

Financial Autarky and International Business Cycles (JME 2002)

Jonathan Heathcote and Fabrizio Perri

9/9/2014

Sargent Reading Group
Joseba Martinez

- International macro is beset by 'puzzles'
- Quest continues for a model that generates cross-country correlations between quantities (not to mention prices) similar to those observed in data
- This paper:
 - Examine effect of different (exogenously specified) risk-sharing arrangements on model moments
 - Compare to data
 - Study effect of alternative calibrations
- **Conclusion:** For plausible parametrization of productivity shocks, bond and complete markets economies very similar.
- Autarky economy is very different, and closer to data in most dimensions.
- Problem: countries definitely do not live in financial autarky!

Discrepancies between complete markets IRBC and data

- Empirical cross-country consumption and output correlations are similar (models predict much higher consumption correlation)
- Investment and employment positively correlated across countries (model predict negative)
- Models generate far less volatility in terms of trade and real exchange rate than in data

- Two countries ($i = 1, 2$)
- Each produces a different intermediate good (a and b)
- Intermediate goods packaged into final goods in each country
- Intermediate goods market is frictionless (implies law of one price holds)
- Capital and labor are not internationally mobile

Objective function

$$\sum_{t=0}^{\infty} \sum_{s^t} \pi(s^t) \beta^t U(c_i(s^t), 1 - n_i(s^t))$$

Subject to budget constraint, where

$$U(c_i(s^t), 1 - n_i(s^t)) = \frac{1}{\gamma} [c_i^\mu(s^t)(1 - n_i(s^t))^{1-\mu}]^\gamma$$

- c_i is consumption of country i final good

Production of intermediates

$$\max_{k_i(s^t), n_i(s^t)} \{F(z_i(s^t), k_i(s^t), n_i(s^t)) - w_i(s^t)n_i(s^t) - r_i(s^t)k_i(s^t)\}$$

Where

$$F(z_i(s^t), k_i(s^t), n_i(s^t)^{1-\theta}) = e^{z_i(s^t)} k_i^\theta(s^t) n_i^{1-\theta}(s^t)$$

$$z(s^t) = [z_1(s^t), z_2(s^t)]$$

$$z(s^t) = Az(s^{t-1}) + \epsilon(s^t)$$

$$k_i(s^{t+1}) = (1 - \delta)k_i(s^t) + x_i(s^t)$$

Final Goods

$$\max_{a_i(s^t), b_i(s^t)} \{G_i(a_i(s^t), b_i(s^t)) - q_i^a(s^t)a_i(s^t) - q_i^b(s^t)b_i(s^t)\}$$

Where

$$G_i(a_i(s^t), b_i(s^t)) = \begin{cases} [\omega a_i(s^t)^{(\sigma-1)/\sigma} + (1-\omega)b_i(s^t)^{(\sigma-1)/\sigma}]^{\sigma/(\sigma-1)} \\ [(1-\omega)a_i(s^t)^{(\sigma-1)/\sigma} + \omega b_i(s^t)^{(\sigma-1)/\sigma}]^{\sigma/(\sigma-1)}, \end{cases}$$

- σ : elasticity of substitution between a and b
- $\omega_1 > 0.5$: home bias in consumption
- q_i^j denominated in units of the country i final good

- Complete Markets

$$\begin{aligned}c_1(s^t) + x_1(s^t) + q_1^a(s^t) \sum_{s_{t+1}} Q(s^t, s_{t+1}) B_1(s^t, s_{t+1}) \\= q_1^a(s^t)(r_1(s^t)k_1(s^t) + w_1(s^t)n_1(s^t)) + q_1^a(s^t)B_1(s^{t-1}, s_t)\end{aligned}$$

- Bond economy

$$\begin{aligned}c_1(s^t) + x_1(s^t) + q_1^a(s^t)Q(s^t)B_1(s^t) \\= q_1^a(s^t)(r_1(s^t)k_1(s^t) + w_1(s^t)n_1(s^t)) + q_1^a(s^t)B_1(s^{t-1})\end{aligned}$$

- Autarky

$$c_1(s^t) + x_1(s^t) = q_1^a(s^t)(r_1(s^t)k_1(s^t) + w_1(s^t)n_1(s^t))$$

Equilibrium - Market Clearing

Intermediates market clearing

$$a_1(s^t) + a_2(s^t) = F(z_1(s^t), k_1(s^t), n_1(s^t))$$

$$b_1(s^t) + b_2(s^t) = F(z_2(s^t), k_2(s^t), n_2(s^t))$$

Finals market clearing

$$c_i(s^t) + x_i(s^t) = G_i(a_i(s^t), b_i(s^t)), \quad i = 1, 2$$

Bonds

$$B_1(s^t, s_{t+1}) + B_2(s^t, s_{t+1}) = 0, \quad \forall s_{t+1} \in S$$

or

$$B_1(s^t) = B_2(s^t)$$

Some definitions

GDP (numeraire is *domestic* final consumption)

$$y_i(s^t) = q_i^a(s^t)F(z_i(s^t), k_i(s^t), n_i(s^t))$$

Terms of trade

$$p(s^t) = \frac{q_i^b(s^t)}{q_i^a(s^t)} \quad i = 1, 2$$

Real exchange rate

$$rx(s^t) = \frac{q_1^a(s^t)}{q_2^a(s^t)} = \frac{q_1^b(s^t)}{q_2^b(s^t)}$$

Calibration

Table 1
Benchmark parameters (period = 1 quarter)

Parameters taken from other studies

<i>Preferences</i>	Discount factor	$\beta = 0.99$
	Consumption share	$\mu = 0.34$
	Risk aversion	$1 - \gamma = 2$

<i>Technology</i>	Capital share	$\theta = 0.36$
	Depreciation rate	$\delta = 0.025$
	Import share of <i>i</i> -firms (for calibrating ω_1)	$is = 0.15$

Estimated parameters

Productivity transition matrix ^a	$A = \begin{bmatrix} 0.970 & 0.025 \\ (0.007) & (0.008) \\ 0.025 & 0.970 \\ (0.008) & (0.007) \end{bmatrix}$
Std. dev. of innovations to productivity	$\sigma_{\varepsilon 1} = 0.0073 \quad \sigma_{\varepsilon 2} = 0.0044$
Correlation of innovations to productivity	$corr(\varepsilon_1, \varepsilon_2) = 0.290$
Elasticity of substitution between intermediate goods ^b	$\sigma = 0.90$ (0.12)

Table 2
Model results (benchmark parameters)

(A) Volatilities^a

Economy	% std. dev. <i>y</i>	% std. dev. % std. dev. of <i>y</i>			% std. dev.			
		<i>c</i>	<i>x</i>	<i>n</i>	<i>ex</i>	<i>im</i>	<i>nx</i>	<i>ir</i>
US data	1.67	0.81	2.84	0.66	3.94	5.42	0.45	4.07
Complete markets	1.21	0.53	2.74	0.31	0.99	0.99	0.20	0.70
Bond economy	1.21	0.52	2.73	0.32	0.96	0.96	0.19	0.76
Financial autarky	1.18	0.51	2.04	0.28	1.29	1.18	0.00	1.51

(B) Correlations with output^b

Economy	correlation between							
	<i>c,y</i>	<i>x,y</i>	<i>n,y</i>	<i>ex,y</i>	<i>im,y</i>	<i>nx,y</i>	<i>p,y</i>	<i>rx,y</i>
US data	0.86	0.95	0.87	0.32	0.81	-0.49	-0.24	0.13
Complete markets	0.96	0.96	0.97	0.55	0.89	-0.64	0.65	0.65
Bond economy	0.95	0.96	0.97	0.59	0.86	-0.65	0.65	0.65
Financial autarky	0.92	0.99	0.99	1.00	0.15	0.00	0.65	0.65

(C) Cross country correlations and international relative price volatility
correlation between

Economy	correlation between				% std. dev.	
	y_1, y_2	c_1, c_2	x_1, x_2	n_1, n_2	p	rx
Data	0.58	0.36	0.30	0.42	2.99	3.73
Complete markets	0.18	0.65	0.29	0.14	0.78	0.55
Bond economy	0.17	0.68	0.29	0.17	0.84	0.59
Financial autarky	0.24	0.85	0.35	0.14	1.68	1.18

Results

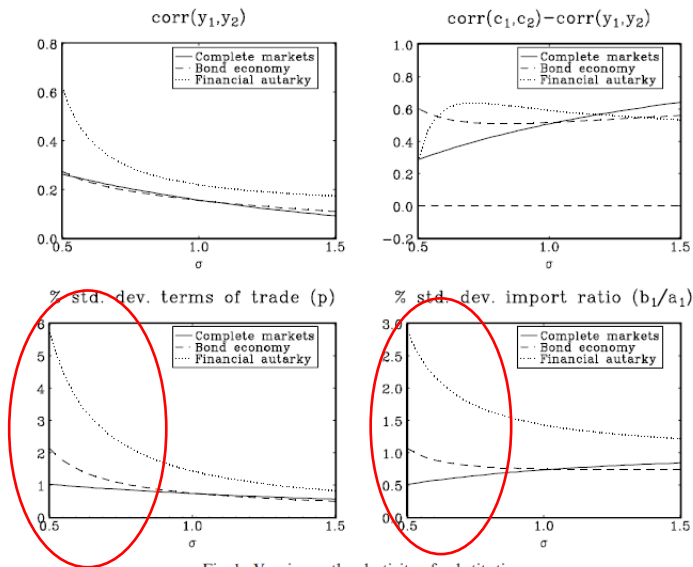


Fig. 1. Varying σ , the elasticity of substitution.

Table 3
Varying shock persistence and degree of substitutability—no spill-overs

	Low persistence shocks			Unit root shocks		
	$\rho = 0.95$ $\sigma = 0.5$	$\sigma = 1.0$	$\sigma = 1.5$	$\rho = 1.0$ $\sigma = 0.5$	$\sigma = 1.0$	$\sigma = 1.5$
(A) $corr(y_1, y_2) - corr(c_1, c_2)$						
Data	0.22					
Complete markets	0.13	-0.13	-0.30	0.08	-0.32	-0.56
Bond economy	-0.37	-0.14	-0.18	-0.14	-0.22	0.02
Financial autarky	-0.08	-0.29	-0.17	-0.12	-0.31	-0.17
(B) $corr(x_1, x_2)$						
Data	0.30					
Complete markets	0.29	0.14	0.02	0.75	0.21	-0.17
Bond economy	0.46	0.14	0.02	0.44	0.19	-0.13
Financial autarky	0.66	0.61	0.46	0.39	0.55	0.41
(C) % std. dev. terms of trade (p)						
Data	2.99					
Complete markets	1.05	0.75	0.57	1.57	1.05	0.73
Bond economy	2.22	0.76	0.49	6.32	0.89	0.27
Financial autarky	5.74	1.41	0.80	6.41	1.27	0.70

The data statistics for international correlations refer to the correlation of US series with series for an aggregate of the rest of the world for the period 1973.1–1998.4 (see Appendix B for details). All series have been logged and Hodrick–Prescott filtered with a smoothing parameter of 1600. The statistics from the model are the averages of 100 simulations each 104 periods long. Standard errors are available upon request.