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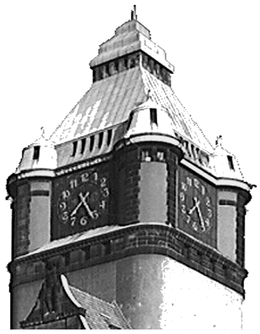

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Abstract:

This paper examines the behavior of the regret-averse multinational firm under exchange rate uncertainty. The multinational firm simultaneously sells in the home market and exports to a foreign country. We characterize the multinational firm's regret-averse preferences by a modified utility function that includes disutility from having chosen ex-post suboptimal alternatives. The extent of regret depends on the difference between the actual home currency profit and the maximum home currency profit attained by making the optimal production and export decisions had the multinational firm observed the true realization of the random spot exchange rate. We show that the conventional results that the multinational firm optimally produces less, sells more domestically, and export less abroad under uncertainty than under certainty holds if the multinational firm is not too regret averse. Using a simple binary model wherein the random spot exchange rate can take on either a low value or a high value with positive probability, we show that the multinational firm may optimally produce more, sell less domestically, and export more abroad under uncertainty than under certainty, particularly when the multinational firm is sufficiently regret averse and the low spot exchange rate is very likely to prevail.

JEL-Classification: D81; F23;F31

Keywords: Exchange rate uncertainty; Multinational firms; Regret theory

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1 Introduction

The study of the multinational firm under exchange rate uncertainty has been the subject of considerable research in decision making under uncertainty (Broll and Zilcha, 1992; Lien and Wong, 2005; Meng and Wong, 2007; to name just a few). The extant literature examines the production and export decisions of the multinational firm using the standard von Neumann-Morgenstern expected utility representation. It is shown that the risk-averse multinational firm optimally produces less, sells more domestically, and exports less abroad when the exchange rate uncertainty prevails than when the random spot exchange rate is fixed at the expected value (say via foreign exchange forward/futures trading).

In reality, multinational firms may have desires to avoid consequences wherein ex-post suboptimal decisions appear to have been made even though these decisions are ex-ante optimal based on the information available at that time. To account for this consideration, Bell (1982, 1983) and Loomes and Sugden (1982) propose regret theory that defines regret as the disutility arising from not having chosen the ex-post optimal alternative, which is later axiomatized by Quiggin (1994) and Sugden (1993). Regret theory is supported by a large body of experimental literature that documents regret-averse preferences among individuals (see, e.g., Loomes, 1988; Loomes et al., 1992; Loomes and Sugden, 1987; Starmer and Sugden, 1993).

The purpose of this paper is to incorporate regret theory into the study of the multinational firm under exchange rate uncertainty. To this end, we characterize the multinational firm's regret-averse preferences by a modified utility function that includes disutility from having chosen ex-post suboptimal alternatives. The extent of regret depends on the difference between the actual home currency profit and the maximum home currency profit attained by making the optimal production and export decisions had the multinational firm observed the true realization of the random spot exchange rate. We are particularly interested in examining the impact of regret on the multinational firm's production and export decisions as compared to the benchmark case of certainty.

We show that the multinational firm optimally produces less, sells more domestically, and exports less abroad under uncertainty than under certainty should the multinational firm be not too regret averse. In this case, the risk-sharing motive remains first-order important to the multinational firm. These findings suggest that it is quite possible that the multinational firm may optimally produce more, sell less domestically, and export more abroad under uncertainty than under certainty should the multinational firm be sufficiently regret averse. To verify this conjecture, we develop a binary model wherein the random spot exchange rate can take on either a low value or a high value with positive probability. In such a binary framework, we show that the conventional results are violated if the multinational firm is sufficiently regret averse and the low spot exchange rate is very likely to prevail. In this case, the optimal levels of domestic sales and foreign exports under certainty are very close to their counterparts that are ex-post optimal at the low spot exchange rate. The sufficiently regret-averse multinational firm as such optimally adjusts its level of foreign exports upward and its level of domestic sales downward so as to limit the potential regret when the high spot exchange rate is actually revealed, thereby rendering the optimal output level under uncertainty to exceed that under certainty.

The rest of this paper is organized as follows. Section 2 delineates the model of the multinational firm under exchange rate uncertainty when the multinational firm's preferences exhibit not only risk aversion but also regret aversion. Section 3 solves the model and provides sufficient conditions under which the behavior of the regret-averse multinational firm is qualitatively the same as that of the risk-averse multinational firm. Section 4 develops a binary model to show the possibility that introducing regret aversion to the multinational firm may induce the multinational firm to optimally produce more, sell less domestically, and export more abroad under uncertainty than under certainty. The final section concludes.

2 The model

Consider the multinational firm under exchange rate uncertainty *à la* Broll and Zilcha (1992). There is one period with two dates, 0 and 1. To begin, the multinational firm produces a single commodity in the home country according to a deterministic cost function, $C(Q)$, where $Q \geq 0$ is the output level, and $C(Q)$ is compounded to date 1 with the properties that $C(0) = C'(0) = 0$, and $C'(Q) > 0$ and $C''(Q) > 0$ for all $Q > 0$.[1] The multinational firm commits to selling Q_1 units of its output at home and exporting Q_2 units to a foreign country, where $Q_1 \geq 0$, $Q_2 \geq 0$, and $Q_1 + Q_2 = Q$.

The multinational firm's domestic sales generate home currency revenues at date 1 specified by a deterministic revenue function, $R_1(Q_1)$, where $R_1(0) = 0$, and $R_1'(Q_1) > 0$ and $R_1''(Q_1) < 0$ for all $Q_1 \geq 0$. On the other hand, the multinational firm's exports generate foreign currency receives at date 1 specified by another deterministic revenue function, $R_2(Q_2)$, where $R_2(0) = 0$, and $R_2'(Q_1) > 0$ and $R_2''(Q_2) < 0$ for all $Q_2 \geq 0$. Due to the segmentation of the home and foreign markets, arbitrage transactions are either impossible or unprofitable, thereby invalidating the law of one price.[2]

We model the exchange rate uncertainty by a random variable, $\tilde{S}$, that denotes the spot exchange rate at date 1 and is expressed in units of the home currency per unit of the foreign currency.[3] $\tilde{S}$ is distributed according to a known cumulative distribution function, $F(S)$, over support $[\underline{S}, \overline{S}]$, where $0 < \underline{S} < \overline{S}$.[4] The multinational firm's home currency profit at date 1 is given by $\Pi(\tilde{S}) = R_1(Q_1) + \tilde{S}R_2(Q_2) - C(Q_1 + Q_2)$.

We define the multinational firm to be regret-averse if its preferences are represented by

[1]The strict convexity of the cost function reflects the fact that the multinational firm's production technology exhibits decreasing returns to scale.

[2]Engel and Rogers (1996, 2001) and Parsley and Wei (1996) provide supportive evidence that arbitrage transactions among national markets are indeed imperfect.

[3]Throughout the paper, random variables have a tilde (~) while their realizations do not.

[4]An alternative way to model the exchange rate uncertainty is to apply the concept of information systems that are conditional cumulative distribution functions over a set of signals imperfectly correlated with $\tilde{S}$ (Broll et al., 2013).

the following modified utility function that includes some compensation for regret:

$$V(\Pi) = U(\Pi) - \beta G(\Pi^{\max} - \Pi), \tag{1}$$

where $\Pi \geq 0$ is the multinational firm's home currency profit at date 1, $U(\Pi)$ is a von Neumann-Morgenstern utility function with $U'(\Pi) > 0$ and $U''(\Pi) < 0$, $\beta \geq 0$ is a constant regret coefficient, and $G(\Pi^{\max} - \Pi)$ is a regret function that depends on the difference between the actual home currency profit, Π, and the maximum home currency profit, $\Pi^{\max}$, that the multinational firm could have earned if the multinational firm had made the optimal production and export decisions based on knowing the realized spot exchange rate.[5] We assume that $G(0) = 0$, and $G'(\Pi^{\max} - \Pi) > 0$ and $G''(\Pi^{\max} - \Pi) > 0$ for all $\Pi^{\max} - \Pi \geq 0$. Since Π cannot exceed $\Pi^{\max}$, the multinational firm experiences disutility from forgoing the possibility of undertaking the ex-post optimal production and export decisions.

To characterize the regret-averse multinational firm's optimal production and export decisions, we have to first determine the maximum home currency profit, $\Pi^{\max}$. If the multinational firm could have observed the realized spot exchange rate, S, the maximum home currency profit would be achieved by choosing $Q_1(S)$ and $Q_2(S)$ that solve $R_1'[Q_1(S)] = C'[Q_1(S) + Q_2(S)]$ and $SR_2'[Q_2(S)] = C'[Q_1(S) + Q_2(S)]$ simultaneously. Differentiating $Q_1(S)$ and $Q_2(S)$ with respect to S yields

$$Q_1'(S) = -\frac{R_2'[Q_2(S)]C''[Q_1(S) + Q_2(S)]}{SR_1''[Q_1(S)]R_2''[Q_2(S)] - \{R_1''[Q_1(S)] + SR_2''[Q_2(S)]\}C''[Q(S)]} < 0, \tag{2}$$

and

$$Q_2'(S) = \frac{R_2'[Q_2(S)]\{C''[Q(S)] - R_1''[Q_1(S)]\}}{SR_1''[Q_1(S)]R_2''[Q_2(S)] - \{R_1''[Q_1(S)] + SR_2''[Q_2(S)]\}C''[Q(S)]} > 0, \tag{3}$$

where $Q(S) = Q_1(S) + Q_2(S)$. The maximum home currency profit as a function of S is given by $\Pi^{\max}(S) = R_1[Q_1(S)] + SR_2[Q_2(S)] - C[Q_1(S) + Q_2(S)]$, which is increasing in S since $\Pi^{\max\prime}(S) = R_2[Q_2(S)] > 0$.

[5] Wong (2011, 2012) considers a regret function that depends on the difference between the utility level of the actual home currency profit and that of the maximum home currency profit, $U(\Pi^{\max}) - U(\Pi)$. Since such a specification is simply a monotonic transformation of ours, none of the qualitative results are affected if we adopt Wong's (2011, 2012) approach.

We can now state the regret-averse multinational firm's ex-ante decision problem. At date 0, the multinational firm chooses the levels of domestic sales and exports, Q_1 and Q_2, so as to maximize the expected value of its regret-theoretical utility function:

$$\max_{Q_1 \geq 0, Q_2 \geq 0} \mathrm{E}\{U[\Pi(\tilde{S})] - \beta G[\Pi^{\max}(\tilde{S}) - \Pi(\tilde{S})]\}, \tag{4}$$

where $\mathrm{E}(\cdot)$ is the expectation operator with respect to the cumulative distribution function, $F(S)$. The first-order conditions for program (4) are given by

$$R_1'(Q_1^*) - C'(Q_1^* + Q_2^*) = 0, \tag{5}$$

and

$$\mathrm{E}\Big\{\{U'[\Pi^*(\tilde{S})] + \beta G'[\Pi^{\max}(\tilde{S}) - \Pi^*(\tilde{S})]\}[\tilde{S}R_2'(Q_2^*) - C'(Q_1^* + Q_2^*)]\Big\} = 0, \tag{6}$$

where an asterisk (*) indicates an optimal level. The second-order conditions for program (4) are satisfied given the assumed properties of $U(\Pi)$, $G(\Pi^{\max} - \Pi)$, $R_1(Q_1)$, $R_2(Q_2)$, and $C(Q)$.

3 Impact of regret on production and export decisions

As a benchmark, suppose that the uncertain spot exchange rate, $\tilde{S}$, is fixed at its expected value, $\mathrm{E}(\tilde{S})$. In this benchmark case of certainty, Eqs. (5) and (6) reduce to

$$R_1'(Q_1^\circ) - C'(Q_1^\circ + Q_2^\circ) = 0, \tag{7}$$

and

$$\mathrm{E}(\tilde{S})R_2'(Q_2^\circ) - C'(Q_1^\circ + Q_2^\circ) = 0, \tag{8}$$

where Q_1° and Q_2° are the optimal levels of domestic sales and exports, respectively. We are interested in comparing Q_1^* with Q_1° and Q_2^* with Q_2°. The following proposition provides sufficient conditions under which we can make unambiguous comparisons.

Proposition 1. *If $U'''(\Pi) \geq 0$ and $G'''(\Pi^{\max} - \Pi) \geq 0$, then a sufficient condition that ensures the regret-averse multinational firm to produce less, i.e., $Q^* < Q^\circ$, sells more in the home market, i.e., $Q_1^* > Q_2^\circ$, and exports less to the foreign country, i.e., $Q_2^* < Q_2^\circ$, as compared to the optimal levels under certainty, is that the constant regret coefficient, β, is sufficiently small such that*

$$\beta \leq \frac{U'\{\Pi^\circ[\mathrm{E}(\tilde{S})]\} - U'[\Pi^\circ(\overline{S})]}{G'[\Pi^{\max}(\overline{S}) - \Pi^\circ(\overline{S})] - G'(0)}, \tag{9}$$

where $\Pi^\circ(S) = R_1(Q_1^\circ) + SR_2(Q_2^\circ) - C(Q_1^\circ + Q_2^\circ)$.

Proof. Let $Q_1(Q_2)$ be the solution to $R_1'[Q_1(Q_2)] = C'[Q_1(Q_2) + Q_2]$. Then, Eqs. (5) and (7) imply that $Q_1(Q_2^*) = Q_1^*$ and $Q_1(Q_2^\circ) = Q_1^\circ$, respectively. Furthermore, we have

$$Q_1'(Q_2) = \frac{C''[Q_1(Q_2) + Q_2]}{R_1''[Q_1(Q_2)] - C''[Q_1(Q_2) + Q_2]} < 0, \tag{10}$$

since $C''(Q) > 0$ and $R_1''(Q_1) < 0$. Substituting $Q_1(Q_2)$ into the objective function of program (4) and differentiating with respect to Q_2 yields

$$\frac{\partial \mathrm{E}\{V[\Pi(\tilde{S})]\}}{\partial Q_2}\bigg|_{Q_1 = Q_1(Q_2)}$$

$$= \mathrm{E}\Big\{\{U'[\hat{\Pi}(\tilde{S})] + \beta G'[\Pi^{\max}(\tilde{S}) - \hat{\Pi}(\tilde{S})]\}\{\tilde{S}R_2'(Q_2) - C'[Q_1(Q_2) + Q_2]\}\Big\}, \tag{11}$$

where $\hat{\Pi}(S) = R_1[Q_1(Q_2)] + SR_2(Q_2) - C[Q_1(Q_2) + Q_2]$. Evaluating Eq. (11) at $Q_2 = Q_2^\circ$ yields

$$\frac{\partial \mathrm{E}\{V[\Pi(\tilde{S})]\}}{\partial Q_2}\bigg|_{Q_1 = Q_1^\circ, Q_2 = Q_2^\circ}$$

$$= \mathrm{E}\Big\{\{U'[\Pi^\circ(\tilde{S})] + \beta G'[\Pi^{\max}(\tilde{S}) - \Pi^\circ(\tilde{S})]\}[\tilde{S} - \mathrm{E}(\tilde{S})]\Big\}R_2'(Q_2^\circ), \tag{12}$$

where we have used Eq. (8) and $Q_1(Q_2^\circ) = Q_1^\circ$.

Let $\Phi(S) = U'[\Pi^\circ(S)] + \beta G'[\Pi^{\max}(S) - \Pi^\circ(S)]$. Differentiating $\Phi(S)$ twice with respect to S yields

$$\Phi'(S) = U''[\Pi^\circ(S)]R_2(Q_2^\circ) + \beta G''[\Pi^{\max}(S) - \Pi^\circ(S)]\{R_2[Q_2(S)] - R_2(Q_2^\circ)\}, \tag{13}$$

and

$$\Phi''(S) = U'''[\Pi^\circ(S)]R_2(Q_2^\circ)^2 + \beta G'''[\Pi^{\max}(S) - \Pi^\circ(S)]\{R_2[Q_2(S)] - R_2(Q_2^\circ)\}^2$$

$$+\beta G''[\Pi^{\max}(S) - \Pi^\circ(S)]R_2'[Q_2(S)]Q_2'(S). \tag{14}$$

Since $U'''(\Pi) \geq 0$ and $G'''(\Pi^{\max} - \Pi) \geq 0$, Eq. (14) implies that $\Phi''(S) > 0$ for all $S \in [\underline{S}, \overline{S}]$.

From Eq. (3), we have $Q_2(S) < (>)\ Q_2^\circ$ for all $S < (>)\ \mathrm{E}(\tilde{S})$, it follows from Eq. (13) that $\Phi'(S) < 0$ for all $S \leq \mathrm{E}(\tilde{S})$. Hence, $\Phi(S) > \Phi[\mathrm{E}(\tilde{S})]$ for all $S < \mathrm{E}(\tilde{S})$. Condition (9) ensures that $\Phi[\mathrm{E}(\tilde{S})] \geq \Phi(\overline{S})$. Since $\Phi(S)$ is strictly convex in S and $\Phi'[\mathrm{E}(\tilde{P})] < 0$, it follows from condition (9) that $\Phi(S) < \Phi[\mathrm{E}(\tilde{S})]$ for all $S > \mathrm{E}(\tilde{S})$. The right-hand side of Eq. (12) as such is negative. It then follows from Eq. (5) and the second-order conditions for program (4) that $Q_2^* < Q_2^\circ$. From Eq. (10), we have $Q_1^* > Q_1^\circ$. Since $R_1''(Q_1) < 0$ and $C''(Q) > 0$, it follows from Eqs. (5) and (7) that $Q_1^* + Q_2^* < Q_1^\circ + Q_2^\circ$. □

The intuition for Proposition 1 is as follows. If $\beta = 0$, the firm is purely risk averse. Broll and Zilcha (1992) show that the risk-averse multinational firm produces less than Q°, sells more than Q_1° domestically, and exports less than Q_2° to the foreign country so as to limit its exposure to the exchange rate uncertainty. For β sufficiently small, introducing regret aversion to the multinational firm would not substantially change such a risk-sharing motive, thereby rendering $Q^* < Q^\circ$, $Q_1^* > Q_1^\circ$, and $Q_2^* < Q_2^\circ$.

4 A binary model

To gain more insights, we consider in this section a simple binary model such that the random spot exchange rate, $\tilde{S}$, takes on the low value, $\underline{S}$, with probability p and the high value, $\overline{S}$, with probability $1-p$, where $0 < p < 1$. In such a binary model, the right-hand side of Eq. (12) becomes

$$p\{U'[\Pi^\circ(\underline{S})] + \beta G'[\Pi^{\max}(\underline{S}) - \Pi^\circ(\underline{S})]\}[\underline{S} - p\underline{S} - (1-p)\overline{S}]R_2'(Q_2^\circ)$$

$$+(1-p)\{U'[\Pi^\circ(\overline{S})] + \beta G'[\Pi^{\max}(\overline{S}) - \Pi^\circ(\overline{S})]\}[\overline{S} - p\underline{S} - (1-p)\overline{S}]R_2'(Q_2^\circ)$$

$$= p(1-p)(\overline{S} - \underline{S})R_2'(Q_2^\circ)\Psi(p), \tag{15}$$

where $\Psi(p) = U'[\Pi^\circ(\overline{S})] + \beta G'[\Pi^{\max}(\overline{S}) - \Pi^\circ(\overline{S})] - U'[\Pi^\circ(\underline{S})] - \beta G'[\Pi^{\max}(\underline{S}) - \Pi^\circ(\underline{S})]$. If right-hand side of Eq. (15) is negative (positive), i.e., $\Psi(p) < (>)\ 0$, it then follows from Eq. (5) and the second-order conditions for program (4) that $Q_2^* < (>)\ Q_2^\circ$.

We state and prove the following proposition.

Proposition 2. *Suppose that the random spot exchange rate, $\tilde{S}$, can take on the low value, $\underline{S}$, with probability p and the high value, $\overline{S}$, with probability $1-p$, where $0 < p < 1$. If the constant regret coefficient, β, is sufficiently small such that*

$$\beta \leq \frac{U'[\Pi^{\max}(\underline{S})] - U'\{R_1[Q_1(\underline{S})] + \overline{S}R_2[Q_2(\underline{S})] - C[Q(\underline{S})]\}}{G'\{\Pi^{\max}(\overline{S}) - R_1[Q_1(\underline{S})] - \overline{S}R_2[Q_2(\underline{S})] + C[Q(\underline{S})]\} - G'(0)}, \tag{16}$$

the regret-averse multinational firm optimally produces less, i.e., $Q^* < Q^\circ$, sells more in the home market, i.e., $Q_1^* > Q_1^\circ$, and exports less to the foreign country, i.e., $Q_2^* < Q_2^\circ$, as compared to the optimal levels under certainty. If β is sufficiently large such that condition (16) does not hold, there exists a unique value, $p^* \in (0,1)$, that solves $\Psi(p^*) = 0$, such that $Q^* < (>)\ Q^\circ$, $Q_1^* > (<)\ Q_1^\circ$, and $Q_2^* < (>)\ Q_2^\circ$, for all $p < (>)\ p^*$.

Proof. In the binary model, we differentiate Eq. (8) with respect to p to yield

$$\frac{\mathrm{d}Q_2^\circ}{\mathrm{d}p} = \frac{(\overline{S} - \underline{S})R_2'(Q_2^\circ)}{\mathrm{E}(\tilde{S})R_2''(Q_2^\circ) - C''[Q_1(Q_2^\circ) + Q_2^\circ][Q_1'(Q_2^\circ) + 1]} < 0, \tag{17}$$

since $R_2''(Q_2) < 0$, $C''(Q) > 0$, and Eq. (10) implies that $Q_1'(Q_2) + 1 > 0$. Differentiating $\Psi(p)$ with respect to p yields

$$\Psi'(p) = (\overline{S} - \underline{S})R_2'(Q_2^\circ)\frac{\mathrm{d}Q_2^\circ}{\mathrm{d}p}\{pU''[\Pi^\circ(\overline{S})] - p\beta G''[\Pi^{\max}(\overline{S}) - \Pi^\circ(\overline{S})]$$

$$+(1-p)U''[\Pi^\circ(\underline{S})] - (1-p)\beta G''[\Pi^{\max}(\underline{S}) - \Pi^\circ(\underline{S})]\} > 0, \tag{18}$$

where the inequality follows from $U''(\Pi) < 0$, $G''(\Pi^{\max} - \Pi) > 0$, and Eq. (17). At $p = 0$, we have $Q_2^\circ = Q_2(\overline{S})$. In this case, $\Psi(0) = U'[\Pi^\circ(\overline{S})] - U'[\Pi^\circ(\underline{S})] + \beta\{G'(0) - G'[\Pi^{\max}(\underline{S}) - \Pi^\circ(\underline{S})]\} < 0$ since $U''(\Pi) < 0$, $\Pi^\circ(\overline{S}) > \Pi^\circ(\underline{S})$, and $G''(\Pi^{\max} - \Pi) > 0$. On the other hand, at $p = 1$, $Q_2^\circ = Q_2(\underline{S})$ and thus $\Psi(1) = U'[\Pi^\circ(\overline{S})] - U'[\Pi^\circ(\underline{S})] + \beta\{G'[\Pi^{\max}(\overline{S}) - \Pi^\circ(\overline{S})] - G'(0)\}$. Condition (16) ensures that $\Psi(1) \leq 0$. In this case, Eq. (18) implies that $\Psi(p) < 0$ for all $p \in (0, 1)$ so that $Q_2^* < Q_2^\circ$. From Eq. (10), we have $Q_1^* > Q_1^\circ$. Since $R_1''(Q_1) < 0$ and $C''(Q) > 0$, it follows from Eqs. (5) and (7) that $Q_1^* + Q_2^* < Q_1^\circ + Q_2^\circ$.

If condition (16) does not hold, we have $\Psi(1) > 0$. It then follows from Eq. (18) that there exists a unique point, $p^* \in (0, 1)$, such that $\Psi(p) < (>)\ 0$ for all $p < (>)\ p^*$. Hence, in this case, we have $Q_2^* < (>)\ Q_2^\circ$, thereby $Q_1^* > (<)\ Q_1^\circ$ and $Q_1^* + Q_2^* < (>)\ Q_1^\circ + Q_2^\circ$, for all $p < (>)\ p^*$. □

The intuition for Proposition 2 is as follows. If condition (16) holds, we have $Q^* < Q^\circ$, $Q_1^* > Q_1^\circ$, and $Q_2^* < Q_2^\circ$, which are consistent with the results of Proposition 1. We now consider the case that condition (16) does not hold. When $\overline{S}$ is very likely to be seen at date 1, Q_2° is closer to $Q_2(\overline{S})$ and further way from $Q_2(\underline{S})$. Introducing regret aversion, which is sufficiently severe, to the multinational firm makes the firm take into account the substantial disutility from the large discrepancy of its export level, $Q_2^\circ - Q_2(\underline{S})$, when the low spot exchange rate is revealed. To avoid regret, the regret-averse multinational firm optimally adjusts its export level downward from Q_2° to move closer to $Q_2(\underline{S})$ so that $Q_2^* < Q_2^\circ$ when p is small. On the other hand, when $\underline{S}$ is very likely to be seen at date 1, in this case Q_2° is close to $Q_2(\underline{S})$. The regret-averse multinational firm as such optimally adjusts its export level upward from Q_2° to reduce the discrepancy of its export level, $Q_2(\overline{S}) - Q_2^*$, when the high spot exchange rate is revealed. Hence, we have $Q_2^* > Q_2^\circ$ when p is large.

5 Conclusion

In this paper, we incorporate regret theory into the study of the multinational firm under exchange rate uncertainty. The multinational firm simultaneously sells in the home market and exports to a foreign country. We characterize the multinational firm's regret-averse preferences by a modified utility function that includes disutility from having chosen ex-post suboptimal alternatives. The extent of regret depends on the difference between the actual home currency profit and the maximum home currency profit attained by making the optimal production and export decisions had the multinational firm observed the true realization of the random spot exchange rate. We show that the conventional results of the extant literature that the multinational firm optimally produces less, sells more domestically, and exports less abroad when the exchange rate uncertainty prevails than when the random spot exchange rate is fixed at the expected value should the multinational firm be not too regret averse. These findings suggest that it is possible that the multinational firm may optimally produces more, sells less domestically, and exports more abroad under uncertainty than under certainty. We verify such a conjecture by using a simple binary model wherein the random spot exchange rate can take on either a low value or a high value with positive probability. We show that the non-conventional results hold in the binary model if the multinational firm is sufficiently regret averse and the low spot exchange rate is very likely to prevail. Regret aversion as such plays a distinctive role, vis-à-vis risk aversion, in shaping the production and export decisions of the multinational firm under exchange rate uncertainty.

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