Modeling Modifications in Rules of Origin: A Partial Equilibrium Approach

James J. Fetzer
Sandra A. Rivera
*U.S. International Trade Commission**

Paper prepared for:
The 8th Annual Conference
On Global Economic Analysis

June 9-11, 2005
Lubeck, Germany

Abstract:

In this paper we explore how changes in ROO have influenced trade flows with FTA partners and other trading partners. As tariffs become less important barriers relative to the implementation of nontariff measures, new and existing FTAs include modifications in rules of origin (ROO). While some work has examined the impact of ROOs on trade flows of intermediate and final goods, none has provided quantitative estimates of the impact of modifying ROO, which we do herein. Using a simple multi-market partial equilibrium model which accounts for linkages between intermediate and final goods, we provide a framework for analysis of the impact of ROO modifications on specific products. In applying this model to recent NAFTA ROO changes in the refined gold and scrap gold markets, trade flows for refined gold and gold jewelry follow expected patterns.

JEL Classification Numbers: F13, F15

Keywords: Rules of Origin; NAFTA; Trade; Partial Equilibrium

* James J. Fetzer james.fetzer@usitc.gov; and Sandra A. Rivera, sandra.rivera@usitc.gov , both from U.S. International Trade Commission. We would like to thank Karl Tsuji for providing background information on the refined gold and gold jewelry industries. The authors are solely responsible for any remaining errors.

I. Introduction

As tariffs become less important barriers relative to the implementation of nontariff measures, new and existing FTAs have a history of including modifications in rules of origin (ROO). Most work in the ROO literature has examined the impact of ROO at an aggregate level. While some work has examined the impact of ROOs on trade flows of intermediate and final goods, none has provided quantitative estimates of the impact of modifying ROO.

The impact of ROO modifications depends on the relative differences in trading costs or other trade restrictions of all products that are conferred (or not) with FTA origin rather than depending only on the product trading costs directly targeted by the rule change. In this paper, we will explore how changes in ROO influence trade flows for specific goods directly and indirectly involved in the change. By conducting our analysis at a 6-digit HS level, we use a partial equilibrium framework to better understand the effects of ROO changes.

For example, a new North American Free Trade Agreement (NAFTA) ROO implemented in January 2005 liberalizes origin determination for precious-metals allows the use of unrefined precious metals and secondary metals from non-NAFTA sources as inputs for precious metals production with NAFTA origin. However, this rule also impacts trade in gold jewelry items, which are the predominate end use for gold.

II. Literature Review

There are two broad categories of ROOs: preferential and non-preferential. As they typically do not violate WTO rules, ROOs are one of the most powerful trade changing instruments available to WTO member countries. According to Estevadeordal and Suominen (2003), the impact of a well-formed ROO can:

- Have different short run and long run implications;
- Insulate an industry from FTA consequences;
- Protect intermediate good producers by favoring intra-preferential trade agreement supply links;
- Motivate investment in specific economic sectors; and
- Motivate trade in specific sectors (although the last two rarely happen at the same time).

ROOs take different forms for each FTA. For example, under NAFTA, the *triple transformation test* applies, signaling that for apparel to be treated as a domestic product, it must go through three basic processes within the NAFTA region. The processes include (1) fiber, (2) cloth and then (3) clothing production.[1] Relative to other ROOs in other trade agreements, Estevadeordal and Suominen (2003) find the NAFTA textile and clothing rules the most restrictive of all, given their triple transformation constraints. In another IMF study, Matoo, Roy and Subramanian (2002) find that had AGOA been implemented without the ROO, the jump in exports would be "nearly five times [400 million] greater" if AGOA had included a ROO "that requires only assembly in the beneficiary countries--as under MFA," rather than the NAFTA modeled rule incorporated.

[1] I. Mac Desler gives a good discussion of the political economy behind the NAFTA ROO. The author posits that if clothing used fiber and fabrics produced in the NAFTA region, U.S. mills were going to gain enormously since the have a comparative advantage in textile production. See "Rules of Origin and U.S. Trade Policy," especially 11-13.

Some studies, such as Francois (2004) and Ju and Krishna (1998) have explored the impact ROO have on trade flows from countries within and outside a FTA. Ju and Krishna find that an FTA with strict ROO on an intermediate good raises imports in the final good market, but reduces imports in the intermediate good market. However, they also find that more restrictive ROO on the final good first raise and then lower imports of the final good and that first lower and then raise imports of the intermediate good. Francois (2004) finds that when intermediate goods are differentiated and when ROO are introduced as a markup on the cost of intermediate goods, import demand for final goods will shift away from FTA partners and toward third-country suppliers and demand for intermediate goods will shift away from third country suppliers and toward FTA-partners.

There also have been a number of papers that have incorporated vertical linkages into partial equilibrium models.[2] As is done in this paper, Fetzer (2005) models vertical linkages in the flat rolled steel market using the constant cross price elasticity specifications of demand and supply used in Sanders, Moxey, and Roningen (2001). This form of supply function is used in most of the models surveyed by Fetzer (2005) and in Ferrantino and Hall (2001), cross price elasticities of supply are assumed to equal the product of the cost share and price elasticity of supply, taking both of these important pieces of information into account. Similar to Roningen (1997), USITC (2001a) and USITC (2001b), demand linkages depend on the usage share of intermediate good used to produce the final good.

III. Model structure

Similar to Francois (2004), we characterize changes in ROO as changes in reduced form trading costs for third-country intermediates used for internally traded final goods. This roughly translates into imports of intermediates not given preferential access from the FTA.

We employ a partial equilibrium framework using vertical linkages between intermediate and final goods to incorporate the ROO changes. Similar to the approach used in Fetzer (2005), we adapt the multi-market partial equilibrium model GSIM model developed in Francois and Hall (2003) to account for linkages between intermediate and final goods. These modifications provide a transparent and parsimonious model that approaches the GSIM model without vertical linkages as the cost share of intermediate goods and usage share of final goods approach zero. The effects of final good price changes are accounted for through the aggregate demand function.

Francois and Hall (2003) define $P_{i,r}$* as the export price received for good i by exporter r on world markets, and $P_{(i,v),r}$ is the internal price for goods from region r within country v, and link the two prices together by:

$$(1) \qquad P_{(i,v),r} = \left(1+t_{(i,v),r}\right)P^*_{i,r} = T_{(i,v),r}P^*_{i,r}$$

where T=1+t is the power of the tariff.

Since a price increase for an intermediate good increases costs for final goods it is used to produce, the export supply takes the form:

[2] See Fetzer (2005) for a review of this literature.

$$(2) \qquad X_{i,r} = f\left(P^*_{i,r}, P_{(k,r),q}\right) \quad \forall k \in U_i, q \in R$$

where $X_{i,r}$ is export supply of good i from country r, $P_{(k,r),q,}$ is price in region r for intermediate good k from country q, and , U_i is the set of intermediate used to produce good i.

Francois and Hall (2003) assumed that import demand within product category i of goods from country r is a function of industry prices and total expenditure. In addition, an increase in the price of a final good increases aggregate demand for all of its inputs, depending on the price change of each final good. Therefore, total expenditures take on the form:

$$(3) \qquad M_{(i,v),r} = f\left(P_{(i,v),r}, P_{(i,v),sr}, y_{(i,v)}, P^*_{j,q}\right) \quad \forall j \in D_i, q \in R$$

where $y_{(i,v)}$ is total expenditure of imports of i in country/region v, $P_{(i,v),r}$ is the internal price for good i in from region r within country v, $P_{(i,v),sr}$ is the price of other varieties, R are regions and D_i are goods final from good i.

Differentiating equations (1), (2) and (3), we can derive:[3]

$$(4) \qquad \hat{P}_{(i,v),r} = \hat{P}^*_{i,r} + \hat{T}_{(i,v),r}$$

$$(5) \qquad \hat{X}_{i,r} = E_{X(i,i,r)}\hat{P}^*_{i,r} + \sum_{k \neq i}^{\forall k \in U_i} \sum^{q \in R} E_{X(i,k,r)}\hat{P}_{(k,r),q}$$

$$(6) \qquad \hat{M}_{(i,v),r} = N_{(i,i,v),(r,r)}\hat{P}_{(i,v),r} + \sum_{s \neq r} N_{(i,i,v)(r,s)}\hat{P}_{(i,v),s} + \sum_{j \neq i}^{\forall j \in D_i} \sum^{\forall q \in R} \sum^{\forall r \in R} N_{(i,j,v)(r,s)}\hat{P}^*_{j,q}$$

where ^ denotes a proportional change.

Substituting (4) into both (5) and (6), we get:

$$(7) \qquad \hat{X}_{i,r} = E_{X(i,i,r)}\hat{P}^*_{i,r} + \sum_{k \neq i}^{\forall k \in U_i} \sum^{q \in R} E_{X(i,k,r)}\left[\hat{P}^*_{k,q} + \hat{T}_{(k,r),q}\right]$$

$$(8) \quad \hat{M}_{(i,v),r} = N_{(i,i,v),(r,r)}\left[\hat{P}^*_{i,r} + \hat{T}_{(i,v),r}\right] + \sum_{s \neq r} N_{(i,i,v)(r,s)}\left[\hat{P}^*_{i,s} + \hat{T}_{(i,v),s}\right] + \sum_{j \neq i}^{\forall j \in D_i} \sum^{\forall q \in R} \sum^{\forall r \in R} N_{(i,j,v)(r,s)}\hat{P}^*_{j,q}$$

Summing (8) over all import markets and setting it equal to (7) yields our global equilibrium condition:

[3] Because intermediate and final goods are introduced into the model, we do make a modification in the notation for elasticities used by Francois and Hall (2003), by adding another subscript, between the first and second subscripts. Therefore, the own price export supply elasticity becomes changes from $E_{x,(i,r)}$ to $E_{x,(i,i,r)}$, the own price demand elasticity changes from $N_{(i,v),(r,r)}$ to $N_{(i,i,v),(r,r)}$, and cross price (with respect to the same product from different sources changes from $N_{(i,v),(r,s)}$ to $N_{(i,i,v),(r,s)}$.

$$E_{X(i,i,r)}\hat{P}^{*}_{i,r} + \sum_{k\neq i}^{\forall k\in U_i}\sum^{q\in R} E_{X(i,k,r)}\left[\hat{P}^{*}_{k,q} + \hat{T}_{(k,r),q}\right]$$

(9)

$$= \sum_{v} N_{(i,i,v),(r,r)}\left[\hat{P}^{*}_{i,r} + \hat{T}_{(i,v),r}\right] + \sum_{v}\sum_{s\neq r} N_{(i,i,v)(r,s)}\left[\hat{P}^{*}_{i,s} + \hat{T}_{(i,v),s}\right] + \sum_{v}\sum_{j\neq i}^{\forall j\in D_i}\sum^{\forall q\in R\forall r\in R}\sum N_{(i,j,v)(r,s)}\hat{P}^{*}_{j,q}$$

We assume that the cross price elasticity of supply between the final good i and each intermediate good k from region r is a function of the own price elasticity supply for the final good and the share of each final good i's cost make up by intermediate good k (C_{ik}), so that the cross price elasticity is:

(10) $$E_{X(i,k,r)} = -E_{X(i,i,r)} * C_{ik}.$$[4]

We assume that demand cross price elasticity of demand between the intermediate product and each of its corresponding final products should be equal to the negative of the product of the own price elasticity of demand for the final product and the share of each intermediate product j used in production of final good i, sold in country v (U_{jiv}), such that:

(11) $$N_{(i,j,v)(r,s)} = -N_{(i,i,v)(r,s)} * U_{jiv}.$$[5]

IV. Results on Examining Impact of ROO: An application in refined gold and gold jewelry markets

A. Changes in ROO

Applying this model to markets for refined gold and gold jewelry, we find that the impact of a recent change in the ROO for refined gold and scrap gold depends on how the rules are characterized. On January 1, 2005 NAFTA ROO were modified to allow the use non-NAFTA originating unrefined precious metals (such as gold, silver, platinum, palladium and rhodium) and secondary precious metals in the production of originating precious metals.[6] While these rule changes apply to various HS lines, we focus on the lines that applied to refined gold and gold scrap.[7] The changes in ROO are as follows:

7108.11-7108.20 (refined gold) [8]

[4] We assume that the cost shares are unaffected by changes in prices or quantities for the goods in question.
[5] We assume that the share of intermediate goods used to produce final goods unaffected by changes in prices or quantities for the goods in question.
[6] See http://www.dfait-maeci.gc.ca/nafta-alena/amendment-401-en.asp, downloaded April 22, 2005.
[7] In particular, this rule change applied to subheadings 7106.10-7106.92, 7108.11-7108.20, 7110.11-7110.49, and 71.12. See http://www.dfait-maeci.gc.ca/nafta-alena/amendment-401-en.asp for details.
[8] In its advice to USTR concerning the rule on this subheading, the USITC characterized the nature of the modification as follows: "The proposed rules would liberalize origin determination for unwrought and semimanufactured forms of gold by allowing certain inputs from within chapter 71, and within HTS heading 7108, unlike the existing rule which requires all inputs to be from outside this chapter. Under these proposed new rules, NAFTA origin would be conferred on products manufactured from gold inputs that undergo either a subheading shift or the specified processes." Correspondence to Ambassador Robert Zoellick, from Chairman Steven Koplan on September 24, 2004, *Advice On The Probable Effect Of*

A change to subheading 7108.11 through 7108.20 from any other subheading, including another subheading within that group; or

No required change in tariff classification to subheading 7108.12, whether or not there is also a change from another subheading, provided that the non-originating materials undergo electrolytic, thermal or chemical separation or alloying.

71.12 (scrap metal (including gold scrap)) [9]

A change to heading 71.12 from any other heading.

These rule changes imply two different "shocks" to the base data for each NAFTA country:

1. All gold scrap shipped from NAFTA countries, is conferred NAFTA origin, regardless of the source of its inputs. Therefore the cost of sourcing gold scrap from all countries is reduced by the amount of the prevailing duty.

2. Since all non-originating unrefined precious metals and secondary precious metals may be used in the production of originating precious metals, gold which is refined in NAFTA countries is conferred with NAFTA origin. Assuming that the base data do not contain transshipments from non-NAFTA sources, the cost of sourcing refined gold from other NAFTA partners is therefore reduced by the amount of the prevailing duty.

B. Assumptions

Since there are no duties on scrap entering NAFTA countries and very modest tariffs on refined gold (see table 1), the direct impact of the rule change on trade flows of refined gold and gold scrap metal should be small. In simulating the liberalization ROO for gold and gold metal scrap, we assume that effectively applied tariff rates for imports of refined gold to the FTA countries are removed.[10] In addition, and additional simulation using MFN rates since it may be that on the margin, the MFN rate is the prevailing duty.[11] There the difference between the applied and MFN rates for refined gold to U.S. market, since several of the eight digit lines within the six-digit subheading are duty-free. The baseline data for refined gold and gold jewelry are in

---

Certain Proposed Modifications To The Rules Of Origin Contained In The North American Free Trade Agreement, Attachment 1. Investigation NAFTA 103-6.

[9] In its advice to USTR concerning the rule on this subheading, the USITC characterized the nature of the modification as follows: "The proposed rule would liberalize origin determination for precious-metal waste and scrap by allowing inputs from within chapter 71, unlike the existing rule which requires all inputs to be from outside this chapter." Correspondence to Ambassador Robert Zoellick, from USITC Chairman Steven Koplan on September 24, 2004, *Advice On The Probable Effect Of Certain Proposed Modifications To The Rules Of Origin Contained In The North American Free Trade Agreement*, Attachment 1. Investigation NAFTA 103-6.

[10] Gold scrap metal, an input for refined gold is also impacted by the modification in the rule of origin. However, since MFN tariffs gold scrap metal are already zero for all countries for and all gold metal scrap production is used in the production of refined gold, the impact on gold metal scrap is omitted to simplify the analysis.

[11] Similar logic is typically used when justifying using the over-quota rate of a tariff-rate-quota to estimate the impact of the tariff-rate-quota. See Fetzer (2005) for an example.

table 1. Trade flows for both refined gold and gold jewelry are based on 2003 UNSD COMTRADE data.[12] Initial duties for refined gold and gold jewelry are assumed to be simple average applied and MFN rates from 2003 UNCTAD TRAINS data.

The assumption that 55 percent of shipments of refined gold in the U.S. market were produced in the U.S. are based on U.S. Geological Survey (USGS) estimates for 2003 of U.S. production of refined gold of 288 tons (92 tons of which were refined from scrap metal), and the $3.2 billion value of mined gold.[13] Due to lack of production data for refined gold other markets, the 55 percent share was also assumed for shipments of home production in other markets. The assumption that 92 percent of refined gold is used to produce gold jewelry was based on USGS estimate that 92 percent of gold was used for "jewelry and arts."[14] The share of U.S. produced refined gold shipped to each country's markets was based on this estimate and the estimated share of U.S. shipments to that market. This assumption was also applied to the other markets, since there was no available data.

We assumed that two-thirds of shipments of gold jewelry in the all three NAFTA markets were produced in the home market and 80 percent of shipments of gold jewelry in the ROW were produced in the ROW. We also assumed that refined jewelry makes up 80 percent of the costs of gold jewelry. The cost share of refined gold from a particular country used as an input for gold jewelry produced in particular market was estimated based on the 80 percent total cost share for refined gold from all sources and the estimated import share of shipments from that source to the each market.

Elasticity estimates (see table 2) for refined gold are based on preliminary estimates of import demand and export supply elasticities are estimated by Kee et al. (2004). Since own price import demand elasticities are not a direct input into this model, aggregate demand elasticities and substitution elasticities which generated own price elasticities similar to Kee *et al.* (2004)'s estimates were chosen. An average of estimated exports supply elasticities were used (see table 2). Because there are more substitutes for gold jewelry than for the input demand for refined gold aggregate demand is assumed to be more elastic. An aggregate demand elasticity of -1.00 and a substitution elasticity of 4 are assumed to reflect this greater price sensitivity.

C. Results

As seen in table 3, when the precious metals ROO are liberalized, imports of refined gold from non-NAFTA members to NAFTA countries increased by 1.1 percent overall, although imports from non-NAFTA members to Mexico fell slightly. Imports from of refined gold from NAFTA members to other NAFTA members fell by 2.1 percent, although imports from NAFTA members to Mexico increased slightly. As a result, the imports of refined gold to NAFTA countries from other NAFTA members decreased relative to imports from non-NAFTA countries to NAFTA members, with Mexico as the obvious exception. With ROO modification, imports of gold jewelry from non-NAFTA countries to all NAFTA countries decreased, while imports from NAFTA countries to all NAFTA countries increased.

---

[12] Using 2002 HS nomenclature, refined gold data includes "gold, nonmonetary, unwrought nesoi (other than powder)" (HS 7108.12) and "gold, nonmonetary, semimanufactured forms nesoi (other than powder)" (HS 7108.13) and gold jewelry includes "jewelry and parts thereof, of precious metal other than silver" (HS 7113.19). Scrap gold metal includes "gold waste and scrap, including metal clad with gold but excluding sweepings containing other precious metals (HS 7112.91).

[13] U.S. Geological Survey, *Mineral Commodity Summaries*, January 2005, pp. 72-73.

[14] U.S. Geological Survey, *Mineral Commodity Summaries*, January 2005, pp. 72.

These results are overall consistent with Francois (2004) seven observations about trade flows that compared an introduction of ROO to a customs union without ROO (see table 3). (Of course since we are liberalizing ROO instead of imposing them, we would expect the opposite results). The first observation that imports of the final good (gold jewelry, in this case) from other FTA countries is true overall and for all three NAFTA countries. Likewise the second observation that these imports increase relative to imports from non-FTA countries has to be true. The third observation, that imports of the intermediate good (refined gold) from FTA countries decreases is true overall, save for Mexico, where relative (and absolute imports) increase. The fourth observation that imports of the intermediate good from FTA countries is ambiguous. NAFTA trade in refined gold decreases overall, which indicates that the substitution away from NAFTA origin refined gold dominates the impact of the cost of production in gold jewelry.

Francois (2004)'s fifth and sixth observations—that relative allocation of total intra-FTA trade will shift from intermediates to final goods and that relative allocation of between exports of intermediates and imports of final goods within the FTA will shift to final goods—also hold for every NAFTA country. The seventh observation indicates that the expected relative allocation between imports of intermediates and imports of final goods with the FTA will be ambiguous. In the U.S. and Canadian markets, NAFTA imports of refined gold fall relative to gold jewelry imports, while the opposite is true for Mexico. Results are the same qualitatively (but generally larger quantitatively) for all seven of these observations when MFN duties are used instead of applied duties as a proxy for trading costs.

V. Summary

In our analysis, we proxy for the effect of NAFTA ROO liberalization for gold with a removal of the applied tariff for refined gold imported into NAFTA from the ROW. As observed by Francois (2003), we find that imports of refined gold to NAFTA countries from other NAFTA countries increases relative to imports of refined gold from ROW. Similarly we find that imports of gold jewelry from other NAFTA countries decrease relative to imports from ROW. Future research should focus on methods for characterizes the shocks of modifying specific ROO, moving beyond treating modification of ROO as trading costs.

Table 1-NAFTA refined and scrap gold ROO liberalization: Inputs

		Destination		
Source	Canada	Mexico	USA	ROW
Baseline (2003) gold trade values (thousands of dollars)				
Canada	0	2,254	1,427,560	47,303
Mexico	0	0	130,207	25,344
USA	82,438	234,824	0	160,211
ROW	253,336	23,680	1,196,971	24,146,130
Baseline (2003) gold jewelry trade values (thousands of dollars)				
Canada	0	58	176,945	16,432
Mexico	1,501	0	94,384	1,041
USA	119,508	132,392	0	1,082,381
ROW	118,685	97,658	5,293,821	8,766,894
Baseline (2003) applied gold duties				
Canada	0.00	0.00	0.00	1.11
Mexico	0.00	0.00	0.00	0.00
USA	0.00	0.00	0.00	2.07
ROW	0.54	0.00	0.73	1.40
Baseline (2003) MFN gold duties				
Canada	0.00	0.00	1.71	1.11
Mexico	0.00	0.00	1.71	0.00
USA	1.00	0.00	0.00	2.07
ROW	1.00	0.00	1.71	5.56
Share of gold used in gold jewelry production (demand linkage)				
Canada	66%	0%	24%	2%
Mexico	0%	76%	16%	0%
USA	1%	1%	82%	8%
ROW	0%	0%	9%	83%
Gold as a share of gold jewelry costs (supply linkage)				
Canada	80%			
Mexico	80%			
USA	80%			
ROW	80%			

Sources: USND COMTRADE, UNCTAD TRAINS, USGS, and authors' calculations

Table 2-NAFTA refined and scrap gold ROO liberalization: Parameters

Parameter	Country			
	Canada	Mexico	USA	ROW
Refined gold				
Market demand	-0.25	-0.25	-0.25	-0.25
Industry supply	60	60	60	60
Substitution	2	2	2	2
Domestic market share	55%	55%	55%	55%
Gold jewelry				
Market demand	-1.00	-1.00	-1.00	-1.00
Industry supply	100	100	100	100
Substitution	4	4	4	4
Domestic market share	67%	67%	67%	80%

Source: Authors' assumptions.

Table 3-NAFTA refined and scrap gold ROO liberalization: Applied rate results

Source	Destination Canada	Mexico	USA	ROW	NAFTA
Percentage change in refined gold shipments					
Canada	-0.3127	0.0084	-0.2425	0.0128	-0.2421
Mexico	0.0000	0.0003	-0.2506	0.0047	-0.2506
USA	-0.3122	0.0088	-0.2421	0.0132	-0.0746
ROW	0.7479	-0.0053	1.1933	-0.0008	1.0975
Percentage change in gold jewelry shipments					
Canada	0.0054	0.0098	0.0078	0.0140	0.0078
Mexico	-0.0041	0.0003	-0.0017	0.0045	-0.0017
USA	0.0036	0.0080	0.0060	0.0122	0.0059
ROW	-0.0092	-0.0048	-0.0068	-0.0006	-0.0068

Absolute change (unless otherwise noted)	Destination Canada	Mexico	U.S.	Total	Francois (2004) Expected sign
NAFTA Gold jewelry (1) (percentage change)	0.00352	0.00797	0.00451	0.00683	Positive
NAFTA Gold jewelry relative to ROW (2)	0.00013	0.00017	0.00001	0.00001	Positive
NAFTA Gold relative to ROW (3)	-0.00342	0.00141	-0.01847	-0.01653	Negative
NAFTA Gold (4) (percentage change)	-0.31225	0.00878	-0.24316	-0.21438	Ambiguous
Jewelry trade relative to gold trade (5)	0.00465	0.00000	0.00043	0.00062	Positive
Gold exports to jewelry imports (6)	-0.02902	-0.00254	-0.00093	-0.00791	Negative
Gold imports to jewelry imports (7)	-0.00215	0.00001	-0.01422	-0.00791	Ambiguous

	(destination) Consumer Price	Output	(source) Producer Price	Market Price
Percentage change in refined gold prices and output				
Canada	-0.1855	-0.2511	-0.0042	-0.0042
Mexico	-0.0021	-0.0684	-0.0011	-0.0011
USA	-0.1454	-0.2176	-0.0036	-0.0036
ROW	0.0005	0.0283	0.0005	0.0005
Percentage change in gold jewelry prices and output				
Canada	-0.0026	0.0063	-0.0033	-0.0033
Mexico	-0.0011	-0.0001	-0.0009	0.0000
USA	-0.0018	0.0066	-0.0028	0.0000
ROW	0.0003	-0.0012	0.0004	0.0000

Source: Authors' partial equilibrium model results.

Table 4-NAFTA refined and scrap gold ROO liberalization: MFN results

Source	Destination Canada	Mexico	USA	ROW	MFN NAFTA
Percentage change in refined gold shipments					
Canada	-0.5749	0.0180	-0.5658	0.0282	-0.5648
Mexico	0.0000	0.0007	-0.5831	0.0109	-0.5831
USA	-0.5725	0.0203	-0.5634	0.0306	-0.1337
ROW	1.3753	-0.0121	2.7667	-0.0018	2.4829
Percentage change in gold jewelry shipments					
Canada	0.0117	0.0211	0.0166	0.0309	0.0166
Mexico	-0.0087	0.0007	-0.0038	0.0105	-0.0039
USA	0.0091	0.0184	0.0139	0.0282	0.0140
ROW	-0.0205	-0.0111	-0.0156	-0.0013	-0.0157

Absolute change (unless otherwise noted)	Destination Canada	Mexico	U.S.	Total	Francois (2004) Expected sign
NAFTA Gold jewelry (1) (pct. ch.)	0.00885	0.01840	0.00948	0.01569	Positive
NAFTA Gold jewelry relative to ROW (2)	0.00030	0.00040	0.00001	0.00003	Positive
NAFTA Gold relative to ROW (3)	-0.00625	0.00325	-0.04222	-0.03699	Negative
NAFTA Gold (4) (pct. ch.)	-0.57253	0.02028	-0.56720	-0.49324	Ambiguous
Jewelry trade relative to gold trade (5)	0.00858	-0.00001	0.00101	0.00143	Positive
Gold exports to jewelry imports (6)	-0.06778	-0.00591	-0.00167	-0.01820	Negative
Gold imports to jewelry imports (7)	-0.00396	0.00003	-0.03311	-0.01820	Ambiguous

	(destination) Consumer Price	Output	(source) Producer Price	Market Price
Percentage change in refined gold prices and output				
Canada	-0.3436	-0.5522	-0.0092	-0.0092
Mexico	-0.0048	-0.1591	-0.0027	-0.0027
USA	-0.3384	-0.5032	-0.0084	-0.0084
ROW	0.0010	0.0640	0.0011	0.0011
Percentage change in gold jewelry prices and output				
Canada	-0.0057	0.0135	-0.0072	-0.0072
Mexico	-0.0026	-0.0001	-0.0021	0.0000
USA	-0.0041	0.0151	-0.0066	-0.0001
ROW	0.0007	-0.0028	0.0008	0.0000

Source: Authors' partial equilibrium model results.

Table 4: NAFTA refined and scrap gold ROO liberalization: MFN liberalization results

Source	Destination Canada	Mexico	USA	ROW
Percentage change in gold shipments				
Canada	-0.5749	0.0180	-0.5658	0.0282
Mexico	0.0000	0.0007	-0.5831	0.0109
USA	-0.5725	0.0203	-0.5634	0.0306
ROW	1.3753	-0.0121	2.7667	-0.0018
Percentage change in gold jewelry shipments				
Canada	0.0117	0.0211	0.0166	0.0309
Mexico	-0.0087	0.0007	-0.0038	0.0105
USA	0.0091	0.0184	0.0139	0.0282
ROW	-0.0205	-0.0111	-0.0156	-0.0013

Absolute change (unless otherwise noted)	Destination Canada	Mexico	U.S.	Total	Expected sign
NAFTA Gold jewelry (1) (pct. ch.)	0.0088	0.0184	0.0095	0.0157	Positive
NAFTA Gold jewelry relative to ROW (2)	0.0003	0.0004	0.0000	0.0000	Positive
NAFTA Gold relative to ROW (3)	-0.0063	0.0032	-0.0422	-0.0370	Negative
NAFTA Gold (4) (pct. ch.)	-0.5725	0.0203	-0.5672	-0.4932	Ambiguous
Jewelry trade relative to gold trade (5)	0.0086	0.0000	0.0010	0.0014	Positive
Gold exports to jewelry imports (6)	-0.0678	-0.0059	-0.0017	-0.0182	Negative
Gold imports to jewelry imports (7)	-0.0040	0.0000	-0.0331	-0.0182	Ambiguous

	(destination) Consumer Price	Output	(source) Producer Price	Market Price
Percentage change in gold prices and output				
Canada	-0.3436	-0.5522	-0.0092	-0.0092
Mexico	-0.0048	-0.1591	-0.0027	-0.0027
USA	-0.3384	-0.5032	-0.0084	-0.0084
ROW	0.0010	0.0640	0.0011	0.0011
Percentage change in gold jewelry prices and output				
Canada	-0.0057	0.0135	-0.0072	-0.0072
Mexico	-0.0026	-0.0001	-0.0021	0.0000
USA	-0.0041	0.0151	-0.0066	-0.0001
ROW	0.0007	-0.0028	0.0008	0.0000

Source: Authors' partial equilibrium model results.

Bibliography

Carrere, Celine and Jaime de Melo, "Are Different Rules of Origin Equally Costly? Estimates from NAFTA," presented at Conference on Rules of Origin in Regional Trade Agreements: Conceptual and Empirical Approaches, *Inter-American Development Bank*, February 20-21, 2004, Washington DC.

Destler, I. Mac "Rules of Origin and U.S Trade Policy," presented at IDB Conference on Rules of Origin in Regional Trade Agreements: Conceptual and Empirical Approaches," Inter-American Development Bank, February 20-21, 2004, Washington DC.

Estevadeordal, Antoni and Kati Suominen, "Rules of Origin in FTAs: A World Map," at http://www.iadb.org/intal/foros/LAestevadeordal.pdf, downloaded March 2005.

Estevadeordal, A., 2000, "Negotiating Preferential Market Access: The case of the North American Free Trade Area." *Journal of World Trade*, 43(1) 141-166.

Ferrantino, Michael J. and Hall, H. Keith, "The Direct Effects of Trade Liberalization on Foreign Direct Investment: A Partial Equilibrium Analysis," Office of Economics Working Paper, USITC, October 2001.

Fetzer, James J., "A Partial Equilibrium Approach of Modeling Vertical Linkages in the U.S. Flat Rolled Steel Market" *USITC Working paper No. 2005-010A*, January 2005.

Francois, Joseph, "Rules of Origin in Regional Trade Agreements: Conceptual and Empirical Approaches," presented at Conference on Rules of Origin in Regional Trade Agreements: Conceptual and Empirical Approaches, *Inter-American Development Bank*, February 20-21, 2004, Washington DC.

Francois, Joseph and H. Keith Hall, "Global Simulation Analysis of Industry-Level Trade Policy" draft, April 21, 2003, downloaded from: http://www.intereconomics.com/handbook/Models/Spreadsheet%20Models/GSIMpaper.pdf

Matoo, Aaditya, Devesh Roy and Arvind Subramanian, "The Africa Growth and Opportunity Act and its Rules of Origin: Generosity Undermined?" *IMF Working paper* #WP/02/158, September 2002.

Ju, Jiandong and Krishna, Kala, "Firm Behavior and Market Access in a Free Trade Area With Rules of Origin," *NBER Working Paper 6857*, December 1998.

Kee, Hiau Kee, Alessandro Nicita and Marcelo Olarreaga, "Import demand elasticities and trade distortions" *World Bank Policy, Research Working Paper WPS3452*, December 2004

Roningen, Vernon O., "Multi-Market, Multi-Region Partial Equilibrium Modeling," In *Applied Methods for Trade Policy Analysis*, edited by Francois, Joseph F. and Reinert, Kenneth P. Cambridge University Press, Cambridge, 1997.

Saudners, Caroline, Moxey, Andrew, and Roningen, Vernon O., "Trade and the Environment. Linking a partial equilibrium trade model with production systems and their environmental consequences," Paper presented at *Symposium on Trade in Livestock Products ITRAC*, Aukland, January 2001.

Stevens, Christopher and Jane Kennan, *G-8 Preferences for Africa: What Country Experience Tells Us.* Report on Phase II of a DFID-commissioned Study, *Institute of Development Studies*, February 2004

U.S. International Trade Commission, *U.S.-Korea FTA: The Economic Impact of Establishing a Free Trade Agreement (FTA) Between the United States and the Republic of Korea.* Publication. 3452, Washington DC, September 2001

U.S. International Trade Commission, .*Processed Foods and Beverages: A Description of Tariff and Non-tariff Barriers for Major Products and Their Impact on Trade* Publication 3455, Washington DC, October 2001