The Short- and Long-Run Benefits of Financial Integration

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There is an extensive economics and finance literature that addresses the potential benefits of financial integration. If on the one hand there is consensus on the significant inherent gain that may be attained in terms of portfolio diversification, decreased cost of equity capital, and reduced financing constraints, on the other hand, economics modeling has typically stumbled in the prediction of negligible welfare gains.

Although the models adopted so far in the literature are able to accurately characterize the joint behavior of a large set of economic variables, they are typically silent about how closely they can track stock markets dynamics. Equivalently, it is still not clear what are the welfare benefits of financial integration when one wants to explain simultaneously prices and quantities.

In order to address this point, we propose a general equilibrium model that is able to simultaneously explain: (i) the volatility of exchange rate and stochastic discount factors; and both (ii) the volatility of net exports and (iii) the amount of cross-country correlation and persistence of consumption growth rates.

In our economy agents have risk-sensitive preferences in the sense of Hansen and Sargent (1995). This implies that investors have a preference for the timing of the resolution of uncertainty. We conduct our analysis for the case in which consumption is a Cobb-Douglas aggregation of domestic and foreign goods, both of which are tradable. Furthermore we let the dynamics of the growth rate of the endowments of the two countries be characterized by the presence of two slowly moving predictive factors. These components, denoted as long-run risks, alter the intertemporal distribution of income risk, by producing slow swings in the long-run growth of the endowments. With this setup, closing international financial markets could result in welfare losses as large as 10% of lifetime consumption. This estimate is two times greater than those found in the existing literature.

The intuition behind our results is that financial integration leads international investors to benefit from increased risk-sharing opportunities at different frequencies. When a transitory shock hits one country, marginal utilities are almost unaffected, leaving little or no room to benefit from international risk-sharing. When, instead, a long-run shock materializes and agents care about the temporal distribution of risk, the investors of the affected country experience a large jump in marginal utility. In this case, a substantial opportunity for international risk-sharing opens up.

Finally, we test the reliability of our welfare benefits measurement by checking whether our model is able to accurately replicate quantity and price features both under a financial autarky and a financial integration regime. In order to do this, we focus on the UK and the US and show that the model reproduces key statistics for these two countries both during and after the Bretton Woods regime.

I. The economy

A. *Preferences and endowments*

There are two countries that we shall denote as home (h) and foreign (f) and two goods, whose endowment at each point in time will be denoted as X_t and Y_t respectively. Agents' preferences are defined over consumption aggregates of the two goods at each history. For exposition purposes, we shall focus on the following functional forms:

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$$C_t^h = (x_t^h)^\alpha (y_t^h)^{1-\alpha} \quad \text{and} \quad C_t^f = (x_t^f)^{1-\alpha}(y_t^f)^\alpha$$

for $\alpha \in (0,1)$.Preferences are recursive, but non-time separable:

$$\begin{aligned} U_t^i &= (1-\delta)\log C_t^i \\ &\quad +\theta \log E_t \exp\left\{\frac{U_{t+1}^i}{\theta}\right\}, \quad \forall i \in \{h,f\} \end{aligned}$$

The preference parameter θ is directly related to the coefficient of intratemporal risk-aversion γ: $\theta = \frac{1}{1-\gamma}$. This class of preferences corresponds to a special case of Epstein and Zin (1989) in which the intertemporal elasticity of substitution parameter approaches 1.

Endowments follow an integrated process of order one. We also allow for the presence of explanatory variables:

$$\begin{aligned} (1)\quad \log X_t &= \mu_x + \log X_{t-1} + z_{1,t-1} + \varepsilon_{x,t} \\ \log Y_t &= \mu_y + \log Y_{t-1} + z_{2,t-1} + \varepsilon_{y,t} \\ z_{j,t} &= \rho_j z_{j,t-1} + \varepsilon_{j,t}, \quad \forall j \in \{1,2\} \end{aligned}$$

B. Portfolio autarky

We follow Cole and Obstfeld (1991) in assuming that the home country's income is its endowment X_t, while the foreign country's income is Y_t. Trade is balanced in every period. Let p_t denote the price of good y in terms of good x. Then portfolio autarky features the following budget constraints

$$(2) \qquad x_t^h + p_t y_t^h = X_t$$

$$(3) \qquad x_t^f + p_t y_t^f = p_t Y_t$$

for the home and the foreign countries, respectively. Equilibrium allocations are:

$$(4) \qquad \begin{aligned} x_t^h &= \alpha X_t, \qquad x_t^f = (1-\alpha) X_t \\ y_t^h &= (1-\alpha) Y_t, \qquad y_t^f = \alpha Y_t \end{aligned}$$

and $p_t = X_t/Y_t$.

C. Complete markets

We compute efficient allocations by solving a Pareto problem. For a given choice of weights $(\mu, 1-\mu)$, the planner's problem is:

$$\begin{aligned} \text{choose} \quad & \left\{x_t^h, x_t^f, y_t^h, y_t^f\right\}_{t=0}^{+\infty} \\ \text{to max} \quad & Q = \mu U_0^h + (1-\mu) U_0^f \\ \text{s.t.} \quad & x_t^h + x_t^f = X_t \\ & y_t^h + y_t^f = Y_t, \quad \forall t \geq 0 \end{aligned}$$

Colacito and Croce (2009) show that this problem can be characterized as one in which the Pareto weights vary over time. Specifically, by denoting $S_t = \mu_t^h/\mu_t^f$, the optimal allocations are:

$$(5) \quad \begin{aligned} x_t^h &= \frac{X_t}{1+\frac{1-\alpha}{\alpha}\frac{1}{S_t}}, \qquad x_t^f = \frac{X_t}{1+\frac{\alpha}{1-\alpha}S_t} \\ y_t^h &= \frac{Y_t}{1+\frac{\alpha}{1-\alpha}\frac{1}{S_t}}, \qquad y_t^f = \frac{Y_t}{1+\frac{1-\alpha}{\alpha}S_t} \end{aligned}$$

where

$$\begin{aligned} S_t &= S_{t-1}\frac{\delta \exp\left\{\frac{U_t^h}{\theta}\right\}}{E_{t-1}\exp\left\{\frac{U_t^h}{\theta}\right\}} \Big/ \\ &\qquad \frac{\delta \exp\left\{\frac{U_t^h}{\theta}\right\}}{E_{t-1}\exp\left\{\frac{U_t^h}{\theta}\right\}}, \quad \forall t \geq 1 \end{aligned}$$

and $\left(\mu_0^h, \mu_0^f\right) = (\mu, 1-\mu)$. The logarithm of the state variable S_t **can** be approximated as a stationary AR(1) process.

II. Reconciling international quantities and prices

Checking whether our model is able to replicate quantity and price features both under a financial autarky and a financial integration regime is important in order to test the reliability of our welfare benefits measurement. In what follows, we use UK and US data both during and after the Bretton Woods regime.

A. Calibration

Table 1 reports our calibrations. The table reports two sets of parameters, as we follow Colacito and Croce (2007) in setting the correlation of the long-run risks components, ρ_{12}, to a higher number for the post-1970 sample. Correspondingly, the last part of the sample features a reduced short-run correlation, ρ_{xy}, in order to keep the international correlation of output

growths constant. All other calibrated parameters are standard in the long-run risks literature.

B. Discussion

In table 2 we report the moments produced by simulating the model under both complete markets and financial autarky. We also report the equivalent moments observed as an average of the data for US and UK. The choice of the two sub-samples we use is motivated by Obstfeld (1998). Obsfeld suggests that there has been an increasing financial integration between the two countries starting only in the late 1960s.

There are several empirical facts that the model is able to reproduce:

1) when markets are complete we are able to get a volatile and very persistent net export-output ratio without needing any real or nominal friction;

2) the contemporaneous correlation between domestic output and domestic consumption decreases, while the correlation of consumption growth rates across countries increases with financial integration;

3) exchange rates are more volatile in the second part of the sample;

4) the model implied volatility of the risk free rate is low and consistent with what suggested by the data.;

5) the volatility of the stochastic discount factors is greater then the Hansen and Jagannathan (1991) bound.

III. The gains from risk sharing

We follow the literature on welfare costs and quantify the benefits of international diversification as the constant fraction of consumption that should be granted in every state and date of the world to make a representative consumer indifferent between having access or not to international financial markets. We proceed in two steps. First, we quantify the welfare benefits under the assumption that the endowments are exposed only to short-run risk. Then we introduce also long-run shocks.

A. Cole and Obstfeld meet Tallarini

We start our analysis of the welfare gains of financial liberalization by focusing on the special case in which the endowments follow pure random walk processes. This setup corresponds to a two country version of the model studied by Tallarini (2000). We report the results in figure 1. In this figure, all parameters are set to the values in Table 1, calibration pre-1970. The benefits are plotted against two dimensions: the degree of home bias (α) and the coefficient of risk aversion (γ). In the figure, we let α range from 0.5 to 1.[1]

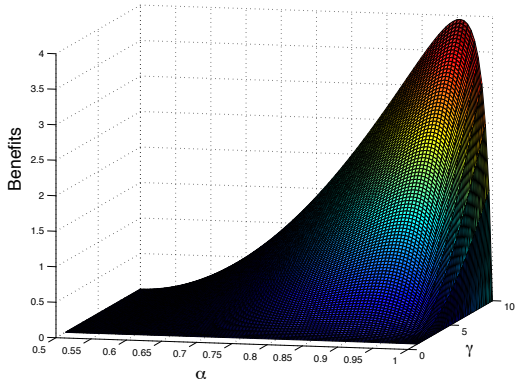

FIGURE 1. THE SHORT-RUN BENEFITS OF INTERNATIONAL FINANCIAL MARKETS INTEGRATION.

Our results revisit the conclusion of Cole and Obstfeld (1991), by pointing out a potentially important role for international financial markets. The benefits are largest for significant amounts of consumption home bias and are increasing in the coefficient of risk aversion. Both facts are intuitive. The closer is α to 1/2, the more the model resembles a one good world. In this setup risks would be undiversifiable and hence nothing could be gained by allowing agents to trade financial assets across countries. On the other hand, when α is close to unity, agents display almost complete home bias and hence they would not benefit from exchanging claims on each other's endowments, because

[1] The results are symmetric when $\alpha \in [0, .5]$.

TABLE 1—BASELINE CALIBRATION

Calibration	μ	σ	σ_x	ρ	ρ_{12}	ρ_{xy}	α	δ^{12}	RRA	IES
Post-1970	.165%	.54%	$4\%\sigma$	.988	.90	.05	.98	.988	7	1
Pre-1970	.165%	.54%	$4\%\sigma$	.988	.50	-.50	.98	.988	7	1

Notes - Benchmark monthly calibrations employed for the pre-Bretton-Woods sample (Pre-BW; 1945-1970) and the post-Bretton-Wood sample (Post-BW; 1971-2003).

TABLE 2—RESULTS

	Pre-1970		**Post-1970**	
	Model (Portfolio Autarky)	Data (US-UK averages)	Model (Complete Markets)	Data (US-UK averages)
$Std[\Delta y^h]$	1.920	4.275	1.920	1.865
$ACF_1[\Delta y^h]$	0.430	0.009	0.431	0.023
$Std[\Delta c^h]$	1.880	2.420	1.780	1.705
$ACF_1[\Delta c^h]$	0.430	0.131	0.463	0.396
$Std[NX^h/Y^h]$	0.000	2.115	0.810	3.020
$ACF_1[NX^h/Y^h]$	-	0.514	0.847	0.750
$corr[\Delta y_t^h, \Delta c_t^h]$	0.990	0.902	0.940	0.573
$corr[\Delta y_t^h, \Delta y_t^f]$	-0.110	0.529	0.367	0.317
$corr[\Delta c_t^h, \Delta c_t^f]$	-0.070	0.361	0.639	0.584
$E[r_f^h]$	2.710	1.006	2.700	1.295
$Std[r_f^h]$	1.210	1.379	1.210	1.200
$corr[r_{f,t}^h, r_{f,t}^f]$	0.500	0.279	0.870	0.672
$Std[\Delta e]$	3.280	8.120	14.500	11.900
$Std[m^h]$	38.100	-	36.200	-

Notes - All the statistics are annual and multiplied by 100 (except for correlations and autocorrelations).

that would not have any significant impact on their consumption. Anywhere in between these two extrema, the benefits are positive. The higher γ, the more concerned agents are about the temporal distribution of risk. Hence there is room for international financial markets to improve on the welfare of the representative consumers of the two countries.

It is interesting to notice that the highest benefits are obtained for remarkably high degrees of consumption home bias. The evidence provided, among others, by Lewis (1999) suggests that this is the most empirically relevant case. It should also be noticed that moderate levels of risk aversion give rise to non negligible welfare benefits in the order of 2% of lifetime consumption. Hence our explanation is not entirely driven by implausible levels of risk aversion.

B. Cole and Obstfeld meet Bansal and Yaron

The second part of the exercise consists in adding back the two slowly moving predictive components of the growth rate of the endowments, in what resembles a two-country version of the model by Bansal and Yaron (2004). Figure 2 suggests that the welfare benefits increase dramatically. Indeed, a ban on international trade of securities could result in a loss of up to 10% of lifetime consumption.

The large increase in the benefits is mainly due to:

1) agents caring about the temporal distribution of risk (i.e., $\gamma > 1$);

2) the two sources of long-run risks not being perfectly correlated.

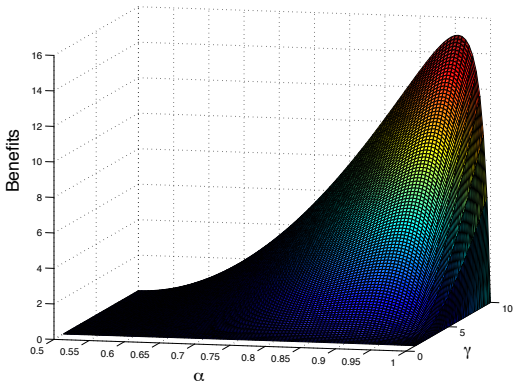

FIGURE 2. THE BENEFITS OF INTERNATIONAL FINANCIAL MARKETS INTEGRATION WITH LONG-RUN RISKS.

That is, if consumers are concerned about shocks that are going to have a persistent effect on the growth of their endowments, and these shocks are at least partially diversifiable across countries, then the benefits of financial integration can be extremely large.

IV. Concluding remarks

In this paper we develop a general equilibrium model that is able to account for a number of quantitatively challenging facts of international finance. For this reason, we consider this model a reasonable benchmark to address the importance of financial integration. Once the intertemporal distribution of output risk is taken into account, the implied benefits of keeping international financial markets open can be as high as 10% of lifetime consumption. In particular, we show that a substantial share of these benefits has to do with risk sharing for the long run.

REFERENCES

Bansal, Ravi and Amir Yaron, "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles," *Journal of Finance*, 2004, *59*, 1481–1509.

Colacito, Riccardo and Mariano M. Croce, "Risks for the long run and the real exchange rate," *Working Paper, UNC, Chapel Hill*, 2007.

_ and _, "Risk sensitive allocations with multiple goods. Existence, survivorship, and dynamics," *Working Paper, UNC, Chapel Hill*, 2009.

Cole, Harald and Maurice Obstfeld, "Commodity trade and international risk sharing. How much do financial markets matter?," *Journal of Monetary Economics*, 1991, *28*, 3–24.

Epstein, Larry G. and Stanley E. Zin, "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework," *Econometrica*, July 1989, *57* (4), 937–69.

Hansen, Lars P. and Ravi Jagannathan, "Implications of Security Market Data for Models of Dynamic Economies," *Journal of Political Economy*, 1991, *99*, 225–262.

_ and Thomas J. Sargent, "Discounted linear exponential quadratic gaussian control," *IEEE Trans. Automatic Control*, 1995, *40(5)*, 968–971.

Lewis, Karen, "Trying to Explain Home Bias in Equities and Consumption," *Journal of Economic Literature*, 1999, *37*, 571–608.

Obstfeld, Maurice, "The Global Capital Market: Benefactor or Menace?," *Journal of Economic Perspectives*, 1998, *12*, 9–30.

Tallarini, Thomas, "Risk-Sensitive Real Business Cycles," *Journal of Monetary Economics*, 2000, *45*, 507–532.