EXPORT AS AN OPTION

UDO BROLL*
University of Munich

This note studies the implications of a firm’s advantage to allocate production to
different markets under exchange rate risk. As exchange rate volatility increases, so
does the value of the option to export. The firm’s flexibility can be seen as a real
hedging instrument. This kind of risk management policy has the advantage that the
hedge instrument is sensitive to the realization of foreign spot exchange rates.
Multinational firms, especially, can be regarded as flexible firms because of their use
of worldwide distribution facilities. [F31, J20]

1. INTRODUCTION

In the last decade international firms and therefore employment in the economy
have been exposed to high foreign exchange risk since major currencies have shown a
substantial volatility. The volatility of prices, interest rates and foreign exchange rates
is affecting employment of labor and the wage process through international trade and
foreign direct investments (see, e.g., Ware and Winter, 1988, Froot, Scharfstein and
Eckwert, 1996).

Empirical evidence, however, regarding the effect of exchange rate risk on trade,
has at best been inconclusive. This note studies the implications of a firm’s advantage
to allocate production to the world market or to the domestic market. The firm has to
deide ex-ante about production, but with respect to the selling market the firm is able
to choose ex-post between the domestic and the world market. The advantage of
flexibility means that the international allocation of production can be made
conditional on the realization of the exchange rate. When the exchange rate surges to
high levels, exports are increasing; when the exchange rate drops below a certain
level, exports fall to zero; when the exchange rate permits profitable exports, the firm
is exporting. Export is a real option which is exercised if profitable. Multinationals,
especially, can be regarded as export flexible firms because of their use of worldwide
distribution facilities (Helpman and Krugman, 1989, Shapiro, 1995, Aizenman, 1996,
Caves, 1996).

With the firm’s advantage to choose between domestic and world market the

*I am very grateful to the anonymous referees for helpful discussions and advice. This
research has been supported by the Deutsche Forschungsgemeinschaft: SFB 178 (A.10). This
paper is dedicated to the memory of Professor Hans Moeller.
export strategy is like an option, because whatever the realized exchange rate turns out to be the domestic market revenue is certain. Therefore the possibility to export when exchange rates are favourable conveys a real call option-like source of income for the firm. Flexibility has value. As exchange rate volatility increases, so does the value of the option to export. Higher volatility increases the potential gains from international trade by making extremely high realizations of the spot exchange rate more likely. The correspondingly higher probabilities of low realizations of the exchange rate do not offset these gains since the firm may choose to walk away from export. Losses are effectively truncated.

In our framework the firm's flexibility can be interpreted as a non-linear real hedging strategy. This kind of risk management policy has the advantage that it is sensitive to the realization of spot exchange rate. For example, if the exchange rate risk increases by a mean-preserving spread, the expected gain from exercising the export option is increasing.

The intuition behind this result is as follows. Given a risk-averse firm, then an increase in foreign market uncertainty induced by an increase in exchange rate volatility reduces the firm's expected utility. This effect implies a decrease in production. On the other hand, higher riskiness makes the real option to export more profitable, provided the firm has the advantage of flexibility. This tends to stimulate employment and exports. Which effect dominates depends on the degree of relative risk-aversion of the firm. This may explain part of the mixed empirical findings in the trade literature.

The following section 2 sets out the basic model which we use. The advantage of flexibility means that the allocation of production can be made conditional on the realization of the exchange rate. In this framework the economic effects of an increase in exchange rate risk are derived and discussed in section 3. A conclusion ends the paper.

2. THE ADVANTAGE OF EX POST FLEXIBILITY

We consider a firm which produces a commodity to be allocated to the domestic and/or the world market. The sole source of uncertainty are fluctuations in the foreign spot exchange rate $S$. Let $P$ be the given foreign-good price and $Q$ be the given domestic price. The decision maker is risk-averse with a von Neumann-Morgenstern utility function $u$. The firm maximizes the expected utility of its local-currency terminal wealth $W$, i.e., $E_u(W)$. We take $u$ to be a strictly concave, increasing and differentiable function, with $u' > 0$, $u'' < 0$, and standard risk aversion $u''' > 0$.

Assumption (A.1): The exchange rate $S$ is random where $\alpha$ is the standard deviation, i.e., $S = \bar{S} + \alpha \varepsilon$, $E(\varepsilon) = 0$, $\text{var}(\varepsilon) = 1$, $\alpha > 0$. Furthermore, the expected exchange rate $\bar{S}$ is equal to the price ratio $Q/P$, $\alpha$ is a shift parameter and $S > 0$ for all realizations.

The time structure of the decision making process is as follows. At the current period the firm decides on production, i.e., on labor input $L$ which gives rise to labor