

Appendices B, C, D, E From “The Size Distribution of Farms and International Productivity Differences”[†]

Tasso Adamopoulos

Diego Restuccia

York University

University of Toronto

October 2011

B Farm and Land Distributions across Countries

Table B.1: Size Distribution of Farms across Countries

	< 1	1 to < 2	2 to < 5	5 to < 10	10 to < 20	20 to < 50	50 to < 100	100 to < 200	200 to < 500	500+
Q1	0.55	0.17	0.22	0.05	0.01	0.00	0.00	0.00	0.00	0.00
Q2	0.39	0.17	0.27	0.09	0.04	0.03	0.00	0.00	0.00	0.00
Q3	0.36	0.18	0.17	0.09	0.07	0.05	0.03	0.02	0.01	0.01
Q4	0.25	0.11	0.20	0.12	0.11	0.10	0.04	0.03	0.02	0.03
Q5	0.12	0.07	0.13	0.13	0.17	0.21	0.10	0.04	0.03	0.02

Source: Authors’ Calculations. Data from the Report on the 1990 World Census of Agriculture. Reported values are means over countries in each income group.

[†]Contact: Tasso Adamopoulos, tasso@econ.yorku.ca; Diego Restuccia, diego.restuccia@utoronto.ca

Table B.2: Land Distribution across Countries

	< 1	1 to < 2	2 to < 5	5 to < 10	10 to < 20	20 to < 50	50 to < 100	100 to < 200	200 to < 500	500+
Q1	0.23	0.19	0.26	0.15	0.13	0.02	0.02	0.00	0.00	0.00
Q2	0.10	0.12	0.25	0.14	0.09	0.18	0.09	0.01	0.01	0.00
Q3	0.08	0.07	0.12	0.09	0.07	0.10	0.07	0.08	0.11	0.22
Q4	0.02	0.03	0.08	0.09	0.18	0.11	0.15	0.16	0.11	0.07
Q5	0.03	0.03	0.05	0.06	0.14	0.28	0.22	0.08	0.02	0.08

Source: Authors' Calculations. Data from the Report on the 1990 World Census of Agriculture. Reported values are means over countries in each income group.

Countries By Quintile Quintile 1 (Q1): Ethiopia, Guinea Bissau, Malawi, Uganda, Burkina Faso, Dem. Rep. of Congo, Nepal, Zambia, Lesotho, Viet Nam, India, Pakistan. Quintile 2 (Q2): Guinea, Honduras, Samoa, Indonesia, Philippines, Egypt, Peru, Djibouti, Albania, Grenada, Iran, Namibia, Turkey. Quintile 3 (Q3): Thailand, Paraguay, Fiji, Colombia, St. Vincent, Panama, Dominica, Saint Lucia, Brazil, Argentina, St. Kitts & Nevis, Rep. of Korea, Greece. Quintile 4 (Q4): Ireland, Portugal, Barbados, Cyprus, Puerto Rico, Slovenia, Spain, Israel, Italy, United Kingdom, Finland, Australia, Bahamas. Quintile 5 (Q5): Belgium, Netherlands, Germany, France, Japan, Canada, Denmark, Austria, Norway, U.S.A, Switzerland, Luxembourg.

C A Counterfactual Exercise

We examine the potential role of differences in the size distribution of farms for agricultural labor productivity across countries by asking: how much would agricultural labor productivity increase in the poorest group of countries (Q1) if they had the farm size distribution of the richest countries (Q5)? In this counterfactual, we assume that differences in labor productivity across farm sizes are the ones observed in the 2007 U.S. Census of Agriculture. We conduct the exercise as follows. Let va_i and n_i denote value added and number of workers (operators and hours adjusted hired labor) in farm size class i . Our measure of labor productivity is value added per worker, va_i/n_i . Then

average labor productivity in agriculture for an economy as a whole is,

$$\frac{va}{n} = \sum_i \frac{n_i}{n} \cdot \frac{va_i}{n_i}. \quad (1)$$

Given that the World Census of Agriculture does not contain labor input by farm size we proxy n_i/n by the reported fraction of farms for each class size. Further, from the US Census of Agriculture 2007 we can calculate differences in labor productivity across the different class sizes va_i/n_i . Given that the ranges in the U.S. Census and the World Census do not correspond one-to-one, we fit a curve to the observed productivities for the US farm sizes (average farm size within each range), and use the fitted equation to calculate productivity for the midpoints of the ranges in the World Census. In particular, we posit a power function of the following form,

$$productivity = c \cdot (size)^b,$$

where c and b are parameters to be estimated. We run the following regression for the US in log form,

$$\ln(productivity) = c_0 + b \cdot \ln(size),$$

where for $size$ we use the average farm size in each range and for $productivity$ we use the (weighted) average value added per worker in each range. Running a simple OLS regression for the US we get estimates for the parameters c_0 and b . We find that $b = 0.49$. We then use the estimated parameters to calculate “predicted” productivity for each of the midpoints of the ranges in the World Census. Then using these predicted productivities and the weights we observe from the World Census for each range, we calculate predicted aggregate productivity for poor (Q1) and rich (Q5) countries, as well as their ratio. We find that if poor countries had the size distribution of farms of the rich countries rather than their own, agricultural productivity would increase by a factor of 4.0.

D Farm-Size Policies

In this section we document several farm-size policies in developing countries from Africa, Asia, and the Americas. We provide information on the type of policy, the title of the legislation, the year it was legislated, and a brief description of its provisions.

Country	Year	Policy	Title	Description
<i>Africa</i>				
Ethiopia	1975	land reform	Proclamation No.31 of 1975	Distribution of private land to the tiller; prohibition of any transfer of use rights by sale or exchange; prohibition of the use of hired labor on an individual's holdings; max size of holding permitted per family: 10 Ha.
Ethiopia	1967	progressive output taxes	Proclamation No.255 of 1967, Article 17B	Steep progressivity in agricultural income tax schedule, with rates ranging from an average of under 3% for income less than Eth. \$1,000, to 20% for income over Eth. \$27,000.
Kenya	2006-2010	input subsidies to smallholders	National Accelerated Agriculture Input Access Project	One time vouchers for fertilizer and seed, with subsequent access to credit for input purchase. Targeted to farmers with land size less than 1 Ha.
Malawi	1998-2000	input subsidies to smallholders	Starter Pack Programme	Small packages of fertilizer, maize seed, and legume seed sufficient for 0.1 ha were distributed for free to maize smallholders.
Malawi	2006-2009	input subsidies to smallholders	Agricultural Inputs Subsidy Programme	Coupons to farmers to purchase fertilizer for maize and tobacco production, and improved maize seed at considerably reduced prices. An upper limit on these coupons implied higher effective subsidy per Ha for smallholders.
Malawi	2004	land redistribution	Community - Based Rural Land Development Project	Pilot program in which the landless and land-poor are given grants to purchase land on willing seller-willing buyer basis.
Namibia	2005	progressive land taxes	Resolutions based on Commercial Land Agriculture Reform Act 1995	General rate at 0.75% of assessed value; a progressive rate of 0.25% for each additional property; and a rate of 1.75% for foreign absentee landlords.

Country	Year	Policy	Title	Description
<i>Africa</i>				
Tanzania	2008	input subsidies to smallholders	Input Voucher Program	Vouchers for fertilizer and seed (maize/rice), sufficient for 0.5 Ha, targeted to smallholders. Vouchers covered 50% of market price of input.
Zambia	2002-2010	input subsidy to smallholders	Fertilizer Support Program	Supplied standardized input packs for maize - containing fertilizer and seed, to plant 1 Ha of maize. Targeted to smallholders. Covered 50%-60% of input cost.
Zimbabwe	1988	progressive land taxes	Rural District Councils Act, No. 8 of 1988	0 - 20 Ha, 0.5 tax unit; 20-1619 Ha, 1 unit; next 809 Ha, 1.2 units; next 2024 Ha, 1.5 units; next 4047 Ha, 2.0 units; next 8094 Ha, 12 units; next 16188 Ha, 32 units; and beyond 40470 Ha, 1.0 unit for each 405 Ha. The value of the unit tax is decided upon by the rural district councils of each region.
Zimbabwe	2000	maximum land size constraints	Rural Land Regulations 2000, Subsection 4	Ceilings on farm sizes that differ according to Natural Region (NR): NR I 250 Ha, NR II 400 Ha, NR III 500 Ha, NR IV 1,500 Ha, or NR V 2,000 Ha.
Zimbabwe	1976 1996	subdivision regulations	Regional Town and Country Planning Regulations 1976 Regional Town and Country Planning Act 1996, Ch.29:12	Subdivision proposals are subjected to: (a) planning assessment (e.g. access to roads, water, electricity, and size of property relative to size of adjacent properties) (b) “agricultural viability” assessment (farm must provide net income equivalent to the salary of a middle manager in the financial and industrial sectors).

Country	Year	Policy	Title	Description
<i>Asia</i>				
Bangladesh	1984	land reform	Land Reform Ordinance	Imposed ceiling of 8 Ha. Prohibition of transfers to relatives to avoid the ceiling.
India	varies by province	land reforms	varies by province	Ceiling on land holdings and year of implementation varied by province: Assam (1956, amended 1976); Bihar (1961, 9.71-29.14 ha [1960-1972] and 6.07-18.21 ha [after 1972]); Gujarat (1960, 4.0553.14 ha [1960-1972] and 4.05-21.85 ha [after 1972]); Karnataka (1974, 4.05-21.85 ha); Kerala (1969, amended 1979, 6.07-15.18 ha [1960-1972] and 4.86-6.07 ha [after 1972]); Madhya Pradesh (1960, 10.12 ha [1960-1972] and 4.05-21.85 ha [after 1972]); Maharashtra (1961); Orissa (1960, amended 1973 and 1976, 8.09-32.37 ha [1960-1972] and 4.05-18.21 ha [after 1972]); Tamil Nadu (1961, 12.14-48.56 ha [1960-1972] and 4.86-24.28 ha [after 1972]); Uttar Pradesh (1960, 16.19-32.37 ha [1960-1972] and 7.30-18.25 ha [after 1972]); West Bengal (1953, 1981, 1986).
India	varies by province	tenancy reforms	varies by province	Include: tenancy security; preferential right of purchase; prohibition of subletting; restrictions on crop shares.
Indonesia	1960	lower/upper limits on size	Basic Agrarian Law	Minimum size: 2 Ha; maximum size: 20 Ha.
Japan	1952	land-tenancy reform	Agricultural Land Law (Nochi Ho)	landlords restricted to selling their leased out land to their tenants; ceiling on farmland holdings set at 3 Ha (12 Ha in Hokkaido); corporations prohibited from owning farmland; land rent ceilings; tenancy rights protection.

Country	Year	Policy	Title	Description
<i>Asia</i>				
Korea (South)	1950	land redistribution	Agricultural Land Reform Amendment Act	Imposed ceiling of 3 Ha on farm land holdings; mandatory sale to government of excess land; prohibition of tenancy arrangements and renting of farm land.
Pakistan	1959	land reforms	The Land Reforms Regulation, 1959, 1972.	1959: ceiling at 202 Ha of irrigated land; 1972: ceiling at 61 Ha of irrigated land, with excess land expropriated without compensation and granted to tenants; 1977: ceiling at 40 Ha of irrigated land, with land in excess of ceiling expropriated with compensation and granted free of charge to tenants.
Pakistan	1976	progressive land taxes	1976 Amendment to the West Pakistan Land Revenue Act	Farmers with holdings less than 5 Ha were exempt; those with holdings 5-10 Ha paid the previous flat rate; those with holdings 10-20 Ha were subject to a 50% increase; those with 20+ Ha were subject to a 100% increase.
Philippines	1972	land reforms	Presidential Decree 27.	1972: covered rice and corn farms; land ownership ceiling of 7 Ha; confiscatory method of land acquisition.
	1988		Comprehensive Agrarian Reform Program - Republic Act 6657	1988: covered all agricultural lands; land ownership ceiling of 5 Ha; compulsory acquisition and voluntary offer to sell.
Philippines	1991	subsidized credit to smallholders	Republic Act 7606	Provides to smallholders: minimum collateral requirements; interest on loans capped at an interest rate 3/4 of the annual market rate.
Sri Lanka	1972	land reform	Land Reform Law, No.I	Imposed ceilings of 10 Ha for paddy land and 20 Ha for other categories of land.
Taiwan	1949-1954	land reform		Imposed ceilings: 1-3 ha for paddy land; 2-6 ha for dry land.

Country	Year	Policy	Title	Description
<i>Americas</i>				
Brazil	1964	progressive land taxes	Estatuto da Terra	Farms less than 2 modulos pay no land tax, while farms greater than 100 modulos pay 3.5% of the unimproved value of their land (terra nua). However the tax can be reduced depending on the intensity of land-use.
Chile	1967-1970	land reform	Agrarian Reform Law 16640	Imposed ceiling of 80 Ha of irrigated land.
Peru	1964-1979	land reform	Agrarian Reform Decree Law 17716 / 1969	Expropriation of excess areas of all land holdings larger than 150 Ha on the coast and larger than 15-55 Ha in the Sierra.
Puerto Rico	1941	land reform	Land Law	Limited landholding to 500 acres in estates; eliminated corporate ownership of large estates; expropriation (with compensation) of excess lands in large estates and redistribution to smallholders; individual farms restricted to be above 5 acres but less than 25 acres; stimulated development of small co-operatives of farmers (proportional profit farms).
Mexico	1940-1976	land reform		Imposed ceiling of 100-200 Ha.

Table D.1: Sources: Bangladesh (CARE, 2003); Brazil (Binswanger, 1991); Chile (de Janvry, 1981); Ethiopia (Nega, Adenew and Sellasie, 2003; Schwab, 1972); India (Besley and Burgess, 2000); Indonesia (FFTC); Japan (Kawagoe, 1999); Kenya (World Bank, 2010); Korea (Jeon and Kim, 2000); Malawi (Levy, 2005; Dorward, Chirwa, and Jayne, 2010; Machira, 2009); Mexico (de Janvry, 1981); Namibia (Childress, Hilton, Solomon, and van den Brink, 2009); Pakistan (Database of Laws in Pakistan; Memon, 1993; Khan and Khan, 1998); Peru (Saulo-Adriano, 1991); Philippines (Saulo-Adriano, 1991; Department of Agriculture, Philippines); Puerto Rico (Santiago Caraballo, 2009); Sri Lanka (Peiris, 1978); Taiwan (Saulo-Adriano, 1991); Tanzania (Pan and Christiansen, 2011); Zambia (World Bank, 2010); Zimbabwe (Roth and Bruce, 1994; Roth and Sukume, 2003).

References

- Besley, Timothy, and Robin Burgess (2000), "Land Reform, Poverty Reduction, and Growth: Evidence from India," *Quarterly Journal of Economics*, pp. 389-430.
- Binswanger, Hans P. (1991), "Brazilian Policies that Encourage Deforestation in the Amazon," *World Development* 19(7), pp.821-829.
- CARE (2003), "Land Policy and Administration in Bangladesh: A Literature Review," CARE Rural Livelihoods Programme.
- Childress, Malcom D., Andrew Hilton, David Solomon, and Rogier van den Brink (2009), "Agricultural Land Tax, Land-Use Intensification, Local Development, and Land Market Reform," Ch.12, in H.P. Binswanger-Mkhize, C. Bourguignon, R. van den Brink (eds.), *Agricultural Land Redistribution: Toward Greater Consensus*, World Bank, 2009, pp.311-333.
- Database of Laws in Pakistan, available online at: <http://www.punjablaws.gov.pk/>.
- de Janvry, Alain (1981), "The Role of Land Reform in Economic Development: Policies and Politics," *American Journal of Agricultural Economics* 63(2), pp. 384-392.
- Department of Agriculture, Philippines, available online at:
<http://www.acpc.gov.ph/batas%5CRA7606.pdf>.
- Dorward, Andrew, Ephraim Chirwa, T.S. Jayne (2010), "The Malawi Agricultural Inputs Subsidy Programme, 2005/6 to 2008/9," World Bank.
- Food and Fertilizer Technology Center (FFTC) for the Asian and Pacific Region,
<http://www.agnet.org/library/eb/344c/>
- Jeon, Yoong-Deok, and Young-Yong Kim (2000), "Land Reform, Income Redistribution, and Agricultural Production in Korea," *Economic Development and Cultural Change* 48(2), pp.253-268.

- Kawagoe, Toshihiko (1999), "Agricultural Land Reform in Postwar Japan: Experiences and Issues," Policy Research Working Paper 2111, World Bank.
- Khan, Mahmood H., and Mohsin S. Khan (1998), "Taxing Agriculture in Pakistan," IMF Paper on Policy Analysis and Assessment, IMF PP AA/98/3.
- Levy, Sarah (2005), "Starter Packs: A Strategy to Fight Hunger in Developing Countries? Lessons from the Malawi Experience 1998-2003," CABI Publishing, Oxfordshire, UK.
- Machira, Stephen (2009), "Pilot-Testing a Land Redistribution Program in Malawi," Ch.14 in in H.P. Binswanger-Mkhize, C. Bourguignon, R. van den Brink (eds.), *Agricultural Land Redistribution: Toward Greater Consensus*, 2009, World Bank.
- Memon, Salam (1993), "Impacts of Land Reform on Farm Production and Income Distribution in the Agricultural Sector of Sindh Province of Pakistan," Ph.D Thesis, Texas Tech University.
- Nega, B., B.Adenew, and S. Gebre Sellasie (2003), "Current Land Policy Issues in Ethiopia," in *Land Reform: Land Settlement and Cooperatives*, Special Edition, FAO and World Bank.
- Pan, Lei, and Luc Christiansen (2011), "Who Is Vouching for the Input Voucher? Decentralized Targeting and Elite Capture in Tanzania," Policy Research Working Paper 5651, World Bank.
- Peiris, G. H. (1978), "Land Reform and Agrarian Change in Sri Lanka," *Modern Asian Studies* 12(4) (1978), pp. 611-628.
- Roth, Michael R., and John W. Bruce (1994), "Land Tenure, Agrarian Structure, and Comparative Land Use Efficiency in Zimbabwe: Options for Land Tenure Reform and Land Redistribution," LTC Research Paper 117, Land Tenure Center, University of Wisconsin-Madison.
- Roth, Michael and Chrispen Sukume (2003), "Farm Size Protection, Informal Subdivisions: The Impact of Subdivision Policy on Land Delivery and Security of Property Rights in Zimbabwe,"

Centre for Applied Social Sciences, University of Zimbabwe, & Land Tenure Center, University of WisconsinMadison.

Santiago Caraballo, Josefa (2009), “Agrarian Reform of 1941,” Puerto Rico Encyclopedia, entry available online at: <http://www.encyclopediapr.org/ing/article.cfm?ref=06102002>

Saulo-Adriano, Lourdes (1991), “A General Assessment of the Comprehensive Agrarian Reform Program,” Working Paper Series No.91-13, Philippine Institute for Development Studies.

Schwab, Peter (1972), *Decision-Making In Ethiopia: A Study of the Political Process*, C. Hurst and Company, London, UK, (Associated University Press Inc), pp.93-94.

World Bank (2010), “Zambia Impact Assessment of the Fertilizer Support Program, Analysis of Effectiveness and Efficiency,” Report No. 54864-ZM.

World Bank (2010), “Implementation Completion and Results Report (TF-94287) on a Grant in the Amount of US\$5 million to the Republic of Kenya for a Kenya Agricultural Input Supply Project,” Report No: ICR00001648, Sustainable Development Department, Agriculture and Rural Development Unit.

E Additional Figures

Figure E.1 displays the exact tax vector in the generic farm-size distortions experiment of Section 5.3.

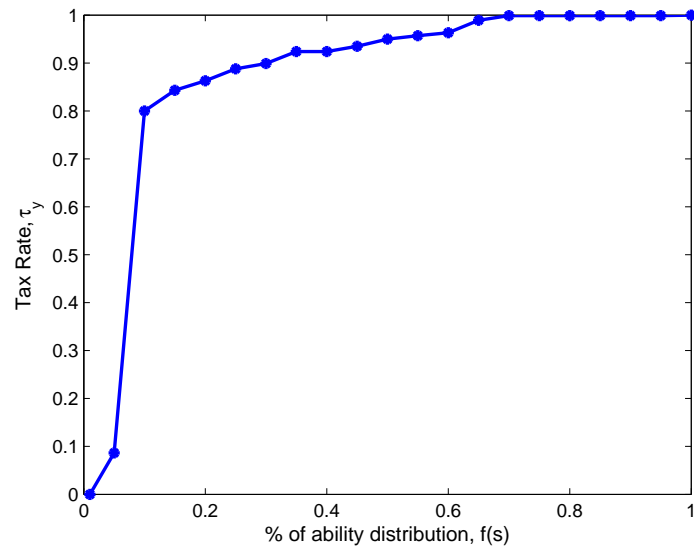


Figure E.1: Output Tax Schedule