

## ACTD 1808-1939: DESCRIPTION OF METHODS AND NOMENCLATURE

This note provides a brief discussion of the basic methodology behind the construction of the export price indices listed in the African Commodity Trade Database (ACTD) for the years 1808-1939, discusses the representativeness of the import price index used to calculate the terms of trade, and explains the geographical reach of the French regions/areas in our sample.

### EXPORT PRICE INDEX

To obtain an aggregate export price index for each area/colony, the country's commodity prices were weighted using its export mix. These export weights were changed at approximately twenty-year intervals to capture long-run shifts in export composition. Country-specific export price indices were aggregated to obtain regional series. The aggregate indices were constructed using area/colony nominal export shares. These weights were also changed at twenty-year intervals to capture the shift in each area's contribution to the value of total African exports.

#### *Methodology*

The basis for our price index is a basic Laspeyres price index. Equation (1) below captures the change in the aggregate price ( $P$ ) of a composite basket of  $i$  goods between period 1 and the base period 0;  $p$  and  $q$  are the price and quantity of each good  $i$  respectively.

$$P^L = \sum_i \frac{p_{i1} \cdot q_{i0}}{p_{i0} \cdot q_{i0}} = \sum_i \frac{p_{i1}}{p_{i0}} s_{i0} \quad (1)$$

The fixed-weight price index is thus the ratio of the total value of goods in base period 0 measured at periods 1's prices to the total value of goods in the base period itself. Or, alternatively, as the change in prices for good  $i$  weighted by the value share ( $s$ ) of product  $i$ ; where

$$s_{i0} = \frac{p_{i0} \cdot q_{i0}}{\sum_i p_{i0} \cdot q_{i0}} \quad (2)$$

In this Laspeyres index, only value shares for period 0 factor into the equation making it particularly sensitive to the choice of base-period. When there are substantial price or quantity changes over time, picking a different base year could significantly alter the results. Equation (3) addresses this issue by using the average value share ( $\bar{s}$ ) over a time span of several years ( $T$ ).

$$P = \sum_i \frac{p_{i1}}{p_{i0}} \bar{s}_i \quad (3)$$

Where the average value share is given by equation (4).

$$\bar{s}_i = \sum_{t=0}^T \frac{p_{it} \cdot q_{it}}{\sum_i p_{it} \cdot q_{it}} / T \quad (4)$$

### *Chaining*

Modern index-number literature emphasizes that weights need to be updated at regular intervals to reflect changing expenditure patterns and incorporate new products in the weighting baskets (Diewert 2014). Setting fixed, time-invariant weights will introduce a sizable bias at any given point in time. Commonly, long indices are constructed using a procedure called chaining, where aggregate price indices are calculated for shorter, partly overlapping sub-periods which are subsequently joined together by rescaling them to make the values equal in the overlapping years

However, if there are considerable fluctuations in the prices and quantities in the intervening periods, chaining may both increase the index number spread and even distort the measure of the overall change between the first and last periods. A solution is to reduce the frequency of chaining and thus lengthen the sub-periods. This can smooth out temporary shocks to prices or quantities and compensate for measurement error in the weights. These issues are particularly relevant for our NBTT series which spans a long time-period, sees the introduction of various new export and import commodities, exhibits a fair amount of volatility in both the prices and quantities for those commodities, and inevitably suffers from some measurement error. We adopt a chaining procedure, setting the chain length at twenty years, and averaging the weights over each sub-period; see equation (5).

$$P^c = \left( \sum_i \frac{p_{i20}}{p_{i0}} \bar{s}_{i\tau} \right) \left( \sum_i \frac{p_{i40}}{p_{i20}} \bar{s}_{i\tau+1} \right) \left( \sum_i \frac{p_{i60}}{p_{i40}} \bar{s}_{i\tau+2} \right) = \prod_{\tau} P_{\tau} \quad (5)$$

Our methodology not only matches the standard practice in the historical trade literature (Blattman et al. 2007; Williamson 2011), it also closely mirrors the methodology currently applied by the World Bank and the IMF (2009). A robustness check of our NBTT index for West Africa (WA) between 1808 and 1884 reveals that alternative choices of chain lengths do not fundamentally alter our findings. Setting the chain length as high as fifty years or as low as two years yields estimates of average annual NBTT growth ranging from 1.51 to 1.87 percent. Our preferred estimate of 1.65, based on twenty-year intervals, sits comfortable

in the middle of this range. Setting the chain length to one, thus updating weights every year, results in an average annual growth rate of NBTT for WA between 1808 and 1884 of 2.38 percent. This substantially higher growth rate is likely the result of chain drift.

#### *African versus London prices*

Comparison of prices between Africa and London is not straightforward. Not all the key African export commodities are listed in the British wholesale price index series (e.g. Sauerbeck), particularly for the nineteenth century. In addition, some of the products that are listed may be of a different quality or have certain characteristics that distinguish them from the commodities listed in the London price series, e.g. wood. Table 1 below lists comparative statistics for 4 key West African products for which prices are available in Sauerbeck or the Historical Statistics of the United States (HSUS). Simple correlations of the levels (where the base years are set to 1900=100) reveal a strong, but not absolute correlation for most time-series. Level correlations for palm oil are quite weak, however, the series diverge particularly during WW1 and the 1920s. Comparing annual growth rates reveals a strong correlation for hides and cotton, but not for rubber and palm oil. A cointegration test finds that the London and African time series for palm oil are cointegrated, as is the case for hides and cotton. The null hypothesis of no cointegration for rubber, however, cannot be rejected at the standard 5 percent significance level.

**Table 1. Correlations and cointegration test**

Commodity	Source	Years	Corr. Levels	Corr. 1 <sup>st</sup> Diff.	H0: 0 coint.	H0: 1 coint.
Palm Oil	Sauerbeck	1846-1939	0.363	0.388	0.047	0.040
Rubber	HSUS	1898-1939	0.871	0.375	0.368	0.798
Hides	Sauerbeck	1846-1939	0.942	0.864	0.005	0.089
Cotton, raw	Sauerbeck	1846-1939	0.732	0.718	0.039	0.071

*Notes:* Correlation of levels Null-test (H0) based on Johansen cointegration test.

In summary, African and London price series tend to be (highly) correlated and show evidence of cointegration. The reasons why price trends do diverge for some years/periods are difficult to determine and beyond the scope of this paper. For the derivation of African ToT it does appear key, however, to base prices for African export commodities on unit values observed at the African coast, which we do.

## **IMPORT PRICE INDEX**

Regional specific terms of trade were derived by dividing the export price indices by a common import price index (Mitchell 1988, pp. 526-28), to capture change in the prices for the primary British manufactures shipped abroad.

In the ACTD we rely on a single import price index to derive the terms of trade for all African countries and regions in our sample. This import price index from Mitchell (1988, pp. 526-28) is based on a comprehensive set of products – the prices of which are observed in the United Kingdom – that are shipped to the British colonies and possessions as well as its other trading partners. The main benefit of relying on this common import price index is that the resulting terms of trade series are consistent with the earlier work of Williamson (2011), making a direct comparison of the relative size and duration of the terms of trade boom between Africa and the other ‘peripheral’ countries possible.

Potential concerns with the use of Mitchell’s import price index are that: (1) the mix of goods shipped to the full range of Britain’s trading partners (including developed countries) may not be representative for the flow of goods sent from the United Kingdom to Africa; (2) the prices of imported goods as observed in Africa may deviate from the prices observed in the United Kingdom; (3) the import price index based on British prices and goods may not be representative for the goods shipped from France to its colonies and possessions. As we will illustrate below, none of these issues appear to have a structural or pronounced effect on the resulting import price index.

To test the representativeness of the import price index by Mitchell, we reconstructed a new price index for the Gambia, Gold Coast and Sierra Leone. For these three British colonies we have reliable data, from 1853 onwards, of the flow and composition of goods shipped from the United Kingdom as well as African price series for the key import items. We derived the value shares of imports from the *Annual Statement of Trade and Navigation* of the United Kingdom, the prices observed at the African coast are from the *Blue Books* and the *Statistical Abstract for the Several Colonial and Other Possessions*, and – for those products where no African prices are available – we used the British export prices from the *Statistical Abstract for the United Kingdom*. Table 2 summarizes the value shares of thirteen key imported goods which together cover over 75 percent of the total value of imports into the Gold Coast, Gambia and Sierra Leone over the period 1853-1902.

**Table 2: Value shares of key imports into British West Africa, 1853-1902 (%)**

<i>Product</i>	<i>Imports into</i>		<i>Exports from</i>	
	<i>Gold Coast</i>	<i>Gambia and Sierra Leone</i>	<i>The Kingdom</i>	<i>United</i>
Rice	1.0	11.3	0.5	
Beer	0.4	1.4	0.7	
Spirits	0.7	1.4	0.6	
Tobacco	1.0	3.3	0.2	
Gunpowder	2.8	4.8	0.1	
Wooden goods	3.1	0.3	0.1	
Silk goods	1.3	...	0.7	
Cotton goods	54.8	52.1	22.2	
Apparel and slops	2.5	5.8	1.4	
Beads	1.6	1.0	...	
Iron	1.6	4.2	8.5	
Brass	2.4	...	0.1	
Firearms	1.7	6.3	0.2	
Other	25.0	8.0	64.6	
<b>TOTAL</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	

*Notes:* items listed as “...” are not mentioned in the primary source.

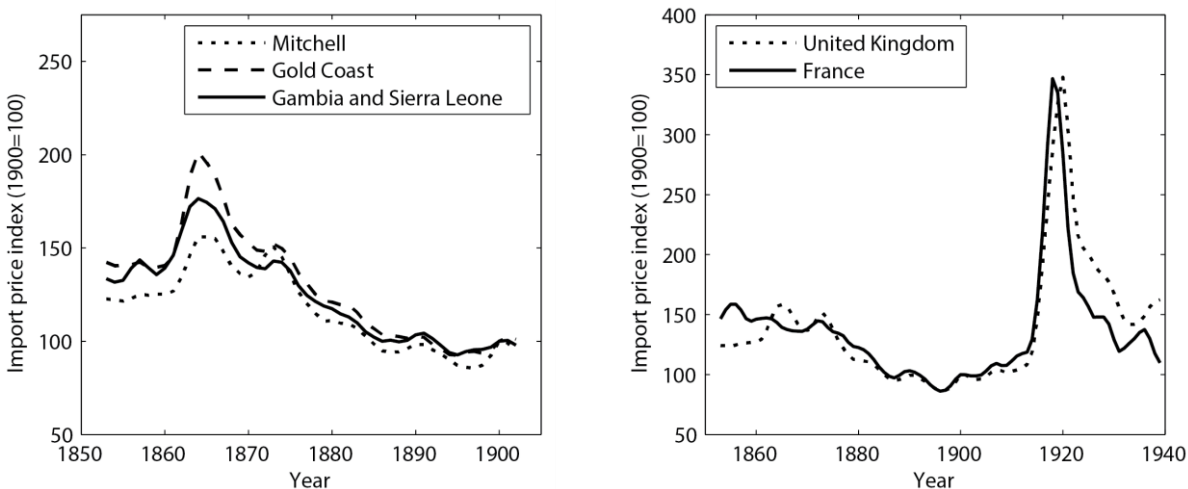
*Sources:* for Gold Coast, Gambia and Sierra Leone: *Annual Statement of Trade and Navigation of the United Kingdom* (1856, 1861, 1866, 1871, 1876, 1881, 1887, 1892, 1897, 1902); for the UK: *Statistical Abstract for the United Kingdom in each of the last fifteen years* (1868, 1874, 1887, 1898, 1903).

Table 2 shows that the import shares for British West Africa did indeed deviate from the overall export mix of the United Kingdom. All three African countries predominantly import *cotton goods*, but *tobacco*, *gunpowder* and *firearms* also make up a sizable share of the value of West African imports. Cotton cloth is a major export item for the United Kingdom, but a substantial share of British exports remains uncovered by these thirteen items. Important items such as machinery, woolen goods and processed food were scarcely imported into Africa.

To see whether the divergent import mix for British West Africa affects the import price index as well, we combine the average value shares for each decade with annual price indices for these thirteen items. Unfortunately, no reliable set of African prices was available for *cotton goods*, *wooden goods* and *brass*.<sup>1</sup> For these items we relied on British export prices instead. Figure 1 compares the new, country-specific import price indices to the original index by Mitchell.

<sup>1</sup> Either price data was absent or, in the case of *cotton goods*, the units (e.g. yards or packages), description and quality changed frequently and were irreconcilable between the years in our sample.

**Figure 1: Import price indices compared, 1853-1939**



*Notes:* French import price index converted to pounds using quoted exchange rates. Import price indices for United Kingdom and France refer to the price of goods shipped from these respective countries to their trading partners and colonies (so technically export price indices). Maintained reference to ‘import’ to retain consistency with main text which views trade from the perspective of African countries.

*Sources:* [left-hand pane] Mitchell (1988, pp. 526-28); Gold Coast, Gambia and Sierra Leone, value shares see table A.1, African prices *Blue Books* (various issues) and *Statistical Abstract for the Several Colonial and Other Possessions* (1865, 1874, 1885, 1891, 1895, 1906), British prices *Statistical Abstract for the United Kingdom in each of the last fifteen years* (1868, 1874, 1887, 1898, 1903). [right-hand pane] United Kingdom from Mitchell (1988, pp. 526-28); France from Mitchell (2007). Exchange rates from Mitchell (1988, pp. 700-03).

The left-hand pane of figure 1 clearly shows that the original index by Mitchell is a good proxy for the price development of imported goods into British West Africa. Between 1853 and the peak of the terms-of-trade boom (1884), the country-specific indices show a slightly greater decline in import prices: -0.87 and -0.82 versus Mitchell’s -0.68 percent per annum. The use of these import prices would thus *increase* the rate of growth of the terms of trade by between 0.14 and 0.19 percentage points per annum for this period. The more pronounced peak in import prices during the early 1860s in the result of rising prices for cotton during the American Civil War which weigh heavily in the West-African import mix (see table 2).

The right-hand pane of figure 1 compares the price index of British commodities to an index of French commodities being traded with the rest of the world. To make both series comparable we converted the French prices into British pounds using quoted exchange rates (Mitchell 1988, pp. 700-03). Again, the original, British index by Mitchell appears to be a good proxy for the price development of imported goods into Africa.

## **FRENCH NOMENCLATURE**

In the ACTD we adopted the French conventions for naming regions, which can at times be rather confusing. A summary is provided below.

### *Cote Occidental d'Afrique*

This represents a residual category, covering the French colonies/possessions on the West coast excluding Senegal, French North Africa, Togo and Dahomey which are listed separately in the trade records. The French statistical abstract explicitly cites the following countries: République du Congo, Soudan française (Mali), Guinée française and Côte d'Ivoire. This in all likelihood also includes Burkina Faso and Niger, and prior to 1910 French Gabon and Chad. Note that after 1910 French Equatorial Africa is separated in the trade records, covering French Gabon, French Congo, Oubangui-Chari, French Chad and French Cameroon (after WWI). This group is not included in the ACTD and thus presents a (minor) break in the series. Also note that prior to 1890 and after 1925 this category also includes Togo and Dahomey.

### *Etablissements Francaises du Golfe de Guinee*

This category is only available from 1890 to 1925 in the French trade statistics and covers Togo and Dahomey.

### *Possessions Anglaises en Afrique*

This group covers all British possessions on the West and East African Coast. It also includes South Africa, which dominates this category.

### *Autres Pays D'Afrique*

All other regions in Africa with which trade is conducted, excluding the French possessions (North, West, Equatorial and Islands), all British possessions and Egypt. Note that it does appear to include Djibouti prior to 1925.

## REFERENCES

- Blattman, Chris, Jason Hwang, and Jeffrey G. Williamson. "The Impact of the Terms of Trade on Economic Development in the Periphery, 1870-1939: Volatility and Secular Change." *Journal of Development Economics* 82 (January 2007): 156–79.
- Diewert, W. Erwin. *Price Level Measurement*. Amsterdam: Elsevier Science Publishing Company, 2014.
- IMF. *Export and Import Price Index Manual: Theory and Practice*. Washington: International Monetary Fund, 2009.
- Mitchell, Brian R. *British Historical Statistics*. Cambridge: Cambridge University Press, 1988.
- \_\_\_\_\_. *International Historical Statistics: Europe 1750-2005*. Basingstroke: Palgrave Macmillan, 2007.
- Sauerbeck, Augustus. "Prices of Commodities and the Precious Metals." *Journal of the Statistical Society of London* 49, no. 3 (1886): 581–648.
- \_\_\_\_\_. "Prices of Commodities in 1893." *Journal of the Statistical Society of London* 57, no. 1 (1894): 172–83.
- \_\_\_\_\_. "Prices of Commodities in 1904." *Journal of the Statistical Society of London* 68, no. 1 (1905): 138–53.
- \_\_\_\_\_. "Prices of Commodities in 1916." *Journal of the Statistical Society of London* 80, no. 2 (1917): 289–309.
- \_\_\_\_\_. "Prices of Commodities in 1931." *Journal of the Statistical Society of London* 95, no. 2 (1932): 303–19.
- \_\_\_\_\_. "Wholesale Prices in 1950." *Journal of the Statistical Society of London* 114, no. 3 (1951): 408–22.
- U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Washington D.C.: U.S. GPO, 1975.
- Williamson, Jeffrey G. *Trade and Poverty: When the Third World Fell Behind*. Cambridge, MA: MIT Press, 2011.