Bilaterally Constrained Trade Balance and Welfare

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Abstract

TBA Extremely incomplete preliminary version, please do not quote!

I. INTRODUCTION

The former socialist countries of Europe had bilateral trade agreements with many Western countries. Some of those imposed the requirement of bilaterally balanced trade, this was especially the case of trade between Finland and Soviet Union which also was more extensive (in relative terms) than for any other Western country, accounting at one point for more than 20 per cent of Finnish exports. This created a closed economy island, where the prices at which trade between the two countries takes place differed from the prices at the Western markets. In the case Finnish-Soviet Union a separate currency, the "transfer-rouble" was created and the financial transactions related to the bilateral trade were conducted through the Bank of Finland. Finnish firms were paid in dollars, but Russian firms obtained "transfer-roubles" which they could only use when trading with Finnish firms. The "transfer-roubles" were created by Finnish imports from Soviet-Union (mostly oil with world-market price). In Soviet-Union the "transfer-roubles" were allocated to firms according to the "goods exchange protocol" negotiated annually by the Finnish and Soviet governments specifying the quantitative targets for the bilateral trade in specific commodities.

The system gave Finnish firms market power vis-a'-vis Soviet partners as for the Finnish firms' trade with Soviet firms was voluntary: they had the option of trading with Western firms, but Soviet firms had no choice but to trade with Finnish firms. This pushed the Finnish export prices to Soviet Union above the prices obtained in Western markets and produced aggregate rents earned by Finland. Nothing similar happened on the Finnish import side as most of Finnish imports from Soviet Union was oil priced at the world market price. For other goods Finnish firms had always the option of buying goods from Western markets and as trade with Soviet firms was voluntary the Soviet traders did not have any market power.

The rents created by this trade certainly improved Finnish terms of trade and increased aggregate income. On the other side of the coin, the relative prices employed in the Finnish-Soviet trade differed from those prevailing in Western trade. In particular, the Finnish-Soviet trade could sustain Finnish production for which no Western markets existed, and thus create potential inefficiency in the economy. The purpose of this paper is to use basic trade theory to illustrate the source, if any, of the inefficiency the system created. I will build a stylized model of the Finnish-Soviet trade to highlight the trade-off between rents and inefficiency with implications also in factor markets. Thereafter I look (theoretically) at the welfare effects of "opening of trade", the abolition of the closed economy island (which took place almost overnight in 1991), and try to

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find out conditions which would guarantee a Pareto-improvement. Given that structural changes
were implied the discussion is connected to the trade-adjustment assistance literature. The results
will be used to evaluate qualitatively the impacts of the collapse of this trading arrangement. An
interesting detail in the trade arrangement was that Finland applied to Soviet trade the same
policies that applied to Finnish trade with EU and EFTA countries.

The impacts of Finnish-Soviet have been mostly studied from macroeconomic point of view
(Gorodnichenko, Mendoza and Tesar 2012, Honkapohja, Koskela, Leibfritz, and Uusitalo 2009,
Conesa, Kehoe and Ruhl 2007) and in relation to the economic depression of Finland in the early
1990’s as that was also a period when the Finnish-Soviet trade collapsed. What is lacking is the
trade theory point of view. Yet, both macroeconomic and trade issues were important when the
trade agreements were negotiated (Holopainen 2009). The next section lays out the elements of
the model to be used to be followed by a section providing special cases of the general framework
to highlight the impacts of the kind of trade conducted between Finland and Soviet Union. The
last section lays out simple welfare analysis.

II. The Model

Let $p$ denote the vector of consumer prices and $q$ denote producer prices in the economy $F$ trading
with $SU$. It is assumed that the country in question is a small open economy in its trading relations
with the Western markets. Hence, without (trade) policies the consumer and producer prices
applying to trade with goods both and sold in Western markets would be equal to the Western
world market prices. A subset of goods is traded also with $SU$. We assume, for simplicity and
realism, that the only good imported to $F$ from $SU$ is oil, and all oil $F$ is importing comes from $SU$.
Assume also that oil is used only by firms facing the price $q^o$. $SU$ is, on the other hand, importing
several goods from $F$. As the imports by $SU$ increasingly consisted of consumer goods in
1980’s (in contrast to earlier times when they consisted of ships and machinery) we assume that
all goods imported by $SU$ are consumer goods.

Let $M$ be the volume of a good exported to $SU$. We assume that it is identical to the good the
firm(s) producing it in Finland export (if any) to Western markets. The unit cost of producing it is
$c(w, q^o)$ where $w$ indicates the prices of all primary inputs and potentially all intermediate goods
except oil. Then total oil imports needed for the production of the exports to $SU$ are

$$M^o = \sum_{i=1}^{m} \frac{\partial c_i}{\partial q^o} M_i$$

We assume that the price $SU$ gets from its oil exports to $F$ equals the world market price,
exactly as was the practice in the Finland - Soviet Union -trade. Thus, the price paid by Finnish
firms for oil is the world market price adjusted for Finnish taxes/subsidies. The demand for other
inputs in $SU$ trade is obviously given by

$$V_j = \frac{\partial c_i}{\partial W_j} M_i$$

where $j$ is the index for inputs. Let $V_M$ denote the vector of inputs used by $F$ firms in their trade
with $SU$. Then the income generated by the economy not serving $SU$ markets is given by the
GDP-function

$$Y^w = G(q, q^o, V - V_M)$$

The producer prices will be explained below. The demand for oil generated by this economy is
and thus, the total "transfer roubles" generated in F is

\[ T = q^{wo} (M^o + M^{wo}) \]  

Note that the total amount of "transfer roubles" generated is a function of "transfer roubles" generated through purchases made from Finnish firms. This is to be allocated to Soviet buyers of Finnish goods. The planned purchases, or their values, are specified in the "commodity exchange protocol". Let us assume that the target value of purchases by SU of industry \( i \) product is \( T_i \), and obviously then \( \sum T_i = T \). The "transfer roubles" allocated to the purchase of particular items is given as a budget for the SU trader, one of them for each industry.

We model the trade volume by a simple standard bargaining model. The idea here is that, ceteris paribus, the trading arrangement gives bargaining power to F sellers as they know that the "transfer roubles" cannot be used for purchases from sellers from other countries. Also, consistent with F firms being small in the world markets, they can be large in the market for goods traded with SU. Since there is no official market and market price but each transaction has to be negotiated with the SU trader and a Finnish firm the negotiation process would be very costly if F firms would have small production capacity. So only firms with large production capacity are engaged in negotiations. We assume there to be only one F firm in each industry negotiating with the SU trader for that industry\(^2\). The price to be used in the negotiation maximizes the Nash-product

\[
\left[ \left( q_i^S - q_i \right) \frac{T_i}{q_i^S} \right]^{\beta_i} \left( \frac{T_i}{q_i^S} - Z_i \right)^{1-\beta_i}
\]

Here \( q_i^S \) = the price applied in the trade and \( q_i = \) the price the would get were it to sell the good in the Western market (if it would be exported) or in the F market (were the good imported to F in net terms). The F firm tries to maximize the rent per unit sold to the SU trader. We assume that there are incentives for the SU trader to maximize the volume of goods obtained, \( Z_i = \) target value for the volume of purchases set in the "commodity exchange protocol" or by the SU planning system. \( \beta_i = \) the negotiation power of the sector \( i \) F firm. The first order condition for the solution can be written as

\[
\frac{q_i^S - q_i}{q_i} = \beta_i \left( 1 - \frac{q_i Z_i}{T_i} \right)
\]

The incentive compatibility condition for the F firms to trade with the SU is

\[
q_i^S \geq q_i \iff q_i^S Z_i \geq q_i Z_i
\]

Since by the SU trader’s budget constraint at the same time \( q_i^S Z_i \leq T_i \) and so \( \frac{q_i Z_i}{T_i} \leq 1 \) with strict inequality holding for there to be trade for any \( 0 < \beta_i < 1 \). It is then clear that the more "transfer

\(^1\)This assumes that all oil imports by F come from SU. This was basically true for the Finnish oil imports. But recall that the oil price was the same as in the world markets and there was potential of benefits from importing it from Soviet Union.

\(^2\)Since the total "pie" is given one could think of the possibility of Finnish firms engaging in some sort of game of attrition to increase their own share. Since Finland was and still is a corporatist state with employers having a centralized organization to present employers in all kinds of negotiations. This was also the case in negotiations over the "commodity exchange protocol".
"roubles" are allocated to a sector the larger will be the rent earned by the F firm in that sector. The closed form solution for the transaction price is:

\[ q_i^S = \frac{q_i}{1 - \beta \left(1 - \frac{q_i Z_i}{T_i}\right)} \] (9)

This shows that for a given allocation of "transfer roubles" between SU buyers F sellers earn larger rents the larger the total amount of "transfer roubles" is. This is one source of potentially surprising effects of the bilateral trade balance requirement: deterioration of a country’s terms of trade (here increase in the price of imported oil) improves the terms of trade in its trade with one partner. The impacts on total income may be ambiguous and thereby also on the welfare.

The final model element needed is to specify the impact of SU trade producer prices on the production decisions at the margin. There are two possibilities. One is that an industry engaged with SU trade also produces for non-SU markets, either for home markets or non-SU export markets or comptes against imports from non-SU markets in F. In all of these cases the price at the margin determining the aggregate production in these sectors is given by the world market prices or by the home market prices. The other possibility is that the SU trade prices are high enough keeping alive F production that otherwise would not exist. In this case total production is determined by the SU trade quota and prices do not matter, the firms in the sector are demand constrained in their production. This case prevails if at the non-SU prices in the sector the unit cost of production are larger than the price. This is an extreme form of trade diversion the bilateral trade balance requirement may create.

This implies that in the only prices appearing are the producer prices of sectors which on the margin are producing for non-SU markets. The aggregate GDP of the economy consists now of the value of production to all markets and the rents earned from the SU-trade. Note that

\[ \frac{T_i}{q_i^S} \equiv M_i \] (10)

Remembering this, the value added at producer prices is

\[ Y = G \left(q^{nSU}, q^o, V - V_M\right) + \sum_{i \in nSU} \left(q_i^S - q_i\right) M_i + \sum_{i \in N \setminus nSU} q_i^S M_i - \sum_{i \in N \setminus nSU} q^o \frac{\partial c_i}{\partial q^o} M_i \] (11)

where \(q^{nSU}\) is the producer price vector for the sectors which are producing also markets other than SU, with \(nSU\) denoting the set of those industries. The first term is the same as above, the value added created by the production for nonSU-markets, the second term are the rents earned from F-Su trade by the firms exporting at the margin to nonSU markets, the third and fourth terms together give the value added produced by the sectors selling only to SU. The third term gives the gross value of production from which the expenditure on oil is deducted (the fourth term) to get the value added produced by those firms.

The factor market equilibrium conditions are

\[ \sum_{i \in nSU} \frac{\partial c_i}{\partial w_j} Q_i + \sum_{i \in N \setminus nSU} \frac{\partial c_i}{\partial w_j} M_i = V_j, j = 1...O \] (12)

where it is assumed that the factor supplies \(V_j\) are fixed.

For firms which are producing also for non-SU markets the price has to equal unit cost:

\[ q_i = c_i \left( w \right) \] (13)

But this does not have to hold for the firms in industries producing solely for SU markets (and by the assumptions above there is only one such firm in each such industry). For these firms then

\[ q_i < c_i(w) \leq q_i^S \tag{14} \]

and the case \( c_i(w) < q_i^S \) is the relevant case. Let us assume that this price is negotiated in the same way as the price of other items exported to SU. In this case the "threat point" of the Finnish exporter is \( c_i(w) \) and the resulting price is

\[ q_i^S = \frac{c_i(w)}{1 - \beta \left(1 - \frac{c_i(w)Z_i}{T_i} \right)} \tag{15} \]

These equations together with 5 and 9 determine the supply side equilibrium. Note that, in general, the factor prices relevant for 15 are determined in the system, as a fixed point, as the existence of the supply to SU markets only has also implications for the factor market equilibrium. The existence of "extra profits" at the margin in the "SU markets only production" is due to the rationing in supply even if there exists potential competition: a given quantity is to be supplied for this purpose only. One could think of the situation where potential suppliers submit bids to the SU traders but again, nothing like that was observed to take place. Also bidding in the form of giving bribes to SU traders was not, surprisingly, observed. One reason may be that it as easy in the Finnish side for potential suppliers to collude.

The practices of negotiating the annual "goods exchange protocol" also helped Finnish firms to maintain their bargaining power (Holopainen 2009). The protocols were negotiated in a special commission where Finnish firms also had their representatives. Individual firms were eager to get their own representative in the commission to establish ties to the Soviet side responsible also for conducting the trade from Soviet side. Finnish representatives were chosen by the office in charge of the Soviet trade in the Ministry of Foreign Affairs in agreement with the Finnish Employer’s Association which included as its most influential members the largest Finnish firms. Thus, the relevant number of firms with which Soviet traders negotiated was small.

The most important item Finland imported from Soviet Union was oil. Initially the trade protocol specified the oil price for a fixed period, the motivation was to stabilize the price. Thus, there were long periods when the price was above or below the world market price. Since the trade was voluntary for Finnish firms the situations where price is above the world market price could not be sustained. As a result, the price of oil was in the end indexed to the world market price. Thus, Soviet side did not have any negotiation power in setting the oil price.

The distinction between goods specific to Soviet markets and goods for which markets in margin were global markets is important. In their work Gorodnichenko et. al (2012) assume that all Finnish exports to Soviet Union were specific to those markets (in the last category of goods discussed above). Yet, for most of the goods exported to Soviet not all of the production/exports went to Soviet Union (Kajaste 1999). One way to understand the actual situation is to think of the industries producing several goods, in particular firms being multiproduct firms with some products being solely designed for Soviet markets (like some textiles). The previous exposition is general enough to include this possibility. To see this assume (in lines e.g. of Laitinen and Theil 1978) that in each industry there is a linearly homogenous production function (sectoral production possibility frontier)

\[ F_i(y_i, v_i) = 0 \tag{16} \]

\(^3\)Finland is one of the least corrupted countries in the world, and also in this case there does not seem to be even any anecdotal evidence of attempts by Finnish firms to bribe Ministry officials.
where \( y_i \) is the vector of products produced and \( v_i \) the vector of (primary) inputs used in sector \( i \). The sectoral GDP function can be defined as

\[
\max q_i y_i \\
\text{s.t.} \\
F_i(y_i, v_i) = 0 \\
v_i \leq \bar{v}_i
\]

This gives the sectoral value added function \( g_i(q_i, \bar{v}_i) \). Assume that all products are unique to one sector, there is no overlap. Then the aggregate GDP function is the value function of the problem

\[
\max \sum_i q_i y_i \\
\text{s.t.} \\
\sum_i \bar{v}_i \leq v
\]

giving the GDP function \( g(q, v), q = (q_1, \ldots, q_n) \). It is straightforward to include foreign imported intermediate good like oil. The competitive market equilibrium conditions are easily expressed in standard fashion if one assume the function \( F_i(y_i, v_i) \) to be separable so that there are both output and input aggregators with which \( F_i(y_i, v_i) = F_i(y_i) = F(Y_i, V_i) \) with both \( Y_i \) and \( V_i \) linearly homogenous implying the existence of an industry price index and unit cost function.

An alternative to this would be to assume that in each industry a variety of differentiated products is produced, each variety by a single firm, like in Falvey (1981). This would lead formally to identical expressions like above.

Using \( \frac{\partial F_i}{\partial y_i} \) it is obvious that for all the varieties supplied at the margin to Western markets one must have

\[
q_{i,s} = \lambda \frac{\partial F_i}{\partial y_i} \\
\]

where \( \lambda = \) Lagrange-multiplier associated with the constraint, while for the variety produced for SU market only

\[
q_{i,s} < \lambda \frac{\partial F_i}{\partial y_i} \leq q_{i,s}^{SU}
\]

The interesting question now is how the production of a new variety made profitable by the price offered affects the industry output (for given prices in Western markets). There are two basic considerations. The first is that, with given sectoral inputs, products may be complements or substitutes, an increase in the price of one product may increase the supply of some products while reducing the supply of other products. The second effect comes from the reallocation of inputs. If the birth of production for SU markets leads to a flow of inputs to the sector it may be the case that the production of all products in the industry expands (with other industries contracting). Within an industry the new product may thus lead to trade creation, increase in exports to both SU and Western markets while the opposite happens in other industries. All these effects can be illustrated with the help of the simplest textbook trade models.
III. Examples

The general model is hard to analyze. To get an idea of how the bilateral balanced trade constraint affects the economy let us as an example first use the simple Heckscher-Ohlin framework. Assume first that there are three sectors all potentially producing for the world markets. Assume two domestic factors of production, capital and labor, and one foreign, oil. These assumptions imply that, in general, for given producer prices only two of the sectors will be producing in , one will not produce anything. Assume that the active sectors are 1 and 2, and both, at the margin, are producing for world markets. Then the factor prices will be both with and without SU trade be determined by

\[ c_1 (w, r, q^o) = q_1 \]
\[ c_2 (w, r, q^o) = q_2 \]

Without SU trade

\[ q_3 < c_3 (w, r, q^o) \]

but with SU trade

\[ c_3 (w, r, q^o) \leq q_3^o \]

The factor market equilibrium conditions are

\[ \frac{\partial c_1 (w, r, q^o)}{\partial r} Q_1 + \frac{\partial c_2 (w, r, q^o)}{\partial r} Q_2 = K - \frac{\partial c_3 (w, r, q^o)}{\partial r} M_3 \]
\[ \frac{\partial c_1 (w, r, q^o)}{\partial w} Q_1 + \frac{\partial c_2 (w, r, q^o)}{\partial w} Q_2 = L - \frac{\partial c_3 (w, r, q^o)}{\partial w} M_3 \]

where \( Q_i, i = 1, 2 \) is the total production in sector \( i \).

These equations show that the SU trade effect from sustaining an "uncompetitive" industry comes through the familiar Rybczynski-effect: SU trade reduces the supply of both factors of production to the competitive industries but also changes the relative factor endowments available to them. The first effect tends to reduce the production of both of the competitive industries, the latter favors one of them and contracts the other further. The net effect on the level of production in any competitive sector is ambiguous but for sure at least one of them contracts and one may expand, all depends on details. In the extreme when the volumes in SU trade are high it can crowd out completely a sector/product which could also sell to non-SU-markets. In this two-sector example this type of crowding out would imply that factor prices would not be nailed down by the industries competitive at non-SU-markets, domestic factor supplies would also matter.

But there is another effect and it is on the composition of non-SU-trade. The previous equations can be rewritten as

\[ \frac{\partial c_1 (w, r, q^o)}{\partial r} (R_1 + M_1) + \frac{\partial c_2 (w, r, q^o)}{\partial r} (R_2 + M_2) = K - \frac{\partial c_3 (w, r, q^o)}{\partial r} M_3 \]
\[ \frac{\partial c_1 (w, r, q^o)}{\partial w} (R_1 + M_1) + \frac{\partial c_2 (w, r, q^o)}{\partial w} (R_2 + M_2) = L - \frac{\partial c_3 (w, r, q^o)}{\partial w} M_3 \]

where now \( R_i, i = 1, 2 \) is the quantity sold in non-SU-markets, \( R_i + M_i = Q_i \).
Now these equations determine the quantity sold in the non-SU-markets. If \( \frac{Q_1}{Q_2} \neq \frac{M_1}{M_2} \) there is another Rybczynski-type of effect coming from the SU trade on F competitive industries. If e.g. \( \frac{Q_1}{Q_2} < \frac{M_1}{M_2} \) the SU trade will crowd out relatively more of sector 1 trade in non-SU market thus, the bilateral trade constraint diverts trade from non-SU markets through two channels here: The direct effect on the supply of factors of production to competitive industries by sustaining non-competitive production and indirect effect coming from trade pattern differences in SU and non-SU trade. Note at this stage that these effects need not reduce welfare (aggregate real income) but they clearly show that trade subject to bilateral trade constraints will, in general, have structural effects.

Note also that nothing here prevents the case where the good being imported in net terms from non-SU-markets is exported from F to SU-markets.

A potentially interesting implication of the bilateral trade balance requirement is that the general equilibrium supply curves can be downward sloping. To see this assume that oil is used in fixed proportion to gross output. This implies that the relevant price for each sector is the value added price \( q^i_o = q_i - \alpha_i q^o \) where \( \alpha_i \) is the sector \( i \) oil requirement per unit of output. In general a change in the oil price will change the relative value added prices with the value added price of a sector more intensively using oil declining with an increase in oil price. In case of no bilateral balance requirement resources would shift towards the sector with increasing relative value added price. But with bilateral trade balance requirement exports to SU (increasing with the price of oil) can reduce the net supply of factors used intensively by the sector experiencing improved terms of trade. This Rybczynski-effect tends to reduce the supply in that sector implying that the net effect of change in relative producer prices on the supplies is ambiguous.

**B:** The other special case is one where one industry is solely producing for F markets when there is no SU-trade (like construction in the Finnish case), otherwise we retain the assumptions above. Then

\[
\begin{align*}
  c_1 (w, r, q^o) &= q_1 \\
  c_2 (w, r, q^o) &= q_2 \\
  q_3 &= c_3 (w, r, q^o)
\end{align*}
\]

where the last equation determines the producer price of the domestic sector. The factor market equilibrium conditions are now

\[
\begin{align*}
  \frac{\partial c_1 (w, r, q^o)}{\partial r} Q_1 + \frac{\partial c_2 (w, r, q^o)}{\partial r} Q_2 + \frac{\partial c_3 (w, r, q^o)}{\partial r} Q_3 &= K \\
  \frac{\partial c_1 (w, r, q^o)}{\partial w} Q_1 + \frac{\partial c_2 (w, r, q^o)}{\partial w} Q_2 + \frac{\partial c_3 (w, r, q^o)}{\partial w} Q_3 &= L
\end{align*}
\]

In this case the SU-trade does **not** have any effect on the structure of production, all sectors earn pure rents. But there is the same effect as above on the structure of non-SU-trade if the structure of the SU-trade differs from the non-SU-trade, as the previous equations can be rewritten as

\[
\begin{align*}
  \frac{\partial c_1 (w, r, q^o)}{\partial r} (R_1 + M_1) + \frac{\partial c_2 (w, r, q^o)}{\partial r} (R_2 + M_2) + \frac{\partial c_3 (w, r, q^o)}{\partial r} (R_3 + M_3) &= K \\
  \frac{\partial c_1 (w, r, q^o)}{\partial w} (R_1 + M_1) + \frac{\partial c_2 (w, r, q^o)}{\partial w} (R_2 + M_2) + \frac{\partial c_3 (w, r, q^o)}{\partial w} (R_3 + M_3) &= L
\end{align*}
\]
These models can be closed by using the bilateral trade balance requirement and the pricing equation and specifying the allocation of "transfer roubles" between sectors. With the help of those one can then calculate the implications of changes in the world market price of oil on the structure of the F economy.

C: With factors specific to industries the SU-trade would have an impact on factor prices also and thereby on the price of the good produced only for the SU markets. But again, without any other changes in the model the effects of SU-trade are analogous to those found above. TBC

The existence of a purely closed/non-traded sector producing only for the domestic market will change many of the conclusions. Now even if all exports to SU were intramarginal and the SU trade would generate pure rents increasing domestic income thereby increasing demand for the non-traded good. The effect is the more pronounced the higher the oil price is: SU-trade would bring resource boom to a country importing the resource. This then leads to all the possibilities of "Dutch disease" (analyzed e.g. in Corden and Neary 1982) and which is the channel which is emphasized e.g. in Gorodichnenko et. al. 2012.

The "Dutch disease" effect can be more pronounced with SU-trade if it involves F production solely for the SU-market, as then there is direct outflow of productive resources from the sectors producing, at the margin, to non-SU-markets. TBC

IV. Welfare and Bilaterally Balanced Trade

The type of trading arrangement modelled above could, in principle, be seen as a special case of a free trade area, where for some goods a market within the area only is formed. One could, thus, try to apply the standard welfare analysis used for the evaluation of welfare impacts of free trade areas (like in Krishna-Panagariya 2007). But this does not seem to be proper. E.g. nothing in the arrangement seems to give any (economic) benefits to the other party (SU). The only meaningful issue then is whether it was beneficial to the other party, F. I first indicate what the trade-offs potentially are.

First, it is obvious that if the trade was completely intramarginal, with marginal exports and imports being conducted at the world market prices, the SU-trade would just bring rents to the F economy and would thus improve F aggregate welfare. This is an example of beneficial trade diversion (case A above). Secondly, by implication, adverse welfare implications can only arise if the SU-trade implies a flow of resources from sectors producing at the margin to non-SU-markets to markets producing only for the SU-markets. To understand the trade-offs involved one can apply the simplest analysis of gains from trade. Let the superscript 1 refer to the case of SU-trade, the superscript 0 to the case without it. Assume that in both cases the consumer prices remain the same and also that the world market prices are unaffected by the SU-trade. This is very much along the lines of case A in the previous section. Let \( E() \) be the expenditure function. Then we have

\[
E\left(p^0, u^1\right) \leq p^0C^1 = G\left(q^0, q^0, V - V_3^{SU}\right) + \pi_1M_1^{SU} + \pi_2M_2^{SU} + q_3y_3 - q^0O_3
\]

\[
< G\left(q^0, q^0, V\right) + \pi_1M_1^{SU} + \pi_2M_2^{SU} + q_3y_3 - q^0O_3
\]

Here \( \pi_i \) is the rent per unit exported to the S-markets of good \( i \), \( O_3 \) is the imports of oil by sector 3.

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4 Assuming that the price of that good would not be pinned down completely by the non-SU-market prices as above, but also the domestic market equilibrium condition is needed.
Clearly, if
\[ \pi_1 M_{1}^{SU} + \pi_2 M_{2}^{SU} + q_1^1 y_3 - q^0 O_3 < 0 \] (37)
we would have
\[ E \left( p^0, u^1 \right) < g \left( q^0, q^o, V \right) = e \left( p^0, u^0 \right) \] (38)
implying that \( u^0 > u^1 \) and the SU-trade would be welfare-reducing. The F-SU-trade is balanced if
\[ \left( q_1^0 + \pi_1 \right) M_{1}^{SU} + \left( q_2^0 + \pi_2 \right) M_{2}^{SU} + q_3^1 y_3 = q^o \left( O_1 + O_2 + O_3 \right) \] (39)
where it is assumed that all oil is being imported from SU. The bilaterally balanced trade implies that
\[ \pi_1 M_{1}^{SU} + \pi_2 M_{2}^{SU} + q_3^1 y_3 - q^o O_3 = q^o \left( O_1 + O_2 \right) - \left( q_1^0 M_{1}^{SU} + q_2^0 M_{2}^{SU} \right) \] (40)

The last term on the right hand side gives the opportunity cost of exporting goods 1 and 2 to SU markets, the income that could have been earned from exports to non-SU-markets. The first term on the RHS gives the oil income sectors 1 and 2 create in the SU-markets which can be used to generate the rents earned by all the F sectors together. If the latter is smaller than the former then the SU-trade leads to (aggregate) welfare loss. This is the case if the production in the sectors exporting at the margin to the non-SU-markets is not very oil intensive but, on the other hand, large share of the production is exported to SU-markets.

If these conditions do not hold then
\[ \pi_1 M_{1}^{SU} + \pi_2 M_{2}^{SU} + q_3^1 y_3 - q^o O_3 > 0 \] (41)

and the SU-trade can be welfare improving. In the period when SU-trade was most extensive the main Finnish export industries were forest industries (paper, pulp, sawmills) which were very energy intensive, along with heavy metal industries. Among the sectors exporting to SU were some parts of the textile industries which were not very energy intensive. Thus, the actual SU-trade could have been welfare improving.

There is another way to approach the welfare comparison, recently proposed by Bernhofen et. al (2011). They argue that the gains from opening a country for (free) trade can be measured by the implicit change in primary production factors embodied in net imports. If the change is positive then there will be gains, as the country has gotten indirect access to the production resources in the rest of the world. The same idea can be used to compare different trading situations. Assume we look at the implications of the move from SU-trade case to the non-SU-case. The net change, evaluated at the SU-factor prices (the factor content equivalent measure) is, assuming that the aggregate F supply of primary factors, \( V \), is the same in both cases. The change in implicit factor supplies is then
\[ \Delta V^E = w^1 A^1 \left( T^0 - T^1 \right) \] (42)

where the superscript 1 again refers to the SU-trade situation, 0 to the case without SU-trade, \( T \) is the net import vector and \( w \) the vector of factor returns, and \( A \) is the input-output-matrix. To evaluate the sign of this expression data exists, at least in principle. This is in contrast to the evaluation of gains from trade from an autarky situation.

TBC
V. ADDITIONS AND CONCLUSIONS

TBA

REFERENCES

ETSG 2011.

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