Economics Bulletin

Volume 31, Issue 2

Wealth effects and cross-country co-movement of labor

Quoc hung Nguyen
Institute of Developing Economies, Japan

Abstract

This paper quantitatively shows that the wealth effect on leisure plays a determining role in generating negative co-movement of employment across countries. Hence, even without restrictions on international capital mobility, a positive cross-country correlation of labor can be obtained by simply incorporating into standard models preferences that rule out the wealth effect.

I would like to thank Paul Beaudry, Viktoria Hnatkovska, Amartya Lahiri, Henry Siu, and particularly Michael Devereux for their useful comments and feedback. All errors are solely mine.

Citation: Quoc hung Nguyen, (2011) "Wealth effects and cross-country co-movement of labor", *Economics Bulletin*, Vol. 31 no.2 pp. 1362-1371.

Submitted: Jan 21 2011. **Published:** May 12, 2011.

Economics Bulletin, 2011, Vol. 31 no.2 pp. 1362-1371

1 Introduction

This paper is motivated by a conclusion in Baxter (1995) that: "It has proved particularly difficult to write down plausibly-parameterized models which can generate positive comovement of labor and investment across countries..."

The main reason for the negative comovements, according to Baxter (1995), is that in the models of one-good with the internationally mobile capital, there is a strong tendency to move capital to the most productive location in response to persistent productivity shocks. The movement of capital to the more productive country leads to a rise in labor returns there accompanied by a fall in labor returns in the other country. Because of the substitution effect, labor input in different country is negatively correlated unless the cross-country correlation of the innovations to country-specific productivity shocks is very high.

However, there is also another effect that causes the cross country negative comovement of employment in these models: the wealth effect. Intuitively, when a positive productivity shock, for example, hits the foreign country, there is an increase in wealth at the home country because of risk sharing via financial markets. Consumers at the home country, therefore, increase their *leisure*. The wealth effect, combined with the substitution effect that already helps raise leisure because of declining home wage rates, magnifies the decrease of the home country's labor supply. As a result, labor inputs are negatively correlated across country despite positive correlations in productivity innovations.

This paper quantitatively shows that without the wealth effect, relatively small positive correlations in cross-country productivity innovations, as suggested by empirical studies, are sufficient to generate significant positive comovement in employment. The result holds under both complete financial markets with perfect risk sharing and incomplete markets with only partial risk sharing, [1] and is robust with various specifications of cross-country productivity innovation process.

[1] I recently became aware of a paper by Johri et al. (2007) who argue that zero wealth effects *combined* with learning-by-doing and *incomplete* markets can generate positive cross-country correlations of hours and investment. In addition, Raffo (2008) briefly shows that preferences with a zero wealth effect can produce positive labor comovement but only with particular specifications. Raffo (2008) also has different explanation and quantitative results. This paper will elaborate the difference.

The structure of this paper is as follows. Section 2 introduces models' setting and calibration. Section 3 discussed quantitative results. Conclusion follows in section 4.

2 The Model

The world consists of two countries: the home country and the foreign country. In the model, the foreign country is distinguished from the home country by a star attached to all foreign-country variables. When there are no stars, the variable, parameter, or function is assumed to be identical across countries. All variables are in per capita terms.

Preferences. The representative household in each country maximizes its expected lifetime utility defined over random sequences of consumption goods (c_t) and labor disutility (l_t):

$$U = E_0 \sum_{t=0}^{\infty} \beta^t U\big(c_t, l_t\big), \quad \text{Home country;} \tag{2.1}$$

$$U^* = E_0 \sum_{t=0}^{\infty} \beta^t U\big(c_t^*, l_t^*\big), \quad \text{Foreign country} \tag{2.2}$$

I consider two types of preferences. The first one is "standard" Cobb-Douglas preferences, which is commonly used in the international business cycle literature and was used by King et al. (1988). Parameter γ determines the value of hours at the steady state.

$$U(c_t, l_t) = \frac{\left(c_t^{\gamma}(1-l_t)^{1-\gamma}\right)^{1-\sigma} - 1}{1-\sigma} \tag{2.3}$$

The second one is GHH preferences:

$$U(c_t, l_t) = \frac{(c_t - \kappa\frac{l_t^{\omega}}{\omega})^{1-\sigma} - 1}{1-\sigma} \tag{2.4}$$

Similar to γ, parameter κ determines the value of hours at the steady state and parameter ω determines the elasticity of labor supply. Unlike Cobb-Douglas preferences, GHH preferences imply a zero elasticity of leisure to income.

Technology. Production functions are in Cobb-Douglas forms; production of the single final good requires the input of both labor and capital. k_t represents capital in place in the home country, but not necessarily capital owned by residents of the home country because capital is internationally mobile. Labor is, however, internationally immobile.

$$y_t = A_t(k_t)^\alpha(l_t)^{1-\alpha} \quad \text{Home country;} \tag{2.5}$$

$$y_t^* = A_t^*(k_t^*)^\alpha(l_t^*)^{1-\alpha} \quad \text{Foreign country.} \tag{2.6}$$

where A_t represents the stochastic level of productivity home country.

Productivity evolves according to the bivariate autoregressive process:

$$\begin{bmatrix} log(A_{t+1}) \\ log(A_{t+1}^*) \end{bmatrix} = \begin{bmatrix} a_1 & a_2 \\ a_2 & a_1 \end{bmatrix} \begin{bmatrix} log(A_t) \\ log(A_t^*) \end{bmatrix} + \begin{bmatrix} \epsilon_{t+1} \\ \epsilon_{t+1}^* \end{bmatrix} \tag{2.7}$$

where a_1 measures the persistence in productivity shocks and a_2 measures the degree of international spillovers. The variance in the innovations is denoted by σ_ϵ^2 and the correlation between ϵ_t and ϵ_t^* is σ_{12}.

Denote investment at time t by i_t and investment adjustment cost parameter by ϕ then the capital stock evolves according to:

$$k_{t+1} = (1-\delta)k_t + t_t - \frac{\phi}{2}k_t\left[\frac{i_t}{k_t} - \delta\right]^2 \tag{2.8}$$

Market Structure. Assume that there is frictionless international trade in output, hence a unified world resource constraint for the single produced good:

$$(y_t - c_t - i_t) + (y_t^* - c_t^* - i_t^*) = 0 \tag{2.9}$$

Regarding financial structures, I consider both complete-markets and bond economies. When markets are complete, the representative agents in both countries can trade a full set of contingent claims. Hence, the budget constraint of the home country's representative household can be expressed as:

$$c_t + i_t + \sum_{s_{t+1}} p(s_{t+1}, s_t)b(s_{t+1}) = y_t + b(s_t) \tag{2.10}$$

where s_t indicates the state in period t and $b(s_{t+1})$ denotes the quantity of contingent claims purchased in period t and paying off one unit of consumption the following period, conditional on the state of the world being s_{t+1}. $p(s_{t+1}, s_t)$ is the price of these contingent assets.

By contrast, in a bond economy, there is only one-period real discount bonds. Let b_{t+1} denote the per capita quantity of these discount bonds purchased by the home economy, which mature in period $t+1$, and p_t^b is its price at time t.

The flow budget constraints for the bond economy are: [2]

$$c_t + i_t + p_t^b b_{t+1} + \frac{\pi_b}{2}(b_{t+1})^2 = y_t + b_t; \quad \text{home country} \tag{2.11}$$

$$c_t^* + i_t^* + p_t^b b_{t+1}^* + \frac{\pi_b}{2}(b_{t+1}^*)^2 = y_t^* + b_t^*; \quad \text{foreign country} \tag{2.12}$$

The world market clearing condition for bonds is:

$$b(s_{t+1}) + b^*(s_{t+1}) = 0; \quad \text{complete markets} \tag{2.13}$$

$$b_{t+1} + b_{t+1}^* = 0; \quad \text{bond economy} \tag{2.14}$$

Calibration. This paper follows closely calibration from Baxter and Crucini (1995), Kehoe and Perri (2002), and Table 1 provides details. In particular, parameter ω, which determines the inter-temporal elasticity of substitution in labor supply is set to 2 as a benchmark. The unit benchmark elasticity is equal to the value implied by standard preferences as in form (2.3). For sensitivity analysis, ω is set from 1.58 [3] to 6, which then implies the intertemporal elasticity of substitution varies from 1.7 to 0.2 accordingly. This is a range suggested by empirical studies.

Parameters, κ, γ in GHH preferences and Cobb-Douglas preferences are chosen so that the hours of working in the steady state are 0.25. Portfolio adjustment costs parameter, π_b is set to 0.0005 so that the implied volatility of the ratio of net exports to output in bond economy models is the same in corresponding financial complete market models. Investment adjustment cost parameter, ϕ is set such that the ratio of investment volatility to that of output match the data, which is equal to 3.24. [4]

Finally, for parameters of the productivity shock's process, which are crucial to quantitative results in the context of international real business cycle mod-

[2] Boileau and Normandin (2008) and others, I impose quadratic portfolio adjustment costs to induce stationarity in incomplete markets. See Boileau and Normandin (2008) for more details about other methods.

[3] 1.58 is the value used by Devereux et al. (1992) in their two-country model; the value was first used by Greenwood et al (1988) in a closed-economy model.

[4] Imposing ϕ be equal to zero does not change qualitative conclusions of these models.

els, [5] I follow Kehoe and Perri (2002) to set $a_1 = 0.95$, $a_2 = 0$ as the benchmark. These values imply that there are medium levels of persistence but there is no direct "spillover" in productivity shocks. For sensitivity analysis, I choose high persistence ($a_1 = 0.99$) (termed HP) and low persistence ($a_1 = 0.90$) (termed LP). I also follow the original results of Backus et al. (1992) (termed BKK) to set $a_1 = 0.906$ and $a_2 = 0.088$, which is similar to Raffo (2008).

Table 1: Parameter values

	Parameters
Preferences	$\beta = 0.99$, $\sigma = 2$, $\omega = 2$
	hours at s.s $l = 0.25$
Technology	$\alpha = 0.3$, $\delta = 0.03$
Productivity shocks	$a_1 = 0.95$, $a_2 = 0$
	var(ϵ_1)=var(ϵ_2)=0.07^2, corr(ϵ_1,ϵ_2)=0.25
Adjustment cost	$\pi_b = 0.0005$

3 Quantitative Results

I solve and simulate the models by the perturbation method [6] and Table 2 provides business cycle statistics from data and those implied by models. The numbers in parentheses are from models with Cobb-Douglas preferences as opposed to those computed from models with GHH preferences for similar specifications.

Figure 1 presents impulse responses of models with complete financial markets in response to a positive shock in the foreign country. It is shown in the figure that employment (hours) in the home country decreases significantly *less or weaker* in models with GHH preferences, which contradicts Raffo (2008)'s explanation in page 28. [7] The reason is straightforward when we focus on the wealth effect derived from risk sharing. Without the wealth effect on leisure,

[5] Accoring to Letendre (2004) and Boileau and Normandin (2008) productivity shock's process parameters are particularly important for quantitative results in international business cycle models with incomplete markets.

[6] For more details, see Schmitt-Grohe and Uribe (2004).

[7] Raffo (2008) argues that the response of labor is stronger.

households in the home country consume significantly less leisure in response to a positive productivity shock in the foreign country, hence reducing labor supply by a relatively smaller amount. Table 2 shows that the cross-country correlations in employment and output are positive in the models with GHH preferences whereas the correlations are negative in the models with Cobb-Douglas preferences.

Table 3 presents the implied business cycle statistics of the model with GHH preferences and complete financial markets when I vary the intertemporal elasticity of substitution in labor supply from 1.7 to 0.2. Table 3 shows that when the elasticity is lower. i.e., labor supply becomes less responsive to shocks the cross-country correlation in employment improves. However, since leisure becomes less responsive to shocks, the cross-country consumption tend to move together, hence, cross-country correlation increases, which is consistent with the results of Devereux et al. (1992).

Finally, Table 4 shows that when there is no wealth effect on leisure the result of cross-country positive correlation in employment is robust with various specifications in the productivity shock process. In particular, when there is spillover in cross-country productivity shocks as in the BKK specification, cross-country employments almost move together. However, even under the same BKK specification, cross-country employments still significantly negatively co-move (the correlation is -0.63) with Cobb-Douglas preferences. These results reconfirm that the wealth effect on leisure plays the crucial role in determining the cross-country correlation in employment. In addition, it turns out that the spill-over specification as in BKK and Raffo (2008) in productivity shocks, which is not strongly supported by many empirical evidence, has significant impacts on the quantitative results but not on the direction. [8]

4 Conclusion

This paper quantitatively shows that the wealth effect on leisure plays a determining role in generating the cross-country negative correlation in employment.

[8]A minor point is that in Table 7 of Raffo (2008), the cross-country correlation of output and labor should be always the same because of GHH preferences' properties. See Schmitt-Grohe and Uribe (2004) for more details.

As a result, a positive cross-country correlation in employment can be obtained by simply using preferences that rule out the wealth effect.

References

Backus, D., P. Kehoe, and F. Kydland (1992). International real business cycles. *Journal of Political Economy 100*, 745–775.

Baxter, M. (1995). International trade and business cycles. *Handbook of International Economics*.

Baxter, M. and M. Crucini (1995). Business cycles and the asset structure of foreign trade. *International Economic Review 36*, 821–854.

Boileau, M. and M. Normandin (2008). Closing international real business cycle models with restricted financial markets. *Journal of International Money and Finance 27*, 733–756.

Devereux, M., A. Gregory, and G. Smith (1992). Realistic cross-country consumption correlations in a two-country, equilibrium, business cycle model. *Journal of International Money and Finance 11*, 3–16.

Johri, A., M. Letendre, and D. Luo (2007). Revisiting cross-country correlation anomalies. *mimeo*.

Kehoe, P. and F. Perri (2002). International business cycles with endogenous incomplete markets. *Econometrica 70(3)*, 907–928.

King, R., C. Plosser, and S. Rebelo (1988). Production, growth and business cycles: The basic neoclassical model. *Journal of Monetary Economics 21*, 195–232.

Raffo, A. (2008). Net exports, consumption volatility and international business cycle models. *Journal of International Economics 75(1)*, 14–29.

Schmitt-Grohe, S. and M. Uribe (2004). Solving dynamic general equilibrium models using a second-order approximation to the policy function. *Journal of Economic Dynamics and Control 28*, 645–658.

Table 2: **Business Cycles Statistics**

Statistics	Data	Economy with Complete Market	 Bond Economy
Std.dev rel. to GDP			
Consumption	0.79	0.71 (0.41)	0.81 (0.51)
Investment	3.24	3.24 (3.24)	3.24 (3.24)
Employment	0.63	0.5 (0.58)	0.5(0.61)
Net Exports/GDP	0.09	0.65 (0.78)	0.65 (0.81)
Domestic Comovement			
Corr. with GDP			
Consumption	0.87	0.96 (0.7)	0.96 (0.58)
Investment	0.93	0.5 (0.51)	0.5 (0.51)
Employment	0.86	1 (0.93)	1 (0.86)
Net Exports/GDP	-0.36	0.17 (0.52)	0.06 (0.5)
International Correlation			
Home and Foreign			
GDP	0.51	0.2 (-0.45)	0.19 (-0.35)
Consumption	0.32	0.68 (0.86)	0.28 (0.42)
Investment	0.29	-0.7 (-0.76)	-0.7 (-0.71)
Employment	0.43	0.2 (-0.87)	0.19 (-0.86)

Table 3: **Sensitivity Analysis**

		ω					
Statistics	Data	1.58	2	3	4	5	6
International Correlation							
Home and Foreign							
GDP	0.51	0.14	0.20	0.24	0.26	0.26	0.27
Consumption	0.32	0.52	0.68	0.84	0.91	0.94	0.96
Investment	0.29	-0.76	-0.7	-0.61	-0.57	-0.54	-0.53
Employment	0.43	0.14	0.20	0.24	0.26	0.26	0.27

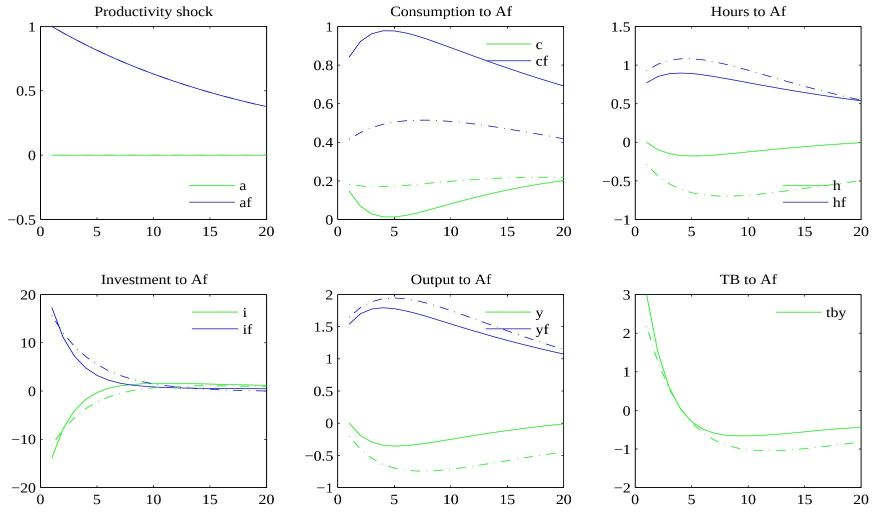
Notes: The statistics in the Data column are taken from Kehoe and Perri (2002), which are calculated from U.S. quarterly time series, 1970:1-1998:4 and an aggregate of 15 European countries. All relevant time series, except ratio of net exports to output, have been logged and HP-filtered. Statistics in Table 2 are computed from models with GHH preferences with $\omega = 2$ and those in parentheses are computed from models with Cobb-Douglas preferences and with the similar specifications. The model statistics in Table 3 are computed from an model economy with GHH preferences and complete markets.

Table 4: **Business Cycles Statistics: Productivity Shock Processes**

		Productivity Shock Process			
Statistics	Data	Benchmark	HP	LP	BKK
Std.dev rel. to GDP					
Consumption	0.79	0.71	0.79	0.67	0.92
Investment	3.24	3.24	3.06	3.24	3.24
Employment	0.63	0.5	0.5	0.5	0.5
Net Exports/GDP	0.09	0.65	0.69	0.58	0.67
Domestic Comovement					
Corr. with GDP					
Consumption	0.87	0.96	0.95	0.96	0.99
Investment	0.93	0.5	0.37	0.61	0.39
Employment	0.86	1	1	1	1
Net Exports/GDP	-0.36	0.17	0.23	0.11	0.00
International Correlation					
Home and Foreign					
GDP	0.51	0.20	0.25	0.22	0.94
Consumption	0.32	0.68	0.76	0.65	0.99
Investment	0.29	-0.7	-0.81	-0.58	-0.72
Employment	0.43	0.20	0.25	0.22	0.94

Notes: The model statistics are computed from an model economy with GHH preferences and complete financial markets. HP denotes the productivity shock process with high persistence. LP denotes the productivity shock process with low persistence. BKK means the productivity shock process with Backus et al. (1992) estimates.

Figure 1: **Impulse Responses: Complete Markets**



Solid line: GHH preference Dashed line: Cobb−Douglas preference