CREDIT Research Paper

No. 98/13

Protection, Trade Policy and Transport Costs: Effective Taxation of Ugandan Exporters

by

Chris Milner, Oliver Morrissey and Nicodemus Rudaheranwa

DFID-TERP: CREDIT DISCUSSION PAPER 7 (CDP007)
This is Discussion Paper No. 7 in the CREDIT Project on 'Infrastructural and Institutional Constraints to Export Promotion', as part of the DFID Trade and Enterprise Research Programme (TERP). The TERP involves research projects by teams in CREDIT, CREEM (SMF, Nottingham), CSAE (Oxford) and IDS.

Centre for Research in Economic Development and International Trade, University of Nottingham

The Centre for Research in Economic Development and International Trade is based in the School of Economics at the University of Nottingham. It aims to promote research in all aspects of economic development and international trade on both a long term and a short term basis. To this end, CREDIT organises seminar series on Development Economics, acts as a point for collaborative research with other UK and overseas institutions and publishes research papers on topics central to its interests. A list of CREDIT Research Papers is given on the final page of this publication.

Authors who wish to submit a paper for publication should send their manuscript to the Editor of the CREDIT Research Papers, Professor M F Bleaney, at:

Centre for Research in Economic Development and International Trade,
School of Economics,
University of Nottingham,
University Park,
Nottingham, NG7 2RD,
UNITED KINGDOM

Telephone (0115) 951 5620
Fax: (0115) 951 4159

CREDIT Research Papers are distributed free of charge to members of the Centre. Enquiries concerning copies of individual Research Papers or CREDIT membership should be addressed to the CREDIT Secretary at the above address. Papers may also be downloaded from the School of Economics web site at:
www.nottingham.ac.uk/economics/research/credit

CREDIT Research Paper

No. 98/13

Protection, Trade Policy and Transport Costs: Effective Taxation of Ugandan Exporters

by

Chris Milner, Oliver Morrissey and Nicodemus Rudaheranwa

Centre for Research in Economic Development and International Trade, University of Nottingham

The Authors

Chris Milner is Professor and Head of School, and Oliver Morrissey is Director of CREDIT and Senior Lecturer, both in the School of Economics, University of Nottingham. Nicodemus Rudaharenwa is a Research Student in the School of Economics, University of Nottingham.

Acknowledgements

This is Discussion Paper CDP007 in the CREDIT Project on 'Infrastructural and Institutional Constraints to Export Promotion', as part of the DFID Trade and Enterprise Research Programme (Research Grant CNTR 96 0494A). Nicodemus Rudaheranwa is grateful to DFID for funding his position as a Research Student on this project.

Manuscript received: December 1998

PROTECTION, TRADE POLICY AND TRANSPORT COSTS: EFFECTIVE TAXATION OF UGANDAN EXPORTERS

by

Chris Milner, Oliver Morrissey and Nicodemus Rudaheranwa

Abstract

Uganda has made significant progress in reducing the anti-export bias in its trade policy in the 1990s. Taxes on exports have been abolished, and import protection has been reduced considerably. Trade policy barriers are only a component, albeit important, of the transactions costs associated with trade. Poor infrastructure, notably by increasing transport costs, and institutional inefficiencies (for example, in customs clearing procedures), can significantly increase trade costs. This paper uses data from a range of sources to estimate the transport costs for imports to, and exports from, Uganda. Separate estimates are provided for road freight, sea freight and air freight for fourteen productive sectors of the economy. The effective protection of imports, and implicit tax on exports, due to transport costs is calculated and compared to effective protection due to trade policy barriers. The results reveal that transport costs are often very high, in many cases representing a greater cost (tax) to exporters than trade policy. Investment in improved transport infrastructure could be of significant benefit to Uganda, especially to exporters.

Outline

1. Introduction
2. Barriers to International Trade
3. Analytical Framework
4. Data and Estimation Procedures
5. Results and Discussion
6. Conclusions

1 Introduction

The main objective in this paper is to quantify the relative importance of 'policy-induced' and 'non-policy' barriers to trade, using an effective protection approach. By policy-induced barriers we refer to price distortions and trade costs associated with trade policy. In particular, this quantifies the effect of taxes on imports (tariffs), non-tariff barriers (NTBs) and taxes on exports. The non-policy barriers are strictly those not associated directly with trade policy. Some will be transactions costs resulting from other (non-trade) policies. For example, a highly regulated exchange rate regime can increase the costs of exchanging currency; exporters may not be able to retain the full true value of foreign exchange earnings, or importers may have difficulty getting the hard currency they require. Similarly, an inefficient financial system can increase the costs of, and ration access to, credit (necessary, for example, to finance trade). More importantly, for present purposes, are what can be termed natural barriers. Some countries will face additional trade costs because of their geographical characteristics. For example, countries like Uganda are land-locked whilst islands like Mauritius are remote. These natural barriers will increase costs (of getting goods to market) for affected countries, relative to countries with more favourable geographical characteristics. We address this by examining transport costs.

To some extent the distinction between trade policy and non-policy barriers is arbitrary. In principle, one could envisage various ways of categorising trade distortions or barriers: trade policy-induced, non-trade policy, infrastructure inefficiencies (that, for example, increase transport, storage and distribution costs), institutional constraints (slow customs procedures at borders, lack of marketing information) and natural barriers. Many of these are difficult to measure, even approximately; we confine attention to two and take the example of Uganda. First, we will measure effective protection due to trade policy (specifically, taxes on imports and exports). Second, using the effective protection formula, we will measure transport costs as an implicit tax on producers; note that this measure conflates two barriers, infrastructure inefficiencies and natural barriers, into one. Importers and exporters in Uganda will face higher transport costs than, for example, competitors in Kenya simply because they have to transport goods further to get to ports to ship goods overseas.[1] This is the natural element. However, if transport infrastructure is poorly maintained and inefficient within Uganda, this increases trade costs; if the modes of transport to a port are inefficient, this increases trade costs. These costs associated with poor infrastructure are avoidable, by improving the quality of infrastructure. By quantifying the costs, one can estimate the potential benefits from investing in improved infrastructure.

The principal aim of this paper is to demonstrate that the implicit tax associated with transport costs in Uganda is quite high, and for many sectors exceeds the costs of trade policy barriers. These high transport costs are one factor that can help to explain why, although significant trade liberalisation has been implemented by Uganda in the 1990s, the supply response of exporters has been sluggish and limited (Morrissey and Rudaheranwa, 1998). Section 2 briefly reviews the literature on the role of transport costs in international trade. Section 3 then presents the analytical framework we will use, while Section 4 describes the data and estimation procedure. The results are discussed in Section 5, with concluding observations in Section 6.

2 Barriers to International Trade

Trade barriers, be they artificial (e.g. tariffs and import restrictions) or natural, such as geographical distance between producing and market centres, increase transaction costs of traders. Early studies (Balassa, 1965; Basevi, 1966; Corden, 1966 and 1971) were concerned with determining the extent to which artificial trade barriers in the importing country impact on domestic prices. Transport costs may pose even more of a constraint to foreign trade (Waters II, 1970; Finger and Yeats, 1976; Yeats, 1977a). Although acknowledged as important, the literature on the impact of transport costs is sparse. This limited attention is often attributed to several factors such as lack of reliable data on incidence, the assumption that transport costs are outside the direct control of policy makers, and that the influence of transport costs on trade flows relative to that of tariffs is small. The latter assumption may have been true in highly protected economies, but one can question whether it is still true following bouts of trade liberalisation over the past decade or so.

---

[1] This specific argument relates to trade with overseas markets. The case of regional markets is different, and addressed below. For example, its land-locked status does not impose a differential cost

Evidence on the importance of freight costs from Waters II (1970), Finger and Yeats (1976), Clark (1981) and Milner (1996) shows that the effective rate of protection due to transport costs is often as high or higher than their tariff counterparts. Finger and Yeats (1976) further indicate that the incidence of freight charges is higher on goods exported by developing countries relative to those of industrial nations. Arguments have been advanced indicating that there are policy options that would reduce the impact of high freight costs in international trade (Amjadi and Yeats, 1995a,b). Such options include exploiting economies of scale in transportation (increasing the volume shipped), increasing efficiency in the shipping system, or increasing the unit value of commodities shipped. All would reduce the relative impact of freight charges on trade flows. Milner and Morrissey (1999) and Milner (1996 and 1998) disaggregate natural barriers into 'avoidable' and 'unavoidable' components and argue that increasing infrastructure efficiency would reduce the avoidable trade barriers.

There are salient advantages of reducing transaction costs resulting from avoidable natural trade barriers relative to the provision of subsidies or export incentives. Reducing transaction costs is an efficient means to resource utilisation and, unlike the provision of subsidies, does not invite retaliation by trading partners. The provision of subsidies encourages rent-seeking and induces economic inefficiency by distorting relative prices. Moreover, there may be inefficiencies and administrative costs on trading agents associated with the implementation of subsidies (Corden, 1971).

Most past research concentrates on protection due international (air/marine) transport costs only, with no adjustment made for overland transport costs borne by land-locked countries.[2] Most researchers use the difference between the f.o.b. and c.i.f. values (a method initially developed by Moneta, 1959) as a proxy for transport costs. The f.o.b. value includes production costs and all charges incurred in placing the goods on board a ship, while the c.i.f. value equals the f.o.b. value plus freight and insurance charges to the entry port of the importing country. Clearly this is a proxy for the extent to which the domestic producer is protected (or an exporter disprotected) by international (both air and marine) transport costs. It excludes transaction costs in the

---

on Uganda's trade with neighbours.

[2] See for example studies by Waters II (1970), Finger and Yeats (1976), Sampson and Yeats (1977),

goods distribution chain between the port of entry and the inland destination. Such transaction costs may arise from inefficiencies in transport, clearing procedures, port facilities and losses due to poor storage facilities in the distribution network. High transaction costs from such a poor infrastructure system may reduce and even nullify any comparative advantage that might be revealed by producer price comparisons (for a broader ranging and innovative study of transactions costs in trade, see Abdel-Latif and Nugent, 1996).

It may not matter whether the country is land-locked or not; significant trade barriers may originate from inefficiency in seaport services. Clark (1981) shows that a high proportion of transport costs originate from inefficiency in stowing, loading and unloading, and clearing of cargo at ports. Furthermore, large countries may have to transport goods long distances over-land. However, the problems are even greater for land-locked countries, especially in the case of exports. For example, Kenya, Tanzania and Uganda all export coffee. Kenya's internal transport infrastructure is probably less inefficient than Tanzania's, although the port at Dar-es-Salaam is probably less inefficient than Mombassa. The transport costs facing Kenyan and Tanzanian producers may be similar, but Ugandan producers (and those in Rwanda and Burundi) face even higher costs as they have to go through one of the former countries. In addition to the overland transport costs, there may also be costs associated with delays and processing at customs points.

Our analysis goes beyond previous studies in a number of respects. First, our transport costs are not based on cif-fob differentials; we use direct estimates of marine and air shipping costs. Second, we incorporate overland freight charges incurred in shipping goods between seaport and inland destinations. Third we use a more general analytical framework to measure transport costs not simply as increasing the price of the good in question but as increasing production costs. In other words, we estimate the effective protection (implicit tax on production) associated with transport costs, rather than simply the nominal protection.

Yeats (1977a,b), Jansson and Shneerson (1978), Clark (1981).

3 Analytical framework

Methods for measuring the impact of trade barriers are well developed (e.g. Greenaway and Milner, 1993). The nominal rate of protection (NRP) captures the price raising effect of a trade barrier on the affected product. For example, a tariff of 15 per cent increases the prices of imports by that percentage, hence domestic producers of competing goods can price up to that level, i.e. the domestic price can exceed the world price by 15 per cent (NRP = 0.15). This ignores the fact that some domestic producers use imported inputs; trade barriers increase the price of inputs, therefore increase production costs (or reduce value added). The effective rate of protection (ERP) incorporates this by measuring the proportional change in the value added for a product (j) as a result of a given trade barrier. Both measures can be adapted to measure the protection (implicit tax) associated with transport costs.

We assume that domestically produced and foreign goods are perfect substitutes. This is a restrictive assumption if one is using a high level of commodity aggregation or for manufactures, but may not be too unrealistic for agricultural commodities (Tsakok 1990). Sadoulet *et al*. (1995), de Melo *et al.* (1981) and Devarajan and Sussangkarn (1992) argue that import penetration and the elasticity of substitution have opposing biases on ERP estimates. Measured ERP is based on the shares of particular inputs in production costs. If import penetration (the share of imports in the market) is high, measured ERP will tend to over-estimate protection; if domestic producers really were being protected, import penetration would not be so high. On the other hand, if the elasticity of substitution is high, measured ERP is more 'accurate' in the sense that (protected) domestic goods can be used in place of imports. Thus, if the elasticity of substitution is high, import penetration should be low for protected goods; in this sense, the two have opposite biases on the interpretation of ERPs. Our assumption of an infinite elasticity of substitution implies that our estimates should be interpreted as at the higher end.

We adopt the following commonly used formula of the ERP,

$$e_j = [t_j - \sum_i a_{ij} t_i]/[1 - \sum_i a_{ij}] \qquad [1]$$

Where t_j and t_i are *ad valorem* tariff rates on imported final output (j) and intermediate inputs (i) respectively while a_{ij} is the technical coefficient that represents the amount of input i used in producing one unit of output j. In the absence of non-policy protective factors, the effective rate of protection afforded by tariffs on product j is given by e_j. This formula can relatively easily be extended to incorporate non-traded inputs and non-tariff barriers (if one has a measure of the tariff-equivalent), issues we return to below.

Extension of the analysis of effective protection to include transport costs can be achieved with a relatively straightforward modification of equation [1] (e.g. Milner and Morrissey, 1999). Assume a world without tariffs and consider the protection afforded to domestic industries by shipping costs on imports. If we let r_j and r_i be the *ad valorem* freight rates borne when shipping output j and input i respectively in the absence of trade policy barriers, we get:

$$e_j = [r_j - \sum_i a_{ij} r_i]/[1 - \sum_i a_{ij}] \qquad [2]$$

In equations [1] and [2], tariffs and freight costs on outputs provide an implicit subsidy to domestic producers of import-competing goods, but disprotect (tax) producers of exports. Tariffs and transport costs on inputs increase costs of production, whether for domestic sales or export market, and therefore implicitly tax both import-competing and export producers. Natural barriers have a double negative impact on production for export, through increased costs on inputs and reduced margins on export sales (Box 1). Unlike producers for the domestic market, exporters may not be able to pass on the cost increases to consumers because of high competition in the export markets. Therefore, the impact of trade barriers will be greater on export producers than producers for the domestic market.

Disprotection to exporters resulting from natural trade barriers is slightly different from that originating from policy barriers. Under trade policy barriers some compensation may be provided to exporters, such as relief of duties paid on imported inputs for production for exports. Measures to offset the impact of duties on imported inputs often include tariff exemptions and duty drawback schemes or provision of explicit export subsidies. If such compensating measures are in place the anti-export bias due to trade policy barriers can be minimised or eliminated. In contrast, it is difficult to avoid the disprotection of exports originating from natural trade barriers, or infrastructure constraints. For example, it may be difficult to compute the subsidy equivalent of the implicit tax originating from a given natural barrier, and there may be no guarantee that if such a subsidy is granted it would benefit export producers rather than shipping agents. It may also be difficult to target the subsidy to exporters. Thus, even if subsidies were possible, they would be indiscriminate and would not eliminate the anti-export bias inherent in natural trade barriers. Measures to reduce infrastructure or institutional constraints, while they would benefit importers, would reduce the anti-export bias as they reduce costs in both directions (from, for imports, and to, for exports, foreign markets). This is especially true for primary commodity exports, where internal transport costs are often high. The various possibilities are summarised in Box 1.

Box 1: The Impact of Trade Barriers

Trade barrier	Importables	Exportables
Output		
Policy-induced Non-policy	subsidy subsidy	tax / neutral tax
Input		
Policy-induced Non-policy	tax tax	tax / neutral tax

Source: adapted from Milner (1998).

In practice, both policy and non -policy barriers may apply in which case a combined effect from the two sources is expected. Following Balassa (1968) and Johnson (1969) there are two approaches when both tariffs and transport costs apply. If tariffs are levied on the f.o.b. value of imports, the combined effect of both barriers is the sum of the two rates of effective protection (equations [1] and [2]). Alternatively, where tariffs are calculated as a proportion of the c.i.f. value (and therefore paid on transportation costs), an interactive effect should de added to the two ERPs.[3]

Whether the f.o.b. or c.i.f. system is used, the party that bears the burden of the tariff or freight costs depends on relative elasticities of demand and supply for the commodity in question (Amjadi and Yeats, 1995a). When the demand elasticity is higher than that of supply, a higher proportion of freight costs will be borne by the exporter. A small country like Uganda is likely to face a more elastic demand than supply for her exports (especially as these are primary commodities for which Uganda is a small producer on the global market), but more elastic supply than demand for imports. Therefore, the burden of shipping costs is likely to be incident on Ugandan exporters and importers. This implies that reducing transaction costs woud be of particular benefit to Uganda. Overall protection is given by:

$$e_j = [(t_j\text{-}\Sigma a_{ij}t_i)/(1\text{-}\Sigma a_{ij})]+[(r_j\text{-}\Sigma a_{ij}\, r_i)/(1\text{-}\Sigma a_{ij})]+[(r_j\, t_j\text{-}\Sigma a_{ij}\, t_i\, r_i)/(1\text{-}\Sigma a_{ij})] \qquad [3]$$

Equation [3] gives the total protection that would result from both tariffs and transport costs under the c.i.f. valuation system. That is, the first term on the right-hand side is the tariff protection given by equation [1], the second term is the natural protection given by equation [2], and the last term is the protection due to the interactive effect. The signs of each component depend on both the market orientation of production and the nature of the trade policy regime (Milner 1996). The relationship between the nominal and effective rates of protection can be distinguished if we assume uniform nominal rates of protection due to natural barriers on inputs and output, i.e. that $r_i = r_j$. For domestic sales, the escalating tariff scenario (output tariffs exceed input tariffs) implies that effective protection exceeds nominal protection[4] (i.e. $e_j \geq t_j \geq t_i$). Under the de-escalating tariff scenario, effective protection will fall short of nominal protection on output ($e_j \leq t_j \leq t_i$). In case of production for the export market, trade barriers would always increase costs of production ($t_i \geq 0$) and if there are no subsidies on exports then effective protection would be negative, or zero if there are exemptions or refunds of duties on inputs ($e_j \leq 0$). For cases where export subsidies

[3] For detailed discussion on the impact of using the c.i.f. or f.o.b. valuation on international trade flows see Yeats (1980) and Erzan and Yeats (1991)

[4] An implicit assumption is being made that $a_{ij} < 1$.

(s_j) are granted but at lower rates than the weighted rates on inputs then exports would still be disprotected, i.e. when $s_j < \Sigma a_{ij}t_i$.

Similar arguments apply for natural trade barriers with two exceptions. First, as noted earlier, exemptions and refunds to off-set costs increases will not effectively target exporters. Second, there will always be net negative protection (implicit tax) on export output from natural trade barriers. It follows that even under assumed uniform nominal rates of protection from natural trade barriers, the effective disprotection on exports from natural trade barriers will always be higher than (or at best equal to) that originating from policy-induced trade constraints. Effective protection due to the interaction of tariffs and natural barriers will be positive for domestic sales under escalating tariffs but negative for export sales in the absence of export subsidies.

The production process also employs non-traded inputs. Ideally, tradables and non-traded goods would be incorporated into measures of protection within a general equilibrium framework (Milner, 1995). An import duty, for example, would affect the demand for (and therefore the price of) non-traded goods. The impact of protection on non-traded goods depends on the substitutability or complementarity between tradables and non-traded goods.[5] First, protection on importables tends to increase the price and therefore production (but reduce consumption) of importables at the expense of both exportables and non-traded goods. Second, where non-traded goods are inputs to production of importables, increased production will increase the demand for, and prices of, non-tradables. This second influence leads to a gap between the intended and true protection of importables, and creates an implicit anti-export bias.

Two approaches (the Corden and Balassa methods) have been developed in the literature to handle non-traded inputs. Under the Corden method, value added is the sum of the returns to the primary factors directly involved in the productive activity and to primary factors embodied in non-traded inputs. The Balassa method refers to the direct value added in the production process only, and therefore encompasses a

[5] The substitution index ranges between one and zero, where one implies perfect substitutes. For example, the substitution index in Cameroon is 0.95 for agricultural prices and 0.62 for industrial

narrower set of activities than the Corden measure. The modified Balassa method considers how protection affects the cost of non-traded inputs. The essential differences between these alternative measures are summarised in Box 2.

Box 2: Alternative Computations of Value Added

Method	***Treatment of Value Added***
Simple Corden method	Value added = Value of output - cost of traded intermediate inputs directly used in production. The value added is the return to primary factors and non-traded inputs and therefore overstates the true value added by the cost of traded components of non-traded intermediate inputs.
Simple Balassa Method	Direct value added = Value of output - (cost of traded + non-traded intermediate inputs). The value added is the return to primary factors directly involved in the productive activity. This underestimates value added by the cost of primary factors used in the production of intermediate non-traded inputs.
Sophisticated Corden method	Value added = Value of output - (cost of direct traded inputs + cost of traded components of non-traded intermediate inputs). This computation requires information on the traded components in the production of non-traded intermediate inputs. Under such a decomposition, the value added correctly measures the return to primary factors directly involved in the productive activity and to primary factors indirectly involved in the productive activity (i.e. via intermediate non-traded inputs).
Modified Balassa Method	Direct value added for border prices = Value of output - (cost of traded + non-traded intermediary inputs - tariff/subsidy on traded components).

The modified Balassa method considers how the protective factors change the cost of non-traded intermediary inputs. In summary, traded inputs, whether direct or indirect, are subtracted from the value of output under the Corden measure while both traded and non-traded intermediary inputs are subtracted under the Balassa system. In our

prices (Milner, 1990), while it is 0.66 for Uganda (Milner and Morrissey, 1997).

estimation process, non-traded inputs are treated according to the Balassa method[6], which assumes an infinite elastic supply of non-traded inputs and therefore that all-non-traded inputs are supplied to the processing sectors at constant costs. It disregards value added embodied in the production of non-traded inputs. As a result the prices of their value added components remain unchanged when domestic values of output and inputs are re-valued at world prices. The resulting formula is:

$$e_j = [(t_j - \Sigma a_{ij} t_i) + (r_j - \Sigma a_{ij} r_i) + (r_j t_j - \Sigma a_{ij} t_i r_i)] / (1 - \Sigma_i a_{ij} - \Sigma_n a_{nj}) \qquad [4]$$

4 Data and Estimation Procedure

To estimate equation [4] we need information on tariffs and transport costs for outputs *j* and inputs *i*, and for the technical coefficients. The technical coefficients are extracted from the 1992 Ugandan Input-Output table, classified into 30 sectors (we are only concerned with the 14 tradables sectors). As these are post-protection technical coefficients they are deflated to arrive at free trade technical coefficients. We employ the method of Balassa *et al.* (1982), given by $\boldsymbol{a_{ij}^{w}} = \frac{(1+tj)}{(1+ti)} \boldsymbol{a_{ij}}$ relating the post-protection (a_{ij}) and free trade (a_{ij}^{w}) input-output coefficients[7]. In transforming the technical coefficients in the production of non-traded inputs, t_i is assumed to equal zero under the Balassa method. The estimated free trade technical coefficients are employed in the ERP estimation.

Uganda uses the c.i.f. valuation system for sales on the domestic market and the f.o.b. valuation system for sales in the export market. Recently Uganda shifted from the f.o.b. Mombasa to f.o.t. (free on truck, or alternatively free on rail) Kampala valuation

[6] The simple Balassa method treats nontradable inputs like tradable inputs with unchanged prices, while the modified Balassa (sometimes called Scott) method treats nontradable inputs like tradable inputs with an allowance of their prices to change as a result of protective measures. There are computation difficulties with the Corden method while the Scott method is not suitable for estimation of ERP under the partial equilibrium framework. This leaves us with the simple Balassa method option only.

[7] Tariffs imposed on inputs would discourage the production of *j* (thus reduced output) and therefore $a_{ij} > a_{ij}^{w}$ while tariffs on output would encourage production of output *j* thus $a_{ij} < a_{ij}^{w}$ and would result into the following relationship $\boldsymbol{a_{ij}} = \frac{(1+ti)}{(1+tj)} \boldsymbol{a_{ij}^{w}}$.

system (which would increase the interaction effect) but the current analysis is based on f.o.b. and c.i.f. Mombasa. Some points need be noted when estimating the ERP for exports. Duties and freight costs on imported inputs explicitly and implicitly tax producers, whether for domestic or export markets. On the other hand freight costs implicitly tax output for export markets. Thus, shipping costs implicitly tax export producers twice, i.e. they increase the costs of imported inputs and exported output hence reducing their profit margin in exporting activities. Moreover, exporters are disadvantaged in that they are price-takers in international markets and therefore may not be able to shift such costs to consumers. In estimating the ERP for exports we set policy-induced NRP equal to zero given that there are neither export subsidies nor export taxes in Uganda (the tax on coffee exports was abolished in 1992, although temporarily reinstated later, see Morrissey and Rudaheranwa, 1998). [8]

The choice of variables is dictated by data availability. The nominal rate of protection would be the *ex-ante* or listed tariff rate if there are no other policy impediments to trade, such as quantitative restrictions, and if there are no exemptions from import duties. To accommodate exemptions, it is appropriate to use *ex-post* or implicit (revenue collected) tariff rates. The tariff rates used in our analysis are *ex-post* rates computed from the 1993/94 tariff schedule provided by Uganda Customs Department, distinguishing trade with African countries in the Preferential Trading Arrangement (PTA, or COMESA) and with the rest of the world (non-PTA, or NPTA).

The commodity categories in the tariff schedule are reported according to the SITC commodity classification although their HS codes (into 97 commodities) are also reported. We first reclassify these commodities under the analysis according to the HS chapter and then aggregated them into various groups that are consistent with sectors given by the Uganda Input-Output table (the sectors are listed in the tables below). This is necessary because the technical coefficients are available at the sector level.

Tariff rates on output (sector) *j* for PTA markets is the ratio of total duty collected on

---

[8] There may be implicit export subsidies on duties paid on imported inputs for export production but we are unable to get relevant information. In practice, the paid duties are supposed to be reimbursed under the duty drawback scheme but it may not be attractive to traders because of the lengthy and difficult bureaucratic procedures of getting the refunds.

commodity *j* to the value of imports of *j* from PTA countries. An equivalent procedure is used to get tariff rates on final outputs from NPTA countries. We use the average tariff rates on imported inputs (averaging across both sources) as we do not know from which market imports to a particular sector were sourced. Import taxes employed in Uganda include import duties, withholding tax and commission charges. Sales tax and Excises are imposed on domestic products also therefore do not provide protection. The implicit tariff rate is given by *t = (Duty + withholding tax + commission)/c.i.f. value.* As the reported tariff rates are on a commodity level within each sector, the tariff rates used for each sector are an average of tariff rates on commodities in that sector. This commodity tariff averaging in a given sector may mask the dispersion of tariff rates across commodities. To allow for this we compute and report maximum and minimum protection rates (i.e. the range) in each sector where possible.

The freight rates used in our estimation are measured as a ratio of shipment value, i.e. *ad valorem* freight rates. Data on individual commodity freight rates for NPTA trade flows were derived from Amjadi and Yeats (1995a) and used to compute sectoral average freight rates. From this source, we can distinguish average marine and air freight costs for each sector; note that these estimates for marine freight include the costs of shipping the goods overland to the seaport. Freight rates on PTA trade flows (which provide an estimate of overland costs) are derived from World Bank (1994), which reports freight rates as an overall average for the country. However, we need freight rates on a sectoral level.

We use NPTA freight rates to derive proxies for PTA freight rates by computing backwards using the following procedure. Let AVF_N and AVF_P be the overall average freight rates for the NPTA and PTA trade flows respectively, while F_{iN} and F_{iP} are freight rates for sector *i* on NPTA and PTA trade respectively. We have data on AVF_P and F_{iN} and we can compute the value AVF_N but no data on F_{iP}. Computing $AVF_N=(\Sigma F_{iN})/\Sigma i$ where Σi is the number of sectors (in our case 14) and then using it in $F_{iP} = (F_{iN}*AVF_P)/AVF_N$, we get the nominal freight rates used in the computation of freight rates of protection for each sector on PTA trade. In other words, we assume for each sector that the ratio of sector transport costs to average transport costs is the same for PTA as for NPTA trade.

In our computation we use road-transport costs on the Kampala-Mombassa route in deriving the sectoral nominal freight rates. Rail transport is used on both Mombassa and Dar-es-Salaam routes, but road transport on the Mombasa route is chosen as it handles a higher volume of traffic and attracts higher freight rates than rail transport. In this sense we may over-estimate potential freight costs for some commodities. Against this, we do not account directly for costs associated with delays and inefficiencies. The raw data on overland freight costs are presented in Table 1.

Table1: Shipping costs for landlocked countries of Eastern Africa (% c.i.f.)

		Uganda		Burundi		Rwanda	
Imports		BB	CNT	BB	CNT	BB	CNT
Mombasa	Road	16.5	9.3	27.0	13.8	26.2	-
	Rail	11.9	7.5	-	-	-	-
Dar	Road	18.7	8.6	22.8	10.5	22.8	-
	Rail	23.0	5.3	13.4	6.5	-	-
Reliability		2.0		1.5		1.6	
Losses		1.0		1.2		1.3	
Exports							
Mombasa	Road	10.6	9.6	17.4	13.6	16.3	12.9
	Rail	10.3	8.8	-	-	-	-
Dar	Road	8.1	9.0	25.8	11.3	9.8	10.7
	Rail	10.2	10.5	10.7	11.7	10.0	10.9
Reliability		1.9		1.4		2.2	
Losses		1.0		1.4		0.9	

Note: BB and CNT refer to break-bulk and containerised shipments.
Source: World Bank (1994).

It is clear from Table 1 that road transport is more expensive than rail on the Mombassa route, although a higher share of shipments are by road. Rail transport may offer low freight rates to attract more cargo, or freight rates may be lower on rail because of its ability to ship in bulk quantities. It is possible that most traders are dealing in shipments of insufficient volume to benefit from the scale economies of bulk rail shipments, while road transport offers greater flexibility. The rail systems in the three East African countries are government-managed and notoriously inefficiencient. This does not imply that road transport is efficient in itself (only efficient relative to rail transport). Freight rates on exports are generally lower than those on imports due to imbalances in trade flows. Import volumes exceed export volumes so that there is excess capacity in trucks or trains returning to sea-ports.

Combining these various sources of data permits us to estimate the average *ad valorem* freight costs for each sector (these transport NRPs are reported in Appendix Tables A2-A4). We do not know the extent to which a sector utilises break bulk or containerised shipping, although we do know that the former is more expensive (Table 1). Similarly, we do not know the extent to which a sector uses alternative road or rail routes. However, we do know which commodities are relatively more expensive to transport, hence which sectors have relatively higher transport costs (from the calculations for NPTA trade outlined above). We can infer that sectors with relatively high transport costs are those using relatively more expensive forms or routes of transport. We will consider the reasons why this may be the case.

5 Results and Discussion

Using data and procedures outlined in the previous section, and assuming perfect substitution between domestic and imported goods, nominal and effective rates of protection associated with trade policy and transport costs (distinguishing land, sea and air freight) are estimated for fourteen production sectors. The detailed results are given in Appendix Tables A1-A4 (we do not report the interactive effect in equation [4] as the values are relatively small). A summary of measures of effective protection against imports is provided in Table 2 (these estimates refer to 1993/94, since when there has been considerable trade liberalisation so that current levels of protection will be much lower). Goods traded within the PTA region receive preferential treatment relative to goods originating outside the region (NPTA), as seen from the evidence that weighted average effective protection rates are 22.3% and 35.8% against imports from PTA and NPTA respectively. The exceptions (manufactured foods, chemicals, beverages and tobacco) are products for which Uganda is concerned about competition from neighbours, in particular Kenya. These are also among the sectors attracting the highest rates of protection. The most highly protected sectors, at least relative to NPTA imports, are textiles, clothing and footwear, and building materials. Table 2 reports average ERPs; we can note that protection rates against NPTA trade exhibit a wider dispersion, with ERPs ranging between 97.9% to 15.2% relative to ERPs against PTA imports ranging between 45.8% and 11.5% (Table A1). This wide dispersion reflects preferential tariff rates and exemptions on PTA imports.

Table 2: Estimates of Effective Protection on Imports

Sector	**PTA**	**NPTA**	**Land**	**Marine**	**Air**
Food Products	0.235	0.274	0.274	0.182	0.183
Animal Products	0.151	0.324	0.093	0.061	0.155
Forestry Products	0.118	0.155	0.237	0.149	0.366
Fish Products	0.320	0.351	0.089	0.055	0.681
Mining & Quarrying	0.045	0.165	0.213	0.137	0.254
Coffee, Cotton, Sugar Mnf.	0.191	0.299	0.163	0.107	0.323
Manufactured Foods	0.268	0.238	0.483	0.287	0.320
Beverages & Tobacco	0.501	0.300	0.613	0.373	1.265
Textile, Cloth & Footwear	0.268	1.419	0.220	0.113	0.392
Building Materials	0.289	0.550	0.609	0.357	1.101
Chemicals	0.272	0.098	0.081	-0.016	0.128
Metal Prod. & Machinery	0.033	0.385	0.159	0.076	0.247
Other Manufactures	0.233	0.213	0.208	0.092	0.390
Transport Equipment	0.201	0.243	0.157	0.077	0.242
Average	*0.223*	*0.358*	*0.257*	*0.147*	*0.432*

Turning to freight costs, separate estimates are presented for land (road through Kenya, for PTA trade), marine (average Mombassa to US) and air (average Entebbe to US).[9] On average, effective protection due to transport costs (25.7%) is higher than that originating from tariffs (22.3%) for PTA trade but falls short of the tariff protection on non-PTA trade (35.8%). There is no clear tendency for sectors with relatively 'heavy' commodities to have higher freight costs, even if one considers only nominal protection associated with transport costs (Tables A2-A4). While building materials tend to have the highest costs, foods (products and manufactures), beverages and tobacco also have relatively high freight costs. As freight costs are

[9] The available data is for international transport to the US. As Ugandan trade is more likely to be with Europe, this implies an overestimate of true transport costs. We hope to address this in future work.

measured relative to value, the latter could have low value-to-weight ratios. Alternatively, shipment volumes may be relatively low, hence do not avail of bulk efficiencies. It is not clear why metal products and machinery, mining and quarrying, and transport equipment have relatively low freight costs. One possibility is that such goods can fill capacity in bulk carriers and/or unit freight costs are low for relatively high value goods (note that the estimation procedure imposes sea freight relativities on land freight). The combined effect is that *ad valorem* transport costs are relatively low.

As all goods have to be transported to a port for shipment overseas, in principle land and marine freight costs should be added to get total transport costs. We do not do this because we are not confident of the accuracy of our land transport cost estimates. The ERPs associated with over-land transport in Table 2 should be interpreted as indicative of magnitudes and relativities. Land transport costs are high, about 10 per cent of value on average (Table 1), and therefore confer protection to domestic producers of importables. This can translate into high levels of effective protection; while the values in excess of 50 per cent for manufactured foods, building materials, beverages and tobacco may be excessive, an overall average around 20 per cent is not unreasonable. Further investigation, to determine the modes of land transport adopted in different sectors, would be necessary to validate the relativities in Table 2.

The column of ERPs associated with costs of sea transport (marine) can be interpreted as at the lower end, as over-land costs are not incorporated. While there is considerable variability, transport costs appear to confer relatively high degrees of protection (ERPs exceeding 25 per cent) for manufactured foods, building materials, beverages and tobacco. These are also sectors with relatively high trade protection. Thus, while the significant trade liberalisation since 1993 (Morrissey and Rudaheranwa, 1998) will reduce levels of trade protection, natural protection still remains high for some sectors. Transport costs may continue to isolate Ugandan producers from world competition. Finally, we simply note that the alternative of importing by air is excessively costly for most goods.

Transport costs impose a very high burden (implicit tax) on export sectors (Table 3). The disprotection of exports from policy-induced barriers is mainly through taxes on imported inputs with no off-setting export subsidies. Average policy-induced disprotection to exports is equivalent to a tax of 12.5 per cent (Table 3). However, we can note that the implicit tax is low on those sectors that provide most of Uganda's exports – coffee, cotton, food and animal products, fish and forestry products. Subsequent tariff reductions will have eroded this disprotection further, but any export response to trade liberalisation in Uganda has at best been sluggish (Morrissey and Rudaheranwa, 1998). Our estimates of the implicit tax on exports associated with transport costs suggests a reason why. Overall, land and marine transport costs each represent an average implicit tax on exports of 30 per cent; air freight represents a tax, on average, almost twice this.

In general, the implicit tax due to transport, of similar magnitudes for land and sea, is lower in the exporting sectors. Sea transport costs represent a tax of about 20 per cent on food and forestry products, though this falls to around ten per cent for coffee and is below ten per cent for animal and fish products. As a guide, we can compare the air alternative to the sum of land and marine transport. Even on this basis, air freight appears to be cost effective only for food products. This may not be surprising given that air transport is likely to be suitable only for high-value goods which may be shipped in relatively small amounts, and therefore may attract high freight rates. Air transport is likely to be faster, more flexible and may be specialised to handle delicate goods with high insurance costs or commodities with short shelf life (perishables) that require urgent deliveries. All these factors contribute to high air freight rates. On the other hand, marine freight rates may be lower because of the nature of the goods being shipped, as it is suitable for goods that can be transported in bulk.

Table 3: Effective Protection Estimates for Exports

Sector	Trade	Land	Marine	Air
Food Products	-0.007	-0.183	-0.191	-0.192
Animal Products	-0.004	-0.067	-0.070	-0.164
Forestry Products	-0.039	-0.202	-0.209	-0.425
Fish Products	-0.055	-0.078	-0.081	-0.707
Mining & Quarrying	-0.035	-0.167	-0.173	-0.291
Coffee, Cotton, Sugar Manufactures	-0.013	-0.115	-0.120	-0.335
Manufactured Foods	-0.177	-0.496	-0.513	-0.546
Beverages & Tobacco	-0.129	-0.584	-0.605	-1.497
Textile, Cloth & Footwear	-0.354	-0.316	-0.325	-0.605
Building Materials	-0.149	-0.649	-0.670	-1.414
Chemicals	-0.231	-0.402	-0.410	-0.554
Metal Products & Machinery	-0.190	-0.252	-0.259	-0.430
Other Manufactures	-0.199	-0.371	-0.381	-0.679
Transport Equipment	-0.166	-0.240	-0.247	-0.411
Average	*-0.125*	*-0.294*	*-0.304*	*-0.589*

The most important point is that transport costs are high. Over-land transport in the region is inefficient, with many delays and losses due to damage or inadequate storage (Morrissey and Rudaheranwa, 1998). It also true that the ports of Mombassa and Dar-es-Salaam are not very efficient. The ERPS associated with land and marine transport could feasibly be halved through investment in improved infrastructure and administrative processing, at customs points and ports. As Uganda tries to diversify its exports it is moving into goods, such as green beans and cut flowers, for which speedy transport is essential. Air freight is appropriate here, but costly (partly because of a lack of refrigeration facilities). Our estimates demonstrate that natural barriers, especially transport costs, are an important constraint to Ugandan exporters.

6 Conclusions

In this paper we used data on freight costs from a variety of sources in an effective protection framework to estimate the protection to imports and implicit taxation of exports associated with transport costs. While some of the estimates are admittedly rough, we have been able to demonstrate that transport costs are in general high, often exceeding the protection (or disprotection of exports) attributable to trade barriers, and represent a significant constraint to Ugandan exporters. Trade liberalisation does much to reduce the anti-export bias inherent in protectionist trade policies, but one reason for the limited export response observed in countries like Uganda could be the significant remaining natural barriers. Investment in infrastructure, and other measures to reduce transactions costs, can play an important role in supporting export growth and diversification in Uganda.

In this analysis we have been unable to distinguish fully the individual components of transport costs. A next step will be to identify each stage: internal (overland) costs in Uganda, Uganda border to seaport overland costs, seaport to market marine costs, and airport to market air freight costs. In particular, it would be informative to be able to compare land plus sea transport costs to air freight costs for particular commodities. However, air freight will only be viable for a few commodities, and the bulk of trade is likely to be transported over land for shipment from ports. It follows that improved road, rail and port facilities would be of major benefit to trade.

The current analysis covers only freight costs, just one component of the infrastructural and institutional constraints facing traders. There are likely to be high transaction costs arising from lack of information, both on local and foreign market conditions, poor communication and cumbersome administrative procedures. Limited access and high costs of credit may be another constraint that is not captured by our analysis. Inefficiency in the banking system in Uganda is reflected in the wide gap between the deposit and lending rates of interest, which stood at 3.2 per cent and 20.3 per cent respectively in 1997. Milner (1996), for example, estimates that inefficiency in the banking system increases the cost of credit by 20 per cent.

There is potential for increased trade flows within the PTA region, given proximity, similarities in level of development and patterns of demand. Increased efficiency in production to increase the quality and value of Ugandan exports within the PTA region could avoid the high transaction costs of shipping goods to overseas markets. One problem to be resolved if this potential is to be exploited is the improvement of internal transport facilities. Transaction costs from natural trade barriers are difficult to eliminate, but one can distinguish avoidable costs associated with inefficiencies from the truly natural barriers. There are ways of minimising transaction costs, including reducing vessel turn around times, simplifying cargo handling and clearing procedures at ports, and in the distribution system generally. Such measures can have important effects in reducing the costs of trade and facilitating an increased volume of trade, especially of exports.

References

Abdel-Latif, A. and J. Nugent (1996), 'Transaction Cost Impairments to International Trade: Lessons from Egypt', *Contemporary Economic Policy*, 14, 1-14.

Amjadi, A. and A. Yeats (1995a), 'Nontariff barriers Africa faces; What did the Uruguay Round accomplish, and what remains to be done', *Policy Research Working Paper 1439*, Washington DC: World Bank, International Trade Division.

Amjadi, A. and A. Yeats (1995b), 'Have transport costs contributed to the relative decline of sub-Saharan African exports? Some preliminary empirical evidence', *Policy Research Working Paper 1559*, Washington DC: World Bank, International Trade Division.

Balassa, B. (1965), 'Tariff Protection in Industrial Countries: An Evaluation', *Journal of Political Economy*, 73, 573-594.

Balassa, B. (1968), 'Tariff Protection in Industrial Nations and its Effects on Exports of Processed goods from Developing Countries', *Canadian Journal of Economics*, Vol. 1, 583-594.

Balassa, B., and Associates (1982), *Development Strategies in Semi-industrial Economies,* Washington, DC: Johns Hopkins University Press.

Basevi, G. (1966), 'The United States Tariff Structure: Estimates of Effective Rates of Protection of United States Industries and Industrial Labour', *The Review of Economics and Statistics*, 48, 147-160.

Clark, D. (1981), 'Protection by International Transport Charges: Analysis by Stage of Fabrication', *Journal of Development Economics*, 8, 339-345.

Corden, W. M. (1966), 'The Structure of a Tariff System and the Effective Protective Rate', *Journal of Political Economy*, 74: 3, 221 -237.

Corden, W. M. (1971), *The Theory of Protection,* London: Oxford University Press.

de Melo, J. and S. Robinson (1981), 'Trade Policy and Resource Allocation in the Presence of Product Differentiation', *R. Economics and Statistics*, 63, 169-177.

Devarajan, S. and C. Sussangkarn (1992), 'Effective Rates of Protection when Domestic and Foreign Goods are not Imperfect Substitutes: The Case of Thailand', *Review of Economics and Statistics*, 74, 701-711.

Erzan, R. and A. Yeats (1991), 'Tariff Valuation Bases and Trade among Developing Countries: Do Developing Countries Discriminate Against their own Trade?' *Journal of Development Studies*, 27: 4, 64-83.

Finger, J. and A. Yeats (1976), 'Effective Protection by Transportation Costs and Tariffs: A Comparison of Magnitude', *Quarterly Journal of Economics*, Vol. XC: 1, 169-176.

Greenaway, D. and C. Milner (1993), *Trade and Industrial Policy in Developing Countries*, London: The Macmillan Press Ltd.

Jansson, J. and D. Shneerson (1978), 'The Effective Protection Implicit in Liner Shipping Freight Rates', *Review of Economics and Statistics*, 60, 569-573.

Johnson, H. G. (1969), 'The Theory of Effective Protection and Preferences', *Economica*, 36, 119-138.

Milner, C. (1990), 'Identifying and Quantifying Anti-Export Bias: The Case of Cameroon', *Weltwirtschaftliches Archiv*, 126, 142-155.

Milner, C. (1996), 'On Natural and Policy-Induced Sources of Protection and Trade Regime Bias', *Weltwirtschaftliches Archiv*, 132, 740-752.

Milner, C. (1998), 'Trade Regime Bias and the Response to Trade Liberalisation in Sub-Saharan Africa', *Kyklos*, 51, 219-236.

Milner, C. and O. Morrissey (1999), 'Measuring Trade Liberalisation in Africa', in M. McGillivray and O. Morrissey (eds), *Evaluating Economic Liberalisation*, London: Macmillan (forthcoming).

Morrissey, O. and N. Rudaheranwa (1998), 'Ugandan Trade Policy and Export Performance in the 1990s', *CREDIT Research paper 98/12 (CDP006).*

Moneta, C. (1959), 'The Estimation of Transportation Costs in International Trade', *Journal of Political Economy*, LXVII, 41-58.

Sadoulet, E. and A. de Janvry (1995), *Quantitative Development Analysis*, Baltimore and London: Johns Hopkins University Press.

Sampson, G. and A. Yeats (1977), 'Tariff and Transport Barriers Facing Australian Exports', *Journal of Transport Economics and Policy*.

Tsakok, I. (1990), *Agricultural Price Policy: A Practitioners Guide to Partial Equilibrium Analysis*, New York: Cornell University Press.

Waters II, W. (1970), 'Transport Costs, Tariffs, and the Pattern of Industrial Protection', *American Economic Review*, 60, 1013-1020.

World Bank (1994), *The Great Lakes Corridor Study*, Washington, DC: World Bank.

Yeats, A. (1977a), 'A Comparative Analysis of the Incidence of Tariffs and Transportation Costs on India's Exports', *Journal of Development Studies*, Vol. 14, 97-107.

Yeats, A. (1977b), 'Do International Transport Costs Increase with Fabrication? Some Empirical Evidence', *Oxford Economic Papers*, 29, 458-471.

Yeats, A. (1980), 'Tariff Valuation, Transport Costs and the Establishment of Trade Preferences among Developing Countries', *World Development*, 8, 129-136.

APPENDIX TABLES

Table A1: Nominal and Effective Protection by Sector, 1994

PTA-Trade	**NRP**			**ERP**		
Sector	Average	Max	Min	Average	Max	Min
Food Products	0.232	0.338	0.050	0.235	0.345	0.045
Animal Products	0.146	0.369	0.034	0.151	0.386	0.032
Forestry Products	0.113	0.240	0.062	0.118	0.292	0.047
Fish Products	0.308	0.308	0.308	0.320	0.321	0.321
Mining & Quarrying	0.053	0.072	0.032	0.045	0.073	0.013
Coffee, Cotton, Sugar Mnf.	0.166	0.261	0.165	0.191	0.308	0.190
Manufactured Foods	0.185	0.269	0.093	0.268	0.470	0.046
Beverages & Tobacco	0.323	0.323	0.300	0.501	0.500	0.455
Textile, Cloth & Footwear	0.196	0.362	0.139	0.268	0.795	0.087
Building Materials	0.155	0.313	0.144	0.289	0.739	0.259
Chemicals	0.151	0.297	0.034	0.272	0.762	-0.118
Metal Prod. & Machinery	0.078	0.223	0.059	0.033	0.445	-0.022
Other Manufactures	0.153	0.339	0.122	0.233	0.755	0.145
Transport Equipment	0.134	0.140	0.100	0.201	0.219	0.109
Average	*0.171*	*0.275*	*0.117*	*0.223*	*0.458*	*0.115*

NPTA-Trade	**NRP**			**ERP**		
Sector	Average	Max	Min	Average	Max	Min
Food Products	0.270	0.340	0.121	0.274	0.347	0.119
Animal Products	0.310	0.339	0.083	0.324	0.355	0.084
Forestry Products	0.141	0.338	0.049	0.155	0.427	0.029
Fish Products	0.333	0.333	0.333	0.351	0.351	0.351
Mining & Quarrying	0.133	0.145	0.090	0.165	0.183	0.100
Coffee, Cotton, Sugar Mnf.	0.253	0.320	0.220	0.299	0.381	0.258
Manufactured Foods	0.172	1.439	0.126	0.238	3.288	0.126
Beverages & Tobacco	0.220	0.340	0.199	0.300	0.533	0.259
Textile, Cloth & Footwear	0.559	1.428	0.183	1.419	4.178	0.227
Building Materials	0.246	0.320	0.190	0.550	0.759	0.390
Chemicals	0.099	0.341	0.021	0.098	0.909	-0.161
Metal Prod. & Machinery	0.202	0.357	0.115	0.385	0.826	0.138
Other Manufactures	0.146	0.337	0.104	0.213	0.750	0.094
Transport Equipment	0.149	0.215	0.103	0.243	0.424	0.117
Average	*0.231*	*0.471*	*0.138*	*0.358*	*0.979*	*0.152*

Table A2: Protection due to Overland Freight Costs (PTA trade)

Imports	**Freight**		**Interaction**	
Sector	**NRP**	**ERP**	**NRP**	**ERP**
Food Products	0.267	0.274	0.062	0.064
Animal Products	0.092	0.093	0.014	0.014
Forestry Products	0.194	0.237	0.022	0.026
Fish Products	0.083	0.089	0.026	0.027
Mining & Quarrying	0.154	0.213	0.008	0.010
Coffee, Cotton, Sugar Mnf.	0.137	0.163	0.023	0.027
Manufactured Foods	0.247	0.483	0.046	0.088
Beverages & Tobacco	0.374	0.613	0.121	0.209
Textile, Cloth & Footwear	0.103	0.220	0.020	0.033
Building Materials	0.270	0.609	0.042	0.095
Chemicals	0.088	0.081	0.013	0.009
Metal Prod. & Machinery	0.088	0.159	0.007	0.005
Other Manufactures	0.125	0.208	0.019	0.027
Transport Equipment	0.088	0.157	0.012	0.020
Average	*0.165*	*0.257*	*0.031*	*0.047*

Exports	**Freight**		**Interaction**	
Sector	**NRP**	**ERP**	**NRP**	**ERP**
Food Products	-0.171	-0.183	0.000	-0.001
Animal Products	-0.059	-0.067	0.000	-0.001
Forestry Products	-0.124	-0.202	0.000	-0.004
Fish Products	-0.054	-0.078	0.000	-0.005
Mining & Quarrying	-0.099	-0.167	0.000	-0.003
Coffee, Cotton, Sugar Mnf.	-0.088	-0.115	0.000	-0.001
Manufactured Foods	-0.159	-0.496	0.000	-0.022
Beverages & Tobacco	-0.240	-0.584	0.000	-0.027
Textile, Cloth & Footwear	-0.066	-0.316	0.000	-0.031
Building Materials	-0.173	-0.649	0.000	-0.024
Chemicals	-0.056	-0.402	0.000	-0.035
Metal Prod. & Machinery	-0.056	-0.252	0.000	-0.015
Other Manufactures	-0.080	-0.371	0.000	-0.027
Transport Equipment	-0.056	-0.240	0.000	-0.013
Average	*-0.106*	*-0.294*	*0.000*	*-0.015*

Table A3: Protection due to Vessel Freight Rates

Imports Sector	**NRP** Average	Max	Min	**ERP** Average	Max	Min
Food Products	0.179	0.272	0.056	0.182	0.279	0.054
Animal Products	0.062	0.138	0.020	0.061	0.142	0.017
Forestry Products	0.130	0.225	0.073	0.149	0.280	0.071
Fish Products	0.056	0.056	0.056	0.055	0.055	0.055
Mineral Products	0.103	0.203	0.018	0.137	0.287	0.009
Coffee, Cotton, Sugar Mnf.	0.092	0.126	0.064	0.107	0.149	0.072
Manufactured Foods	0.166	0.559	0.041	0.287	1.233	-0.014
Tobbaco & Beverages	0.251	0.354	0.148	0.373	0.574	0.173
Textile, Clothing, Footwear	0.069	0.192	0.038	0.113	0.503	0.014
Building Materials	0.181	0.323	0.086	0.357	0.761	0.088
Chemicals	0.059	0.138	0.009	-0.016	0.248	-0.183
Metal Prod. & Machinery	0.059	0.237	0.002	0.076	0.583	-0.086
Other Manufactures	0.084	0.175	0.027	0.092	0.348	-0.069
Transport Equipment	0.059	0.237	0.002	0.077	0.566	-0.079
Average	*0.111*	*0.231*	*0.046*	*0.147*	*0.429*	*0.009*

Exports Sector	**NRP** Average AVR	Max	Min Range	**ERP** Average AVR	Max	Min Range
Food Products	-0.179	-0.272	-0.056	-0.191	-0.288	-0.063
Animal Products	-0.062	-0.138	-0.020	-0.070	-0.150	-0.025
Forestry Products	-0.130	-0.225	-0.073	-0.209	-0.340	-0.131
Fish Products	-0.056	-0.056	-0.056	-0.081	-0.081	-0.081
Mineral Products	-0.103	-0.203	-0.018	-0.173	-0.324	-0.045
Coffee, Cotton, Sugar Mnf.	-0.092	-0.126	-0.064	-0.120	-0.162	-0.085
Manufactured Foods	-0.166	-0.559	-0.041	-0.513	-1.459	-0.212
Tobbaco & Beverages	-0.251	-0.354	-0.148	-0.605	-0.805	-0.404
Textile, Clothing, Footwear	-0.069	-0.192	-0.038	-0.325	-0.716	-0.227
Building Materials	-0.181	-0.323	-0.086	-0.670	-1.074	-0.401
Chemicals	-0.059	-0.138	-0.009	-0.410	-0.674	-0.243
Metal Prod. & Machinery	-0.059	-0.237	-0.002	-0.259	-0.766	-0.097
Other Manufactures	-0.084	-0.175	-0.027	-0.381	-0.637	-0.221
Transport Equipment	-0.059	-0.237	-0.002	-0.247	-0.735	-0.090
Average	*-0.111*	*-0.231*	*-0.046*	*-0.304*	*-0.586*	*-0.166*

Table A4: Protection due to Air Freight Rates

Imports	**NRP**			**ERP**		
Sector	Average	Max	Min	Average	Max	Min
Food Products	0.180	0.498	0.017	0.183	0.514	0.013
Animal Products	0.151	0.357	0.040	0.155	0.373	0.038
Forestry Products	0.287	0.464	0.093	0.366	0.609	0.098
Fish Products	0.569	0.569	0.569	0.681	0.681	0.681
Mineral Products	0.181	0.181	0.181	0.254	0.254	0.254
Coffee, Cotton, Sugar Mnf.	0.267	0.502	0.032	0.323	0.612	0.033
Manufactured Foods	0.180	0.498	0.017	0.320	1.086	-0.072
Tobbaco & Beverages	0.709	0.915	0.502	1.265	1.666	0.862
Textile, Clothing, Footwear	0.157	0.323	0.022	0.392	0.919	-0.037
Building Materials	0.443	0.485	0.386	1.101	1.220	0.939
Chemicals	0.102	0.302	0.014	0.128	0.797	-0.166
Metal Prod. & Machinery	0.119	0.367	0.007	0.247	0.953	-0.071
Other Manufactures	0.190	0.782	0.030	0.390	2.056	-0.060
Transport Equipment	0.119	0.367	0.007	0.242	0.923	-0.066
Average	*0.261*	*0.472*	*0.137*	*0.432*	*0.905*	*0.175*

Exports	**NRP**			**ERP**		
Sector	**Average**	**Max**	**Min**	**Average**	**Max**	**Min**
Food Products	-0.180	-0.498	-0.017	-0.192	-0.523	-0.022
Animal Products	-0.151	-0.357	-0.040	-0.164	-0.382	-0.047
Forestry Products	-0.287	-0.464	-0.093	-0.425	-0.669	-0.158
Fish Products	-0.569	-0.569	-0.569	-0.707	-0.707	-0.707
Mineral Products	-0.181	-0.181	-0.181	-0.291	-0.291	-0.291
Coffee, Cotton, Sugar Mnf.	-0.267	-0.502	-0.032	-0.335	-0.625	-0.046
Manufactured Foods	-0.180	-0.498	-0.017	-0.546	-1.312	-0.154
Tobbaco & Beverages	-0.709	-0.915	-0.502	-1.497	-1.898	-1.094
Textile, Clothing, Footwear	-0.157	-0.323	-0.022	-0.605	-1.132	-0.176
Building Materials	-0.443	-0.485	-0.386	-1.414	-1.533	-1.252
Chemicals	-0.102	-0.302	-0.014	-0.554	-1.223	-0.260
Metal Prod. & Machinery	-0.119	-0.367	-0.007	-0.430	-1.136	-0.111
Other Manufactures	-0.190	-0.782	-0.030	-0.679	-2.345	-0.229
Transport Equipment	-0.119	-0.367	-0.007	-0.411	-1.092	-0.104
Average	*-0.261*	*-0.472*	*-0.137*	*-0.589*	*-1.062*	*-0.332*