Intl. Business Cycles with Incomplete Mkts.

Baxter + Crucini (IER, 1995)

- Baxter & Crucini study the same model as BKK, except they compare complete mkts. with incomplete mkts.

- Incomplete Mkts = Domestic + Foreign residents can only trade non-contingent (riskless) bonds.

- Conclusion

Incomplete Mkts. don't matter if productivity shocks are (trend) stationary and/or if they rapidly diffuse across countries. However, if productivity shocks are permanent (i.e., they have a unit-root component) then incomplete markets have a big effect. In particular, consumption becomes less correlated across countries and output becomes more correlated

- Intuition

The key to understanding the effects of incomplete markets is to understand the implied wealth effects

Preferences

$$H: \quad E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\rho}\left[C_t^{\theta} L_t^{1-\theta}\right]^{1-\rho}$$

$$F: \quad E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\rho}\left[(C_t^*)^{\theta}(L_t^*)^{1-\theta}\right]^{1-\rho}$$

Time Constraints

$$L_t + N_t \leq 1$$

$$L_t^* + N_t^* \leq 1$$

Technology (Note: Considering a 1-good economy)

$$H: \quad Y_t = A_t K_t^{1-\alpha}(X_t N_t)^{\alpha}$$

$$K_{t+1} = (1-\delta)K_t + \phi(I_t/K_t)K_t$$

$$F: \quad Y_t^* = A_t^* (K_t^*)^{1-\alpha^*}(X_t^* N_t^*)^{\alpha^*}$$

$$K_{t+1}^* = (1-\delta)K_t^* + \phi(I_t^*/K_t^*)K_t^*$$

Note: K_t refers to capital located in H, which is not the same thing as capital owned by H residents.

Complete MKts.

With complete markets, the planner maximizes a weighted sum of utilities subject to a single aggregate resource constraint

$$C_t + C_t^* + I_t + I_t^* \leq Y_t + Y_t^*$$

Incomplete MKts.

With incomplete markets, each country faces its own sequence of budget constraints

$$p_t^B b_{t+1} + c_t + i_t \leq y_t + b_t$$

$$p_t^B b_{t+1}^* + c_t^* + i_t^* \leq y_t^* + b_t^*$$

where $p_t^B = \frac{1}{1+r_t}$

Bond market clearing requires

$$b_t + b_t^* = 0 \qquad \text{(assuming symmetry)}$$

Solution Strategy

With incomplete markets the equilibrium is no longer Pareto optimal, so we cannot characterize it as the solution of a planner's problem. Instead, we must solve a system of (nonlinear) stochastic difference equations which describe each country's FOCs. When doing this, we must impose the TVCs

$$\lim_{t \to \infty} \beta^t \lambda_t b_{t+1} = 0$$

$$\lim_{t \to \infty} \beta^t \lambda_t^* b_{t+1}^* = 0$$

(λ^*, λ are Lagrange multipliers on the bud. const.)

Wealth Effects

With incomplete markets, shocks produce wealth redistributions across countries. These wealth redistributions cause even temporary shocks to have permanent consequences. As a result, equilibrium quantities will have unit roots, and the model will not possess a unique steady state! This can create problems for linear approximation solution methods. Where do you linearize around?

TABLE 1

BUSINESS CYCLE STATISTICS FOR 8 OECD COUNTRIES

	Relative volatility				Contemporaneous correlation	
Country	σ_c/σ_y	σ_i/σ_y	$\sigma_{nx/y}$	ρ_y	$\rho(c, y)$	$\rho(i, y)$
Australia	0.69	2.17	1.46	0.67	0.62	0.55
Canada	0.88	2.83	0.83	0.79	0.72	0.62
France	0.89	1.92	0.81	0.79	0.58	0.45
Germany	0.70	3.40	0.88	0.71	0.64	0.80
Italy	0.82	2.49	1.76	0.78	0.70	0.80
Japan	1.12	2.31	0.93	0.74	0.47	0.60
Switzerland	0.77	2.88	1.50	0.70	0.74	0.73
United States	0.67	3.00	0.41	0.84	0.88	0.90

	Correlation with same U.S. variable	
Country	output	consumption
Australia	0.24	0.11
Canada	0.77	0.65
France	0.50	0.28
Germany	0.44	0.45
Italy	0.47	0.23
Japan	0.42	0.41
Switzerland	0.28	0.22
United States	1.00	1.00

Additional labor market statistics for the U.S.	
σ_N/σ_y:	0.84
$\sigma_{\text{prod}}/\sigma_y$:	0.57
$\rho(N, y)$:	0.83
$\rho(\text{prod}, y)$:	0.54
$\rho(\text{prod}, N)$:	−0.04

Note. With the exception of the U.S. labor market statistics, all statistics are taken from Baxter and Crucini (1993). The data is from the International Financial Statistics, and is quarterly postwar data, with coverage varying by country. This is the same database used by Backus, Kehoe, and Kydland (1992) who graciously provided us with their data.

Statistics for U.S. labor markets were taken from Baxter and King (1991); the original data source was Citibase. The data is quarterly data from 1955:1–1990:3. In this table, "*N*" denotes labor input (hours worked), and "prod" denotes productivity computed as output per manhour.

All data has been detrended using the Hodrick-Prescott (1980) filter.

TABLE 3
TREND STATIONARY SHOCKS

(1) Results for complete markets economy
(2) Results for economy trading noncontingent bonds and goods only

	Standard deviation		Relative standard deviation		Persistence		Correlation w/y, lag 0			Other correlations	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)		(1)	(2)
Output	2.01	1.99	1.00	1.00	0.75	0.76	1.00	1.00	y, y^*	-0.04	0.06
Consumption	0.97	0.98	0.48	0.49	0.81	0.81	0.82	0.84	c, c^*	0.95	0.92
Investment	3.72	3.55	1.85	1.79	0.73	0.74	0.98	0.97	i, i^*	0.02	0.12
Labor	1.07	1.02	0.53	0.51	0.73	0.72	0.91	0.91	N, N^*	−0.70	−0.67
Wage	1.13	1.14	0.56	0.57	0.80	0.80	0.92	0.93	w, w^*	0.75	0.72
Net exports	0.57	0.59	0.29	0.30	0.80	0.80	0.65	0.65	s, i	0.95	0.94
Bonds	0.00	3.22	0.00	1.62	0.00	0.98	0.00	0.23	w, N	0.66	0.69

TABLE 4
UNIT ROOT IN PRODUCTIVITY

(1) Results for complete markets economy
(2) Results for economy trading noncontingent bonds and goods only

	Standard deviation		Relative standard deviation		Persistence		Correlation w/y, lag 0			Other correlations	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)		(1)	(2)
Output	2.58	1.59	1.00	1.00	0.87	0.82	1.00	1.00	y, y^*	−0.41	0.54
Consumption	1.03	1.67	0.40	1.05	0.82	0.80	0.72	0.85	c, c^*	0.89	−0.28
Investment	11.84	4.74	4.60	2.98	0.77	0.78	0.71	0.74	i, i^*	−0.92	−0.50
Labor	1.58	0.71	0.61	0.45	0.89	0.78	0.93	0.19	N, N^*	−0.91	−0.56
Wage	1.25	1.62	0.48	1.02	0.83	0.80	0.89	0.90	w, w^*	0.50	−0.11
Net exports	2.39	1.61	0.93	1.01	0.81	0.77	−0.18	−0.28	s, i	0.74	0.04
Bonds	0.00	8.18	0.00	5.13	0.00	0.98	0.00	0.35	w, N	0.66	−0.25

Summary

Permanent Shocks

Complete

$Y\uparrow$, $Y^*\downarrow$

$C\uparrow$, $C^*\uparrow$

$I\uparrow$, $I^*\downarrow$

$N\uparrow$, $N^*\downarrow$

$w\uparrow$, $w^*\uparrow$

$r\uparrow$

$\boxed{\text{wealth}\downarrow \text{, wealth}^*\uparrow}$

$B^* = 0$

Bonds Only

$Y\uparrow$, $Y^*\uparrow$

$C\uparrow$, $C^*\downarrow$

$I\uparrow$, $I^*\downarrow$

$N\downarrow$, $N^*\uparrow$

$w\uparrow$, $w^*\downarrow$

$r\uparrow$

$\boxed{\text{wealth}\uparrow \text{, wealth}^* \text{ (no change)}}$

$B^*\uparrow$

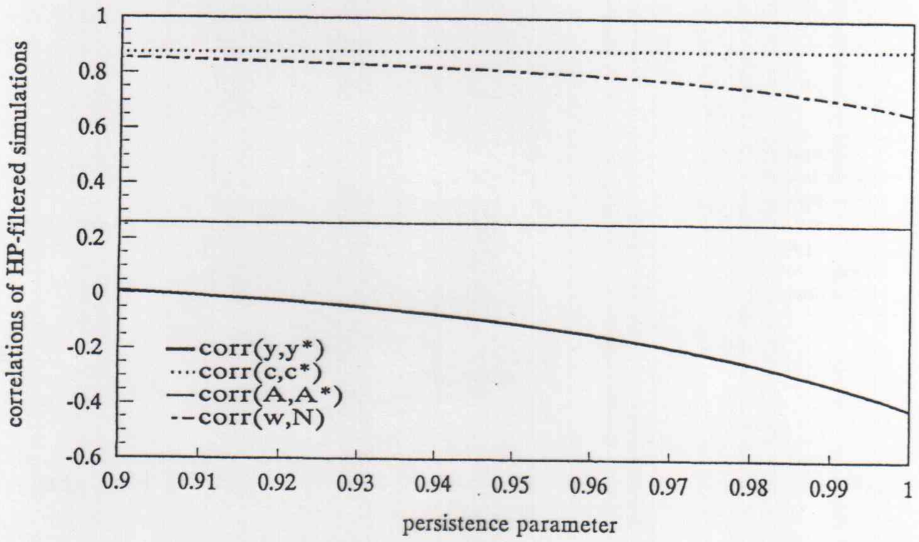

FIGURE 1A

COMPLETE MARKETS MODEL WITHOUT SPILLOVERS

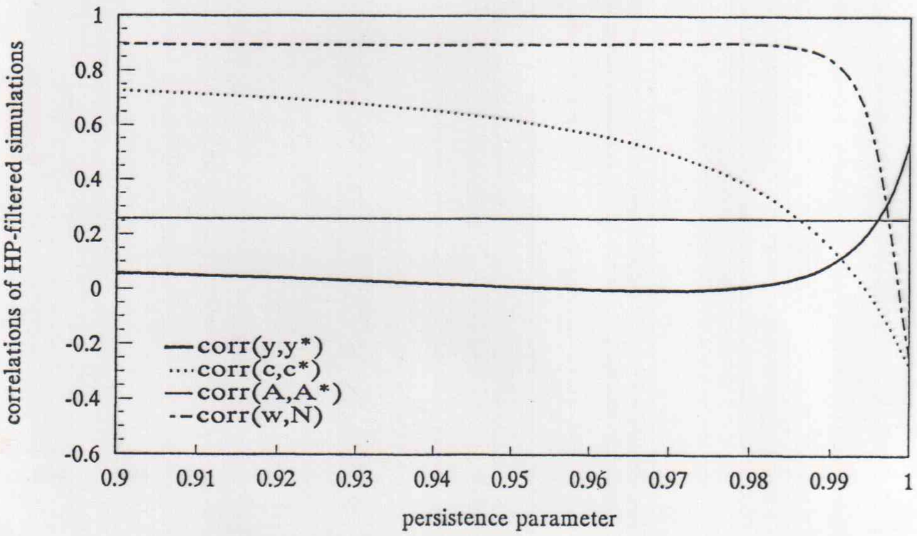

FIGURE 1B

INCOMPLETE MARKETS MODEL WITHOUT SPILLOVERS

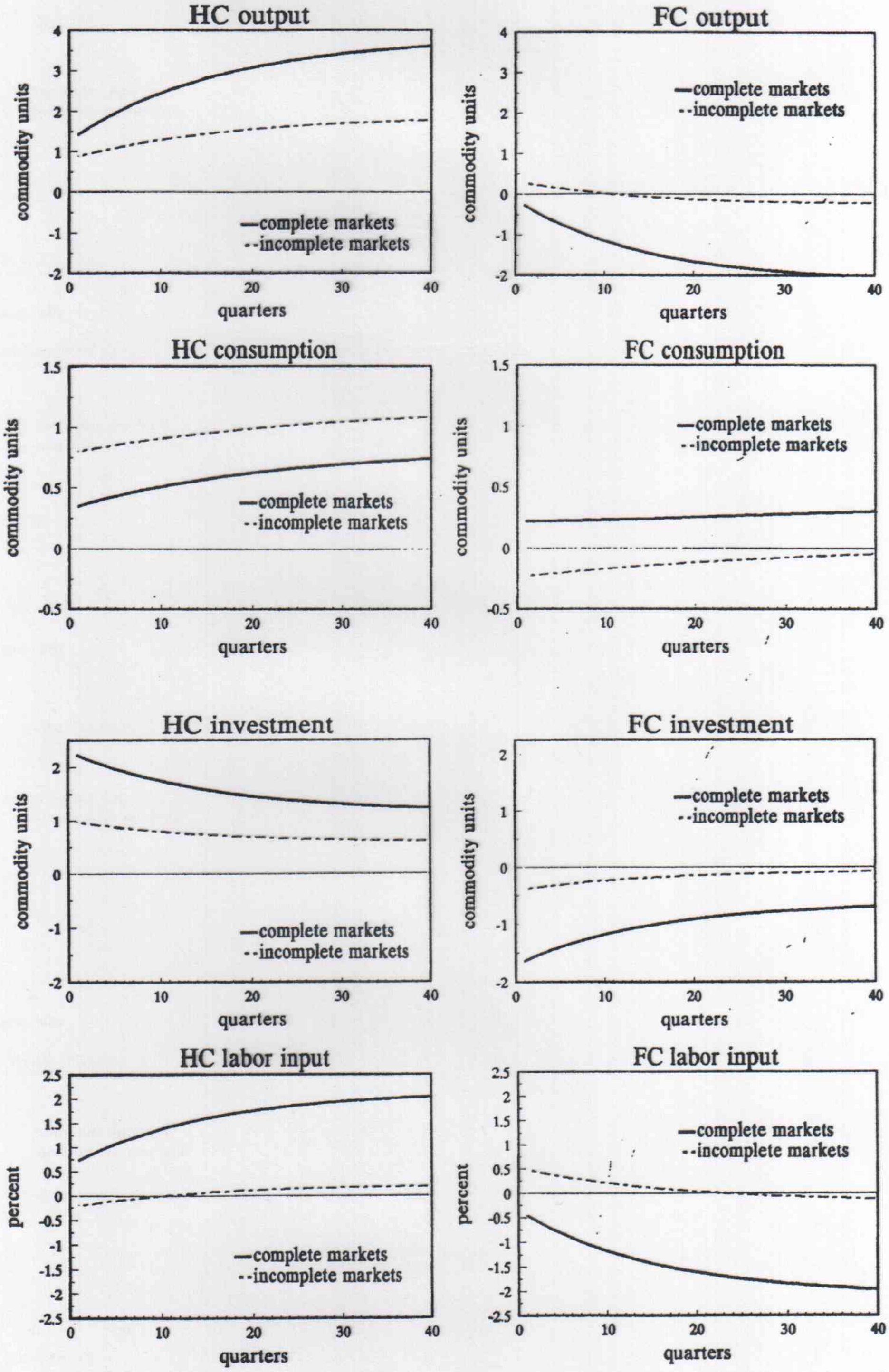

FIGURE 2

RANDOM WALK PRODUCTIVITY WITHOUT SPILLOVERS:
QUANTITY RESPONSES TO POSITIVE PRODUCTIVITY SHOCK IN HOME COUNTRY

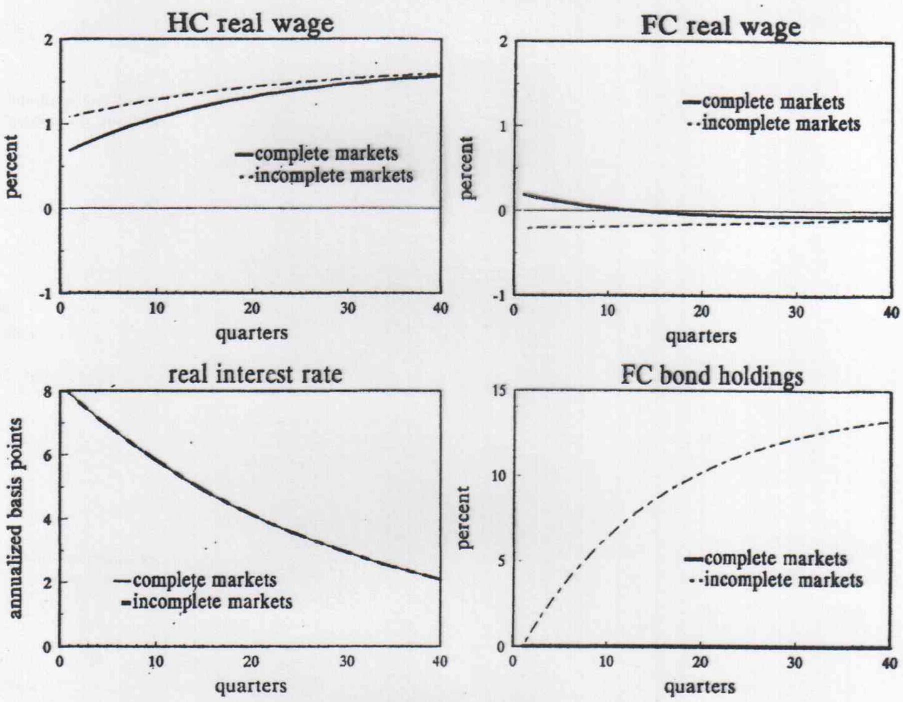

FIGURE 3

RANDOM WALK PRODUCTIVITY WITHOUT SPILLOVERS:
PRICE AND INTEREST RATE RESPONSES TO POSITIVE PRODUCTIVITY SHOCK IN HOME COUNTRY

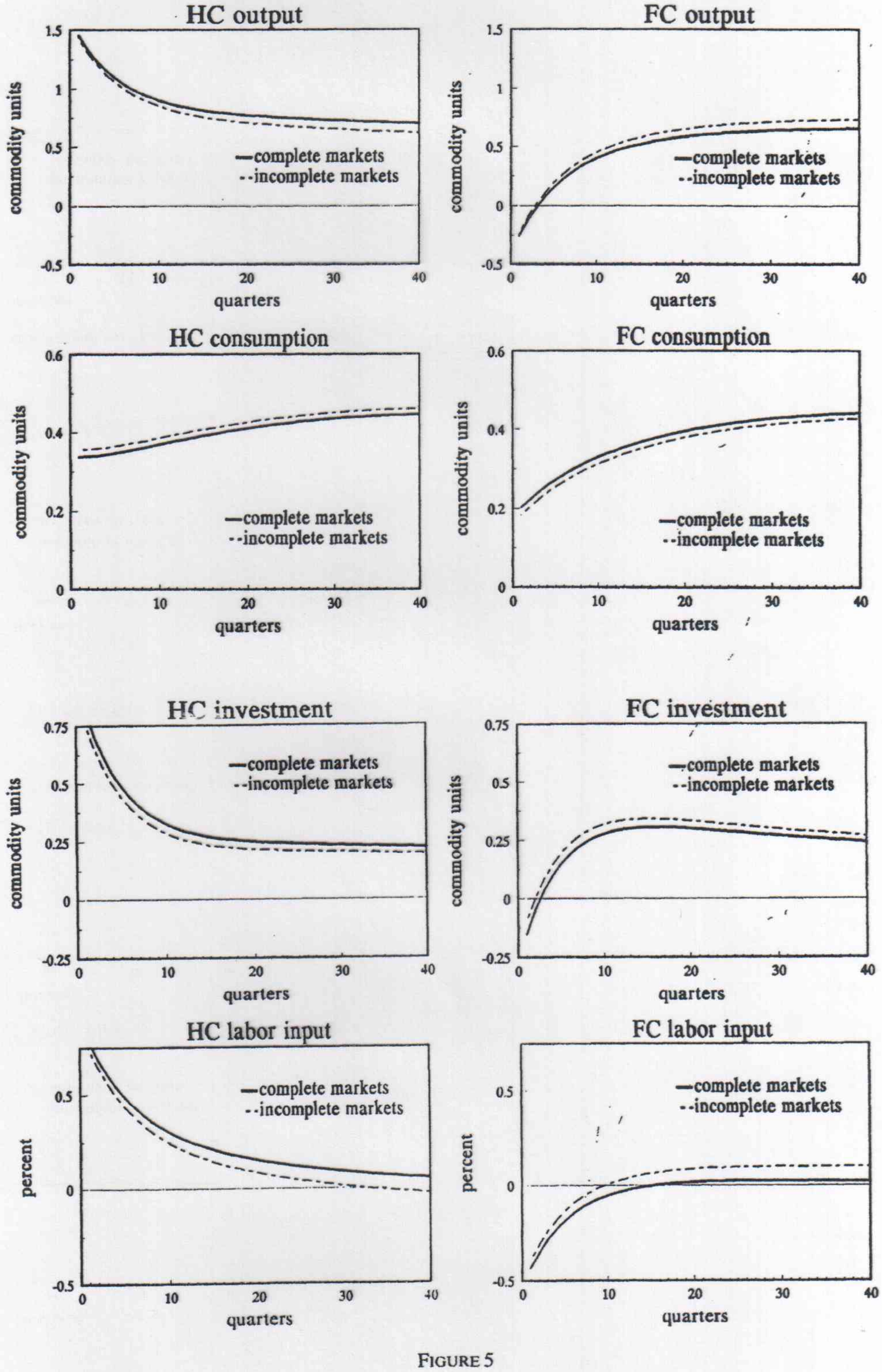

FIGURE 5

TREND-STATIONARY PRODUCTIVITY WITH SPILLOVERS:
QUANTITY RESPONSES TO POSITIVE PRODUCTIVITY SHOCK IN HOME COUNTRY

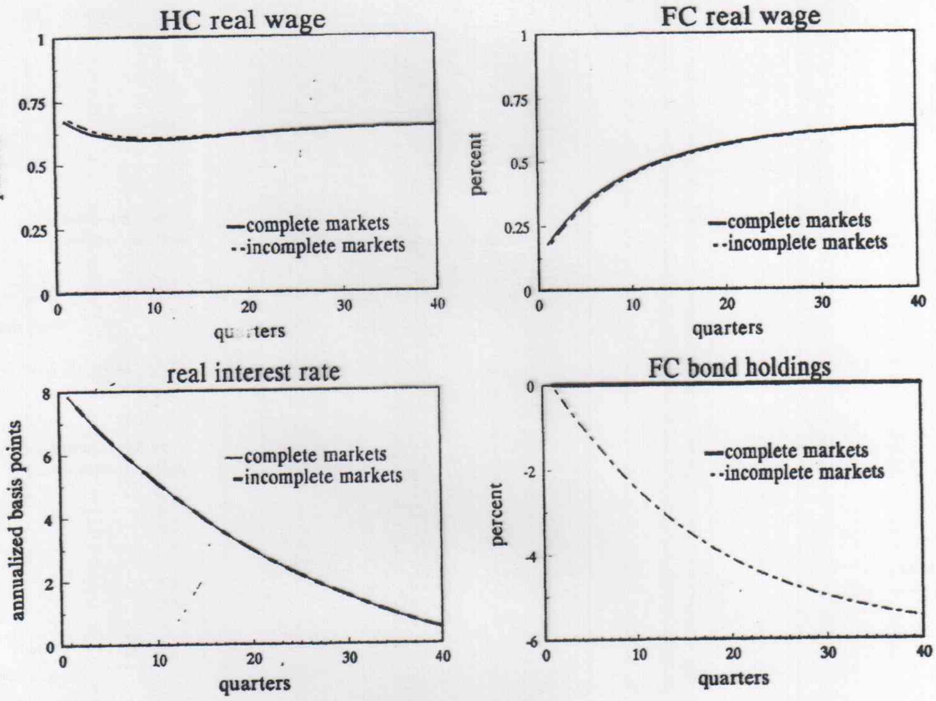

FIGURE 6

TREND-STATIONARY PRODUCTIVITY WITH SPILLOVERS:
PRICE AND INTEREST RATE RESPONSES TO POSITIVE PRODUCTIVITY SHOCK IN HOME COUNTRY