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Technical Annex

Varieties or Qualities? Horizontal and Vertical Intra-industry Trade within the NAFTA Trade Bloc

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This document is the technical annex to the full paper "Varieties or Qualities? Horizontal and Vertical Intra-industry Trade within the NAFTA Trade Bloc" which is available separately.

Methodology and Data

In order to disentangle horizontal and vertical IIT we follow the Greenaway, Hine, and Milner (1994, 1995) approach, using the Grubel-Lloyd (1975) index of IIT and information on unit values (UVs) of exports and imports. The assumption is that prices of exports and imports (as measured by UVs) reflect quality (Stiglitz, 1987). In general, the GL index is defined as

$$IIT = GL_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)}, \quad (1)$$

where X_i and M_i are exports and imports of industry i, respectively. The GL index can be calculated for bilateral (between two countries) and multilateral (between one country and all its trading partners) trade flows and be summed across industries after

weighting by trade shares. It ranges between zero and one, where an index value of zero indicates trade in industry *i* to be completely of the inter-industry type and a value of one indicates complete intra-industry trade. In this study, the GL indices are not adjusted for aggregate trade imbalance, as it has been shown that adjusted indices are of inferior quality compared to unadjusted indices and that there are no strong theoretical and statistical arguments for such adjustments (Kol and Mennes, 1989; Vona, 1991). In the recent literature, this approach is the standard practice.

Here, IIT and UVs of exports and imports are calculated at the SITC four-digit level, which constitutes the elementary or product level. The industry level is defined as the three-digit SITC product group, which contains the four-digit SITC products (any three-digit SITC division is divided further into four-digit SITC items). In order to disentangle IIT into its horizontal and vertical components, matched trade in each four-digit SITC product is calculated and categorized as 1) horizontal if the UV of exports (UV^X) relative to the UV of imports (UV^M) lies within a range of ± 25 percent, or 2) vertical if relative UVs of exports and imports lie outside this range. The range of ± 25 percent is used because UVs are affected by product aggregation, transportation costs, and exchange rate fluctuations. A 25 percent threshold has been increasingly used in recent studies (e.g., Aturupane, Djankov, and Hoekman, 1999; Fukao, Ishido, and Ito, 2003).

Thus, HIIT in any three-digit SITC industry is the sum of horizontal matched trade of four-digit SITC products (that comprise that particular three-digit industry) relative to total industry trade, that is,

$$HIIT_i = \frac{\sum_{p_H}\left(X_{ip_H} + M_{ip_H}\right) - \sum_{p_H}\left|X_{ip_H} - M_{ip_H}\right|}{\sum_{p}\left(X_{ip} + M_{ip}\right)}, \qquad (2)$$

where, X_{ipH} (X_{ip}) and M_{ipH} (M_{ip}) represent exports and imports of horizontally differentiated products (all products) within industry *i*, respectively. Equation (2) is the GL index, calculated only for those products that satisfy the condition

$$0{,}75 \le \frac{UV^X}{UV^M} \le 1{,}25 \ .$$

Similarly, VIIT in any three-digit SITC industry is the sum of vertical matched trade of four-digit SITC products (that constitute that particular three-digit SITC industry) relative to total trade in that industry, that is,

$$VIIT_i = \frac{\sum_{p_V}\left(X_{ip_V} + M_{ip_V}\right) - \sum_{p_V}\left|X_{ip_V} - M_{ip_V}\right|}{\sum_{p}\left(X_{ip} + M_{ip}\right)}, \quad (3)$$

where, X_{ipV} (X_{ip}) and M_{ipV} (M_{ip}) denote exports and imports of vertically differentiated products (all products) within industry *i*, respectively. Thus, equation (3) is the GL index, calculated only for those products that satisfy one of the following conditions:

$$\frac{UV^X}{UV^M} < 0{,}75 \text{ or } \frac{UV^X}{UV^M} > 1{,}25 .$$

Given all the above definitions, it is obvious that

$$IIT_i = HIIT_i + VIIT_i . \quad (4)$$

Finally, data are obtained from the OECD's International Trade by Commodities Statistics (ITCS) database at the four-digit and three-digit levels of the Standard International Trade Classification (SITC) for the manufacturing products (SITC sections 5 through 8) and for the years 1992, 1994, 1996, 1998, 2000, and 2002, where values are expressed in current US dollars and quantities are expressed in kilograms.