Transport Costs and their Impact on Trading through Simulations in a Specified Dornbruch-Fischer -Samuelson Model-1977

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Abstract: We propose here a brief presentation of the Ricardian model with continuum of goods known as the Dormbusch-Fischer-Samuelson-1997, named by the ones who created it. Starting from this theoretical basis we will create numerous examples made by an informatics program and we will focus over the impact on transport costs at the level of countries .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

Jel Classification: L9, L90, L98, L91

A brief presentation of the model

The Ricardian model with continuum goods, D.F.S., means an extension of the classic comparative advantage model, which Paul A. Samuelson was appreciating it as "the most beautiful idea from the economic science."

D.F.S model shows the existence of two countries, which we will use it as I.T. (internal country) and E.C. (external country), with only one production element (work); its offer is designed by L and L*.

Every country is able to produce and waste a big number of goods, any good being individualised by a symbol that belongs to the brake [0,1] that asks for a specific work measure, obviously they are 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 a report as: A(z)=a*(z)/a(z) meaning measuring ratio in I.C. comparing with E.C.

$$A(0) \geq A(z) \geq A(1) \text{ and } \frac{d}{dz} A(z) < 0$$

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

The cost of production for a good z in I.C is Wa (z),W represent 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 inequation:

Wa(z)<W*a*(z) or through modifications if W/W*<a*(z)/a(z) or A(z)>W/W*

This way, basing on A(z) curb and rate of wage W/W* it can be studied the origin of countries' specialisation for an infinity of goods. See figure 1.

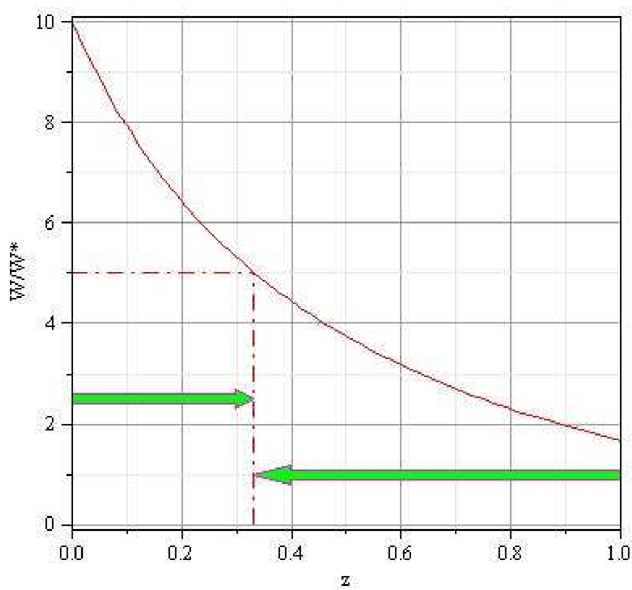

Fig 1 The ratio between the wage W/W* and the goods symbols z

It will be a good (limit) z1 where the inequation will become equation A(zl)=W/W* and it will generate all good shaving clues smaller than z1 will be made in I.C, and also, all the other goods with clues bigger than z1 will 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 that a weight b(z) from world income is spend on purchasing good z.

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

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

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

But the world income is the only production factor that it is shown by the sum of income wages such as: world income = W L +W*L*

This way, previous relation it retyped as: W L =G(zl)(W L+W*L*) or by rearranging W/W*=B(zl)(L*/L), where B(zl)=G(zl)/(1-G(zl)

This last relation shows that B(z1) will be bigger, when income will be smaller and z1 is rising, that is it will be the same way to modify z1 and B(z).There will be more goods that I.C. will produce and waste; so E.C., as much as relative dimension for work is bigger in I.C, which will be shown by a bigger rate of wage. We obtain a relationship between relative rate of wage and indexes of goods, which graphic is shown in figure 2, showing the dimension composition in this model:

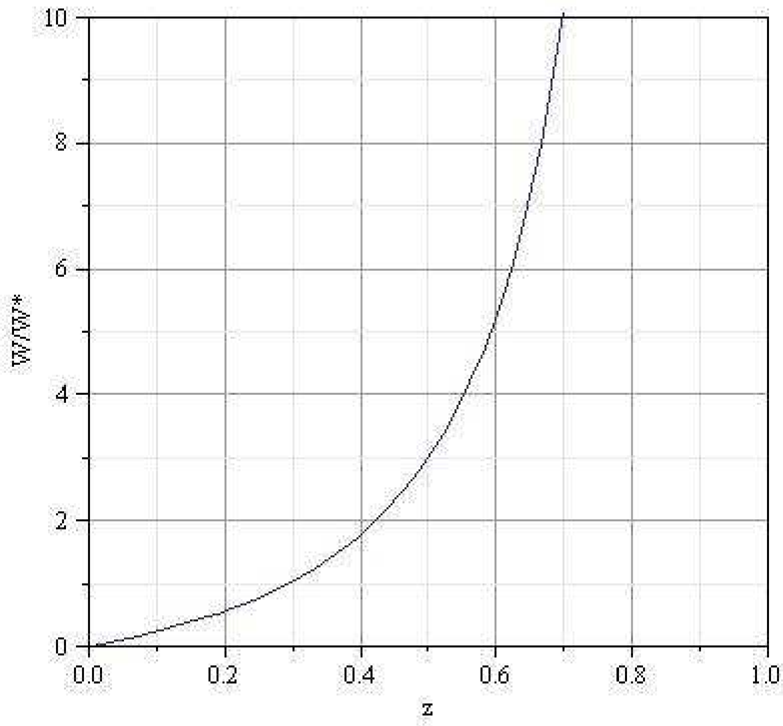

Fig 2 The relation between relative wage and the symbol of goods, the component of the demand.

From the turn of the two curbs it will appear a level of relative wage rate and an 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)>W/W*,when for E.C by A(z)<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 “icebergs”, meaning from a unit of goods send just a fraction t(z) reaches effectively at its destination, the rest of it “melting” on the way. Also, we impose, the condition that the measure of transport costs is the same for all goods t(z)=t and it is independent of the goods flux between the countries.

In this situation, I.C. will produce and export these goods and the equation will be solved: $wa(z) \leq (1/t)w^*a^*(z)$ or that can be retyped as $w/w^* \leq A(z)/t$.

In mutual way, E.C. will make and export these goods which for the measure of unitary costs of work it is smaller than the one of imported goods, respective when the inequation will be solved: in figure there are represented by A(z) curbs - interrupted blue- adn A(z)/t-continuum red, depending on z and the relative salary.

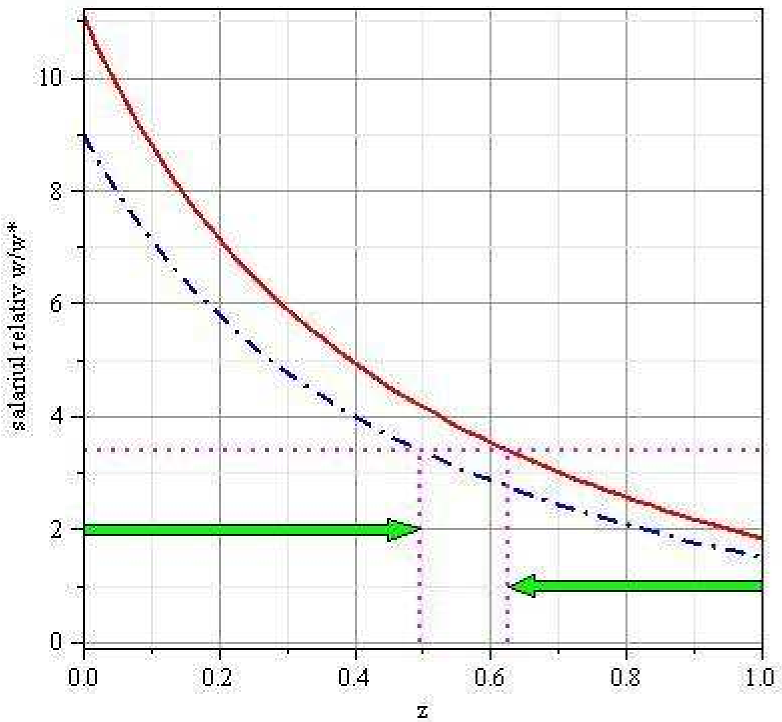

Fig 3 The impact of bringing transportation cost on the I.C. produced goods

This way, for a relative given wage, I.C. will produce and export all the goods in the left side of A (z)/t curb, arrow to right, both countries will produce intermediate goods, uncovered by arrows, and T.E. will produce and export the goods from the right side of A(z)/t, and the arrow to left.

As the transport costs t is defined, as a fraction from a unit that reaches the destination, that means that the smaller the value of t is, the bigger is the transport cost, the good "melting" on the way, and figure 4 shows the extension of commercialized goods.

4) Numerical simulation:

We can explain this function: $A := \frac{c - d\,z1}{(e + f\,z1)\,t}$ $AA := \frac{(c - d\,z2)\,t}{e + f\,z2}$

$\lambda 1 := \int_{z1}^{1} b(z)\,\mathrm{d}z$ $\lambda 2 := \int_{0}^{z2} b(z)\,\mathrm{d}z$ $b(z) := 2 - 2z$

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 L1, L2 and t.

This way, for c=10,d=5,e=1,f=2,L1=10, L2=10 and transport costs between 0.75 and 0.95 we obtain next specialisations origins, see table no.1.

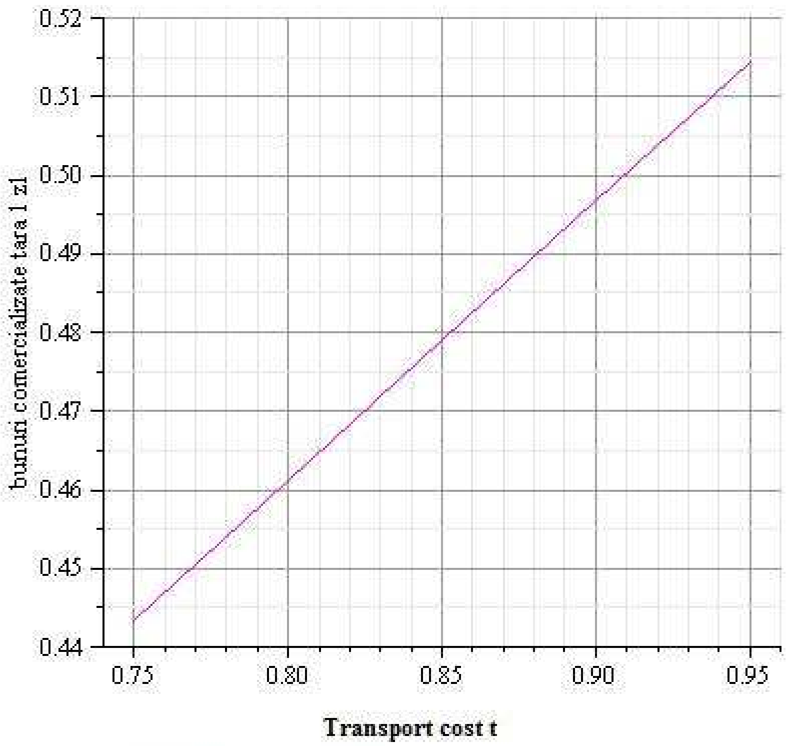

Fig. 4 The dependence between the transport costs and the series of goods commercialised by the country 1

Table no. 1 Basic model

transport cost	0.75	0.80	0.85	0.90	0.95
Goods exported by the I.C.	0,44337	0,46117	0.47899	0,49671	0,51427
Goods exported by the E.C.	0,79657	0,73479	0,67785	0,32528	0,57666

If we would record a growth on work offer of I.C., presumptive L1=L2, all the remaining measures have not changed, we will obtain information from table no. 2.

Table no.2 A growth in work offer of I.C.

cost de transport	0.75	0.80	0.85	0.90	0.95
Goods exported by the I.C.	0.41141	0.43058	0.44969	0.46864	0.48736
Goods exported by the E.C.	0.76234	0.70230	0.64708	0.59622	0.54926

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 shortening of coefficient e and f, presumed to be e=0.75 and f=1.5 in the condition of keeping to the other values constant, the information being centralized in table 3.

Table no. 3 A growth of work productivity in I.C.

cost de transport	0.75	0.80	0.85	0.90	0.95
Goods exported by the I.C.	0.49268	0.50837	0.52419	0.54003	0.55580
Goods exported by the E.C.	0.84835	0.78421	0.72484	0.66983	0.61881

We can see a growth of exported goods by I.C. and a decrease of the exported goods domain by E.C. while the work productivity does not modify.

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