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State-uncertainty preferences and the risk premium in the exchange rate market

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ABSTRACT

This paper shows that state-uncertainty preferences help to explain the observed exchange rate risk premium. In the framework of Lucas (1982) economy, state-uncertainty preferences amount to assuming that a given level of consumption will yield a higher level of utility the lower is the level of uncertainty perceived by consumers. Under these preferences we can distinguish between two factors driving the exchange rate risk premium: "macroeconomic risk" and "the risk associated with variation in the private agents' perception on the level of uncertainty". Empirical evidence from three main European economies in the transition period to the euro provides empirical support for the model. The model is more successful in accounting for the observed currency risk premium than models with more standard preferences, and the general perception of risk by private agents is shown to be a more important determinant of risk premium than macroeconomic uncertainty.

1. Introduction

According to the standard uncovered interest rate parity condition, the expected variation in an exchange rate should be equal to the interest rate differential between foreign and domestic risk-free bonds. Instead, empirical work usually shows that the slope coefficient from the linear projection of the change in the foreign exchange rate on the interest rate differential is often significantly negative, which implies that the domestic currency is expected to appreciate when domestic nominal interest rates exceed foreign interest rates. This is puzzling because economic intuition suggests that international investors would demand higher interest rates on currencies that are expected to depreciate.

Among the explanations of this anomaly is that there exists a time-varying risk premium in currency markets. Attempts to account for the forward premium anomaly by time varying risk premium have mostly focused on exploring dynamic, stochastic general equilibrium models with identical consumers endowed with isoelastic expected utility preferences. Engle (1982) provides an excellent survey of this literature and shows that most of these models are unable to explain the risk premiums observed in actual financial markets. The problem resides in the smoothness of implied consumption growth, relative to the volatility of the risk premium embedded in asset prices.

Inside the representative agent framework, several authors have attempted to rationalize asset pricing through state-dependent preferences. Examples include papers where the utility produced by a given level of consumption depends on the previous level of consumption (habit formation), (as in Constantinides, 1990 and Campbell and Cochrane, 1999), relative social standing (as in Bakshi and Chen, 1996), or stochastic subsistence consumption levels (Campbell and Viceira, 2002). We take an alternative avenue that considers the perception by consumers on the current level of uncertainty as the state variable in preferences. A given level of consumption would then yield a higher level of utility when the consumer feels relatively certain about his future income stream than in periods when the range of possible income streams is wider. Such preferences are bound to induce real effects from changes in the perception on the level uncertainty through shifts in aggregate demand.

That this effect can improve the explanation of the observed behaviour in currency premium relative to previous specifications is shown here in a model taken from Lucas (1982). First order conditions for the time aggregate, expected utility maximization problem under standard distributional assumptions lead to an analytical expression that allows us to examine the effect on risk premium of both, private agents' perception on the level of uncertainty or state-uncertainty, and the uncertainty produced by the time evolution of macroeconomic aggregates. That way, we can discuss the relative importance of each type of uncertainty to explain excess returns in the exchange rate market.

We take advantage of the unique experiment provided by the convergence process to a monetary union in Europe to test our model. Becoming a member of the currency union would suggest higher credibility, with low inflation and increased stability, the opposite being the case if the country does not enter the union. We assume that the level of uncertainty in the economy is adequately represented by

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private agents' perceptions about the probability of their country entering the Eurozone. Changes in the perceived probability of that event will alter the level of uncertainty on future economic policy and hence, changes in the marginal utility of consumption and in the allocation of resources throughout the economy. For robustness, we also consider an alternative representation for state-uncertainty, in which filtering techniques are used to construct a proxy for the perception of uncertainty in the economy with no explicit link to the possibility of becoming a member of the Eurozone.

We proceed as follows: we present the theoretical model in section two, describing the relationships implied by optimality conditions among risk premium, the volatility of fundamental variables and the level of state-uncertainty. We also derive an analytical expression for the risk premium that allows for statistical tests to be performed. In the third section, we use our model to account for the risk premium during the transition period to the European currency. Section four presents the main conclusions.

2. Optimal decisions, the level of uncertainty and the foreign exchange risk premium

Fama (1984) defines the foreign exchange risk premium, RP^e_{t+1}, as the difference between the market expectation of currency depreciation and the current one-period forward premium, fp_t^{t+1}:

$$\begin{aligned} RP^e_{t+1} &= [E_t(s_{t+1})-s_t]-fp_t^{t+1} \\ &= [E_t(s_{t+1})-s_t]-\left[f_t^{t+1}-s_t\right] = E_t(s_{t+1})-f_t^{t+1} \end{aligned} \tag{1}$$

where s_t and f_t denotes the logarithm of spot and forward rates. The exchange rate risk premium can be interpreted as the excess return of a domestic investor who borrows one unit of domestic currency, buys $1/S_t$ worth of foreign currency, lends it on the foreign market for one period, and reconverts his earnings to the domestic currency.

Traditional families of preferences are generally incapable of delivering enough volatility in consumption to explain the empirically observed risk premium, but state-dependent preferences may be able do so. In particular, preferences that depend on the general level of uncertainty can deliver a significant and time-varying currency risk even if the fundamental shocks have low variance. In fact, the goal of this paper is to search for evidence on the role of private agents' perceptions on the level of uncertainty to explain the currency market anomaly in a basic representative agent, consumption-based asset pricing model [Lucas (1982) and Hu (1997)]. The model considers two countries (domestic and foreign) and two perishable commodities. In each country, a different currency is used to pay for transactions in their respective commodities. Each period t, the domestic (foreign) country receives an exogenous stochastic endowment Y_t^D (Y_t^F), and zero units of the other commodity. The domestic (foreign) country also receives an exogenous stochastic endowment M_t^D (M_t^F) of its own currency.

Consumers are identical in both countries. The model is written from the perspective of the domestic country. The representative consumer maximizes time aggregate, discounted expected utility:[1]

$$U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} U\left(c_{is}^D, c_{is}^F, Z_{is}\right) \quad 0<\beta<1 \tag{2}$$

where E_t denotes the conditional expectation based on information known at the beginning of period t. c_{is}^D and c_{is}^F represent the consumption levels of the domestic and foreign goods by the representative agent of country i at period s, and Z_{is} denotes the perceived level of uncertainty in country i, $i = D, F$, at time s. We assume the utility function $U(.,\ .)$ to be bounded, continuously differentiable, increasing in the consumption of domestic and foreign goods, decreasing in the level of uncertainty, and strictly concave. The cross derivative U_{CZ} can take any sign, and β is the constant time discount factor.

The equilibrium exchange rate, in units of domestic currency per unit of foreign currency, is:

$$S_t = \frac{P_t^D}{P_t^F} \cdot \frac{U_{c_D^F}\left(c_{Dt}^D, c_{Dt}^F, Z_{it}\right)}{U_{c_D^D}\left(c_{Dt}^D, c_{Dt}^F, Z_{it}\right)} \ . \tag{3}$$

Therefore, if we denote by q_{t+1}^j the intertemporal marginal rate of substitution (IMRS):

$$q_{t+1}^j = \beta \frac{U_{c_D^j}\left(c_{Dt+1}^D, c_{Dt+1}^F, Z_{it+1}\right) P_t^j}{U_{c_D^j}\left(c_{Dt}^D, c_{Dt}^F, Z_{it}\right) P_{t+1}^j}, \text{ for } j = D, F. \tag{4}$$

Then the rate of change in the equilibrium foreign exchange rate is given by:

$$\frac{S_{t+1}}{S_t} = \frac{q_{t+1}^F}{q_{t+1}^D}. \tag{5}$$

Additionally, a *forward* contract specifies at date t the number of units of domestic currency F_t^{t+1} to be exchanged at time $t+1$ for one unit of foreign currency. *Forward* contracts allow consumers to insure themselves against the uncertainty on the future purchasing power of their own currencies. This contract specifies a net flow of $F_t^{t+1} - S_{t+1}$ units of domestic currency at date $t+1$. Since it involves no payments at date t, the fair (absence of arbitrage) pricing relationship implies [see Backus et al. (2001)]:

$$E_t\left[q_{t+1}^D\left(F_t^{t+1} - S_{t+1}\right)\right] = 0. \tag{6}$$

Dividing Eq. (6) by S_t and using Eq. (5), we obtain:

$$\left(F_t^{t+1}/S_t\right)E_t\left(q_{t+1}^D\right) = E_t\left(q_{t+1}^D(S_{t+1}/S_t)\right) = E_t\left(q_{t+1}^F\right),$$

so that, we get for the forward premium fp_t^{t+1}:

$$\frac{F_t^{t+1}}{S_t} = \frac{E_t\left(q_{t+1}^F\right)}{E_t\left(q_{t+1}^D\right)}. \tag{7}$$

Thus, given Eqs. (1), (5) and (7) the risk premium RP^e_{t+1}becomes equal to the difference between "the expectation of the log" and the "log of the expectation" of the IMRS for the foreign and domestic goods:

$$RP^e_{t+1} = E_t\left(\log q_{t+1}^F\right) - E_t\left(\log q_{t+1}^D\right) - \left[\log\left(E_t\left(q_{t+1}^F\right)\right) - \log\left(E_t\left(q_{t+1}^D\right)\right)\right]. \tag{8}$$

As it is standard in the literature,[2] we assume that, conditional on information available at time t, Ω_t, stochastic discount factors follow a log–normal distribution: $\log q_{t+1}^i/\Omega_t$:$N(\mu_{t+1}^i, \sigma^2_{q_{t+1}^i})$, $i = D,F$. Then,

$$\begin{aligned} RP^e_{t+1} &= \mu_{t+1}^F - \mu_{t+1}^D - \left(\mu_{t+1}^F + \frac{1}{2}\sigma^2_{q_{t+1}^F} - \left(\mu_{t+1}^D + \frac{1}{2}\sigma^2_{q_{t+1}^D}\right)\right) \\ &= \frac{1}{2}\sigma^2_{q_{t+1}^D} - \frac{1}{2}\sigma^2_{q_{t+1}^F}, \end{aligned} \tag{9}$$

[1] This specification is in the spirit of formulations proposed for state-dependent preferences with different rationalizations for the state variable. In Bakshi and Chen (1996) the state depends on social standing, while Campbell and Cochrane (1999) use state-dependent preferences with habits.

[2] See Backus et al. (2001) and Alvarez et al. (2007), among many others.