TRANSPORT COSTS AND THEIR IMPACT ON TRADING THROUGH SIMULATIONS IN A SPECIFIED DORNBRUCH-FISCHER-SAMUELSON MODEL - 1977

Prof. univ. dr. Viorica PUŞCĂCIU
Prof. univ. dr. Florin Dan PUŞCĂCIU
Universitatea „Danubius” din Galaţi

Abstract: We propose here a brief presentation of the Ricardian model with continuum of goods known as the Dormbusch-Fischer-Samuelson-1997, by the name of the ones who created it. Starting from this theoretical base we will create numerous examples which will be made by an informatic program and we will concentrate over the impact on transport costs at countries levels. We want to measure the transport impact over the countries specializations and over the range of good trades.

Keywords: ricardian model with continuum of goods, transport costs, specialisation, trading, numerical simulation

A brief presentation of the model:
The ricardian model with continuum goods, D.F.S., means an extention of the classic comparative advantage model, which Paul A. Samuelson was appreciating it like „the most beautiful idea from economical science.”

D.F.S model shows the existence of two countries, which we will symbolize for simplification with I.T.(internal country) and E.C. (external country), gifted with only one production element(work), whose offer is designated by L and L*.

Every country is able to produce a big number of goods, any good being individualised by a symbol that belongs to the brake [0,1] and asking for a specific work measure, obviously different between countries. For example, for good z, a(z) means the unit requirement of label in I.C., and a*(z) means the unit requirement of label in E.C. We can define like this a report like A(z)=a*(z)/a(z) meaning measuring ratio in I.C. comparing with E.C.

\[ A(0) \geq A(z) \geq A(1) \quad \text{și} \quad \frac{d}{dz} A(z) < 0 \]

In other order of meaning, using this dispose of goods in decreasing order, we make a hierarchy based on comparative advantage of the I.C. We can display in graphic way the relationship between relative rate of wages or relative productivity and a specified good, showed by his index z, which can be found on A(z) curve created by an infinity of goods, which will have a continuum and decreasing form.

The cost of production for a good z in I.C is Wa(z), W representing the wage in this country, in same time the same good will have a cost in E.C. W*a*(z), W*, being the wage in this country. Ny consequence the good z will be a little cheaper in being made in I.C., comparing E.C., if is fulfilled the inequality:

\[ Wa(z) < W*a*(z) \quad \text{or through modifications if W/W*a(z)/a(z) or A(z) > W/W*} \]

This way, basing on A(z) curve and rate of wage W/W* it can be study the origin of specialisation of countries for an infinity of goods. See figure 1.
It will be a good(limit) z1 which the incuation will become ecuation A(z1)=W/W* and will generate all good shaving clues smaller than z1 to be made in I.C, and also, all the other goods with clues bigger than z1 to be made in E.C.; see the arrows in figure 1. We presume that the measure of waste for purchasing a good has a constant weight in income, and by consequence we admit a weight b(z) from mondial income is spent on purchasing good z.

By consequence we are measuring the weight that is spend from mondial income for purchasing goods made in I.C., goods that will have smaller hierarchy of index than z1. The weight of mondial income spent for all the goods made in I.C. will be:

$$G(z_1)=b(1)+b(2)+b(3)+\ldots+b(z_1) = \int_0^{z_1} b(z) \, dz$$

The total value of spending circumstance of goods purchase made in I.C. l will be G(z) multiplied with mondial income, nut this is equal with the product between wage and the number of workers in this country, so we have: W_L = G(z1) mondial income.

But mondial income were work is the only production factor is shown by the sum of income wages like this: mondial income = W_L + W^* L^*

This way, previous relation it retiped like: W_L = G(z1)(W_L + W^* L^*) sau prin rearanjari W/W^* = B(z1)(L^*/L), in care B(z1) = G(z1)/(1 - G(z1))

This last relation shows that B(z1) will be bigger, when income will be smaller when z1 is raising, in other meaning it will be a same way of modification between z1 and B(z). There will be more goods that I.C. will produce and waste and so E.C., as much as relative diment for work is bigger in I.C, which will be shown by a bigger rate of wage. We obtain a relationship between relatit rate of wage and indexes of goods, which graphich is shown in figure 2, showing the dimend composition in this model:
From the turn of the two curbes it will appear a level of relative wage rate and a index of limit good, which will show the structure of goods made in I.C and E.C.

In terms of goods lines, the origin of specialisation is made for I.C. by \(A(z) > \frac{W}{W^*}\), when for E.C by \(A(z) < \frac{W}{W^*}\).

3) The introduction of transport costs

The introduction of transport costs in D>F>S model are achieved through the presumption that those are like „iceberg”, meaning from a unit of good send just a fraction \(t(z)\) reaches effectively at his destination, the rest of it „melting” on his way. Also, we impose, the condition that the transport cost measure is the same for all goods \(t(z) = t\) and it is independent of the goods flux between countryes.

In this situation, I.C. will produce and export these goods and the equation will be solved:

\[\text{(1/t)}w_0(z) \leq \frac{w_0(z)}{\frac{w_0(z)}{w_0(z)}} \leq \frac{1}{t}A(z)\]

In mutual way, E.C. will make and export these goods which for the measure of unitary cost of work is smaller than the one of imported goods, respective when the inecuation will be solved: in figure three are represented \(A(z)\) curves interrupted blue- and \(A(z)/t\)-continuum red, depending on \(z\) and the relativ salary.

This way, for a relativ wage given, I.C. will produce and export all the goods sitated in the left side of \(A(z)/t\) curve, arrow to right, both countryes will produce intermediate goods, uncovered by arrows, and T.E.. will porduce and export the goods from the right side of \(A(z)/t\), the arrow to left.
As the transport cost $t$ is defined, as a fraction from a unit that reaches at destination, that means that the smaller the value of $t$ is, the bigger the transport cost is, the good „melting” on his way, and figure 4 show the extension of comercialized goods.

4) Numerical simulation:

We can explain these function: 

\[ A := \frac{c - dzL}{(e + f zL)} t \]

\[ AA := \frac{(c - dzL)}{e + f zL} t \]

\[ \lambda_1 := \int_{x1}^{1} b(z) dz \]

\[ \lambda_2 := \int_{0}^{x2} b(z) dz \]

\[ b(z) := 2 - 2z \]

That keeps the properties given by the model which will permit the numerical simulations, for different measures of the coefficients: $c$, $d$, $e$, $f$ and of the parameters $L_1$, $L_2$ and $t$.

This way, for $c=10, d=5, e=1, f=2, L_1=10, L_2=10$ and transport costs between 0.75 and 0.95 we obtain next origins of specialisations, see table nr 1.

Tabel Nr. 1 Basic model

<table>
<thead>
<tr>
<th>cost de transport</th>
<th>0.75</th>
<th>0.80</th>
<th>0.85</th>
<th>0.90</th>
<th>0.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>bunuri exportate de tara interna</td>
<td>0.4433€</td>
<td>0.4611€</td>
<td>0.47899€</td>
<td>0.49671€</td>
<td>0.5142€</td>
</tr>
<tr>
<td>bunuri exportate de tara externa</td>
<td>0.7965€</td>
<td>0.7347€</td>
<td>0.6778€</td>
<td>0.6252€</td>
<td>0.5766€</td>
</tr>
</tbody>
</table>

If we would record a growth on work ofert of I.C., presumptive $L_1=L_2$, all other measures remaining not changed we will obtain informations from table nr2.
We can see smaller domains for commercialised goods by I.C., while the goods of E.C. are extending. If we would register a growth of work productivity, it would show a shorten of coefficient e and f, presumed to be e=0.75 și f=1.5 în the condition of keeping to the other values constant, the informations beeing centralized în table three.

We can see the growth of exported goods by I.C. and a decrease of the exported goods domain by E.C. where work productivity is not modifies.

**Bibliography:**

2) Thiemer, A. - *A Ricardian Model with Very Many Goods FH-Kiel*, University of Applied Sciences, 2002;