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Consumption and real exchange rates in professional forecasts

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ABSTRACT

Standard models of international risk sharing with complete asset markets predict a positive association between relative consumption growth and real exchange-rate depreciations across countries. The striking lack of evidence for this link — the consumption/real-exchange-rate anomaly or Backus–Smith puzzle — has prompted research on risk-sharing indicators with incomplete asset markets. That research generally implies that the association holds in forecasts, rather than realizations. Using professional forecasts for 28 countries for 1990–2010 we find no such association, whether for floating nominal exchange rate regimes, fixed exchange rates, or common currencies, thus deepening the puzzle.

1. Introduction

Many international macroeconomic models imply a positive relationship between relative consumption growth and real exchange rate growth (real depreciations) as a consequence of integrated asset markets and risk sharing. As is well known, though, most of the evidence is that there is no such link in historical data, or that the relationship may even be negative. This rejection of an implication of these models is sometimes called the consumption/real-exchange-rate anomaly or Backus–Smith puzzle.

Recently, a number of researchers have proposed theoretical models in which asset markets are incomplete in specific ways, and shown that they can produce low or even negative correlations over time between relative consumption growth and the growth of the real exchange rate. This property is a form of indirect inference in favor of these models. But these same models typically also imply that the original relationship holds in conditional expectations, rather than state-by-state, due to conditional risk sharing. Testing this alternative prediction is more elaborate, because it requires a joint test of risk sharing and of a model of expectations formation. Two main approaches have been followed. One approach is to use instrumental variables (*e.g.* Kollmann, 1995; Obstfeld, 1994; Head et al., 2004). A second approach looks at conditional predictions from structural VARS (*e.g.* Corsetti et al., 2006, 2009). In most cases, these tests fail to support the hypothesis of conditional risk-sharing; they do not show a positive relationship between conditional expectations of exchange rate change and conditional relative consumption growth across countries.

These tests may be hampered, however, by the difficulties of forecasting consumption growth and real exchange rate growth. It would therefore be useful to have an alternative test of conditional risk-sharing, complementary to the two approaches mentioned above. This paper provides a new, direct test of an implication of the incomplete-markets models. We investigate the link between relative consumption growth and real exchange rate growth in panels of forecasts made by professional forecasters. We provide graphical and statistical evidence using these forecasts for 28 countries over 1990–2010. We also specialize the evidence by pairs of countries, by time, and by exchange-rate regime.

The overall evidence is negative. There is no evidence of a positive relationship for the entire group of countries. Further, for pairs of countries with a fixed exchange rate or common currency there is a significant, negative correlation between forecasts of the growth rates of relative consumption and the real exchange rate. We view

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this finding as deepening the puzzle. To the extent that forecast data can be taken as accurate measures of the market's conditional expectations, and for these countries and this time period, there is no evidence of conditional risk-sharing in the forecasts.

The approach jointly tests the hypotheses of conditional risk sharing, the standard model of preferences, and the representation of expectations by professional forecasts. Thus the rejection could be due to any of these components. We show, though, that the hypothesis that the forecasts are unbiased cannot be rejected, a property consistent with rational expectations. The study is designed to include the widest possible cross-section of countries, and so features some relatively short time spans of data, which inhibits the power of these rationality tests. However, unbiasedness can be rejected for some individual pairs of economies. Nevertheless, omitting those pairs from the panel does not affect the overall conclusions. We also show how to extend the method to allow for preferences with external habit, and again find that the risk-sharing condition does not hold in forecasts.

Section 2 outlines notation and the risk-sharing conditions. Section 3 describes the tests of necessary conditions used in previous work as well as the findings of those tests. Section 4 outlines the sources of the forecast data and tests for accuracy. Section 5 presents the evidence, in the form of scatter plots and econometric results. Section 6 concludes.

2. Risk-sharing indicators and incomplete markets

We start with some basic theory. Take an N-country world economy where households within a country i, $i=1,2,\ldots,N$, have identical preferences and unrestricted access to intra-national markets for risk sharing. Time is discrete, beginning at $t=0$. In each time period the aggregate state is labeled z_t, which comes from a finite set of possible states of the world. At time t the state history is labeled $z^t=\{z_0,z_1,\ldots,z_t\}$, and $\pi(z^t)$ is the probability of history z^t. Households in country i have time-separable preferences given by:

$$E_0\sum_{t=0}^{\infty}\sum_{z^t}\beta^t\pi\left(z^t\right)u\left(c^i\left(z^t\right)\right), \tag{1}$$

where $c^i(z^t)$ represents country i's consumption composite at history z^t. While preferences over consumption composites are identical across countries, consumption aggregates are not necessarily the same in each country. There may be country-specific, non-traded goods for example.

For each country, the consumer price index is $p^i(z^t)$, defined in terms of currency i. Nominal exchange rates are defined with respect to a numeraire currency. Letting currency 1 be the numeraire currency, we define $s^i(z^t)$ as the currency-1 price of currency i, with $s^1(z^t)=1$. Hence the real exchange rate between country 1 and country i is defined in the usual way as $q^i(z^t)=s^i(z^t)p^i(z^t)/p^1(z^t)$. We make no special assumptions about real exchange rate determination; $q^i(z^t)$ may reflect the presence of trade frictions, non-traded goods, sticky prices, or other goods-market imperfections. Table 1 summarizes the notation used so far and supplemented below.

We begin with risk-sharing under complete markets. If there exists a set of assets which have payoff in currency 1 in each possible history (assets paying off in other currencies are redundant because markets are complete), then we may express the risk-sharing condition as:

$$\frac{u'\left(c^i\left(z^{t+1}\right)\right)}{u'\left(c^i\left(z^t\right)\right)}\Bigg/\frac{u'\left(c^j\left(z^{t+1}\right)\right)}{u'\left(c^j\left(z^t\right)\right)}=\frac{q^{ij}\left(z^t\right)}{q^{ij}\left(z^{t+1}\right)}, \tag{2}$$

$\forall i,j=1,\ldots,N$, which says that the ex-post ratio of intertemporal marginal rates of substitution should equal the ex-post growth rate of the real exchange rate. Using dots to denote growth rates, and taking a linear approximation of the risk-sharing condition (2) around a non-stochastic steady state, we have:

$$\dot{c}^i_{t+1}-\dot{c}^j_{t+1}=\gamma\dot{q}^{ij}_{t+1}, \tag{3}$$

$\forall i,j=1,\ldots,N$, where γ is the common elasticity of intertemporal substitution. (No approximation is involved when utility is isoelastic.) Thus, full risk sharing implies that the difference between ex-post growth rates in consumption across countries i and j should be a positive, linear function of the ex-post growth rate of the real exchange rate q^{ij}.

Condition (3) presents a simple and intuitive condition for testing risk sharing across countries. Cross-country deviations in consumption per capita should occur only to the extent that there are offsetting real exchange rate changes. A country's relative consumption should rise when the relative price of consumption falls. Note that the source of real exchange rate variation has no bearing whatever on the prediction of condition (3).

This risk-sharing condition must be amended if some asset market are missing. Consider the case where only non-contingent, currency-1-denominated, nominal bonds are available. This case has been studied by Kollmann (1995) and Corsetti, Dedola, and Leduc (2008) for example. Then, it is easy to show that, up to a linear approximation, the risk-sharing condition for this economy is:

$$\mathrm{E}\left[\left(\dot{c}^i_{t+1}-\dot{c}^j_{t+1}\right)\Big|z^t\right]=\mathrm{E}\left[\gamma\dot{q}^{ij}_{t+1}\Big|z^t\right]. \tag{4}$$

Under this asset market arrangement, the time-t conditional expectation of the differences in consumption growth rates should be proportional to the conditional expected growth rate of the real exchange rate.

The models we test in this paper have incomplete international risk sharing, but complete risk sharing across households within a country, so that there is a representative agent in each economy. Kocherlakota and Pistaferri (2007) consider the opposite case, where there is limited risk sharing within each economy but complete insurance against economy-specific shocks. The forecasts for aggregates we study cannot be used to test the predictions of their models, which require data disaggregated by households.

We also emphasize that the tests in this paper apply to models of incomplete markets in which the assets do not span the possible outcomes, but do not apply to models of endogenous incompleteness due to limited information or enforcement. In the latter models, the shadow price of assets is not equal for all agents, since it is bound by incentive constraints. Thus, the tests of conditional risk sharing described above do not apply. Scholl (2005) and Bodenstein (2008) develop such models and show that the necessary condition is not of the form (4).

Table 1
Notation.

t	time	i,j	countries
u	period utility	β	discount factor
γ	EIS	z^t	state history
c	consumption	p	price
π	state probability	w	instruments
s	nominal exchange rate	q	real exchange rate
y^{ij}	$\dot{c}^i_t-\dot{c}^j_t$	x^{ij}	$\dot{q}^{ij}_t\equiv\ \dot{s}^{ij}_t+\dot{p}^j_t-\dot{p}^i_t$

3. Tests and previous evidence

The complete-markets theory predicts a positive relationship between the predicted consumption growth differential and the predicted real depreciation rate:

$$\dot{c}^i_t-\dot{c}^j_t=\gamma\dot{q}^{ij}_t. \tag{5}$$