Économie internationale 94-95 (2003), p. 235-260.

ÉCONOMIE
INTERNATIONALE

Exploring the links between transaction costs, income distribution and economic performance in a case study for Colombia

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Article received on February 4, 2002
Accepted on March 21, 2003

ABSTRACT. Standard international trade models have consistently produced results that, compared ex post with real world data, show the right sign but much smaller magnitudes. Besides, for the case of developing countries, these same models predict that unskilled labour would gain from liberalization, and this too contrasts with empirical evidence. This paper proposes a new approach by considering transaction costs reductions as an important factor explaining developing countries' actual performances. A clear mapping of the analytical channels through which changes of transaction costs affect the economic results is achieved by using a general equilibrium model with explicit transaction costs. Additionally this paper examines how transaction costs influence income distribution. Numerical simulations based on Colombia are presented.

JEL Classification: D58; F11; F13; O10; O54.
Keywords: International Trade; Transaction Costs; Simulation Models; Income Distribution.

RÉSUMÉ. Les modèles standards du commerce international ont toujours donné des résultats qui, comparés *ex post* aux chiffres réels, s'avèrent justes au niveau du signe mais d'un niveau plus faible. En outre, dans le cas des pays en développement, les mêmes modèles prédisent que le travail non qualifié serait gagnant à la libéralisation, ce qui est aussi contredit sur le plan empirique. Cet article propose une approche nouvelle en considérant que la réduction des coûts de transaction est un facteur explicatif important des résultats actuels des pays en développement. La mise en évidence des canaux par lesquels les changements dans les coûts de transaction affectent les résultats économiques est réalisée grâce à l'utilisation d'un modèle général calculable qui intègre explicitement les coûts de transaction. En outre, l'article examine l'incidence des coûts de transaction sur la distribution du revenu ; il donne enfin les résultats des simulations faites pour la Colombie.

Classification *JEL* : D58 ; F11 ; F13 ; O10 ; O54.
Mots-clefs : Commerce international ; coûts de transaction ; modèles de simulation ; distribution des revenus.

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The debate on trade liberalization and development has focussed on two issues. On the one hand, standard international trade models have consistently produced results that, compared ex post with real world data, show the right sign but much smaller magnitudes. These models normally estimate gains from increased openness corresponding to just small fractions of real GDP: a meagre benefit, often insufficient to provide support for trade liberalization. On the other hand, the additional standard prediction on income distribution effects – namely that unskilled labour, the most abundant factor in many low-income countries, would gain from liberalization – has not found empirical support. Several authors have emphasized that empirical evidence contrasts with this prediction: increased relative wages for skilled labour are often observed in developing countries.[2]

To address the issue of the minor estimates for the gains of trade liberalization (the *small numbers* issue), economists have expanded their models in two directions, that of dynamics and that of non-convexities, i.e. economies of scale and imperfect competition.[3] New models have incorporated the insights of a large literature that emphasises openness' important role in boosting economic performances and growth. In a variety of theoretical approaches, a liberal external policy by facilitating financial and trade flows helps an economy to get its domestic prices right, to allocate its resources to their best uses, to acquire new technologies, to increase its primary factors' productivity, to increase competition and X-efficiency, to reduce rent seeking, and even to improve its domestic governance. The strength of the links between trade policy and some of these positive effects is challenged by some authors and indeed the debate is still open, however models including some of these dynamic and non-convex features have produced large numbers.

Without rejecting standard models, most studies explain the puzzling inter-skill widening wage gap – the income distribution issue mentioned above – by considering skill-biased technological change, or factor markets rigidities, as the primary causes for it and by attributing just a minor role to trade.[4]

Instead of challenging this literature, this paper proposes a complementary approach by considering transaction costs reductions as an important factor in the explanation of developing countries' trade and growth, and income distribution performances. A striking difference between the OECD and poorer economies is the presence of much larger transaction costs in the latter; doing business in Africa, Asia or Latin America can be extremely profitable but it is certain that in these regions logistic problems (a synonym of transaction costs) are

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2. Slaughter and Swagel (1997) cite evidence for Mexico, Meller and Tokman (1996) study the Chilean case, and Bernal *et al.* (1998) examine the Colombian case. See Davis (1992) and Wood (1994) for multi-country studies covering this issue.
3. For surveys see Baldwin and Venables (1995), Brown (1993), Burfisher and Jones (1998), Francois and Shiells (1994), Hertel (1997) and others, US International Trade Commission (1998), and US International Trade Commission (1992).
4. For empirical evidence on the US see Lawrence and Slaughter (1993), Krugman and Lawrence (1993), Leamer (1996), Baldwin and Cain (1997). See Abrego and Whalley (2000) for a survey of this debate and their original contribution.

more severe than in the Western world. It is also true that poor people suffer almost always from being disconnected from the formal economy. High transaction costs due to remoteness and bad road/communication infrastructure can be an important determinant of persistent poverty.

This transaction cost approach has recently been advocated to explain the development failures of numerous African countries. According to Collier (1997, 98) many African countries face unusually high, and policy-induced, transaction costs that, by generating comparative disadvantages in manufactured exports, lower growth performance. Elbadawi Mengistae and Zeufack (2001) and Elbadawi (1998) argue that this transaction costs hypothesis is supported by empirical evidence, even when specific geographic and endowment variables are controlled for.

This paper – rather than presenting econometric estimates of transaction costs from reduced form equations, as for the cited studies – explicitly introduces transaction costs in a system of structural form equations to build a general equilibrium simulation model. A clear mapping of the analytical channels through which changes of transaction costs affect the economic performance of an economy is thus a primary objective of this study. Besides, by considering the distributional effects of a reduction in transaction costs, some fresh insights in the trade and wage gap debate are offered here.

Beyond the analytical motivation for this exercise, the direct exploration of the effects of transaction costs on aggregate incomes and relative wages has valuable policy relevance. Firstly, showing that transaction costs reduction may be an important channel through which trade liberalization affects incomes should help policy makers in gaining support for an outward-oriented development strategy. Secondly, domestic as well as international trade policies can influence transaction costs and given that these policies are often implemented as parts of comprehensive packages, their correct coordination becomes essential to their success. Because of the scope of indirect effects, the signs and magnitudes of induced adjustments are difficult to ascertain and the need for numerical simulation models of the type presented here becomes evident.

This study focuses on Latin America by actually calibrating a series of trade models with transaction costs on Colombian data for the mid 90s. This country undertook extensive trade liberalisation towards the end of the 80s and serious discussions were initiated to enter NAFTA soon after its implementation. Although its current trade barriers are not too high, a renewed trade-led reform process, granted by the western hemisphere trade area agreement, would most likely help Colombia in reducing its quite high transaction costs. Besides, the choice of Colombia is not crucial, in fact its main characteristics underlying the numerical implementation of the models used here are quite commonplace in other Latin American countries, so that the results shown below may be, with caution, generalised.

The paper is organised as follows: section 1 discusses the transaction cost approach by describing a simple partial equilibrium model followed by a brief review of the theoretical pedigree of the transaction cost idea and concluded by some evidence of its empirical relevance; section 2 presents the structure of general equilibrium models used to study the effects of transaction cost reductions, its calibration on Colombian data and the main numerical results; section 3 concludes.

TRANSACTION COSTS: BASIC THEORY AND EMPIRICAL EVIDENCE

A very simple transaction costs model

The following four equations representing demand, supply and equilibrium conditions in a generic market can exemplify a simple partial equilibrium model with transaction costs:

$P_d = a - b\, Q_d$ (demand function)

$P_s = c + d\, Q_s$ (supply function)

$Q_d = Q_s$ (market equilibrium)

$P_d = P_s + T$ (Transaction cost mark-up)

In the last equation transaction costs represent a wedge between the supplier and demander's price that is a fixed mark-up equal to T and paid by the demander on each unit of the good exchanged. The equilibrium quantity Q_e can easily be calculated as a function of T and of the other parameters as follows:

$$Q_e = \frac{a - c - T}{b + d}$$

and the basic comparative statics result is:

$$\frac{\partial Q_e}{\partial T} = -\frac{1}{b + d}$$

Thus it clearly appears that the quantity exchanged is reduced by rising transaction costs and that it can go to zero if these reach or are above the value (a – c), which may be labelled the autarky limit. On the other hand and depending on the initial level of transaction costs, their reduction may *create* a market or simply increase the quantity exchanged.

In this simple set-up, if one thinks of T as if it were an excise tax, the following crucial question should arise: "what happens to the *revenues* ($Q_e * T$) collected from this tax?" If these revenues simply disappear, then clearly a reduction in T would be a sort of windfall with positive effects. If instead other agents in the economy received these revenues, then the net effect of a reduction in transaction costs should be calculated by considering both winners and losers.

A first important point should already be apparent: transaction costs reduction corresponds to *rectangles* reduction and thus have larger impacts than the usual reduction of deadweight loss *triangles*. A model including transaction costs can then fit the large numbers observed in reality with or without recurring to exogenous or endogenous technological change, but what about the income distribution question? Before fully answering this second important question, a brief digression on how the productivity (technological change) approach works may be useful.

Technology and relative poverty[5]

The reason why technological progress can have a strong distributional effect is intuitive: if a new technology increases the efficiency of a certain factor of production over that of the others, then it directly confers higher economic rewards to the owners of this more efficient factor given that its demand will increase proportionally more than that of the other less efficient factors. More formally, consider an economy where goods are produced using just two factors, skilled and unskilled labour, and that unskilled workers represent the poor. Firms demand labour of the two categories up to the point where the value of the production of an additional worker covers the cost of employing her. In a simple formula this is:

$$L_d = P * MPL \tag{1}$$

Equation (1) states that labour demand is equal to the marginal product of labour (*MPL*) in value (i.e. multiplied by the price *P* at which it can be sold in the market). Factors' rewards are determined by the equality of their demands and supplies. To keep things very simple, assume full employment that is equivalent to have fixed labour supplies.

In this framework we can consider two types of technological shocks. In the first, the shock affects the efficiency of skilled and unskilled workers in the same way (factor neutral case); in the second, technological progress is skill-biased and one factor becomes more efficient than the other (factor biased case). Poverty effects are easily traceable since they correspond to the wage ratio of skilled over unskilled workers, as defined in equation (2):

$$\frac{W_S}{W_U} = \frac{P \cdot MPL_S}{P \cdot MPL_U} = \frac{MPL_S}{MPL_U} \tag{2}$$

Clearly, with factor neutrality the same change affects both marginal productivities thus leaving the wage ratio equal to the value it had in its initial equilibrium. The whole economy becomes more efficient, goods production goes up (with the same quantity of resources), and the rewards go to the poor in the same way as they go the non-poor. If a hypothetical poverty line were exceeded thanks to the new higher wage, no more poor would exist in this simple economy.

With factor bias, and suppose that the new technology makes skilled labour more efficient, inequality would rise given that the wage ratio would be higher after the technological shock. However notice that this particular increase in inequality does not translate into an increase in *absolute* poverty, given that the wage rate of the poor (unskilled) goes up as well.

5. This paper does not directly provide estimates for *absolute* poverty. Instead income distribution is considered here and, in particular, the paper uses the skilled-unskilled labour wage gap as an indicator of *relative* poverty.

A straightforward variation of this simple framework can be used to construct a case where technological progress, even in its factor-neutral form, can indeed increase relative as well as absolute poverty. The variation consists of moving from a partial equilibrium approach exemplified above to a general equilibrium setting where there are two sectors of production that employ skilled and unskilled labour with different intensities. Consider, for instance, an economy with an advanced and a traditional sector, and that the former uses proportionally more skilled workers than the latter. Assume now that a new factor neutral technology is introduced in this economy and that it is initially adopted by the advanced sector and not by the other. Production in the advanced sector becomes more profitable and more firms enter the sector. Its expansion occurs at the expenses of a contracting traditional sector, now less profitable. Given the different factor intensities of the two sectors, skilled workers, employed in the advanced sector at a rate exceeding that at which they are released by the traditional sector, experience high demand for their services and rising wages; the opposite situation affects unskilled workers whose demand in production as well as wages are decreasing. If unskilled workers were initially above the poverty line and the wage decrease leaves them below, then absolute poverty would have been caused by a factor neutral sector biased technological change.

Numerous variations of this basic set-up have been provided in the literature. One can think of production that requires more than two factors and that certain factors are complements and other substitute. A realistic case may involve firms adopting a technology that uses simultaneously more of capital and skilled labour thus leaving less capital available for unskilled labour and reducing its productivity and wage. Another extension considers more sophisticated modelling of labour supply including either education and training, or migration. Finally international flows of goods, factors, and technologies may be considered.

This paper shows that transaction costs shocks can have distributional effects similar to those originating from productivity changes. Before showing how a standard general equilibrium trade model can be modified to take into account transaction costs, a brief description of their theoretical pedigree and empirical relevance is provided in the remainder of this section.

Transaction costs theory

Since the seminal work of Coase, transaction costs economics has tried to resolve the apparent inconsistence in the co-existence of markets and firms or, in current terms, of markets and institutions. Coase observed that if markets were perfect forms to organize production and exchange there would not be a need for firms to emerge or, by turning the argument around, if firms had advantages over markets why shouldn't we observe a single giant firm producing all that is demanded. His fundamental intuition was that differential transaction costs generate situations where both firms, or institutions, and markets are observed. In terms of the simple model above, there are certain types of activities for which transaction costs are above the autarky limit and exchanges take place inside institutions, and other types for which markets exist because transaction costs are below that limit. This has been an extremely significant contribution and it is probably one of the founding ideas of the voluminous transaction costs and institutional economics literature that followed.[6] This literature is not free from criticism, in particular sceptics point out the difficulty in making the concept of transaction cost operational. In Goldberg (1985) words, explaining economic phenomena by appeals to transaction costs "is the all encompassing answer that tells us nothing".

Another approach uses the concept of transaction costs in a less abstract and perhaps less interesting way but it may be more helpful for the purpose of understanding how changes in transaction costs may explain developing countries' performance. The crucial difference of this approach is that rather than being concerned about changes in transaction costs close to the breaking point of the autarky limit, it considers how exchanges already taking place in the market may be affected by variations in transaction costs.

The antecedents to this approach may be found in general equilibrium theory and international trade. In an effort to enrich the theory of general equilibrium as formulated by Arrow and Debreu[7], a few authors[8] have studied how this should be modified to incorporate transaction costs and what would be the consequences of such a modification on the major predictions of the standard theory. In Foley's words "the key aspect of the modification I propose is an alteration in the notion of "price". In the present model there are [...] a buyer's and a lower seller's price [and their] difference yields an income which compensate the real resources used up in the operation of the markets". This can be considered as a first answer the question posed above: where do transaction costs revenues go? When the operation of a market needs intermediaries that provide information or other services to buyers and sellers so that they can realize an exchange, then these intermediaries would receive the income generated by charging a transaction *fee* (=cost).

Another form of transaction costs has been considered in international trade and explicitly incorporated into models since Samelson's paper[9] of transport costs. The basic idea here is that trade involves transaction costs and that these may be simply thought of as a fraction of the traded good itself, as if "only a fraction of the ice exported reaches its destination as unmelted ice". This "iceberg model" provides another answer to the basic question on the fate of the transaction costs' revenues and it clarifies how a reduction in transaction costs saves real resources and makes an economy more efficient.

Transaction costs: empirical basis

To organise a large and disperse body of empirical evidence, it is possible to group transaction costs in three broad categories, namely geography-, technology/infrastructure-, and institution/policy-related transaction costs.

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6. For a recent survey see Williamson (2000).
7. See Debreu (1959).
8. Kurz (1974), Hahn (1971), Foley (1970).
9. See Samuelson P.A. (1954).

A major example of the first category is given by transportation margins. These are also probably the easiest to observe and possibly to measure. In an international context they can be measured by the cif/fob ratio giving the 'carriage, insurance and freight' costs of countries' imports. Henderson, Shalizi, and Venables (2001) estimate that they can "range from a few percent of the value of trade, up to 30-40% for the most remote and landlocked (and typically African) economies." Limao and Venables (2002) find that being landlocked raises transport costs by more than 50% and that the level of infrastructure development is an important variable in explaining differences in shipping costs. Estimates for within country trade and transport costs are not easily available, however, even if smaller, distances may still play a role in generating transaction costs in national markets. In a recent study on Africa, Elbadawi *et al.* (2001) show that domestic transportation costs are an even stronger influence on export (and growth) performance than international transport costs.

Additionally, in developing countries, poor people usually living in rural or remote areas are often victims of high transaction costs that partially disconnect them from the rest of the society. Jalan and Ravallion (1998) find that road density was one of the significant determinants of household-level prospects of escaping poverty in rural China.[10]

Table 1 - Percent of poor households with infrastructure in home, in poorest urban and rural deciles in each country

Country	Electricity		In-house water		Sewer		Telephone	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Asia								
Pakistan	88	44	34	5	20	0	1	0
Vietnam	57	16	4	0	–	–	–	–
Nepal	43	1	7	4	7	0	0	0
Eastern Europe & Central Asia								
Russia	–	–	84	31	78	12	39	13
Kazakhstan	100	100	78	12	70	8	38	20
Bulgaria	100	100	84	27	86	18	51	20
Albania	100	100	90	0	–	–	0	0
Kyrgyz	99	99	54	5	22	3	20	5
Latin America & the Caribbean								
Panama	91	2	36	4	25	0	20	0
Jamaica	55	44	23	2	15	6	10	6
Ecuador	92	63	25	7	42	5	5	0
Nicaragua	71	13	44	4	9	0	0	0
Sub-Saharan Africa								
South Africa	32	8	23	1	–	–	6	0
Côte d'Ivoire	39	8	7	0	–	–	–	–
Ghana	38	0	2	0	–	–	–	–

Source: World Bank data.

10. See also Antle, J.M. (1983) and Fan, Hazel, Thorat, (1999).
11. A recent literature labels these technologies as "General Purpose Technologies". See Helpman, Elhanan (1998), and Bresnahan, Tratjenberg (1995).

The second category of transaction costs includes those related to technology and infrastructure. It is clear that drastic technological innovations affecting the whole infrastructure of an economy and having the potential to be used in a variety of sectors, such as steam power, electricity, telecommunications, can have profound effects on transaction costs and indirectly on an economy's growth and poverty record.[11] Any technological advance providing the poor with better and cheaper access to national and international markets should, at least in principle, help them. As shown in TABLE 1 the margin of manoeuvre in improving access to basic infrastructure for the poor is quite large.

A clear example of technology/infrastructure transaction costs can be seen in the information and communication sector. The internet explosion and its connected technologies have dramatically reduced exchange and search costs in most OECD countries. Although just indicative and not directly transferable to developing countries, some estimates for the cost savings (i.e. reduction in transaction costs) due to B2B electronic commerce are available for a few sectors of the US economy and are reported in TABLE 2.

Table 2 - Potential cost savings from B2B electronic commerce in the US

Industry	Potential cost savings %	Industry	Potential cost savings %
Electronic components	29-30	Chemicals	10
Machining	22	MRO	10
Forest products	15-25	Communications	5-15
Freight services	15-20	Oil and gas	5-15
Life sciences	12-19	Paper	10
Computing	10-20	Healthcare	5
Media & advertising	10-15	Food ingredients	3-5
Aerospace machining	11	Coal	2
Steel	11		

Source: Goldman Sachs, 1999 cited in KPMG (2000).

Related to the above, an interesting working paper by C. Freund and D. Weinhold (2000) finds that, when introduced in a standard gravity model, cyber-mass (i.e. internet hosts per capita) is a significant positive variable that, while increasing the overall explanatory power of the regression, does not reduce the magnitude and significance of the physical distance.

Indirect evidence of technology/infrastructure-related transaction costs is found by looking at the level of manufacturing inventories across countries. Guasch and Kogan (2000) report on huge inter country differences in inventory levels. TABLE 3, taken from Guasch and Kogan (2000), reports on the very large disadvantage of Latin American economies vis-à-vis the US with respect to inventories: on average these countries hold twice as much raw material and finished products as the US. According to the authors, higher transaction costs explain a relevant part of these inventories discrepancies: Latin American countries faced with uncertain demand, longer delays in shipments, and larger costs for small frequent shipments, choose to maintain larger reserves. Considering that the cost of capital is normally higher in

Latin America than in the US, the authors point out that these high inventory levels translate into considerable costs and ultimately in lower competitiveness and diminished growth.

The last category of transaction costs includes those related to institutions or economic policies. Rent seeking is probably the most well known example, however, even by just considering trade policy, a few others are worth mentioning.

A well-established literature finds that an international border has a large dampening effect on trade. This has also been termed the home bias in trade. Most of the literature is focussed on the Canada-US trade, but this empirical puzzle applies to any region of the world. Obstfeld and Rogoff (2000) label the home bias in trade one of the "six major puzzles in international macroeconomics". With the existence of large home biases firmly established, the search for explanations has begun. Evans (2000) finds little support for the hypothesis that the home bias is not due to the border itself but instead to inherent differences in domestic and foreign goods; Obstfeld and Rogoff (2000) argue that empirically reasonable trade (i.e. transaction) costs can explain much of the home bias; and Anderson (2000) points to information costs and imperfect contract enforcement as worthwhile avenues of inquiry.

Deep policy switches such as the creation of the common European market in 1992 have also induced researchers to evaluate their economic impacts. A large collection of studies known as the "Costs of Non-Europe", supported by the European Commission, mainly consists of detailed estimations of the costs of borders in Europe. The most cited reference is the Checchini report that finds that these costs are considerable and sum up to a small percentage of the European GDP. Harrison, Rutherford and Tarr (1996) explicitly model these costs in a general equilibrium framework and reach similar conclusions.

Table 3 - Latin America ratios to US inventories (all industries)

	Chile	Venezuela	Peru	Bolivia	Columbia	Ecuador	Mexico	Brazil
Raw materials inventory level ratios: ratio to US level by industry (average of all available data for 1990s)								
Mean	2.17	2.82	4.19	4.20	2.22	5.06	1.58	2.98
Minimum	0.00	0.30	0.10	0.11	0.52	0.86	0.42	0,8
1st quartile	0.36	1.87	1.25	1.39	1.45	2.55	1.06	1.6
Median	1.28	2.61	2.30	2.90	1.80	3.80	1.36	2.00
3rd quartile	2.66	3.12	3.90	4.49	2.52	5.64	2.06	3.1
Maximum	68.92	7.21	31.1	34.97	13.59	20.61	3.26	7.1
Final goods inventory levels: ratio to US level by industry (average of all available data for 1990s)								
Mean	1.76	1.63	1.65	2.74	1.38	2.57	1.46	1.98
Minimum	0.01	0.10	0.39	0.11	0.19	0.67	0.35	0.75
1st quartile	0.17	0.87	1.17	1.13	1.05	1.67	0.82	1.1
Median	0.72	1.60	1.54	2.02	1.28	1.98	1.36	1.60
3rd quartile	1.38	21.4	2.11	3.18	1.63	2.86	2.14	2.00
Maximum	31.61	5.29	3.87	21.31	5.31	7.94	4.91	5.2

Source: Guasch and Kogan (2000).

Another more recent example of trade-policy related transaction costs is found in Hertel, Walmsley and Itakura (2001). The particular trade liberalization policy evaluated in their study includes a series of measures intended to lower non-tariff trade costs between Japan and Singapore. In fact, by imposing the adoption of computerized procedures, an explicit objective of this policy was a reduction of the costs of customs clearance, a clear policy-related transaction cost. For the case of the Japan-Singapore FTA, the effect of linking the two customs' systems is expected to generate additional reductions in effective prices amounting to 0.065% in Japanese imports from Singapore and 0.013% in Singaporean imports from Japan, and these cost saving refer solely to the cost of reduced paperwork, storage and transit expenses. However, in addition to the direct cost savings, there are indirect savings associated with the elimination of customs-related delays in merchandise flows between these two countries. Hummels (2000) emphasizes that such time-savings can have a profound effect on international trade by reducing both "spoilage" and inventory holding costs. He argues that spoilage can occur for many types of reasons. The most obvious might be agricultural and horticultural products that physically deteriorate with the passage of time. However, products with information content (newspapers), as well as highly seasonable (fashion) goods may also experience spoilage. Hummels points out that inventory costs include not only the capital costs of the goods while they are in transit, but also the need to hold larger inventories to accommodate variation in arrival time (see also Guasch and Kogan, cited above). He finds that the average value of firms' willingness to pay for one day saved in trade is estimated to be 0.5% ad valorem (i.e., one-half percent of the value of the good itself). This value of time-savings varies widely by product category, with the low values for bulk commodities and the highest values for intermediate goods.

In summary, even if in identifying empirical estimates for transaction costs we have stretched their definition to include quite different things, it seems clear that geographic characteristics, poor transportation and communication infrastructure, and bad economic policies may directly affect transaction costs, and that their presence can be documented in a variety of ways.

Transaction costs: some theory-consistent numerical simulations for Colombia

The following section considers two different ways of modelling transaction costs and several analytical structures to examine the main channels of transmission from transaction costs reduction to income determination (its level and distribution). In addition, to evaluate the empirical relevance of transaction costs, the different model versions are parameterised using data from a typical Latin American country.

Transaction costs are modelled as either a mark up on the seller's price or as icebergs melting a la Samuelson. With the former approach transaction margins generate income and they are fully comparable to transportation margins, with the latter they simply produce costless inefficiencies.

The basic general equilibrium model used here represents a small price taker economy and it is implemented here in three main versions: the first version is a standard Heckscher-Ohlin international trade model with homogeneous goods, the second introduces intermediate consumption, and the third considers a model with differentiated goods which generalizes the Heckscher-Ohlin structure. A main contribution of the paper consists of pointing out how differences in structural models matter for the estimation of the effects of transaction cost reductions.

The Colombian economy: stylised facts of a Latin American country

The crucial characteristics of our initial data for Colombia are shown in TABLE 4, where it is possible to observe some of the stylised facts of a typical Latin American country. The economy has been aggregated into two sectors: an export oriented sector (*Exportables*) and an import competing one (*Importables*). The first two rows in the table show the relative size of the two sectors and their trade intensity (measured as exports or imports over production). Colombia is relatively abundant in unskilled labour and its exportables sector uses more intensively this factor of production. The initial wage gap, measured as the ratio of skilled over unskilled labour average incomes, is quite high with skilled workers earning almost two and an half times more than unskilled workers. Exportables use slightly less intermediates than importables but bear an almost identical transaction cost, as shown by the "ad valorem" estimate.

Table 4 - Initial data – main characteristics

	Sectors		
	Exportables		Importables
Production shares %	31		69
Trade intensity %	33		16
Skill abundance unskill/skill		3.6	
Skill intensity unskill/skill	18.0		1.9
Skill wage gap		2.4	
Intermediates as % of production	30		42
Transaction costs sector allocation	26		74
Transaction costs ad valorem %	11.6		11.9
Ownership shares	**Skill labour**		**Unskill labour**
Skilled head	100		0
Unskilled head	0		100
Consumption shares	**Skill head**		**Unskill head**
Exportables	17		19
Importables	83		81

Notice also that transaction margins (when modelled as mark-ups) generate income that is allocated across sectors in the same way as total demand (26 percent goes to exportables and 74 to importables). This deserves some further comment: whenever transaction margins are reduced, the price wedge between seller and buyer is narrowed, and the total revenues raised fall; initially these revenues are used to buy exportables and importables in fixed shares and these shares are chosen to reflect the structure of total demand so that they should be as neutral as possible. With this assumption, a fall in revenues should not directly affect the overall demand structure. Clearly, another way of thinking of the sectoral allocation of transaction margin income is that transaction costs are produced using exportables and importables as inputs. The current sectoral allocation may not reflect the real world "production structure" of transaction costs nevertheless, without additional empirical evidence, the current choice allows to by-pass the problem without introducing unjustifiable biases.[12]

Additionally, TABLE 4 displays households' shares of factor ownership and goods consumption. Households have been classified according to their main income source and this is reflected in the ownership structure, but different classification, such as rural-urban, can be considered. Overall consumption shares do not differ greatly across households.

Most of the estimates shown in the table are direct calculations from Colombia's national accounts and input-output tables, however transaction costs have been estimated using raw data on geographic distances and inputs of transport/communication/distribution services.[13]

In summary – in this set-up given similar sectoral ad valorem transaction margins, their neutral revenue allocation and the across household similar consumption pattern – a reduction in transaction costs affect households' poverty and income mainly through changes in factor rewards.

Main features of the models

Model 1. A simple Heckscher-Ohlin homogeneous good trade model

The model includes two tradable homogeneous commodities, two factors of production and two households. The economy produces two goods, an aggregate exportable commodity (X) and an importable commodity (M), using combinations of skilled and unskilled labour in a Cobb-Douglas constant-returns to scale technology. We assume full employment of fixed endowments of skilled ($\overline{Ls}$) and unskilled ($\overline{Lu}$) labour, so that their supplies will be completely inelastic with respect to their prices. These are thus determined by firms' demands that, in competitive markets, are equal to their marginal product in value.

Transaction costs are modelled as a mark-up on commodity prices. This is equivalent to an excise tax or a transport margin and, since they do not increase with the value of the exchan-

12. In fact one can think of two alternatives to this assumption: in the first, if it were known that producers of transaction services operate exclusively in the importables sector, then transaction cost revenues could be entirely allocated to buy output from the importables sector. Alternatively, it may be possible to estimate a transaction cost production function that uses a mix of primary factors. In this case producers of transaction services would minimize their cost of production subject to a budget constraint that equals transaction costs revenues.

13. These data were obtained from a Social Accounting Matrix estimated by Bussolo and Correa (1998). More details are available upon request.

ged commodity but are proportional to their quantity, they are consistent with the empirical hypotheses on transaction costs described above. Revenues generated by the wedge t_i between the seller and buyer's price are used to buy transaction services from both sectors of the economy according to the fixed structure described above.

The model includes two households, a skilled headed (HHs) and an unskilled headed (HHu) household, that receive income from selling factor services and demand commodities *via* an optimisation of a Cobb-Douglas utility function. Households are thus differentiated by their consumption patterns and according to their ownership shares, with the skilled-headed household representing loosely the rich household.

Imports, exports and domestically produced goods are homogeneous, so that trade, in any of the two goods, can only be one-way (either import or export) and it originates only when domestic demand and supply differ; in equilibrium, trade balance will hold. Producers' prices are equal to the world prices given the small country assumption, and export or import flows quantities will be derived from the equality of supply and demand where the latter includes final consumption as well as transaction services demands. Factors' market-clearing conditions simply state that the sums of factors demands must equal the fixed factors' endowments.

In this simple model the poverty measure is a relative poverty index equal to the ratio of skilled to unskilled labour rewards. Given fixed factors ownership shares for the rural and urban households and a poverty line, it would not be difficult to calculate absolute households' poverty measures. The advantage of considering household-specific absolute poverty indices is that we would be able not only to trace the effects of changes in transaction costs on the supply/income generation side, but also on the demand/income use side.

Model 2. A simple Heckscher-Ohlin homogeneous good trade model with intermediate goods

This model introduces a simple variation in the previous one: the use of intermediate goods in the production process. Intermediates are employed in fixed proportion to production with a standard Leontief structure. It should be noticed that in this model value added prices are equal to world prices minus the cost of intermediates which are valued at world prices plus transaction cost mark-ups.

Model 3. A heterogeneous good trade model

This third model introduces several variants to the ones described above. First of all transaction costs are modelled as iceberg wedges, i.e. the quantities sold by suppliers reach the purchasers with a certain fractional loss (some quantity of the commodity melts away). In this way transaction costs do not generate any income (or revenue) and they are in fact denominated in the same units of measurement (i.e. real value or quantity) of the good exchanged.

In addition imports and domestically produced goods are imperfect substitutes in consumption. Of the domestically produced goods one is not traded and only consumed at home and the other is either exported or consumed. These changes alter the fixed world price structure of the homogeneous goods model and allow for the price of the domestically good, which is imperfectly substitutable with the imported one, to differ from the world price. This type of model has been extensively used in the literature and its properties are well known.[14]

In this model there are three goods which enter the consumer utility function, an import good M, a domestic non traded good D, and an export good X. Domestic production occurs only for D and M with a CES technology that includes only skilled and unskilled inputs (the CES function represents another difference form the models shown above).

Factor markets equations remain unaltered apart from the obvious changes due to the new functional form. Prices for commodities M and X are fixed and endogenously determined for the non-traded commodity D; in fact supply and demand equilibrium such as in equation (9) determines the price of D.

TABLE 5 displays the main changes that affect the structure of the initial Colombian data for this third model and it should be contrasted with TABLE 4 above. Salient features are the high skill intensity in the production of domestic non-traded goods (this is derived mainly from the production structure of non-tradable services that include a high percentage of white collar workers of the government sector, a large employer in Latin American countries), and the lower transaction wedge experienced in exchanges in the same sector.

Table 5 - Initial data – main characteristics with three sectors

		Sectors	
	Importables	Exportables	Domestic
Production shares %		22	78
Trade intensity %	100	76	0
Skill intensity unskill/skill		34.9	2.2
Transaction wedge	1.17	1.10	1.06

Numerical results

The general equilibrium models just described were used to conduct basic experiments aimed at investigating the aggregate effects of a reduction in transaction costs and the analytics of the link between *relative* poverty and transaction costs; the following numerical results should not be considered exact estimates, but just indications on the potential magnitude and sign of the effects.

As already described in the introduction, for a large body of literature, both empirical and theoretical, openness improves an economy's performance beyond the near disappearance of tariffs' deadweight loss triangles. In this study, openness is supposed to bring innovations in the transaction technology and their adoption is modelled by a decrease in transaction costs

14. See de Melo and Robinson (1989) or more recently Bhattarai *et al.* (1999).

without any indirect effect on the productivity of primary factors. Two sets of experiments are carried out: in the first, transaction costs are exogenously reduced; in the second, their reduction is linked endogenously to the degree of openness.

Consider first the scenario with exogenous transaction costs. The main effects of this scenario for model 1 are summarised in TABLE 6. Given fixed world prices and inelastic supplies of labour, a reduction in transaction costs does not produce any change neither in domestic producers' prices nor in factor rewards so that incentives to alter output levels do not arise and output of both sectors stays constant. Relative poverty, the ratio of skilled over unskilled wage, does not change due to the fact that resources do not move across sectors. In this model, consumption due to transaction costs revenues is substituted by households' consumption (or exports) that can increase without an accompanying increase in domestic output.

Table 6 - **Basic experiment of reduction in transaction costs, percentage variations with respect to initial equilibrium – model 1**

Percent variations	%		%
Output of exportables	0.0	Exportables demand by HHs	4.7
Output of importables	0.0	Importables demand by HHs	10.3
Producer price of exportables	0.0	Exportables demand by HHu	4.7
Producer price of importables	0.0	Importables demand by HHu	10.3
Exports	12.4	Tc demand of exportables	–47.0
Imports	7.3	Tc demand of importables	–44.2
Wage S	0.0	Real HHs income	9.4
Wage U	0.0	Real HHu income	9.4
Ratio Ws/Wu	0.0	Total real income	9.4

It should be emphasised that even with different initial transaction cost mark-ups across sectors or with a sector bias in reduction of transaction costs, these results would not qualitatively change: output and factor rewards will be still unaltered.

An important result obtained with this very simple model is that large increases, of almost 10 per cent, are registered in real incomes. These are large numbers and their occurrence is entirely due to the elimination of the deadweight *rectangles* of transaction costs (rather than the elimination of triangles associated for example to tariff reductions).

The same experiment, reduction of fifty percent of *exogenous* transaction costs mark-ups, produces quite different relative poverty results when intermediates are introduced in the production process as in model 2. Using e-commerce jargon, it seems that B2B is far more important than B2C. In this case the reduction of transaction costs changes the relative profitability of the two sectors: the importables sector, using a larger share of intermediates, enjoys larger savings than the exportables one. This translates *via* equation (7b) into a larger increase of the value added price of importables, 4.6 percent in contrast with 2.7 percent for exportables, and into a large increase of importables output, see TABLE 7. Importables use intensively skilled labour that now enjoys an increase in its reward: the relative poverty index worsens by about 4 percent.[15]

It should be stressed though that a reduction in transaction costs brings positive increases in both labour types wages so that absolute levels of poverty (and welfare) should be reduced (increased) with a reduction in transaction costs.

How robust is the relative poverty result? It can be easily shown that it crucially depends on the sectoral differences in the Leontief a_{ij} coefficients, which directly influence the size of the savings due to the reduction in transaction costs. The same experiment performed on a Colombian economy where all sectors were assigned the same intermediates coefficients would produce identical changes in both skilled and unskilled wages, even in the case of sectorally unequal transaction costs mark-ups.

Table 7 - Basic experiment of reduction in transaction costs, percentage variations with respect to initial equilibrium – model 2

Percent variations	%		%
Output of exportables	–5.6	Exportables demand by HHs	10.0
Output of importables	3.0	Importables demand by HHs	13.2
Val. added price of exportables	2.7	Exportables demand by HHu	5.4
Val. added price of importables	4.6	Importables demand by HHu	8.4
Exports	–9.2	Tc demand of exportables	–48.4
Imports	–12.0	Tc demand of importables	–47.0
Wage S	6.6	Real HHs income	12.6
Wage U	2.1	Real HHu income	7.9
Ratio Ws/Wu	4.4	Total real income	9.8

Aggregate results are still positive and large as shown by the increases in real households' incomes. In summary, reduction in transaction costs can have strong positive effects on private consumption and therefore on households welfare and their absolute poverty, however its effect on relative poverty depends more directly on the economic structure of the country under investigation, and in particular on the intermediates as well as primary factor intensities. A country implementing policies to reduce its transaction costs can indeed experience increased factor income inequality whenever cost savings are lower for the sectors that use intensively the more abundant factor.

Results from the first type of basic experiment performed with the third model are shown in TABLE 8. The main novelty here is that a reduction in transaction cost seems to have a lower effect on aggregate income and to reduce wage dispersion, the measure of relative poverty.

15. To put this number in context consider that between 1980 and 1995 UK wage gap worsened by about 15 percent.

This qualitatively different outcome can be fully explained by the initial sectoral difference in transaction wedges[16]. In model 2, sectoral differences in transaction cost mark-ups do not matter for relative poverty, but in this model they are crucial. Due to the fact that domestic goods are not perfect substitutes with importables, a sectorally differential transaction cost shock alters relative prices across these categories of commodities, and triggers a series of additional effects on output levels, factors' allocation and rewards.

Table 8 - Basic experiment of reduction in transaction costs, percentage variations with respect to initial equilibrium – model 3

Percent variations	%		%
Output of X	0.5	HH demand of M	8.5
Output of D	–0.1	HH demand of X	4.7
Price of M	0.0	HH demand of D	2.8
Price of X	0.0		
Price of D	–0.3	Tc demand of exportables	0.0
Exports	0.7	Tc demand of importables	0.0
Imports	0.7		
		Real HH income	3.9
Wage S	–0.55		
Wage U	0.04		
Ratio Ws/Wu	–0.60		

A reduction of transaction costs lowers the wedge between demanded and supplied quantities of each commodity. Given the small country assumption, prices of "M" and of "X" do not change and, for these markets, the new equilibrium is reached *via* changes in export and import flows. Conversely, for commodity "D" the market clearing condition determines its equilibrium price, which, in this case, is reduced. In turn, a falling price results into lower profitability for this sector and gives rise to resources reallocation. Finally, a reduction in wages of skilled workers is due to the more intensive use of this factor in the production of commodity "D" with respect to the other sectors.

To emphasize the economic policy relevance of the transaction costs approach and to clearly compare it to a standard general equilibrium model, a second scenario with endogenous transaction costs was carried out. In this case, model 1 is extended to include tariffs and transaction costs are dependent on the degree of openness of the economy. This link is supported by the literature on the relationship of corruption (and potentially other governance variables) and openness, which finds a negative correlation between corruption and openness.[17] Two main channels can explain why in theory corruption is reduced by openness: firstly, import openness, by increasing the level of competition in the domestic markets and lowering economic rents, reduces corruption's incentives; secondly, long-term "natural"

16. See TABLE 5 and notice also that transaction costs are now modelled as iceberg melting rather than mark-up margins.
17. See Bonaglia, Braga de Macedo and Bussolo (2001), Ades and Di Tella (1999).

openness results in societies with higher incentives to control bureaucrats because of the higher opportunity costs of losing business (i.e. income) with foreigners.

The two tables below show the main results of a 50% reduction in the tariff rates. TABLE 9 reports results for the model with exogenous transaction costs and so it shows the pure effects of tariff reduction, TABLE 10 illustrates the case with tariff reduction and endogenous transaction costs.

Table 9 - **Basic experiment of reduction (50%) in tariffs, percentage variations with respect to initial equilibrium – model 1 Exogenous TC**

Percent variations	%		%
Output of exportables	20.9	Exportables demand by HHs	–14.3
Output of importables	–11.8	Importables demand by HHs	–8.9
Producer price of exportables	0.0	Exportables demand by HHu	1.5
Producer price of importables	–7.3	Importables demand by HHu	7.9
Exports	56.9	Tc demand of exportables	5.8
Imports	56.9	Tc demand of importables	12.5
Wage S	–14.2	Real HHs income	–9.7
Wage U	2.1	Real HHu income	6.9
Ratio Ws/Wu	–15.9	Total real income	0.3
Transaction costs of exportables	0.0		
Transaction costs of importables			

The striking result is that real income increases (with respect to the initial equilibrium) from 0.3 in the exogenous case to 1.6 in the endogenous case, the difference in the two cases is of almost 6 times! Notice that the introduction of intermediates as in model 2 would enhance this differential. Clearly this result depends on the elasticity of corruption with respect to openness and on the relationship between corruption and transaction costs, however, a larger income effect is an unambiguous result of the model with endogenous transaction costs.

Table 10 - **Basic experiment of reduction (50%) in tariffs, percentage variations with respect to initial equilibrium – model 1 Endogenous TC**

Percent variations	%		%
Output of exportables	20.9	Exportables demand by HHs	–13.0
Output of importables	–11.8	Importables demand by HHs	–7.8
Val. added price of exportables	0.0	Exportables demand by HHu	3.0
Val. added price of importables	–7.3	Importables demand by HHu	9.2
Exports	58.0	Tc demand of exportables	–1.8
Imports	55.6	Tc demand of importables	4.2
Wage S	–14.2	Real HHs income	–8.6
Wage U	2.1	Real HHu income	8.3
Ratio Ws/Wu	–15.9	Total real income	1.6
Transaction costs of exportables	–16.8		
Transaction costs of importables	–6.4		

Figure 1 - Aggregate income effects

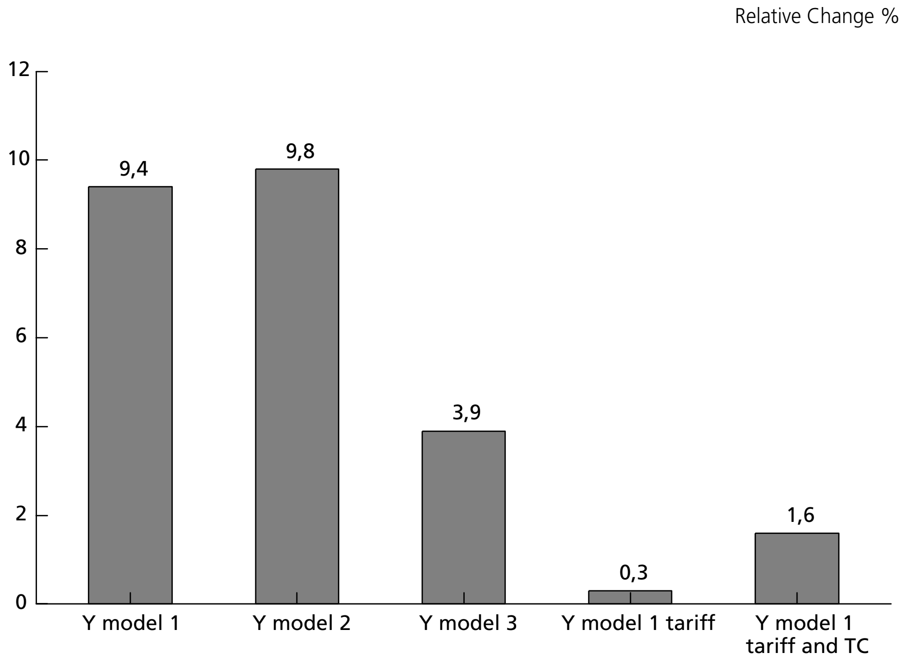

FIGURE 1 summarizes the results obtained with the various models, the large numbers issue is clearly illustrated by the considerable relative change in aggregate income ("Y" stands for aggregate income in the figure). It should be noticed that the three leftmost columns refer to a different experiment than that of the last two rightmost columns.

CONCLUSIONS

The experiments discussed above show that different analytical structures highlight different transmission channels and can produce quite different final results.

From a static or long term equilibrium point of view, the debate on whether an improvement in transaction costs should benefit the poor seems essentially to be an empirical one. This paper's results though clearly show that transaction cost reductions can account for a large share of income changes normally recorded in internationally integrating economies, a novelty when contrasted with more traditional trade models. Clearly these conclusions echo very closely those reached when technology advances are modelled as productivity changes, and the transaction cost approach may indeed complement that of productivity. However, unless technology is modelled endogenously, a daunting task especially when developing countries are the object of study, a productivity shock represents a totally exogenous windfall, whereas a reduction in transaction costs feeds back in the models used here in a reduction of intermediation, and may be simpler to implement empirically. Notice also that, in the models examined here, transaction costs affects only commodity exchanges, but it should not be too difficult to introduce them also in factors markets. In this way it would then be possible to simulate changes in education, training, health, or even migration, that originate from lower transaction costs, even larger numbers may thus emerge.

M.B. & J.W.

Annex 1
Models structures

■ Model 1.
A simple Heckscher-Ohlin homogeneous good trade model

The model includes two tradable homogeneous commodities, two factors of production and two households.

- Equations

Production

$Q_i = \eta_i Ls_i^{\alpha_i} Lu_i^{1-\alpha_i}$ with the commodities index i = X, M (1)

Factor markets

$$ws = \alpha_i P_i \frac{Q_i}{Ls_i} \qquad i = X, M \qquad (2)$$

$$wu = (1-\alpha_i) P_i \frac{Q_i}{Lu_i} \qquad i = X, M \qquad (3)$$

Transaction costs

$$Pt_i = P_i + t_i \qquad i = X, M \qquad (4)$$

$$TC\_revenues = \sum_i t_i Q_i \qquad (5)$$

Consumption

$Qd_{H\,i} = \beta_{H\,i} \frac{Y_H}{Pt_i}$ with the household index H = hs, hu and i = X, M (6)

Trade and equilibrium conditions

$$\sum_i Pw_i T_i = 0 \qquad i = X, M \qquad (7)$$

$$P_i = Pw_i \qquad i = X, M \qquad (8)$$

$$Q_i + M_i = \sum_H Qd_{Hi} + Qt_i + X_i \qquad i = X, M \qquad (9)$$

$$\sum_i L_i = \bar{L} \text{ and } \sum_i K_i = \bar{K} \qquad i = X, M \qquad (10)$$

- Variables

Q_i	quantity produced of the two goods
Ls_i	skilled labour employment in sector *i*
Lu_i	unskilled labour employment in sector *i*
$\overline{Ls}$	fixed endowment of skilled labour
$\overline{Lu}$	fixed endowment of unskilled labour
ws	wage of skilled labour
wu	wage of unskilled labour
P_i	producer commodity sale price of the two goods
Pt_i	consumer commodity purchase price of the two goods
Pw_i	world price of the two goods
t_i	wedge between the seller and buyer's price
Qd_{Hi}	household-specific quantity demanded
Qt_i	transaction costs-related quantity demanded
Y_H	households' income
T_i	import or export quantities

- Parameters

η_i	sector specific technical level
α_i	Cobb-Douglas output elasticity
β_{Hi}	utility share parameter

Model 2.
A simple Heckscher-Ohlin homogeneous good trade model with intermediate goods

This model introduces a simple variation in the previous one: the use of intermediate goods in the production process.

- Equations

Same equations of model 1, with the exception of equations (8) and (9) of model 1 that become:

$$P_i = Pw_i - \sum_i \left(Pw_i + tc_i\right) a_{ji} \qquad i = X, M \qquad (8b)$$

$$Q_i + M_i = \sum_H Qd_{Hi} + \sum_i Q_i a_{ji} + Qt_i + X_i \qquad i = X, M \qquad (9b)$$

• Variables

Same as in model 1.

• Parameters

Same as in model 1 with the exception of:

a_{ji} Leontief intermediate shares

■ MODEL 3. A HETEROGENEOUS GOOD TRADE MODEL

In this model there are three goods which enter the consumer utility function, an import good M, a domestic non traded good D, and an export good X. There are two factors of production and one representative household.

• Equation

Production

$$Q_i = \left[\beta u_i (Lu_i)^{-\rho_i} + \beta s_i (Ls_i)^{-\rho_i}\right]^{-1/\rho_i} \qquad i = X, D \qquad (10)$$

Factor markets

$$wu = P_i \left[\beta u_i (Lu_i)^{-\rho_i} + \beta s_i (Ls_i)^{-\rho_i}\right]^{-1/\rho_i - 1} \beta u_i (Lu_i)^{-\rho_i - 1} \qquad i = X, D \qquad (11)$$

$$ws = P_i \left[\beta u_i (Lu_i)^{-\rho_i} + \beta s_i (Ls_i)^{-\rho_i}\right]^{-1/\rho_i - 1} \beta s_i (Ls_i)^{-\rho_i - 1} \qquad i = X, D \qquad (12)$$

Transaction costs and demand supply equilibrium in goods markets

$$Q_i = C_i tc_i \qquad i = D \qquad (13)$$

$$Exp = Q_i - C_i tc_i \qquad i = X \qquad (14)$$

$$Imp = C_i tc_i \qquad i = M \qquad (15)$$

Consumption

C_i derived from CES utility of D, M, and X (16)

Other equations

Same as in model 1

• Variables

tc_i iceberg ratio

Exp Export quantities

Imp Import quantities

• Parameters

$\cdot_i$ CES exponent

β_{ui}, β_{si} CES factor shares

References

Abrego, L., Whalley, J. 2000. Demand side considerations and the trade and wages debate, NBER Working Paper 7674, National Bureau of Economic Research.

Adelman, I., Robinson, S., 1978. *Income Distribution Policies in Developing Countries*, Stanford University Press: California.

Ades, A., Di-Tella, R., 1999. Rents, competition, and corruption, *American-Economic-Review* 89(4), September, 982-93.

Anderson, J.E., 2000. Why do nations trade (so little)?, *Pacific Economic Review* 5, 115-134.

Antle, J.M., 1983. Infrastructure and aggregate agricultural productivity: international evidence, *Economic Development and Cultural Change* 31(3), 609-19.

Baldwin, R.E., Cain, G.G., 1997. Shifts in US relative wages: the role of trade, technology and factor endowments, NBER Working Paper 5934, National Bureau of Economic Research.

Baldwin, R.E., Venables, A.J., 1995. Regional economic integration, in Grossman, G. Rogoff, K. (Eds), *Handbook of International Economics*, Vol. III, Elsevier, Amsterdam.

Bhattarai, K., Ghosh, M., Whalley, J., 1999. On some properties of a trade closure widely used in numerical modelling, *Economics Letters* 62(1), January, 13-21.

Bernal, R., Cardenas, M., Sanchez, F., Nunez, J., 1998. Macroeconomics performance and inequality in Colombia: 1976-1996, in Sanchez F. (Ed), *La Distribucion del Ingreso en Colombia*, TM Editores, National Planning Department.

Bonaglia, F., Braga de Macedo, J., Bussolo, M., 2001. How globalization improves governance, CEPR Discussion Paper 2992, October.

Bresnahan, T., Tratjenberg, M., 1995. General purpose technologies: engines of growth, *Journal of Econometrics* 65, 83-108.

Brown, D.K., 1993. The impact of a North American Free Trade Area: applied general equilibrium models, in Lusting, N., Bosworth, B.P., Lawrence, R.Z. (Eds). *Assessing the Impact, North American Free Trade*, Washington, DC: The Brookings Institution.

Burfisher, M.E., Jones, E.A. (Eds), 1998. Regional trade agreements and US agriculture, Economic Research Service, AER 771, Washington, DC: US Department of Agriculture.

Bussolo, M., Correa, R., 1998. A 1994 detailed social accounting matrix for Colombia, Working Paper 2, Fedesarrollo, Bogota.

Coase, R., 1937. The Nature of the firm, *Economica* 4 (November), 386-405.

Collier, P., 1997. Globalization: what should be the African policy response?, mimeo, Centre for the Study of African Economies, University of Oxford.

Collier, 1998. Globalization: implications for African economic management, mimeo, World Bank, Washington, DC.

Davis, S.J., 1992. Cross-country patterns of change in relative wages, in Blanchard, O., Fischer, S., (Eds), *NBER Macroeconomic Annual 1992*, MIT Press, Cambridge, MA.

Debreu, G., 1959. *Theory of Value, An Axiomatic Analysis of Economic Equilibrium*, Wiley, New York.

Dervis, K., de Melo, J., Robinson, S., 1982. *General Equilibrium Models for Development Policy*, Cambridge University Press and the World Bank.

Elbadawi, A.I., 1998. Can Africa export manufactures? the role of endowment, exchange rates and transaction costs, mimeo, World Bank.

Elbadawi, I., Mengistae, T., Zeufack, A., 2001. Geography, supplier access, foreign market potential, and manufacturing exports in Africa: an analysis of firm level data, World Bank Working Paper.

Fan, S., Hazel, P., Thorat, S., 1999. Linkages between government spending, growth and poverty in rural India, Research Report 110, International Food Policy Research Institute, Washington, DC.

Foley, D.K., 1970. Economic equilibrium with costly marketing, *Journal of Economic Theory* 2, 276-291.

Francois, J.F., Shiells, C.R., 1994. AGE models of North American Free Trade, in Francois, J.F., Shiells, C.R. (Eds), *Modeling Trade Policy, Applied General Equilibrium Assessments of North American Free Trade*, Cambridge: Cambridge University Press.

Freund, C., Weinhold, D., 2000. On the effect of the internet on international trade, International Finance Discussion Papers 693, Board of Governors of the Federal Reserve System.

Goldberg, V. 1985. Production functions, transaction costs and the new institutionalism, in Feiwel, G.R., (Ed), *Issues in Contemporary Microeconomics and Welfare*, SUNY Press, Albany.

Guasch, J.L., Kogan, J., 2001. Inventories in developing countries: levels and determinants – a red flag for competitiveness and growth, World Bank Working Paper 2552.

Hahn, F.H., 1971. Equilibrium with transaction costs, *Econometrica* 2, 276-291.

Harrison, G.W., Rutherford, T.F., Tarr, D.G., 1996. Increased competition and completion of the market in the European Union: static and steadystate effects, *Journal of Economic Integration*, 11(3), 332-365.

Helpman, E., (Ed), 1998. *General Purpose Technologies and Economic Growth*, Cambridge: MIT Press.

Henderson, J.V., Zmarak, S., Venables, A., 2001. Geography and development, *Journal of Economic Geography* 1, 81-106

Hertel, T.W., Walmsley, T.L., Itakura, K., 2001. Dynamic effects of the "New Age", free trade agreement between Japan and Singapore, *Journal of Economic Integration* 16(4), 446-448.

Hummels, D., 2001. Time as a trade barrier, Working Paper, Purdue University.

Jalan, J., Ravallion, M., 1998. Are there dynamic gains from a poor-area development program?, *Journal of Public Economics* 67, 65-85.

KPMG, 2000. The impact of the new economy on poor people and developing countries, Draft Final Report to the UK Department for International Development, 7 July.

Krugman, P., Lawrence, R., 1993. Trade, jobs, and wages, NBER Working Paper 4478, National Bureau of Economic Research.

Kurz, M., 1974. Equilibrium with transaction cost and money in a Single Market exchange economy, *Journal of Economic Theory* 7, 418-452.

Lawrence, R. Z., Slaughter, M., 1993. International trade and American wages in the 1980s: giant sucking sound or small hiccup?, in Baily, M.N., Winston, C. (Eds), *Brookings Papers on Economic Activity: Microeconomics 2*, 161-211.

Leamer, E., 1996. Wage inequality from international competition and technological change: theory and country experience, *American Economic Review*, Papers and Proceedings, May, 309-314.

Limao, N., Venables, A., 2002. Infrastructure, geographical disadvantage, transport costs and trade, with Limao, N., forthcoming in *World Bank Economic Review*.

Meller, P., Tokman, A., 1996. Chile: apertura comercial, empleo y salarios, International Labor Organization Working Paper 38.

Obstfeld, M., Rogoff, K, 2000. The six major puzzles in international macroeconomics: is there a common cause?, NBER Working Paper 7777, National Bureau of Economic Research.

Redding, S., Venables, A., 2001. Economic geography and international inequality, unpublished paper.

Sadoulet, E., de Janvry, A., 1995. *Quantitative Development Policy Analysis*, Johns Hopkins University Press.

Samuelson, P.A., 1954. The transfer problem and transport costs, II: analysis of effects of trade impediments, *Economic Journal*.

Slaughter, M.J., Swagel, P., 1997. Does globalization lower wages and export jobs?, *Economic Issues* 11, International Monetary Fund, Washington, DC.

US International Trade Commission, 1992. *Economy-Wide Modeling of the Economic Implications of a FTA with Mexico and a NAFTA with Canada and Mexico*, Publication 2516, May.

US International Trade Commission, 1998. *The Economic Implications of Liberalizing APEC Tariff and Non-tariff Barriers to Trade*, Publication 3101, April.

Williamson, O., 2000. The new institutional economics: taking stock, looking ahead, *Journal of Economic Literature* Vol. XXXVIII, (September), 595–613.

Wood, A., 1994. *North-South Trade, Employment and Inequality*, Clarendon Press, Oxford.