma_W)^{(1-\rho)/(1+\rho)}(g_{W_0})^{-1/(1+\rho)}(M_{W_0})^{-1/\rho}(\Phi_W)^{1/(1+\rho)}$;

$a_2 = \gamma^{(1-\rho)/2}(\gamma_W)^{(1-\rho)/2(1+\rho)}(g_{W_0})^{-(1-\rho)/(2(1+\rho))}(g_0)^{-1/2}(M_{R_0})^{-(1-\gamma)}(M_{W_0})^{-1/\rho}\Phi^{1/2}(\Phi_W)^{(1-\rho)/(2(1+\rho))}$;

$a_3 = \chi[(1 + \delta)/\delta]\gamma^\rho(\gamma_W)^{\rho(1-\rho)/(1+\rho)}(g_{W_0})^{-\rho/(1+\rho)}M^{-1}_{W_0}(\Phi_W)^{\rho/(1+\rho)}$;

$a_4 = \gamma(\gamma_W)^{(1-\rho)/(1+\rho)}(\Phi_W)^{1/(1+\rho)}$;

$a_5 = \gamma^{(1-\rho)/2}(\gamma_W)^{(1-\rho)/2(1+\rho)}\Phi^{1/2}(\Phi_W)^{(1-\rho)/(2(1+\rho))}$;

$a_6 = \chi[(1 + \delta)/\delta]\gamma^\rho(\gamma_W)^{(\rho(1-\rho))/(1+\rho)}(\Phi_W)^{(\rho/(1+\rho))}$;

$a_7 = \beta^{-1}(g_{W_0})^{\rho/(1+\rho)}M_{W_0}$;

$a_8 = [\gamma/(1 - \gamma)]^{-(1+\rho)/2}(g_{R_0})^{-1/2}M^{-1}_{R_0}(\Phi_R)^{1/2}$;

$a_9 = \chi^*\chi^{-1}[\gamma/(1 - \gamma)]^{-\rho}$;

$a_{10} = [\gamma/(1 - \gamma)]^{-(1+\rho)/2}(\Phi_R)^{1/2}$;

$a_{11} = (a_4)^\rho a_5(a_6)^{-1}\Phi^{-1}$.

index. When the short-run relative price of the Foreign good rises, demand for the Home good increases relative to the Foreign good. Home agents' nominal incomes increase relative to Foreign agents, but their purchasing power declines proportionally. Therefore, agents have no incentive to lend or borrow internationally. If the elasticity of substitution were larger than one—as in Obstfeld and Rogoff [1995]—the real incomes of Home agents would increase relative to Foreign agents. Home residents would then desire to lend resources abroad for consumption-smoothing purposes, becoming net creditors vis-à-vis the Foreign country.

The closed-form solution of the model is shown in Table II, which focuses on the Home country with the understanding that

similar relations hold for the Foreign country.[12] Table II expresses all endogenous variables as functions of policy innovations. In the tradition of the "sums" versus "differences" approach in general equilibrium open-economy models (see Aoki [1981]), in the table we denote with the subscript R (for "relative") the ratio between Home and Foreign variables. Thus, relative policy stance indexes are

$$(27) \qquad M_R = \bar{M}_R \equiv \bar{M}/\bar{M}^* \quad \bar{g}_R \equiv \bar{g}/\bar{g}^*.$$

The subscript W (for "world") instead denotes a geometric average of Home and Foreign variables, using γ and $1 - \gamma$ as weights. So, the world money stock and the world fiscal stance are defined as

$$(28) \qquad M_W = \bar{M}_W \equiv \bar{M}^\gamma(\bar{M}^*)^{1-\gamma} \quad \bar{g}_W \equiv \bar{g}^\gamma(\bar{g}^*)^{1-\gamma}.$$

The constant terms are functions of the parameters of the model, including the preshock policy variables. Notice that the equilibrium system is log-linear with no need for local approximations. This is in contrast to Obstfeld and Rogoff [1995], who cannot solve the model without local approximations.

Welfare analysis in our model is based on the lifetime utility of the Home representative agent, as given by equation (29):

$$(29) \quad U = \frac{C^{1-\rho}}{1-\rho} + \chi \ln \frac{\bar{M}}{P} + V(G) - \frac{\kappa}{2} Y^2$$

$$+ \frac{1}{\delta} \left[\frac{\bar{C}^{1-\rho}}{1-\rho} + \chi \ln \frac{\bar{M}}{\bar{P}} + V(\bar{G}) - \frac{\kappa}{2} \bar{Y}^2 \right].$$

As stressed above, we restrict our analysis to the range of policy shocks that do not cause real wages to fall below the marginal rate of substitution. Explicit boundaries for admissible monetary and fiscal innovations can be derived by using the equilibrium current account identity to rewrite the participation constraints (16) and its Foreign equivalent as

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12. To obtain a closed-form solution, one needs both Cobb-Douglas preferences and zero initial net-asset positions. Our welfare and positive results below, however, hold for more general model specifications, such as CES preferences, as long as the intratemporal elasticity of consumption is smaller than the domestic elasticities of input substitution (ϕ and ϕ^*). In a more general framework the model exhibits some dynamics of the current account. The refinement and generalization of our results for small deviations from the initial equilibrium are presented in Tille [2001].

(30) $\qquad C^{1-\rho} \geq \kappa \, \dfrac{Y^2}{g} \quad$ and $\quad (C^*)^{1-\rho} \geq \kappa^* \, \dfrac{(Y^*)^2}{g^*}$

and replacing C, C^*, Y, and Y^* with the corresponding expressions in Table II.

IV. OPENNESS AND THE EFFECTS OF DOMESTIC MONETARY SHOCKS

A. Macroeconomic Effects

We first analyze the domestic macroeconomic and welfare implications of a Home permanent monetary expansion. From Table II we see that the nominal exchange rate moves one-to-one with the relative money stock.[13] A depreciation raises the price of Home imports, contributing to domestic inflation. However, as P_H is fixed, the overall price index P rises by only a fraction $1 - \gamma$ of the expansion in money supply. Home agents' real balances thus increase with a positive monetary shock. At the same time, as the real interest rate falls worldwide responding to a higher world money average $\bar{M}_W$, consumption grows symmetrically in both countries. A higher world consumption coupled with a higher relative price of Foreign goods unambiguously increases the demand for Home goods, raising short-run output Y.

In the long run, because of the absence of current account effects, money shocks are neutral: $\bar{P}_H$ moves one-to-one with $\bar{M}$, consumption and output in both countries return to the initial levels, and so do world real balances and the real exchange rate.[14]

B. Can a Monetary Expansion Reduce Welfare?

A central message in our analysis is that, despite the presence of monopolistic distortions and sticky prices, a monetary shock boosting short-run demand for domestic output can be

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13. As in Obstfeld and Rogoff [1995], the nominal exchange rate adjusts on impact, without lasting dynamics: $\mathscr{E} = \bar{\mathscr{E}}$. For a discussion see Corsetti and Pesenti [1997].

14. The analysis of temporary shocks is qualitatively similar to the above analysis of permanent shocks. The key difference is the dynamics of the exchange rate and the nominal interest differential. While in the short run the nominal exchange rate depreciates to clear the money market, it is expected to appreciate in the long run, and move back to the initial level. Expectations of an appreciation then lower the Home nominal interest rate vis-à-vis its Foreign counterpart, raising demand for Home money and dampening the effects of the monetary expansion on the exchange rate (as well as the global expansionary impact of the policy shock). Real money holdings grow faster at Home than abroad, but the adjustment of the nominal interest rates guarantees that consumption grows at the same rate in both countries.

welfare-reducing in an open economy with monopoly power on its terms of trade. In this subsection we show this possibility in the case of small policy shocks. We discuss the case of large shocks in the next section.

Differentiating the lifetime utility of a representative Home agent with respect to $\bar{M}$ yields

$$(31) \qquad \frac{\partial U}{\partial \bar{M}} = \frac{\gamma}{\rho \bar{M}} \left[C^{1-\rho} + \chi\rho - \kappa \, \frac{Y^2}{g} \left(1 + \rho \, \frac{1-\gamma}{\gamma} \right) \right].$$

To analyze the effects of marginal deviations from the initial steady state, we evaluate (31) at $\bar{M} = M_0$. Using Table II, and abstracting from government spending ($g_0 = g = 1$),[15] we can write

$$(32) \quad \mathrm{sign} \left(\frac{\partial U}{\partial \bar{M}} \right) \Bigg|_{\bar{M}=M_0} = \mathrm{sign} \left[1 + \chi\rho(\gamma\gamma_W^{(1-\rho)/(1+\rho)}\Phi_W^{1/(1+\rho)})^{\rho-1} \right.$$
$$\left. - \frac{\phi-1}{\phi} \left(1 + \rho \, \frac{1-\gamma}{\gamma} \right) \right].$$

This expression sheds light on a key difference between closed and open economies. In a closed economy ($\gamma = 1$), the sign of the above derivative is *always* positive: a small monetary shock unambiguously improves domestic welfare. Note that this is true regardless of liquidity effects (i.e., for any arbitrarily small level of χ). Because of monopolistic distortions, in the initial steady-state equilibrium real wages are excessively high, while world output and consumption are suboptimally low. In the presence of nominal rigidities, a small inflationary shock reduces real wages raising output and employment. The welfare benefit from a higher level of domestic consumption dominates the disutility of the additional work effort.

In an open economy ($\gamma < 1$), however, a monetary expansion also induces a real depreciation that lowers the purchasing power of domestic agents' incomes. Expression (32) shows that this negative terms of trade externality may more than offset the positive aggregate demand externality described above. Ruling out unrealistically large values of χ, there are two intuitive conditions under which the sign of (32) is negative: a marginal monetary innovation is *beggar-thyself* when γ is not too large (i.e.,

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15. We will consider the interplay between fiscal and monetary shocks in Section VII.

if Foreign goods represent a substantial share of Home consumption), or when ϕ is not too small (i.e., if monopoly distortions in the Home economy are relatively weak).[16]

C. Welfare Effects of Large Shocks: the "Optimal Tariff" Argument Revisited

The analysis of noninfinitesimal money shocks sheds light on another key difference between closed and open economies. Consider the first-order condition for maximizing U with respect to $\bar{M}$:

$$(33) \qquad C^{1-\rho} - \kappa \, \frac{Y^2}{g} = -\chi\rho + \frac{1-\gamma}{\gamma} \, \rho \, \frac{Y^2}{g} \, ,$$

and compare this expression with (30). In a closed economy ($\gamma = 1$), the monetary stance solving (33) is outside the range of shocks defined by the participation constraint (30). Denoting this stance by $\tilde{M}$, the best Home policy-makers can do is to choose $\bar{M} \leq \tilde{M}$ such that (30) holds as an equality—i.e., to bring employment and output up to potential.[17] It follows that, in a closed economy, the marginal benefit from monetary innovations is positive for *all* shocks whose size does not violate the participation constraint (30): the relation between money innovations and utility is monotonically increasing.

In an open economy ($\gamma < 1$), instead, this relation can take the shape of an inverted U. In other words, the marginal contribution of a *large* monetary expansion to social welfare can be negative, even in those cases in which a *small* deviation from the initial steady state would increase domestic utility. In fact, unless χ is very large, after a money shock equal to $\tilde{M}$, the participation constraint (30) still holds as a strict inequality. Home agents' utility is at a maximum, but real wages in the Home economy remain above the marginal rate of substitution between consumption and leisure. It follows that there exists a range of monetary shocks slightly above $\tilde{M}$ which turn expression (31) negative, yet do not violate (30).

An important corollary of our analysis is that, in an open economy, the Home monetary innovation which maximizes Home welfare is less expansionary than required to close the gap between actual and potential output. Relative to shocks large

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16. Note also that, abstracting from liquidity effects ($\chi \cong 0$), a low elasticity of intertemporal substitution (a large ρ) tends to reduce the benefits from monetary expansions.

17. Note that $\bar{M}$ tends to $\tilde{M}$ as χ approaches 0.

enough to offset monopolistic distortions in production, smaller monetary expansions improve the terms of trade and raise the purchasing power of Home incomes for any given Foreign policy stance. At the margin the gains from appreciating the terms of trade offset the efficiency losses from lower output. This result is reminiscent of the "optimal tariff" argument in the international trade literature. Only if the monetary expansions were jointly implemented (so that $\bar{M}$ and $\bar{M}^*$ move in parallel), the exchange rate effect would disappear, and each country would benefit from bringing output to its potential level.

V. MONETARY INTERDEPENDENCE AND THE INTERNATIONAL TRANSMISSION MECHANISM

What are the effects of a permanent monetary expansion originating abroad? From Table II we note that an increase in $\bar{M}^*$ appreciates the Home currency through its effect on $\bar{M}_R$, and raises short-run consumption everywhere in the global economy through its effect on $\bar{M}_W$. Short-run output in the Home country is subject to two contrasting forces: demand for Home goods is boosted by the Foreign country expansion (with elasticity $(1 - \gamma)/\rho$) but reduced by the real appreciation of the Home currency (with elasticity $1 - \gamma$). Thus, a Foreign monetary expansion has a positive impact on Home output when $\rho < 1$, and a negative effect when $\rho > 1$. With logarithmic preferences ($\rho = 1$) output remains unchanged.

A way to interpret this result is in terms of complementarity of Home and Foreign goods in consumption. With CES consumption indices and power utility, two goods are complements—that is, the marginal utility of one good increases with the consumption of the other good—when the elasticity of intertemporal substitution is larger than the elasticity of intratemporal substitution, and substitutes otherwise. In our specification, the intertemporal elasticity is $1/\rho$ while the intratemporal elasticity is 1. Since world consumption of the Foreign good is unambiguously higher after the Foreign monetary expansion, world demand for Home goods (and Home employment) increases only insofar as Home and Foreign goods are complements (when $\rho < 1$), and falls otherwise.

To assess the impact of a Foreign monetary expansion on Home welfare, consider the partial derivative of the indirect utility of wealth U with respect to $\bar{M}^*$:

(34) $$\frac{\partial U}{\partial \bar{M}^*} = \frac{1 - \gamma}{\rho \bar{M}^*} \left[C^{1-\rho} + \chi\rho - \kappa \frac{Y^2}{g} (1 - \rho) \right].$$

As long as (30) holds, the sign of the above expression is unambiguously positive: monetary shocks always have a *prosper-thy-neighbor* effect. Intuitively, an expansion abroad raises domestic welfare as the improved terms of trade allow domestic agents to finance higher consumption expenditure for any given level of labor effort.

This result stands in contrast with popular analyses of policy interdependence, in which monetary expansions and exchange rate devaluations abroad can have negative (*beggar-thy-neighbor*) repercussions on domestic welfare, by shifting aggregate demand toward Foreign goods. The key policy implication of our analysis is that there are no welfare incentives to engage in competitive devaluations: regardless of whether policies abroad boost or squeeze domestic employment, their external effect on national welfare is positive overall.[18]

VI. FISCAL INTERDEPENDENCE

Using the expressions for C, Y, and $\mathscr{E}P_{\mathrm{F}}^*/P_{\mathrm{H}}$ in Table II, we see that an unexpected fiscal expansion has no short-run effect on domestic consumption, but increases domestic demand and employment at unchanged terms of trade.[19] If the shock were tem-

18. This conclusion is subject to an important caveat. As discussed in Corsetti, Pesenti, Roubini, and Tille [2000], the welfare impact of a devaluation crucially depends on the degree of exchange rate pass-through. Consider, for instance, the extreme case of zero exchange rate pass-through: international markets are segmented, and prices are sticky in the buyer's currency. In this case, a devaluation by the Foreign country does not increase real incomes in the Home country. In the short run, the Foreign real interest rate falls relative to the Home interest rate. Foreign consumption rises relative to Home consumption, while Home labor effort increases to meet the increase in foreign demand for Home goods. As a result, a devaluation by one country has negative welfare repercussions on the other. See also Betts and Devereux [2000] and Tille [1999].

19. Underlying these results are two features of our model. First, utility is additively separable in private and public consumption: if this were not the case, changes in government spending would affect the marginal utility of private consumption leading to a change in relative prices. Second, the equilibrium exchange rate only depends on relative money supply. Government spending can nonetheless be included among the determinants of the nominal exchange rate with a simple extension of the model, that is, by modeling aggregate money demand as a function of both private and public consumption. Then, given money supply, a fiscal expansion would bring about an appreciation of the exchange rate in both nominal and real terms. In light of this observation, the policy experiment considered in the main text could be interpreted as the result of a fiscal expansion that is accommodated by monetary policy.

porary, after one period the economy would move back to the initial equilibrium. When the shock is permanent, however, the increase in demand for Home goods requires an upward adjustment of Home wages in the long run. Thus, in the new steady state the relative price of Home goods rises, and the Home currency appreciates in real terms. Because of the real wage adjustment, long-run Home output increases by less than public spending, and world consumption falls while prices increase in both countries. The economy reaches an equilibrium corresponding to lower consumption and higher output levels relative to the initial steady-state allocation.

In Table II observe that a Foreign expansion does not affect short-run variables in the Home country, with the only exception of the real interest rate that falls in anticipation of lower world consumption in the future. The effects of an increase in $\bar{g}^*$ on the Home economy are only felt in the long run, when the expansion abroad depreciates the Home terms of trade and reduces Home real wages. While the new equilibrium unambiguously corresponds to a lower level of consumption, output can either fall or increase. Since the Foreign fiscal shock reduces the availability of Foreign goods to world consumers ($\bar{Y}^* - \bar{G}^*$ falls), world demand for Home goods increases if the two national goods are substitutes ($\rho > 1$), and falls otherwise. Note that the mechanism of transmission described above holds regardless of the nature of public expenditure: government spending at home and abroad may be purely dissipative ($V = 0$)—in which case the domestic welfare impact of a fiscal expansion is unambiguously negative—or fall on public goods that increase agents' utility ($V' > 0$). The crucial element is that domestic government spending is exclusive in domestic goods (or, more generally, is more intensive in domestic goods than private consumption): if this were not the case, domestic spending would not alter relative demand.

To analyze the welfare impact of an increase in Foreign spending, we differentiate the indirect utility function of the Home representative agent with respect to $\bar{g}^*$. Focusing on consumption and output effects, we can write

$$(35) \qquad \text{sign}\left(\frac{\partial U}{\partial \bar{g}^*}\right) = \text{sign}\left(\frac{\phi - 1}{\phi}\frac{1 - \rho}{2}\bar{g} - 1\right).$$

In interpreting this expression, recall the two key features of fiscal policy transmission in the world economy. First, by depreciating the Home real exchange rate, a Foreign fiscal expansion

reduces purchasing power and consumption in the Home country. The spillover through this channel is unambiguously negative. Second, the fall in demand for the Foreign good can either decrease or increase the demand for the Home good, depending on whether national goods are complements ($\rho < 1$) or substitutes ($\rho > 1$) in consumption. The sign of the spillover through this channel is ambiguous: it is positive for $\rho < 1$, as Home production falls and the consumption of leisure increases.

The negative channel dominates for a wide range of parameter values, so that fiscal spillovers are generally *beggar-thy-neighbor*.[20] The positive channel prevails in a special, yet interesting, case. Note that, when $\rho < 1$, a spending *cut* abroad increases world consumption of the Home good and therefore raises Home output. For a given target $\bar{g}$, the increase in output allows the Home government to adjust its spending upward. If the targeted spending-to-output ratio is sufficiently high, and the distortions in the labor markets are sufficiently small, Home welfare may actually fall because of an excessive reduction in leisure.

VII. INTERNATIONAL POLICY LINKS

We now provide a synthesis of our results, shedding light on the interplay between fiscal and monetary links that, in our model, are active only in the short run. Exploiting the log-linear properties of our model, we can derive an explicit solution for the welfare-maximizing monetary surprises in the two countries as functions of all policy and structural variables.[21] Setting (31) and its Foreign analog equal to zero, and disregarding liquidity effects, we obtain

$$(36) \quad \left(\frac{\gamma}{\rho} + 2 - \gamma\right) \ln \frac{\bar{M}}{M_0} = -\ln \left[\frac{\phi - 1}{\phi}\left(1 + \frac{1 - \gamma}{\gamma}\rho\right)\right]$$

$$- (1 - \gamma)\left(\frac{1 - \rho}{\rho}\right) \ln \frac{\bar{M}^*}{M_0^*} - \ln \frac{g}{g_0}$$

and

$$(37) \quad \left(\frac{1-\gamma}{\rho} + 1 + \gamma\right) \ln \frac{\bar{M}^*}{M_0^*}$$

$$= -\ln\left[\frac{\phi^* - 1}{\phi^*}\left(1 + \frac{\gamma}{1-\gamma}\rho\right)\right] - \gamma\left(\frac{1-\rho}{\rho}\right)\ln\frac{\bar{M}}{M_0} - \ln\frac{g^*}{g_0^*}.$$

The first term on the right-hand side of these equations describes the interplay between internal distortions due to monopoly power in supply, and external distortions due to monopoly power on the terms of trade, as analyzed in Section IV. Unlike in a closed economy, domestic market failures need not impart an inflationary bias to optimal policies. The more open the economy, the lower the incentive for domestic policy-makers to create unexpected inflation—even when employment levels are inefficiently low. In fact, unless monopolistic distortions are very large (ϕ or ϕ^* close to one), the expression in square brackets is above one, consistent with a *deflationary* bias.[22]

The second term captures policy interdependence due to the transmission of monetary shocks across countries. Note that an expansion abroad can have quite different implications for the domestic welfare-maximizing monetary policy, depending on whether ρ is smaller or larger than unity. As seen in Section V, when the goods are complements ($\rho < 1$), a Foreign expansion boosts demand for Home goods. While such an expansion increases Home welfare, a monetary tightening in the Home country and an additional appreciation of the Home currency can raise Home welfare even farther by reducing the high disutility of work effort—that is, by cooling down an overheated economy. The opposite result holds if the goods are substitutes ($\rho > 1$).

The third term captures the interaction between monetary and fiscal innovations in policy design. Consider the effects of shocks to g and g^* in the short run. We have seen in Section VI that unexpected fiscal expansions bring the domestic economy closer to potential output at unchanged relative prices, thus worsening the terms-of-trade/employment trade-off. Other things equal, the optimal monetary response to a fiscal shock is a con-

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22. This result is supported by recent literature, providing econometric evidence of a negative relationship between openness and inflation in a large cross section of countries. See Romer [1993], Campillo and Miron [1997], and Lane [1997].

traction. Note that the Home monetary authorities have no rea-
son to offset the Foreign fiscal shock directly, since the latter
leaves the Home economy unchanged in the short run. However,
a Foreign fiscal shock can have an indirect effect on Home
monetary policy, to the extent that the Foreign monetary author-
ities adjust their monetary stance in response.

VIII. CONCLUSIONS

The key results of our analysis, as well as the departures
from the previous literature, have already been outlined in the
introduction, and need not be restated here. We conclude instead
by emphasizing two possible implications for future work in the
field.

First, by showing how and why terms-of-trade effects may
welfare-dominate aggregate demand externalities, our theoreti-
cal apparatus sheds new light on the perceived policy trade-offs
between internal and external objectives. These results have
far-reaching implications for a literature that is currently explor-
ing the range and scope of applicability of its paradigm to many
long-standing policy issues. A sample of these problems include
competitive devaluations and currency crisis contagion across
countries, the international effects of fiscal contractions, the costs
and benefits of international policy coordination, the conse-
quences of exchange rate volatility, and the choice of an exchange
rate regime.[23]

Second, critics of the new literature have often pointed at
its shortcomings relative to the standards of simplicity and
malleability of the traditional apparatus—standards that have
certainly played a role in determining the success and longev-
ity of the classic Mundell-Fleming-Dornbusch model as the
benchmark for international policy evaluation. In response to
this criticism, our paper provides a set of analytical results
that are fully micro-founded, yet match the tractability and
immediateness of the textbook model. By reducing the gap
between the old and the new generations of interdependence
models, such tools can contribute to increasing the appeal of

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23. A fast-growing literature covering the topics mentioned in the text in-
cludes Obstfeld and Rogoff [1998, 2000], Devereux and Engel [1998], Bacchetta
and van Wincoop [2000], Corsetti and Pesenti [1999], Tille [1999], and Corsetti,
Pesenti, Roubini, and Tille [2000].

the "new open-economy macroeconomics" as a launching pad for further policy-oriented research.

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