УДК 339.16.012.23

Yuzefovych O. A.

OPTIMAL *TRADE* AND INDUSTRIAL POLICY IN TRANSITION ECONOMIES: THE CASE OF UKRAINIAN IRON ORE INDUSTRY

The objective of the paper is to estimate the deadweight losses from the government industrial policy of regulating price for iron ore raw materials. The analysis is done with the help of partial equilibrium analysis for a "Large" country case which Ukraine is on the world (Eastern European) market. The "Large" country case allows Ukraine to have some power on the market to change the world price.

Introduction

Iron ore mining and enrichment industry is a strategically important industry of the Ukrainian economy. It provides raw materials for metallurgical industry, jobs to thousands of people, and is a town-making industry for the cities of Krivyy Rih, Zaporizhia, Komsomolsk. Currently there are eight mining enterprises in the industry. These companies produce a full range of iron ore products: lump ore, agglomerates, pellets and concentrates. The products of these enterprises sold both on domestic and foreign markets. The Ukrainian mining companies' share of home market is 80% and that of Eastern Europe — *40%*. Therefore, although Ukraine is small country in terms of volumes of production, it is a "Large" one in terms of market power that it exercises on the market of Eastern Europe.

The current problem of the domestic market is the shortage of iron ore experienced by Ukrainian metallurgical plants. A paradoxical situation has arisen: while Ukrainian iron ore export has grown by 8 % in 2003, metallurgical plants increased import of ore (from Russia) by 52,8 % in comparison with 2002. The reason is the government intervention that sets the quantities of iron ore that should be shipped my mining companies to metallurgical plants. Such a situation has evolved as a result of a strong metallurgical lobby in the Ukrainian political circles. Naturally, in search of super normal profit they look for cheap raw material for their metallurgical plants. The latest manifestation of the government policy is the decision to fix the prices for iron ore products at the level of 2003. The outcome of such "enforcement" is a lower price level that exists on the domestic market than that on the Eastern European market since mining companies have to ship iron ore anyway. So, in effect, the metallurgical works are latently subsidized at the cost of mining companies. The consequence is that to work with domestic metallurgical plants is becoming all the more unattractive and Ukrainian mining companies prefer to export ore rather than sell on the home market. In view of the above said, the current research will focus on evaluating the losses of the mining companies from the government planning and the formulation of the optimal trade policy.

"Large" Country Case

The "large country" case refers to a situation where a country possesses a share of the world market large enough to change the world price. Therefore, price difference will affect supply and demand and influence the welfare both on the domestic and world markets. The assumptions of a large country are as follows:

- The markets are perfectly competitive.
- The schedule of import demand has a downward slope.

When the price difference exists in the large country case the following conditions must hold:

1) there are two countries — exporting and importing;

2) $P^w = P^u + s;$

3) $ES^u = ES^u(P^u, P^w) = S(P^w) - D(P^u);$

4) $ID^w(P^w) = ES^u(P^w, P^u);$

5) $\infty < \frac{P^w}{ID^w} * \frac{\partial ID^w}{\partial P^w} < 0.$

The conditions are the same except for the last one which makes the difference between a large and small country cases — it requires price elasticity of demand to be negative and finite. That is, a country is large to change the world price.

The effect of the price difference is tantamount of analyzing the export subsidy and is depicted in Figure 1.

The graph pictures the effect of a consumption subsidy (which is, in effect, a lower price for iron

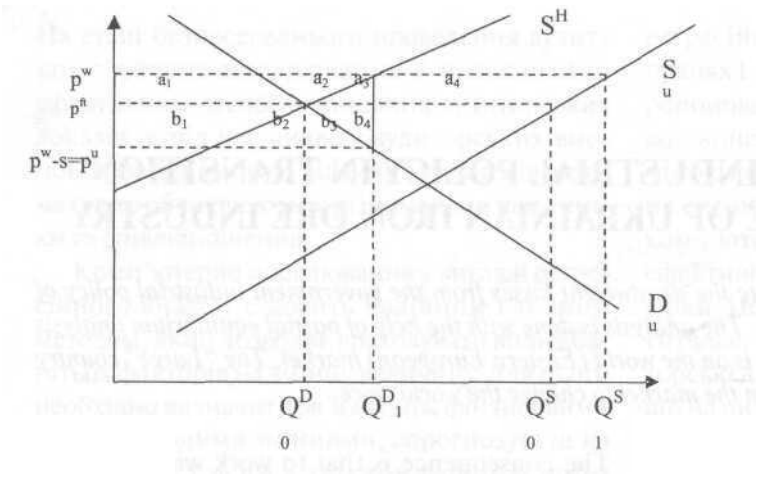

Fig. 1. Export subsidy analysis

ore on the domestic market). The supply (S) and demand (D) curves are domestic demand and supply schedules.

S^H is the supply of iron ore to the home market, S^u is the total supply of iron ore by Ukrainian producers and the distance between them is the amount of iron ore imported by the rest of the world, such that S(P w) - ID(P »). Thus at the free trade price $P^{ft} > Q^S_0$ - QV$^{5\ tne}$ amount of iron ore imported by the rest of the world and thus Ukraine's imports.

As a result of government's setting the target price, the price on the domestic market goes down to p", while the price on the world market increases (we assume Ukraine to be a large country and able to change the world price). This causes exports to change to Q^s, - Q^D, which is exported at p^w, the now world price. Clearly, the government must be able to strongly influence iron ore producers if they are to comply with the target.

We can summarize the effect of the export subsidy as follows:

Ukraine's producers. Producers gain from a higher price for the commodity on the world market — (a_1 + a_2 + a_3 + a_4). Producers also lose the amount of (a_1 + a_2+ a_3 + a_4 + b_1 + b_2 + b_3 + b_4) because they sell Q^{suk}_{Don} the domestic market at the lower target price p^u. The net effect on the producer surplus is equal to a_4 — (b_1 + b_2+ b_3+ b_4).

Ukraine's consumers. The consumer surplus rises by the amount of b_1 + b_2 + b_3

Total welfare of the exporting country. It is easy to see that the aggregate welfare is a_4 — b_4 = (a_3 + a_4) - (a_3 + b_4), where the first term in the brackets is terms of trade gain from higher prices and the second one is distortionary loss. Obviously, the end result can be either positive or negative depending on the amount the new world price exceeds the free trade price. If the difference between them is large, area a_4 is greater than b_4 and the impact on overall welfare is positive. If world price exceeds the free trade price by a small margin, the welfare can be negative. If the price gap, *s,* is sufficiently small and the demand curve is less than infinitely elastic, the change in welfare will be positive.

Estimation of the optimal pricing policy

The suggested pricing policy is similar to a consumption subsidy. The optimal pricing policy thus corresponds with the optimal consumption policy.

From Figure 1 we inferred that the change in total welfare equals the sum of areas of consumer's surplus, producer's surplus and government loss. First, we express the equilibrium condition of the market, which says that import demand as a function of the world price plus domestic demand, a function of restricted domestic price, equals the total supply. Totally **differentiating** the equation and factoring out $\frac{dp^w}{ds}$ we obtain:

$$Q^{md}(p^w) + Q^d(p^w - s) = Q^s(p^w)$$

$$\frac{dp^w}{ds} = \frac{\varepsilon^d}{\varepsilon^d + \frac{p^u Q^{md}}{p^w Q^d}\varepsilon^{md} - \frac{p^u Q^s}{p^w Q^d}\varepsilon^s}.$$

We express consumer and producer surpluses as well as total change in welfare obtained above in mathematical terms.

Producer's surplus $PS = a_4 - (b_1 + b_2 + b_3 + b_4)$

$$= \int_{p^{ft}}^{p^w(s)} Q^S(p^w)dp^w - S * Q^D(p^w(s) - s).$$

Consumer's surplus $CS = b_1 + b_2 + b_3 =$

$$\int_{p^w(s)-s}^{p^w} Q^D(p^{uk})dp^{uk}.$$

Change in total welfare then is

$$\Delta TS = \int_{p^0}^{p^w(s)} Q^S(p^w)dp^w - S * Q^D(p^w(s) - s) + \int_{p^w}^{} Q^D(p^{uk})dp^{uk}$$

Differentiating with respect to 5 and setting the result equal to zero we derive the optimal subsidy as a ratio of subsidy to the domestic price.

$$\frac{s}{p^u} = \frac{1}{\left|e^{md}\right| - 1 + \frac{Q^s}{Q^{md}} e^s}$$

The derivations are available upon request.

We now consider an alternative policy where iron exports are taxed. This policy also lowers the Ukrainian price in relation to the world price.

Determination of the Optimal Export Tariff

To determine the optimal export tariff we follow the basic principle of microeconomics that marginal revenue of a good should equal marginal cost. First, we express $p^w = D_{ROW}(Q)$ as indirect demand function, where

p^w — is the world price of a commodity;

$D_{ROW}(Q)$ - demand from the ret of the world for the commodity.

Next, we derive the marginal revenue function:

$$TR = Q^* p^w = Q^* D_{ROW}(Q)$$

$$(TR)' = MR = p^w + Q^* \frac{\partial D_{ROW}}{\partial Q} = p^{w*}\left(1 - \frac{1}{\varepsilon^D}\right).$$

Imposition of an export tax means implies that $P_w(1 + t) = P_w$

$$MC = P_{uk} = \frac{P_w}{1+t}$$

$$MC = MR$$

$$\frac{1}{1+t} = \frac{\varepsilon^D - 1}{\varepsilon^D}$$

$$t = \frac{1}{\left|\varepsilon^D\right| - 1}.$$

While the optimal export tax may be higher or lower than the optimal consumption subsidy, the export tax is more restrictive on exports because iron production is reduced in addition to the increase in the domestic consumption of iron.

Econometric Estimation

First, we estimate elasticity coefficients of supply and demand on domestic and foreign market using constant elasticity assumptions. That is, we estimate equations in log-log form, which allows to obtain the elasticity coefficients.

Domestic market:

$$\ln(Q_t^D) = \alpha_0 + \alpha_1 \ln(p_{ore}^u) + \alpha_2 \ln(p_{st}^u) + \alpha_3 \ln(GDP^{us});$$

$$\ln(Q_t^S) = \beta_0 + \beta_1 \ln(p_{ore}^w) + \beta_2 \ln(S^u).$$

Foreign Market:

$$\ln(p_{ore}^w) = \gamma_0 + \gamma_1 \ln(Q_t^{MD}) + \gamma_2 \ln(p_{st}^w) + \gamma_3 \ln(GDP^{US}) + \gamma_4 D + \gamma_5 D^* \ln(p_{st}^w), \text{ where}$$

Q_t^D, Q_t^S – quantities of iron ore demanded (supplied) at t;

p_{ore}^u – domestic price of iron ore;

p_{st}^u – domestic price of steel;

p_{st}^w – world price of steel;

p_{ore}^w – world price of iron ore;

p_{wage}^u – wage in iron ore and metallurgical industry of Ukraine;

GDP^u – Ukrainian GDP;

GDP^{US} – US GDP;

Q_t^{MD} – import demand from the rest of the world for Ukrainian ore;

D – a dummy variable that takes values of 0 from January 2000 to March 2002 and 1 thereafter and stands for the change in the US policy towards steel imports (US introduces safeguard measures restricting steel imports);

$D^*\ln(p_{st}^w)$ – interaction term that captures how US price for steel changed after the new safeguard policy.

S – total change in stocks over the last 3 months.

Econometric estimation of the above equations gives us the following elasticity coefficients (Table 1):

Using the estimated elasticity coefficients from the aggregated series and an Excel spreadsheet we design a number of scenarios and look for the one that maximizes national welfare.

Welfare Analysis

We calculated that the price subsidy that Ukrainian consumers of iron got over the last 4 years is as high as 80 percent and with time gradually moves all he way down to zero. Its downward trend is explained by the fact that as time goes on the government has les

Tablel. **Estimated elasticity coefficients**

Equation	Elasticity Coefficient	p-value
Domestic Demand Equation	0.7364	0.098
Export Supply Equation	0.2691	0.011
Import Demand Equation	-6.578	0.031

leverage over the enterprises since these mining companies increase the share of stock that private investors hold and become all the more reluctant to comply with the government regulation. The average price subsidy overthe 4 yearperiod amounts to 32 %, while the calculated optimal subsidy fluctuates around 15 % and the optimal export tariff is exactly 18 %. Obviously, the situation is far from optimal and we look at the possible scenarios of moving from current price regulation to free trade and from free trade to optimal export tax, consumption subsidy and pricing policy.

"Actual" Consumption Subsidy — Free Trade

In this scenario we analyze the move to free trade, that is a situation when a 32 % consumption subsidy is eliminated to zero. With a free trade the world price equals domestic and reduces from 84 hrv/ton to 79, 5 hrv/ton, which implies that Ukraine does not have much market power to influence the world price. Domestic producers gain from a higher price on the home market and the amount of the producer Surplus is 66 883 068 hryvnias, while consumers lose from higherprices and their loss is 66 516 566. On net, the change in the total surplus for Ukraine is negative and amounts to 2633 497 hryvnias per month. Although this is not a huge sum, the situation supports the argument that Free Trade Policy may not be individually rational.

Free Trade — Actual Consumption Subsidy

Now we look at a situation when a government sets a consumption subsidy equal 32 %. This is a mirror case of the above scenario and the gain in the national welfare is 2 633 497 hrv. per month. We use this case as reference point to compare with the optimal tariffand subsidy situations.

Free Trade — Optimum Pricing (consumption subsidy)

Ad valorem Consumption subsidy amounts to 16 % and, when introduced, it benefits domestic consumers and hurts producers. The price on the domestic market goes down 70,9 hrv. per ton while on the world market it sets on the level of 82 hrv. per ton. As a result, consumer surplus is positive and is 34 432 725 hrv., while producers surplus is negative and equals 30 447 772 hrv. per ton. Thus, the change in total welfare is 3984 953 hrv. per month.

Free Trade - Optimum Export Tax

The optimum export tax is calculated to be 18 % and this leads to a price of70,77 hrv. per ton on domestic market and 83,46 on the world market. Consumers gain since quantity supplied to the domestic market is larger than quantity exported. Thus consumer gain is 30 089 765 hrv. per ton and producer loss is 57 968 682. The government gains 28 765 423 in revenue. On net, the total gain in the national welfare is 5 877507 hrv. a month, which a maximum out of all above mentioned policies.

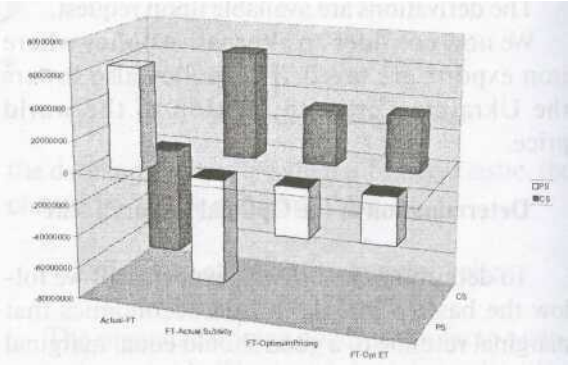

Fig. 2. Producers and consumer surpluses under different policy regimes

Fig. 3. The total change in national welfare under different policies

We see from Figure 5 that national welfare is maximized when a country moves from free trade to setting an optimal export tariff. Free trade seems not to be the optimal choice for Ukraine.

Conclusions

The empirical estimation showed that Ukraine does have market power at least on regional iron ore market. Thus the large country case is relevant. Even so, Ukraine faces a foreign elasticity of demand that appears to be in the vicinity of 7 to 8 and may be as high as 14. This is sufficiently elastic that Ukraine has modest market power.

The analysis showed that regime of "suggesting" lower iron ore prices for domestic market restricts exports and raises the world price, which is beneficial to Ukraine. Since Ukraine has rather limited market power, the overall gain to Ukraine is modest in comparison with free trade. The market simulation suggests that Ukraine's pricing policy has been subopti-

mal and that, on average, for the past 4 years the gap between the world and the domestic price has been too large. Even with the optimum pricing strategy, Ukraine's gains relative to free trade would have been relatively small. The distributive effect of the pricing policy has been much larger. In comparison with free trade iron producers have experienced substantial losses as have, in effect, subsidized the buyers.

The "suggested" pricing policy is becoming increasingly untenable, with the passage of time and further privatization iron producers are increasingly unwilling to follow suggested pricing guidelines. While a true consumption subsidy with payment made by government could be imposed, greater welfare gain are available to Ukraine from an export tax and move to an optimal export tax would reduce the losses of iron producers in comparison with the current pricing regime and leave positive, but lower benefits to consumers. Even with the optimum export tax, however, the overall gains relative to free trade appear small. Consequently, moving to free trade in iron would not be a major concession in Ukraine's WTO accession negotiations.

REFERENCES

1. *da Silva Neto A.L.* The international effects of mining projects. The case of Carajas iron ore // Resources Policy- 1993.- R 124-130.

2. *Gaisford J. D., Kerr W. A.* Economic Analysis for International trade Negotiations.- Edward Elgar, 2001.

3. *Gujaraii D. N.* Basic Econometrics.- McGraw-Hill: International Edition, 1994,

4. Optimal Trade and Industrial Policy under Oligopoly//The Quarterly Journal of Economics.— 1986.— May—V 101, Iss. 2.— P. 383-406.

5. ***Stlranovic*** *Steven M.* International Trade Theory and Policy Analysis.— 2000.— http://internationalecon.com

6. *Tarr D. G., Morkre M. E.* Aggreagate costs to the United States of tariffs an quotas on imports. General tariff Cuts and Removal of Quotas on Automobiles, Steal, Sugar, and Textiles // Bureau of Economics Staff Report to the Fedeal Trade Commision.- 1984 (December).

7. *Tcha MoonJong, Wright D.* (1999) Determinants of China's import demand for Australia's iron ore // Resources Policy— 1999.-№25.-P. 143-149.

8. *Tcha MoonJong.* East Asia Demand for Iron Ore.— 1997.— http://www.econs.ecel.uwa.edu.au/economics/Research/1997/dp9711.pdf

О. Юзефович

ОПТИМАЛЬНА ТОРГОВА ТА ПРОМИСЛОВА ПОЛІТИКА В УКРАЇНСЬКІЙ ЗАЛІЗОРУДНІЇ ГАЛУЗІ

Устатті визначається оптимальна торговельна політика для українського залізорудного сектора. Протягом останніх років у галузі існувало приховане планування обсягів залізорудної сировини, що мають постачатися на українські металургійні комбінати. Як наслідок, рівень цін на внутрішньому ринку був значно нижчий, ніж на зовнішньому, отже, українські металурги мали прибутки за рахунок виробників сировини. Оцінюється величина цих втрат та вираховується розмір оптимальної субсидії для виробників залізорудної сировини.