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Elasticity of risk aversion and international trade ☆

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Abstract

This paper analyzes export production in the presence of exchange rate uncertainty under mean-variance preferences. We present the elasticity of risk aversion, since this elasticity concept permits a distinct investigation of risk and expectation effects on exports. Counterintutitive results are possible, e.g. although the home currency is revaluating (devaluating), exports by the firm increase (decrease). This fact may contribute to the explanation of disturbing empirical results.

Keywords: Exchange rate risk; Trade; Elasticity of risk aversion; Mean-variance model; Devaluation

JEL classification: F21; F31

1. International trade and uncertainty

In the last decade the exchange rates of the major industrial countries have shown substantial volatility. Exchange rate uncertainty has become a concern of international firms and, therefore, affected and is affecting international trade and foreign investments, although empirical findings are mixed.

☆ This paper was completed while I was visiting the Department of Economics, Monash University, Australia.

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Empirical studies regarding the relationship between exchange rate risk and international trade flows do not necessarily confirm the intuition that higher exchange rate volatilities lead to a reduction in international trade.[1] The purpose of this paper is to give an explanation why a positive link between exchange rate risk and exports is possible from the point of view of portfolio theory. We apply the mean-standard deviation approach for a scale and location family of probability distributions in order to examine an exporting firm that is subject to revenue risk without hedging opportunities.

In order to study the decision problem of a risk averse competitive exporting firm under exchange rate risk we use a basic model from the literature.[2] The firm produces the quantity Q of a final good at an increasing marginal cost: $C'(Q)>0$, $C''(Q)>0$. The foreign exchange rate $\tilde{e}$ is random. The commodity price P, denominated in foreign currency, is given. The objective is to maximize the expected value of a von Neumann–Morgenstern utility function of profit $U(\Pi)$, with $U'>0$ and $U''<0$. $\Pi=\tilde{e}PQ-C(Q)$ denotes the risky profit of the exporting firm. Hence, the export decision problem reads:

$$\max_{Q} \; EU(\tilde{e}PQ-C(Q)),$$

where E denotes the expectation operator. Meyer (1987) and others have shown that under some conditions (Section 2) the expected utility decision problem can be transformed into the mean (μ)-standard deviation (σ) framework.[3] That is to say, there exists a function $V(\mu, \sigma)$ such that (i)

$$V(\mu,\sigma)=EU\left(\tilde{\Pi}\right)=\int_{-\infty}^{\infty}U(\Pi)f_{\tilde{\Pi}}(\Pi;\mu,\sigma)\mathrm{d}\Pi,$$

where μ denotes the mean and σ the standard deviation of risky profit for the pdf $f_{\tilde{\Pi}}$; and that (ii) function V satisfies the following properties, where $V_x=\partial V/\partial x$ is the partial derivative: $V_\mu>0$, $V_{\mu\mu}\leq 0$, $V_\sigma<0$, $\sigma>0$ and $V_\sigma(\mu, 0)=0$; the partial derivatives $V_{\sigma\sigma}$ and $V_{\mu\sigma}$ exist and V is a strictly concave function. The indifference curves are upward sloping and concave in the (μ, σ)-space.

2. Location–scale parameter condition and elasticity

Let us start by defining the so-called location and scale parameter condition of a probability distribution (Feller (1966), Meyer (1987)). This framework applies to our model of the exporting firm, since the random profit of the firm $\tilde{\Pi}$ is a positive linear transformation of the random foreign exchange rate $\tilde{e}$.

Definition 1. (Seed random variable) Let $\tilde{\eta}$ be the seed random variable with zero mean and unit standard deviation. The nondegenerate random foreign exchange rate $\tilde{e}$ is defined to be

$$\tilde{e}=\mu_{\tilde{e}}+\sigma_{\tilde{e}}\tilde{\eta},\ \text{with}\ \sigma_{\tilde{e}}>0.$$

[1] See Krugman (1989), Bini-Smaghi (1991), Gagnon (1993), Taylor (1995), McKenzie (1999), Lyons (2001) and others.
[2] Holthausen (1979), Kawai and Zilcha (1986), Broll, Wahl and Zilcha (1995) and others.
[3] See Schneeweiss (1967), Sinn (1983), Meyer (1987), Ormiston and Schlee (2001) and others.