

# International financial market dynamics : an empirical investigation of exchange rates, interest rates and stock returns

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## Chapter 8

# Summary and Suggestions for Further Research

### 8.1 Summary

The present thesis describes an empirical study of the dynamics of exchange rates, interest rates and stock returns. The innovative character of the thesis resides not so much in the choice of the subjects but rather in the use of alternative techniques and data.

Many studies that deal with the concept of international integration compare prices of commodities and financial assets across countries. The basic idea is that in the absence of any barriers to trade, arbitrage ensures that identical tradable goods and assets in different countries have identical prices when denominated in the same currency.

When commodity prices as well as financial prices are examined across countries three fundamental parities play an important role, i.e. purchasing power parity (PPP), uncovered interest rate parity (UIP) and the Fisher parity. As the thesis deals with international financial market dynamics, PPP, UIP and the Fisher parity have been discussed in detail.

The first of the fundamental relations, PPP, occurs in the market of goods and services as a result of goods market arbitrage. According to PPP, the exchange rate between two countries is determined by the two countries' relative price levels. The two other parities occur in financial markets. The first, UIP, points out that as a result of uncovered arbitrage, the difference between interest rates on securities that are denominated in different

currencies, equals the expected change in the exchange rate between the two countries. The Fisher parity, the second financial relationship, states that the nominal interest rate is equal to the real interest rate plus the markets' expected rate of inflation.

Chapter 2 establishes the theoretical foundation of the three parities. The parities are not new; they were already formulated at the beginning of this century. Subsequently, they were subjected to empirical tests by many researchers. The general conclusion that emerges from this research is that there are substantial short-run deviations from all three parities.

The traditional derivation of PPP is based on goods market arbitrage. Roll (1979) argues that alternatively an efficient markets version of PPP may be derived when combining UIP and the Fisher parity. It is not surprisingly, therefore, that explanations to deviations from these three fundamental parities share a common theoretical foundation.

The most commonly suggested explanation is that deviations from these parities are due to risk premiums. Furthermore, it is said that systematic (rational) forecast errors that may arise as a result of discrete changes in regimes that are expected but not realized in a particular period, may also cause these deviations. Third, the presence of transaction costs may lead to inactivity bands where no arbitrage takes place and price differences across countries are not equalized.

Chapters 3 to 5 empirically investigate each of these three parities.

Recently, the debate on PPP received a new stimulus through a theoretical contribution by Sercu, Uppal and Van Hulle (1995). Sercu and Uppal (1995), who generalize this study, show that in the presence of transaction costs the exchange rate change will be equal to the risk-aversion weighted differential of growth in nominal spending deflated with the total-consumption weighted inflation rate plus a 'marginal' inflation differential. In chapter 3 we use panel techniques to test both absolute as well as relative versions of Sercu and Uppal's (1995) model for sixteen countries over the period 1973-1993. In the empirical tests we impose restrictions that make parameter estimates invariant to the choice of the numeraire currency. Surprisingly, our results show that PPP holds very strongly at horizons of approximately three years. We fail to find any evidence, however, for the theoretical effect of real expenditure on nominal exchange rate changes. We conclude that rejections of PPP parity in the seventies and eighties were not so much related to shortcomings of the underlying theoretical model, but much more to the empirical tests that were used.

Chapter 4 deals with the second parity, which is the so-called UIP. This parity implies that the forward rate is an unbiased prediction of the future spot rate. In this chapter

we test the unbiasedness hypothesis using a panel approach for fifteen countries during the period 1979-1996. We distinguish time effects models and random effects models. Our results indicate that the rejection of UIP is not as severe as is commonly found. Traditional single-country times series tests of the unbiasedness hypothesis usually find negative slope coefficients in a regression of the forward premium on the future exchange rate. Our panel estimates, however, show a pooled slope coefficient that is equal to 0.5. Moreover, we show that the slope coefficient is even very close to unity if only the largest five to ten percent of the observations are taken into account. These findings point to the potential importance of peso-problems and/or inactivity bands as explanation for the rejection of UIP.

The last parity that we consider, the so-called Fisher parity, is addressed in chapter 5. This parity relates the nominal interest rate and the future expected inflation. The puzzle to be explained is why nominal interest rates do not move proportionally with the level of expected inflation. In this chapter, we try to explain this puzzle by the incorporation of macroeconomic risk in the Fisher equation. From an intertemporal consumption capital asset pricing model, we derive a generalized Fisher equation in which the nominal interest rate is a function of inflation and the conditional second moments of money and production growth.

The conditional second moments of these macroeconomic variables are computed along two independent methods that both allow for stochastic volatility: a recursive Bayesian forecasting method - the multi state Kalman filter - and the so-called multivariate stochastic volatility model.

Since both the short-term interest rate and inflation are potentially nonstationary we use the Johansen (1988) test for cointegration and find that the nominal interest rate, the inflation and the conditional volatility of money growth are cointegrated. Our results suggest that the common rejection of the Fisher parity in the literature could at least partly be due to a misspecification bias. Incorporating macroeconomic risk by means of the conditional variance of money growth into the Fisher equation is important. Moreover, it is relevant that the econometric techniques used to estimate the conditional second moments allow for the possibility of permanent shocks to the risk premium and hence for a potential unit root.

Research on the price implication of financial integration is not only restricted to international bond markets, but also looks at international stock markets. To investigate stock returns in an integrated world, an international capital asset pricing model (ICAPM) is called for. Deviations from PPP play an important role in the ICAPM.

Chapter 6 investigates an ICAPM that allows for deviations from PPP. One of the key assumptions of this model is that financial markets are integrated internationally. In other words, the model assumes that there are no barriers to international financial transactions. This assumption has important implications for the calculation of the cost of capital. In an integrated world the cost of capital should therefore be determined using the international capital asset pricing model (ICAPM) rather than the domestic capital asset pricing model (CAPM).

In this chapter we look at the domestic pricing error using an international asset pricing model that explicitly allows for deviations from PPP. The pricing error when using the CAPM rather than an ICAPM is zero if diversifiable domestic risk is orthogonal to the global market portfolio return and foreign currency changes. We use Hansen's (1982) generalized method of moments to test for orthogonality and implement this test for more than three thousand individual stocks from ten different countries. We cannot reject the hypothesis that the local market portfolio contains all the information relevant to price domestic assets. We find that the global market portfolio and the foreign currencies affect the cost of capital of an individual firm only through the effect of the global market on the risk premium of the local market and not through the global beta of the firm.

The final chapter has a somewhat isolated position within the framework of this thesis, as it does not examine an equilibrium model for financial prices but focuses on the volatility dynamics of the short-term interest rate.

Generally, a distinction between two types of volatility specifications is made. On the one hand, there are the econometric specifications of financial markets' volatility - like GARCH models - which concentrate on volatility persistence and clustering. Term structure models, on the other hand, relate volatility directly to the interest rate level. In this chapter both approaches are integrated as we present a model for the short-term interest rate volatility that encompasses both the level effect and the conditional heteroskedasticity effect of the GARCH class of models. The flexible specification of the conditional variance equation allows different effects to dominate as the level of the interest rate varies.

The different models are estimated for monthly as well as for weekly data. We find that both GARCH effects and level effect are important determinants of interest volatility. The empirical results show that under all volatility specifications, the interest rate innovations exhibit fatter tails than the normal distribution.

Ignoring GARCH effects creates an omitted variables problem for the estimate of the level effect in the volatility. The parameter that measures the sensitivity of the interest rate

volatility with respect to the interest rate level turns out to be highly significant.

As the volatility of the short-term interest rate is one of the determinants for the pricing of interest rate contingent claims, we investigate the implications of the dynamics of short-term interest rate volatility for the pricing of discount bond options. The main problem is that a closed-form solution for the term structure is not available for the KNSW-model. We propose, therefore, an efficient simulation algorithm to obtain an approximation of the term structure, which is a crucial input in the option price formula.

Our results suggest that the inclusion of a GARCH effect in addition to a level effect in the model specification is relevant for the pricing of short-term discount bond options.

## 8.2 Suggestions for Further Research

The motivation for the ICAPM of Adler and Dumas (1983) was the observation that PPP is violated instantaneously and could be expected to be violated for any forecast horizon. The empirical evidence in this thesis regarding PPP, UIP and the Fisher parity shows, however, that in some periods the parities do hold and in other periods they do not. These findings challenge the appropriateness of the specification of the ICAPM as the model does not take into account this feature of the data. Future research could be directed at ICAPMs that explicitly account for these empirical findings. A starting point may be the model of Dumas (1992) that assumes that international shipment is costly. One important implication is that PPP deviations are slowly mean-reverting.

Peso-problems, transaction costs and risk premiums can explain deviations from PPP, UIP and the Fisher parity. We subscribe the viewpoint of Lewis, who states that to obtain useful results in future research, the individual explanations of parity deviations should be integrated. It might be interesting to investigate the implications for ICAPMs that arise from the integration of risk premiums, transaction costs and peso-problems. The integration of these three elements might possibly solve the home bias puzzle in international equity holdings.

A final suggestion for future research arises from chapter 7. In this chapter we propose an efficient simulation method to approximate a two factor term structure model. The reason that we use this simulation is that there is no closed form solution for the term structure available. It might be interesting to investigate the accuracy of the proposed simulation method. One way to get an idea about this is to compare the precision of this simulation

method to a multifactor term structure model that has a closed form solution, like the Longstaff and Schwartz (1992) model.