How Voluntary are Voluntary Import Expansions?

1. Introduction

Since the middle of 1980s, Voluntary Import Expansions (VIEs) have become new protective trade policies among industrialized countries. VIEs began with the semiconductor agreement between US and Japan in 1986. Are VIEs not voluntary for the importing country? If voluntary, under what conditions? Compared with the analyses of VERs, the voluntariness of VIEs has not been taken up in the literatures. The purpose of this paper is to fill this gap by considering the welfare effects of VIEs on the importing country.

2. Model

Greaney (1996) is the first rigorous analysis of VIEs which uses a Bertrand model of duopoly with substitute goods. In contrast, this paper examines the welfare effects of VIEs on the importing country in a Cournot model. We start from a simple model and then extend it. Assume domestic and foreign country, where each has one firm. Both firms produce a homogenous good and compete in domestic market in a Cournot fashion. Let marginal cost be the same and constant. We assume two stages game. In the first stage the government of two countries negotiate on the market share of foreign firm in the domestic market. In the second stage, both firms compete non-cooperatively in domestic market in Cournot fashion.

Assume following inverse demand function:

\[ p = a - bX, \]

where, \( X = x + x^* \) (\( (x, x^*) \) is the supply of domestic (foreign) firm). Let the cost functions be: \( C(x) = cx \) and \( C^*(x^*) = cx^* \). The best response function of two firms are: \( x(x^*) = \frac{(a - c)}{2b} - \frac{x^*}{2} \) and \( x^*(x) = \frac{(a - c)}{2b} - \frac{x}{2} \), from which we obtain the free trade Cournot-Nash equilibrium output of two firms and total supply:

\[ x_f = x^*_f = \frac{(a - c)}{3b}, \quad X_f = 2 \frac{(a - c)}{3b}. \]
Assume that a VIE agreement is in terms of the market share and it is represented as:

\[ x^* / (x + x^*) \geq m = m_f. \]  

(3)

where, \( m_f \) is the market share under initial free trade. (3) is written as:

\[ x \geq (1 - m_f) x^* / m_f. \]  

(4)

By placing such constraints on the domestic firm, VIEs alter the domestic best response function as:

If \((1 - m_f) x^* / m_f \leq x_f(x^*)\), then \(x_m(x^*) = (1 - m_f) x^* / m_f\).

If \((1 - m_f) x^* / m_f > x_f(x^*)\), then \(x_m(x^*) = x(x^*)\).  

(5)

where, \(x_m(x^*)\) is the reaction function of domestic firm under VIEs. Assuming that the VIE constraint being binding, the output of two firms and total supply are:

\[ x_m = (a - c)(1 - m) / b (1 + m), \quad x^* = (a - c) m / b (1 + m), \]

\[ X_m = (a - c) / b (1 + m). \]  

(6)

Profit of two firms are:

\[ \pi(m) = m (1 - m)(a - c)^2 / b (1 + m)^2, \quad \pi^*(m) = (a - c)^2 m^2 / b (1 + m)^2. \]  

(7)

Consumer’s surplus is: \(CS(m) = bX_m^2/2\).

The welfare of domestic country is:

\[ W(m) = \pi(m) + CS(m) = (a - c)^2 [2m (1 - m) + 1] / 2b (1 + m)^3. \]  

(8)

From (8), we have:

\[ dW(m)/dm = -3(a - c)^2 m / b (1 + m)^3 < 0. \]

**Proposition 1.** VIEs are not voluntary for an importing country in the case of Cournot duopoly with identical and constant costs.

3. **Extensions.**

The model is extended to four cases: 1) marginal cost is constant but different-case1, 2) marginal cost declines in foreign country-case2, 3) number of firms is different between two countries-case 3, 4) two commodities are differentiated.

In case 1, we have: \(dW(m)/dm = -3m(a - c^*)^2 / b (1 + m)^3 < 0\). This produces:

**Proposition 2.** Under different cost, VIEs are not voluntary to the importing country.

In case 2, we have: \(dW(m)/dm > 0, \quad \text{iff} \quad (x^*/x) > -(2 + \phi^*(x^*)/(1 + \phi^*(x^*)), \quad \text{where} \)
Proposition 3. A VIE is voluntary if and only if the output of foreign firm is sufficiently high at the initial free trade equilibrium.

In case 3, we have:

\[ dW(m)/dm = \frac{[(a - c)^2 \left((n^* - n)(2nn^* + n + n^*)m - n(n^* + 1)^2\right)]}{b(n + 1)^2(n^* + 1)^2}. \]

This produces:

Proposition 4. If \( n \geq n^* \), a VIE reduces domestic welfare. A necessary condition for VIE to be voluntary is \( n^* > n \).

In case 4, assuming the production cost to be zero, we have:

\[ \text{sign } dW(m)/dm = \text{sign } [3m(\beta - 2a) - 2(\beta - a)], \]

where \( a \) and \( \beta \) are own and cross price effect in demand function. This produces:

Proposition 5. If \( 1 \geq a \geq \beta \geq 0 \), a VIE reduces domestic welfare.

4. Political Economy Explanation of VIEs

Government of each country has non-economic objectives and cares about foreign interests. To consider this fact, we introduce “a good trade relation with other countries” as a non-economic objective and assume that the profit of foreign firm is used as an index of foreign interests. We introduce the welfare of domestic government \( V(m) \) and assume that it is the weighted sum of private welfare of (8) and foreign profit of (7). Let \( \rho \) be the weight of the domestic government on the private welfare, we have:

\[ V(m) = \rho \frac{(a - c)^2 \left[2m(1 - m) + 1\right]}{2b(1 + m)^2} + (1 - \rho) \frac{(a - c)^2 m^2}{b(1 + m)^2}. \]

(9)

From (9), we obtain:

\[ dV/dm = \left[(a - c)^2 m(2 - 5\rho)\right]/b(1 + m)^3. \]

This produces:

Proposition 6. If \( \rho < 2/5 \), domestic country prefers a VIE as a whole.
5. Conclusions

Using a Cournot duopoly model with import market share target, we analysed the effects of VIEs and derived different results from Greaney (1996). We also extended the previous analyses by including political economy aspects of VIEs.

References


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