

Technical Appendix for Export Quality database

1. This technical appendix elaborates in three brief sections on the data used in deriving quality estimates, the estimation methodology itself, and finally quality database and its construction through aggregation. Further information can be found in the accompanying working paper: [Henn, Christian, Papageorgiou, Chris and Nikola Spatafora, 2013, "Export Quality in Developing Countries", IMF Working Paper 13/108](#). Please cite this paper if using these quality data in your work.

Data used in estimating export quality

2. **The quality estimates are derived from a large trade dataset.** This dataset is a significantly extended version of the UN-NBER dataset and covers the 1962–2010 period. Starting with the COMTRADE database, the trade dataset is constructed by supplementing importer-reported data by exporter-reported data where former does not exist.¹ Consistency over time and in aggregating to broader categories is ensured by using the methodology of Asmundson (2012). This dataset is analogous to the UN-NBER dataset, but provides longer time coverage. The dataset contains 45.3 million observations on bilateral trade values and quantities at the SITC 4-digit (Revision 1) level. Any given importer-exporter-product-year combination will have more than one observation for the same 4-digit category whenever import quantities are reported for more than one set of units (e.g. kilograms and dozens of units for apparel). In this case, the two sets of import quantities are considered distinct "SITC 4-digit-plus" products, so that comparable unit values can be obtained within each product category. The total number of "SITC 4-digit-plus" products based on this procedure is 851.²

3. **Quality is then estimated, as described below, using this trade dataset (on trade prices, values and quantities) and a host of other information.** Latter includes data on preferential trade agreements, taken from the World Trade Organization's Regional Trade Agreements database, and other gravity variables are taken from CEPII (Head and Mayer, 2013). Data on income per capita was taken from the Penn World Tables, version 7.1.

Estimation methodology

4. **The estimation methodology derives quality from unit values, but with two important adjustments.** The methodology is a modified version of Hallak (2006), which sidesteps data limitations to achieve maximum country and time coverage.³ As a first step, for any given product, the trade price (equivalently, unit value) p_{mxt} is assumed to be determined by the following relationship:

$$\ln p_{mxt} = \zeta_0 + \zeta_1 \ln \theta_{mxt} + \zeta_2 \ln y_{xt} + \zeta_3 \ln \text{Dist}_{mx} + \xi_{mxt}, \quad (1)$$

where the subscripts m , x , and t denote, respectively, importer, exporter, and time period. Prices reflect three factors. First, unobservable quality θ_{mxt} . Second, exporter income per capita y_{xt} ; this is meant to capture cross-country variations in production costs systematically related to income. With high-income countries typically being capital-abundant, we expect $\zeta_2 < 0$ for capital-intensive sectors and $\zeta_2 > 0$ for labor-intensive sectors. Third, the (great circle) distance between importer

¹ The only exceptions to this methodology are export flows as reported by the U.S., which take precedence over importer-reported flows.

² Some SITC 4-digit-plus products made up a very small fraction of trade in the corresponding SITC 4-digit category. These SITC 4-digit-plus products were dropped if they met either of two criteria for smallness. First, the product comprised less than 1 percent of total observations or trade value of the corresponding SITC 4-digit product. Second, the product had less than 1000 observations, and comprised less than 25 percent of total observations or trade value of the corresponding SITC 4-digit product. In addition, outliers were eliminated by excluding any observation with: (i) a quantity of 1; or (ii) a total trade value of less than \$7,500 at 1989 prices; or (iii) a unit value above the 95th or below the 5th percentile in 1989 prices within any given product.

³ The key difference is that here unit values at the SITC 4-digit level are used to achieve the desired maximum country and time coverage. Meanwhile Hallak gathers unit values at the 10-digit level and then normalizes them into a price index for each 2-digit "sector".

and exporter, $Dist_{mx}$. This accounts for selection bias: typically, the composition of exports to more distant destinations is tilted towards higher-priced goods, because of higher shipping costs.

5. **Next, a quality-augmented gravity equation is specified.** This equation is specified separately for each product, because preference for quality and trade costs may vary across products:

$$\ln(Imports)_{mxt} = ImFE + ExFE + \alpha \ln Dist_{mx} + \beta I_{mxt} + \delta \ln \theta_{mxt} \ln y_{mt} + \varepsilon_{mxt} \quad (2)$$

$ImFE$ and $ExFE$ denote, respectively, importer and exporter fixed effects. Distance is as defined above. The matrix I_{mxt} is a set of standard trade determinants from the gravity literature.⁴ The exporter-specific quality parameter is θ_{mxt} , which enters interacted with the importer's income per capita y_{mt} . If $\delta > 0$, then greater income increases the "demand for quality". The estimation equation is then obtained by substituting observables for the unobservable quality parameter in the gravity equation. Rearranging (1) for $\ln \theta_{mxt}$, and substituting into (2), yields:

$$\ln(Imports)_{mxt} = ImFE + ExFE + \alpha Dist_{mx} + \beta I_{mxt} + \zeta_1' \ln p_{mxt} \ln y_{mt} + \zeta_2' \ln y_{xt} \ln y_{mt} + \zeta_3' \ln Dist_{mx} \ln y_{mt} + \xi'_{mxt} \quad (3)$$

where $\zeta_1' = \frac{\delta}{\zeta_1}$, $\zeta_2' = -\frac{\delta \zeta_2}{\zeta_1}$, $\zeta_3' = -\frac{\delta \zeta_3}{\zeta_1}$, and $\xi'_{mxt} = -\frac{\delta \zeta_0' + \delta \xi_{mxt}}{\zeta_1} \ln y_{mt} + \varepsilon_{mxt}$.

6. **Equation (3) is estimated separately for each of the 851 SITC 4-digit-plus product categories in the dataset.** This yields 851 sets of coefficients. Estimates are obtained by two stage least squares. ξ_{mxt} is a component of p_{xmt} , so that the regressor $\ln p_{xmt} \ln y_{mt}$ is correlated with the disturbance term ξ'_{mxt} . Therefore $\ln p_{xmt-1} \ln y_{mt}$ is used as an instrument for $\ln p_{xmt} \ln y_{mt}$. Where a unit value for the preceding year is not available (for instance, because the good was not traded), the unit value in the closest available preceding year is used, going back up to 5 years.⁵

7. **The regression coefficients are used to calculate a comprehensive set of quality estimates as follows.** Rearranging (1) and using the estimated coefficients, quality is calculated as the unit value adjusted for differences in production costs and for the selection bias stemming from relative distance:

$$Quality\ estimate_{mxt} = \delta \ln \theta_{mxt} = \zeta_1' \ln p_{mxt} + \zeta_2' \ln y_{xt} + \zeta_3' \ln Dist_{mx} \quad (4)$$

As is standard, quality θ_{mxt} and importers' taste for quality δ are not separately identified.⁶ This yields quality estimates in 851 SITC 4-digit-plus product categories for each importer-exporter-year observation with complete data. There are over 20 million quality estimates at this (SITC4plus-importer-exporter-year) level.⁷

⁴ It includes indicator variables for a common border, a common language, the existence of a preferential trade agreement, a colonial relationship, and a common colonizer.

⁵ If unit values are not available in any of the preceding 5 years, the observation is excluded from the estimation.

⁶ The preference for quality parameter δ will also vary across sectors. Therefore, when later quality estimates are aggregated across sectors, the procedures necessarily also aggregates across these heterogeneous preferences for quality.

⁷ This number is smaller than the 45.3 million in the original dataset because of: (i) missing observations for other regressors, primarily Penn World Table per capita income; and (ii) elimination of outliers (see fn.).

The Quality Dataset and its Construction

8. **These quality estimates (from eqn. (4)) are then aggregated into the present multi-level database.** To enable cross-product comparisons, all quality estimates are first normalized by their 90th percentile in the relevant product-year combination. The resulting quality values typically range between 0 and 1.2. The quality estimates are then aggregated, using current trade values as weights. The aggregation first consolidates across importers to obtain an aggregate at the SITC4plus-exporter-year level. Then further aggregations provide estimates at the SITC 4-, 3-, 2-, 1-digit, and finally country-level averages for each exporter.⁸ At each aggregation step, the normalization to the 90th percentile is repeated.⁹ Aggregations are also produced based on the BEC classification, as well as on 3 broad sectors (agriculture, non-agricultural commodities, and manufactures). The names of these quality series is "Qual" and are referred to as the Quality Index.

9. **It is important to highlight that the quality value for a category cannot be derived by users from the quality values in associated subcategories.** That is true, even if users had contemporaneous trade values available to reconstruct the trade weights used in the aggregation. This from the normalization to the 90th percentile at every aggregation level, which depends on all other countries' export qualities also. Users will consequently need to download the quality data for all aggregate and subcategories that they intend to use in their work.

10. **A comparable unit values series is also supplied.** This series, named "Sup_uv", is also rebased to the 90th percentile at each aggregation step, with the objective of providing an exact analogue to the quality series ("Qual") for comparison purposes. These series can be used to construct charts such as Figures 3 and 4 in the accompanying working paper ([Henn, Papageorgiou, and Spatafora, 2013](#)).

11. **Finally, series are supplied measuring the average quality (unit value) demanded in an exporter's present destination markets for any product.** This series can reveal whether exporters have potential for quality upgrading presently, or whether first they may need to broaden their range of export destinations toward high-quality importers (as in Figure 12 of Henn, Papageorgiou, and Spatafora, 2013). To obtain this series, the import-weighted average of quality demanded by each importer is obtained from the output of the estimation, i.e. from the quality estimates at the SITC4plus-exporter-importer-year level (resulting from equation (4) and before any aggregation). Then the aggregation of this series, named "Sup_qual_Mmean" proceeds in the same way as for the "Qual" series above by using export weights. In this fashion, a series is obtained that measures the average quality demanded in an exporters current destination markets for a product. A value of 1 in this series characterizes an exporter, which exports a given product, to destinations that demand a very high quality of that product on average in their imports. A unit value analogue to this series is also supplied and named "Sup_uv_Mmean".

⁸ Changes in the higher-level (including country-level) quality estimates will in general reflect both quality changes *within* disaggregated sectors, and reallocation *across* sectors with different quality levels. measure. If the composition of exports is shifting toward product lines characterized by low quality levels, it is quite possible for the quality of any given product to be rising sharply, but country-level quality to rise slowly (or indeed decline). We will examine the robustness of the conclusions to using constant weights, or a chain-weighted quality measure.

⁹ With even high quality exporters not achieving the 90th percentile level in many products that they export, aggregation without normalization would imply that the value of 1 would not characterize the 90th percentile anymore. Rather, some value lower than 1 would characterize 90th percentile and this value would differ from sector to sector.

References

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