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RELATIVE WEALTH, GROWTH, AND TRANSITIONAL DYNAMICS: THE SMALL OPEN ECONOMY CASE

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In this paper we investigate the growth implications of relative wealth preferences in a small open economy model. Domestic capital accumulation, subject to installation costs, is the engine of economic growth in this framework. Crucial in deriving the balanced growth rate is the effective rate of return that arises from agents' status preferences. This results not only in a common balanced growth rate for consumption, the domestic capital stock, and net international financial assets, but also saddle-path dynamics in response to structural shifts. We investigate the short- and long-run dynamics of the model by considering the following standard fiscal shocks: (i) government expenditure, (ii) capital tax, (iii) tax on international financial assets, (iv) consumption tax. Among our results, we find that a permanent fiscal expansion leads to a temporary increase in growth and that a rise in the consumption tax results in a temporary decrease in growth.

Keywords: Status Seeking, Relative Wealth, Growth, Transitional Dynamics

1. INTRODUCTION

What are the economic implications of status-seeking behavior? The modern literature dealing with this long-standing question can be traced back to Duesenbery (1949), with more contemporary treatments given by authors such as Frank (1985a, 1985b). In the macroeconomic context researchers have explored, among other questions, the implications of the quest for status on issues such as overconsumption and whether a "rat race" with excessive work effort arises if people care about relative position.[1]

A modeling approach followed by many researchers is to specify that an agent's instantaneous utility function depends on a measure of individual consumption or wealth relative to their corresponding economywide averages. We also adopt this approach and focus on the specification in which status depends on relative wealth. The relative wealth approach has been employed by authors such Corneo and Jeanne (1997), Rauscher (1997), and Futagami and Shibata (1998), who explore its implications for the rate of economic growth, which is also our concern

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in this paper. However, unlike these researchers, who conduct their analyses in a closed economy setting, we focus on the effects of status preferences in an open economy framework featuring endogenous growth.

Recent authors who model the implications of relative wealth in the open economy context economy include Fisher (2004, 2005), Fisher and Hof (2005, 2008), and Hof and Wirl (2008), who work in an exogenous growth setting. One concern of this research is to derive the conditions under which the undesirable zero-root property of the small open economy Ramsey framework can be eliminated. This done in the basic model by setting the domestic rate of time preference equal to the exogenous world interest rate.[2]

Our goal in this paper is to extend the insights of the recent relative wealth literature to a small open economy model with endogenous growth. As in the work of Turnovsky (1996, 1997b), the engine of ongoing economic growth in our model is domestic capital accumulation, subject to quadratic installation costs. We adopt, then, a standard AK technology to derive sustained economic growth in a framework in which agents face no borrowing or lending constraints in international financial markets. In a single-factor model, AK technology and adjustment costs are essential, though not sufficient, conditions to obtain continuous economic growth. In particular, the installation costs assumption in the small open economy framework excludes implausible discrete jumps in the stock of domestic capital.

A key feature of the canonical Turnovsky (1996, 1997b) model is that the growth equilibrium "decouples" into distinct steady-state growth rates for consumption and the capital stock, with the growth rate of domestic wealth converging to the higher of the two.[3] This result is a consequence of the small open economy assumption that the economy faces an exogenous, time-invariant world interest rate. By incorporating relative wealth preferences into this framework, we show that the small open economy equilibrium depends, instead, on an endogenous *effective rate of return* that is a function of agents' attitude to status. Under appropriate conditions, this leads not only a balanced growth equilibrium for all variables of interest, including consumption and domestic capital, but also to saddle-path dynamics in response to structural shifts.[4]

To explore the dynamic properties of this model, we consider the implications of several standard fiscal policy shocks: (i) government expenditure, (ii) capital tax, (iii) tax on international financial assets, and (iv) consumption tax. We not only derive the long-run implications of these disturbances, but also consider the corresponding saddle-path adjustment of the small open economy. Among our results we find that whereas a fiscal expansion temporarily *increases* the rate of growth, a rise in the consumption tax temporarily *decreases* it. In contrast, an increase in the capital tax decreases the growth rate not only in the long run, but also during the transition. The opposite is the case for a higher tax levied on international interest payments: this causes a substitution toward domestic capital that raises the growth rate during the transition and in the steady state. One key finding is that the results of Turnovsky (1996, 2002) with respect to the response

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of the consumption growth to capital and asset taxes are overturned in this relative wealth framework.

The paper is organized as follows: Section 2 describes our model of agents who have preferences over relative wealth, accumulate physical capital, and lend to the rest of the world. We calculate the necessary optimality conditions and derive the resulting small open economy equilibrium. In Section 3 we derive the economy's dynamics in terms of the ratios of consumption and net financial assets to domestic capital and derive the condition for a saddle-point equilibrium. We obtain the balanced-growth steady state in Section 4 and calculate the long-run government expenditure and tax rate multipliers. The transitional adjustments to these fiscal policy disturbances are also analyzed in this section. We close the paper in Section 5 with brief concluding remarks. A mathematical appendix supports the analytical results discussed in the main text.

2. THE MODEL

The small open economy consists of a large number of identical, infinitely lived consumer–producers. We abstract from population growth and assume that agents have preferences over consumption c and status s and possess the following instantaneous felicity function employed by Futagami and Shibata (1998):

$$U(c, s) = (1 - \theta)^{-1}[(c^{\eta}s^{\gamma})^{1-\theta} - 1], \tag{1a}$$

where $\eta > 0$, $\gamma > 0$, $\theta > 0$, $1 - \eta(1 - \theta) > 0$, $1 - \gamma(1 - \theta) \geq 0$, and $1 - (\gamma + \eta)(1 - \theta) \geq 0$. To model status, we use a simple ratio specification,

$$s = s(a, A) \equiv a/A, \quad s_a = A^{-1} > 0, \quad s_A = -a/A^2 < 0, \tag{1b}$$

so that an agent's social position is a function of own assets a relative to the average net assets A.[5] Domestic net assets A consist of domestic physical capital K and net financial assets N—or loans—of the private sector ($A \equiv K + N$). At an individual level net assets are, thus, $a \equiv k + n$. We restrict our analysis to the case in which net assets are strictly positive, a convenient formulation in a model of ongoing growth.[6]

Agents borrow (and lend) financial assets in integrated international financial markets at the given, time-invariant world interest rate r^*. In addition, they produce a domestic output y that trades at a unitary international price using a linear production function, $y = \alpha k$, $\alpha > 0$. The accumulation of capital (abstracting from physical depreciation) involves adjustment costs according to the following standard formulation:

$$\Psi(i, k) = i\,[1 + (hi/2k)], \quad h > 0, \tag{2}$$

where i is (gross) physical investment and the parameter h measures the increase in the marginal cost of installing another unit of capital. The agent faces, then, the

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following flow budget and capital accumulation identities:

$$\dot{n} + i\,[1 + (hi/2k)] = (1 - \tau_k)\alpha k + (1 - \tau_n)r^* n - (1 + \tau_c)c - z, \qquad \textbf{(3a)}$$

$$\dot{k} = i, \qquad \textbf{(3b)}$$

where τ_k, τ_n, τ_c, are, respectively, the marginal tax rates on capital, net financial assets, and consumption, with z representing lump-sum tax payments net of transfers.

The agent solves the following problem:

$$\max \int_0^\infty \{(1-\theta)^{-1}[(c^\eta s^\gamma)^{1-\theta} - 1]\} e^{-\rho t}\, dt, \quad \rho > 0, \qquad \textbf{(4)}$$

subject to the flow constraints (3a) and (3b), the initial conditions $n(0) = n_0$, $k(0) = k_0 > 0$, and the no-Ponzi-game restriction $\lim_{t\to\infty} ae^{-r^* t} \geq 0$, where ρ is the exogenous rate of time preference. A key aspect of the agent's optimization is that he takes the path of average wealth, $A \equiv K + N$, as given. In other words, the agent ignores the effect of his saving/consumption choices on average wealth. The current-value Hamiltonian for this problem corresponds to

$$H(c, n, k, \lambda, q) = (1-\theta)^{-1}\left\{\left[c^\eta\left(\frac{k+n}{K+N}\right)^\gamma\right]^{1-\theta} - 1\right\}$$
$$+ \lambda[(1 - \tau_k)\alpha k + (1 - \tau_n)r^* n - i\,[1 + (hi/2k)] - (1 + \tau_c)c - z] + q' i, \qquad \textbf{(5)}$$

where λ is the current shadow value of wealth and $q' = q\lambda$ is the shadow price of domestic capital in terms of foreign assets. Employing the usual methods of optimal control, it is straightforward to calculate the following necessary conditions for an interior maximum:

$$\frac{\eta(c^\eta s^\gamma)^{1-\theta}}{c} = (1 + \tau_c)\lambda, \qquad \textbf{(6a)}$$

$$i = (q-1)\,k/h \qquad \Rightarrow \qquad \frac{i}{k} = \frac{\dot{k}}{k} = \frac{q-1}{h} = \phi, \qquad \textbf{(6b)}$$

$$\dot{\lambda} = [\rho - (1 - \tau_n)\,r^*]\lambda - \frac{\gamma c^{\eta(1-\theta)} s^{[1-\gamma(1-\theta)]}}{s \cdot (K+N)}, \qquad \textbf{(6c)}$$

$$\dot{q}' = \rho q' - \lambda[(1 - \tau_k)\alpha + h/2\,(i/k)^2] - \frac{\gamma(c^\eta s^\gamma)^{1-\theta}}{s \cdot (K+N)}, \qquad \textbf{(6d)}$$

where $s \equiv a/A$ and ϕ refers to the rate of growth of the domestic capital stock, the solution for which is discussed in Section 3.

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Using the necessary conditions (6b) and (6c) and the definition $q' = q\lambda$, we express domestic capital's optimality condition (6d) as

$$\frac{(1-\tau_k)\alpha}{q} + \frac{(q-1)^2}{2hq} + \frac{\gamma(1+\tau_c)c}{\eta s(K+N)q} + \frac{\dot{q}}{q} = (1-\tau_n)\,r^* + \frac{\gamma(1+\tau_c)c}{\eta s(K+N)}. \quad \textbf{(6d}')$$

Equation (6d′) is a rate-of-return equality condition, adjusted for taxes, between domestic capital and international financial assets. In this setting the return on capital has four elements: (i) the constant after-tax marginal product of capital in terms of the domestic shadow price q, (ii) the gain in terms of lower adjustment costs from installing new capital, (iii) the status gain—in terms of real goods—that capital accumulation generates, and (iv) anticipated capital gains/losses ($\dot{q}/q$). In turn, financial assets yield (i) the direct after-tax payoff $(1-\tau_n)r^*$ and (ii) the utility return from acquiring international assets. Along with the necessary conditions (6a)–(6d′), we impose the following transversality conditions on the limiting behavior of net loans and domestic capital:

$$\lim_{t\to\infty} \lambda n e^{-\rho t} = \lim_{t\to\infty} \lambda q k e^{-\rho t} = 0. \quad \textbf{(6e)}$$

Regarding the public sector, we exclude public debt and assume that it finances its (useless) expenditure G using distortionary and lump-sum taxation according to

$$G = \tau_k \alpha k + \tau_n r^* n + \tau_c c + z. \quad \textbf{(7)}$$

Furthermore, the fiscal authorities set exogenously the proportion of government expenditure in output, $g = G/\alpha k$, which is a condition for a sustainable growth equilibrium.[7]

To study the dynamic properties of the model, we restrict our analysis to a symmetric equilibrium in which identical agents make the same consumption/saving decisions, which implies that $(k+n) = (K+N)$ $(s=1)$ holds $\forall t \geq 0$. From this point on in the paper we use lower-case variables to denote economywide quantities. Imposing $(k+n) = (K+N)$ on (6a)–(6d′), we obtain the following open economy equilibrium:

$$\eta c^{-[1-\eta(1-\theta)]} = (1+\tau_c)\lambda, \quad \textbf{(8a)}$$

$$\frac{i}{k} = \frac{\dot{k}}{k} = \frac{q-1}{h} = \phi, \quad \textbf{(8b)}$$

$$\dot{\lambda} = [\rho - (1-\tau_n)r^*]\lambda - \frac{\gamma(1+\tau_c)c^{\eta(1-\theta)}}{k+n}, \quad \textbf{(8c)}$$

$$\dot{q} = (1-\tau_n)r^* q - (1-\tau_k)\alpha - \frac{(q-1)^2}{2h} + \frac{(q-1)\gamma(1+\tau_c)c}{\eta(k+n)}, \quad \textbf{(8d)}$$

$$\dot{n} = \alpha(1-g)k + r^* n - \frac{(q^2-1)k}{2h} - c, \quad \textbf{(8e)}$$

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together with the initial conditions $n(0) \equiv n_0, k(0) \equiv k_0 > 0$ on net assets and the limiting transversality conditions (6e).[8] Observe that we substitute the government budget identity (7) and $g = G/\alpha k$ to derive (8e), corresponding to the current account balance. As will be clear, it is convenient to analyze the economy's growth equilibrium and dynamics in terms of the control variable consumption, c, rather than the costate variable, λ. To derive $\dot{c}$-equation, we take the time derivative of (8a) and combine with (8c) to yield

$$\dot{c} = \sigma^e c[r^e(r^*, c, a) - \rho]. \tag{9a}$$

The crucial features of this modified Euler equation are (i) the *effective* elasticity of intertemporal substitution σ^e and (ii) the *effective* domestic, or internal, rate of return on assets r^e:

$$\sigma^e \equiv [1 - \eta(1-\theta)]^{-1}, \qquad r^e(r^*, c, k, n) \equiv (1-\tau_n)r^* + \frac{(\gamma/\eta)\,(1+\tau_c)c}{k+n}. \tag{9b}$$

The effective rate of return r^e corresponds to the sum of the after-tax return on international assets and the marginal rate of substitution (MRS) of own assets $(a = k + n)$ for consumption c in the symmetric equilibrium:

$$\text{MRS}\,(c, s) = \frac{U_s\,(c, 1)}{U_c\,(c, 1)} s_a(a, a) = \frac{(\gamma/\eta)\,(1+\tau_c)c}{k+n}. \tag{9c}$$

The latter represents the additional return from acquiring net assets attributable to the status motive. It is straightforward to show that the MRS of net assets for consumption—and, thus, the effective rate of return r^e—is a positive function of consumption and a negative function of net asset holdings. Furthermore, observe that the parameter γ scaling the "weight" of status in instantaneous preferences increases the willingness of agents to trade consumption for net assets and, thus, the effective rate of return.

3. DYNAMIC EQUILIBRIUM

In this section of the paper we analyze the small open economy dynamic equilibrium. To do so, we derive it in terms of variables that attain a stationary steady state and employ the following "ratio" specification for domestic consumption and net loans expressed in terms of the domestic capital stock: $\chi \equiv c/k$ and $\Omega \equiv n/k$. Taking the time derivatives of χ and Ω, we obtain $\dot{\chi}/\chi = \dot{c}/c - \dot{k}/k$ and $\dot{\Omega}/\Omega = \dot{n}/n - \dot{k}/k$. Substituting (8b) and (9a) into $\dot{\chi}/\chi$, we obtain the equation describing the dynamics of the consumption–capital ratio:

$$\dot{\chi} = \chi \left\{ \sigma^e \left[(1-\tau_n)r^* + \frac{(\gamma/\eta)\,(1+\tau_c)\chi}{1+\Omega} - \rho \right] - \frac{q-1}{h} \right\}. \tag{10a}$$

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Using (8b) and (8e), we next derive the differential equation for the net loans–capital ratio:

$$\dot{\Omega} = \alpha\,(1-g) + r^*\Omega - \chi - \frac{(q^2-1)}{2h} - \frac{q-1}{h}\cdot\Omega. \tag{10b}$$

Finally, the dynamic equation for the shadow price of domestic capital corresponds to

$$\dot{q} = (1-\tau_n)r^*q - (1-\tau_k)\alpha - \frac{(q-1)^2}{2h} + \frac{(q-1)\gamma(1+\tau_c)\chi}{\eta(1+\Omega)}. \tag{10c}$$

To study the dynamics of $(\dot{\chi}, \dot{\Omega}, \dot{q})$, we linearize (10a)–(10c) about the steady state $(\tilde{\chi}, \tilde{\Omega}, \tilde{q})$:

$$\begin{bmatrix} \dot{\chi} \\ \dot{\Omega} \\ \dot{q} \end{bmatrix} = \begin{bmatrix} \delta_{11} & \delta_{12} & -\tilde{\chi}/h \\ -1 & r^* - \tilde{\phi} & -(\tilde{q}+\tilde{\Omega})/h \\ \delta_{31} & \delta_{32} & \tilde{r}^e - \tilde{\phi} \end{bmatrix} \begin{bmatrix} \chi - \tilde{\chi} \\ \Omega - \tilde{\Omega} \\ q - \tilde{q} \end{bmatrix}, \tag{11}$$

where

$$\tilde{\phi} = (\tilde{q}-1)/h, \qquad \tilde{r}^e = (1-\tau_n)r^* + \frac{(\gamma/\eta)\,(1+\tau_c)\tilde{\chi}}{1+\tilde{\Omega}},$$

$$\delta_{11} = \frac{\sigma^e\gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})}, \qquad \delta_{12} = -\frac{\sigma^e\gamma(1+\tau_c)\tilde{\chi}^2}{\eta(1+\tilde{\Omega})^2} < 0,$$

$$\delta_{31} = \frac{(\tilde{q}-1)\gamma(1+\tau_c)}{\eta(1+\tilde{\Omega})}, \qquad \delta_{32} = -\frac{(\tilde{q}-1)\gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})^2} < 0.$$

The trace of the Jacobian matrix **J** of (11) equals

$$\mathrm{Tr}\,(\mathbf{J}) = \mu_1 + \mu_2 + \mu_3 = (\tilde{r}^e - \tilde{\phi}) + (r^* - \tilde{\phi}) + \frac{\sigma^e\gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})}, \tag{12a}$$

where $\mu_j = 1, 2, 3$ are the corresponding eigenvalues of the system (11). To exclude the case of all negative eigenvalues, we assume $\mathrm{Tr}(\mathbf{J}) > 0$.[9] Evaluating the determinant of **J**, we calculate

$$\det\,(\mathbf{J}) = \frac{\gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})}[\sigma^e(\tilde{r}^e - \tilde{\phi}) + \tilde{\phi}]\left[r^* - \tilde{\phi} - \frac{\tilde{\chi}}{1+\tilde{\Omega}}\right]. \tag{12b}$$

Consequently, the dynamic system (11) has a saddle-point equilibrium if $\det(\mathbf{J}) = \mu_1\mu_2\mu_3 < 0$, a condition that obtains if

$$r^* - \tilde{\phi} - \frac{\tilde{\chi}}{1+\tilde{\Omega}} = r^* - \tilde{\phi} - \frac{\tilde{c}}{\tilde{a}} < 0. \tag{12c}$$

Thus, the system (11) possesses one negative (stable) eigenvalue equal to $\mu_1 < 0$ and two positive (unstable) eigenvalues corresponding to $\mu_2 > 0$, $\mu_3 > 0$. This

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implies that whereas the net loans to capital ratio Ω is constrained to adjust continuously, both the consumption–capital ratio χ and the shadow price of capital q are "jump" variables that respond instantaneously to new information. In the Appendix we show that the unique saddle-point stable-adjustment path of the economy equals

$$\Omega(t) = \tilde{\Omega} - (\tilde{\Omega} - \Omega_0)e^{\mu_1 t}, \tag{13a}$$

$$\chi(t) - \tilde{\chi} = \Gamma_\chi[\Omega(t) - \tilde{\Omega}], \tag{13b}$$

$$q(t) - \tilde{q} = \Gamma_q[\Omega(t) - \tilde{\Omega}], \tag{13c}$$

where

$$\Gamma_\chi = -\frac{1}{\Lambda}\left\{[r^* - \tilde{\phi} - \mu_1]\frac{\tilde{\chi}}{h} - \delta_{12}\frac{(\tilde{q} + \tilde{\Omega})}{h}\right\} > 0,$$

$$\Gamma_q = -\frac{1}{\Lambda}\{(\delta_{11} - \mu_1)[r^* - \tilde{\phi} - \mu_1] + \delta_{12}\} \gtrless 0,$$

with $\Lambda = -[(\delta_{11} - \mu_1)(\tilde{q} + \tilde{\Omega}) + \tilde{\chi}/h] < 0$. The slopes of the saddle paths in (Ω, χ) and (Ω, q)-space are

$$\frac{d\chi}{d\Omega}_{|X} = \Gamma_\chi > 0, \qquad \frac{dq}{d\Omega}_{|Y} = \Gamma_q \gtrless 0.$$

The positive slope of the X isocline in (Ω, χ)-space is attributable to the fact that higher values of Ω imply higher interest payments, leading to greater consumption and, thus, a rise in χ. This is augmented by the fact, due to the status motive, that a rise in Ω lowers the effective rate of return r^e, which implies a "less steep" consumption path and results in an increase in c relative to k. The sign of the slope of the Y isocline in (Ω, q)-space is ambiguous. The case $\Gamma_q > 0$, which we focus on in Section 4, reflects the fact that higher values of Ω correspond to a relative "scarcity" of domestic capital and lead to a rise in its shadow value q. In contrast, if $\Gamma_q < 0$, then the fact that a higher value of Ω lowers the effective rate of return and, thus, q is more important. The X and Y isoclines are illustrated in Figure 1, along with the corresponding initial equilibria D and E.

4. FISCAL POLICY AND INTERTEMPORAL ADJUSTMENT

Letting $\dot{\chi} = \dot{\Omega} = \dot{q} = 0$ in (10a)–(10c), we derive the following system of equations that solve for $(\tilde{\chi}, \tilde{\Omega}, \tilde{q})$ and, thus, the (common) long-run growth rate $\tilde{\phi}$:

$$\sigma^e(\tilde{r}^e - \rho) = \sigma^e\left[(1 - \tau_n)r^* + \frac{(\gamma/\eta)(1 + \tau_c)\tilde{\chi}}{1 + \tilde{\Omega}} - \rho\right] = \frac{\tilde{q} - 1}{h} = \tilde{\phi}, \tag{14a}$$

$$(1 - g)\alpha - \tilde{\chi} - \frac{(\tilde{q}^2 - 1)}{2h} = -(r^* - \tilde{\phi})\tilde{\Omega}, \tag{14b}$$

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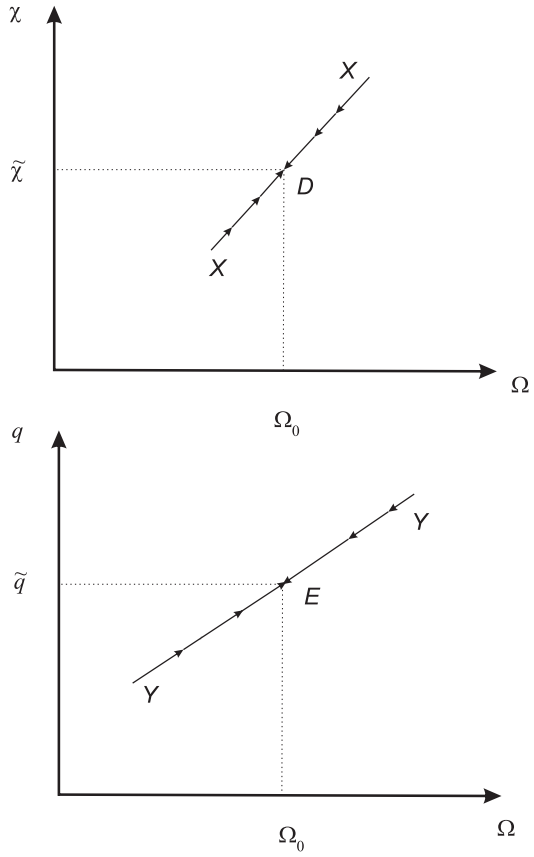


FIGURE 1. Saddle-path dynamics.

$$(1-\tau_k)\alpha + \frac{(\tilde{q}-1)^2}{2h} = (1-\tau_n)r^*\tilde{q} + \frac{(\tilde{q}-1)\gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})}. \qquad \textbf{(14c)}$$

Equation (14a) is the steady-state version of the modified Euler equation, whereas (14b) represents the long-run current account equilibrium, in which the trade balance equals international interest income. In turn, equation (14c) is the steady-state rate-of-return condition for domestic capital and international net loans.[10]

In this part of the paper we model the dynamic implications of fiscal policy shocks on the growth equilibrium. The analytical basis for our long-run results is the steady-state system (14a)–(14c), whereas we employ (13a)–(13c) for the economy's saddle-path adjustment. As indicated, we consider, in turn, government expenditure disturbances, g, and three tax shocks, capital, international bond, and consumption, (τ_k, τ_n, τ_c).[11]

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4.1. Government Expenditure

The long-run effects of a permanent increase in the proportion g of government expenditure, financed by lump-sum taxation, equal

$$\frac{\partial \tilde{\chi}}{\partial g} = \frac{\alpha \tilde{\chi}}{1+\tilde{\Omega}} \cdot \frac{1}{r^* - \tilde{\phi} - \tilde{\chi}/(1+\tilde{\Omega})} < 0, \tag{15a}$$

$$\frac{\partial \tilde{\Omega}}{\partial g} = \frac{\alpha}{r^* - \tilde{\phi} - \tilde{\chi}/(1+\tilde{\Omega})} < 0, \qquad \frac{\partial \tilde{q}}{\partial g} = h \cdot \frac{\partial \tilde{\phi}}{\partial g} = 0, \tag{15b}$$

where we substitute for $\det(\mathbf{J})$ to obtain the expressions for $\partial \tilde{\chi}/\partial g$ and $\partial \tilde{\Omega}/\partial g$ in (15a) and (15b). The long-run shadow value of domestic capital, and thus the equilibrium growth rate, is independent of the fraction g of resources devoted to public expenditure. In contrast, both the consumption–capital and the financial asset–capital ratios decline in the balanced-growth equilibrium due to the crowding-out effect of public expenditure.

Figure 2 illustrates the saddle-path adjustment to a fiscal expansion. Under the consumption-smoothing motive, the agent runs current account deficits, implying that $\dot{\Omega} < 0$ along both the X' and Y' isoclines. We depict in Figure 2 the case in which the "dissaving" effect is strong enough so that $\chi(0)$ rises. Furthermore, because the fiscal expansion causes a substitution from international financial assets and toward domestic capital accumulation, this leads to a *temporary* increase in the shadow value of domestic capital. This is illustrated by the jump of $q(0)$ to the new isocline X'. Because q remains above its unchanged long-run value during the whole of the transition, the balanced growth rate $\phi(t)$ is also greater than $\tilde{\phi}$ for $t \geq 0$. Recalling the long-run multiplier $\partial \tilde{\Omega}/\partial g < 0$ in (15b), consumption is ultimately crowded out by the rise in g—whether or not it rises initially—an adjustment depicted in Figure 2 by the decline in the consumption–capital ratio to $\tilde{\chi}_1$.

4.2. Capital Tax

Turning to the steady state effects of a rise in the capital tax rate τ_k, we calculate the following long-run effects:

$$\frac{\partial \tilde{\chi}}{\partial \tau_k} = -\frac{\alpha \tilde{\chi}}{\det(\mathbf{J})h}\left[\frac{\sigma^e \gamma (1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})^2} \cdot (\tilde{q}+\tilde{\Omega}) + r^* - \tilde{\phi}\right] > 0, \tag{16a}$$

$$\frac{\partial \tilde{\Omega}}{\partial \tau_k} = -\frac{\alpha \tilde{\chi}}{\det(\mathbf{J})h}\left[1 + \frac{\sigma^e \gamma (1+\tau_c)}{\eta(1+\tilde{\Omega})} \cdot (\tilde{q}+\tilde{\Omega})\right] > 0, \tag{16b}$$

$$\frac{\partial \tilde{q}}{\partial \tau_k} = h \cdot \frac{\partial \tilde{\phi}}{\partial g} = -\frac{\alpha \sigma^e \tilde{\chi}}{\sigma^e(\tilde{r}^e - \tilde{\phi}) + \tilde{\phi}} < 0, \tag{16c}$$

where we substitute for $\det(\mathbf{J})$ to derive the expression for $\partial \tilde{q}/\tau_k$ in (16c). A permanent rise in the capital tax rate reduces the incentives to accumulate physical

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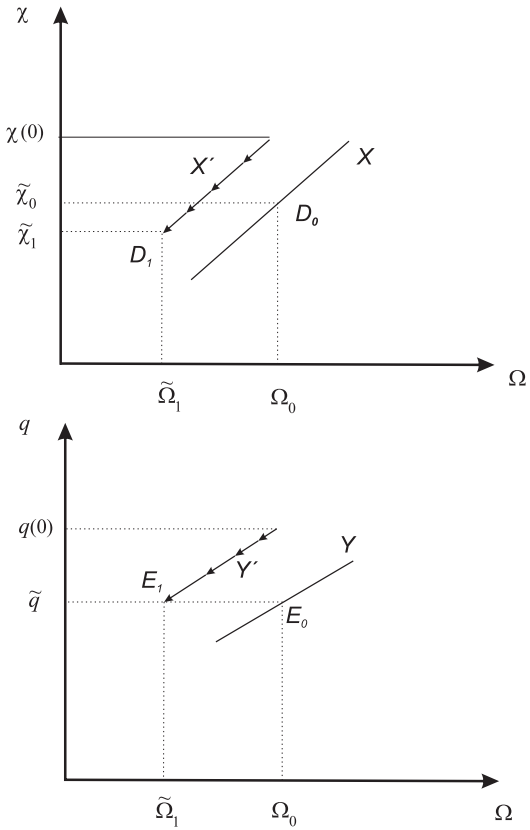


FIGURE 2. Fiscal expansion.

assets, which lowers $\tilde{q}$ and the balanced growth rate $\tilde{\phi}$. Observe that this is in contrast to Turnovsky (1996, 2002), where the growth rate of consumption is independent of τ_k.[12] The decline in the rate of return to domestic capital causes agents to substitute in favor of international financial assets, resulting in a rise in $\tilde{\Omega}$. This results in greater net interest income that permits a long-run rise in consumption and is reflected in the rise in $\tilde{\chi}$ in (16a).

Figure 3 depicts the transitional response to a rise in the capital tax τ_k. The isocline in (Ω, q)-space shifts down to Y' and results in an initial decline in the shadow value $q(0)$. Indeed, because the isocline is upward-sloping, the fall in $q(0)$ overshoots its long-run decline from $\tilde{q}_0$ to $\tilde{q}_1$, so that $\dot{q}(t) > 0$, $t \geq 0$. Moreover, during the transition, the balanced growth rate is *below* its steady-state level, $\phi(t) < \tilde{\phi}$, $t \geq 0$. Equally, the shift away from domestic capital accumulation leads to greater international lending, implying $\dot{\Omega} > 0$. In the upper panel of Figure 3, we illustrate the case in which the isocline X' shifts up, resulting in a rise

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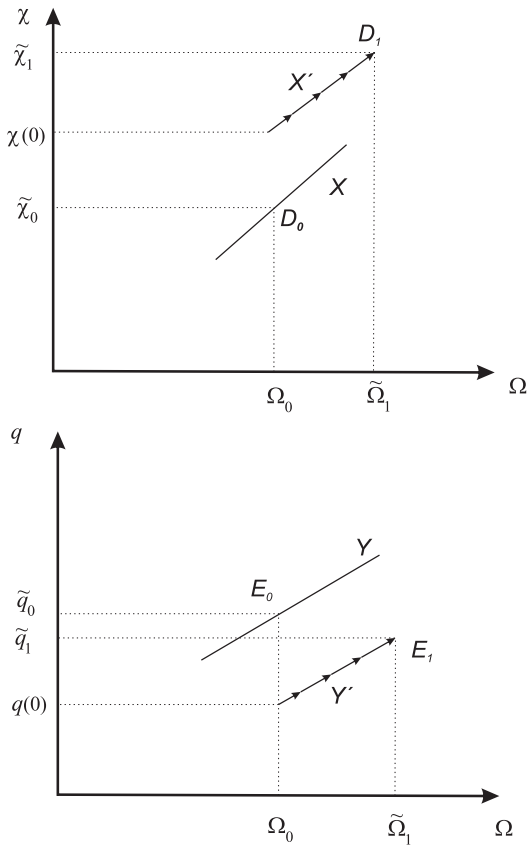


FIGURE 3. Rise in the capital tax.

in $\chi(0)$. Whether or not the isocline X rises or declines at $t = 0$, the consumption–capital ratio rises, $\dot{\chi} > 0$, in transition to the new long-run equilibrium illustrated by point D_1.

4.3. Tax on International Bonds

We next calculate the effects of an increase in the tax levied on net loans:

$$\frac{\partial \tilde{\chi}}{\partial \tau_n} = \frac{r^* \tilde{\chi}}{\det(\mathbf{J})} \left\{ (r^* - \tilde{\phi}) \left[\sigma^e (\tilde{r}^e - \tilde{\phi}) + \frac{\tilde{q}}{h} \right] + \frac{\sigma^e \gamma (1 + \tau_c) \tilde{\chi}}{\eta (1 + \tilde{\Omega})^2} \cdot \frac{\tilde{q} + \tilde{\Omega}}{h} \right\} < 0, \tag{17a}$$

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$$\frac{\partial \tilde{\Omega}}{\partial \tau_n} = \frac{r^* \tilde{\chi}}{\det(\mathbf{J})} \left\{ \sigma^e (\tilde{r}^e - \tilde{\phi}) + \frac{\tilde{q}}{h} + \frac{\sigma^e \gamma (1+\tau_c)}{\eta (1+\tilde{\Omega})} \cdot \frac{\tilde{q}+\tilde{\Omega}}{h} \right\} < 0, \tag{17b}$$

$$\frac{\partial \tilde{q}}{\partial \tau_n} = h \cdot \frac{\partial \tilde{\phi}}{\partial g} = \frac{\sigma^e r^*}{\sigma^e (\tilde{r}^e - \tilde{\phi}) + \tilde{\phi}} > 0, \tag{17c}$$

where we use $\det(\mathbf{J})$ to obtain (17c). In terms of its long-run growth implications, a rise in τ_n has the opposite implication to a rise in τ_k. Agents switch to domestic capital accumulation if the after-tax return on international loans falls, which is reflected in a corresponding rise in $\tilde{q}$ and the steady-state growth rate $\tilde{\phi}$. This finding is also in stark contrast to Turnovsky (1996, 2002), where a higher tax on net loans causes the growth rate of consumption to *fall*.[13] The reallocation of savings, then, is reflected in a fall in $\tilde{\Omega}$ and in $\tilde{\chi}$. Because these two effects have opposing implications for consumption—the rise $\tilde{\phi}$ in tends to increase it, whereas the fall in $\tilde{\Omega}$ tends to decrease it—the response of $\tilde{\chi}$ to the rise in τ_n is ambiguous.

A rise in the tax on international loans, as indicated above, causes a substitution toward domestic capital accumulation. In Figure 4 this is illustrated by an increase in the shadow value to $q(0)$ along Y'. Because a rise in τ_n reduces the effective rate of return r^e, expected capital losses are needed to maintain the rate-of-return condition (6d′), i.e., $\dot{q}/q < 0$. This, in turn, implies that $q(0)$ overshoots its steady-state increase. Clearly, growth is *above* its higher long-run level during the adjustment phase. Lending abroad declines, however, subsequent to a rise in τ_n. The resulting current-account deficits—and declines in Ω—are depicted in Figure 4 by the downward movement of the economy along X' and Y'. In Figure 4 we also illustrate the the case in which the initial response of the consumption–capital ratio is positive.

4.4. Consumption Tax

Finally, the long-run consumption tax multipliers correspond to

$$\frac{\partial \tilde{\chi}}{\partial \tau_c} = -\frac{r^* - \tilde{\phi}}{r^* - \tilde{\phi} - \tilde{\chi}/(1+\tilde{\Omega})} \cdot \frac{\tilde{\chi}}{1-\tau_c} > 0, \tag{18a}$$

$$\frac{\partial \tilde{\Omega}}{\partial \tau_c} = -\frac{1}{r^* - \tilde{\phi} - \tilde{\chi}/(1+\tilde{\Omega})} \cdot \frac{\tilde{\chi}}{1-\tau_c} > 0, \tag{18b}$$

$$\frac{\partial \tilde{q}}{\partial \tau_c} = h \cdot \frac{\partial \tilde{\phi}}{\partial \tau_c} = 0, \tag{18c}$$

where (18a) and (18b) are obtained by substituting $\det(\mathbf{J})$. As in the case of an increase in g, a higher consumption tax rate has no effect on capital's long-run shadow value $\tilde{q}$ and growth rate $\tilde{\phi}$.[14] Nevertheless, the change in tax policy

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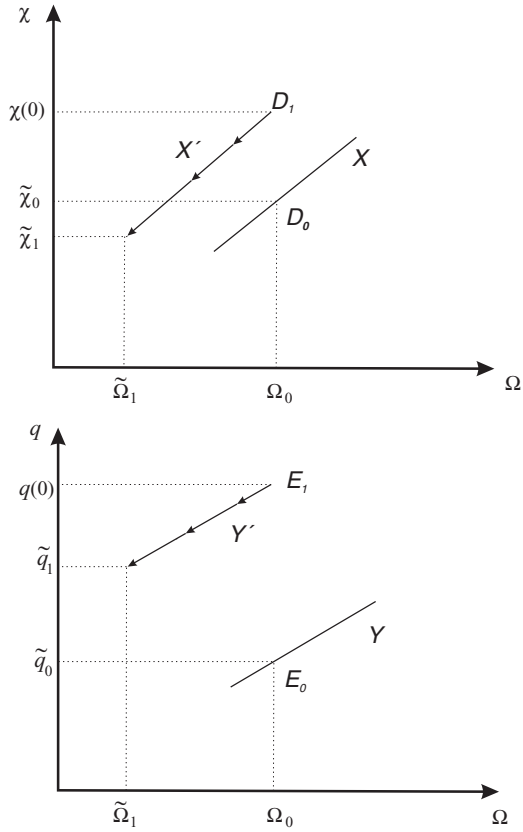


FIGURE 4. Rise in the tax on loans.

causes more international net lending and, thus, current account surpluses, which raise $\tilde{\Omega}$ in the long run. Whereas the higher τ_c tends to decrease the steady state consumption, the rise in international asset income, mirrored in the rise in $\tilde{\Omega}$, tends to increase it. On net, the latter effect dominates in the steady state, so that $\tilde{\chi}$ rises.

Finally, using Figure 5, we illustrate the economy's adjustment to a higher consumption tax. This results in current account surpluses and, consequently, $\dot{\Omega} > 0$ along X' and Y', both of which shift down. Due to relative wealth preferences, a higher consumption tax increases the effective rate of return r^e, which leads to a fall in $q(0)$—along with expected capital gains $\dot{q}/q > 0$—to maintain (6d′). Consequently, the balanced growth rate $\phi(t)$ falls *below* its unchanged long-run rate $\tilde{\phi}$ for the duration of the transitional adjustment. Figure 5 also depicts the initial fall in the consumption–capital ratio, followed by its long-run rise along X' to χ_1.

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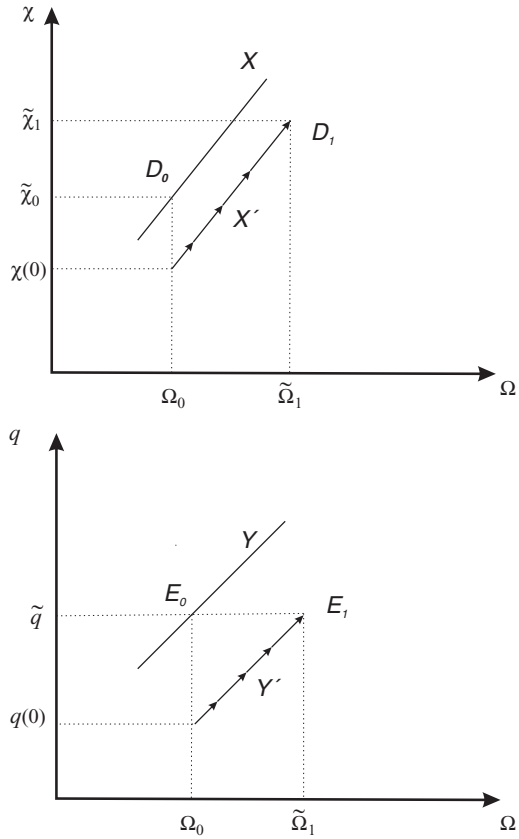


FIGURE 5. Rise in the consumption tax.

5. CONCLUDING REMARKS

In this paper we develop a small open economy model of relative wealth that sustains an endogenous growth equilibrium. Crucial in deriving the balanced growth rate is the effective rate of return that arises from agents' status preferences. This results in a common balanced growth rate for consumption, the domestic capital stock, and net financial assets.

To study the properties of the growth model with relative wealth, we model the effects of public expenditure and tax rate shocks. In terms of the short-term properties of these disturbances, we show that whereas a fiscal expansion temporarily increases the growth rate, a rise in the consumption tax decreases it. In contrast, a rise in the capital tax reduces the growth rate in the long run, as well as during the transition. If, instead, a higher tax is levied on international interest income, agents switch toward domestic capital accumulation. This raises the endogenous growth rate during the transition and in the balanced-growth steady state.

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NOTES

1. See, for example, Dupor and Liu (2003) and Liu and Turnovsky (2005), who address these questions in the relative consumption context.

2. See Turnovsky (1997b, Chaps. 2 and 3), who describes alternative ways to exclude the zero-root property in the small open economy framework.

3. A detailed analysis of these properties in found in Turnovsky (1996, 1997b, Chap. 5). Turnovsky (2002) also discusses the decoupling of the growth rates of consumption and physical capital in his general account of "knife-edge" conditions in small open economies.

4. In Turnovsky (1997a) the saddlepoint property is obtained by incorporating an upward-sloping interest-rate relationship that is a function of the ratio of national debt to physical capital.

5. The simple ratio specification is adopted by Fisher (2004).

6. See Fisher (2005) and Fisher and Hof (2005) for more general specifications of the status function that allow for negative net assets.

7. Due to the lack of a common growth rate in Turnovsky (1996, 1997b), public expenditure must be set in proportion to consumption or wealth.

8. It is straightforward to show that the transversality condition requires $r^e > \phi$. This imposes an upper bound on the shadow value of domestic capital. Equally, given the preference parameters (γ, η) and the exogenous world interest rate r^*, it also places restrictions on the values of the tax rates τ_n and τ_c

9. A sufficient condition for $\mathrm{Tr}(\mathbf{J}) > 0$ is $r^* > \tilde{\phi}$, which we use for the rest of the paper.

10. Combining (14a)–(14c), we obtain the quadratic equation determining $\tilde{q}$. It is straightforward to show that the unstable solution satisfies the transversality condition and generates ongoing growth for the case $(1 - \tau_k)\alpha > (1 - \tau_n)r^*$. Turnovsky (1996, 1997b) provides a detailed analysis of the general solution procedure.

11. It is obvious that relative wealth preferences lead to negative externalities. Interestingly, the socially optimal economy, in which the planner sets $s = 1$, coincides with canonical model of Turnovsky (1996, 1997b). An analysis of optimal tax policy to achieve this outcome is, nevertheless, beyond the scope of the paper.

12. See Turnovsky (1996, 2002, Proposition 2).

13. This result [Turnovsky (1996, 2002, Proposition 2)] is due to the decoupling of growth rates in the canonical model. There, the rise in the tax on net bond holdings directly lowers the exogenous growth rate of consumption.

14. Observe that the implications of a rise in τ_c are the same as those of an increase in the preference weight γ on relative wealth.

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APPENDIX

A.1. DERIVATION OF THE SADDLE-PATH SOLUTION

In this part of the Appendix we derive the saddle-path solution of the small open economy. We posit that the solution to (χ, Ω, q) takes the form

$$\begin{aligned} \chi(t) &= \tilde{\chi} + A_1 e^{\mu_1 t}, \\ \Omega(t) &= \tilde{\Omega} + B_1 e^{\mu_1 t}, \\ q(t) &= \tilde{q} + C_1 e^{\mu_1 t}, \end{aligned} \tag{A.1}$$

where $(\tilde{\chi}, \tilde{\Omega}, \tilde{q})$ is the steady state and (A_1, B_1, C_1) are constants to be determined. Substituting (A.1) into the differential equations system (11), we obtain

$$\begin{bmatrix} \delta_{11} - \mu_1 & \delta_{12} & -\tilde{\chi}/h \\ -1 & r^* - \tilde{\phi} - \mu_1 & -(\tilde{q} + \tilde{\Omega})/h \\ \delta_{32} & \delta_{32} & \tilde{r}^e - \tilde{\phi} - \mu_1 \end{bmatrix} \begin{bmatrix} A_1 \\ B_1 \\ C_1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \tag{A.2}$$

where $(A_1, B_1, C_1)'$ is the eigenvector associated with $\mu_1 < 0$. Because the ratio of net loans to physical capital $\Omega(t)$ is constrained to adjust from a given initial level Ω_0, we obtain $B_1 = -(\tilde{\Omega} - \Omega_0)$ and $\Omega(t) = \tilde{\Omega} - (\tilde{\Omega} - \Omega_0)e^{\mu_1 t}$. Replacing $B_1 = -(\tilde{\Omega} - \Omega_0)$ in (A.1),

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we obtain the solution for (A_1, C_1). The two equivalent representations of this solution are

$$\begin{bmatrix} -1 & -(\tilde{q}+\tilde{\Omega})/h \\ \delta_{31} & \tilde{r}^e - \tilde{\phi} - \mu_1 \end{bmatrix} \begin{bmatrix} A_1 \\ C_1 \end{bmatrix} = \begin{bmatrix} \tilde{r}^e - \tilde{\phi} - \mu_1 \\ \delta_{32} \end{bmatrix} (\tilde{\Omega} - \Omega_0) \tag{A.3a}$$

and

$$\begin{bmatrix} \delta_{11} - \mu_1 & -\tilde{\chi}/h \\ -1 & -(\tilde{q}+\tilde{\Omega})/h \end{bmatrix} \begin{bmatrix} A_1 \\ C_1 \end{bmatrix} = \begin{bmatrix} \delta_{12} \\ \tilde{r}^e - \tilde{\phi} - \mu_1 \end{bmatrix} (\tilde{\Omega} - \Omega_0). \tag{A.3b}$$

From (A.3a) the solution for (A_1, C_1) is

$$\begin{aligned} A_1 &= \left[(r^* - \tilde{\phi} - \mu_1)(\tilde{r}^e - \tilde{\phi} - \mu_1) - \delta_{32} \frac{\tilde{q}+\tilde{\Omega}}{h} \right] \frac{(\tilde{\Omega} - \Omega_0)}{\Delta}, \\ C_1 &= -[\delta_{32} + \delta_{32}(\tilde{r}^e - \tilde{\phi} - \mu_1)] \frac{(\tilde{\Omega} - \Omega_0)}{\Delta}, \end{aligned} \tag{A.4a}$$

where $\Delta = (\tilde{r}^e - \tilde{\phi} - \mu_1) - \delta_{31}(\tilde{q}+\tilde{\Omega})/h \gtrless 0$. From (A.3b) the solution for (A_1, C_1) equals

$$\begin{aligned} A_1 &= \left[(r^* - \tilde{\phi} - \mu_1) \frac{\tilde{\chi}}{h} - \delta_{12} \frac{\tilde{q}+\tilde{\Omega}}{h} \right] \frac{(\tilde{\Omega} - \Omega_0)}{\Lambda}, \\ C_1 &= [(\delta_{11} - \mu_1)(r^* - \tilde{\phi} - \mu_1) + \delta_{12}] \frac{(\tilde{\Omega} - \Omega_0)}{\Lambda}, \end{aligned} \tag{A.4b}$$

where $\Lambda = -[(\delta_{11} - \mu_1)(\tilde{q}+\tilde{\Omega}) + \tilde{\chi}/h] < 0$. The second representation of the solution in (A.1) is convenient for studying the dynamics of (χ, Ω, q) in Section 4 and is stated in (13a)–(13c), where

$$A_1 = -\Gamma_\chi(\tilde{\Omega} - \Omega_0), \qquad C_1 = -\Gamma_q(\tilde{\Omega} - \Omega_0). \tag{A.5}$$

A.2. Steady State Comparative Statics

Differentiating the relationships (14a)–(14c), we obtain the steady state system that is the basis of our discussion of the long-run effects of fiscal policy in Section 4:

$$\begin{aligned} &\begin{bmatrix} \dfrac{\sigma^e \gamma(1+\tau_c)}{\eta(1+\tilde{\Omega})} & -\dfrac{\sigma^e \gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})^2} & -\dfrac{1}{h} \\ -1 & r^* - \tilde{\phi} & -\dfrac{\tilde{q}+\tilde{\Omega}}{h} \\ \dfrac{(\tilde{q}-1)\gamma(1+\tau_c)}{\eta(1+\tilde{\Omega})} & -\dfrac{(\tilde{q}-1)\gamma(1+\tau_c)\tilde{\chi}}{\eta(1+\tilde{\Omega})^2} & \tilde{r}^e - \tilde{\phi} \end{bmatrix} \begin{bmatrix} d\tilde{\chi} \\ d\tilde{\Omega} \\ d\tilde{q} \end{bmatrix} \\ &= \begin{bmatrix} 0 \\ \alpha \\ 0 \end{bmatrix} dg + \begin{bmatrix} 0 \\ 0 \\ -\alpha \end{bmatrix} d\tau_k + \begin{bmatrix} \sigma^e r^* \\ 0 \\ r^* \tilde{q} \end{bmatrix} d\tau_n + \begin{bmatrix} -\dfrac{\sigma^e \gamma \tilde{\chi}}{\eta(1+\tilde{\Omega})} \\ 0 \\ -\dfrac{(\tilde{q}-1)\gamma\tilde{\chi}}{\eta(1+\tilde{\Omega})} \end{bmatrix} d\tau_c, \end{aligned} \tag{A.6}$$

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where the determinant of the coefficient matrix of (A.6) equals

$$\frac{\det(\mathbf{J})}{\tilde{\chi}} = \frac{\gamma(1+\tau_c)}{\eta(1+\tilde{\Omega})}[\sigma^e(\tilde{r}^e - \tilde{\phi}) + \tilde{\phi}]\left[r^* - \tilde{\phi} - \frac{\tilde{\chi}}{1+\tilde{\Omega}}\right] < 0.$$

Because $\det(\mathbf{J}) < 0$ by the saddle-point property, the determinant of the coefficient matrix is also negative.

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