Food and Agricultural Policy: Stylized Facts and Explanations

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Abstract
This paper describes agricultural policy choices and tests some predictions of major political economy theories, exploiting the new Anderson et al. (2008a) dataset of policy-induced price changes in 68 countries, affecting a total of 77 commodities from 1960 through 2004. We begin by establishing key stylized facts about the *development paradox* of switching from taxation to subsidization of farmers as per-capita income rises, the *anti-trade bias* arising from taxing both imports and exports, and the *resource curse* from higher taxation where resources are more abundant. Against that background, we test a series of political-economy explanations for policy choices, finding results consistent with hypothesized effects of rural and urban constituents' *rational ignorance* about small per-person effects, governance institutions' control of *rent-seeking* by political leaders, governments' *revenue motives* for trade restrictions, and the role of *time consistency* in policy-making. Interestingly, we find that larger groups obtain more favorable policies, suggesting that *median-voter* effects outweigh differences in *free ridership*. A novel result is that demographically-driven *entry of new farmers* is strongly associated with less favorable farm policies, which is consistent with a model in which the arrival of new farmers erodes policy rents and discourages political activity by incumbents. Another new result is that policies achieve very little price stabilization. Instead, we find that policies actually destabilize the domestic prices of exportables, and that significant price stabilization overall is achieved only in richer countries. Price stability is often a stated goal of policy, and would be predicted by status-quo bias or loss aversion, but on average it is not achieved by the policies we observe.

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1. Introduction

Government policies that distort agricultural prices have been a concern of economists since the beginning, since Adam Smith's analysis of Britain's Corn Laws in Book IV of *The Wealth of Nations*. The extent and persistence of these policies remains puzzling. To explain them, a wide range of political economy theories have emerged, some of which offer unambiguous predictions about how agricultural policy might relate to underlying economic conditions. This paper offers new tests of these predictions, using a new dataset estimating the magnitude of agricultural price distortions around the world, covering 68 countries and a total of 77 commodities over the 1960-2004 period.

Our data on government policies are derived from a very large research project on Distortions to Agricultural Incentives, led by Kym Anderson and others at the World Bank in 2006 and 2007. The project followed an iterative process: a common methodology was initially proposed and debated at a launch workshop in Washington, then applied by specialist consultants in their target countries, debated again at regional workshops and revised into the final methodology described in Anderson et al. (2008b). The authors of each country study submitted draft results to the regional coordinators and the project managers in Washington, who checked for completeness and consistency before assembling the final worldwide dataset that is detailed in Anderson et al. (2008a). The senior author of this paper wrote the country study for Senegal and co-authored the study for Cameroon, and is also co-editor of the volume presenting the results for all of Africa (Anderson and Masters 2008). Details on the project are provided online, at www.worldbank.org/agdistortions.

In this paper, the methodology and notation used to measure policies is presented very briefly in Section 2, and a few summary statistics on the resulting data are shown in Section 3. We then introduce some key patterns in the data in Section 4, and test their magnitude and significance across regions in Section 5. In Section 6 we consider the extent of reform and the degree to which policy reforms have moved towards freer trade. Section 7 tests the degree to which policies have stabilized domestic prices. Section 8 tests a few possible political economy theories that might help explain our results. Section 9 sketches the demographic influences in agricultural protection, and Section 10 draws conclusions.

2. Methodology and data sources

Our measures of agricultural trade policy are tariff-equivalent "Nominal Rates of Assistance" (NRA), defined as:

$$NRA \equiv \frac{P - P^*}{P^*} \qquad (1)$$

In equation (1), P is the actual domestic price in local currency and P^* is the estimated domestic price that would hold in the absence of commodity-market or exchange-rate intervention. By definition, such an NRA would be zero in a free-trade regime, and is positive where producers are subsidized by taxpayers or consumers. The NRA is negative where producers are taxed by trade policy, for example through export restrictions or an overvalued exchange rate.

The authors of each country study in our dataset were asked to measure P and P^* using the most appropriate available datasets for their country, and their best judgment regarding how local markets would adjust to "stroke of the pen" reforms that replace current trade policies with a free-trade regime. Separate estimates were to be made for all major agricultural commodities, accounting for at least 70 percent of each country's agricultural value added. A customizable template spreadsheet for data entry and calculation was used to organize the data, and facilitate comparisons across countries.

Case-study authors who found government interventions to be taxes, subsidies or other price-based mechanisms were asked to estimate the NRA for producers directly from policy data, as:

$$NRA = t \tag{2}$$

where t is the net sum of all observed taxes and subsidies. In the simplest case, t might be just an import tariff or production subsidy (both positive), or a tax on exports or production (both negative), but in most cases multiple instruments were involved. Authors were asked to include all instruments that were tied directly to the production and marketing of that particular commodity, but not taxes and subsidies that apply to inputs used in multiple products (hence the term "nominal" as opposed to "effective" rate of assistance). An important innovation in our methodology was to allocate the incidence of domestic instruments along the marketing chain using author-determined elasticities for marketing and processing services. Most previous work of this type implicitly assumed infinitely elastic supply of marketing services and complete pass-through of policy effects to farmers; in our case authors could build on recent empirical studies regarding how policy change might affect the entire marketing chain.

To take account of state trading, market regulation and quantitative restrictions, the NRA was sometimes estimated by the price-comparison method in which P is observed locally and P^* is estimated as:

$$P^* = (1 \pm m) \cdot E^* \cdot P_b \tag{3}$$

where P_b is an observed foreign-currency price on the outside of the country's borders, E^* is the author's estimate of the exchange rate that would apply to that commodity in the absence of foreign-exchange intervention, and m is the author's estimate of the marketing margin between domestic and outside-the-border prices that would apply in a competitive market, after "stroke of the pen" reforms. Authors were asked to estimate those margins given the current condition of a country's infrastructure and institutions, to reflect a change in trade policies only.

The NRA estimates we present here are based on country authors' efforts to obtain the best-possible data and apply appropriate assumptions about international opportunity costs and transaction costs in each market. The resulting estimates are subject to considerable measurement error, but the project's design is intended to limit systematic biases and leave only the inevitable random noise. Then, by covering a very large fraction of the world's countries and commodities, over a very long time period, we can detect patterns and trends that might otherwise remain hidden. To do so, we will use first the estimated NRAs for individual commodities in each country and year, and then also consider value-weighted averages over groups of commodities.

The Anderson et al. project was designed to measure policy effects on price levels. A distinctive feature of this paper is to use these data to measure policy effects on price variability from year to year, by comparing the variability of domestic prices (P) with the variability of estimated free-trade prices (P^*). To control for policy-induced changes in average price levels, we use the coefficient of variation (CV) of each price, in a ratio that we call the Stabilization Index (SI):

$$SI \equiv \frac{CV(P^*) - CV(P)}{CV(P^*)} \cdot 100 \qquad (4)$$

A policy that does not influence price stability at all, such as an ad-valorem tax or subsidy, would generate an SI of zero. Policies that stabilize domestic prices, such as a variable tariff that is negatively correlated with the world price, would generate a positive SI. And policies that actually de-stabilize domestic prices, such as import quotas that leave domestic prices vulnerable to local supply or demand shocks, would generate a negative SI. Note that the SI for a particular product in a particular country is calculated over the 1960-2004 period, and refers to the ensemble of all policies over that time period. In this way, we capture not only the impact of a given policy on price stability while that policy is in place, but also the impact on stability of introducing or removing policies.

The NRA and SI estimates allow us to describe key stylized facts about policy choices, and then test the degree to which the relationships implied by political economy models actually fit the data. Most of these hypotheses are tested with OLS regressions, but to test for the role of new farmers' entry we account for its potential endogeneity using lagged demographic and structural data as instrumental variables in 2SLS estimates. Regressors are drawn from public data disseminated by the World Bank, FAO, the Penn World Tables or others, as detailed in Appendix Table A1.

3. Summary statistics

To set the stage, Tables 1 and 2 summarize the NRA data from Anderson et al. (2008a) by country and then by commodity.

Table 1. Summary of NRA data by country

Country	ISO code	No. of products	No. of NRA obs.	Average NRA	Median NRA	Std. Deviation	Cum. value at undist. prices (US$ b.)
Argentina	ARG	6	230	-0.154	-0.134	0.143	273.5
Australia	AUS	23	1125	0.103	0.001	0.261	402.1
Austria	AUT	19	789	0.338	0.000	0.595	75.6
Bangladesh	BGD	6	187	0.262	0.000	1.020	148.0
Brazil	BRA	10	333	-0.001	0.009	0.395	688.1
Bulgaria	BGR	10	140	-0.011	-0.057	0.312	22.1
Cameroon	CMR	11	476	-0.068	0.000	0.174	48.9
Canada	CAN	10	430	0.181	0.020	0.577	335.8
Chile	CHL	7	307	0.116	0.013	0.335	42.3
China	CHN	11	275	-0.012	0.000	0.335	3,960.8
Colombia	COL	11	505	0.147	0.065	0.327	176.6
Cote d'Ivoire	CIV	4	173	-0.320	-0.395	0.281	56.0
Czech Rep.	CZE	9	108	0.189	0.179	0.262	27.7
Denmark	DNK	20	817	0.483	0.164	0.801	133.4
Dominican Rep.	DOM	10	510	0.431	0.101	0.969	19.4
Ecuador	ECU	11	418	0.170	0.010	0.688	51.5
Egypt	EGY	7	357	-0.113	-0.244	0.590	193.2
Estonia	EST	10	120	0.116	0.141	0.282	3.0
Ethiopia	ETH	8	189	-0.296	-0.342	0.194	140.8
Finland	FIN	20	593	0.454	0.035	0.891	43.3
France	FRA	18	878	0.603	0.261	0.887	699.8
Germany	DEU	20	861	0.623	0.281	0.927	678.4
Ghana	GHA	7	319	0.011	0.000	0.629	51.0
Hungary	HUN	12	144	0.266	0.170	0.475	37.1
India	IND	13	502	0.209	0.093	0.389	1,897.8
Indonesia	IDN	8	273	0.068	0.005	0.315	580.2
Ireland	IRL	20	795	0.522	0.177	0.871	73.9
Italy	ITA	18	889	0.555	0.225	0.897	447.3
Japan	JPN	19	620	0.988	0.517	1.246	768.7
Kenya	KEN	6	324	-0.036	-0.028	0.266	37.6
Korea	KOR	12	459	1.336	1.000	1.478	179.2
Latvia	LVA	11	132	0.210	0.102	0.464	5.1
Lithuania	LTU	11	132	0.200	0.106	0.510	11.1
Madagascar	MDG	10	420	-0.230	-0.035	0.324	27.6
Malaysia	MYS	4	173	0.111	-0.031	0.453	141.4
Mexico	MEX	15	390	0.155	0.037	0.548	401.7
Mozambique	MOZ	8	238	-0.269	-0.389	0.505	5.8
Netherlands	NLD	20	855	0.603	0.290	0.886	203.5
New Zealand	NZL	12	612	0.154	0.029	0.279	166.7
Nicaragua	NIC	12	165	0.004	-0.063	0.347	13.4
Nigeria	NGA	10	440	0.428	0.010	0.943	362.2
Norway	NOR	20	642	2.228	1.702	2.067	176.6
Pakistan	PAK	6	260	0.273	0.053	0.730	146.5
Philippines	PHL	7	282	0.250	0.191	0.427	472.4
Poland	POL	11	132	0.195	0.183	0.273	91.9
Portugal	PRT	20	827	0.122	0.000	0.628	68.6
Romania	ROM	13	182	0.426	0.270	0.601	60.8
Rep. of S. Africa	ZAF	10	618	0.053	0.000	0.276	152.9
Russia	RUS	12	168	0.089	0.017	0.405	243.1
Senegal	SEN	4	164	-0.052	0.000	0.396	14.0
Slovakia	SVK	13	156	0.212	0.168	0.259	11.6
Slovenia	SVN	10	120	0.759	0.772	0.426	4.0
Spain	ESP	20	858	0.256	0.000	0.662	363.5
Sri Lanka	LKA	7	284	0.220	-0.088	1.023	41.5
Sudan	SDN	12	594	-0.101	-0.223	0.472	145.9
Sweden	SWE	18	674	0.529	0.217	1.147	69.4
Switzerland	CHE	20	794	1.936	1.805	2.080	86.0
Taiwan	TWN	6	271	0.569	0.351	0.707	76.8
Tanzania	TZA	18	522	-0.242	-0.170	0.492	47.4
Thailand	THA	6	196	-0.031	-0.057	0.182	467.2
Turkey	TUR	18	232	0.429	0.336	0.588	208.9
Uganda	UGA	13	499	-0.033	0.000	0.283	56.8
UK	GBR	20	805	0.657	0.250	1.165	368.3
Ukraine	UKR	13	178	0.049	-0.038	0.522	126.0
USA	USA	10	510	0.197	0.020	0.378	3,208.9
Vietnam	VNM	6	95	0.109	-0.032	0.559	95.6
Zambia	ZMB	10	387	-0.307	-0.311	0.335	10.1
Zimbabwe	ZWE	8	340	-0.333	-0.406	0.382	31.9
Total (68 cos.)		77	28493	0.354	0.026	0.970	20,478.0

Table 2. Summary of NRA data by major product

Product	No. of countries	No. of NRA obs.	Average NRA	Median NRA	Std. Deviation	Cum. Val. (US$ b.)
Maize	52	1824	0.040	0.010	0.306	1,618
Sugar	52	1756	0.294	0.182	0.610	1,051
Wheat	51	1880	0.138	0.066	0.345	1,657
Rice	46	1655	0.172	-0.076	1.131	2,493
Beef	45	1636	0.285	0.020	0.699	1,876
Milk	44	1545	0.914	0.559	1.167	1,789
Poultry	43	1481	0.210	0.002	0.498	990
Pig Meat	39	1329	0.067	0.000	0.498	2,332
Eggs	33	1128	0.193	0.139	0.557	375
Soybeans	32	890	0.007	0.000	0.242	786
Barley	30	1018	0.390	0.101	0.721	318
Sunflowers	26	701	-0.092	-0.055	0.201	80
Sheep Meat	22	944	0.448	0.245	0.780	169
Oats	22	835	0.437	0.222	0.752	71
Potatoes	21	863	0.355	0.163	0.643	236
Rapeseed	20	727	0.148	0.000	0.296	116
Cotton	19	759	-0.002	0.030	0.340	421
Tomato	17	775	0.017	0.023	0.197	284
Oilseeds	16	121	1.085	0.915	1.436	15
Coffee	15	528	-0.236	-0.225	0.285	223
Wine	14	505	-0.100	0.000	0.290	33
Sorghum	12	467	0.297	0.075	0.648	111
Coarse Grains	11	63	0.017	0.010	0.019	3
Groundnuts	9	352	-0.008	0.035	0.347	111
Cassava	8	324	-0.038	0.000	0.062	195
Cocoa	7	298	-0.385	-0.418	0.252	69
Millet	7	285	-0.010	0.000	0.146	43
Grapes	6	272	0.323	0.163	0.491	44
Tea	6	238	-0.212	-0.179	0.246	30
Tobacco	6	208	-0.139	-0.309	0.473	24
Beans	6	175	-0.164	-0.154	0.368	29
Rye	6	76	-0.005	-0.053	0.306	7
Apples	5	221	0.119	0.123	0.175	42
Yams	5	195	-0.039	0.000	0.051	129
Rubber	5	179	-0.112	-0.115	0.178	127
Bananas	4	182	-0.145	-0.072	0.202	22
Coconut	4	175	-0.132	-0.114	0.132	342
Plantain	4	132	-0.001	0.000	0.002	30
Onion	3	99	1.153	0.835	1.014	11

Note: An additional 38 products are included in two or one country's case study. Some products have multiple NRA observations for a given year and country (e.g. for different regions of the country).

To summarize Tables 1 and 2 above, note that there are over 28,000 observations from 68 countries ranging from the United States, China and India to a cross-section of smaller countries facing a wide range of circumstances. The number of commodities studied in each country range from a high of 23 in Australia to a low of 4 in Cote d'Ivoire, Malaysia, and Senegal, for a total of 77 different commodities. About three-quarters of countries have positive average NRAs, implying net subsidies to farmers over this period, while one-quarter impose net taxation. The most extreme subsidizers are Norway and Switzerland, and the most extreme taxers are Zimbabwe and Cote d'Ivoire. Across commodities, the most subsidized commodities are oilseeds, onion, and milk, and the most taxed commodities are cocoa and coffee.

4. The stylized facts of agricultural policy

Our dataset covers an extraordinary diversity of commodities and countries, with huge variation in agricultural policies. In this section we explore a few key stylized facts, to establish the background variation for which we will want to control when testing the predictions of specific theories. A given theory could help explain these patterns, or could fit the residual variation they leave unexplained. In either case, controlling for key characteristics of commodities and countries allows us to test each theory's explanatory power in a consistent framework.

The stylized facts for which we want to control include the oldest and most general observations about agricultural policy, linking policy choices to a commodity's direction of trade, a country's real income per capita, and its endowment of farmland per capita. The direction of trade might matter to the extent that agricultural trade policy is simply trade policy, and so could be linked to a government's more general anti-trade bias. A country's real income might matter to the extent that the role of agriculture changes with economic growth, so that it is subject to the development paradox. Finally, land abundance might matter because agriculture is a natural-resource intensive sector, and could be subject to the natural resource curse. We address each of these in turn below.

The anti-trade bias of governments is among the first concerns of economics, dating back to Adam Smith and David Ricardo who first described how restrictions on imports and exports affect incentives for specialization. In this paper we capture anti-trade bias of domestic instruments as well as trade restrictions, by linking measured NRAs to whether a commodity is importable or exportable in a given country and year.

A second stylized fact is the development paradox, in which the governments of poorer countries are typically observed to impose taxes on farm production, while governments in richer countries typically subsidize it. The modern literature documenting this tendency begins with Bale and Lutz (1981), and includes notable contributions from Anderson and Hayami (1986), Lindert (1991), Krueger, Schiff and Valdes (1991) among others. This pattern is paradoxical insofar as farmers are the majority and are poorer than

non-farmers in low income countries, whereas in high income countries farmers are a relatively wealthy minority.

A third kind of pattern involves the resource curse, whereby countries with a greater resource rent available for extraction from a sector may be tempted to impose a heavier tax burden on it. A vast literature such as Auty (2001) addresses this question, usually focusing on mineral resources; applications to agriculture include McMillan and Masters (2003) and Isham et al. (2005). The resource rent which may be available in agriculture is measured crudely here by arable land area per capita, allowing us to ask whether more land-abundant countries tend to tax the agricultural sector more (or subsidize it less), when controlling for both anti-trade bias and the development paradox.

Note that anti-trade bias could help account for the development paradox, to the extent that low-income countries tend to be net exporters of farm products while richer countries tend to be net importers of them. And both could be driven by changes in the relative administrative cost of taxation, insofar as a country's income growth and capital accumulation allows government to shift taxation from exports and imports (at the expense of farms and farmers) to other things (at the expense of firms and their employees). Thus we need to control for income when testing for anti-trade bias, and control for anti-trade bias when testing for the development paradox, while controlling for both of these when looking at the resource curse.

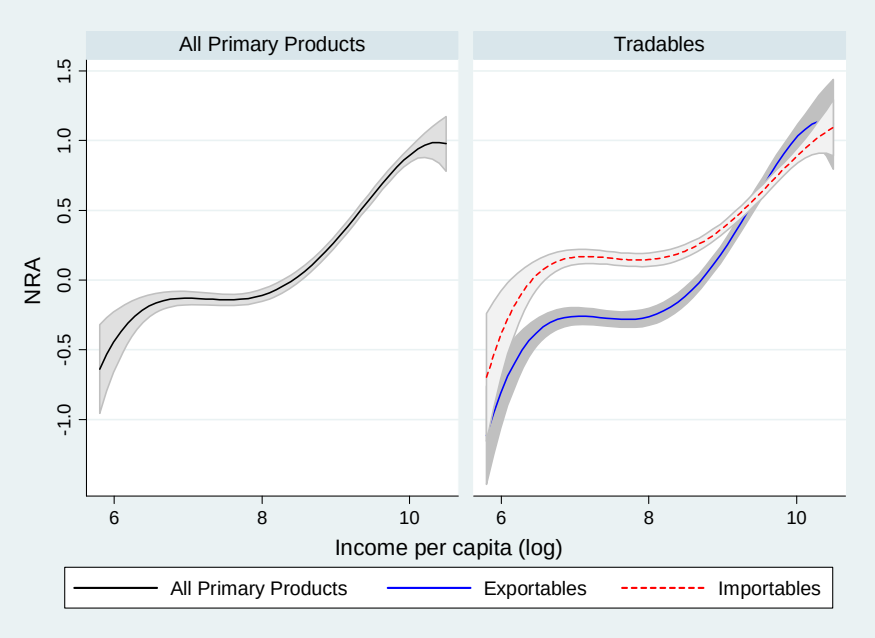
To test the magnitude and significance of these patterns in the NRA data, we use data on the direction of trade from our own database, and data on a country's average income per capita data from the Penn World Tables (2007). Income is defined here as real gross domestic product in PPP prices, chain indexed over time in international dollars at year-2000 prices. Finally, data on the agricultural sector's land abundance comes from FAOSTAT (2007), as the per-capita availability of arable land, defined as the area under temporary crops, temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow.

4.1 A graphical view of the data

Our analysis of stylized facts begins with a graphical view of the data, focusing on the development paradox and anti-trade bias across countries and regions. One way to test for significant differences in NRAs across the income spectrum is to draw a smoothed nonparametric regression line through the data, which then allows us to compare these relationships across trade sectors. The general tendency of governments in poorer countries to tax their farmers while governments in richer countries tend to subsidize them is illustrated with smoothed lines in Figure 1, showing countries' aggregate NRAs relative to their level of real per-capita income in that year. These are weighted-average covered NRAs, summing across commodities by their value at undistorted prices, so as to represent the total burden of taxes or subsidies on farm production. (In contrast, the data of Tables 1 and 2 are simple averages, counting small commodities the same as large ones.)

Interestingly, the relationship between taxation/protection and average per-capita income is strong but non-linear, and is different for exportables and importables. Governments in the poorest countries have imposed heavy taxes on all kinds of farmers. Tax rates move rapidly towards zero as incomes rise, then at income levels of about one to eight thousand dollars per year they stabilize with slight protection of importables and strong taxation of exportables, and as incomes rise above that all crops become heavily protected.

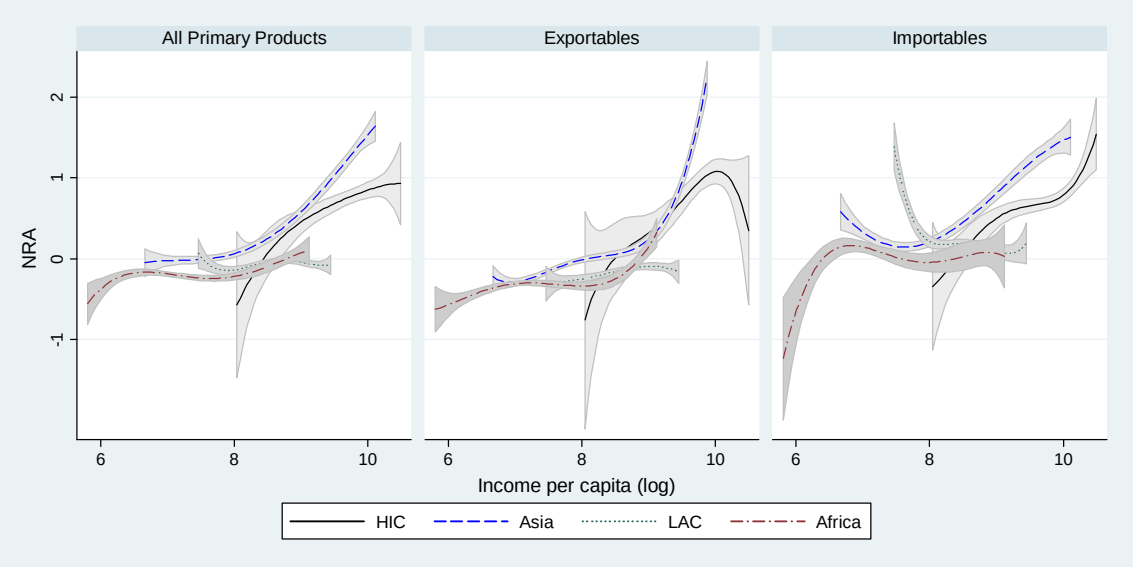
Figure 1. National-average NRAs and real income per capita



Note: Smoothed line and 95% confidence interval computed with Stata's *lpolyci* using bandwidth 3 and degree 4. Income per capita is expressed in I$ (2000 constant prices).

Figure 2 presents these results separately for Asia, Africa, Latin American countries (LAC), and high income countries (HIC). The left panel reveals that African countries' weighted-average covered NRAs are typically below those found in other regions at similar levels of per-capita income, but for most of the sampled income range the difference is not statistically significant. The middle panel shows the same result for exportable commodities. In both cases, as incomes in the rest of the world rise above African levels, their NRAs continue to rise, until a level of about $25,000 of PPP international dollars per capita. The right panel shows the striking result that for importables (unlike the exportables shown), at LAC's very low income levels, there is no positive correlation between income and NRA.

Figure 2. National-average NRAs and real income per capita, by region



Note: Smoothed line and 95% confidence interval computed with Stata's *lpolyci* using bandwidth 3 and degree 4.

4.2 Anti-trade bias, the development paradox and the resource curse

Table 3 describes the data in yet more detail, using an OLS model to test the correlations between NRAs and their key determinants. Table 3 offers a series of simple OLS regressions. In all cases, we control for the link to income in logarithm form, with log income as the only regressor in columns 1 and 5. The additional regressors in other columns are often significant, but they raise the regression's R^2 relatively little. Income alone explains most of the variance that is explained in any of the regressions shown here. Columns 1-4 use commodity level NRA as the dependent variable while columns 5-7 use covered aggregate NRA.

Table 3. Stylized facts of the commodity-level NRA

Explanatory variables	***Model***						
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***
Income (log)	0.2553***	0.2277***	0.2549***	0.2186***	0.3383***	0.3700***	0.2841***
	(0.0048)	(0.0050)	(0.0057)	(0.0110)	(0.0124)	(0.0135)	(0.0194)
Importable		0.1939***	0.1136***	0.0884***			
		(0.0113)	(0.0125)	(0.0123)			
Exportable		-0.1685***	-0.1859***	-0.1875***			
		(0.0090)	(0.0097)	(0.0095)			
Land per capita			-0.2508***	-0.2467***		-0.4084***	-0.4281***
			(0.0075)	(0.0077)		(0.0271)	(0.0280)
Africa				0.0289			0.0956**
				(0.0227)			(0.0393)
Asia				0.2955***			0.2253***
				(0.0245)			(0.0358)
Latin America				-0.0638***			-0.1442***
				(0.0159)			(0.0194)
High income countries				0.1856***			0.4152***
				(0.0167)			(0.0353)
Constant	-1.8905***	-1.6868***	-1.7727***	-1.5653***	-2.6407***	-2.7731***	-2.2228***
	(0.0392)	(0.0374)	(0.0407)	(0.0977)	(0.0968)	(0.1006)	(0.1731)
R^2	0.0848	0.1152	0.1349	0.1456	0.2705	0.3467	0.3989
No. of obs.	27600	27600	24900	24900	2484	2233	2233

Note: NRA by commodity is the dependent variable for models 1-4 is and covered total NRA for models 5-7. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels. Income per capita is expressed in I$ (2000 constant prices). The Europe and Central Asia region is the omitted continent variable.

As expected, across the income spectrum countries tend to tax all kinds of trade, thus introducing an anti-trade bias in favor of the home market. From column 2, controlling for income the average NRA on an importable product is 19 percent higher and on an exportable it is 17 percent lower than it otherwise might be. Most interestingly, LAC have NRAs that are a further 7 and 14 percent lower (columns 4 and 7) than those of other regions. Relative to Africa, Latin America and the omitted region (Eastern Europe), Asia and the High Income Countries have unusually high NRAs when controlling for their income level.

Table 4 presents similar regression results for each region. Land abundance per capita is not significant within Africa. The ECA region is the only region where the average exportable presents a higher NRA, a result that is not even present in HIC. In HIC, the average importable is protected more than the average exportable commodity. Interestingly, income per capita has a negative correlation with the level of protection in LAC.

Table 4. Stylized facts of the commodity-level NRA, by region

	Model				
Explanatory variables	***Asia***	***Africa***	***LAC***	***ECA***	***HIC***
Income (log)	0.3049***	0.0479***	-0.0917***	0.0261	0.2872***
	(0.0261)	(0.0083)	(0.0332)	(0.0388)	(0.0276)
Importable	0.4250***	0.0854***	0.3652***	0.5642***	-0.1642***
	(0.0271)	(0.0196)	(0.0226)	(0.1270)	(0.0527)
Exportable	-0.2603***	-0.2447***	-0.0225	0.3361***	-0.2902***
	(0.0148)	(0.0088)	(0.0164)	(0.1262)	(0.0511)
Land per capita	-0.2647*	0.0147	-0.1836***	-0.6287***	-0.2683***
	(0.1592)	(0.0271)	(0.0468)	(0.0568)	(0.0084)
Constant	-2.1702***	-0.3576***	0.7973***	-0.1454	-1.8368***
	(0.2080)	(0.0569)	(0.2686)	(0.3668)	(0.2732)
R^2	0.2371	0.0882	0.1363	0.1438	0.0475
No. of obs.	3124	5471	2666	1646	12000

Notes: Dependent variable for all regressions is NRA by commodity and year. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

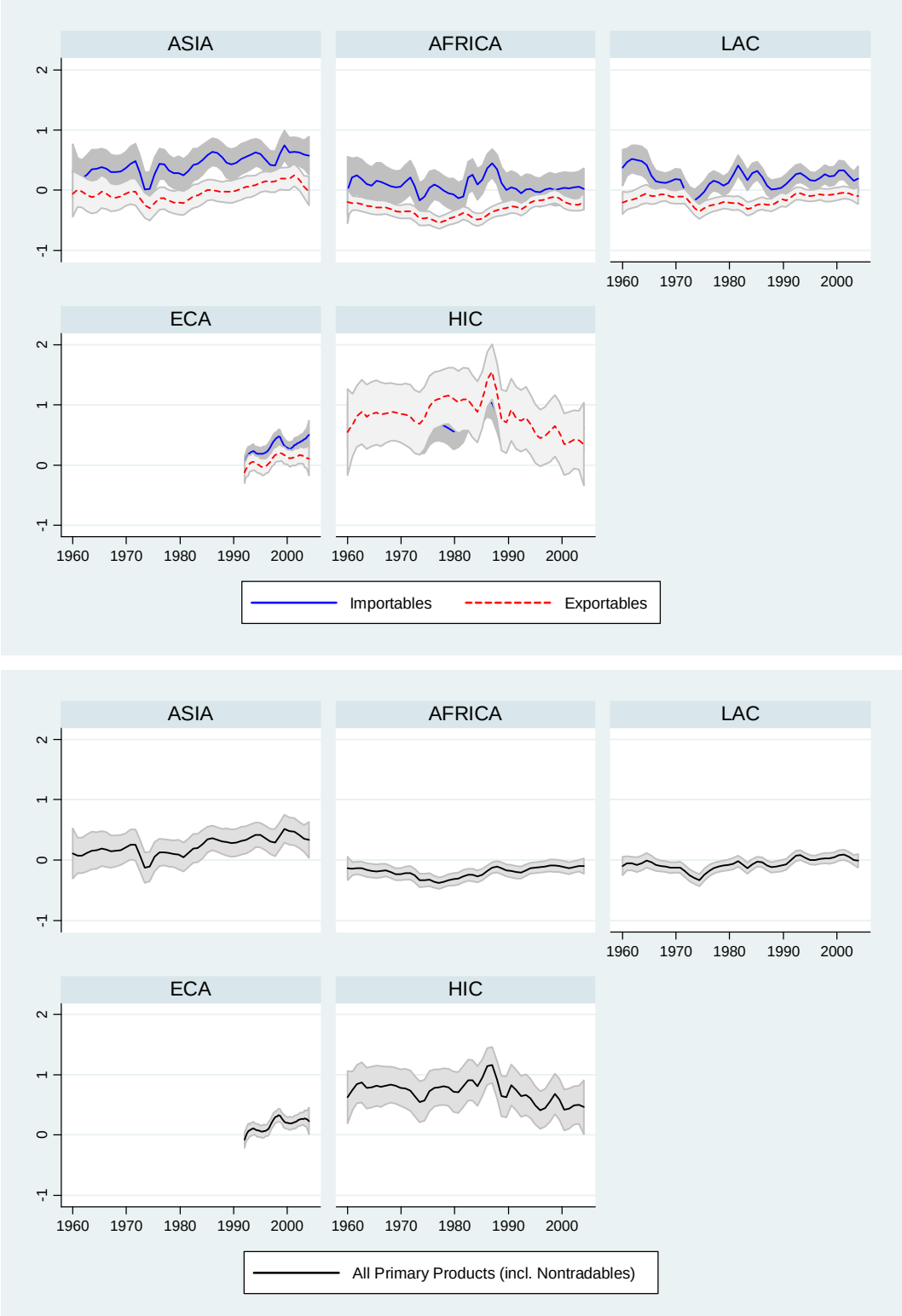
In summary, our brief comparison shows that there is an anti-trade bias in favor of the home market, and that the level of protection increases with economic development.

4.3 Policy change over time

Before we turn to detailed hypothesis tests, we must ask whether the stylized facts in the historical data presented above still apply today. Have liberalizations and other reforms eliminated these relationships? Each country case study provides an analytical history of policymaking by successive governments, and it is clear from those studies that national trade policies are not determined in isolation: there are waves of policy change that occur more or less simultaneously across countries, driven by economic conditions and the spread of ideas. These policy trends are often geographically concentrated, perhaps due to common economic circumstances or intellectual conditions.

Figure 3 decomposes and summarizes the country NRAs into each region's average for all exportables, importables, and total tax/subsidy burden for all farm production. In each panel of Figure 3, the gap between the top and bottom lines measures the region's average degree of *anti-trade* bias: the top line is average NRA on importables, the bottom line is average NRA on exportables, and the gap between them is the degree to which production incentives are distorted towards serving the home market as opposed to international trade. The central line measures the region's average degree of *anti-farm* bias, which includes any policy intervention on nontradable products.

Figure 3. National-average NRA over time, by trade status and region



Notes: LAC – Latin America, ECA – Europe and Central Asia, HIC – High income countries. Smoothed line and 95% confidence interval computed with Stata's *lpolyci* using bandwidth 1 and degree 2.

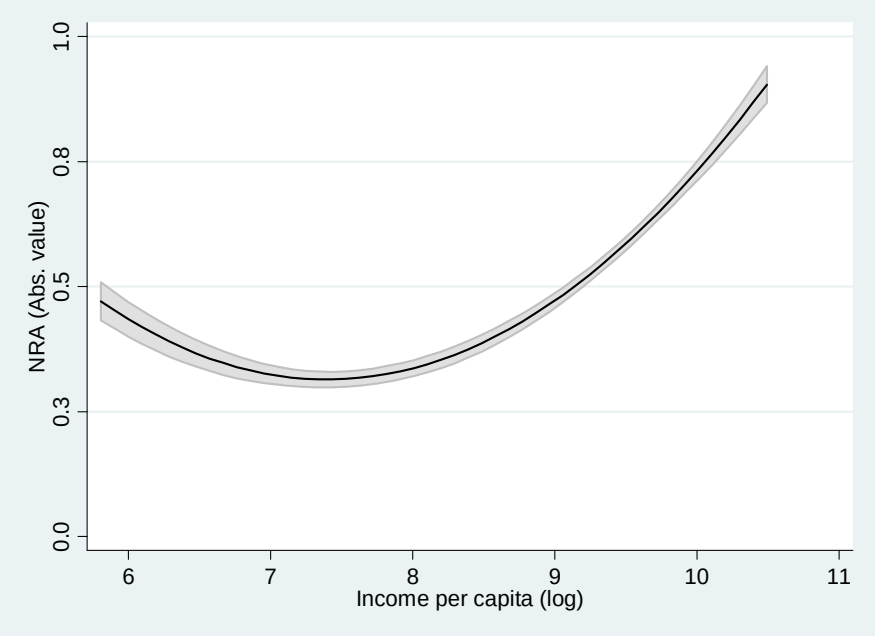
The Africa data in Figure 3 reveal a decade-long trend from the early 1960s to the early 1970s towards greater anti-farm bias, due to less protection on importables and more taxation of exportables. After 1980 this was followed by twenty years of slow reduction in the taxation of exportables, and a rise then fall in protection on importables, so that anti-trade bias actually expanded in the early 1980s and was then reduced substantially after 1990.

The data for other regions in Figure 3 show a range of experiences, but all except ECA (Eastern Europe and Central Asia) show a trend towards reduced anti-trade bias in the 1990s. In Asia there were increasingly heavy taxes on farm exports through the 1970s, but reform came earlier and faster than in Africa so that export taxes were largely eliminated by the 1990s. Latin America during the 1970s shares some of Africa and Asia's growing anti-farm bias, and has had an even greater degree of reform towards freer trade (NRAs of zero) in the 1990s. The ECA region, on the other hand, experienced a rapid rise in its NRA levels towards the norms seen in High Income Countries, whose NRA levels fluctuate but show little trend from the 1960s to today.

4.4 Deviations from free trade and the absolute value of NRA

For some models of trade reform it is helpful to think in terms of deviations from free trade, irrespective of direction. For this we use the absolute value of the NRA, as shown across all individual commodities in Figure 4 as a smoothed line against income. In this figure we observe that the level of distortions initially declines but when income per capita is greater than $1,500, distortions start to increase at an increasing rate.

Figure 4. Distortions (absolute value of NRA) and real income



Note: Smoothed line and 95% confidence interval computed with Stata's *lpolyci* using bandwidth 3 and degree 2.

4.5 Trade policy and price stabilization

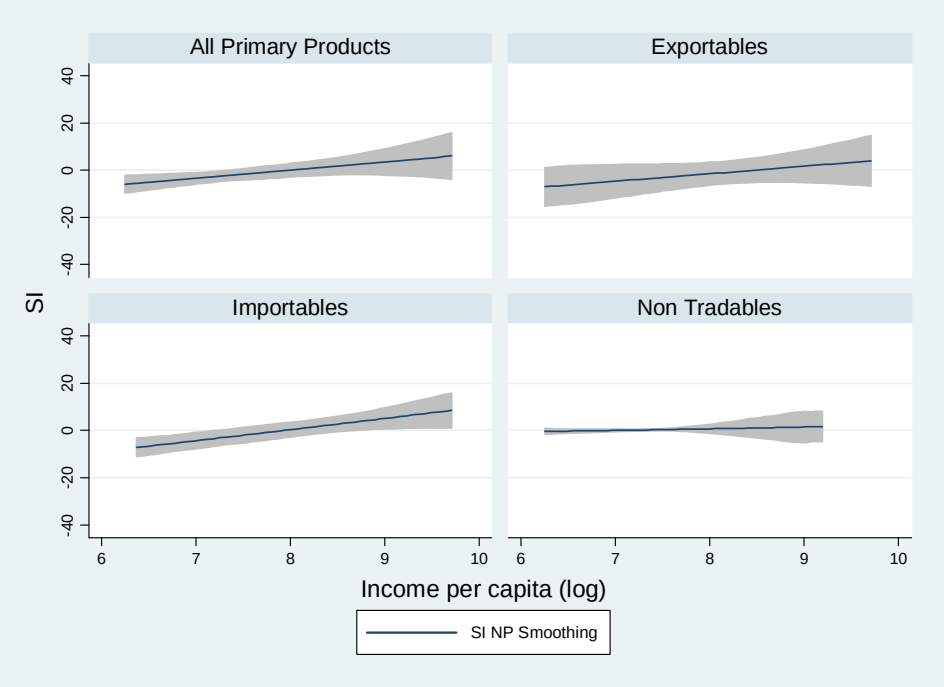
Trade policy often aims to stabilize domestic prices as well as change their level. As detailed by Timmer (1989) and Dawe (2001) among others, stabilization of agricultural product prices may be especially important for low-income countries, where food prices have a large impact on consumer expenditure and farmgate prices have a large impact on real incomes. Table 5 shows that on average, policies have stabilized imports more successfully than exports. Latin American countries have stabilized both imports and exports, while Africa's policies have de-stabilized domestic prices for commodities in both markets.

Table 5. Stabilization index by trade status and region

	Stabilization Index			
Region	*All*	*Non-Tradables*	*Imports*	*Exports*
Asia	1.6063	-0.8211	6.8570	-0.3123
Africa	-2.9289	0.1510	-4.7060	-3.2535
LAC	2.2851	0.0902	3.6796	1.4549
ECA	1.9191	33.3068	3.4658	-2.6902
All Regions	0.3192	1.7330	1.8960	-1.6422

The link between a country's income and the degree to which its trade policies actually stabilize prices is illustrated in Figure 6. The top left panel shows country-average results, while the other three panels show individual products that are exportable, importable or nontradable. The clear pattern is that lower-income countries provide *less* stability.

Figure 5. Stabilization index and real income, by trade status



Notes: Income per capita is expressed in I$ (2000 constant prices) and represents the average for the 1960-2004 period. Data shown for "All Primary Products" are country averages, while all other panels show individual products. Smoothed line and 95% confidence interval computed with Stata's *lpolyci* using bandwidth 3 and degree 1.

Table 6 provides a statistical test of SI's determinants. Here income and exportables are the only significant correlates of stabilization, as dummy variables for importables and regions all have no significant link to the SI.

Table 6. Stylized facts of the stabilization index

	Model				
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***
Income (log)	3.3688**		3.5884**	4.4651**	4.5150**
	(1.6309)		(1.7654)	(1.8686)	(1.9386)
Importable		1.8312	-1.8936		-1.992
		(1.7042)	(2.1666)		(2.2391)
Exportable		-1.1927	-4.2642**		-4.0880*
		(2.5573)	(2.1518)		(2.1890)
Asia				4.4549	4.017
				(3.7726)	(3.6650)
Africa				2.8246	2.3508
				(3.4862)	(3.5089)
Latin America				2.9695	2.7003
				(3.4594)	(3.3706)
Constant	-27.0646**	0.2264	-26.0637**	-38.1504**	-35.5378**
	(12.4652)	(0.5972)	(12.9289)	(15.4190)	(15.5131)
R^2	0.0085	0.0019	0.0104	0.0102	0.0118
No. of obs.	610	610	610	610	610

Notes: Dependent variable for all regressions is the Stabilization Index by country and product. Stabilization Index data not available for high income countries. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

5. Testing political economy theories of agricultural policy

The stylized facts presented above could be driven by many different influences. What kinds of political economy models can best explain the patterns we see? In these models, observed policies are an equilibrium outcome to be explained, like a market price. If policymaking were to operate with full competitive efficiency, a political Coase theorem would apply: individuals would "buy" and "sell" their policy interests and thereby acquire a Pareto-optimal set of policies. But the policies we observe appear to impose costs on some people that exceed their gains to others, so our explanations all involve one or another mechanism that might prevent the competitive market sketched in Coase (1960) from applying. Each model posits a specific mechanism which prevents losers from buying out the gainers and thereby obtaining Pareto-improving reforms, and suggests certain variables that might therefore be correlated with the particular policies we observe.

The following sections describe various possible mechanisms, drawing on the last half-century of political economy modeling, and test their implications in the context of our generic stylized facts as control variables. The models are well known so we describe them only briefly, and focus on testing their explanatory power in a consistent framework. Testing which kinds of political market failures have been most important could help policymakers circumvent these constraints, through rules and other interventions that help shift the political-economy equilibrium towards Pareto-improving policy outcomes.

5.1 Explaining the data: six major political economy theories

The simplest kind of explanation is *rational ignorance*, by which individuals will not invest in learning or taking action about a policy if the policy's cost (or benefit) to them exceeds their cost of political organization. This helps to explain why observed policies tend to generate highly concentrated gains that provide substantial benefits to a few people, thereby motivating them to act politically, at the cost of dispersed losses that impose small costs on many others who remain on the sidelines. This focus on per-capita effects is due largely to Anthony Downs (1957), and is probably the most powerful explanation for all of the patterns we observe. Influential applications to agriculture include Anderson (1995), who demonstrated how the concentration of gains and losses shifts during economic development.

Table 7 tests for the relative importance of rational ignorance, using the magnitude of total cost of policy-induced income transfers per rural person and per urban person. In the absence of detailed data on the number of people who actually produce and consume each commodity in each country, we consider only the sum of all income transfers and use the total number of rural and urban people to approximate the number of producers and consumers. The dependent variable is the value-weighted average of all commodity NRAs for the country as a whole, and the independent variable used to test for rational ignorance is its total cost (benefit) per capita in that sector.

Results are shown when all NRAs are included in columns 1 and 3, and with only positive NRAs in columns 2, 4 and 5. All estimates control for income, and columns 3-5 also control for the resource-curse effect and continent dummy variables. The results show a large and significant rational-ignorance effect: when costs (benefits) per capita are larger, the percentage NRA levels are correspondingly smaller (higher). Furthermore, the magnitude of this effect is much bigger in magnitude for people living in urban areas, as percentage NRAs are more sensitive to their level of per-capita costs or benefits.

Column 5 of Table 7 tests a related but different explanation: *free-ridership*, in which the absolute size of the group influences each member's incentive to shirk in the pursuit of political action. This idea, popularized in recent times by Mancur Olson (1965), suggests that for a given size of gains per person, smaller groups will be more effective in obtaining the policies they want, because they will be more effective in persuading potential "free riders" to join in their collective political action. An opposite effect of group size is implied by *median-voter* models, where larger groups are more influential.

Table 7. Rational ignorance and group size effects among rural and urban constituents

	Model				
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***
Policy transfer cost per rural person	-0.3685*** (0.0329)	-0.3919*** (0.0329)	-0.3746*** (0.0325)	-0.3926*** (0.0325)	-0.3901*** (0.0323)
Policy transfer cost per urban person	-1.4710*** (0.0802)	-1.4956*** (0.0809)	-1.4561*** (0.0790)	-1.4816*** (0.0802)	-1.4673*** (0.0802)
Rural population					-0.0091 (0.1314)
Urban population					-0.8613*** (0.3065)
Income (log)	0.1969*** (0.0103)	0.1846*** (0.0134)	0.1722*** (0.0159)	0.1895*** (0.0217)	0.1982*** (0.0244)
Land per capita	-0.2054*** (0.0156)	-0.2191*** (0.0163)	-0.2183*** (0.0153)	-0.2276*** (0.0165)	-0.2288*** (0.0165)
Asia			0.1969*** (0.0300)	0.2775*** (0.0382)	0.3120*** (0.0418)
Africa			0.1128*** (0.0298)	0.2467*** (0.0430)	0.2580*** (0.0461)
LAC			-0.0865*** (0.0150)	-0.0009 (0.0164)	0.0135 (0.0189)
HIC			0.2487*** (0.0240)	0.2341*** (0.0244)	0.2409*** (0.0247)
Constant	-1.4559*** (0.0780)	-1.2536*** (0.1071)	-1.3766*** (0.1418)	-1.4941*** (0.1955)	-1.5570*** (0.2171)
R^2	0.7297	0.6922	0.7509	0.7064	0.7086
No. of obs.	2233	1328	2233	1328	1328

Note: The dependent variable is the absolute value of national average value-weighted NRAs over all covered products. Models 2, 4, and 5 only use positive NRAs. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

Surprisingly, column 5 of Table 7 shows no support for free-ridership, and is consistent with the implications of median-voter models only for the size of the urban population: when controlling for per-capita gains, there is no additional significance for the absolute number of rural people, and a larger absolute size of the urban population actually increases their political effectiveness.

Table 8 provides additional tests of a group size effect, at the level of individual commodities controlling for their direction of trade in columns 1 and 2, as well as for the national average NRAs in columns 3 and 4. In all cases, larger groups obtain policies that are more favorable to them, in that a larger rural (urban) population is associated with a higher (lower) level of NRA. This is a weak test of group-size effects since we make no attempt to control for reverse causality, but it remains striking that a median-voter type of explanation appear to outweigh any free-ridership effects in this context, perhaps because all of these groups are very large and have similar levels of free-ridership.

Table 8. Group size effects among rural and urban constituents

	Model			
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***
Rural Population	1.0870***	0.3759***	1.8685***	1.2747***
	(0.0683)	(0.0832)	(0.1364)	(0.1544)
Urban Population	-2.4613***	-2.0620***	-4.4979***	-3.6532***
	(0.1832)	(0.1775)	(0.3871)	(0.3731)
Income (log)	0.2827***	0.2440***	0.4212***	0.3428***
	(0.0066)	(0.0116)	(0.0165)	(0.0221)
Importable	0.1165***	0.0682***		
	(0.0125)	(0.0124)		
Exportable	-0.1682***	-0.1973***		
	(0.0098)	(0.0098)		
Land per capita	-0.2568***	-0.2496***	-0.4060***	-0.4238***
	(0.0076)	(0.0078)	(0.0256)	(0.0265)
Asia		0.3452***		0.2564***
		(0.0266)		(0.0398)
Africa		0.0361		0.1449***
		(0.0231)		(0.0432)
LAC		-0.0393**		-0.0924***
		(0.0163)		(0.0232)
HIC		0.1741***		0.3990***
		(0.0165)		(0.0351)
Constant	-1.9911***	-1.7373***	-3.1573***	-2.6962***
	(0.0473)	(0.1023)	(0.1216)	(0.1948)
R^2	0.1395	0.1493	0.3743	0.4163
No. of obs.	24900	24900	2233	2233

Note: Dependent variables are the commodity-level NRA for models 1 and 2, and the national value-weighted average NRA among covered products for models 3 and 4. Rural and urban populations are expressed in millions. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

A third category of explanation concerns the *rent-seeking* behavior of political leaders themselves. This terminology is associated with Anne Krueger (1974), and suggests that Pareto-inefficient policy choices will persist as long as government officials can avoid accountability. By focusing on policymakers' behavior, the rent-seeking approach explains the observed pattern of policy intervention in terms of the checks and balances that constrain policymakers differently across countries and across sectors. The clear prediction is that governments facing more checks and balances will choose policies that are closer to Pareto-optimality.

In Table 9, we test this view using the absolute value of NRA as our dependent variable, and either the World Bank's Governance Indicators or the Freedom House measure of economic freedom as our measures of politicians' power. Results are significant in all specifications except one (when the World Bank's Governance Indicators are used with continent dummy variables), suggesting that after controlling for income, governments that offer citizens more freedom do have less distortionary policies.

Table 9. Rent-seeking and revenue-motive effects

	Model						
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***
World Bank	-0.0799***		0.0000			-0.0778***	
Governance Indicators	(0.0190)		(0.0184)			(0.0202)	
Freedom House		-0.0341***		-0.0703***			-0.1008***
Econ. Freedoms Index		(0.0113)		(0.0129)			(0.0143)
Monetary depth (M2/GDP)					-0.0014***	-0.0589***	-0.0361***
					(0.0004)	(0.0050)	(0.0050)
Monetary depth * Income					0.0002***	0.0060***	0.0038***
					(0.0001)	(0.0005)	(0.0005)
Income (log)	0.1311***	0.1157***	0.2254***	0.2130***	0.1697***	0.0629**	0.0757**
	(0.0170)	(0.0126)	(0.0268)	(0.0241)	(0.0083)	(0.0310)	(0.0320)
Importable	0.3421***	0.3898***	0.3797***	0.4212***	0.5018***	0.4018***	0.4840***
	(0.0177)	(0.0182)	(0.0207)	(0.0186)	(0.0127)	(0.0215)	(0.0207)
Exportable	0.1406***	0.1796***	0.1971***	0.2333***	0.1470***	0.1851***	0.1954***
	(0.0185)	(0.0171)	(0.0197)	(0.0171)	(0.0097)	(0.0200)	(0.0179)
Land per capita	-0.2837***	-0.2373***	-0.2212***	-0.2101***	-0.3083***	-0.3607***	-0.3554***
	(0.0180)	(0.0149)	(0.0144)	(0.0146)	(0.0097)	(0.0310)	(0.0278)
Asia			0.3384***	0.3900***		0.3401***	0.2840***
			(0.0555)	(0.0480)		(0.0862)	(0.0701)
Africa			0.3060***	0.3033***		0.1150*	0.1626***
			(0.0530)	(0.0424)		(0.0618)	(0.0548)
LAC			-0.0750***	0.0087		-0.1530***	-0.0630**
			(0.0275)	(0.0249)		(0.0285)	(0.0255)
HIC			-0.2318***	0.0748**		(0.0409)	0.3821***
			(0.0375)	(0.0293)		(0.0660)	(0.0642)
Constant	-0.8937***	-0.5637***	-1.8551***	-1.4007***	-1.0946***	(0.1352)	0.1403
	(0.1313)	(0.0698)	(0.2414)	(0.1951)	(0.0590)	(0.2558)	(0.2692)
R^2	0.0774	0.0692	0.1128	0.0849	0.1470	0.2052	0.1807
No. of obs.	4112	6365	4112	6365	17100	2995	4416

Notes: The dependent variable is the absolute value of national average value-weighted NRAs over all covered products. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

Table 9 also tests a fourth type of model, in which observed policies may be by-product distortions caused by policies chosen for other reasons, such as a *revenue motive*. Governments in low-income countries need revenue to pay for basic public goods such as the police and the justice system, but the transaction costs associated with taxes on income, property or consumption in domestic markets may lead governments to tax imports and exports instead. In this context, we use the country's monetary depth, as measured by the ratio of M2 to GDP, as a measure of how much of domestic activity is exposed to alternative kinds of taxation. Results confirm that, controlling for income, more monetized economies have less distortionary agricultural trade policies, although again this is a weak test as we make no attempt to control for endogeneity.

A fifth type of explanation involves *time consistency* and commitment mechanisms. Such theories are associated with Kydland and Prescott (1977), who show that current policy choices depend in part on how easily future governments can change those policies. Without an institutional commitment device such as constitutional rules or international treaties, introducing and sustaining a desirable policy may be impossible – particularly if the policy's success depends on its ability to elicit irreversible investment that would be vulnerable to a future reversal of that policy. This idea is applied to help explain agricultural policy in Africa by McMillan and Masters (2003), who show that tree crops and other irreversible investments are more vulnerable to high taxation. Time consistency is confirmed by model 1 in Table 10, where perennials are taxed more than annuals.

The time-consistency effect involves differences across crops, and perennials are not the only crops that seem to attract unusual treatment. Indeed, Table 10 shows that the "rice pudding" crops of rice, dairy and sugar, plus wheat, are taxed more than other commodities at low incomes, and then as income grows, policies switch towards subsidization of these previously taxed commodities.

Table 10. Time consistency and the wheat/rice pudding effect

	Model				
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***
Perennials	-0.0744***	-0.0913***			0.0365**
	(0.0139)	(0.0147)			(0.0167)
Animal Products	0.3310***	0.3372***			0.3776***
	(0.0161)	(0.0162)			(0.0172)
Others	-0.4133***	-0.4439***			-0.2619***
	(0.0136)	(0.0138)			(0.0145)
Sugar			-1.1052***	-1.2347***	-1.4911***
			(0.1851)	(0.1787)	(0.1809)
Rice			-0.5977***	-0.6812***	-0.9267***
			(0.1895)	(0.1876)	(0.1905)
Milk			-4.6251***	-4.4799***	-5.0371***
			(0.3706)	(0.3533)	(0.3541)
Wheat			-0.9518***	-0.9770***	-1.2089***
			(0.1423)	(0.1430)	(0.1445)
Other Cereals			0.7328***	0.7429***	0.4236***
			(0.0998)	(0.0993)	(0.1017)
Sugar*Income			0.1833***	0.1992***	0.2448***
			(0.0214)	(0.0207)	(0.0209)
Rice*Income			0.0725***	0.0796***	0.1234***
			(0.0242)	(0.0238)	(0.0240)
Milk*Income			0.6012***	0.5867***	0.6237***
			(0.0424)	(0.0407)	(0.0407)
Wheat*Income			0.1088***	0.1128***	0.1553***
			(0.0164)	(0.0165)	(0.0166)
Other*Income			-0.0839***	-0.0831***	-0.0309***
			(0.0116)	(0.0115)	(0.0117)
Income (log)	0.2206***	0.2012***	0.2113***	0.1839***	0.1471***
	(0.0057)	(0.0116)	(0.0061)	(0.0112)	(0.0114)
Importable	0.0743***	0.0607***	0.1577***	0.1438***	0.0940***
	(0.0126)	(0.0124)	(0.0141)	(0.0140)	(0.0142)
Exportable	-0.2225***	-0.2102***	-0.2057***	-0.1960***	-0.2334***
	(0.0109)	(0.0106)	(0.0109)	(0.0108)	(0.0121)
Land per capita	-0.2580***	-0.2515***	-0.2389***	-0.2327***	-0.2354***
	(0.0076)	(0.0078)	(0.0072)	(0.0073)	(0.0075)
Asia		0.3843***		0.3377***	0.4103***
		(0.0258)		(0.0241)	(0.0248)
Africa		0.1420***		0.0791***	0.1617***
		(0.0248)		(0.0229)	(0.0236)
LAC		(0.0021)		-0.0497***	0.0097
		(0.0169)		(0.0170)	(0.0174)
HIC		0.2369***		0.1988***	0.2602***
		(0.0178)		(0.0170)	(0.0177)
Constant	-1.5047***	-1.5268***	-1.4904***	-1.4009***	-1.2357***
	(0.0408)	(0.1024)	(0.0448)	(0.0986)	(0.1000)
R^2	0.1642	0.1765	0.2083	0.2199	0.2411
No. of obs.	24700	24700	24700	24700	24700

Notes: Commodity level NRA is the dependent variable. Results are OLS estimates, with standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

A sixth kind of political-economy model involves pure *status-quo bias*, in which political leaders resist change as such, even if the change would be desirable in retrospect. Status quo bias could lead policymakers to resist both random fluctuations and persistent trends, even when accepting these changes would raise economic welfare.

Several different mechanisms have been proposed to explain why change would be resisted *ex ante*, despite the desirability of reform *ex post*. An informal version of this idea that is specific to policy-makers is described by Corden (1974) as a "conservative welfare function." A formal micro-foundation could be individual-level "loss aversion", as formalized by Kahneman and Tversky (1979): people systematically place greater value on losing what they have than on gaining something else. Status quo bias can also arise for other reasons: most notably, Fernandez and Rodrik (1991) show how Pareto-improving reforms may lack political support if those who will lose know who they are, whereas those who could gain do not yet know if they will actually benefit.

If status-quo bias leads policymakers to resist change in world prices, observed NRAs would be higher when world prices have fallen. NRAs could also try to resist other kinds of changes, and be higher when acreage planted in that crop has fallen. We test for both kinds of status quo bias in Table 11, and find no significant effect. With our usual controls there is no remaining correlation between policies and lagged changes in either world prices or domestic acreage.

Table 11. The (absence of) status quo bias

	Model			
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***
Lagged Change in Border Prices	0.0000	0.0000		
	0.0000	0.0000		
Lagged Change in Crop Area			0.0039	-0.0015
			(0.0162)	(0.0161)
Income (log)	0.1702***	0.1687***	0.1601***	0.2129***
	(0.0085)	(0.0136)	(0.0058)	(0.0149)
Importable	0.2277***	0.1918***	0.1137***	0.0992***
	(0.0136)	(0.0140)	(0.0125)	(0.0142)
Exportable	-0.2353***	-0.2624***	-0.1916***	-0.1969***
	(0.0085)	(0.0086)	(0.0087)	(0.0096)
Land per capita	-0.3718***	-0.2227***	-0.1349***	-0.1060***
	(0.0251)	(0.0234)	(0.0076)	(0.0069)
Asia		0.1822***		0.3184***
		(0.0288)		(0.0368)
Africa		-0.0663**		0.0770**
		(0.0269)		(0.0320)
LAC		-0.1223***		-0.0619***
		(0.0174)		(0.0236)
HIC		0.0000		-0.0578**
		0.0000		(0.0267)
Constant	-1.1262***	-1.1105***	-1.1280***	-1.6235***
	(0.0575)	(0.1167)	(0.0410)	(0.1327)
R^2	0.1996	0.2235	0.1417	0.1648
No. of obs.	10800	10800	13300	13300

Notes: Commodity level NRA is the dependent variable. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.90% (*) levels.

5.2 A new explanation: demographic influences on political pressures

The six political economy models tested above could all potentially explain the results we observe, and are often mentioned in the political economy literature. A seventh kind of explanation is more subtle: it is based on exogenous but predictable changes in employment that affect whether other people are likely to enter the sector in the future. This could drive the level of political support in a dynamic political economy model, where individuals' incentives to invest in politics depend crucially on the probability of others' future entry to their sector and the resulting level of expected future rent dissipation.

A forward-looking model of lobbying effort driven by the entry of new agents has been suggested by Hillman (1982) and also Baldwin and Robert-Nicoud (2002), who used it to help explain why governments protect declining industries. In their models, declining industries invest more to seek policy-induced rents because their secular decline creates a barrier to entry in the future. Agriculture experiences this kind of secular decline in its

labor force only after the "structural transformation turning point", when total population growth is slow enough and nonfarm employment is large enough for the absolute number of farmers to decline (Tomich, Kilby and Johnston 1995). Before then, the number of farmers is rising, whereas after that point the number of farmers falls or remains constant.

The secular rise and then fall in the number of farmers could help explain NRA levels, to the extent that the entry of new farmers erodes policy rents obtained from lobbying. This would discourage farmers from organizing politically as long as new farmers are entering the sector, and facilitate organization once the entry of new farmers stops. Focusing on this dynamic of entry, as opposed to the absolute size of the group, could help explain the timing of transition from taxation to protection and also help explain the persistence of protection even where agriculture is not a declining industry. In most industrialized countries, for example, agriculture thrives but fixed land area imposes a strong barrier to entry, so incumbent producers capture policy rents they may obtain through lobbying.

Results shown in Table 12 confirm the link between NRAs and past changes in the number of farmers: policies are less favorable after the number of farmers has risen. In this case, we do not control for land per capita, since this is closely tied to agricultural population growth. Most importantly, the potential endogeneity of agricultural population growth can be overcome using instrumental variables, instead of the OLS estimates used in previous regressions.

Our instrumentation strategy here is based on the idea that each year's change in the agricultural population is largely exogenous to agriculture, with the exogenous component driven by total population growth and the proportion of people already in urban areas. Using lagged population growth and urbanization rates as instruments for rural population growth, columns 3 and 6 show 2SLS results. At the commodity level, the 2SLS coefficient is similar to the OLS result (comparing columns 3 and 2), and at the national-average level the 2SLS coefficient is even larger (comparing 6 and 5).

Table 12 confirms that demographically-driven entry of new farmers is associated with more taxation of agriculture. Observed policies become more favorable to farmers when farm population growth slows or declines. This result is quite different from the predictions of other models, and offers a potentially powerful explanation for the timing of policy change and the difficulty of reform.

Table 12. Demographic influences on agricultural price distortion

	Model					
Explanatory variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Lagged change in agric. population	-3.0775*** (0.3384)	-3.0882*** (0.3710)	-2.7124*** (0.6578)	-3.0719*** (0.8573)	-3.8790*** (0.9294)	-9.4049*** (1.8903)
Income (log)	0.1761*** (0.0081)	0.1559*** (0.0124)	0.1613*** (0.0140)	0.2851*** (0.0231)	0.2304*** (0.0255)	0.1492*** (0.0339)
Importable	0.1754*** (0.0117)	0.1136*** (0.0121)	0.1151*** (0.0125)			
Exportable	-0.1716*** (0.0093)	-0.2022*** (0.0107)	-0.2023*** (0.0107)			
Perennial		-0.0880*** (0.0146)	-0.0889*** (0.0147)			
Animal		0.3382*** (0.0165)	0.3386*** (0.0164)			
Other		-0.3839*** (0.0128)	-0.3843*** (0.0127)			
Africa		0.2523*** (0.0275)	0.2429*** (0.0319)		0.2587*** (0.0462)	0.4250*** (0.0739)
Asia		0.4971*** (0.0282)	0.4891*** (0.0312)		0.4562*** (0.0441)	0.6066*** (0.0659)
LAC		0.1241*** (0.0212)	0.1127*** (0.0271)		0.0367 (0.0379)	0.2233*** (0.0721)
HIC		0.2628*** (0.0194)	0.2544*** (0.0237)		0.4635*** (0.0376)	0.6012*** (0.0632)
Constant	-1.2585*** (0.0637)	-1.3698*** (0.1069)	-1.4064*** (0.1136)	-2.2242*** (0.1864)	-2.0828*** (0.2103)	-1.5618*** (0.2506)
R^2	0.1196	0.1614	0.1613	0.2889	0.3398	0.3244
No. of obs.	24800	24600	24600	2221	2221	2221

Notes: Models 3 and 6 instrument the change of economically active population in agriculture with the lagged share of people living in urban areas and the change in total population. Commodity level NRA is the dependent variable for models 1-3. Covered average NRA is the dependent variable for models 4-6. Results are OLS estimates, with robust standard errors and significance levels shown at the 99% (***), 95% (**), and 90% (*) levels.

6. Conclusions

This paper uses results from a major new research project to test standard political-economy theories of why governments intervene to influence agricultural prices. Our key data source provides estimates for the tariff-equivalent effect on price of all types of agricultural trade policies across 68 countries from 1955 through 2005. Policy impacts are measured for 77 products, chosen to account for the bulk of agricultural value added in each country, resulting in a total of over 28,000 distinct estimates from particular products, country and year.

Our analysis begins by confirming three previously observed stylized facts: (i) a consistent anti-trade bias in all countries, (ii) the development paradox of anti-farm bias in poorer countries and pro-farm bias at higher incomes, and (iii) the resource curse tendency towards higher taxation (or less subsidization) of agriculture in more land-abundant countries. To explain these effects, we find strong support for a number of mechanisms that could help explain government choices. Results support rational ignorance effects as smaller per-capita costs (benefits) are associated with higher (lower) proportional NRAs, particularly in urban areas. Results also support rent-seeking and revenue motives for trade policy, as countries with fewer limits on the exercise of political power and/or less monetary depth have greater distortions, and we find support for time-consistency effects, as perennials attract greater taxation than annuals.

Two of our results run counter to much conventional wisdom. First, we find no support for a stabilization function of policy, as would be implied by status-quo bias or loss aversion: we find that NRAs are not significantly correlated with the lagged changes in world price or domestic acreage, and that only high-income countries actually provide any counter-cyclical stabilization of domestic prices at all. Second, we find no support for the idea that larger groups of people will have more free-ridership and hence less political success. Our results are consistent with the alternative hypothesis of a median-voter approach, since larger groups tend to be given more favorable levels of NRA.

An important novelty in our results is the finding that demographically-driven entry of new farmers is associated with less favorable policies. This result is consistent with models in which new entrants erode policy rents, making political organization depend on barriers to entry that allow incumbents to capture the benefits of policy change. This result is visible in an OLS regression, and the relationship remains unchanged or is stronger when the entry of new farmers is instrumented by past population growth and the proportion of people already living in urban areas.

Our data find robust support for some theories and not others, but none of our regressions account for more than a third of the variance across countries and over time. To explain the remainder would require deeper analyses of policies' institutional context in particular countries and commodities, and further econometric tests. Such research will also point the way towards improvements in data quality to reduce measurement error. Our project's methodology aimed for much more consistency in data sources, definitions and assumptions than is usually possible to achieve over such a large sample, but the data are inevitably noisy with important random and also systematic variance in our estimates. We hope that future work will produce even more useful datasets, as well as further analysis of the hypotheses tested here.

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Appendix

Table A1. List of variables

Variable name	Definition	Source
Agricultural population	The part of the economically active population engaged in or seeking work in agriculture, hunting, fishing or forestry.	FAOSTAT (2007)
Border prices	Price at which a commodity could be imported (cif) or exported (fob), as applicable, in each country and year	Authors' calculation from Anderson et. al (2008a) database
Crop area	The area from which a crop is gathered. Area harvested, therefore, excludes the area from which, although sown or planted, there was no harvest due to damage, failure, etc.	FAOSTAT (2007)
Economic Freedom Index	The average of five dimensions of economic freedom: size of government; legal structure and security of property rights; access to sound money; freedom to trade internationally; and regulation of credit, labor and business.	Freedom House (2007)
Governance Indicators	The average of six dimensions of governance: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.	World Bank (2007), Governance Matters Database
Importable (Exportable)	Indicator variable for commodity-level NRAs, equal to 1 if the NRA is observed in a year when the commodity was imported (exported) and 0 otherwise.	Authors' calculation from Anderson et. al (2008a) database
Income	Real gross domestic product per capita, at PPP prices, chain indexed. Expressed in international dollars of 2000.	Penn World Tables 6.2
Land per capita	Area of arable land as defined by the FAO, divided by the total population.	FAOSTAT (2007)
Monetary depth (M2/ GDP)	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government	World Bank (2007), World Development Indicators
Policy transfer cost per rural (urban) person	The sum of each commodity NRA times value of production at border prices, divided by populations as defined above. Results are shown as costs of policy, so NRAs per rural person are multiplied by -1.	Authors' calculation from Anderson et. al (2008a) database
Rural (Urban) population	Rural population estimates are based on UN Population Projection estimates of total population, minus urban population using varying national definitions of urban areas	FAOSTAT (2007)