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

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Outline

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Abstract

- We consider one-sector economy with two countries, monopolistic competition.
- We study the case of one-part 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.

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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.

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The Problem

- To determine how much and when it is profitable to insert custom 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, Thisse (2010), for the analysis of trade instruments and calculate the characteristics of wage, domestic and external demand, concentration of production.

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Background literature

Venables (1981) He calculates optimal ad valorem tariff introducing by the country in the monopolistic competition sector with utility function of general type. The result is that the growth of social welfare is possible when consumer surplus from import goods is bigger than from home goods.

Gross (1987) Monopolistic competition trade model for two countries, CES preferences, ad valorem tariffs. He proves the existence of optimal custom tariff for both countries. This custom tariff is increasing function w.r.t. the size of economy and w.r.t. the level of the goods differentiation.

Helpman, Flam (1986) Consequences of the insertion the export subsidies for some sectors of the economy are ambiguous. The decreasing of welfare under subsidies is possible.

Etro (2008) One-sided stimulation of export is profitable to the country, also to developed countries.

The aim. Study the trade policy questions under unspecified form of utility function.

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General plan of the study

- *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.*

- Determine the advantages of the *inserting one-side import tariff.*

- The existence of these advantages allows to justify the existence of "tariff wars".

- Consider the outcome of "tariff wars".

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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.

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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

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

where utility function $u(.), x_i^{FH}$ 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 $j, i \in \{H, F\}$:

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

Inverse Demand function.

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Profit maximization (home country)

For home country one has

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

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

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

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

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Profit maximization (foreign country)

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

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

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"

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

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

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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.

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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

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

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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 $(f + cx)N = L$.

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Equilibrium equations

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

$$\frac{u'(x^{FF})}{u'(x^{HF})} = \frac{1}{w} \cdot \frac{1 - r_u(x^{HF})}{1 - r_u(x^{FF})} \tag{2}$$

$$p^{HF} x^{HF} N^H + p^{FF} x^{FF} N^F = 1 \tag{3}$$

$$p^{HH} x^{HH} N^H + p^{FH} x^{FH} N^F = w + \hat{\tau} x^{FH} N^F \tag{4}$$

$$s \frac{r_u(x^{HH}) x^{HH}}{1 - r_u(x^{HH})} + (1 - s) \frac{r_u(x^{HF}) x^{HF}}{1 - r_u(x^{HF})} = \frac{F}{cL} \tag{5}$$

$$s \tau \frac{r_u(x^{FH}) x^{FH}}{1 - r_u(x^{FH})} + (1 - s) \frac{r_u(x^{FF}) x^{FF}}{1 - r_u(x^{FF})} = \frac{F}{cL} \tag{6}$$

$$N^H \left(F + c(sLx^{HH} + (1 - s)Lx^{HF}) \right) = sL \tag{7}$$

$$N^F \left(F + c((1 - s)Lx^{FF} + sLx^{FH}) \right) = (1 - s)L \tag{8}$$

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Wage

Proposition

In the equilibrium, the relative nominal wage satisfies to

$$1 \le w \le \tau.$$

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 $\tau \to 1$, $w \to 1$ and $x^{HH} = x^{FH} = x^{HF} = x^{FF} = x$, one has that elasticity of wage w.r.t. custom tariff 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.

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Consumption

Proposition

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

$$\varepsilon_{x_{HH}} > 0 > \varepsilon_{x_{HF}},$$

$$\varepsilon_{x_{FF}} > 0 > \varepsilon_{x_{HF}}.$$

It is important to note that, under the increasing the custom tariff, 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.

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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.

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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.

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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 tariff. While in foreign country the number of firms increases. В случае $r'_u(x) > 0$ имеем $\varepsilon_{N^F} < s$.

"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:

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

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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	ε_{xHH}	ε_{xFH}	ε_{xHF}	ε_{xFF}	ε_{NF}	ε_{NH}	ε_W	ε_{qH}	ε_{qF}
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, 2011), in our setting the qualitative results of the analysis stand by.

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

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

$$\frac{\partial \left(N^H u \left(x^{HH} \right) + N^F u \left(x^{FH} \right) \right)}{\partial \tau} = N^F u(x) \left(\frac{(1 - r_u(x))^2 s}{(2 - r_{u'}(x))} + \varepsilon_u(x) \cdot \left(\varepsilon_{x^{FH}} - \varepsilon_{x^{HF}} \right) \right).$$

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

Positivity condition: positive if (but not "if and only if")

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

$$r_{\ln u}(x) - 1 < 0.$$

Theorem

Conditions for the positive response of utility to increasing tariff:
$r_u(x) \leq min\{s, 1 - \varepsilon_u(x)\}$.

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Reciprocal tariff τ for 2 identical countries

What happens when 2 countries set equal reciprocal tariffs $\tau \lesseqgtr 0$ on imports?

First answer amounts to finding socially-optimal Pigouvian tax $\tau \lesseqgtr 0$ in a closed economy. Relying on the known criterion for inefficiently big (small) number of firms:

Theorem

When 2 identical countries impose cooperatively socially-optimal Pigouvian tariff on import, its sign (tariff or subsidy) is determined as

$$\tau \lesseqgtr 0 \Leftrightarrow r_{\ln u} \gtreqless 1$$

What happens when 2 countries set equal indivudually-optimal reciprocal tariffs $\tau > 0$ on imports?

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Conjecture. When 2 identical countries impose individualy-optimal Pigouvian tariff on import (Nash behavior), the sign (tariff or subsidy) coincides with socially-optimal Pigouvian tariff.

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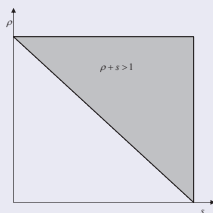
Utility in the case of CES-preferences

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

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

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.

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Thank you