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Mitigation of Foreign Direct Investment Risk and Hedging

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Abstract:

Instruments of risk mitigation play an important role in managing country risk within the foreign direct investment (FDI) decision. Our study assesses country risk by state-dependent preferences and introduces futures contracts as a tool of risk mitigation. We show that country risk assessments related to foreign direct investment do not matter if the multinational firm enters currency futures markets. Besides currency risk, multinationals cross-hedge country risk via the derivatives market. This may explain the empirical result, why host country risk is not a significant determinant of FDI (Bevan/Estrin 2004) together with the fact that almost all (92 %) of the world's top 500 companies enter derivatives markets for hedging purposes (ISDA 2008).

JEL-Classification: F21, F23, G32

Keywords: state-dependency, country risk, foreign direct investment, hedging

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1 - Introduction

Multinational firms are key players in globalized economies. Multinationals are often different from purely national firms. They are relatively large and they have power in the market place and bargaining power in the policy making arena, particularly in transition economies and developing countries. They are able to move activities between their plants at relatively low cost, removing benefits as rapidly as they deliver them.[1] However, it is well known that foreign portfolios or foreign direct investments (FDI) suffer from political as well as economic risk. The reason for political risk is that there is no legal recourse if the host country government chooses to default on a debt contract or expropriate a real or financial asset. Therefore, the global business environment that multinational firms face depends upon the policies that individual nations pursue. Hence, the multinational firm must assess the country's risk profile by studying the linkage between the country's economics policies and the degree of economic risk.[2]

Country risk can be separated into six main categories of risk: economic risk, transfer risk, exchange rate risk, location risk, sovereign risk and political risk. Given the recognition of these kinds of country risk, the multinational firm has at least four policies to manage country risk: avoidance, insurance, structuring the investment and negotiating with the host country government.[3]

This paper is an extension of the theory of the multinational firm with special emphasis on the impact of country risk and state-dependent preferences. The purpose of the study is to introduce the state-dependency of preferences to account for country risk in a broader sense. For the basic concept of state-dependent preferences, we refer to Karni 1985; some applications are given by Karni 1983, Broll/Eckwert 1998, Broll/Wong 2002.

Suppose that country risk is generated by an underlying risk source, e.g. the business cycle. We propose a direct impact of the risk source upon preferences, since in very bad states of nature of economic policy of the host country the probability of survival of the foreign direct investment constitutes a relevant decision criterion for the multinational firm besides expected profits and profit risk. In our economic setting (section 2) we would like to know whether or not the well-known separation theorem and the full-hedge theorem are still valid in a state-dependent utility framework of a multinational firm with foreign direct investment.

The analysis is organized as follows: In section 2 the model of a multinational firm with foreign direct investment is presented. The effect of country risk on international capital allocation is investigated. In section 3 the impact of country risk with state-dependent preferences on foreign direct investment and risk mitigation is analyzed. We demonstrate that the separation theorem holds whereas the full-hedge theorem is violated. Finally, in section 4, we conclude the paper after some general remarks.

[1] For facts and issues about multinational firms, see, Navaretti/Venables 2004, Schmidt/Broll 2009

[2] See, for example, Bouchet/Clark/Groslambert 2003, Navaretti/Venables 2004, Altug/Demers/ Demers 2007, Wagner 2007, OECD 2007).

[3] See, Shapiro 2006.

2 - FDI under country risk

Our investigation rests on the following set of assumptions:

We consider a multinational firm with capital stock K_0. The firm allocates investments Z abroad and $K_0 - Z$ at home. The foreign direct investment Z is positive if the Inada-conditions hold.[4] The firm's domestic profit reads $\Pi_d(K_0 - Z)$. The stochastic foreign profit, denominated in domestic currency, is given by $\Pi_f(Z;\tilde{\theta})$, while $\tilde{\theta}$ assesses country risk.[5] The country risk may consist of economic risks, transfer risks, exchange rate risk, sovereign risk, political risks, business cycle risk.[6] It causes the uncertainty of the multinational firm's total profit, which reads

$$\tilde{\Pi} = \Pi_d(K_0 - Z) + \Pi_f(Z;\tilde{\theta}),$$

if the multinational firm has no access to any hedging opportunities.[7]

With respect to foreign profit, realisations of the country risk measure have the following impact: $\partial\Pi_f / \partial\theta > 0$ and $\partial\Pi'_f / \partial\theta = \partial^2\Pi_f / \partial Z\partial\theta > 0$, i.e., foreign profit and marginal foreign profit becomes larger when higher realisations of the measure occur.

Optimum FDI decision under risk averse behaviour of the firm[8] follows from maximizing expected utility of a twice-differentiable von Neumann-Morgenstern utility function $U(\Pi)$. Marginal utility is positive, i.e. $U' > 0$ and continuously decreasing and differentiable, i.e. $U'' < 0$:

$$\max_Z EU(\tilde{\Pi}),$$

where E denotes the expectation operator.

The first-order condition for optimum FDI yields:

$$EU'(\tilde{\Pi}^*)(\Pi'_d(K_0 - Z^*) - \Pi'_f(Z^*;\tilde{\theta})) = 0.$$

Given the profit motive to invest abroad, risk aversion and foreign profit characteristics imply $\mathrm{cov}(U'(\tilde{\Pi}^*), \Pi'_f(Z^*;\tilde{\theta})) < 0$. This leads to

$$E\Pi'_f(Z^*;\tilde{\theta}) > \Pi'_d(K_0 - Z^*).$$

[4] See, Inada 1963. For an extension, see Barelli/Abreu Pessôa 2003.
[5] Random variables have a tilde '~', while their realisations do not.
[6] See, Hauser 2006, p. 16.
[7] We introduce futures-hedging in section 3.
[8] There has been a lengthy discussion about managerial risk aversion as a rationale for corporate risk management. One important argument is the existence of capital market imperfections (see, e.g., Froot/Scharfstein/Stein 1993), destroying the Modigliani-Miller theorem.

Hence there is a positive expected profit margin to FDI. The extent of FDI, Z^*, depends upon capital stock, preferences and expectations of the multinational firm.

Consider optimum FDI under certainty, Z_c^*, that is to say under a non-risky country specific parameter θ_c. Optimum FDI has to satisfy $\Pi'_f(Z_c^*;\theta_c) = \Pi'_d(K_0 - Z_c^*)$.

Let us now analyze the so-called certainty equivalent case[9], i.e. $E\Pi'_f(Z^*;\tilde{\theta}) = \Pi'_f(Z_c^*;\theta_c))$. We obtain $\Pi'_d(K_0 - Z_c^*) > \Pi'_d(K_0 - Z^*)$. Hence $Z^* < Z_c^*$, since the firm's marginal profit is decreasing. Therefore, introducing country risk reduces the amount of foreign direct investment.

Result 1: *If country risk occurs, FDI lessens.*

3 - FDI and hedging under country risk

In the following we study the incentive of the risk averse multinational firm to mitigate the effect of country risk on FDI by entering the futures market. Thereby we also introduce and motivate the notion of state-dependent utility when investigating n the country risk problem.

3-1 FDI and futures-hedging

Let us consider the special source of country risk, namely the foreign exchange rate risk. Current empirical literature reports that exchange rate risks seem to be the most important source of risk from the point of view of multinational enterprises in transition economies (Hauser 2006, Table 2.1). We therefore identify the country risk parameter $\tilde{\theta}$ as the risky foreign exchange rate $\tilde{e}$.

We study the following economic setting: The firm enters the currency futures market by selling or buying futures contracts, given the foreign exchange forward rate e_f. The foreign currency hedging volume is denoted by H. While the market price e_f does not depend upon the firm's hedging policy, the contractual amount H is contingent on e_f.

With respect to country risk we study a multiplicative risk. We make the following

Assumption: $\Pi_f(Z;e) = \Pi_f(Z)e$, for all *e*, and $\Pi_f(Z)$ denominates in foreign currency.

Hence the uncertain total profit of the multinational firm becomes:

$$\tilde{\Pi} = \Pi_d(K_0 - Z) + \Pi_f(Z)\tilde{e} + (e_f - \tilde{e})H.$$

The first-order conditions for optimum FDI and hedging are given by:

$$EU'(\tilde{\Pi}^*)(\Pi'_d(K_0 - Z_h^*) - \Pi'_f(Z_h^*)\tilde{e}) = 0,$$
$$EU'(\tilde{\Pi}^*)(e_f - \tilde{e}) = 0,$$

[9] See, e.g., Kawai/Zilcha 1986.

while Z_h^* denotes optimum FDI under futures-hedging. Adding both equations yields $\Pi'_d(K_0 - Z_h^*) = \Pi'_f(Z_h^*)e_f$. Therefore the separation theorem[10] holds and we obtain the following

Result 2: *The FDI decision of the multinational firm depends neither on the firm's degree of risk aversion nor upon the firm's assessment of the foreign exchange rate risk.*

The essentials are forward foreign exchange rate, capital stock and marginal domestic and foreign profit. Two multinational firms which are identical regarding these essentials will take the same FDI decision despite of differences in risk aversion or assessments of country risk.

The hedging optimality condition gives

$$EU'(\tilde{\Pi}^*)(e_f - \tilde{e}) = EU'(\tilde{\Pi}^*)(e_f - E(\tilde{e})) - \text{cov}(U'(\tilde{\Pi}^*), \tilde{e}) = 0.$$

Since expected marginal utility of profits is strictly positive, the sign of the covariance follows the sign of the premium $(e_f - E(\tilde{e}))$. Hence we obtain the result that $\text{sgn}(e_f - E(\tilde{e})) = \text{sgn}\ \text{cov}(U'(\tilde{\Pi}), \tilde{e})$. Let us rewrite profits as $\tilde{\Pi} = e_f H + \Pi_d(K_0 - Z) + (\Pi_f(Z) - H)\tilde{e}$. It follows the full-hedge theorem:[11] $\text{sgn}(H^* - \Pi_f(Z_h^*)) = \text{sgn}(e_f - E(\tilde{e}))$, for marginal utility of profits is continuously differentiable and monotonically decreasing.

Result 3: *The multinational firm fully (under-)[over-]hedges foreign profits if, and only if, the forward rate is fair (in backwardation)[in contango].*

Under futures-hedging the certainty equivalent comparison leads to $Z_c^* = Z_h^*$, since for consistency the forward rate has to be set equal to the certain foreign exchange rate.

3-2 FDI and state-dependency

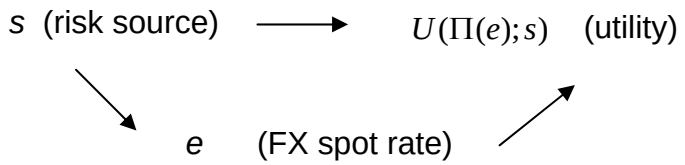
In section 3-1 preferences are assumed to be state-independent. The model of this section is intended to be used as a benchmark. Typically, preferences of a firm are state-dependent (Karni 1983, and Zilcha 1987). In general, the firm's decision making under uncertainty will be affected, because differences in the effect of risk occur. Hence the state-dependency of the multinational firm's preferences is an important feature of production and hedging decisions.

Creeping expropriation, insecure property rights due to weak institutions and political turnaround are important sources of country risk. In very bad states of nature the foreign direct investments of the multinational firm may then be at high risk. If the probability of the survival of the foreign venture constitutes an important decision criterion besides expected profits and foreign exchange risk preferences are affected. Hence, important aspects of country risk directly produce a change of preferences by altering risk attitude. Therefore, state-dependent utility seems an appropriate approach when specific sources of country risk

[10] See, e.g., Broll/Wahl 1993.
[11] See, e.g., Broll/Wahl 1993.

dominate. Whether or not the firm's business outlook is good or bad may then constitute a difference in the preferences structure.

Let $\tilde{s}$ denote an aggregate measure of the uncertain state of nature. The foreign exchange rate as well as the utility function depend upon the realisations of this risk measure:



For instance, state *s* may be the multinational firm's state of being on the verge of failure in the host country. It affects the firm's preferences *directly*, and *indirectly* through the foreign exchange spot market. Hence, marginal utility is affected directly and indirectly. It will be shown that the firm's hedging policy takes all risk effects into account. While under state-independent utility an unbiased forward rate, i.e. $e_f = E(\tilde{e})$, allows for a risk-free profit by a unit hedge ratio, under state-dependent utility a full-hedge is not optimal in this case and the profit of the multinational firm remains risky. Hence risk effects on profits differ when preferences become state-dependent.

Optimum FDI and hedging decisions of the multinational firm follow from maximizing expected state-dependent utility:

$$\max_{Z,H} EU(\tilde{\Pi};\tilde{s}).$$

Calculating the first-order conditions yields:

$$EU'(\tilde{\Pi}^*;\tilde{s})(\Pi'_d(K_0 - Z_s^*) - \Pi'_f(Z_s^*)\tilde{e}) = 0,$$
$$EU'(\tilde{\Pi}^*;\tilde{s})(e_f - \tilde{e}) = 0,$$

while Z_s^* denotes optimum FDI under state-dependency of preferences. By adding both equations we wind up with $\Pi'_d(K_0 - Z_s^*) = \Pi'_f(Z_s^*)e_f$ and we obtain the following

Result 4: *With state-dependent preferences and the use of a currency futures market the separation theorem holds. Additionally, the state-dependency of the firm's preferences does not affect the firm's FDI decision.*

Result 5: *The full-hedge theorem does not hold.*

An unbiased currency futures market, i.e. $e_f = E(\tilde{e})$, implies from the optimum hedge condition that $\text{cov}(U'(\tilde{\Pi}^*;\tilde{s}),\tilde{e}) = 0$. While a full hedge, i.e. $H^* = \Pi_f(Z_s^*)$, would eliminate currency risk, marginal utility would still be risky because of state-dependency. In general, hedging policy has to account for the country risk by refraining from a full hedge, which violates the full-hedge theorem. Hence, the firm uses the opportunity to cross-hedge country risk via futures-hedging.

3-3 FDI and mean-variance

For explanatory reasons let us investigate the related mean-variance model. We consider the preference function $U = V(\mu, \sigma)$ which possesses the necessary properties.[12] Expected profits are state-dependent and given by $\mu = E(\tilde{s}\tilde{\Pi})$. The variation of profits, for simplicity, is assumed to be: $\sigma^2 = \text{var}(\tilde{\Pi})$. In other words, while expected profits exhibit a 'trend shock', profit risk does not. Notwithstanding, the variance of profits depends upon the state variable $\tilde{s}$, since optimum profits depend upon the realisation of the state variable. Hence both arguments in the preference function are affected by country risk.[13]

Maximizing the preference function $V(\mu, \sigma)$ with respect to the amount of foreign direct investment Z and the foreign currency hedging volume H yields the following first-order conditions:

$$E(\tilde{s}(\Pi'_f(Z^*)\tilde{e} - \Pi'_d(K_0 - Z^*))) = R^*(\Pi_f(Z^*) - H^*)\Pi'_f(Z^*)\sigma_e^2,$$
$$E[\tilde{s}(e_f - \tilde{e})] + R^*(\Pi_f(Z^*) - H^*)\sigma_e^2 = 0,$$

where $\sigma_e^2 = \text{var}(\tilde{e})$ is the exogenous risk of the foreign exchange rate and $R \equiv -\frac{1}{\sigma}\frac{d\mu}{d\sigma} > 0$ is the risk aversion measure. From the second optimum condition the firm's hedging policy has to satisfy:

$$H^* = \Pi_f(Z^*) + \frac{E[\tilde{s}(e_f - \tilde{e})]}{R^*\sigma_e^2}.$$

For our economic setting with the assumption that the currency futures market is unbiased, i.e. $e_f = E(\tilde{e})$, and that, therefore, $E[\tilde{s}(e_f - \tilde{e})] = -\text{cov}(\tilde{s}, \tilde{e})e_f$ we obtain for the firm's contractual hedging volume:

$$H^* > (=)[<]\Pi_f(Z^*) \text{ if, and only if, } \text{cov}[\tilde{s}, \tilde{e}] < (=)[>]0.$$

The economic intuition for the firm's risk mitigation policy using foreign currency futures is the following: Diversification pays, since currency futures cross-hedge business cycle risk. This result follows from the fact that the FDI decision is separable from the hedging decision.

Result 5: *Futures-Hedging mitigates the impact of the risk source on preferences by diversification: The less positively correlated the risk source (e.g., the business cycle) with the foreign currency, the higher the demand for futures contracts.*

[12] See Meyer 1987, Battermann/Broll/Wahl 2002, Broll/Wahl/Wong 2006.

[13] State-dependent profit risk, i.e. $\sigma^2 = \text{var}(\tilde{s}\tilde{\Pi})$ involves significant technical problems, since the variation of a *product* of random variables is considered (see Bohrnstedt/Goldberger 1969), without adding much to economics.

4 - Conclusion

Country risk analysis attempts to identify imbalances that increase the risk of a direct investment in a foreign country. This paper describes the interaction between financial instruments of risk mitigation in managing country risk within the direct investment decision of a multinational firm.

We demonstrate that if country risk considerations lead to a state-dependency of preferences the separation theorem holds, i.e., it is rational to separate the FDI decision from the hedging decision and neglect preferences and country risk assessments. But the full-hedge theorem is violated and futures-hedging, which accounts for preferences and expectations, becomes a complex policy.

Suppose that in very bad states of nature the probability of failure of the foreign direct investment constitutes an important decision criterion for the multinational firm besides expected profits and risk. Then this aspect of country risk can be mitigated by futures-hedging, since entering the futures market enables the multinational firm to cross-hedge country risk. Because of the incentive of the multinational firm to diversify risks, the demand for currency futures contracts increases when the risk source (e.g., the business cycle) becomes less correlated with the foreign exchange rate.

The paper concludes that risk assessments related to the foreign direct investment decision do not matter if the multinational firm enters a currency futures market. Furthermore, state-dependency of the preferences of the multinational firm places additional emphasis on corporate futures-hedging, since the demand for futures contracts is also concerned with country risk.

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