Appendix:
The Present-Value Model of the Current Account Has Been Rejected: Round Up the Usual Suspects

James M. Nason[†]
Research Department
Federal Reserve Bank of Atlanta
1000 Peachtree St., N.E.
Atlanta, GA 30033
email : jim.nason@atl.frb.org

John H. Rogers[†]
MS 22, International Finance Division
Board of Governors of the
Federal Reserve System
Washington, D.C. 20551
email : John.H.Rogers@FRB.GOV

January 25, 2005

Appendix

This appendix describes the analytics of the rejection of the exact orthogonality conditions of the PVM by the RBC model, sketches the non-parametric density estimation procedure, presents the Euler equations of the internalized risk premium-RBC model, reports simulation experiements when preferences are changed to $r^* < (1-\beta)/\beta$ from the permanent income restriction, outlines the impact of the terms-of-trade shock on the equilibrium and optimality conditions of our RBC model, and discusses the Bayesian calibration and results of the associated simulation experiments. These items appear in sections $A.1$, $A.2$, $A.3$, $A.4$, $A.5$, and $A.6$, respectively.

A.1 Orthogonality Conditions and the RBC Model

This section of the appendix explains why the small open economy-RBC model will always reject the exact version of the orthogonality condition. Note that an implication of the unit root technology shock (10) is that NY_t can be decomposed as $NY_t = NY_{P,t} + NY_{\tau,t}$, where $NY_{P,t}$ and $NY_{\tau,t}$ are the permanent and transitory components of net output. It follows that the permanent component is a random walk with drift, $NY_{P,t} = \gamma + NY_{P,t-1} + \varepsilon_t$. Subsequent to applying this decomposition of NY_t to the PVM equation

$$CA_t = NY_t + \frac{r}{1+r}\sum_{j=0}^{\infty}\left(\frac{1}{1+r}\right)^j \mathbf{E}_t\left\{NY_{t+j}\right\},$$

we find $CA_t = constant + \zeta(\mathbf{L})NY_{\tau,t}$, where $\zeta(\mathbf{L})$ is a lag polynomial of order m (possibly infinite) implied by the ARMA process of $NY_{\tau,t}$. The linearized solution (18) and (19) of the RBC model yields the equilibrium process $\widetilde{NY}_t = \pi_{\mathcal{S},NY}\mathcal{S}_t$, where $\pi_{\mathcal{S},NY}$ is a row vector conformable with the state vector $\mathcal{S}_t$. Identify the detrended and demeaned component of NY_t with its transitory component and it is easy to see that

$$\mathcal{CA}_t = \Delta\widetilde{NY}_t + [1-(1+r)\mathbf{L}]\zeta(\mathbf{L})\widetilde{NY}_t,$$

where any constants have been ignored. Hence, $\mathcal{CA}_t$ is serially correlated and correlated with information of date $t-1$ and earlier. It is important to note that this holds even when the innovation to the technology shock, ε_t, is the only exogenous state variable of the RBC model. Hence, the test of the orthogonality condition of the exact PVM possess no power against alternatives like our small open economy-RBC model.

A.2 Non-Parametric Density Estimation

Non-parametric density estimation uses the normal kernel $\mathcal{N}(x) = \exp\{-0.5x^2\}/\sqrt{2\pi}$ where x is the distance between two points in the density. The density, $d(x) = (1/\mathcal{J})\sum_{i=1}^{\mathcal{J}} \mathcal{N}([\mathcal{X} - \mathcal{X}_i]/h)$, simply plugs in the kernel, where h is the bandwidth or smoothing parameter of the density and $\mathcal{X}_i$ is the ith Monte Carlo replication of either the Wald statistic of $\mathcal{H}_{\mathcal{T}}$ or the LM statistic, $T \times R^2$. We follow Silverman (1986) to compute $d(x)$.

A.3 Optimality Condistions under the Internalized Risk Premium

Under an internalized risk premium, we derive the following intertemporal optimality conditions

$$\left(\frac{I_t}{K_t}\right)^{\alpha} = \mathbf{E}_t\left\{\Gamma_{t+1}\left[\theta(1-\alpha)\frac{Y_{t+1}}{K_{t+1}}\left[1 + \varphi\left(\frac{B_{t+1}}{Y_{t+1}}\right)^2\right] + \left[1-\delta + \alpha\left(\frac{I_{t+1}}{K_{t+1}}\right)^{1-\alpha}\right]\left(\frac{I_{t+1}}{K_{t+1}}\right)^{\alpha}\right]\right\}, \tag{A.1}$$

and

$$1 = \mathbf{E}_t\left\{\Gamma_{t+1}\left(1 + r_{t+1} - \varphi\frac{B_{t+1}}{Y_{t+1}}\right)\right\}. \tag{A.2}$$

The stochastic discount factor, Γ_{t+1}, equals $\beta\,(C_{t+1}/C_t)^{\phi(1-\psi)-1}\,([1 - N_{t+1}]/[1 - N_t])^{(1-\phi)(1-\psi)}$ if period utility is given by (4) or $\beta\,(C_{t+1}/C_t)^{-1}$ when period utility is (3). Equation (A.6) sets the marginal cost of increasing date t investment equal to the expected discounted benefit of the extra unit of capital available at date $t+1$. The extra unit of capital contributes to greater production gross of the risk premium, higher depreciation, and smaller adjustment costs. This is the expected return to an additional unit of capital and is the right hand side of the Euler equation (A.1). The Euler equation (A.2) describes optimality in the international bond market. It states that the unit of consumption foregone by holding one more bond is equal to the expected discounted benefit of holding that bond. The benefit includes the world real interest rate, r_{t+1}, net of the risk premium, $-\varphi(B_{t+1}/Y_{t+1})$, which moves endogenously with the bond-output ratio. The labor market optimality condition is given by eqution (17) in the text. Also note that the Euler equations of the canonical RBC model is obtain by setting $\varphi = 0$ in Euler equations (A.1) and (A.2).

There are several issues worth noting about our approach to internalizing the risk premium. Besides its contribution to a stationary solution for the linearized small open economy-RBC model, internalizing the risk premium (6) yields a set of optimality and equilibrium conditions for the social planner that produce data observationally equivalent to those generated by Mendoza (2002) and Valderrama (2002). Its should not be a surprise that the solution of the social planner's problem can be interpreted as a compeitive equilibrium because of the discussion and results in section 6.2 of Arrow and Hahn (1971). They show that the characterization of a competitive equilibrium depends on the extent to which agents recognize that their actions affect the preference or profit functions of other agents (and the converse). The implication is that there exists a decentralized version of our small open economy-RBC model with an internalized risk premium that generates a compeitive equilibrium similar to those studied by Mendoza (2002) and Valderrama (2002).

A.4 Changing Preferences: What if $r^* < (1-\beta)/\beta$?

Up to this point, we have imposed the PIH restriction, $q^* = (1-\beta)/\beta$. This restriction, or more generally $r^* \geq (1-\beta)/\beta$, is problematic when studying the limiting distributions of small open economies, if φ is identically zero. Under these conditions, domestic households are sufficiently patient that the small open economy eventually accumulates the entire universe of wealth. In this case, the joint limiting distribution of the endogenous variables is not defined.[A.1] This problem can be rendered moot if it is assumed that $r^* < (1-\beta)/\beta$, even when $\varphi = 0$. In this case, the future discounted marginal utility of consumption converges in the limit, which produces a finite level of consumption and bond value. Therefore, it is potentially useful to study cases in which $r^* < (1-\beta)/\beta$.[A.2]

We present simulation results from the canonical, fiscal and world real interest rate shocks, and imperfect capital mobility models in table $A.1$ and figures $A.1 - A.4$ that are, conditional on the restriction $r^* < (1-\beta)/\beta$.[A.3] Table $A.1$ lists the ensemble averages of the elements of $\mathcal{H}_{\mathcal{T}}$ for these models. The estimates of $\mathcal{H}_{\mathcal{T},5}$ are all far from unity – the theoretical PVM value – under the $r^* < (1-\beta)/\beta$. This restriction also creates excess sensitivity of the current account forecast to current output growth and in some cases to its lags and lags of the current account, in particular the canonical and imperfect capital mobility models.

Figures $A.1 - A.4$ provide theoretical 90 percent confidence bands of current account forecasts and densities of the LM and Wald statistics generated by the canonical, fiscal and world real interest rate shocks, and imperfect capital mobility models, under the impatience restriction $r^* < (1-\beta)/\beta$. This restriction leads the canonical and fiscal shock experiments to produce nearly identical CIC statistics for the LM and Wald tests, about one-third and zero, as shown in the right-side

---

[A.1] Chamberlain and Wilson (1984) discuss this problem in the context of a household saving problem. Aiyagari (1994) provides intuition and suggests a resolution, while chapter 14 of Ljungqvist and Sargent (2000) is a good introduction.

[A.2] Under this restriction, a linear solution of the small open economy-RBC model still requires $\varphi > 0$.

[A.3] We impose $\beta_j = 1/(1+q_j^*) - (0.01 \times \breve{\beta}_j)$ where the prior of q^* is described in section 3.3 and $\breve{\beta}$ is normally distributed with mean 0.9940 and 95 percent coverage interval $[0.9920,\ 0.9961]$.

windows of figures $A.1$ and $A.2$. The world real interest rate shock model also fails to match the empirical density of the Wald test, but this model fits better to the density of the empirical LM test. The CIC statistic of the former is 0.19 and the latter is 0.54 (see figure $A.3$). We find the opposite is true is for the imperfect capital mobility experiment. Figure $A.4$ reports CIC statistics of 0.32 and 0.73 for the LM and Wald tests for the model with the large non-internalized risk premium, conditional on $r^* < (1 - \beta)/\beta$. The LM and Wald tests indicate that the impatience restriction $r^* < (1 - \beta)/\beta$ fails to push the models either in the direction of the present-value theory or the actual data. The canonical, fiscal shock, and imperfect capital mobility models are closer the PVM prediction that the history of output growth and the current account fail is orthogonal to current account forecasts. Note we obtain the same result for the canonical model under the PVM restriction $r^* = (1 - \beta)/\beta$. The only experiment that replicates the sample rejection of the PVM orthogonality restriction is generated by the world real interest rate shock model, given $r^* < (1 - \beta)/\beta$.

The holds true for the theoretical 90 percent confidence bands of the current account forecasts and densities of the LM and Wald statistics generated by the canonical, fiscal and world real interest rate shocks, and imperfect capital mobility models, under the impatience restriction $r^* < (1 - \beta)/\beta$. Figures $A.1$ and $A.3$ show that the actual Canadian current account wanders in and out of the theoretical 90 percent confidence bands of the canonical and world real interest rate shock experiments. The former model has confidence bands that exhibit a saw-tooth pattern not observed in the actual current account. The confidence bands of the world real interest rate shock experiment are almost always wider than the empirical 90 percent confidence bands, yet do not contain the actual current account around $1970, -1971$, $1981 - 1982$, and during the later 1980s and early 1990s. The imperfect capital mobility experiment generates even wider theoretical 90 percent confidence bands, as seen in figure $A.4$. This model's predicts that the Canadian current account ranged between $\pm\$4,900$ 1992 Canadian dollars during the sample. This is more than three times its actual size (in absolute value). The assumption $r^* < (1 - \beta)/\beta$ and a world real interest rate shock cause the small open economy model to act as if it is more patient. Figure $A.3$ reveals theoretical 90 percent confidence bands that lay everywhere below the actual current account.

Table $A.2$ contains the ensemble averages of the elements of $\mathcal{H}_{\mathcal{T}}$ and their SDM statistics for (i) our canonical RBC model, (ii) the fiscal shock and the world real interest rate shock experiments, and (iii) the alternative that allows for imperfect international capital mobility, given an internalized risk premium and $r^* < (1 - \beta)/\beta$.[A.4] Densities of

[A.4]These simulation experiments employ the same restriction on β_j and priors on $\breve{\beta}_j$) as described in footnote $A.2$.

the LM and Wald statistics and plots of the 90 percent confidence bands for these experiments appear in figures $A.5 - A.8$.

The results in table $A.2$ for the canonical RBC model given $r^* < (1 - \beta)/\beta$ show the model fails to match the actual data and the theoretical predictions of the PVM. For example, $\mathcal{H}_{\mathcal{T},1} = 0.48$ indicates excess sensitivity of the current account to movements in changes in net output, while $\mathcal{H}_{\mathcal{T},5} = 0.36$ is well below the theoretical restriction that this element of $\mathcal{H}$ equals one. This is reflected in the 90 percent confidence bands of the left-side window of figure $A.6$. The bands are always below the actual current account. The restriction that the steady state world real interest rate is below the subjective rate of time preference gives the small open economy incentive to bring consumption forward, thereby leading to a lower current account balance. The left-side window of figure $A.5$ suggests that such modifications to the canonical RBC model do not bring the current account forecast closer to the actual Canadian data. The densities of the LM and Wald statistics provide further evidence on the usefulness of relaxing the PIH restriction. For the LM test, both specifications of the model yield CICs of about one-third. For the Wald test, relaxing the PIH restriction worsens the fit, as the CIC falls to only 0.03.

The impact of the fiscal and the world real interest rate shocks on the theoretical predictions of the small open economy-RBC model are qualitatively the same. The ensemble averages of the elements of $\mathcal{H}_{\mathcal{T}}$ from the 5000 replications neither match the sample estimates nor the theoretical PVM restrictions as found in the middle columns table $A.2$. This is apparent from the 90 percent confidence bands of the left-side window of figures $A.6$ and $A.7$, which are wide, and the theoretical distributions of the Wald test of the PVM cross-equation restrictions, which are flat. Unlike the small open economy-RBC model with the PIH restriction $r^* = (1 - \beta)/\beta$, the fit of the model is not improved by the fiscal and the world real interest rate shocks when it is assumed that households are "impatient".

Finally, we conduct an experiment that assumes $r^* < (1 - \beta)/\beta$ and allows for imperfect international capital mobility. Qualitatively, the results are little changed from those we presented in the previous section. The fit of the model in terms of the densities of the LM and Wald statistics is reasonable as shown in the right-side windows of figure $A.8$. The problem is that model with a prior centered on a 50 basis point per annum risk premium predicts that the PVM current account forecast exhibits excess sensitivity to lags of net output changes and a negative response to contemporaneous and lagged current account movements. This evidence is found in the right-most column of table $A.2$ and the left-side window of figure $A.8$. Thus, our results show that even fairly small and conservatively calibrated imperfections in capital mobility induce too much volatility in the current account no matter the restrictions on r^* and β.

In this section, we presents results from eight experiments that impose the change in preferences afforded by $r^* < (1-\beta)/\beta$. This restriction seldom moves the model further away from the PVM predictions, but not in such a way as to move it closer to the actual data. For example, excess sensitivity of current account forecasts to output growth, the current account, or their lags, appears in all of the $\mathcal{H}_{\mathcal{T}}$ vectors, given the small open economy is restricted to be more patient. Only models with imperfect capital mobility are able to match the theoretical orthogonality condition and cross-equation restrictions and remain near the Canadian data, under the impatience assumption. Thus, the restriction $r^* < (1-\beta)/\beta$ fails to help us understand rejections of the PVM by the Canadian data.

A.5 The Small Open Economy-RBC Model with a Terms-of-Trade Shock

The transitory terms-of-trade shock, s_t, enters the small open economy-RBC model through its resource constraint

$$Y_t \quad = \quad C_t \quad + \quad I_t \quad + \quad G_t \quad + \quad s_t NX_t. \tag{A.3}$$

We assume the terms-of-trade shock follows a AR(1) processes

$$s_{t+1} \quad = \quad s^{*\,(1-\rho_s)}\, s_t^{\rho_s}\, exp\left\{\tau_{t+1}\right\}, \quad |\rho_s| \ < \ 1, \quad \tau_{t+1} \ \sim \ \mathbf{N}\left(0,\, \sigma_\tau^2\right), \tag{A.4}$$

where s^* is the steady state or unconditional mean of s_t and the innovation τ_t is uncorrelated at all leads and lags with all other shock innovations. Note that s_t is the relative price of the net flow of goods internationally to a unit of domestic output.

The optimality conditions (17) and (A.1) – (A.2) of the internalized risk premium-small open economy-RBC model become

$$\left(\frac{1 \ - \ \phi}{\phi}\right)\frac{C_t}{1 \ - \ N_t} \quad = \quad (1 \ - \ \theta)\frac{Y_t}{N_t}\left[1 \ + \ s_t\varphi\left(\frac{B_t}{Y_t}\right)^2\right], \tag{A.5}$$

$$\left(\frac{I_t}{K_t}\right)^{\alpha} \ = \ \mathbf{E}_t\left\{\Gamma_{t+1}\left[\theta(1-\alpha)\frac{Y_{t+1}}{K_{t+1}}\left[1 \, + \, s_{t+1}\varphi\left(\frac{B_{t+1}}{Y_{t+1}}\right)^2\right] \, + \, \left[1-\delta \, + \, \alpha\left(\frac{I_{t+1}}{K_{t+1}}\right)^{1-\alpha}\right]\left(\frac{I_{t+1}}{K_{t+1}}\right)^{\alpha}\right]\right\}, \tag{A.6}$$

and

$$1 \quad = \quad \mathbf{E}_t\left\{\Gamma_{t+1}\frac{s_{t+1}}{s_t}\left(1 \ + \ r_{t+1} \ - \ \varphi\frac{B_{t+1}}{Y_{t+1}}\right)\right\}. \tag{A.7}$$

given the terms-of-trade shock (A.4). The non-internalized risk premium-small open economy-RBC model drops the terms $s_t\varphi\,(B_t/Y_t)^2$, $s_{t+1}\varphi\,(B_{t+1}/Y_{t+1})^2$, and $-\varphi B_{t+1}/Y_{t+1}$ from optimality conditions (A.5), (A.6), and (A.7), respectively.

The terms-of-trade shock induces more persistence and volatility in the labor market optimality condition (A.5) and the Euler equation of capital (A.6) in the internalized risk premium model. The real wage the firm offers is more persistent and volatile because the left-side of (A.5) is driven, in part, by s_t. The same is true for the discounted expected benefits the small open economy demands for it to increase its stock of capital by one unit. A persistent terms-of-trade shock generates negative income effects in the labor market and higher returns to domestic capital that introduce another way for the risk premium to affect the small open economy intertemporally.

The impact on the Euler equation of the unit discount bond (A.7) of the terms-of-trade shock is strikingly different. It creates a "taste" shock, s_{t+1}/s_t, that alters the stochastic discount factor, Γ_{t+1}, of the small open economy, irrespective of the treatment of the risk premium by the small open economy. Note that the "taste" shock only appears in the optimality condition the small open economy uses to derive its net demand for foreign assets. Thus, the terms-of-trade shock provides another wedge between domestic returns to capital and way in which the small open economy discounts the returns it receives from the rest of the world. This emphasizes the substitution effect aspect of the terms-of-trade shock s_t.

A.6 Bayesian Calibration and Monte Carlo Experiment of the Small Open Economy-RBC Model with a Terms-of-Trade Shock

The Bayesian calibration of the terms-of-trade shock employs Canadian import and export price deflators and a least squares regression. The slope coefficient of the estimated AR(1) is 0.9621. Thus, the half-life of a Canadian terms-of-trade shock is nearly 4.5 years. This is more persistent than the exogenous shock to the world real interest rate, but much less persistent than the fiscal policy shock. The prior on ρ_s is lognormal (the same distribution used for ρ_g and ρ_q), with a 95 percent coverage interval of [0.9000 0.9857]. We find the sample standard error of the terms-of-trade regression to be 0.0121, which makes s_t a bit less volatile than the degenerate prior on the fiscal policy shock. A normal distribution is employed for the prior of the standard deviation of τ_t. The priors' 95 percent coverage interval is [0.0112 0.0130].

We operate the Bayesian Monte Carlo experiment of the small open economy RBC models perturbed by the terms-of-trade shock s_t as described in sections 3.3, 4.1, and 4.4 of the paper. The results are found in table $A.3$ and figures $A.9$ and $A.10$. The ensemble averages of the elements of $\mathcal{H}_{\mathcal{T}}$ and the associated standardized difference of means of the non-internalized and internalized risk premium-small open economy-RBC models are close to the theoretical PVM predictions. The predictions for the canonical model suggest the addition of the terms-of-trade shock s_t pushes the canonical RBC model closer to the data, as does the internalized risk premium. Figure A.9 should disabuse one of this notion. The actual Canadian current account is above or on the upper 90 percent confidence band of the theoretical current account forecast for the entire sample (see the left-side window). This reflects the "taste" shock imposed on the Euler equation of the unit discount bond, which tilts the consumption path to induce less patience by the small open economy. Hence, the small open economy runs a smaller current account, on average. Otherwise, the simulation results show the densities of the LM and Wald tests produced by the terms-of-trade shock experiment to fit to the actual Canadian data as well as the canonical model.

The terms-of-trade shock-internalized risk premium-small open economy-RBC model yields results in line with its counterpart non-internalized risk premium model, with one exception. The right-most column of table $A.3$ shows that the theoretical estimates of $\mathcal{H}_{\mathcal{T}}$ for this version of the internalized risk premium model are qualitatively similar to the non-internalized risk premium model. The theoretical densities of the LM and Wald statistics of the terms-of-trade shock models are also not that different and appear in the right-side column of figure $A.10$. The CIC statistics of these densities are 0.32 and 0.69, respectively. These statistics are nearly identical to those produced by terms-of-trade shock-non-internalized risk model 0.33 and 0.70, as shown in figure $A.9$.

The important difference between terms-of-trade shock-non-internalized and internalized risk model is in their 90 percent confidence bands. Figure $A.10$ contains the 90 percent confidence bands of the theoretical current account forecast and the theoretical densities of the internalized risk premium-small open economy-RBC model. Since these 90 percent confidence bands are always above the actual Canadian current account (see the left-side window of figure $A.10$), the "taste" shock s_t causes the internalized risk premium-small open economy to become more patient, as if $r^* > (1-\beta)/\beta$. Hence, the small open economy runs a larger current account, on average. We conclude the terms-of-trade shock is an inadequate explanation of tests of the PVM on and fluctuations of the Canadian current account either in the non-internalized or internalized-small open economy-RBC models.

References

Aiyagari, S.R., 1994. Uninsured idiosyncratic risk and aggregate saving, Quarterly Journal of Economics 103, $659-684$.

Arrow, K.J., F.H. Hahn, 1971. General Competitive Analysis, Elsevier Science Publishers Inc., New York, NY.

Chamberlain, G., C. Wilson, 1984. Optimal intertemporal consumption under uncertainty, SSRI Working Paper 8422, Department of Economics, University of Wisconsin, Madison.

Ljungqvist, L., Sargent, T.J., 2000. Recursive Macroeconomic Theory, MIT Press, Cambridge, MA.

Silverman, B.W., 1986. Density Estimation for Statistics and Data Analysis. Chapman and Hall, Ltd., London, England.

Table A.1: Tests of the Canonical RBC Specification with Smaller β to Force $r^* < (1-\beta)/\beta$

	Experiment			
	Canonical Model	Transitory Fiscal Shock	World Interest Rate Shock	Imperfect Capital Mobility
$\mathcal{H}_{\mathcal{T},1}$	1.49	0.57	0.27	-0.37
	(6.92)	(2.39)	(0.89)	(-2.26)
$\mathcal{H}_{\mathcal{T},2}$	1.16	0.29	0.18	0.88
	(6.27)	(1.69)	(1.13)	(4.79)
$\mathcal{H}_{\mathcal{T},3}$	0.52	0.09	0.10	0.71
	(4.43)	(1.20)	(1.26)	(5.82)
$\mathcal{H}_{\mathcal{T},4}$	-0.00	-0.00	0.05	-0.00
	(-0.87)	(-0.88)	(-0.28)	(-0.88)
$\mathcal{H}_{\mathcal{T},5}$	-0.33	0.24	0.02	2.08
	(-0.61)	(0.48)	(0.07)	(3.99)
$\mathcal{H}_{\mathcal{T},6}$	0.10	0.17	-0.20	-1.37
	(0.45)	(1.00)	(-2.01)	(-11.30)
$\mathcal{H}_{\mathcal{T},7}$	0.29	0.12	-0.14	-0.19
	(2.73)	(1.28)	(-0.87)	(-1.31)
$\mathcal{H}_{\mathcal{T},8}$	0.26	0.06	-0.07	0.72
	(3.49)	(1.57)	(0.31)	(7.86)

Details about the canonical RBC specifications are in the notes at the bottom of table 1. The restriction $r^* < (1-\beta)/\beta$ is satisfied at the jth replication by drawing from the prior of q^* to create $\beta_j = 1/(1+q^*_j) - (0.01 \times \breve{\beta}_j)$ where the prior of $\breve{\beta}$ is normally distributed with mean 0.9940 and 95 percent coverage interval $[0.9920, 0.9961]$. Otherwise, the priors of the model parameters are discussed in section 3.3 of the text.

Table A.2: Tests of the Internalized Risk Premium-RBC Specification with Smaller β to Force $r^* < (1-\beta)/\beta$

	Experiment			
	Canonical Model	Transitory Fiscal Shock	World Interest Rate Shock	Imperfect Capital Mobility
$\mathcal{H}_{\mathcal{T},1}$	0.48	0.30	-16.48	-0.04
	(1.93)	(1.03)	(-81.78)	(-0.66)
$\mathcal{H}_{\mathcal{T},2}$	0.19	0.14	-14.40	-1.89
	(1.20)	(0.94)	(-75.40)	(-9.74)
$\mathcal{H}_{\mathcal{T},3}$	0.05	0.06	-10.02	-1.00
	(0.86)	(0.93)	(-74.74)	(-7.04)
$\mathcal{H}_{\mathcal{T},4}$	-0.00	0.01	0.02	-0.01
	(-0.90)	(-0.72)	(-0.64)	(-0.94)
$\mathcal{H}_{\mathcal{T},5}$	0.36	-0.23	15.50	-1.00
	(0.71)	(-0.42)	(29.61)	(-1.88)
$\mathcal{H}_{\mathcal{T},6}$	0.19	-0.19	-1.76	2.41
	(1.18)	(-1.86)	(-14.44)	(18.87)
$\mathcal{H}_{\mathcal{T},7}$	0.09	-0.10	-4.03	-0.06
	(1.10)	(-0.56)	(-33.73)	(-0.18)
$\mathcal{H}_{\mathcal{T},8}$	0.03	-0.05	-9.62	-0.98
	(1.33)	(0.56)	(-90.10)	(-8.29)

Details about the internalized risk premium-RBC simulations, under $r^* < (1-\beta)/\beta$, are found in the notes at the bottom of table 1 and table $A.1$.

Table A.3: Tests of the Terms-of-Trade Shock, s_t

	Experiment	
	Non-Internalized Risk Premium	Internalized Risk Premium
$\mathcal{H}_{\mathcal{T},1}$	0.09	0.15
	(0.02)	(0.31)
$\mathcal{H}_{\mathcal{T},2}$	0.15	0.14
	(1.00)	(0.93)
$\mathcal{H}_{\mathcal{T},3}$	0.07	0.05
	(1.04)	(0.84)
$\mathcal{H}_{\mathcal{T},4}$	0.00	0.01
	(-0.82)	(0.78)
$\mathcal{H}_{\mathcal{T},5}$	0.92	0.88
	(1.79)	(1.70)
$\mathcal{H}_{\mathcal{T},6}$	-0.10	-0.04
	(-1.21)	(0.68)
$\mathcal{H}_{\mathcal{T},7}$	0.04	0.05
	(0.61)	(0.68)
$\mathcal{H}_{\mathcal{T},8}$	0.07	0.04
	(1.65)	(1.38)

Details about the terms-of-trade canonical and internalized risk premium RBC specifications are in the notes at the bottom of table 1. The prior on the AR1 coefficient, ρ_s, of the terms-of-trade shock is lognormal with a 95 percent coverage interval of [0.9000 0.9857]. A normal distribution is employed for the prior of the standard deviation of the innovation to the terms-of-trade shock, τ_t. Its 95 percent coverage interval is [0.0112 0.0130]. Otherwise, the priors of the model parameters are discussed in section 3.3 of the text.