Lecture 4

International risk sharing and the transmission of productivity shocks

Quantitative issues

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EUI March 2011

Introduction

- Goal: reconsider the transmission mechanism analyzed in the analytical lecture in a quantitative framework with traded and non-traded goods (as in Stockman and Tesar).

- Focus: incomplete versus complete market economy. Source: Corsetti Dedola Leduc (2008)

1 International business cycle: stylized facts once again

- In what follows, US versus the rest of the industrial world (EU Japan and Canada), 1970-2001. Data (as well as artificial time series) that are HP filtered (alternatively first-difference). See CDL paper for details.

- First-order Taylor series expansion around the deterministic steady state. The model is simulated using King and Watson [1998]'s algorithm. Model's statistics are computed by logging and filtering the model's artificial time series using the Hodrick and Prescott filter and averaging moments across 100 simulations. Consistently with the data, changes in all real aggregate variables (e.g. GDP) are computed using constant (steady-state) prices.

DATA: *Output Consumption Investment and Employment*

- all positively correlated across countries.
  - correlation US vs. OECD-average: Y(.68), C(.6), I(.25), E(.54)
- Consumption is less correlated than output (.6 vs. .68).
  - Most IRBC models predicts the opposite – this is one essential dimension of the 'quantity puzzle'.

Export

- Correlation between real (constant price) **net export** and GDP is negative (-.48).
  - Real net exports do not include changes in the value of net exports due to equilibrium movements in the terms of trade, i.e. X-M versus NX/P.

- Volatility (standard deviation) of **Import ratio** (ratio of import to nonexported tradable output) is 4.94; Volatility of net export over GDP is .64.
  - A possible issue with calibrating a low elasticity is that imports may become too smooth.

International price volatility: level and ranking

- Real exchange rates (RER) is more volatile than Terms of trade (TOT).
  - Relative to St.Dev. of GDP, the st.dev. of RER and TOT is 3.90 and 1.68.
  - In models with only tradable goods, we have seen that RER and TOT are proportional. This suggests the need to have a richer model (non-tradables).
  - Ranking is difficult to match in most models
- RER and TOT are positively correlated (.86)

Correlation between relative consumption and RER (Backus-Smith)

- Correlation is negative (-.71).

- Same pattern emerges with the TOT (-.74).

  – This is at odds with model predicting high risk sharing, unless marginal utility is assumed to vary randomly (taste shocks).

- Correlation between relative output and RER/TOT is also negative (-.19; -.33)

Nominal and real exchange rate and local-currency prices

- Nominal and real exchange rates are highly correlated (.9-1)

- Correlation between nominal (real) exc. rate and tot is positive.

- Correlation between nominal exchange rate and import prices is positive but not perfect (.4)

  - Exchange rate pass-through on import prices incomplete (see future lectures)

- Correlation between nominal exchange rates and the CPI is close to zero or negative (local currency price stability).

2 Model (Corsetti Dedola Leduc 2008)

- 2 symmetric countries each specialized in the production of a traded and nontraded good ($Y_{\mathsf{H}}, Y_{\mathsf{N}}$ and $Y_{\mathsf{F}}, Y^*_{\mathsf{N}}$)

- One pure-discount bond (incomplete asset markets). Without loss of generality, this is denominated in home currency — the model is real: currencies only provide units of account.

- Firms either produce goods or distribute them: Perfectly competitive firms in both sectors

- Bringing one unit of traded goods to consumer requires η units of a the nontraded good: Leontief technology

Firms: intermediate good sector

Firms in the traded and nontraded goods sectors choose labor and capital to maximize profit:

$$
\begin{aligned}
\pi_{\mathsf{H}} &= \bar{P}_{\mathsf{H},t} Y_{\mathsf{H},t} - W_t L_{\mathsf{H},t} - R_t K_{\mathsf{H},t} \\
\pi_{\mathsf{N}} &= P_{\mathsf{N},t} Y_{\mathsf{N},t} - W_t L_{\mathsf{N},t} - R_t K_{\mathsf{N},t},
\end{aligned}
$$

where a bar denotes wholesale prices, and

$$
\begin{aligned}
Y_{\mathsf{H}} &= Z_{\mathsf{H}} K_{\mathsf{H}}^{1-\xi} L_{\mathsf{H}}^{\xi} \\
Y_{\mathsf{N}} &= Z_{\mathsf{N}} K_{\mathsf{N}}^{1-\zeta} L_{\mathsf{N}}^{\zeta},
\end{aligned}
$$

Firms: distribution

Firms in the distribution sector buy traded goods and distribute them to consumers using nontraded goods (services) in fixed proportions. Consumers thus pay

$$P_{\mathsf{H},t} = \bar{P}_{\mathsf{H},t} + \eta P_{\mathsf{N},t}.$$

$$P_{\mathsf{F},t} = \bar{P}_{\mathsf{F},t} + \eta P_{\mathsf{N},t}.$$

However, we posit that investment goods require no distribution service.

Households preferences and budget constraint

$$E\left\{\sum_{t=0}^{\infty} U\left[C_t, \ell_t\right] \exp\left[\sum_{\tau=0}^{t-1} -\nu\left(C_t, \ell_t\right)\right]\right\}$$

$$C_t \equiv \left[a_{\mathsf{T}}^{1-\phi} C_{\mathsf{T},t}{}^{\phi} + a_{\mathsf{N}}^{1-\phi} C_{\mathsf{N},t}{}^{\phi}\right]^{\frac{1}{\phi}}, \qquad \phi < 1,$$

$$C_{\mathsf{T}} = \left[(a_{\mathsf{H}})^{1-\rho}(C_{\mathsf{H}})^{\rho} + (a_{\mathsf{F}})^{1-\rho}(C_{\mathsf{F}})^{\rho}\right]^{\frac{1}{\rho}}, \qquad \rho < 1$$

$$P_{\mathsf{H},t}C_{\mathsf{H},t} + P_{\mathsf{F},t}C_{\mathsf{F},t} + P_{\mathsf{N},t}C_{\mathsf{N},t} + B_{\mathsf{H},t+1} + \bar{P}_{\mathsf{H},t}I_{\mathsf{H},t} \leq W_t\ell_t + R_tK_t + (1+r_t)B_{\mathsf{H},t}.$$

$$K_{t+1} = I_{\mathsf{H},t} + (1-\delta)K_t.$$

General arguments for modelling distribution services

1. Evidence on distributive trade is pervasive (see Burstein et al. 2002)

2. Local costs can account for a low elasticity of **consumer prices** with respect to the exchange rate: Posit that the law of one price holds at the dock, $\bar{P}_{\mathsf{F},t} = \mathcal{E}\bar{P}_{\mathsf{F},t}$. Then

$$\frac{\partial P_{\mathsf{F},t}/P_{\mathsf{F},t}}{\partial \bar{P}_{\mathsf{F},t}/\bar{P}_{\mathsf{F},t}} = \frac{1}{\bar{P}_{\mathsf{F},t} + \eta P_{\mathsf{N},t}}$$

the larger the share of distribution, the lower this elasticity.

3. Distributive trade helps addressing the quantity puzzle via ‘complementarity’: a correlated increase in the consumption of tradables across borders triggers an increase in the production of non-tradables (required to provide distribution services) in both countries.

4. Moreover, to the extent that the **elasticity of substitution** between tradable goods and distribution services is lower than one (the Cobb-Douglas case), distribution has also important implications for the trade elasticity. Because of distribution costs, the relative price of imports in terms of Home exports at the consumer level does not coincide with the terms of trade $\bar{P}_{\mathsf{F},t}/\bar{P}_{\mathsf{H},t}$— as in most standard models (e.g. Lucas [1982]):

$$\frac{P_{\mathsf{F},t}}{P_{\mathsf{H},t}} = \frac{\bar{P}_{\mathsf{F},t} + \eta P_{\mathsf{N},t}}{\bar{P}_{\mathsf{H},t} + \eta P_{\mathsf{N},t}} = \frac{1 - a_{\mathsf{H}}}{a_{\mathsf{H}}} \left(\frac{C_{\mathsf{H},t}}{C_{\mathsf{F},t}} \right)^{\frac{1}{\omega}} \tag{1}$$

Define the distribution margin in steady state:

$$\mu = \eta \frac{P_{\mathsf{N}}}{P_{\mathsf{H}}}$$

By log-linearizing, we get:

$$\widehat{TOT_t} = \frac{1}{\omega\left(1-\mu\right)}\left(\widehat{C_{\mathsf{H},t}} - \widehat{C_{\mathsf{F},t}}\right) \tag{2}$$

where the terms of trade TOT is measured at the producer-price level so that $\omega\left(1-\mu\right)$ can be thought of as the producer price elasticity of tradables. Clearly, both ω and μ impinge on the *magnitude* of the international transmission of country-specific shocks through the equilibrium changes in the terms of trade. A low trade elasticity does not necessarily imply strong complementarity in preferences or production.

Advantages of modelling non tradables and distribution

Consumer price level is quite insulated from exchange rate movements, and the model may fit the **ranking** of volatility between RER and TOT

$$\widehat{RER_t} = (1-\mu)(2a_{\mathsf{H}}-1)\widehat{TOT_t} + \mu\left(\widehat{P^*_{\mathsf{N},t}} - \widehat{P_{\mathsf{N},t}}\right) + \Omega\left(\widehat{q^*_t} - \widehat{q}_t\right) \quad (3)$$

where $0 < \Omega < 1$ and q_t represents the relative price of non-tradables. The expression decomposes the movements of RER into movements in TOT terms of trade and in the relative price of non-traded goods. Clearly if $\mu = 0$ (absent distribution, i.e. no wedge between producer and consumer prices) and $\Omega = 0$ (absent movements in the price of non-tradables across countries, the model would not replicate the empirical ranking of volatility.

Incomplete asset markets and endogenous discount factor

If markets are complete, relative wealth is constant and the model has a unique steady state. With incomplete markets, without some additional assumptions the wealth distribution in the deterministic steady state would be indeterminate and the first-order approximation around it would contain a unit root. In turn, this unit root would imply that the wealth distribution in the approximate solution to the stochastic economy does not converge to a stationary distribution. This would occur despite the stationarity of the shocks.

Schmitt-Grohe and Uribe [2003] discusses several alternative ways to ensure that the model has a unique steady state in spite of incomplete markets: costs of holding bonds (e.g. Heatcoate and Perri [2003]), borrowing constraint (e.g. CKM), and endogenous discount factor (e.g. Mendoza and this model).

2.1 Calibration

η Distribution costs = 50% of consumer prices (Burstein, Neves, & Rebelo [2002])

α_H Imports = 5% of GDP (average of US data 1960-2002) — HOME BIAS is high

α_T Nontraded goods = 53% of consumption as in US data

φ Tradables/nontradables elasticity of substitution set to 0.74 (Mendoza [1991])

σ Utility is CRRA, with coefficient of relative risk aversion equal to 2

Productivity

- Symmetric stochastic process for 4 productivity shocks Z_H, Z_F, Z_N, Z_N^*.
  - estimated for the US and OECD countries, annual data on manufacturing and services from OECD-STAN database;
  - AR coefficient is .82 for tradables, .96 for nontradables;
  - notable positive spillovers from nontradables shocks.

Issues in calibration: elasticity of substitution

In previous lecture, we have seen that the behavior of the model hinges crucially on the elasticity of substitution. However, there is considerable uncertainty about aggregate trade elasticities: U.S. estimates range from 0.4 to 2.5 (see Hooper et al. 2000). Micro studies point to even larger values.

2 calibration strategies suggested by theoretical considerations in first lecture:

1. set elasticity in the model as to match a set of moments

2. set high values from trade studies and analyze the implications of persistent shocks.

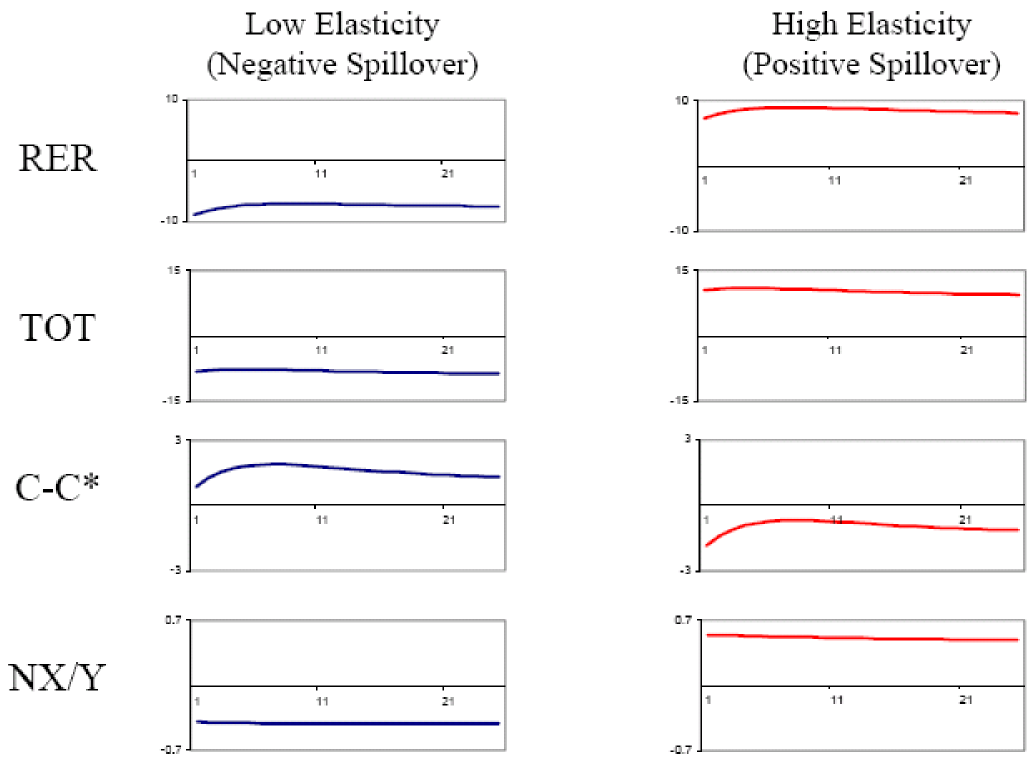
Calibrating ω: first approach (1)

Suppose one set tradables elasticity of substitution ω to match RER volatility relative to output, which in the US is:

$$\frac{\sigma(RER)}{\sigma(Y)} = 3.9$$

Consistent with theory, one gets low values of ω. However, the calibration will not be unique: there will be two (low) values for ω matching the condition, implying two different transmission mechanisms: (a) positive for the higher value (b) negative for the lower value. Need to use additional moments.

Responses to a Technology Shock in the Traded-Goods Sector



Calibrating ω: first approach (2)

Simulated method of moments: choose ω to minimize the distance, between model and data, of the following (equally weighed) four moments: (i) the volatility of the real exchange rate, (ii) the volatility of the terms of trade, (iii) the correlation between the real exchange and the output ratio, and (iv) the correlation between the real exchange rate and net exports.

Note: GMM estimators remains unbiased and consistent, even if an optimal weighting matrix is not used — see the textbook by Greene [1997], page 525.

- Matching the first two moments, addresses the following issue: do large international price movements amplify wealth effects and the consumption risk of productivity shocks? It may well be possible that volatility in the data is not high enough to generate the mechanism illustrated in the first lecture.

- There are two transmission mechanisms through which price volatility can generate low risk sharing: the third moment helps discriminating between the two.

- Including the fourth moment mimics the comovements between relative prices and intertemporal trade in the data.

Result from the first approach

The procedure yields an estimate of ω equal to 0.85 — actually including the first two moments only give you values close to this.

- Given the calibrated value of μ, the implied trade price elasticity is below $1/2$, well within the range of available macro estimates, but at odds with some micro evidence.

Calibrating ω: Second approach

The first lecture showed that strong relative wealth effects driving a wedge between the complete-markets and the incomplete-markets allocation could be generated by persistent shocks, provided the elasticity is sufficiently high.

In a second calibration, set the trade elasticity equal to 4 based on the estimates in the trade literature, namely, by Bernard, Eaton, Jensen, and Kortum [2003]. Given the size of the distribution sector, this means $\omega = 8$.

Calibrating ω: Second approach

The literature (Baxter and Crucini [1995]) has long made clear that an autoregressive process close to a unit root can generate large relative wealth effects in one-good models. Can the same process make the model fit also the Backus-Smith evidence?

- Verify whether, with $\omega = 8$, the estimated shocks are persistent enough to generate strong wealth effects.

- If not, run simulations raising the persistence of the process driving tradables productivity shocks to 0.99, while shutting down technological spillovers to keep the process stationary. As a check, assume a macro shock with high persistent (as in Baxter 1995).

2.2 Results from first calibration (low elasticity)

- RER and TOT volatility
  - ‘high volatility’ is not necessarily evidence that the exchange rate is ‘disconnected’ from fundamentals.

- Negative Backus-Smith correlation
  - not perfect per effect of intertemporal trade: negative on impact, positive over time.
  - Also C/C* is negatively correlated with TOT.

Wealth effects

To estimate wealth effects from a shock: first, calculate the discounted present value of the change in utility caused by the change in the path of consumption and leisure following a shock; then calculate the constant C and L that gives the same change in utility, a the initial steady-state prices (and interest rates). Wealth effects differ substantially:

- Large wedge in wealth corresponding to the case of incomplete markets with low trade elasticity.

- RER more volatile than TOT
  - TOT and RER are positively correlated, as in the data.
  - Volatility of the price of nontradables in the ball park

- High correlation of output driven by 2 factors
  - positive correlation of innovations (mostly)
  - negative transmission mechanism: the Home TOT appreciation produce a negative wealth effect abroad, which make foreign consumers supply more labor and thus increases foreign output. This effect is however stronger at sectoral level, than in the aggregate.

- Consumption correlation remains positive because of cross-border spillovers, despite negative transmission

- Output is more correlated than consumption
  - complementarities due to distribution help

- Import ratio is as volatile as in standard calibration: with incomplete markets, a low elasticity does not reduce volatility.

Robustness

- No distribution: model still works but calibrated elasticity is very low; behavior of real exchange rate and prices is not in line with facts.

- Taste shocks:

  – Do not affect baseline specification with incomplete markets,

  – Improve Arrow-Debreu Economy $=>$ evidence that 'demand' side matters.

2.3 Results from second calibration (high elasticity)

- Standard AR shocks are not persistent enough to generate strong wealth effects.

- Raising the autoregressive coefficient close to .99 (while shutting down cross-country spillovers) creates strong wealth effects (BS correlation is -.12), provided trade elasticity is large enough (above 4).

- Dynamics adjustment of output (hump shaped) and TOT and RER (appreciation is followed by depreciation).

Model performs as well as with calibration 1, except:

- No volatility in international prices
- correlation of employment
- correlation of net export and GDP.

2.4 Conclusions

- Evidence that international consumption risk sharing is limited. Need for international business cycle models to account for possible large, uninsurable wedges between domestic and foreign wealth following shocks to fundamentals

- Equilibrium allocation in many standard specifications is not significantly away from the complete-market benchmark: the Backus-Smith puzzle is a crucial dimension to assess the performance of business cycle models.

- But there are contrarian views. See e.g. Andrea Raffo, stressing that investment shocks and a specific form of nonseparability in preferences can generate a negative BS correlation even with perfect risk sharing. Idea: investment-specific shocks act as a ‘demand shock’ (like a taste shock), and utility from leisure is assumed to be falling in consumption.

Avenues of research

- Strong wealth effects from low trade elasticities
- Persistent shocks with high trade elasticities
  - hump-shaped output, or ‘news shocks’, or investment-specific shocks

- Distinguishing between short-run versus long run elasticities. Different approaches: Firm Entry (Ruhl), Nested elasticities (Cooley and Quadrini), Deep Habits (Ravn, Schmitt-Grohe and Uribe), Costumers as capital (Drosz).

- Wealth effects from financial frictions within a country, say, limited participation in asset markets by some domestic households.

Table 3. Benchmark parameter values

Benchmark Model

Preferences and Technology

Risk aversion	$\sigma = 2$
Consumption share	$\alpha = 0.34$
Elasticity of substitution between:	
Home and Foreign traded goods	$\frac{1}{1-\rho} = 0.85$
traded and non-traded goods	$\frac{1}{1-\phi} = 0.74$
Share of Home Traded goods	$a_{\mathrm{H}} = 0.72$
Share of non-traded goods	$a_{\mathrm{N}} = 0.45$
Elasticity of the discount factor with respect to C and L	$\psi = 0.08$
Distribution Margin	$\eta = 1.09$
Labor Share in Tradables	$\xi = 0.61$
Labor Share in Nontradables	$\zeta = 0.56$
Depreciation Rate	$\delta = 0.10$

Productivity Shocks

$$\lambda = \begin{bmatrix} 0.82 & -0.06 & 0.10 & 0.24 \\ -0.06 & 0.820 & 0.24 & 0.10 \\ -0.02 & 0.02 & 0.96 & 0.01 \\ 0.02 & -0.02 & 0.01 & 0.96 \end{bmatrix}$$

Variance-Covariance Matrix (in percent)

$$V(u) = \begin{bmatrix} 0.047 & 0.022 & 0.009 & 0.004 \\ 0.022 & 0.047 & 0.004 & 0.009 \\ 0.009 & 0.004 & 0.009 & -0.001 \\ 0.004 & 0.009 & -0.001 & 0.009 \end{bmatrix}$$

Table 4a. Exchange rates and prices in the theoretical economies[a]
(Method of Moments estimation of ω)

Statistics	Data	Baseline Bond Economy $\omega = 0.85$	Arrow-Debreu Economy $\omega = 0.85$	Variations on the Baseline Bond Economy: CES Investment $\omega = 0.5$	No Spillovers $\omega = 0.87$	No Distribution Economy $\omega = 0.16$	Taste Shocks: Bond economy $\omega = 0.82$	Taste Shocks: Arrow-Debreu $\omega = 0.85$
Standard deviation relative to GDP								
Real exchange rate	3.90	2.99	0.73	3.06	2.69	2.98	2.94	0.99
Terms of trade	1.68	2.42	0.83	2.40	2.64	2.47	2.45	1.07
Relative price of nontradables	0.86	0.77	0.51	0.65	0.70	1.53	0.76	0.48
Cross-correlations								
Between real exchange rate and								
Relative GDPs	-0.19	-0.54	0.21	-0.53	-0.99	-0.25	-0.55	-0.28
Relative consumptions	-0.71	-0.24	0.98	-0.13	-0.62	-0.03	-0.30	-0.29
Real net exports	0.60	0.96	-0.62	0.88	0.91	0.97	0.93	0.57
Terms of trade	0.52	0.99	0.16	0.99	0.94	0.99	0.99	0.59
Between terms of trade and								
Relative GDPs	-0.33	-0.55	0.87	-0.53	-0.95	-0.14	-0.56	0.11
Relative consumptions	-0.74	-0.27	0.31	-0.15	-0.83	0.05	-0.40	-0.54
Real net exports	0.67	0.97	0.63	0.88	0.99	0.94	0.97	0.82

[a] $\omega = \dfrac{1}{1-\rho}$ denotes the elasticity of substitution between Home and Foreign traded goods. The data reported under the heading "Data" are those of the U.S. vis-à-vis the rest of the OECD countries. See the text for a description of the variations on the benchmark economy.

Table 4b. Business cycle statistics in the theoretical economies[a]
(Method of Moments estimation of ω)

Statistics	Data	Baseline Bond Economy $\omega = 0.85$	Arrow-Debreu Economy $\omega = 0.85$	Variations on the Baseline Bond Economy: CES Investment $\omega = 0.5$	No Spillovers $\omega = 0.87$	No Distribution $\omega = 0.15$	Taste Shocks: Bond Economy $\omega = 0.82$	Taste Shocks: Arrow-Debreu $\omega = 0.85$
Standard deviation relative to GDP								
Consumption	0.94	0.48	0.48	0.48	0.58	0.45	0.53	0.67
Investment	4.33	3.20	3.21	2.98	3.23	3.22	3.13	2.91
Employment	1.19	0.53	0.52	0.45	0.54	0.53	0.59	0.85
absolute (in percent)								
Import ratio	4.94	1.62	0.55	0.87	1.85	0.62	1.63	0.81
Real net exports over GDP	0.64	0.17	0.03	0.29	0.22	0.16	0.18	0.13
Cross-correlations								
Between foreign and domestic								
GDP	0.68	0.38	0.39	0.38	0.44	0.39	0.38	0.33
Consumption	0.60	0.30	0.37	0.25	-0.24	0.50	0.16	-0.01
Investment	0.25	0.45	0.45	0.21	0.49	0.44	0.45	0.44
Employment	0.54	0.45	0.49	0.36	0.51	0.47	0.35	0.16
Between real net exports and GDP	-0.48	-0.38	0.21	-0.47	-0.48	-0.23	-0.39	-0.28

[a] $\omega = \frac{1}{1-\rho}$ denotes the elasticity of substitution between Home and Foreign traded goods. The data reported under the heading "Data" are those of the U.S. vis-à-vis the rest of the OECD countries. See the text for a description of the variations on the benchmark economy.

Table 5. Wealth Effects of a Home Productivity Shocks in the Tradable Sector (in percent)

	Home Consumption	Foreign Consumption	Home Hours Worked	Foreign Hours Worked
$\omega = 0.85$				
$\eta = 0.5$				
Baseline Bond Economy	0.06	-0.02	-0.40	0.17
Arrow-Debreu Economy	0.03	0.002	-0.22	-0.01
$\eta = 0$				
Baseline Bond Economy	0.04	0.01	-0.18	-0.05
Arrow-Debreu Economy	0.04	0.01	-0.20	-0.04

Table 6a. Exchange rates and prices in the theoretical economies[a]
(Trade elasticity equal to 4)

Statistics	Data	*Baseline Shocks* Bond Economy $\omega = 8$	*Baseline Shocks* Arrow-Debreu Economy $\omega = 8$	*Persistent Tradable Shocks* Bond Economy $\omega = 8$	*Persistent Tradable Shocks* Arrow-Debreu Economy $\omega = 8$	*Persistent Aggregate Shocks* Bond Economy $\omega = 8$
Standard deviation relative to GDP						
Real exchange rate	3.90	1.17	0.88	1.60	0.95	0.35
Terms of trade	1.68	0.48	0.44	0.70	0.50	0.39
Relative price of nontradables	0.86	0.55	0.51	0.67	0.55	0.06
Cross-correlations						
Between real exchange rate and						
Relative GDPs	-0.19	-0.20	-0.25	-0.55	-0.21	-0.69
Relative consumptions	-0.71	0.73	0.97	-0.12	0.97	-0.67
Real net exports	0.60	0.79	0.04	0.87	-0.01	0.96
Terms of trade	0.52	0.74	0.17	0.90	0.12	0.99
Between terms of trade and						
Relative GDPs	-0.33	0.45	0.77	-0.66	0.81	-0.71
Relative consumptions	-0.74	0.98	0.36	-0.33	0.31	-0.69
Real net exports	0.67	0.99	0.99	0.98	0.99	0.97

[a] $\omega = \frac{1}{1-\rho}$ denotes the elasticity of substitution between Home and Foreign traded goods. The data reported under the heading "Data" are those of the U.S. vis-à-vis the rest of the OECD countries.

Table 6b. Business cycle statistics in the theoretical economies[a]
(Trade elasticity equal to 4)

Statistics	Data	*Baseline Shocks* Bond Economy $\omega = 8$	*Baseline Shocks* Arrow-Debreu Economy $\omega = 8$	*Persistent Tradable Shocks* Bond Economy $\omega = 8$	*Persistent Tradable Shocks* Arrow-Debreu Economy $\omega = 8$	*Persistent Aggregate Shocks* Bond Economy $\omega = 8$
Standard deviation relative to GDP						
Consumption	0.94	0.42	0.48	0.58	0.48	0.76
Investment	4.33	3.25	3.27	2.86	2.86	1.90
Employment	1.19	0.55	0.59	0.30	0.49	0.2
absolute (in percent)						
Import ratio	4.94	3.06	2.84	3.63	2.91	1.25
Real net exports over GDP	0.64	0.20	0.15	0.30	0.16	0.12
Cross-correlations						
Between foreign and domestic						
GDP	0.68	0.31	0.26	0.46	0.18	0.28
Consumption	0.60	0.60	0.25	-0.01	0.16	0.17
Investment	0.25	0.35	0.28	0.28	0.03	0.03
Employment	0.54	0.26	0.07	0.80	-0.43	0.54
Between real net exports and GDP	-0.48	0.22	0.46	-0.39	0.50	-0.49

[a] $\omega = \frac{1}{1-\rho}$ denotes the elasticity of substitution between Home and Foreign traded goods. The data reported under the heading "Data" are those of the U.S. vis-à-vis the rest of the OECD countries.

Table 7. Wealth Effects of a Persistent Home Productivity Shocks in the Tradable Sector (in percent)

	Home Consumption	Foreign Consumption	Home Hours Worked	Foreign Hours Worked
$\eta = 0.5$ *and:*				
$\omega = 8$				
Bond economy	0.13	0.003	-0.98	-0.02
Arrow-Debreu Economy	0.05	0.09	-0.36	-0.64
$\omega = 3$				
Bond Economy	0.13	0.01	-0.93	-0.07
Arrow-Debreu Economy	0.10	0.04	-0.71	-0.28