

Chapter 6: Price interconnections

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Coffee forms a complex global network of international relations, not only between producer and consumer countries, but also amongst consumer and producer countries, as shown in figure 1. Both consumer and producer countries, for example, import coffee from Italy, a “consumer” country. Producer and consumer countries interact with each other through the global market, and have long-standing trade relations that form the backbone of this market.

Coffee consumption has increased steadily for the past 20 years (see figure 2). The greatest drivers behind this recent growth have been producer countries, calling into question many traditional assumptions about the coffee market.

Despite the relatively smooth increase in coffee production, prices have historically swung wildly over the past 50 years, as shown in figure 3. There have been many reasons for these swings. These include political and economic changes, speculation, and the effects of disease and the environment.

In this section, we study the determinants of prices in the coffee market, from the perspective of both producer and consumer countries.

Coffee is an important contribution to the economy of many countries. The prices paid to farmers account for over 3% of the GDP of four countries (Burundi, Honduras, Nicaragua, and Ethiopia; see Appendix .5. The total value of coffee to seven countries exceeds 10% of their GDP (those above and Rwanda, Uganda, and Guatemala) (International Coffee Organization, *ming*). Understanding what drives prices for consumer and producer countries is important to these regions as well as the world’s 25 million coffee farmers.

0.1 Market data

The coffee market model incorporates coffee production divided out by producer countries, coffee consumption divided out by consuming countries, and the national and international drivers of the prices paid to growers and by consumers. The following inputs are used to construct an empirically-grounded market model. All are available at least at a yearly resolution, and are here implicitly indexed by year.

q_i	Production in country i	USDA and FAO
p_i	Price to growers in country i	ICO
d_j	Consumption in country j	UN Comtrade
c_j	Retail price in country j	ICO
e_{ij}	Export from country i to j	UN Comtrade
u	International coffee price	World Bank

Below, we use a consumer price index¹ to translate prices to year 2000 US dollars, as shown for Arabica and Robusta international prices in figure 4. Coffee consumers have enjoyed a significant reduction in prices, in real terms, since the 1970s and 1980s.

The following sections estimate empirical price relationships. While these are greatly simplified, they provide approximation to the drivers of the international coffee market.

¹We use a single CPI across all countries, calculated by International Financial Statistics for their “All Items” goods in advanced economies.

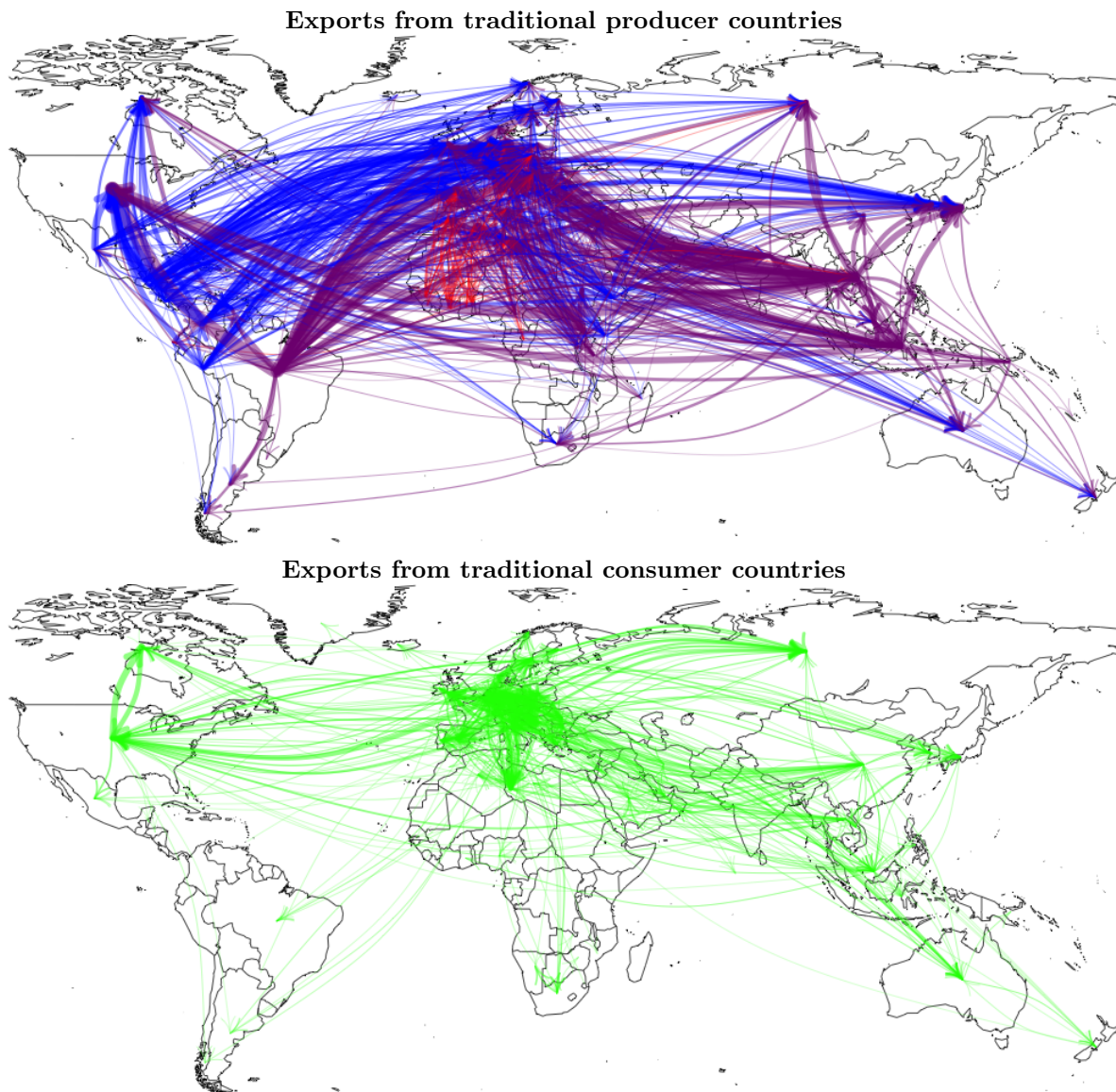


Figure 1: Exports from traditional producer (top) and consumer (bottom) countries. Above, blue arrows show Arabica exports, red arrows show Robusta exports, and purple arrows show exports that include both. The width of the lines increases with the yearly exports. Trade data from Comtrade (2015), producer classifications from International Coffee Organization (2015).

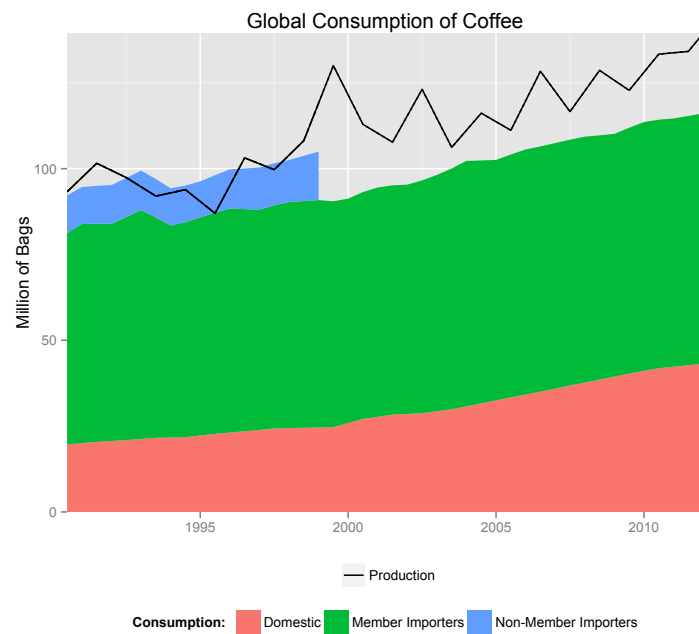


Figure 2: Global production (line) and consumption (colored areas) of coffee from ICO data. Non-member country consumption is unavailable after 1999. Most of the recent growth in consumption is driven by consumption within producing countries (domestic consumption), now equaling more than 50% of importing country consumption.

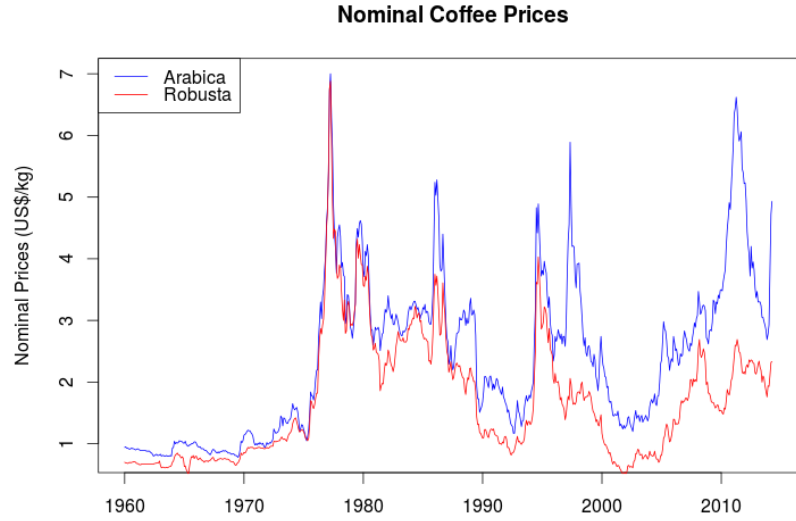


Figure 3: Nominal world prices of Arabica and Robusta coffee (in \$/kg), from the World Bank Pink Sheet. The general shape is very erratic, with nominal prices not yet returning to their peak in 1977. Robusta prices have also diverged from Arabica prices, as Robusta production has spread, although the two remain closely correlated.

0.2 International prices and production

International prices are partially driven by global production, but with considerable autocorrelation. The simplest form of this relationship is:

$$u = \alpha_0 + \alpha_1 \sum_i q_i + \alpha_2 u_{t-1}$$

This expression represents the fundamental driver of international coffee prices: scarcity increases prices and a glut of coffee reduces them. α_1 is negative to capture this relationship. α_2 represents the extent to which prices adjust slowly and are driven by other shocks. If α_2 is near 1, coffee prices have a long memory; while if it is near 0, they respond immediately to production changes. The result is estimated in table 1.

This estimate places the entire weight of the predictive capacity on the autoregressive term. In other words, the only significant information about the future international price is the current international price.

To improve this analysis, we model the dynamics of Arabica and Robusta stocks as a closer proxy for the driving quantities on the market, in Appendix .1. We find that international prices continue to be best explained by their own internal dynamics.

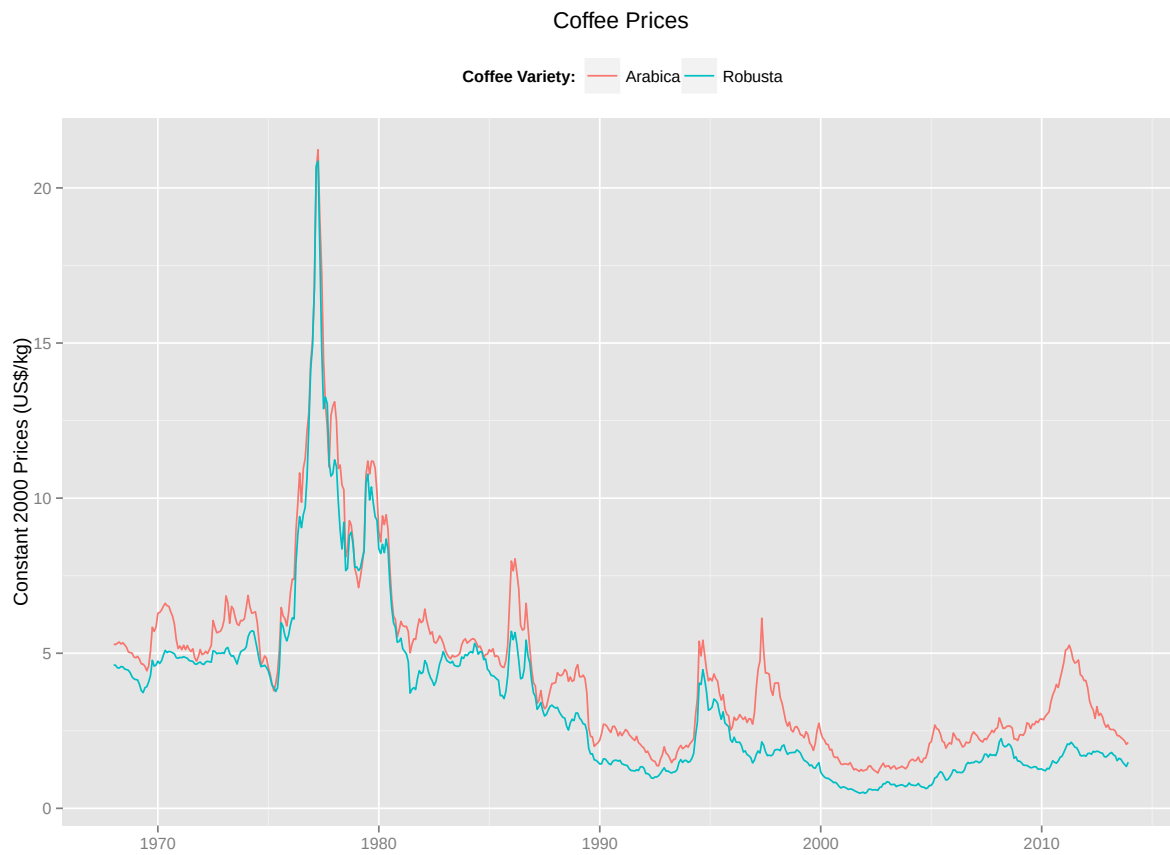


Figure 4: Arabica and Robusta green bean coffee prices, in terms of constant year 2000 US\$ per kilogram.

	<i>Dependent variable:</i>	
	Arabica	Robusta
	(1)	(2)
α_0	0.059 (0.075)	0.074 (0.060)
α_1	-0.00000 (0.00001)	-0.00001 (0.00002)
α_2	0.988*** (0.007)	0.987*** (0.007)
Observations	551	551
R ²	0.975	0.980
Adjusted R ²	0.975	0.980
Residual Std. Error (df = 548)	0.458	0.410
F Statistic (df = 2; 548)	10,669.730***	13,612.970***
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

Table 1: Estimate of the effect of production on international prices.

0.3 Prices to growers

Prices paid to farmers vary across countries by an order of magnitude, as shown in figure 5. While this figure represents average prices, the amount paid to farmers also varies year-to-year. We look at two determinants of these fluctuations: the international price paid for coffee and the country production level in that year.

Prices to growers are affected by both international prices and local production:

$$p_i = \beta_0 + \beta_1 q_i + \beta_2 u$$

Farmers are paid more when coffee fetches a higher price on the international market ($\beta_2 > 0$), but less if there is a relative excess of coffee produced in their country in a given year ($\beta_1 < 0$). We further allow for country-specific unexplained variation. The results of this estimate are shown in figure 6 and in the table in Appendix .2. The data is from International Coffee Organization (2015).

Figure 6 shows the amount of variance explained (out of 1) by these two parameters. The effect of international prices on prices paid to farmers is very clear, across all countries and globally. Furthermore, this explains 46% of the variation in year-to-year farmer prices.

The effect of production, however, is much less clear. Although it has a significant effect for about 30% of countries, the direction of the effect varies, with almost half of countries showing prices that increase with the level of production. This is at odds with at least a simple view of the relevant economics: we would expect a glut on the market to drive down prices. Even so, the effect of production on farmer prices explain typically less than 1% of the variation in these prices.

Unweighted, Robustas have a mean variance explained by international prices of 57% to 69% for the other Arabica varieties. Weighted by production, the difference is 63% to 82%. This lower explained variance

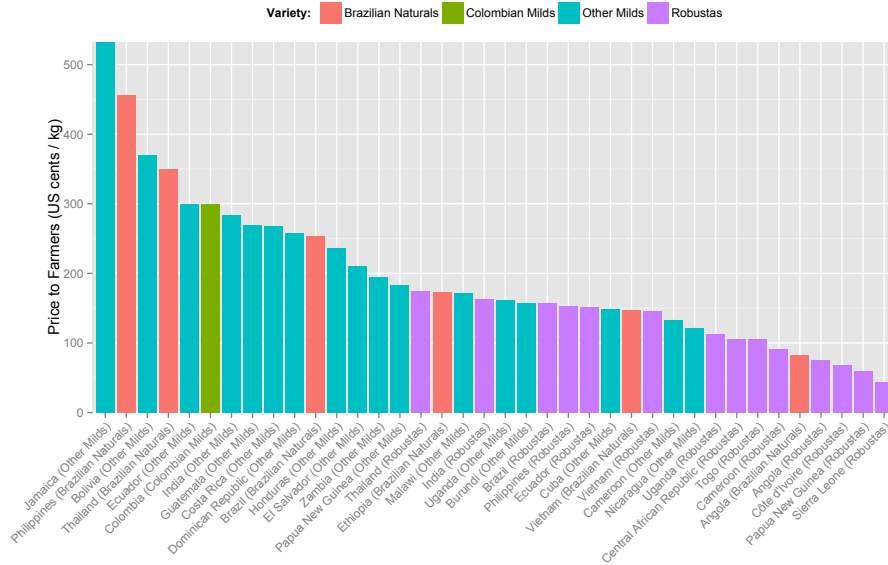


Figure 5: Price paid to farmers in U.S. cents per kg, averaged over 2009 - 2013, from the ICO.

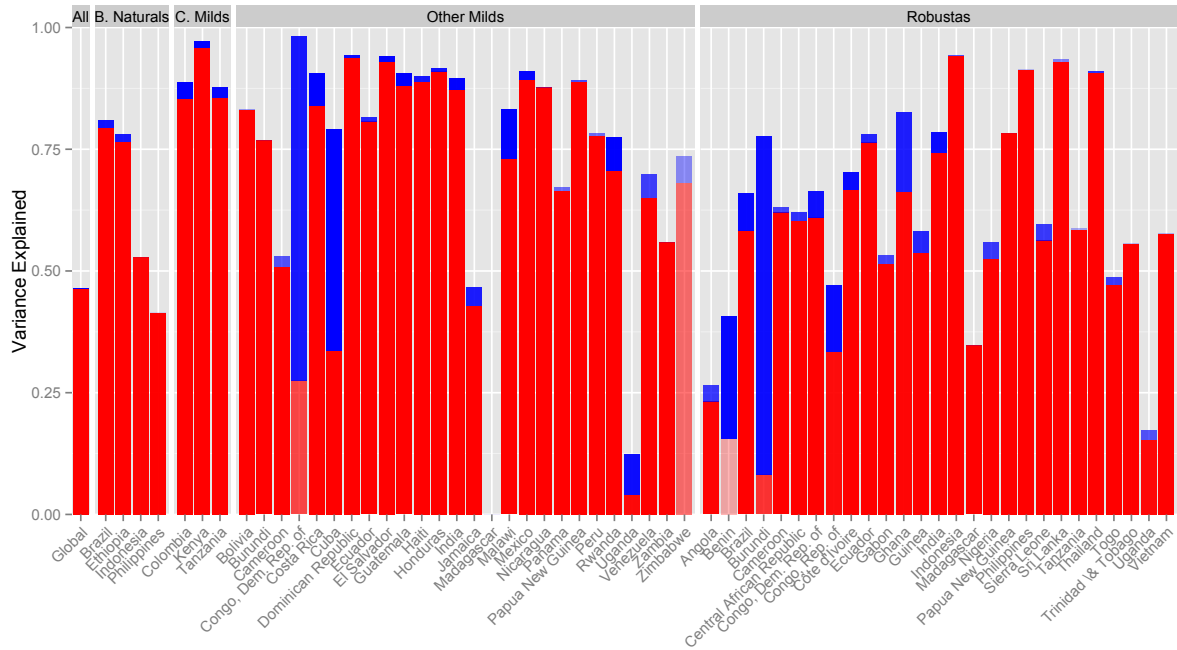


Figure 6: Variance of local prices explained by international prices (red) and local production (blue). Bars are faded according to their p-values.

is only slightly reflected in the level of variance explained by country production. This suggests that price changes are also significantly affected by other factors, such as national price interventions.

0.4 Consumer response to prices

In 2009, consuming countries spent \$27.1 billion for coffee (United Nations International Merchandise Trade Statistics, 2009). This value came after a decade of the lowest coffee prices, in real terms, ever seen, below \$2.50 per kg. Consumers responded to these low prices by growing the total financial size of the coffee market. In recent years, retail prices for roasted beans in consumer countries have ranged from \$6.65 per kg to \$14.60 per kg (see 7).

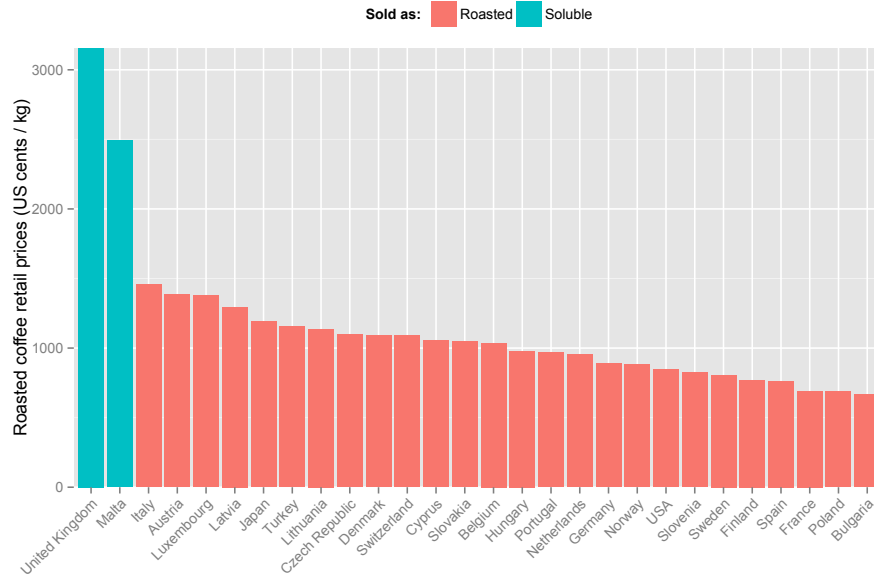


Figure 7: Retail price for roasted beans in U.S. cents per kg, between 2009 - 2013, from ICO.

We expect consumption to decrease with retail prices:

$$d_j = \gamma_0 + \gamma_1 c_j + \gamma_2 d_{j,t-1}$$

Demand does not re-calibrate immediately to changes in retail prices ($\gamma_2 > 0$), but we assume that high prices produce a downward force while low prices produce an upward force ($\gamma_1 < 0$). However, we allow for this “economic” force to be dominated by internal consumption dynamics, represented here as external demand shocks that persist through the autoregression term γ_2 . These results are shown in figure 8 and in table 4 in the Appendix. The data is from International Coffee Organization (2015).

Retail prices appear to have an uncertain effect on consumption, with consumption often climbing as retail prices climb. The direction of causality could be a problem in this case, where prices could be being driven higher by higher consumption. Only 1% of the variance in consumption is explained globally by retail prices (see figure 8). Mostly, retail prices appear to be determined by their level in the previous year. In other words, they may follow a kind of random walk, determined more endogenously than by external factors.

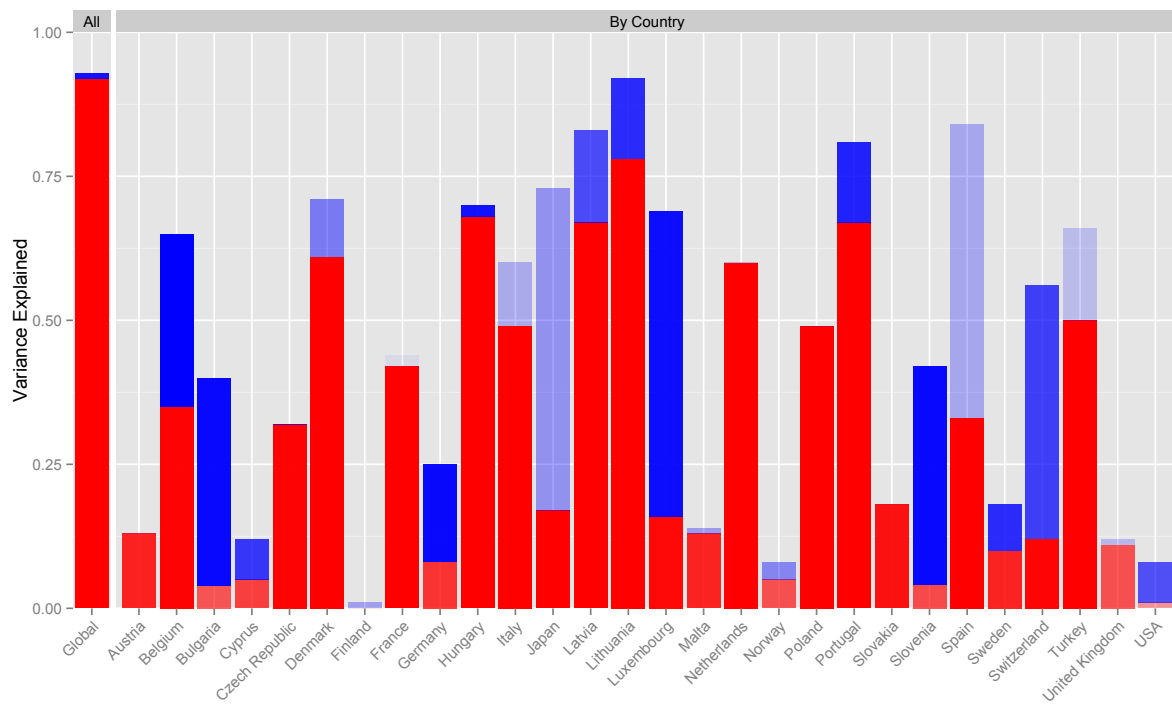


Figure 8: Variance of demand as explained by previous-year demand (red) and retail prices (blue). Bars are faded according to their p-values.

0.5 Retail prices follow costs

Finally, we relate retail costs in consuming countries to prices paid to farmers in producing countries. Thurston et al. (2013) shows that for coffee sold in the U.S. and under modest assumptions, retail profit is only 6% of the entire price of the product, and similarly modest shares are taken by actors upstream. We can therefore expect that retail prices are largely driven by economic necessities.

Using a statistical model, we can identify the share of costs going to each country and to some processes within countries.

Retail costs are a composite of the costs for imports from each country, plus a markup:

$$c_j = \phi_j + \sum_i \frac{e_{ij}}{d_j} (p_i + \theta_i + l_{ij})$$

Retailers respond to the costs of their inputs, which combine country-specific production prices (p_i), added prices for processing and tariffs (θ_i), a cost related to the transportation between them (l_{ij}), and added costs specific to the retailing country (ϕ_j). The extent to which each of the producing country variables (p_i, θ_i, l_{ij}) impact the final retail price is determined by the fraction imported from each country (e_{ij}/d_j). Our results are divided into producer country results and consumer country results. This is because each producing country sells to multiple consuming countries, and visa versa. The producer country results reflect the average of the effects they produce across all consuming countries, while the consuming country results reflect the effects produced by their mix of producing country imports. The trade relation data is from Comtrade (2015).

0.5.1 Producer countries

Producer country prices are divided into the share to farmers, in US cents per kg, and an additional mark up inferred from retail prices. See figure 9 and the table in Appendix .4.1.

The “To Farmers” column is reported in ICO data, and included in the table as the mean farmer price across all available years, in constant year 2000 cents. The remaining inferred producing cost for each country is the producer-side markup. While this may not be captured by producing-countries, it is associated with them: where this value is high, a large markup exists between retail prices that import from this country and farmer prices. Most markups are between 450 and 550 cents per kg, with Brazil and Vietnam as notable outliers. The greatest inferred markup comes from Indonesia.

0.5.2 Consumer countries

The consumer country values include prices to farmers (“To Farmers”) as averaged across all imports; distribution costs (averaged over country-to-country specific inferred transportation costs), the final retail prices (from ICO, averaged over available years in constant year 2000 cents), and the additional markup associated with the consuming country.

The farmer price is taken as the weighted average of farmer prices that make up imports in a given year, and adjusted for 16% loss of weight. See figure 10 and table 6 in the Appendix.

The largest markups are associated with soluble coffee prices (the United Kingdom and Malta). Japan also has very high markups. Low markups exist in Bulgaria, France, and Slovenia.

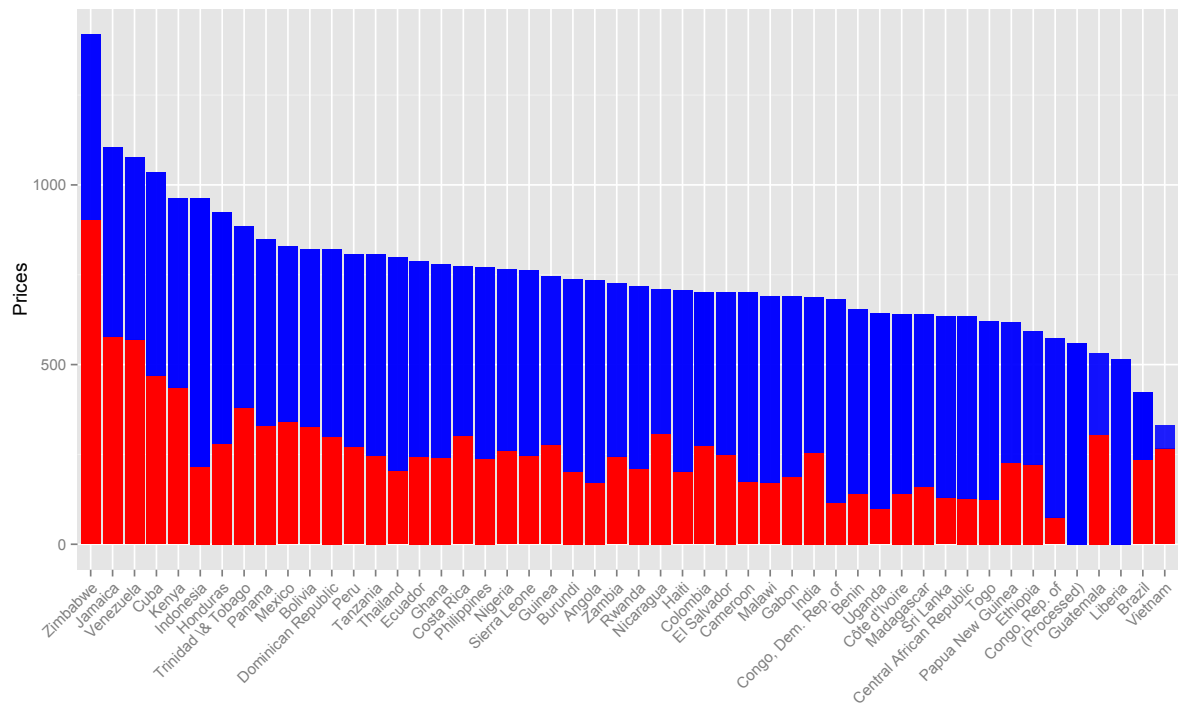


Figure 9: Producer country prices to farmers (red) and producer-associated markups (blue). Producer markups are faded by p-value.

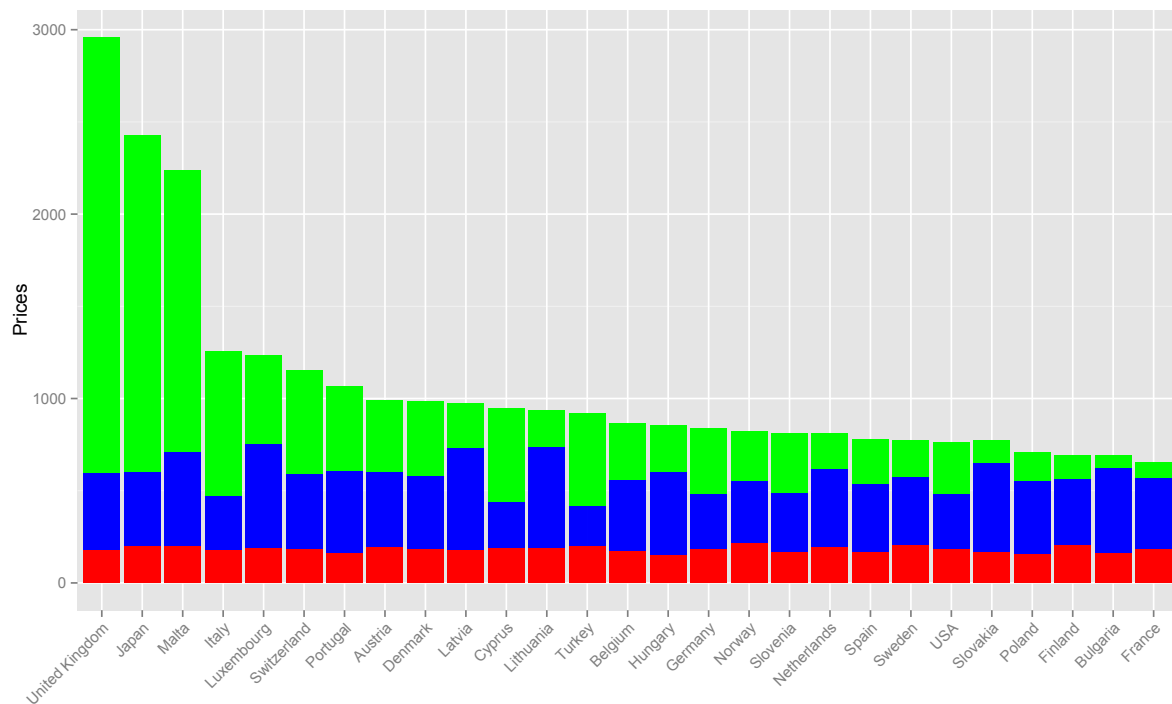


Figure 10: Consumer country prices to farmers (red), the distribution network (blue) and consumer-associated markups (green). Distribution prices are faded by p-value.

.1 Stock analysis

As an improvement, we note that prices are determined more directly by the stocks of coffee beans available to coffee markets. Therefore, we explore adding stocks of Arabica and Robusta to the model. These are not recorded separately by variety, although the USDA Foreign Agricultural Service reports total coffee stocks. We use a Bayesian model to infer the stocks, informed simultaneously by monthly production and the ability of these stocks to inform prices. The inferred stocks are shown in figure 11.

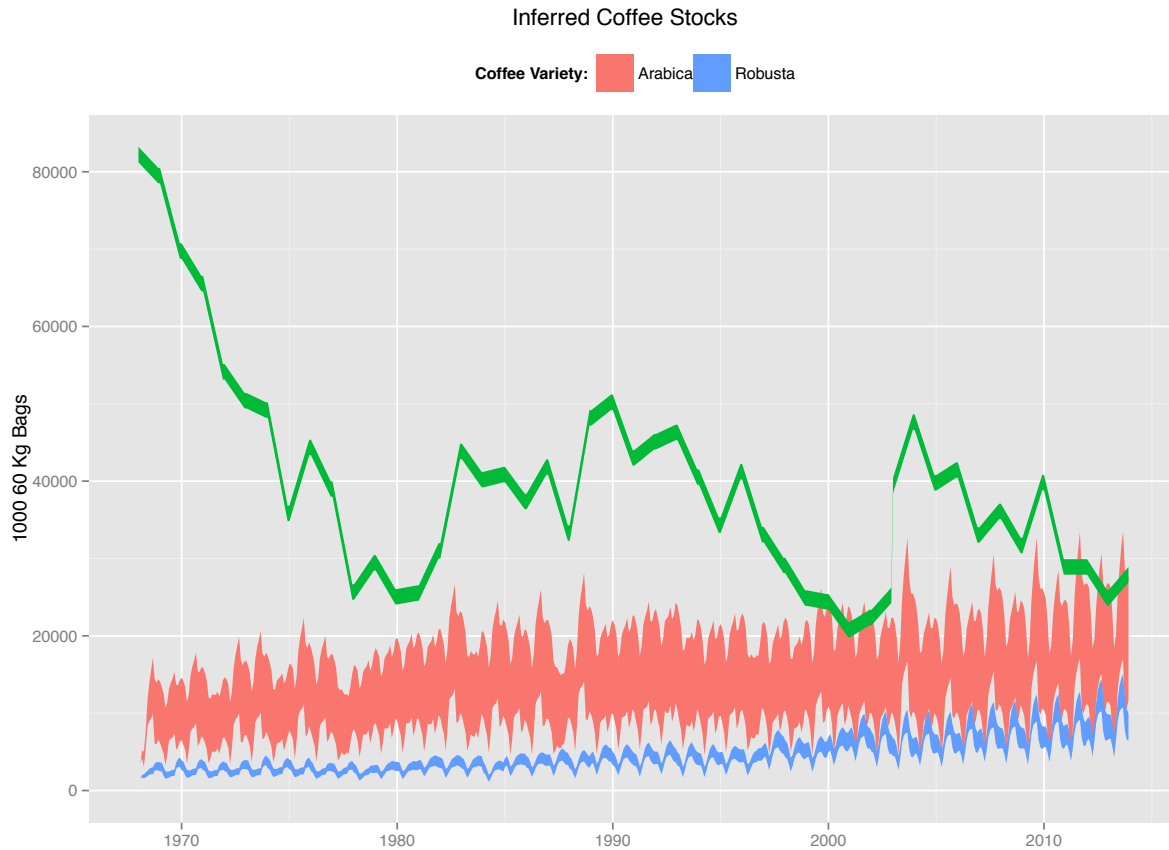


Figure 11: Inferred stocks of Arabica (red) and Robusta (blue) coffee, compared with reported stocks (green) summed over all countries. Arabica and Robusta curves are shown with 50% confidence intervals, while the recorded curve is shown with a constant width.

Reported stocks were much higher than those inferred by the model. This is because the model attempts to use low initial stocks to explain the high international coffee prices in the 1970s. Later, bursts in stock correspond closely with increases in recorded stocks—for example, in 1982, 1988, and 2003. However, the model predicts a rapid decrease in the stock after the burst, while recorded stocks remain high after each event. This could reflect the sensitivity of the market to “fresh” green beans, rather than stored ones.

The stocks are estimated simultaneously with the effect they have on the prices, thereby using the price

to inform the level of stock. We further estimate the price in logs, and add an effect of the CPI (c_t), to produce our final model:

$$\log u = \alpha_0 + \alpha_1 s_i + \alpha_2 \log u_{t-1} + \alpha_3 \log c_t$$

The estimates and their standard deviations are shown in table 2. The effect of stock levels is still negative as expected, but not statistically significant. The autocorrelation in α_2 is decreased because of the other informative elements. The coefficients also suggest that as CPI increases, international prices decrease, although this might just reflect the general downward trend in prices.

	Arabica		Robusta	
	Mean	Std. Dev.	Mean	Std. Dev.
α_0	0.96	1.08	0.48	0.6
α_1	-8.47×10^{-7}	4.32×10^{-6}	-8.85×10^{-6}	1.17×10^{-5}
α_2	0.73	0.31	0.89	0.14
α_3	-0.16	0.17	-0.08	0.1

Table 2: Coefficient estimates for the full stock model. Only α_2 , the coefficient on delayed international price, is significant at a 95% level.

.2 Explaining prices to farmers

Estimates for the determinants of prices to growers of coffee.

Country	Type	International	Log Product.	Int. V.E.	Prod. V.E.	Int. P(> t)	Prod. P(> t)
Colombia	Colombian Milds	16.190	-0.004	0.855	0.033	0.000	0.001
Kenya	Colombian Milds	42.872	-0.037	0.958	0.013	0.000	0.001
Tanzania	Colombian Milds	26.367	0.110	0.856	0.022	0.000	0.022
Bolivia	Other Milds	26.126	0.126	0.831	0.002	0.000	0.635
Burundi	Other Milds	13.918	0.006	0.768	0.000	0.000	0.819
Cameroon	Other Milds	17.297	-0.043	0.509	0.021	0.000	0.351
Congo, Dem. Rep. of	Other Milds	5.788	-0.148	0.275	0.708	0.297	0.098
Costa Rica	Other Milds	21.069	-0.052	0.839	0.066	0.000	0.000
Cuba	Other Milds	14.087	0.584	0.337	0.455	0.000	0.000
Dominican Republic	Other Milds	32.377	-0.040	0.937	0.006	0.000	0.046
Ecuador	Other Milds	23.186	-0.025	0.807	0.010	0.000	0.151
El Salvador	Other Milds	33.379	-0.018	0.930	0.011	0.000	0.010
Guatemala	Other Milds	20.445	-0.019	0.881	0.025	0.000	0.002
Haiti	Other Milds	19.746	0.097	0.888	0.012	0.000	0.094
Honduras	Other Milds	35.087	0.009	0.910	0.007	0.000	0.072
India	Other Milds	17.230	-0.039	0.873	0.023	0.000	0.006
Jamaica	Other Milds	18.733	1.791	0.428	0.038	0.000	0.113
Madagascar	Other Milds	0.211	-0.074	0.000	0.001	0.987	0.933
Malawi	Other Milds	28.364	0.277	0.731	0.102	0.000	0.004
Mexico	Other Milds	25.079	-0.023	0.892	0.018	0.000	0.016
Nicaragua	Other Milds	39.074	-0.010	0.877	0.001	0.000	0.641
Panama	Other Milds	13.132	-0.131	0.665	0.008	0.000	0.451
Papua New Guinea	Other Milds	21.258	-0.023	0.888	0.003	0.000	0.302
Peru	Other Milds	47.729	-0.013	0.778	0.006	0.000	0.458
Rwanda	Other Milds	13.679	0.084	0.706	0.069	0.000	0.005
Uganda	Other Milds	2.894	0.043	0.040	0.083	0.039	0.053
Venezuela	Other Milds	22.230	0.138	0.650	0.048	0.001	0.261
Zambia	Other Milds	13.538	-0.041	0.559	0.000	0.000	0.852
Zimbabwe	Other Milds	14.874	3.177	0.681	0.055	0.455	0.585
Brazil	Brazilian Naturals	22.184	0.001	0.794	0.016	0.000	0.067
Ethiopia	Brazilian Naturals	14.567	-0.006	0.765	0.015	0.000	0.097
Indonesia	Brazilian Naturals	31.851	0.005	0.528	0.001	0.011	0.919
Philippines	Brazilian Naturals	28.897	-0.040	0.414	0.001	0.005	0.901
Angola	Robustas	6.650	0.010	0.232	0.033	0.019	0.241
Benin	Robustas	0.449	-0.637	0.155	0.252	0.711	0.016
Brazil	Robustas	27.762	0.002	0.583	0.077	0.000	0.028
Burundi	Robustas	5.382	1.301	0.082	0.696	0.210	0.055
Cameroon	Robustas	10.715	0.012	0.620	0.012	0.000	0.283
Central African Republic	Robustas	7.394	0.039	0.602	0.018	0.000	0.196

Congo, Dem. Rep. of	Robustas	10.625	-0.023	0.610	0.055	0.000	0.059
Congo, Rep. of	Robustas	1.318	0.227	0.333	0.137	0.047	0.030
Côte d'Ivoire	Robustas	9.459	0.006	0.667	0.036	0.000	0.030
Ecuador	Robustas	36.988	-0.022	0.764	0.018	0.000	0.154
Gabon	Robustas	9.228	0.409	0.514	0.018	0.000	0.286
Ghana	Robustas	6.622	-0.721	0.663	0.164	0.023	0.123
Guinea	Robustas	14.037	-0.434	0.537	0.045	0.000	0.157
India	Robustas	23.426	0.007	0.743	0.043	0.000	0.030
Indonesia	Robustas	25.263	0.003	0.942	0.002	0.000	0.339
Madagascar	Robustas	6.512	0.004	0.347	0.001	0.001	0.813
Nigeria	Robustas	8.682	-0.439	0.525	0.034	0.001	0.240
Papua New Guinea	Robustas	28.154	0.028	0.783	0.000	0.000	0.923
Philippines	Robustas	23.835	-0.007	0.913	0.000	0.000	0.780
Sierra Leone	Robustas	11.475	0.181	0.563	0.034	0.000	0.245
Sri Lanka	Robustas	31.224	-0.183	0.930	0.005	0.001	0.547
Tanzania	Robustas	16.526	-0.018	0.585	0.003	0.000	0.689
Thailand	Robustas	28.468	-0.022	0.906	0.004	0.000	0.193
Togo	Robustas	5.642	0.022	0.472	0.016	0.000	0.255
Trinidad & Tobago	Robustas	24.719	0.426	0.555	0.001	0.002	0.786
Uganda	Robustas	2.255	-0.005	0.153	0.019	0.026	0.354
Vietnam	Robustas	77.812	-0.001	0.576	0.002	0.000	0.745
Global	All	25.651	-0.002	0.463	0.000	0.000	0.000

.3 Explaining consumer demand

Country	Retail Pr.	Previous Yr.	Ret. V.E.	Prev. V.E.	Ret. Pr(> t)	Prev. Pr(> t)
Austria	0.01	0.35	0.00	0.13	0.88	0.14
Belgium	-0.47	1.13	0.30	0.35	0.00	0.01
Bulgaria	0.15	0.20	0.36	0.04	0.03	0.37
Cyprus	-0.02	0.23	0.07	0.05	0.24	0.28
Czech Republic	-0.01	0.69	0.00	0.32	0.37	0.01
Denmark	0.03	0.83	0.10	0.61	0.53	0.00
Finland	0.04	0.03	0.01	0.00	0.70	0.88
France	-0.00	0.66	0.02	0.42	0.95	0.00
Germany	-0.08	-0.35	0.17	0.08	0.04	0.22
Hungary	-0.06	0.86	0.02	0.68	0.07	0.00
Italy	0.02	0.79	0.11	0.49	0.74	0.00
Latvia	0.01	0.72	0.16	0.67	0.32	0.00
Lithuania	0.01	0.83	0.14	0.78	0.18	0.00
Luxembourg	-1.42	0.52	0.53	0.16	0.06	0.03
Malta	0.00	0.43	0.01	0.13	0.68	0.15
Netherlands	-0.05	0.74	0.00	0.60	0.76	0.00
Poland	0.00	0.77	0.00	0.49	0.86	0.00
Portugal	-0.02	0.79	0.14	0.67	0.14	0.00
Slovakia	0.00	-0.46	0.00	0.18	0.93	0.08
Slovenia	0.02	0.21	0.38	0.04	0.03	0.32
Spain	0.01	0.91	0.51	0.33	0.72	0.00
Sweden	-0.04	0.30	0.08	0.10	0.18	0.15
United Kingdom	0.01	0.36	0.01	0.11	0.80	0.35
Japan	0.00	0.78	0.56	0.17	0.64	0.00
Norway	0.03	0.23	0.03	0.05	0.58	0.34
Switzerland	-0.04	0.58	0.44	0.12	0.27	0.02
Turkey	-0.00	1.02	0.16	0.50	0.82	0.00
USA	-0.01	0.12	0.07	0.01	0.35	0.64
Global	-0.01	0.70	0.01	0.92	0.08	0.00

Table 4: Determinants of consumption of coffee.

.4 Inferred markups

.4.1 Producer country markups

Mark-ups over the prices paid to farmers, by producer country, in US cents per pound. These are estimated simultaneous with the consumer country mark-ups.

Country	To Farmers	Mark Up	Std. Dev.
Bolivia	148.59	223.80	112.91
Brazil	107.06	84.80	31.14
Burundi	91.43	242.62	113.93
Cameroon	79.02	239.24	105.61
Sri Lanka	59.24	228.88	117.07
Colombia	124.50	194.32	70.11

Country	To Farmers	Mark Up	Std. Dev.
Congo, Dem. Rep. of	52.37	257.35	116.00
Costa Rica	137.20	214.23	102.04
Cuba	212.77	256.45	122.19
Dominican Republic	135.59	236.17	113.14
Ecuador	110.42	246.34	115.02
El Salvador	113.71	204.70	99.97
Ethiopia	101.05	168.01	94.98
Gabon	84.70	228.00	113.03
Ghana	108.59	244.26	121.38
Guatemala	137.95	102.30	70.70
Guinea	126.11	212.57	109.47
Haiti	91.81	229.51	114.36
Honduras	126.66	292.54	113.00
Indonesia	97.53	339.22	88.09
Côte d'Ivoire	63.74	226.83	96.66
Jamaica	262.39	239.55	116.14
Kenya	198.15	239.01	109.90
Madagascar	72.44	218.01	109.38
Malawi	77.87	235.31	117.05
Mexico	155.06	221.07	106.49
Nicaragua	139.47	182.82	96.48
Panama	149.15	235.36	106.61
Papua New Guinea	102.78	177.36	100.33
Peru	123.27	243.61	106.00
Rwanda	95.20	230.81	113.27
India	114.96	196.25	92.03
Vietnam	120.97	29.68	25.36
Thailand	93.03	268.90	122.50
Togo	55.70	225.31	108.66
Uganda	44.89	246.98	80.22
Tanzania	111.59	254.27	120.02
Venezuela	258.16	230.70	115.24
Zambia	110.58	219.19	112.56
Congo, Rep. of	33.52	226.88	120.91
Nigeria	118.40	228.59	114.78
Sierra Leone	111.94	234.04	110.40
Zimbabwe	408.97	234.58	118.08
Central African Republic	58.13	229.93	116.94
Trinidad & Tobago	173.12	228.67	114.16
Philippines	107.48	241.64	119.16
Angola	77.44	255.29	117.56
Benin	63.19	233.40	112.44
Liberia	NA	234.01	115.80
(Processed)	NA	254.26	34.22

.4.2 Consumer country markups

Country	To Farmers	Distribution	Retail	Mark Up	Std. Dev.
Austria	89.40	184.31	448.67	175.07	34.15
Belgium	79.54	173.86	392.38	139.93	38.09
Bulgaria	74.88	208.52	283.88	31.51	25.96
Cyprus	86.47	112.54	429.70	230.73	35.58
Denmark	84.43	179.78	447.29	184.20	33.37
Finland	93.54	162.29	309.97	58.43	31.33
France	82.91	176.00	283.45	37.98	26.30
Germany	83.16	136.86	380.83	162.09	35.53
Hungary	68.32	205.45	387.22	114.71	39.63
Italy	81.08	132.38	571.66	356.53	37.01
Latvia	82.82	249.52	441.37	109.76	42.82
Lithuania	86.29	248.47	422.60	89.78	43.23
Luxembourg	87.45	254.18	559.21	217.24	48.44
Malta*	92.70	228.81	1019.96	692.57	41.21
Netherlands	88.05	192.84	366.49	86.88	34.92
Poland	71.99	178.79	317.54	70.10	32.04
Portugal	74.36	202.26	484.34	206.79	34.62
Slovakia	76.42	219.32	342.90	54.81	31.93
Slovenia	77.50	144.39	367.10	146.78	38.11
Spain	77.46	165.04	350.89	109.90	31.78
Sweden	93.92	168.28	350.25	89.53	34.55
United Kingdom*	81.04	190.61	1354.07	1070.48	37.39
Japan	91.23	182.71	1107.51	828.59	35.21
Norway	98.18	152.83	372.36	122.48	36.67
Switzerland	84.83	184.49	524.88	254.33	35.19
Turkey	91.25	99.09	416.92	226.54	39.70
USA	85.46	133.48	345.80	127.57	37.40

Table 6: Mark-ups over the prices paid to farmers, by consumer country, in US cents per pound. These are estimated simultaneous with the producer country mark-ups.

.5 Economic importance of coffee

Country	Variety	Farm (\$/kg)	Intl. (\$/kg)	Production (kg)	Local Value (\$)	Intl Value (\$)	GDP (\$)	(%)
Angola	arabica	0.82	2.74	0	0	0	44080659100	0.00
Angola	robusta	0.59	1.46	1698000	1004067	2483891	44080659100	0.01
Bolivia	arabica	3.70	2.74	8442000	31232762	23162986	11362240323	0.20
Brazil	arabica	2.12	2.74	202650000	4294893862	5560268994	1019917358692	0.55
Brazil	robusta	1.39	1.46	711900000	991280609	1041391089	1019917358692	0.10
Burundi	arabica	1.28	2.74	16026000	20465292	43971809	1320071226	3.33
Burundi	robusta		1.46	0		0	1320071226	0.00
Cameroon	arabica	1.41	2.74	5532000	7807333	15178588	18629569264	0.08
Cameroon	robusta	0.97	1.46	39630000	38314825	57972087	18629569264	0.31
Central African Republic	robusta	0.91	1.46	1518000	1378446	2220581	1631792478	0.14
Colombia	arabica	2.38	2.74	597966000	1422490591	1640686804	175186920716	0.94
Congo, Dem. Rep. of	arabica		2.74	5262000		14437767	14788569483	0.10
Congo, Dem. Rep. of	robusta		1.46	11724000		17150259	14788569483	0.12
Congo, Rep. of	robusta		1.46	0		0	7163015187	0.00
Costa Rica	arabica	2.15	2.74	104058000	223638738	285512199	23899924562	1.19
Côte d'Ivoire	robusta	0.61	1.46	121800000	73750900	178173107	18513289732	0.96
Cuba	arabica	1.39	2.74	7740000	10766855	21236853	49991611345	0.04
Dominican Republic	arabica	2.14	2.74	27162000	58194207	74526537	42066031892	0.18
Ecuador	arabica	2.45	2.74	25110000	61503896	68896301	47883528950	0.14
Ecuador	robusta	1.30	1.46	17400000	22547442	25453301	47883528950	0.05
El Salvador	arabica	1.70	2.74	87264000	148428732	239433167	18219072282	1.31
Ethiopia	arabica	1.47	2.74	315408000	465181914	865409979	18472707950	4.68
Ghana	robusta		1.46	2214000		3238713	14161252979	0.02
Guatemala	arabica	2.24	2.74	232476000	521865895	637862864	31344823589	2.03
Guinea	robusta		1.46	23412000		34247855	3208509564	1.07
Haiti	arabica		2.74	19368000		53141520	4429227578	1.20
Honduras	arabica	1.92	2.74	227994000	438103331	625565245	11134160781	5.62
India	arabica	2.35	2.74	98028000	230277245	268967209	1109531099998	0.02
India	robusta	1.43	1.46	187410000	268898827	274149605	1109531099998	0.02
Indonesia	arabica	2.09	2.74	69150000	144393359	189732347	353469522531	0.05
Indonesia	robusta	0.82	1.46	461700000	377800422	675390175	353469522531	0.19
Jamaica	arabica	5.55	2.74	1686000	9360707	4626012	11075778481	0.04
Kenya	arabica	1.45	2.74	47946000	69690082	131553248	22500842427	0.58
Liberia	robusta		1.46	1836000		2685762	839609172	0.32
Madagascar	arabica	0.99	2.74	1632000	1611367	4477848	5652013484	0.08
Madagascar	robusta	0.79	1.46	30264000	23879354	44271190	5652013484	0.78
Malawi	arabica	1.54	2.74	1560000	2402418	4280296	3465670842	0.12
Mexico	arabica	2.00	2.74	251100000	502945556	688963012	943131575944	0.07
Nicaragua	arabica	1.17	2.74	99240000	115978241	272292670	7096139115	3.84
Nigeria	robusta		1.46	2226000		3256267	144037995041	0.00

Country	Variety	Farm (\$/kg)	Intl. (\$/kg)	Production (kg)	Local Value (\$)	Intl Value (\$)	GDP (\$)	(%)
Panama	arabica		2.74	7044000		19327182	21253648150	0.09
Papua New Guinea	arabica	1.59	2.74	59610000	94843298	163556691	6141247952	2.66
Papua New Guinea	robusta	0.56	1.46	2748000	1542012	4019866	6141247952	0.07
Peru	arabica	1.13	2.74	224640000	253661686	616362609	96436263271	0.64
Philippines	arabica	2.01	2.74	1950000	3915230	5350370	123566704265	0.00
Philippines	robusta	1.33	1.46	27990000	37124998	40944707	123566704265	0.03
Rwanda	arabica	0.76	2.74	17640000	13479953	48400269	3504265695	1.38
Sierra Leone	robusta	0.44	1.46	3414000	1517699	4994113	1998841063	0.25
Sri Lanka	arabica		2.74	594000		1629805	31081582880	0.01
Sri Lanka	robusta		1.46	1446000		2115257	31081582880	0.01
Tanzania	arabica	0.91	2.74	31134000	28441963	85424828	18155123928	0.47
Tanzania	robusta	0.38	1.46	19248000	7401039	28156617	18155123928	0.16
Thailand	arabica	3.50	2.74	0	0	0	199643270642	0.00
Thailand	robusta	1.30	1.46	53166000	69270076	77773000	199643270642	0.04
Togo	robusta	0.96	1.46	20520000	19786230	30017341	2406177565	1.25
Trinidad & Tobago	robusta		1.46	336000		491512	18345375584	0.00
Uganda	arabica	1.37	2.74	37038000	50823541	101624102	12065197411	0.84
Uganda	robusta	1.03	1.46	143748000	148064470	210279374	12065197411	1.74
Venezuela	arabica		2.74	50298000		138006617	171452404755	0.08
Vietnam	arabica	1.47	2.74	30684000	45130389	84190128	72353243154	0.12
Vietnam	robusta	1.26	1.46	1108206000	1395836280	1621120737	72353243154	2.24
Zambia	arabica	1.91	2.74	3132000	5972119	8593517	11256721495	0.08
Zimbabwe	arabica		2.74	2538000		6963712	5603223515	0.12

References

- Comtrade, U. (2015). United nations commodity trade statistics database. Available at <http://comtrade.un.org>.
- International Coffee Organization (2015a). Climate change and coffee: Enhancing the coffee sector's response to climate change. Technical report.
- International Coffee Organization (2015b). ICO Historical Data. Supplied by ICO, May 7, 2015.
- Thurston, R. W., Morris, J., and Steiman, S. (2013). *Coffee: A Comprehensive Guide to the Bean, the Beverage, and the Industry*. Rowman & Littlefield Publishers.
- United Nations International Merchandise Trade Statistics (2009). Commodity pages, 071, coffee and coffee substitutes. In *Yearbook 2009*. <http://comtrade.un.org/pb/CommodityPagesNew.aspx?y=2009>, accessed June 11, 2011.

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