

The influence of Import Tariffs on economic activity: Monopolistic Competition Model

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Outline

- 1 International trade and Import Tariffs
 - Introduction
 - The model
 - Comparative statics. The case of the small custom tariff

Abstract

- We consider one-sector economy with two countries, **monopolistic competition**.
- We study the case of **unilateral import tariffs** to import the commodity producing in another economy.
- The import tariff charges per unit of production (**specific**).
- Results. We calculate the basic equilibrium characteristics;
 - study the comparative statics of relative wages,
 - size of the firm,
 - number of firms,
 - the opposite effect to the “home market effect”,
 - prices,
 - of consumption in the own and foreign countries.

Motivation

The study the trade policy of countries based on the introduction the customs barriers and subsidizing some export sectors.

- It is known that **the trade barriers influence on the competitiveness** of the firms which import the articles and the firms within the country. **This change the structure and concentration of the sectors.**
- As usual, generally, the barriers **aggravate foreign-trade climate**: they reduce the possibility to supply the economy with varied and cheap goods. It can have negative impact on the welfare, also for consumers of the country installed the barriers.
- As usual, the barriers **protect** the business within the country, support some level of the **employment**, provide economic **independence** of the country.

Background literature

Oligopoly: Eaton, Grossman (1986); Brander, Spenser (1985)

Monopolistic Competition (MC):

Venables (1981):

- **Optimal ad valorem tariff** introducing by the country in the MC sector with **utility function of general type**.
- **The growth of social welfare** is possible when consumer surplus from import goods is bigger than from home goods.

MC under **CES preferences, ad valorem tariffs:**

- Venables (1987): Positive influence of subsidies and unilateral tariffs on the import to increase welfare in a country
- Gross (1987): Tariff war does not benefit in the case when the size of the country is less than some value depending of the number of firms
- Jørgensen, Schröder (2007): Different kinds of trade tariffs can be expressed via **ad valorem tariffs**

The Problem

- To determine how much and when **it is profitable to insert tariff** for the state.
- Monopolistic competition, specific tariff, utility function of general form, non-homogeneous goods.
- Adapt approach of Krugman (1979), developed in Zhelobodko, Kokovin, Parenti, Thisse (2012), for the analysis of trade instruments and calculate the characteristics of wage, domestic and external demand, concentration of production.

General plan

- *Consider under general assumptions the trade of two countries in the case of inserting the custom barriers of specific type, study the equilibrium situations arised.ty*
- Determine the advantages of the *inserting unilateral import tariff*.
- The existence of these advantages allows to justify the existence of “tariff wars”. Show the possibility of tariff wars.

Producer

- 1 **Increasing returns to scale.** Each firm produces one “variety”. The only production factor is **labour**. To produce the unit of goods, it is necessary $l = F + cx^{ii}$ units of labour. All **firms are symmetric**.
- 2 The production is divided into the commodity produced and consumed within the country - x^{ii} , and the commodity produced in the country and consumed in another country - $x^{ij}, i \neq j, i, j \in \{H, F\}$, where H - **home country** and F - **foreign country**.
- 3 **Free entry** drives all profits to zero. **Free entry** condition drives profit to zero in long-run period.
- 4 **Number of firms is big** enough - to ignore one firm's influence on the whole industry/economy.

The main problem of consumer

For home country: On the space of producers

$j, i \in [0, N], N = N^F + N^H$, maximize utility function under budget constraint

$$\int_0^{N^H} u(x_i^{HH}) di + \int_0^{N^F} u(x_i^{FH}) di \rightarrow \max_{x_i^{HH}, x_i^{FH}}, \int_0^{N^H} p_i^{HH} x_i^{HH} di + \int_0^{N^F} p_i^{FH} x_i^{FH} di \leq w^H,$$

where utility function $u(\cdot)$, x_i^{FH} is the demand of i -th variety produced in country F and consumed in country H , p_i^{FH} is price on this variety. Lagrange multiplier λ , wage w^H . Wage is normalized relatively the wage in foreign country (where it assumed as = 1), hence $w^H = w$.

First Order Conditions (FOC) under $j, i \in \{H, F\}$:

$$p^{ji}(x^{ij}, \lambda) = \frac{u'(x^{ij})}{\lambda^j}$$

Inverse Demand function.

Profit maximization (home country)

For home country one has

$$\pi = \left[\frac{u'(x^{HF})}{\lambda^F} - cw \right] L(1-s)x^{HF} + \left[\frac{u'(x^{HH})}{\lambda^H} - cw \right] sLx^{HH} - f \rightarrow \max_{x^{HH}, x^{HF}}$$

Lagrange multiplier λ becomes some market statistic about the prices in the corresponding country (in CES-case it is Price Index). The producer, when enters into the market, considers this statistic as given.

First Order Conditions

$$\frac{x^{HF} u''(x^{HF}) + u'(x^{HF})}{\lambda^F} (1-s)L - wc(1-s)L = 0,$$

$$\frac{x^{HH} u''(x^{HH}) + u'(x^{HH})}{\lambda^H} sL - cswL = 0$$

Profit maximization (foreign country)

For foreign country the profit maximization problem ($\hat{\tau}$ - the value of tariff)

$$\left[\frac{u'(x^{FH})}{\lambda^H} - c - \hat{\tau} \right] Ls x^{FH} + \left[\frac{u'(x^{FF})}{\lambda^F} - c \right] (1-s)Lx^{FF} - f \rightarrow \max_{x^{FH}, x^{FF}};$$

First Order Conditions

Let us set $\tau = \frac{c+\hat{\tau}}{c} > 1$. The meaning of τ is similar to the transport costs of "iceberg type"

$$\frac{x^{FH} u''(x^{FH}) + u'(x^{FH})}{\lambda^H} sL - c\tau sL = 0,$$

$$\frac{x^{FF} u''(x^{FF}) + u'(x^{FF})}{\lambda^F} (1-s)L - c(1-s)L = 0.$$

Elasticity of substitution

The main characteristic is the elasticity of substitution. When the consumption of a variety increases, the elasticity of substitution can increase or decrease. Moreover, it can be constant (in case of CES-function). It can be expressed with the help of the Arrow-Pratt measure of concavity of utility function $u(x)$

$$r_u(x) = -\frac{xu''(x)}{u'(x)}.$$

Such characteristic of utility is known as “relative risk aversion” in risk theory and as “relative love for variety” (RLV) in monopolistic competition.

Prices

Home country

$$p^{HH} = \frac{cW}{1 - r_u(x^{HH})}, \quad p^{FH} = \frac{c\tau}{1 - r_u(x^{FH})}.$$

Foreign country

$$p^{HF} = \frac{cW}{1 - r_u(x^{HF})}, \quad p^{FF} = \frac{c}{1 - r_u(x^{FF})}.$$

Equilibrium conditions

- 1 **Optimality in consumption** (profit maximization under optimal consumption: $\frac{\partial \pi(x)}{\partial x} = 0$).
- 2 **Budget constraint** $Np(x)x = w$.
- 3 **Free entry** condition (the firm's profit is zero)
 $\pi = (p(x) - c)xL - f = 0$.
- 4 **Balance on the labour market** condition $(f + cx)N = L$.

Equilibrium equations

$$\frac{u'(x^{HH})}{u'(x^{FH})} = \frac{w}{\tau} \cdot \frac{1 - r_u(x^{FH})}{1 - r_u(x^{HH})}$$

$$\frac{u'(x^{FF})}{u'(x^{HF})} = \frac{1}{w} \cdot \frac{1 - r_u(x^{HF})}{1 - r_u(x^{FF})}$$

$$p^{HF} x^{HF} N^H + p^{FF} x^{FF} N^F = 1$$

$$p^{HH} x^{HH} N^H + p^{FH} x^{FH} N^F = w + (\tau - 1) c x^{FH} N^F$$

$$s \frac{r_u(x^{HH}) x^{HH}}{1 - r_u(x^{HH})} + (1 - s) \frac{r_u(x^{HF}) x^{HF}}{1 - r_u(x^{HF})} = \frac{F}{cL}$$

$$s\tau \frac{r_u(x^{FH}) x^{FH}}{1 - r_u(x^{FH})} + (1 - s) \frac{r_u(x^{FF}) x^{FF}}{1 - r_u(x^{FF})} = \frac{F}{cL}$$

$$N^H (F + c(sLx^{HH} + (1 - s)Lx^{HF})) = sL$$

$$N^F (F + c((1 - s)Lx^{FF} + sLx^{FH})) = (1 - s)L$$

Wage

Proposition

In the equilibrium, the relative nominal wage satisfies to

$$1 \leq w \leq \tau.$$

Interpretation. The wage in the country that inserts the trade barriers is always **bigger** than in the country that does not inserts the trade barriers.

Proposition

*In the equilibrium, when $\tau \rightarrow 1$, $w \rightarrow 1$ and $x^{HH} = x^{FH} = x^{HF} = x^{FF} = x$, one has that **elasticity of wage w.r.t. custom duty is positive** and equals to*

$$\varepsilon_{\tau}^w = s(1 - r_U(x)).$$

Interpretation. The bigger the country, the bigger the growth of the wage. The bigger countries heterogeneity, the stronger the wage differentiation.

Consumption

Proposition

Elasticities of the consumption of the own goods w.r.t. to custom duty is positive, while elasticities of consumption of imported goods is negative:

$$\epsilon_{xHH} > 0 > \epsilon_{xHF},$$

$$\epsilon_{xFF} > 0 > \epsilon_{xHF}.$$

It is important to note that, under the increasing the custom duty, consumption of imported goods decreases in home country and in foreign country, **but** the reasons of the decreasing is different. In home country the reason is the growth of the price of imported goods, while in foreign countries the reason is the decreasing of relative wage.

Intuition

- For **home** country the principal role plays **effect of substitution** of expensive goods by the cheap goods. This effect **dominates the income effect** (consumption increasing due to wage growth).
- For **foreign** country the principal role plays **the trade equilibration**. The decreasing of export leads to the import decreasing and stimulates the home consumption.

The size of the firm

Proposition.

1. *The output of each firm in the home country does not depend from custom tariff. While **the output of each firm in foreign country decreases** when the value of custom tariff increases.*
2. *Moreover this **decreasing is proportional** to the size of **home country**.*
3. *The bigger home country, the stronger the decreasing of the output of each firm in foreign country.*
4. *The output of each firm in home country is bigger than the output of each firm in foreign country.*

Number of firms in economy

Proposition

Number of firms in the economy of home country does not depend on the absolute value of the inserting custom duty. While in foreign country the number of firms increases.

"Home market effect" means that, in bigger market, the concentration of firms is bigger "more than proportional" $\frac{N^H}{N^F} > \frac{L^H}{L^F} = \frac{s}{1-s}$.

Proposition

There is the effect, opposite to the home market effect. The concentration of the firms in home country is disproportionately smaller than in foreign country:

$$\frac{N^H}{N^F} < \frac{s}{1-s}$$

The comparison of results for function of general type and for CES-function

One has for the case of general utility and for the case of CES-preferences $u(x) = x^\rho$

Elasticity	$\epsilon_{x^{HH}}$	$\epsilon_{x^{FH}}$	$\epsilon_{x^{HF}}$	$\epsilon_{x^{FF}}$	ϵ_{NF}	ϵ_{NH}	ϵ_w	ϵ_{q^H}	ϵ_{q^F}
General	+	-	-	+	+	0	+	0	-
CES	+	-	-	+	$s\rho$	0	$s\rho$	0	$-sx$

where $q^H = sx^{HH} + (1-s)x^{HF}$ is the production of a firm in home country while $q^F = sx^{FH} + (1-s)x^{FF}$ is the production of a firm in foreign country.

In spite of that for CES-function the results (about comparative statics w.r.t. market size) are degenerate (ZKPT, 2012), in our setting [the qualitative results of the analysis stand by.](#)

Conditions for the positive shift of utility w.r.t. tariff τ

The shift of utility when custom duty in home country inserts, can be represented this way

$$\frac{\partial (N^H u(x^{HH}) + N^F u(x^{FH}))}{\partial \tau} = N^F u(x) (\varepsilon_{N^F} + \varepsilon_u(x) \cdot (\varepsilon_{x^{FH}} - \varepsilon_{x^{HF}})).$$

where $\varepsilon_u(x) = \frac{x \cdot u'(x)}{u(x)}$.

Positivity condition: positive if (but not “if and only if”)

$$s - r_u(x) > 0$$

and moreover

$$\varepsilon_u(x) + r_u(x) - 1 < 0$$

The influence of the tariff τ on the welfare

Theorem:

- Conditions of the positive shift of utility: $r_u(x) \leq \min\{s, 1 - \varepsilon_u(x)\}$.
- Conditions of the negative shift of utility: $r_u(x) \geq \max\{s, 1 - \varepsilon_u(x)\}$.

$$r_{ln u}(x) = \varepsilon_u(x) + r_u(x) \begin{matrix} \leq \\ \geq \end{matrix} 1$$

the monotonicity of the elasticity of utility

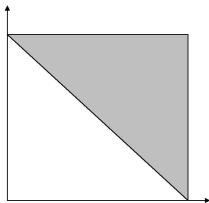
Utility in the case of CES-preferences

We can estimate the shift of utility when custom duty inserts, for the partial case of CES-preferences $u(x) = x^\rho$

$$\frac{\partial (N^H u(x^{HH}) + N^F u(x^{FH}))}{\partial \tau} = N^F \rho^2 x^\rho (s + \rho - 1).$$

Hence the utility strictly increases if and only if $(s + \rho) > 1$.

The increasing of the utility is possible under the definite combination of the size of home country and the elasticity of the demand.



Thank you