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Trade Policy and Redistribution When Preferences Are Non-Homothetic

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Abstract

This paper compares redistribution through trade restrictions versus domestic lump-sum transfers. When preferences are non-homothetic, even domestic lump-sum transfers affect relative prices. Thus, contrary to the conventional wisdom, domestic lump-sum transfers are not necessarily superior to distortionary trade policy. The paper develops this argument in the context of the food export bans imposed by many developing countries in the late 2000s.

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Trade Policy and Redistribution When Preferences Are Non-Homothetic

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1 Introduction

Should restrictive trade policy be used as a means of redistribution within a country? Conventional wisdom in trade policy analysis offers an unequivocal "no" answer. The reason is that trade policy distorts prices and thus generates misallocation of resources. According to this line of reasoning purely domestic redistribution policies, ideally in the form of lump-sum transfers, are superior to trade restrictions as they generate fewer or no distortions, either domestically or internationally.

This paper shows that the presence of non-homothetic preferences importantly qualifies or even erases the superiority of domestic redistribution over trade restrictions. This is because under non-homothetic preferences, even lump-sum transfers between individuals/groups with different income elasticities of consumption have an impact on prices, making them more similar to the distortionary trade restrictions.

We develop this argument in the context of the food export bans that were imposed by a number of developing countries during the last commodity price boom. Sharma (2011) estimates that 33 countries imposed some forms of export restrictions on grains and other food commodities between 2007 and 2011. These policies met strong resistance from the international community. Then World Bank president Robert Zoellick urged countries "to remove export bans and restrictions. These controls encourage hoarding, drive up prices, and hurt the poorest people around the world who are struggling to feed themselves."[1] A few years later, then U.S. Secretary of State Hillary Clinton issued a similar call: "[s]ome policies that countries enacted with the hope of mitigating the crisis, such as export bans on rice, only made matters worse. (...) And that sounder approach includes (...) abstaining from export bans no matter how attractive they may appear to be, using export quotas and taxes sparingly if at all (...)."[2]

At first glance this setting should be a textbook application of the conventional wisdom. The trade policy implemented by these countries was an export quota, widely considered the least efficient type of trade restriction. While the redistributionary objective of these export bans was widely recognized in the global policy making circles, these countries were advised to achieve that objective by means of domestic policies. Our analysis will consider the best kind of domestic policy, namely a lump-sum transfer.

In our model, there are N countries, two commodities, Food and Garments, and two types of

[1] 2008 High-Level Conference on World Food Security: http://go.worldbank.org/BUEP7C3NC0
[2] http://www.state.gov/secretary/rm/2011/05/162795.htm

individuals, rich and poor. Preferences are Stone-Geary in Food and Garments, with a minimum Food consumption requirement. We analyze the case in which the poor consume only Food, and compare the effects of two policies in an individual country. The first is a binding Food export quota, corresponding to the Food export bans implemented in many developing countries. The second is a lump-sum redistribution policy from the rich to the poor. When preferences are homothetic, it is immediate that a lump-sum transfer achieves the government's redistributionary objective without distorting the world market for Food. Thus, the first-best outcome obtains.

However, under non-homothetic preferences, even lump-sum redistribution affects prices. Because the poor have a higher propensity to consume Food than the rich – indeed, in the case we analyze all of their extra income goes to Food consumption – a transfer of one dollar of income from the rich to the poor increases demand for Food, and therefore the Food price. Thus this purely domestic lump-sum transfer has, at least qualitatively, a similar effect on the price of Food as the export quota. In the limit, as non-homotheticity becomes extreme – that is, the income elasticity of Food consumption of the rich goes to zero while the poor continue consuming only Food – the domestic lump-sum redistribution policy converges to the export ban in its effect on the global Food price.

Our paper makes contact with two literatures. The first is the older debate on how trade policy compares to other policy instruments (Haberler 1950, Hagen 1958, Bhagwati and Ramaswami 1963, Corden 1974). The main thrust of this literature is that trade restrictions are not normally the most efficient way to achieve a given policy objective. We show that this conclusion must be qualified if preferences are non-homothetic. Epifani and Gancia (2009) show that countries have an incentive to increase the size of government as doing so improves the country's terms of trade. Because government expenditure is mainly on non-tradeables, increasing it pulls labor out of the tradeable sector, reducing export supply and thus raising the prices of the country's exports. Ours is a qualitatively different mechanism, as it does not rely on non-tradeability of government-provided goods, or indeed on the existence of the government expenditure on goods or services. The policy we consider is a pure lump-sum transfer.

The second is the line of research on trade policy in the presence of preference non-homotheticity. While a number of recent influential papers model non-homothetic preferences and the impact of trade opening on agents at the different points on the income distribution (Fajgelbaum, Grossman and Helpman 2011, Fajgelbaum and Khandelwal 2016), there is comparatively less theoretical or empirical work on trade policy in particular. Porto (2006) and and Faber (2014) analyze the dis-

tributional impact of individual trade agreements. Gresser (2002) documents that in the United States, tariffs are strongly anti-poor. None of these papers compare tariff reductions to alternative policies to benefit the poor. Most closely related to ours is the paper by Glazer and Ranjan (2007), who develop a theoretical framework in which an import tariff lowers the poor's marginal utility of income and makes redistribution to them less efficient, a different interaction between trade policy and redistribution than the one we consider here. The rest of the paper is organized as follows. Section 2 presents the model and derives the main results. Section 3 concludes.

2 Baseline model

2.1 Preliminaries

Consider an endowment economy with two goods – Food and Garments – and N equal-sized countries that trade with one another. Country c has an endowment profile (Φ_c, Γ_c) of Food and Garments, respectively. Each country is populated with two types of agents: the rich and the poor, who are assumed to be in equal number. The poor have endowment $(\lambda_c \Phi, \lambda_c \Gamma)$ while the rich own the remaining $((1-\lambda_c)\,\Phi, (1-\lambda_c)\,\Gamma)$. Agents have non-homothetic preferences and we assume they are of the Stone-Geary form:

$$u_c\,(f, g) = (f - \phi_c)^{\alpha_c} g^{1-\alpha_c},$$

where f and g are respectively the amounts of Food and Garments consumed by an individual in country c and ϕ_c is the minimum level of Food consumption to be met before households diversify and consume other goods.[3]

Stone-Geary preferences imply that agents with income below a given threshold will spend it all on Food, while agents with income above will also consume Garments. Trading of Garments and Food takes place on a spot market. Denote by p_c and q_c the prices of Food and Garments in country c. Trade is free of physical impediments but may be restricted by policy. Without loss of generality, we henceforth consider policies in country $c = 1$, and restrict the analysis to the case in which only this country implements a policy.

The two available policies are a lump-sum redistribution scheme and an export quota. Denote by τ_1 a lump-sum transfer from the rich to the poor in country $c = 1$. Without loss of generality,

[3] From an empirical perspective, the higher propensity of the poor to consume food is referred to as Engel's law and has ample empirical support; see e.g. Houthakker (1957).

assume that transfers are made in units of Food. The stated objective of trade insulation practices is to protect domestic net Food consumers from high international Food prices. The second policy we thus consider is a Food export quota $\dot{X}_1$ in country 1.

An **equilibrium** of the world exchange economy is a set of consumption allocations $\left\{F_c^i, G_c^i\right\}_{c=1,\ldots N}^{i=\{rich,poor\}}$ and relative prices $\{p_c, q_c\}_{c=1,\ldots N}$ such that (i) agents maximize their utility, and (ii) markets clear.

2.2 Laissez-faire equilibrium

As there are no trade costs, the laissez-faire equilibrium prices for Food and Garments are the same for every country and denoted by $(\bar{p}, \bar{q})$. The poor dedicate their entire endowment $(\lambda_c \Phi_c, \lambda_c \Gamma_c)$ to Food consumption, while the rich spend a fraction α_c of their adjusted income on Food. Denoting $\mu_c = \lambda_c + \alpha_c (1 - \lambda_c)$, we can write aggregate Food consumption in country c as

$$\bar{F}_c = \mu_c \Phi_c + (1 - \alpha_c)\phi_c + \frac{\bar{q}}{\bar{p}} \mu_c \Gamma_c.$$

Global market clearing conditions pin down equilibrium prices. Without policy interventions, the equilibrium price is:

$$\frac{\bar{q}}{\bar{p}} = \frac{\frac{1}{N}\sum_c [(1 - \mu_c)\,\Phi_c - (1 - \alpha_c)\phi_c]}{\frac{1}{N}\sum_c \mu_c \Gamma_c}. \tag{1}$$

Prices are the usual preference-weighted ratio of aggregate endowments adjusted for the Stone-Geary parameters.

Since we restrict the analysis to policies aimed at protecting the poor (and resulting in an increase in Food consumption by the poor), $\frac{\bar{q}}{\bar{p}}$ will be the upper-bound for international prices, while one lower-bound, which we denote $\frac{\bar{q}^{\min}}{\bar{p}^{\min}}$, corresponds to the case where country $c = 1$ consumes food only ($\alpha_1 = 1$), i.e.

$$\frac{\bar{q}^{\min}}{\bar{p}^{\min}} = \frac{0 + \sum_{c>1} [(1 - \mu_c)\,\Phi_c - (1 - \alpha_c)\phi_c]}{\Gamma_1 + \sum_c \mu_c \Gamma_c}. \tag{2}$$

To ensure that throughout the analysis, the property that the poor in every country only consume Food, while the rich diversify their consumption, it is sufficient to ensure that for every c,

$$\lambda_c \left(\Phi_c + \frac{\bar{q}}{\bar{p}} \Gamma_c\right) \leq \phi_c \quad \text{and} \quad (1 - \lambda_c)\left(\Phi_c + \frac{\bar{q}^{\min}}{\bar{p}^{\min}} \Gamma_c\right) \geq \phi_c.$$

To that end, we make the following assumption, which we will henceforth refer to as the *Stone-*

Geary conditions:

A1: Stone-Geary conditions. For every country c,

$$\phi_c < \Phi_c \tag{3}$$

$$\lambda_c < \min\left\{\frac{\phi_c}{\Phi_c + \frac{\bar{q}}{\bar{p}}\Gamma_c}; 1 - \frac{\phi_c}{\Phi_c + \frac{\bar{q}^{\min}}{\bar{p}^{\min}}\Gamma_c}\right\}. \tag{4}$$

Note that prices are functions of λ_c, so we need to verify that the set of parameters λ_c that satisfy (4) is not empty. To see this, note that the first argument in the bracket is positive, and (3) implies that the second also is for every value of λ_c.

Finally, the level of Food exports by country c under the laissez-faire equilibrium is given by

$$\bar{X}_c = [(1-\mu_c)\Phi_c - (1-\alpha_c)\phi_c] - \frac{\bar{q}}{\bar{p}}\mu_c\Gamma_c. \tag{5}$$

2.3 Trade insulation

Now consider a binding export quota $\dot{X}_1 < \bar{X}_1$, where $\bar{X}_1$ is the laissez-faire level of exports from country 1. In the trade insulation equilibrium, prices in country 1 will now differ from prices in every other country in the world. The equilibrium thus features a set of two prices $\left\{\frac{\dot{p}_1(\dot{X}_1)}{\dot{q}_1(\dot{X}_1)}, \frac{\ddot{p}(\dot{X}_1)}{\ddot{q}(\dot{X}_1)}\right\}$, where $\frac{\dot{p}_1(\dot{X}_1)}{\dot{q}_1(\dot{X}_1)}$ is the domestic relative price of Food in country $c = 1$ and $\frac{\ddot{p}}{\ddot{q}}$ is the international relative price of Food. Assuming that export quota $\dot{X}_1$ applies uniformly, country $c = 1$ derives its income from selling $\dot{X}_1$ units of Food at international price $\frac{\ddot{p}(\dot{X}_1)}{\ddot{q}(\dot{X}_1)}$ and the remainder, $\Phi_1 - \dot{X}_1$ at domestic price $\frac{\dot{p}_1(\dot{X}_1)}{\dot{q}_1(\dot{X}_1)}$.

Aggregate consumption of Food in country $c = 1$ is thus

$$\dot{F}_1(\dot{X}_1) = \mu_1\left[\Phi_1 + \frac{\ddot{p}(\dot{X}_1) - \dot{p}_1(\dot{X}_1)}{\dot{p}_1(\dot{X}_1)}\dot{X}_1\right] + (1-\alpha_1)\phi_1 + \frac{\dot{q}_1(\dot{X}_1)}{\dot{p}_1(\dot{X}_1)}\mu_1\Gamma_1,$$

Other countries face international price $\frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)}$ and consume

$$\dot{F}_c(\dot{X}_1) = [\mu_c\Phi_c + (1-\alpha_c)\phi_c] + \frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)}\mu_c\Gamma_c.$$

International prices International prices clear the international market for Food, i.e.

$$\frac{1}{N}\sum_c[(1-\mu_c)\Phi_c-(1-\alpha_c)\phi_c]=\frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)}\left(\frac{1}{N}\sum_c\mu_c\Gamma_c-\frac{1}{N}\mu_1\Gamma_1\right)+\frac{1}{N}\left[(1-\mu_1)\Phi_1-(1-\alpha_1)\phi_1-\dot{X}_1\right],$$

which can be solved to derive the expression for the relative price:

$$\frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)}=\frac{\bar{q}}{\bar{p}}\left[1-\frac{1}{N}\frac{1}{1-\gamma_1}\frac{\bar{X}_1-\dot{X}_1}{\frac{1}{N}\sum_c[(1-\mu_c)\Phi_c-(1-\alpha_c)\phi_c]}\right], \tag{6}$$

where γ_1 measures the relative size of country 1 with respect to the rest of the world, i.e.

$$\gamma_1=\frac{1}{N}\frac{\mu_1\Gamma_1}{\frac{1}{N}\sum_c\mu_c\Gamma_c}. \tag{7}$$

Similarly, we define

$$\ddot{\theta}(X)=\frac{1}{N}\frac{1}{1-\gamma_1}\frac{\bar{X}_1-X}{\frac{1}{N}\sum_c[(1-\mu_c)\Phi_c-(1-\alpha_c)\phi_c]} \tag{8}$$

in order to express (6) as

$$\frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)}=\frac{\bar{q}}{\bar{p}}\left[1-\ddot{\theta}(\dot{X}_1)\right]. \tag{9}$$

The function $\ddot{\theta}(.)$ is decreasing in X: as export restrictions are lifted, the upward pressure on Food prices is released. Naturally, when $\dot{X}_1=\bar{X}_1$, the export restriction no longer binds and $\ddot{\theta}(\bar{X}_1)=0$.

Domestic prices The domestic market clearing condition on the other hand is given by

$$(1-\mu_1)\Phi_1-(1-\alpha_1)\phi_1 \quad = \quad \frac{\dot{q}_1(\dot{X}_1)}{\dot{p}_1(\dot{X}_1)}\mu_1\Gamma_1+\left[1+\mu_1\frac{\ddot{p}(\dot{X}_1)-\dot{p}_1(\dot{X}_1)}{\dot{p}_1(\dot{X}_1)}\right]\dot{X}_1, \tag{10}$$

which after rearranging becomes

$$\frac{\dot{q}_1(\dot{X}_1)}{\dot{p}_1(\dot{X}_1)}=\frac{\bar{q}}{\bar{p}}\left[1+\dot{\theta}_1(\dot{X})\right] \tag{11}$$

where

$$\dot{\theta}_1(X)=\frac{(\bar{X}_1-X)-\frac{\ddot{\theta}(X)}{1-\ddot{\theta}(X)}\mu_1X}{(1-\mu_1)\Phi_1-(1-\alpha_1)\phi_1-\bar{X}_1+\frac{1}{1-\ddot{\theta}(X)}\mu_1X}. \tag{12}$$

Conversely, the function $\dot{\theta}_1(.)$ is decreasing: the domestic price of Food increases as more Food is being exported. We summarize these results in Proposition 1 below; the proof is in the appendix.

Proposition 1: Trade insulation equilibrium Suppose that assumption A1 holds. There exists an export quota $\dot{X}_1^m < \bar{X}_1$, such that for any quota $\dot{X}_1 > \dot{X}_1^m$, the equilibrium prices of the economy are characterized by (9) and (11).■

The implication of Proposition 1 is that by imposing an export quota on Food, country 1 improves its terms of trade, negatively affecting its average trading partner. By lowering the domestic price of Food, an export quota $\dot{X}_1$ benefits the poor in country $c = 1$. However, it is accompanied by increased international prices as reflected in (9). This effect is behind the significant amount of opposition to export bans outside of the countries imposing them. We next demonstrate that in the presence of non-homothetic demand, even purely domestic lump-sum transfers have a similar effect.

2.4 Redistribution

Since domestic lump-sum transfers do not impede international exchange, in the equilibrium with only domestic redistribution the prices are equalized in all countries. We denote the equilibrium world price ratio by $\frac{\hat{p}(\tau_1)}{\hat{q}(\tau_1)}$, indexing it explicitly by the amount of redistribution. Equilibrium consumption of Food in country $c = 1$ is given by

$$\hat{F}_1(\tau_1) \quad = \quad \mu_1\Phi_1 + (1-\alpha_1)\phi_1 + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)}\mu_1\Gamma_1 + (1-\alpha_1)\,\tau_1.$$

Redistributing resources from the rich to the poor induces income to be transferred from agents with a low propensity to consume Food towards agents with a high propensity to do so. Aggregate Food consumption in country $c = 1$ hence increases.

In other countries, consumption remains equal to

$$\hat{F}_n(\tau_1) = \mu_n\Phi_n + (1-\alpha_n)\phi_n + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)}\mu_n\Gamma_n.$$

Equalizing aggregate consumption and aggregate endowment yields

$$\frac{\hat{q}(\tau)}{\hat{p}(\tau)} = \frac{\bar{q}}{\bar{p}}\left[1 - \frac{1}{N}\frac{(1-\alpha_1)\tau_1}{\frac{1}{N}\sum_c[(1-\mu_c)\Phi_c - (1-\alpha_c)\phi_c]}\right]. \tag{13}$$

As above, we define

$$\hat{\theta}(\tau) = \frac{1}{N}\frac{(1-\alpha_1)\tau}{\frac{1}{N}\sum_c[(1-\mu_c)\Phi_c - (1-\alpha_c)\phi_c]}, \tag{14}$$

which is increasing with τ; we can rewrite (13) as

$$\frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} = \frac{\bar{q}}{\bar{p}}\left[1 - \hat{\theta}(\tau_1)\right]. \tag{15}$$

We summarize the results in the Proposition below, the proof is in the appendix:

Proposition 2: Domestic redistribution equilibrium When the Stone-Geary conditions hold, there exists a positive τ_1^m, such that any redistribution $\tau_1 \in (0, \tau_1^m)$ from the rich to the poor in country $c = 1$ leads to an equilibrium relative price characterized by (15). ■

A redistributive domestic policy has international price implications when preferences are non-homothetic. In equilibrium domestic redistribution τ_1 leads to higher Food prices as the size of the transfer from the rich to the poor increases. Thus, this policy also improves country 1's terms of trade as long as it is a net exporter of Food.

2.5 Trade insulation as redistribution

To compare the effect of lump-sum transfers and export quotas on the world relative price of Food, let's consider a redistribution policy τ_1 and choose a level of export quota $\dot{X}_1$ that keeps the poor in country c at an identical welfare level. Export quota $\dot{X}_1$ will henceforth be said to be the *pro-poor-equivalent* of the social protection policy τ_1: the values $\dot{X}_1$ and τ_1 are characterized by equal welfare levels of the poor. Thus, choosing τ_1 low enough so that the characterization of the equilibrium in Proposition 2 holds implies that its pro-poor-equivalent export quota $\dot{X}_1$ is also sufficiently large for the equilibrium to be properly characterized by Proposition 1. Thus, $\dot{F}_1(\dot{X}_1) = \hat{F}_1(\tau_1)$ implies

$$\frac{\tau_1}{\lambda_1}\left[1 - \gamma_1 \frac{\lambda_1}{\mu_1}(1 - \alpha_1)\right] = \left(\frac{\ddot{\theta}(\dot{X}_1) + \dot{\theta}_1(\dot{X}_1)}{1 - \ddot{\theta}(\dot{X}_1)}\dot{X}_1\right) + \frac{\bar{q}}{\bar{p}}\dot{\theta}_1(\dot{X}_1)\Gamma_1, \tag{16}$$

where $\dot{\theta}_1(.)$ and $\ddot{\theta}(.)$ are defined by (12) and (8), respectively. Both left-hand and right-hand sides of equation (16) are strictly increasing in their respective arguments, which implies a one-to-one correspondence between τ and $\dot{X}$.

Next we want to compare the price implications of using export quotas in lieu of redistribution in order to assess the inefficiencies of export restrictions. Let's consider τ a redistribution parameter in country $c = 1$ and X its pro-poor-equivalent export quota. The world Food price difference

between the redistribution and the export quota equilibria is:

$$\frac{\hat{q}(\tau)}{\hat{p}(\tau)} - \frac{\ddot{q}(X)}{\ddot{p}(X)} = \frac{\bar{q}}{\bar{p}}\left[\ddot{\theta}(X) - \hat{\theta}(\tau)\right] = \frac{1}{N}\frac{\frac{1}{1-\gamma_1}(\bar{X}_1 - X) - (1-\alpha_1)\tau}{\frac{1}{N}\sum_c \mu_c \Gamma_c}. \tag{17}$$

We can thus linearize (16) and establish the following proposition:

Proposition 3: Distortions from trade insulation For large N and for any redistribution $\tau_1 < \tau_1^m$ adopted in country $c = 1$, its pro-poor-equivalent export restriction $\dot{X}_1$ will generate increased Food prices such that

$$\frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} - \frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)} \approx \frac{1}{N}\frac{\alpha_1 \tau_1}{\lambda_1 \frac{1}{N}\sum_c \mu_c \Gamma_c} \equiv \frac{1}{N}\Delta(\tau_1). \tag{18}$$

■

Export quotas distort prices, which induces the rich in country $c = 1$ to over-consume Food. Export quotas could thus be viewed as a poorly targeted social transfer program that leads to negative terms-of-trade effects for the rest of the world. To further inform the comparison between lump-sum redistribution and export quotas, we next show that export-quota-related distortions vanish as preference for Food among the rich goes to zero.

Proposition 4: Trade insulation as redistribution Consider a sequence of economies indexed by $n \geq 1$, where $\{\alpha_1^n\}$ characterizes consumer preferences in country $c = 1$. Denote by $\{\Delta^n(\tau)\}$ the associated price distortions induced by an export quota pro-poor equivalent to redistribution τ. If $\lim_{n\to\infty} \alpha_1^n = 0$, then for every τ, $\lim_{n\to\infty} \Delta^n(\tau) = 0$. ■

As n increases, consumption patterns in country $c = 1$ become fully polarized: the poor consume Food only and the rich consume Garments only (except for the minimum required ϕ_c), so that an export quota becomes akin to a lump-sum transfer from the rich to the poor. The substitution effect no longer operates: when α goes to zero, domestic demand for Food becomes price inelastic. There is no longer any distortion because the rich do not increase their consumption of Food when domestic prices drop. Put another way, the distortion created by an export quota is lower when the commodity being targeted for export quotas is an inferior good, the demand for which has higher income elasticity.

For the rest of the world, we have just shown that redistribution is always preferred to the export ban by country 1, as it worsens its terms of trade by less. For country 1 which of these policies is preferred is ambiguous, as it trades off the greater terms of trade improvement under the export

ban against the deadweight loss of a distorting policy. We can show that a small country ($N \to \infty$) will always prefer redistribution, as the terms-of-trade effect is zero in that case. But when the country is not small, the comparison between an export quota and redistribution is ambiguous. A fuller evaluation of this tradeoff should also acknowledge that both policies likely involve substantial additional frictions, such as rent-seeking to capture export quota rents (Krueger 1974), as well as inefficiencies and leakages that plague domestic redistribution schemes (see e.g. Murgai, Ravallion and van de Walle 2013).

3 Conclusion

When preferences are non-homothetic, even lump-sum redistribution will affect equilibrium prices. We explore the trade consequences of this phenomenon, in the context of food export bans introduced by developing countries during the last commodity price boom. Export bans indeed raise the world price of food and improve the export-banning countries' terms of trade. What has been underappreciated is that in this context, even purely domestic redistribution policies might have a qualitatively similar effect. The terms-of-trade improvement under domestic lump-sum redistribution is in the limit as large as under export quotas.

References

Bhagwati, Jagdish and Vangal K Ramaswami, "Domestic distortions, tariffs and the theory of optimum subsidy," *Journal of Political Economy*, 1963, *71* (1), 44–50.

Corden, W Max, *Trade policy and economic welfare*, London: Oxford University Press, 1974.

Epifani, Paolo and Gino Gancia, "Openness, Government Size and the Terms of Trade," *The Review of Economic Studies*, 2009, *76* (2), 629–668.

Faber, Benjamin, "Trade liberalization, the price of quality, and inequality: Evidence from Mexican store prices," 2014.

Fajgelbaum, Pablo D and Amit K Khandelwal, "Measuring the unequal gains from trade," *The Quarterly Journal of Economics*, August 2016, *131* (3), 1113–1180.

Fajgelbaum, Pablo, Gene M. Grossman, and Elhanan Helpman, "Income Distribution, Product Quality, and International Trade," *Journal of Political Economy*, 2011, *119* (4), 721 – 765.

Glazer, Amihai and Priya Ranjan, "Trade protection to reduce redistribution," *European Journal of Political Economy*, 2007, *23* (3), 790–805.

Gresser, Edward, "Toughest on the Poor: America's Flawed Tariff System," *Foreign Affairs*, November/December 2002, *81* (6), 9–14.

Haberler, Gottfried, "Some Problems in the Pure Theory of International Trade," *Economic Journal*, 1950, *60*, 223–240.

Hagen, Everett, "An Economic Justification of Protectionism," *Quarterly Journal of Economics*, 1958, *72*, 496–514.

Houthakker, H. S., "An International Comparison of Household Expenditure Patterns, Commemorating the Centenary of Engel's Law," *Econometrica*, 1957, *25* (4), 532–551.

Krueger, Anne O., "The Political Economy of the Rent-Seeking Society," *The American Economic Review*, 1974, *64* (3), 291–303.

Murgai, Rinku, Martin Ravallion, and Dominique van de Walle, "Is Workfare Cost-Effective against Poverty in a Poor Labor-Surplus Economy?," Policy Research Working Paper 6673, The World Bank, Washington D.C. October 2013.

Porto, Guido G, "Using survey data to assess the distributional effects of trade policy," *Journal of International Economics*, 2006, *70* (1), 140–160.

Sharma, Ramesh, "Food Export Restrictions: Review of the 2007-2011 Experience and Considerations for Disciplining Restrictive Measures," FAO Commodity and Trade Policy Research Working Paper 32, Food and Agriculture Organization May 2011.

A Appendix: Proofs of Propositions

A.1 Proof of Proposition 1

We have left to find the conditions such that in every country, the poor do not consume any Garments, while the rich consume both. First, note that aggregate income in country $c = 1$ is given by $\left[\dot{p}(\dot{X}_1)(\Phi_1 - \dot{X}_1) + \ddot{p}(\dot{X}_1)\dot{X}_1 + \dot{q}(\dot{X}_1)\Gamma_1\right]$.

Since $\ddot{p}(\dot{X}_1) > \dot{p}(\dot{X}_1)$, $\Phi_1 + \left[\frac{\ddot{p}(\dot{X}_1)}{\dot{p}(\dot{X}_1)} - 1\right] \dot{X}_1 > \Phi_1$ so that, by virtue of Stone-Geary condition (3), the income of the rich in country 1 exceeds ϕ_1, for any export quota $\dot{X}_1$. They thus consume both goods.

For the poor in country $c = 1$, consumption of Food only would imply

$$\lambda_1 \left[(\Phi_1 - \dot{X}_1) + \frac{\ddot{p}(\dot{X}_1)}{\dot{p}(\dot{X}_1)} \dot{X}_1 + \frac{\dot{q}(\dot{X}_1)}{\dot{p}(\dot{X}_1)} \Gamma_1 \right] \quad < \quad \phi_1,$$

which can be rewritten as

$$\lambda_1 \left[\Phi_1 + \frac{\bar{q}}{\bar{p}} \Gamma_1 + \left(\frac{\ddot{p}(\dot{X}_1)}{\dot{p}(\dot{X}_1)} - 1 \right) \dot{X}_1 + \left(\frac{\dot{q}(\dot{X}_1)}{\dot{p}(\dot{X}_1)} - \frac{\bar{q}}{\bar{p}} \right) \Gamma_1 \right] < \phi_1. \tag{19}$$

As $\dot{X}_1$ goes to $\bar{X}_1$, the left-hand side of equation (19) converges to $\lambda_1 \left[\Phi_1 + \frac{\bar{q}}{\bar{p}} \Gamma_1 \right] < \phi_1$ by virtue of Stone-Geary condition (4). By continuity, there exists $\dot{X}_1^m < \bar{X}_1$ such that the poor consume Food only under trade insulation regime $\dot{X}_1 > \dot{X}_1^m$.■

A.2 Proof of Proposition 2

As for the case of Proposition 1, we have left to show that in country $c = 1$, the poor only consume Food, while consumption of both Food and Garments is taking place for the rich. The Stone-Geary conditions imply that this is indeed the case in countries $c > 1$.

For consumers in country $c = 1$, the conditions for the poor to consume Food only and the rich to consume both are

$$\lambda_1 [\Phi_1 + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} \Gamma_1] + \tau_1 \leq \phi_1 \quad \text{and} \quad (1 - \lambda_1)[\Phi_1 + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} \Gamma_1] - \tau_1 \geq \phi_1,$$

which is equivalent to

$$\tau_1 < \min \left\{ \phi_1 - \lambda_1 \left(\Phi_1 + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} \Gamma_1 \right); (1 - \lambda_1) \left(\Phi_1 + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} \Gamma_1 \right) - \phi_1 \right\}. \tag{20}$$

Note that Stone-Geary condition (4) implies

$$\phi_1 - \lambda_1 \left(\Phi_1 + \frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)} \Gamma_1 \right) > \phi_1 - \lambda_1 \left(\Phi_1 + \frac{\bar{q}}{\bar{p}} \Gamma_1 \right) > 0$$

and

$$(1-\lambda_1)\left(\Phi_1+\frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)}\Gamma_1\right)-\phi_1>(1-\lambda_1)\left(\Phi_1+\frac{\bar{q}^{\min}}{\bar{p}^{\min}}\Gamma_1\right)-\phi_1>0.$$

Thus, there exists $\tau_1^m>0$ such that (20) holds for every $\tau_1<\tau_1^m$.■

A.3 Proof of Proposition 3

Considering equation (17), the first-order term in $1/N$ can be obtained by taking the limit:

$$\Delta(\tau_1)=\lim_{N\to\infty}N\cdot\left[\frac{\hat{q}(\tau_1)}{\hat{p}(\tau_1)}-\frac{\ddot{q}(\dot{X}_1)}{\ddot{p}(\dot{X}_1)}\right]=\lim_{N\to\infty}\frac{\frac{1}{1-\gamma_1}(\bar{X}_1-\dot{X}_1)-(1-\alpha_1)\tau_1}{\frac{1}{N}\sum_c\mu_c\Gamma_c} \tag{21}$$

First, note that we have:

- from equation (7): $\lim_{N\to\infty}\gamma_1=0$
- from expression (8): $\lim_{N\to\infty}\ddot{\theta}(\dot{X}_1)=0$
- from expression (12):

$$\lim_{N\to\infty}\dot{\theta}_1(\dot{X}_1)=\frac{\bar{X}_1-\dot{X}_1}{(1-\mu_1)\Phi_1-(1-\alpha_1)\phi_1-\bar{X}_1+\mu_1\dot{X}_1}=\frac{1}{\mu_1}\frac{\bar{X}_1-\dot{X}_1}{\frac{\bar{q}}{\bar{p}}\Gamma_1+\dot{X}_1}$$

which allows us to substitute using (16) to determine the limit:

$$\lim_{N\to\infty}\left[\bar{X}_1-\dot{X}_1-(1-\alpha_1)\tau_1\right]=\left(\frac{\mu_1}{\lambda_1}-(1-\alpha_1)\right)\tau_1=\frac{\alpha_1}{\lambda_1}\tau_1. \tag{22}$$

Substituting in equation (21) leads to expression (17). ■

A.4 Proof of Proposition 4

For every n,

$$\Delta^n(\tau)=\alpha_1^n\frac{\tau_1}{\lambda_1\frac{1}{N}\mu_1^n\Gamma_1+\sum_{c>1}\mu_c\Gamma_c} \tag{23}$$

and $\lim_{n\to\infty}\alpha_1^n=0$, we have by continuity

$$\lim_{n\to\infty}\Delta^n(\tau)=0 \tag{24}$$

for every τ.■