Workshop / *Atelier*
Wednesday-Thursday, June 24-25, 2015 / *Mercredi-Jeudi 24-25 Juin 2015*

Commodity market instability and asymmetries in developing countries: Development impacts and policies

Les asymétries et l'instabilité du marché des matières premières dans les pays en développement : politiques et impacts sur le développement

The Political Economy of Food Policy During Price Spikes

By

Hannah Pieters and Johan Swinnen1

The Political Economy of Food Policy During Price Spikes

Hannah Pieters[1] and Johan Swinnen[1,2]

[1] LICOS Centre for Institutions and Economic Performance
KU Leuven

[2] Centre for Food Security and the Environment
Stanford University

Version: 22 June 2015

Abstract

This paper studies the political economy of government interventions in agricultural and food markets during the recent price spikes. We develop a Grossman-Helpman-style model to derive how much distortions a government would introduce when its decisions are influenced by lobbying from producers and consumers with limited policy options. All interest groups care about the size of the policy rents, the induced distortions and price stability. We derive hypotheses on the optimal combination of distortions and stability for given international price shocks and interest groups preferences for stability.

When explicitly taking into account distortion-volatility (DV) trade-off, our political model identifies reasons for being removed from the optimal DV trade-off line. We present empirical evidence which is generally consistent with the hypotheses. We find that a low policy efficiency during the price spikes is correlated with ex-ante policy distortions and being landlocked, but not with the trade status of the market (country).

This research was financially supported by the KU Leuven (Methusalem Program) and the European Commission (FoodSecure FP7). The authors thank Koen Deconinck for suggestions on the political economy theory and Steve McCorriston, Will Martin and participants at conferences in Ljubljana (EAAE) and Minneapolis (AAEA) for comments on the paper.

1. Introduction

A large political economy literature has focused on what Kym Anderson (2009) refers to as "distortions to agricultural incentives" (see Anderson et al., 2013b; de Gorter and Swinnen, 2002; Rausser et al. 2011; Swinnen, 2009 for reviews). As is well known, all over the world, politicians and governments are regularly under pressure from agricultural producers and food consumers to intervene in agricultural and food markets. In the longer run, this has led to a series of "patterns" of policy distortions in agricultural and food markets (Kreuger et al., 1991; Anderson et al., 2013b).

However in recent years, much of the discussion on global agricultural and food prices has focused on the, often short-run, volatility of these prices and the associated policy interventions. Many governments have intervened in an attempt to reduce short run price fluctuations with global food price spikes (Naylor, 2014; Pinstrup-Andersen 2014)[1]. These government interventions have often been ad hoc - resembling what Swinnen (1994) called "fire brigade policy-making" when governments are confronted with shocks in the external environment.

While economists and advisors point at the importance of reducing price volatility based on efficiency gains (FAO, 2011; FAO and OECD, 2011; Prakash, 2011; World Bank, 2012), economists and policy advisors have often been critical of these policy interventions, criticizing governments for (a) being ineffective, (b) causing distortions in the economy, and (c) reinforcing price fluctuations, etc. (e.g. Anderson et al., 2013a).

Yet, the basic economic model with static supply and demand equations and perfect markets is not very adequate to capture and measure distortions and inefficiencies in such conditions of market imperfections and volatility. In fact in

[1] Government interventions to counter market fluctuations are not unusual. To the contrary, they are a key 'stylized fact' of agricultural and food policies (Anderson et al., 2013b) and there is much evidence to document this for other periods and regions (e.g. Gardner, 1989; Swinnen, 2009)

environments with important market imperfections (e.g. in insurance and other factor markets) government interventions that reduce price instability could be efficiency enhancing. However, economists have typically argued that this is an issue of policy instrument choice, and that governments should use other instruments (than market interventions) to address the volatility problems. This argument has not gone unchallenged. Some argue that because of (transaction) costs and capacity of governments to implement certain policy instruments, market and trade interventions may be the most effective (e.g. Munk, 1989; Munk, 1994).

In this perspective, Pieters and Swinnen (2015) raise the question to what extent governments have traded off price distortions for reduced volatility in intervening in agricultural and food markets. They analyze how much distortions a welfare maximizing government would introduce when it cares about stability (i.e. if it wants to limit price volatility for domestic producers and consumers) in a situation with limited policy options. They derive a socially optimal distortion-volatility (DV) frontier, and compare this frontier with empirical indicators of government interventions in staple food markets. They find that several countries are close to the DV-frontier, i.e. they have been able to reduce (short run) price volatility in the domestic markets while at the same time allowing structural (medium and long term) price changes to pass through to producers and consumers. However, they also conclude that, even when explicitly taking into account this trade-off (and the benefits of reducing volatility), many countries (governments) are far removed from the DV frontier and that many policy distortions do not seem to be consistent with minimizing volatility on domestic markets.

The objective of our paper is to use a political economy model to explain the policy distortions when one allows for stability concerns and objectives for interest

groups and politicians. The paper is organized as follows. Section 2 develops a conceptual model of the economy when consumers and producers care about distortions and volatility and summarizes the key empirical findings on the distortions-volatility (DV) trade-off for staple food markets. Section 3 integrates this economic model into a political economy model for a government influenced by political considerations. Section 4 presents empirical evidence on the potential political economy explanation. Section 5 concludes.

2. The Distortion-Volatility Trade-Off

Our economic specification of the distortion-volatility (DV) trade-off is the model of Pieters and Swinnen (2015), which in itself is based on Barrett (1996), Turnovsky et al. (1980), Newbery and Stiglitz (1981) and Gouel et al. (2014).

Following Barrett (1996), we use a two period model with product prices unknown when production decisions are made and with post-harvest prices announced before the consumer makes its decisions. Even though consumers know the prices upfront, variations in prices may still leave consumers better or worse off than stable commodity prices especially (Helms, 1985). This issue is especially important in a context were consumers are not able to fully insure themselves against variations in utility.

Consider a small open economy with two goods: (1) food and (2) a composite index of nonfoods (which is defined as the numéraire). The domestic price p^D represents the ratio between the price of food and non-food commodities and the price on the world market is p^W. Define consumer utility u^C as

$$u^C(p^D) = CS(p^D) - \frac{\delta}{2}(p^D - \bar{p}^W)^2 + \gamma^C (p^D - p^W)(D(p^D) - S(p^D)) \quad (1)$$

where the first term is the consumer surplus[2]. The second term represents the welfare cost of price volatility which is zero if the prices are stable and increasing and negative otherwise. The welfare cost is a convex function of the difference in the domestic prices and the mean undistorted world market price and is weighted by the preference of the consumer for price stability (δ). The preference for price stability δ is defined as $\frac{D(\bar{p}^W)}{\bar{p}^W}(\beta(r-\eta))$ with β the budget share of food in total income ($0 \leq \beta \leq 1$), r the relative income risk aversion ($r \geq 0$), and η the income elasticity ($\eta \geq 0$). The consumer will be more likely to gain from price stability when its budget share spend on food is large or when the consumer is very risk averse and as a result the consumer will have higher preferences for stable prices.[3] The third term is the consumer's share in tax revenue or the share in subsidy expenditures with γ^C representing the share the consumers receive (with $0 \leq \gamma^C \leq 1$) and $(p^D - p^W)(D(p^D) - S(p^D))$ representing total budgetary costs or revenues. $D(\cdot)$ and $S(\cdot)$ represent domestic demand and supply and $D(\cdot) - S(\cdot)$ the net imports.

Producer utility u^P is defined as

$$u^P(p^D) = \pi(p^D) - \frac{\mu}{2}(p^D - \bar{p}^W)^2 + \gamma^P (p^D - p^W)(D(p^D) - S(p^D)) \qquad (2)$$

where $\pi(p^D)$ are the producer's profits, the second term represents a quadratic welfare cost for producers of deviating from the undistorted mean world price, specified similarly as for consumers. The preference of the producers for stable food prices ($\mu \geq 0$) is defined as $\frac{S(\bar{p}^W)}{\bar{p}^W}(\lambda(\rho-\kappa))$ with λ the dominance of the food crop in total production ($0 \leq \lambda \leq 1$), ρ the relative income risk aversion ($\rho \geq 0$), and κ the income elasticity ($\kappa \leq 0$). Price stabilization will be more preferred by producers

[2] The consumer surplus is defined as $CS(p^D) = -\int_0^{p^D} D(p)dp$.

[3] On the contrary, when the consumer does not care about price stability ($\delta = 0$), then the consumer will gain from price instability with a downward sloping demand curve.

who are highly dependent on food production for their income or by more risk averse producers. The third term is the producer's share in tax revenue or subsidy expenditures (with $0 \leq \gamma^P \leq 1$)[4]. Price volatility might reduce the utility of both consumers and producers, but the effect may be different as δ and μ differ.

Policy interventions

The government can influence consumer and producer welfare by intervening in food markets. For simplicity we assume that the government can set the domestic price p^D (and that this is the only price that consumers face).

For a government maximizing social welfare (i.e. $u^C + u^P$) the optimal domestic price p^{D*} is determined by:

$$\begin{bmatrix} -D(p^{D*}) - \delta(p^{D*} - \bar{p}^W) + \gamma^C \left(D(p^{D*}) - S(p^{D*})\right) + \\ \gamma^C \left(p^{D*} - p^W\right)\left(D'(p^{D*}) - S'(p^{D*})\right) \end{bmatrix} +$$

$$\begin{bmatrix} S(p^{D*}) - \mu(p^{D*} - \bar{p}^W) + \gamma^P \left(D(p^{D*}) - S(p^{D*})\right) \\ +\gamma^P \left(p^{D*} - p^W\right)(D'(p^{D*}) - S'(p^{D*})) \end{bmatrix} = 0 \qquad (3)$$

To relate these theoretical results to empirical indicators, we can express condition (3) as a relationship between price distortions, volatility, marginal distortions and preferences for stability.

$$(p^{D*} - p^W) = \varepsilon\ (p^{D*} - \bar{p}^W) \qquad (4)$$

with $p^{D*} - p^W$ measuring distortions (*d*) and $p^{D*} - \bar{p}^W$ measuring volatility (*v*) and $\varepsilon = \frac{\delta+\mu}{D'-S'}\left(= \frac{\theta}{\theta-1}\right) < 0$ measuring the ratio of the preferences for stability ($\delta + \mu$) over the (marginal) distortionary effect (captured by $D' - S'$ which reflects the

[4] The sum of the shares is equal to one ($\gamma^C + \gamma^P = 1$) as we assume that the total tax revenues or budgetary costs are divided among consumers and producers. The formulated cost equation does not take into account the distortionary effect related to the collection of the government's import or export revenues/subsidies.

elasticities of demand and supply). The absolute size of ε is increasing with preferences for stability of consumers and producers and decreasing with the distortionary effects of price deviations from the world market price.

With distortions measured in absolute values (negative and positive value distortions should be considered equally distortive). Figure 1 presents the optimal DV frontier, which represents the optimal combinations of domestic volatility and distortions for different values of ε for a given price shock. The choice of the government will be more towards the North-West with a lower ε. With higher ε, i.e. higher marginal distortions and less preference for stability, the choice will be more towards the South-East of the line.

Empirical indicators of the DV trade-off

Figure 2 presents empirical indicators on distortions and volatility for various countries over the past decade for wheat, rice, and maize markets from 2007 to 2013. The most common used measure to estimate food price volatility is the coefficient of variation (v) which is calculated as:

$$v = \frac{s}{\omega} \tag{5}$$

where s is the standard variation and ω is the mean. The measure of distortion (d) is calculated as the average of the absolute difference between the domestic and international price at each point in time:

$$d = \sum_{t=0}^{T} \frac{1}{T} |p_t^D - p_t^W| \tag{6}$$

Figure 2 presents the empirical equivalent of the DV trade-off frontier as developed above. More in specific the empirical DV frontier is constructed as the line between two extreme cases. The point on the horizontal axis represents the volatility of the

world market price when there are no distortions. This point is represented by V(D=0) in figure 2 and is empirical equivalence of the point ($\varepsilon = 0$) on the theoretical DV line in figure 1. The point on the vertical axis represents the minimum deviation from the world market price when there is no volatility. This point is represented by D(V=0) in figure 2 and is the empirical equivalence of the point ($\varepsilon = -\infty$) in figure 1.

Distortions in staple food markets in developing and emerging countries

Figures 2a-c illustrate the trade-off between price distortions and volatility combination for wheat, rice and maize. Several countries are on (or close to) the DV frontier. This is the case for China, Sri Lanka and Pakistan for rice; for Pakistan, Bangladesh, India, and Brazil for wheat; for Thailand, Brazil and South Africa for maize. However, it is also obvious that the majority of the countries is not close to the DV frontier. It appears that especially African countries are far away.

In summary, figure 2 suggests a large heterogeneity in the performance of countries in this DV trade-off framework. Some seem to have done well in this trade-off but other could have had much lower distortions, even when intervening to reduce volatility on the domestic markets. In fact several countries have done worse in both distortions and volatility than could have been possible. This raises the question: *why?*. One possible explanation is that political concerns in these countries may have caused unnecessary distortions in the face of volatile markets.

3. Political Optimum with Adjustment Costs

The most obvious reason why there may be a significant distance with the DV frontier is that in reality governments of course do not only care about social welfare even

when accounting explicitly for stability but also about other things, such as staying in power, providing rents to those who support them politically, etc. (Anderson et al., 2013b; Rausser et al., 2011; Swinnen, 1994). We, therefore, develop a political economy model in which both consumers and producers are actively lobbying.

Consider a government that sets the domestic price such that it maximizes its political objective function. Following Grossman and Helpman (1994) we assume that the political objective function is a weighted sum of the political contributions of consumers, political contributions of producers and social welfare. In addition, we assume that both the consumer and producer groups lobby at the same time in order to affect the price setting by the government.

The truthful contribution schedule of the consumers' interest groups is equal to the following function[5]

$$C_C = \max[0,\ u^C(p^D) - b_c\ ] \tag{7}$$

with the constant b_c representing the share of the utility that consumers do not want to invest in lobbying with the government[6]. In other words, the consumers only will invest in lobbying as long as the cost of lobbying is smaller than the expected minimum gain (b_c) related to the lobbying. The truthful contribution schedule of the producer' interest group is defined in a similar way:

$$C_P = \max\big[0,\ u^P(p^D) - b_p\ \big] \tag{8}$$

[5] Notice that the use of a Grossman-Helpman (GH) political support function still requires explicitly specifying the stability preference in consumer and producer welfare since the GH model does not imply anti-cyclical political interventions (see Swinnen, 2010 for more details), unlike other political models such as those of Hillman (1982) or Swinnen and de Gorter (1993).

[6] The truthful contribution function – defined as in Bernheim and Whinston (1986) – reflects the true preferences of the producer or consumer lobby. In our model this implies that the consumer and producer lobby groups will set their contributions in line with their expected consumer utility and profits and will depend on the marginal impact of a price change on the utility and profits. The proof for the truthfulness of the contribution schedules for both consumers and producers can be found in the appendix.

The constant b_p reflects the minimum level of profits for which the producers believe that the gains will be higher than the costs related to lobbying. The government maximizes a weighted sum of the political contributions of the consumers (weighted by α^c), the political contributions of the producers (weighted by α^p), and social welfare, where α^c and α^p represent the relative strength of the consumer and producer lobby. This can be written as:

$$max_{p^D}\ \alpha^c C_c(p^D) + \alpha^p C_p(p^D) + W\ (p^D) \tag{9}$$

with the social welfare function $W\ (p^D)$ equal to the sum of the consumer and producer utility.

The government will set a domestic price such that it maximizes its own objective function as specified in equation (9). Each price level chosen by the government is related to a certain level of consumer or producer utility (see proof 1 in the Appendix). As a result, each price level can therefore also be linked to the consumer and producer's contribution schedules. The government will receive higher contributions from the consumer if the price level generates a higher utility for the consumer. In contrast, when a chosen price level generates lower consumer' utility the consumer will reduce their contributions. Similarly, governments will increase the contributions of the producer if the domestic price increases the producer' utility, and vice versa. As a result, the government will set its optimal price in a way that it maximizes the following objective function:

$$max_{p^D}\ (1+\alpha^c)\left[\ u^c(p^D)\right] + (1+\alpha^p)\ \left[u^P(p^D)\right] \tag{10}$$

This results in the following general first order condition with the political optimal price p^{DO}:

$$\left(p^{DO} - p^W\right)\left(D'(p^{DO}) - S'(p^{DO})\right)$$

$$= [\delta + \mu]\left(p^{DO} - \overline{p}^{W}\right) + [\alpha^{c}\delta + \alpha^{p}\mu]\left(p^{DO} - \overline{p}^{W}\right) + \alpha^{c}D\left(p^{DO}\right) - \alpha^{p}S\left(p^{DO}\right)$$

$$- [\gamma^{C}\alpha^{C} + \gamma^{P}\alpha^{P}]\left[\left(D\left(p^{DO}\right) - S\left(p^{DO}\right)\right) + \left(p^{DO} - p^{W}\right)\left(D'\left(p^{DO}\right) - S'\left(p^{DO}\right)\right)\right] \quad (11)$$

Adding the strength of the consumer and producer lobby influences the government's choice of the optimal price in two ways: by changing the weights of the price distortions and the preferences for stability in the final trade-off.

To see how consumer and producer lobbying affects the optimum, consider first the case of the politically optimal price when there is no volatility –or when nobody cares about volatility, p^{D+}. In this case optimality condition (11) reduces to:

$$\left(p^{D+} - p^{W}\right)\left(D'(p^{D+}) - S'(p^{D+})\right) = \alpha^{c}D(p^{D+}) - \alpha^{p}S(p^{D+})$$

$$- [\gamma^{C}\alpha^{C} + \gamma^{P}\alpha^{P}]\left[\left(D(p^{D+}) - S(p^{D+})\right) + \left(p^{D+} - p^{W}\right)\left(D'(p^{D+}) - S'(p^{D+})\right)\right] \quad (12)$$

Condition (12) shows that depending on the strength of the consumer and producer lobby, the optimal price p^{D+}will shift below or above the world price and that there will be price distortions even without volatility.[7] When consumers have more influence (e.g. consider the case that $\alpha^{p} = 0$ and $\alpha^{c} = 1$), the government will set the optimal price below the world market price in response to consumer pressure, as their utility increases with lower prices. As a result, the price distortion ($p^{D+} - p^{W}$) will be maximized below the world price. On the other hand, if producers have more influence the government will set the price above the world price as higher prices increase the profit of the producers.

Lobbying may also have an impact on the price distortions because of different preferences of the consumers and producers for stability. Condition (11) can be rewritten as:

[7] Remember that in this case the social optimal price policy is $p^{D*} = p^{W}$.

$$(p^{DO} - p^{W}) = \frac{A}{B+C}\,(p^{DO} - \bar{p}^{W}) + \frac{D}{B+C}\,(p^{DO} - \bar{p}^{W}) + \frac{E - C \cdot F}{B+C} \qquad (13)$$

with

$$A = (\delta + \mu) \qquad (14)$$

$$B = D'(p^{DO}) - S'(p^{DO}) \qquad (15)$$

$$C = \alpha^{c}\gamma^{c} + \alpha^{p}\gamma^{p} \qquad (16)$$

$$D = \alpha^{C}\delta + \alpha^{P}\mu \qquad (17)$$

$$E = \alpha^{C}D(p^{DO}) - \alpha^{P}S(p^{DO}) \qquad (18)$$

$$F = D(p^{DO}) - S(p^{DO}) \qquad (19)$$

The first term of condition (13) consists of three factors A, B, and C. Factor A represents the consumer and producer preferences for stability and B is the marginal increase in consumption and production distortions caused by deviations from the world market price. The government will set the domestic price closer to the undistorted world market price for lower price stabilization preferences (A) and for higher marginal distortionary effects on consumption and production (B). Factors A and B are also part of the social welfare maximization (see equation 4). The effect of factors A and B is, however, constrained by a factor C which represents how much each lobby group will be affected by the budgetary effect of a deviation from the international price. Hence, the first term reflects the preferences for price stability of the consumers and producers, but these preferences are constrained by the distortionary effects and budgetary effects of a deviation from the international price.

The second term gives more weight to the relative stability preferences of the producers or consumers depending on their lobby power and their stability preferences (factor D). If the consumers have a more powerful lobby group compared to the producers and if the consumers care less about stable food prices, the government will attach more weight to the preferences of the consumers and will set

the domestic price closer to the undistorted world market price. As in the previous term, the preferences are also weighted by a factor accounting for the distortionary effect (factor A) and budgetary preference effect (factor B) resulting from a deviation from the world market price.

The third term consists of a direct lobbying effect of demand and supply reactions on price distortions (factor E) which can be reinforced or weakened due to the budgetary effects of the price policy of the government (factor $C \cdot F$). Depending on the strength of the consumer or producer lobby the government will set the optimal price below or above the world market price. If the producer lobby has more power than the consumer lobby, the government will maximize its political objective function by setting a price that is higher than the world market price. These distortions can be reinforced or weakened depending on the international trade status of the country. The distortions become larger in the case of export taxations and import tariffs and will become smaller in the case of import or export subsidies. If a country is net-exporting and the consumer lobby is more powerful than the producer lobby, the consumers will lobby for a domestic price that is lower than the international price. At the same time it is also beneficial for both consumers and producers to have a lower domestic price as the export taxation generates additional revenues for the government and thus also for consumers and producers. The effect of $(E - C \cdot F)$ is however dampened by the factor $(B + C)$ as deviations from the international price create inefficiencies.

Hence the impact of lobbying on the extent of the distortions for a given level of global price volatility $(p^{DO} - p^{W})$ is conditional on the combination of differences in lobby power, differences in relative preferences for stability of different interest groups and consumer and producer shares in tax revenue.

The optimal DV combination of the absolute values of the domestic volatility and distortions for a given price shock in a political economy framework is presented in figure 3. The first and the second term will determine the position on the DV trade-off line. As the budgetary effect comes into play, the government will give relatively less weight to volatility compared to the ε in equation 4 (see Figure 3 point E^0) and the optimal combination on the DV line will shift towards the South-East. The second term, on the other hand, will give relatively more weight to volatility and will shift the optimal government policy along to DV line towards the North-East of the line. The position of the optimal policy choice on the DV line will be above or below ε in equation 4 (point E^0) depending on the power of the lobby groups and their share in the total tax revenues or subsidies . For example, if the consumer lobby is the only pressure group and if the full share of the budget will be borne by the consumers than the government will choose an optimal policy with less distortions than E^0 and will therefore shift along the DV line to the South East of E^0. If, on the other hand, the producers are paying all the budgetary costs of the distortions, the consumers will not care about the budgetary effect and will therefore lobby for more stability. As a result the government will set a policy to the North East of E^0. The third term, on the other hand, will bend the DV line upwards and defines the distance between the old DV line and the new (dotted) DV trade-off line (see figure 3). The degree of the shift will depend on the direct effect of the lobbying and on the budgetary effect which might decrease or further increase the distortion.[8]

It is thus obvious that the divergence of the political from the social optimum is conditional upon several exogenous factors.

[8] A more formal proof that shows that pivot of the DV line can only pivot to the right can be found in the appendix.

To illustrate this, consider the case where the consumer lobby has all the power ($\alpha^p = 0$ and $\alpha^c = 1$). In this case, governments will set the domestic price below the world market price ceteribus paribus. So for the same level of volatility the government will set a lower domestic price than the optimal domestic price without lobbying. However, this may result in more or less distortions, depending on whether the domestic price declines as a result of falling global prices (in which case distortions may be smaller) – or increases with upward global price shocks (in which case distortions will be larger). An additional effect of strong consumer lobby is a change in the relative impact of its preferences for stability. The magnitude of this effect depends on the adjustment costs of producer and consumer related to volatility of prices (δ and μ). If consumers are more concerned than producers about volatility, there will be an additional pressure (and influence) on the government to increase distortions and to reduce the domestic price. However, with prices on average falling and declining to the same extent the impact should be an increase in distortions, on average.

7. Potential Causes for Low Policy Efficiency

Measuring inefficiency in a DV trade-off framework

To get a better empirical perspective on the extent of the inefficiencies, we now calculate three indicators of inefficiency in this DV trade-off framework. Using the DV frontier, we can estimate the "efficiency" of each observed government policy combination by measuring the distance between the outcome of the government policy and the frontier. The distance represents the possible efficiency improvements that can be made by the government. The first estimator *VD* measures the *vertical* distance between the actual price distortion and volatility of a country and the closest point on the optimal DV frontier. The second estimator *HD* measures *horizontal*

distance and the final estimator *OD* measures the *overall* inefficiency of a country's actual policy decision.

The closest point on the DV frontier to a country's actual policy decision (v_C, d_C) is given by the following coordinates (v_{DV}, d_{DV}):

$$v_{DV} = \frac{v_C + m \cdot d_C - m \cdot k}{m^2 + 1} \tag{21}$$

$$d_{DV} = m \frac{v_C + m \cdot d_C - m \cdot k}{m^2 + 1} + k \tag{22}$$

with *m* and *k* representing respectively the slope and intercept of the DV trade-off frontier.

The vertical inefficiency indicator is measured as the vertical distance between the optimal price distortion of the theoretical best outcome (d_{DV}) and the distortion in a country (d_C).

$$VD = |d_C - d_{DV}| \tag{23}$$

The horizontal inefficiency is calculated as the horizontal distance between the closest point (v_{DV}, d_{DV}) on the DV frontier and the actual price volatility faced by a country (v_C):

$$HD = |v_C - v_{DV}| \tag{24}$$

Finally, the overall inefficiency measures the distance between the closest point on the DV frontier and a country's policy combining both horizontal and vertical inefficiencies:

$$OD = \sqrt{(d_C - d_{DV})^2 + (v_C - v_{DV})^2} \tag{25}$$

Figure 4 presents the calculated efficiency in observations of the government policy compared to the distortion and volatility trade-off. China's policy intervention in the rice market is closest to the (theoretically) best outcome measured in terms of all three inefficiency measures. Similarly, the best performer in the wheat market is

Pakistan in terms of a reduction of volatility and distortions over the 2007-2013 period. For the maize market the best performer is Thailand.

The efficiency indicators in figure 4 confirm that there are a lot of countries with very low performance levels compared to the DV frontier. In most of the cases, these inefficiencies are caused by very high price distortions (vertical inefficiencies). Compared to the best outcome these countries are confronted with large deviations from the international food prices for similar volatility levels. This is especially true for the Ghana's policy interventions in the rice market.

The impact of the political factors on efficiency

As we have shown in the previous section, the political economy factors, demand and supply effects and budgetary effects of the government policy may induce government to set prices away from the original DV line. To get a feeling about the importance of these potential factors, we first do a simple graphical analysis and later perform a regression analysis.

First, the best way to empirically test for the political economy effects is to use a full-fledged political econometric model such as used by e.g. Gardner (1989), Olper et al. (2014) or Swinnen et al. (2001). However, in a first step here we use a "short-cut" to measure the potential importance of political factors by using pre-crisis policy distortion indicators which have been shown to be influenced by political factors (Anderson, 2009; Olper et al., 2014). More specifically, the best indicator available for the political pressures faced by the government in their agricultural and food policies is the Nominal Rate of Assistance (first developed by Anderson and Valenzuela in 2008). To see to what extent these political pressures influence the DV efficiency during the 2007-2013 period, we compared the 2007-2013 distortions with the NRA in the preceding period (to reduce endogeneity problems). For this, we use

the absolute value of the "ex-ante NRA" which is calculated as the absolute value of the average NRA over the period 2000-2005 (for those countries for which NRA data are available). This variable will proxy the history of policy interventions and gives an indication of the intensity of the past policy interventions by the government. Countries that have a long history of distortionary policies may also have a lower efficiency in the 2007-2013 period as the political factors behind the distortions are likely to have continued, causing deviation from the DV frontier.

Figure 5 shows that there are indeed positive correlations between the overall inefficiency in the period 2007-2013 and the absolute NRA in the pre-food crisis period (2000-2005), but the correlation is only strong for rice and much less clear for wheat (where there are few observations) and maize. This figure suggests that at least in the rice markets countries that intervened more heavily before 2005 are also more inefficient in their policies during 2007-2013.

Second, to empirically test the impact of the budget effect, we construct a dummy for having import tariffs or export taxes. In other words, if a country is a net-importing country and has a domestic price that is higher than the international price than the country can be classified as a country with import tariffs (see figure 6) ; a net-exporting country with lower domestic prices than the international price is classified as a country with export taxes. Since import tariffs and export taxes generates additional incomes for the government, the government will choose for a policy combination which is located further away from the original DV line.

Table 1 shows that there is indeed a negative correlation between the DV inefficiencies in the period 2007-2013 and having import tariffs or export taxes between 2007 and 2013, but this correlation is only strong for rice and much less clear for wheat and even weakly positive for maize. The t-test of confirms that efficiency is

significantly lower for countries with import and export tariffs in the rice market. In the case of wheat and maize there is no significant difference in efficiency between countries with import or export tariffs and countries that are subsidizing exports and imports.

To estimate the joint effect of these two factors we ran a simple regression model:

$$E_i = \beta_1(ea\_NRA)_i + \beta_2 Taxation_i + \beta_5 Wheat_i + \beta_6 Maize_i + \varepsilon_i \qquad (26)$$

where the dependent variable, E_i , is our overall inefficiency measure (OD) of the implemented policy for country *i*. *Ea-NRA* is the ex-ante NRA as defined above. *Taxation* is an indicator for the taxation structure and is equal to 1 if a country has either import tariffs or export taxes. The dummies *Wheat* and *Maize* control for the commodity fixed effects.

The results of the OLS regression are shown in table 2. The results are based on a pooled dataset of the three commodities: rice, wheat, and maize. The results show that the pre-food crisis NRA is positively correlated with the inefficiency of the government policy. This result confirms that past policy interventions are correlated with the 2007-2013 DV efficiency, which suggest the continued influence of lobby groups causing policy distortions. In addition, we do not find any evidence that countries with import or export taxes are more inefficient than countries with export and import subsidies. These results cannot confirm that the export and import taxes shifts the DV trade-off line further away from the original DV trade-off. In table 3 we also control for commodity fixed effects. The results are robust to the inclusion of commodity fixed effects.

Other Potential Causes for Low Policy Efficiency

There may also be other explanations for the low efficiency indicators such as the lack of integration in the international markets due to natural barriers (e.g. for landlocked countries) or there may be inaccuracies in our measures (which may be reflected in structural differences between import and exported commodities).

First, the measurement error in the border price may depend on the import-export status of a country. In our analysis distortions were defined as the difference between the domestic and the border prices, where we proxied a country's border price by the world market price. The border price, however, must be measured as sum between the world market price plus or minus the transportation costs, depending whether a country the product is exported or imported. This may cause some bias in the estimated distortions. In addition, the import-export status is likely to also affect the political economy outcome (see e.g. Anderson, 1995; Swinnen, 1994).

However, the data provide a mixed picture on the relationship between net-imports status and DV efficiency. Figure 7 indicates a negative relationship between the share of net-imports and DV efficiency for rice and maize but a positive relationship for wheat. Hence, there is no clear conclusion coming out of this graphical analysis.

Second, higher food prices have hit many countries around the world, but the impact for landlocked countries might have been larger than for coastal countries. Landlocked countries often suffer from extra transportation costs and have to wait, on average, longer for arrival of imported goods due to logistic issues (Arvis et al., 2010).

Figure 8 shows that the DV inefficiencies for landlocked countries are indeed larger than for coastal countries. Most of the landlocked countries are situated in the

lower tail of the graphs. For example, in the case of rice 5 out of the 8 landlocked countries belong to the 10 worst performing countries.

To estimate the joint effect of these two factors we ran a simple regression model:

$$E_i = \beta_1(ea\_NRA)_i + \beta_2 Taxation_i + \beta_3\, Import_i + \beta_4\, Landlocked_i + \beta_5\, Wheat_i + \beta_6 Maize_i + \varepsilon_i \quad (27)$$

where the dependent variable, E_i , is our DV inefficiency measure of the implemented policy for country I. *Ea-NRA* and *Taxation* are defined above. *Import* is an indicator for the trade status and is measured as the net-import share in total production. *Landlocked* is a dummy which is equal to 1 if a country is completely surrounded by land. The dummies *Wheat* and *Maize* control for the commodity fixed effects.

The results of the OLS regression are shown in table 4. The results show that ex-ante NRA and taxation remain robust to the inclusion of the net-import status of a country. The correlation between net-import status and the efficiency indicator is found to be insignificant. The inclusion of the dummy for being landlocked, however, takes away the significant effect of indicator variable for import and export taxes.

5. Conclusion

The question addressed in this paper is to what extent governments may have traded off price distortions for reduced volatility in intervening in agricultural and food markets. In this paper we developed a political economy model to derive how much distortions a government would introduce when it cares about stability (i.e. if it wants to limit price volatility for domestic producers and consumers) in a situation with limited policy options. We showed that there is a trade-off between volatility and distortions in situations with limited policy options, both for welfare maximizing and

politically optimizing governments; and we identified a DV frontier as the optimal combination of distortions and stability for given international price shocks and various preferences.

However, this is not the general (or average) case. The average "DV efficiency" is rather low. For many countries, even when explicitly taking into account this trade-off (and the benefits of reducing volatility) government policies appear far removed from the optimal distortion-volatility (DV) combination and that there appears to be, thus, much room for policy improvement.

We find that a low DV efficiency during the price spikes is correlated with ex-ante policy distortions and being landlocked, but not with the trade status of the market (country).

There are several ways in which this analysis can be further refined, and several issues need to be taken into consideration when interpreting the results. One is to improve the empirical indicators by better correcting for differences in transportation costs. A second is related to the conceptual model and the availability and costs of using alternative instruments. Our assumption was that to address the volatility governments would intervene in markets and did not have other instruments, such as income support as an alternative option. A more elaborate model with multiple policy instruments (and their respective implementation costs and distortions) would improve the conceptual analysis. Finally, an issue we ignored is the spillover effects (and potentially secondary price effects) of domestic policies on international markets, an issue emphasized by e.g. Ivanic and Martin (2014). Our analysis and results are complementary to the findings of these studies.

References

Anderson, K. (1995). Lobbying Incentives and the Pattern of Protection in Rich and Poor Countries. *Economic Development and Cultural Change* 43(2): 401-423.

Anderson, K. (ed.) (2009). *Distortions to Agricultural Incentives: A Global Perspective, 1955-2007*. London: Palgrave Macmillan and Washington DC: World Bank.

Anderson, K. (ed.) (2013). *The Political Economy of Agricultural Price Distortions*. Cambridge University Press.

Anderson, K., Ivanic, M. and Martin, W. (2013a). Food Price Spikes, Price Insulation, and Poverty. NBER Chapters, in: The Economics of Food Price Volatility National Bureau of Economic Research, Inc.

Anderson, K., Rausser, G.C., and Swinnen, J.F.M. (2013b). Political Economy of Public Policies: Insights from Distortions to Agricultural and Food Markets. *Journal of Economic Literature* 51(2): 423-477.

Anderson, K., and Valenzuela, E. (2008). *Estimates of Global Distortions to Agricultural Incentives, 1955 to 2007.* World Bank, Washington D.C., October 2008. *(Available at www.worldbank.org/agdistortions website)*

Arvis, J., Rabbaland, G. and Marteau, J. (2010). The Cost of Being Landlocked: Logistics Costs and Supply Chain Reliability. The World Bank, Washington, DC.

Baltzer, K. (2013). International to domestic price transmission in fourteen developing countries during the 2007-08 food crisis. Working Paper Series UNU-WIDER Research Paper, 2013/031.

Bernheim, D.B. and Whinston, M.D. (1986). Menu Auctions, Resource Allocation and Economic Influence. *Quarterly Journal of Economics* 101(1): 1-31.

De Gorter, H. and Swinnen, J., (2002). Political Economy of Agricultural Policies, Chapter 36, *The Handbook of Agricultural Economics*, Volume 2, Edited by B. Gardner and G. Rausser, Elsevier Science: North Holland, Amsterdam, 2073- 2123.

FAO (2011). The State of Food Insecurity in the World. How does international price volatility affect domestic economies and food security?. Rome, 2011.

FAO and OECD (eds.) (2011). Price Volatility in Food and Agricultural Markets: Policy Responses. OECD.

Gardner, B. L. (1987). Causes of U. S. Farm Commodity Programs. *Journal of Political Economy*, 95(2): 290–310.

Gouel, C., Gautam, M. and Martin, W.J. (2014). Managing Food Price Volatility in a Large Open Country. The Case of Wheat in India, mimeo.

Grossman, G.M. and Helpman, E. (1994). Protection for Sale. *American Economic Review* 84 (4): 833-850.

Helms, J.L., (1985). Errors in the Numerical Assessment of the Benefits of Price Stabilization. *American Journal of Agricultural Economics* 67(1): 93-100.

Hillman, A.L. (1982). Declining Industries and Political-Support Protectionist Motives. *American Economic Review* 72(5): 1180-1187.

Ivanic, M. and Martin, W. (2014). Implications of domestic price insulation for global food price behaviour. *Journal of International Money and Finance* 42: 272-288.

Krueger, A.O., Schiff, M. and Valdés, A. (1991). *The Political Economy of Agricultural Pricing Policy*, London: Johns Hopkins University Press for the World Bank.

Munk, K.J. (1989). Price support to EC agricultural sector: an optimal policy?. *Oxford Review of Economic Policy* 5(2): 76-89.

Munk, K.J. (1994). Explaining agricultural policy: EC agricultural policy for the 21st century. *European Economy*, Reports and Studies 4 (Annex): 93-119.

Naylor, R.L. (ed.) (2014). *The Evolving Sphere of Food Security.* Oxford University Press.

Newbery, D.M.G., and Stiglitz, J.E. (1981). *The Theory of Commodity Price Stabilization. A Study in the Economics of Risk.* Clarendon Press, Oxford.

Newbery, D.M.G. and Stiglitz, J.E. (1984). Pareto Inferior Trade. *Review of Economic Studies* 51: 1-12.

Olper, A., Falkowski, J., Swinnen, J.F.M. (2014). Political reforms and public policy: evidence from agricultural and food policies. *The World Bank Economic Review* 28(1): 21-47.

Pieters, H. and Swinnen, J. (2015). Trading-off Volatility and Distortions? Food Policy During Price Spikes. mimeo.

Pinstrup-Andersen, P. (ed.) (2014). *Food Price Policy in an Era of Market Instability: A Political Economy Analysis*, Oxford, UK: Oxford University Press, forthcoming.

Prakash, A. (2011) Why volatility matters. In: Prakash A, editor. Safeguarding food security in volatile global markets. Rome: Food and Agriculture Organization of the United Nations, 2011.

Rausser, G.C., Swinnen, J.F.M. and Zusman, P. (2011). *Political Power and Economic Policy. Theory, Analysis, and Empirical Applications*. Cambridge University Press.

Swinnen, J.F.M. (1994). A positive theory of agricultural protection. *American Journal of Agricultural Economics* 76 (1): 1-14.

Swinnen, J.F.M. (2009). The Growth of Agricultural Protection in Europe in the 19th and 20th centuries?. *The World Economy* 32(11): 1499-1537.

Swinnen, J.F.M. (2010). The Political Economy of Agricultural and Food Policies: Recent Contributions, New Insights, and Areas for Further Research. *Applied Economic Perspectives and Policy* 32: 33-58.

Swinnen, J.F.M., Banerjee, A., and de Gorter, H. (2001). Economic Development, Institutional Change and the Political Economy of Agricultural Protection: An Empirical Study of Belgium since the 19th Century *Agricultural Economics* 26(1): 25-43.

Swinnen, J.F.M., and de Gorter, H. (1993). Why small groups and low income sectors obtain subsidies: The 'altruistic' side of a 'self–interested' government. *Economics and Politics* 5 (3): 285–296.

Turnovsky, S.J., Shalit, H., and Schmitz, A. (1980). Consumer's surplus, Price Instability, and Consumer Welfare. *Econometrica* 48 (1): 135-152.

World Bank. (2012). Responding to Higher and More Volatile World Food Prices. Washington, DC.

Appendix: Figures and Tables

Figure 1: Optimal combinations of observed volatility and distortions for a given price shock

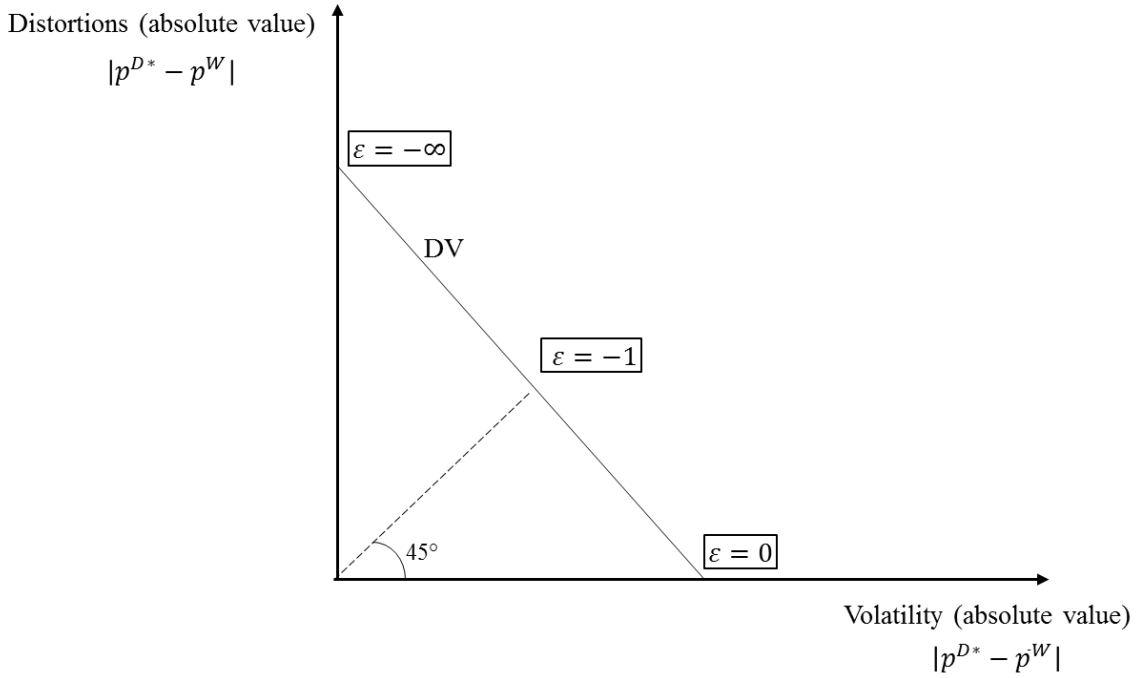
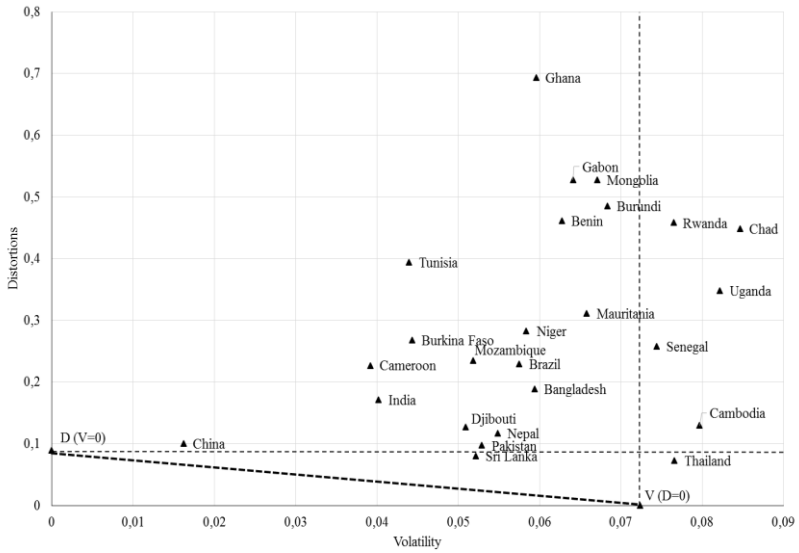


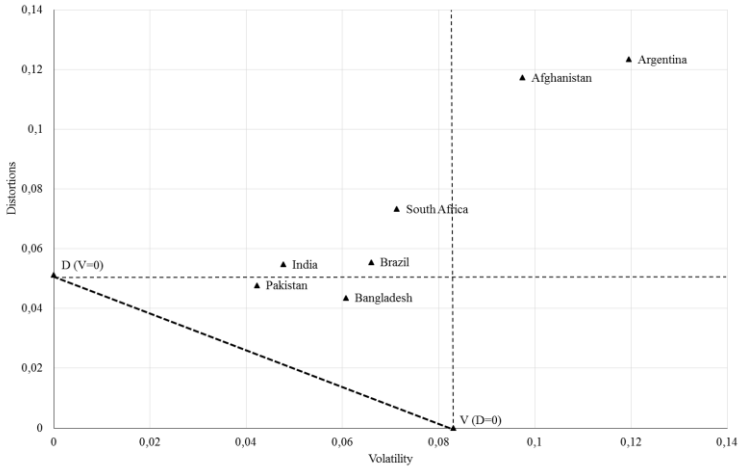
Figure 2: Distortions and volatility (2007-2013)

a) Rice



Note: D (V=0): Minimum distortions at zero volatility
V (D=0): Volatility at zero distortions (= world market price volatility)

b) Wheat



c) Maize

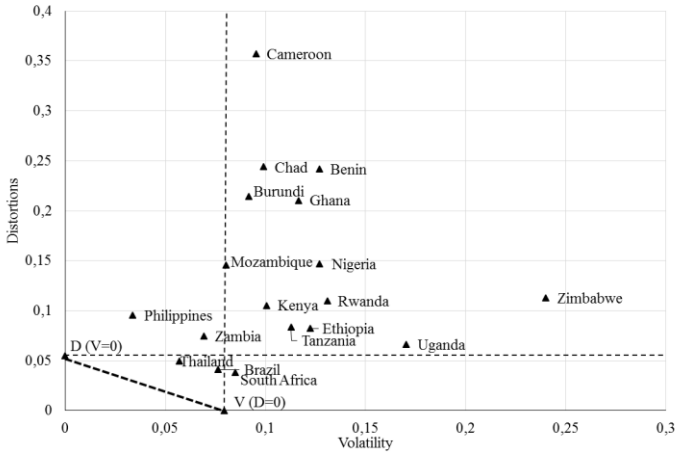


Figure 3: Optimal combinations in a political framework of observed volatility and distortions for a given price shock

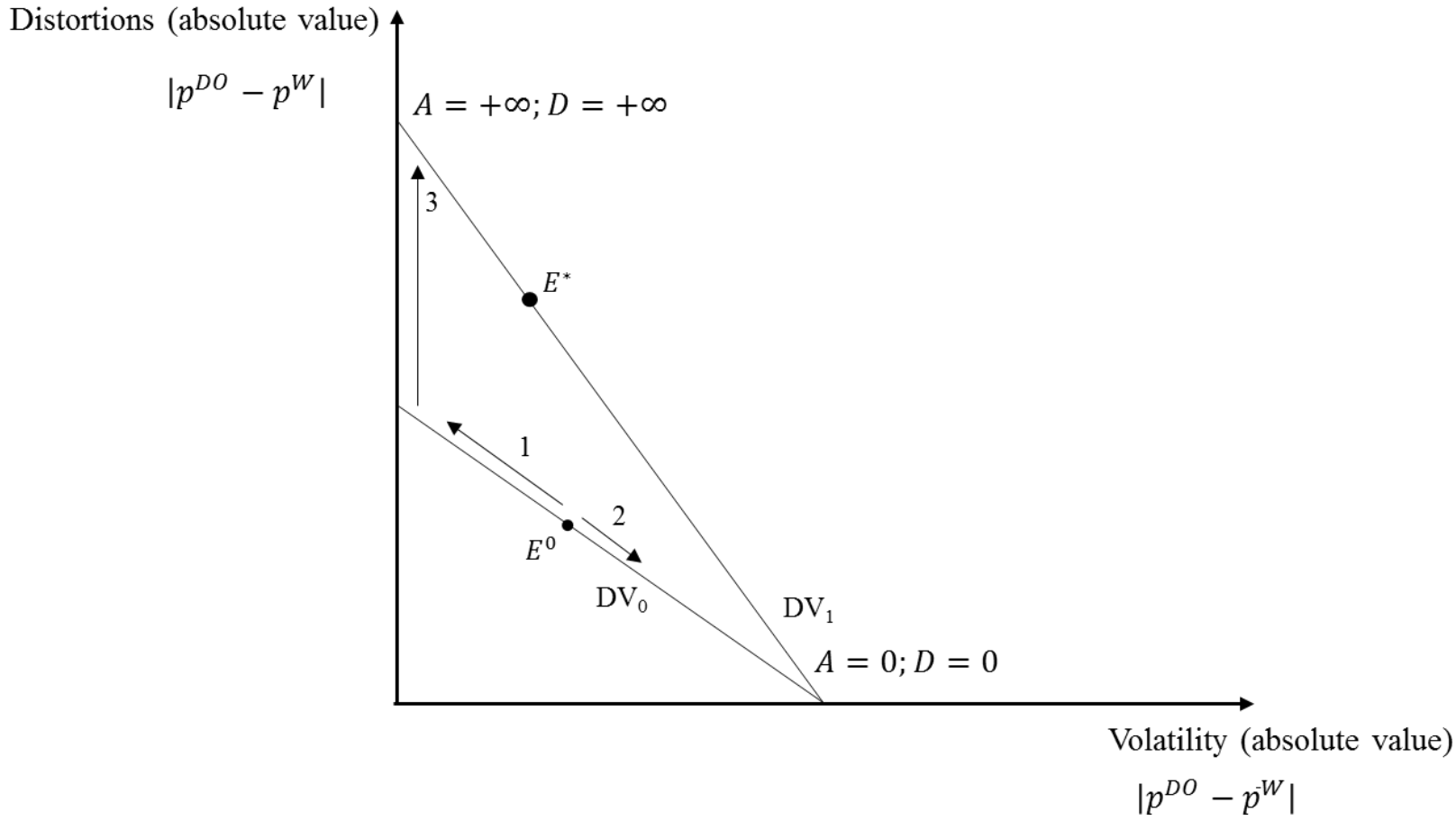
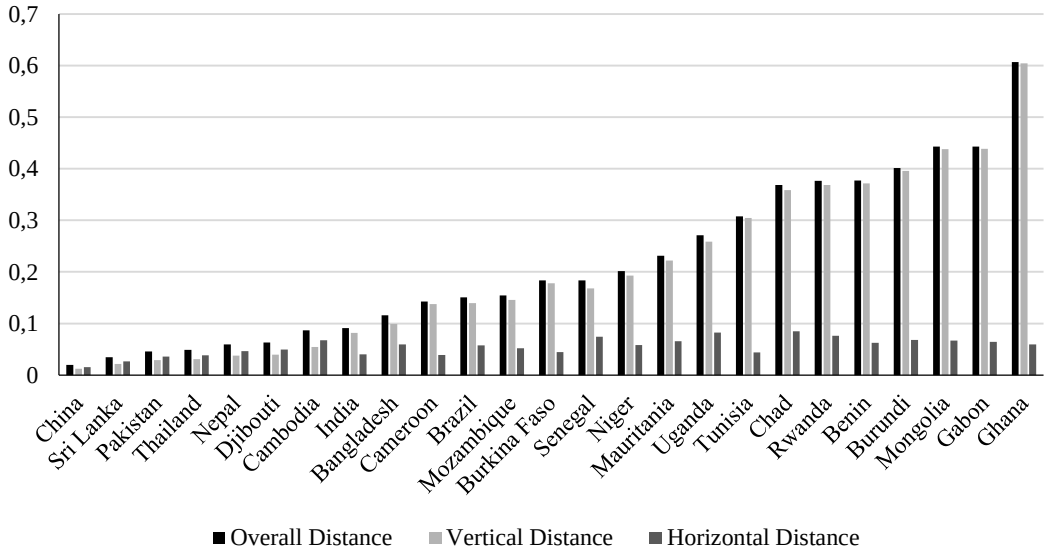
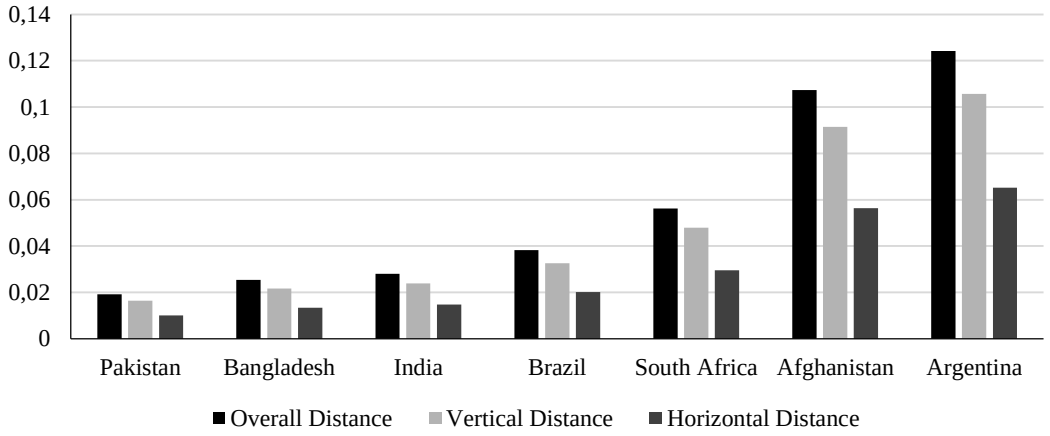


Figure 4: Efficiency relative to the DV frontier

a) Rice



b) Wheat



c) Maize

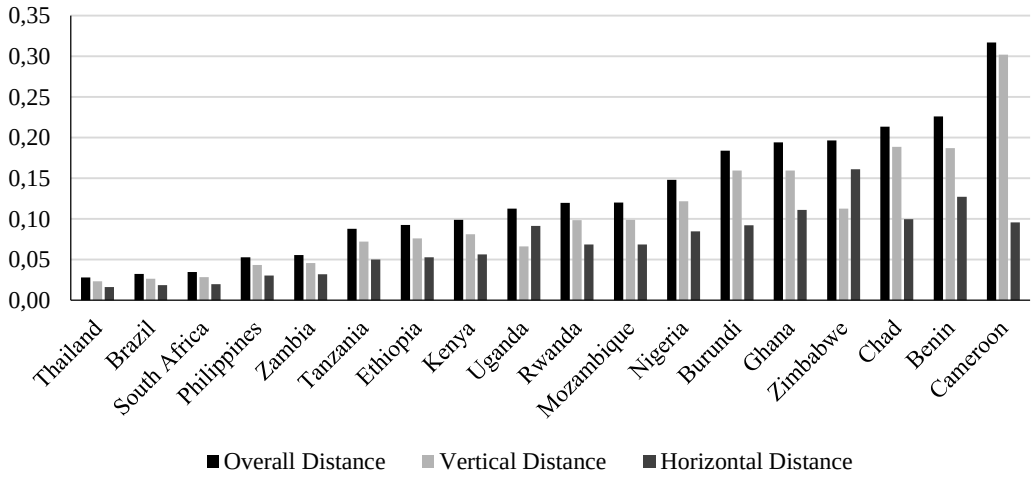
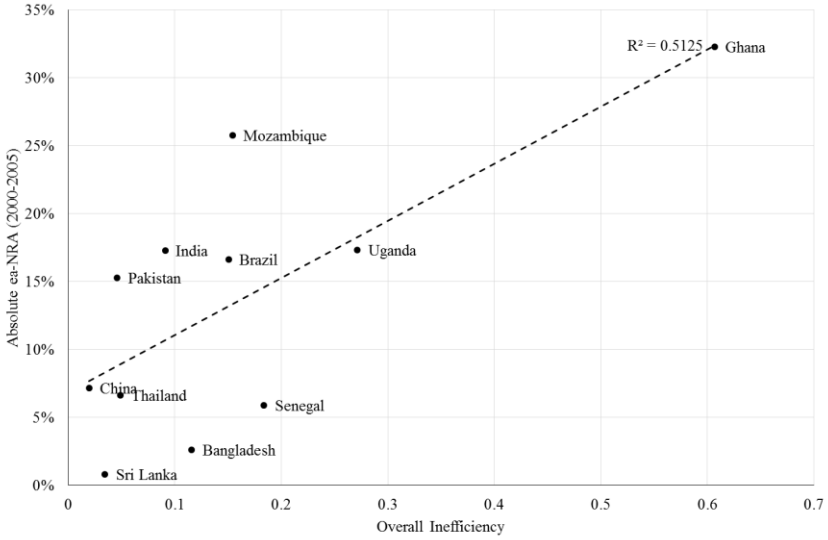
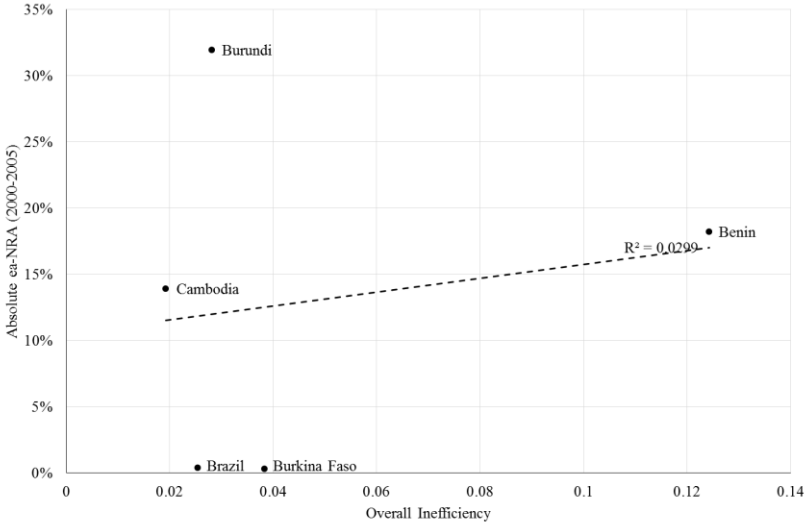


Figure 5: Overall DV inefficiency (2007-2013) and absolute ea-NRA (2000-2005)

a. Rice



b. Wheat



c. Maize

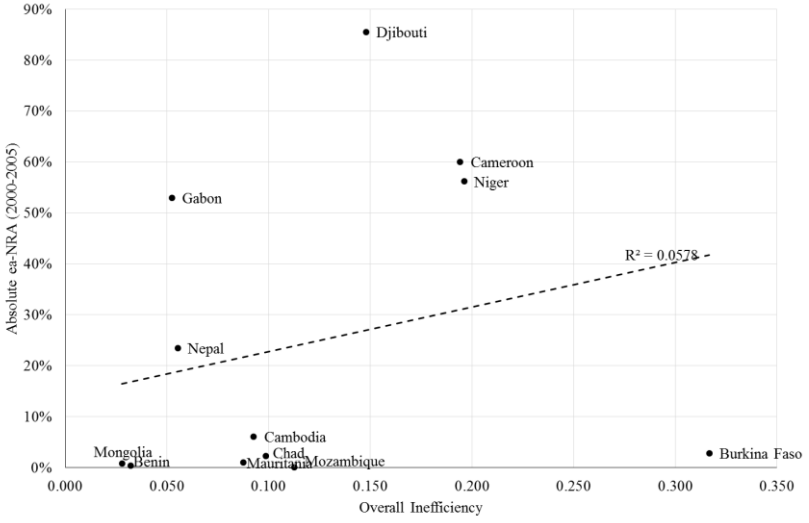
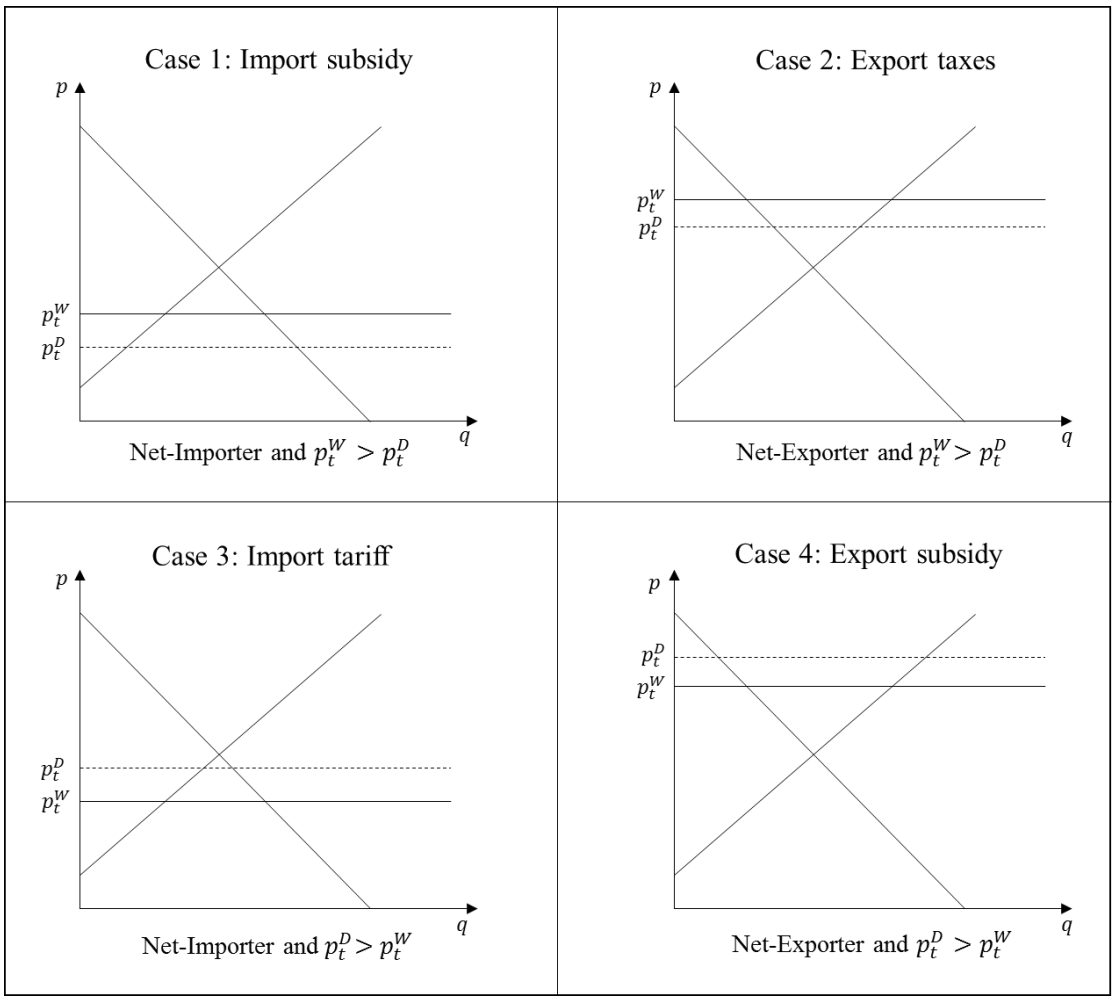


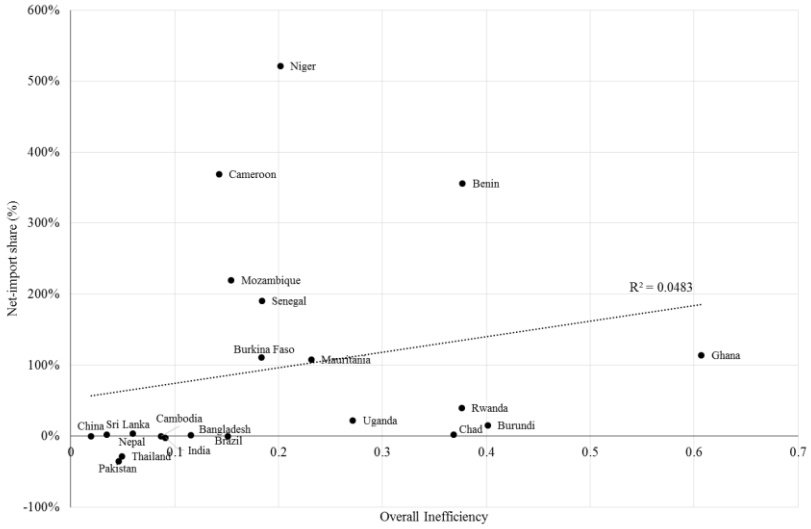
Figure 6: The four possible taxation and subsidy structures*



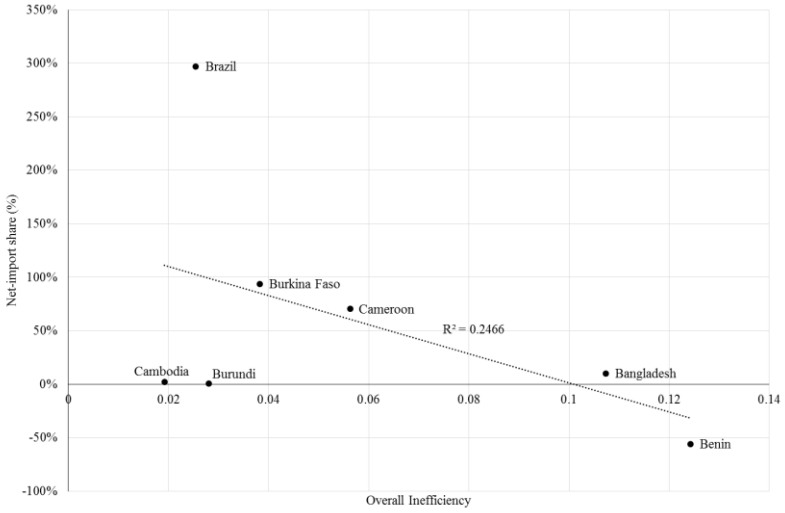
*Still needs to be revised by the authors

Figure 7: DV efficiency (2007-2013) and net-import share (2007-2011)

a. Rice



b. Wheat



c. Maize

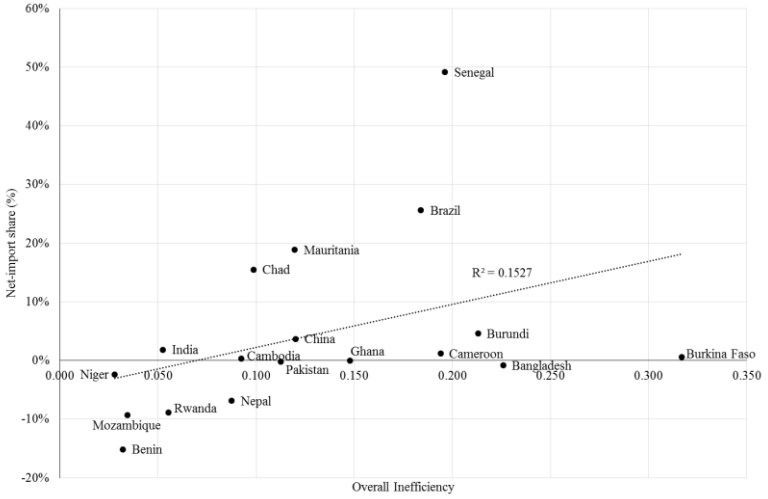
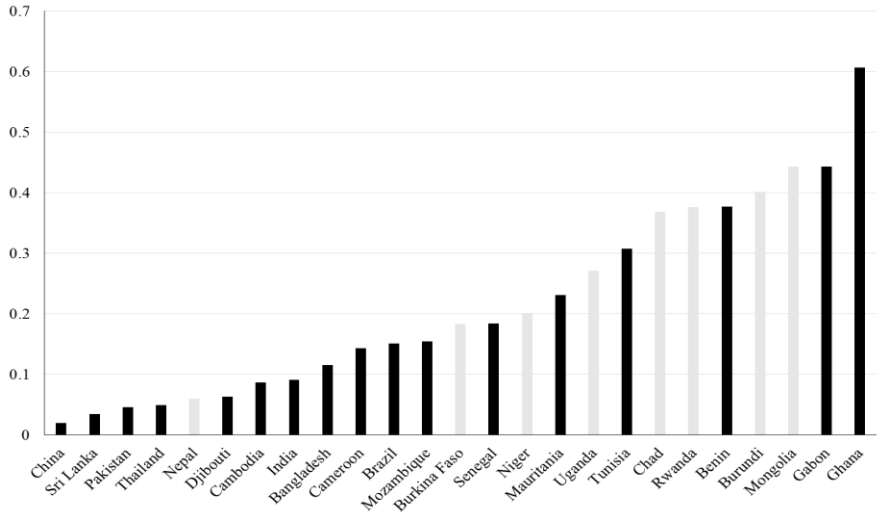
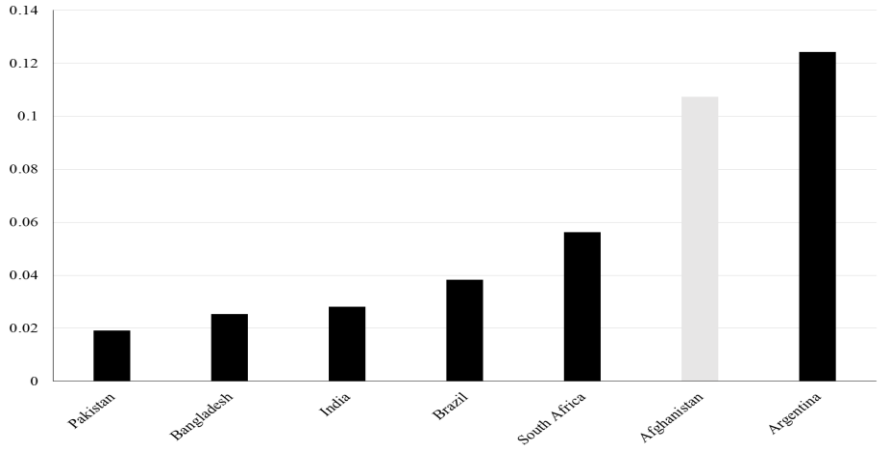


Figure 8: DV efficiency for landlocked (light grey bars) and coastal countries

a. Rice



b. Wheat



c. Maize

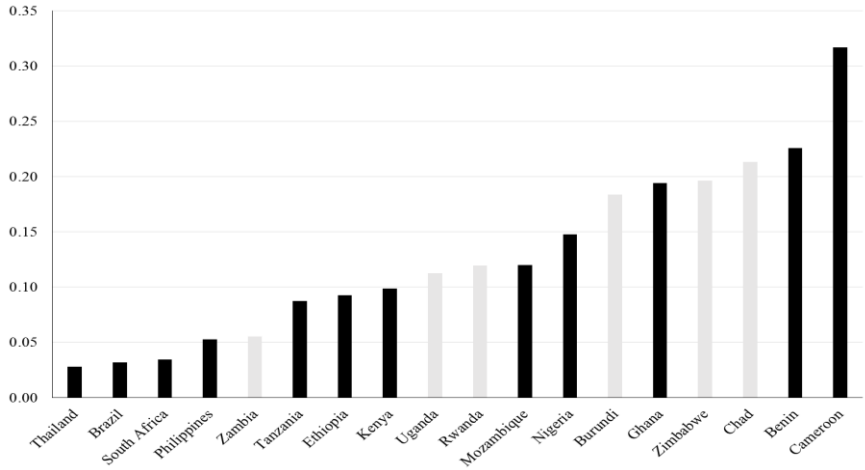


Table 1: Two-Sample T-Test Assuming Unequal Variances

a. Rice

	Import/Export Subsidies	*Import/Export Tariffs*
Mean Overall Inefficiency	0.106	0.274
Variance	0.014	0.024
Observations	8	13
Hypothesized Mean Difference	0	
df	18	
t Stat	-2.795	
P(T<=t) one-tail	0.006	
t Critical one-tail	1.734	
P(T<=t) two-tail	0.012	
t Critical two-tail	2.101	

b. Wheat

	Import/Export Subsidies	*Import/Export Tariffs*
Mean Overall Inefficiency	0.031	0.067
Variance	0.000	0.003
Observations	3	3
Hypothesized Mean Difference	0	
df	2	
t Stat	-1.161	
P(T<=t) one-tail	0.183	
t Critical one-tail	2.920	
P(T<=t) two-tail	0.365	
t Critical two-tail	4.303	

c. Maize

	Import/Export Subsidies	*Import/Export Tariffs*
Mean Overall Inefficiency	0.129	0.128
Variance	0.008	0.004
Observations	11	7
Hypothesized Mean Difference	0	
df	16	
t Stat	0.030	
P(T<=t) one-tail	0.488	
t Critical one-tail	1.746	
P(T<=t) two-tail	0.976	
t Critical two-tail	2.120	

Table 2: Regression results (OLS)

	Coefficients	*Standard Error*	*P-value*
Absolute Ex-ante NRA	0.212	0.118	0.085
Taxation indicator	-0.062	0.051	0.234
Intercept	0.113	0.033	0.002
R-Square	0.120		
Observations	28		

Table 3: Regression results (OLS with commodity fixed effects)

	Coefficients	*Standard Error*	*P-value*
Absolute Ex-ante NRA	0.212	0.118	0.085
Taxation indicator	-0.057	0.051	0.277
Maize dummy	-0.045	0.052	0.395
Wheat dummy	-0.107	0.064	0.107
Intercept	0.149	0.040	0.001
R-square	0.218		
Observations	28		

Table 3: Results OLS regression controlling for the net-import status and being landlocked

	Coefficients	*Standard Error*	*P-value*
Absolute Ex-ante NRA	0.145	0.114	0.218
Taxation indicator	0.001	0.056	0.989
Net-Import share	0.032	0.031	0.310
Landlocked	0.119	0.056	0.046
Maize dummy	-0.060	0.050	0.245
Wheat dummy	-0.095	0.061	0.132
Intercept	0.101	0.044	0.033
R-square	0.377		
Observations	28		

Proof of the truthfulness of the contribution schedules

Define L as the set of lobby groups with L = {c,p}, p^{DO} as the optimal price, and C_j^O as the optimal contribution schedules tendered by lobby group j. Following Lemma 2 of Bernheim and Whinston (1986) and Proposition 1 of Grossman and Helpman (1994), $(\{C_j^O\}_{j \in L}, p^{DO})$ is a sub-game perfect Nash equilibrium of the price setting game if and only if the following conditions are fulfilled:

a) C_j^O is feasible for all $j \in L$

b) p^{DO} maximizes $\alpha^c C_c(p^{DO}) + \alpha^p C_p(p^{DO}) + W(p^{DO})$

c) p^{DO} maximizes $\Pi_k(p^D) - C_k^O(p^D) + \alpha^c C_c(p^D) + \alpha^p C_p(p^D) + W(p^D)$ for every $k \in L$ with $\Pi_c(p^D) = CS(p^D) - \frac{\delta}{2}(p^D - \bar{p}^W)^2 + \gamma^C(p^D - p^W)(D(p^D) - S(p^D))$ and $\Pi_p(p^D) = \pi(p^D) - \frac{\mu}{2}(p^D - \bar{p}^W)^2 + \gamma^P(p^D - p^W)\big(D(p^D) - S(p^D)\big)$.

d) For every $k \in L$ there exists a p_t^{Dk} that maximizes $C_c(p^D) + \alpha^p C_p(p^D) + W(p^D)$ such that $C_k^O(p^{Dk}) = 0$.

From condition (c) we derive the following first order condition:

$$\frac{\partial \Pi_k(p^D)}{\partial p^D} - \frac{\partial C_k^O(p^D)}{\partial p^D} + \alpha^c \frac{\partial C_c(p^D)}{\partial p^D} + \alpha^p \frac{\partial C_p(p^D)}{\partial p^D} + \frac{\partial W(p^D)}{\partial p^D} = 0 \qquad \text{(A1)}$$

Government maximization of the objective function as defined in (b) requires the following first order condition:

$$\alpha^c \frac{\partial C_c(p^D)}{\partial p^D} + \alpha^p \frac{\partial C_p(p^D)}{\partial p^D} + \frac{\partial W(p^D)}{\partial p^D} = 0 \qquad \text{(A2)}$$

Taken together, condition (A1) and (A2) imply

$$\frac{\partial \Pi_k(p^D)}{\partial p^D} = \frac{\partial C_k^O(p^D)}{\partial p^D} \qquad \forall\, k \in L \qquad \text{(A3)}$$

Condition (A3) shows that the contribution schedules are locally truthful around p^{Dk}. That is, each contribution schedule is set by the consumer or producer lobby in a way

that the marginal change in the contribution is equal to the marginal change in consumer utility or producer profits following from a change in domestic price.

Proof : Show that $|\sigma| \geq |\tau|$

There are only two cases where the budgetary effect might wipe out the direct effects of lobbying on the distortions i.e. when the county is subsidizing imports or exports.

Case 1:

Suppose that a country is subsidizing imports. So, imports are larger than exports and the domestic price is lower than the international price. Since the domestic price is lower than the international price, we know that in our model the consumer lobby must be stronger than the producer lobby.

➔ $|\sigma| \geq |\tau|$

➔ $|\alpha^C D(p^D) - \alpha^P S(p^D)| \geq |[\alpha^c \gamma^c + \alpha^p \gamma^p](D(p^D) - S(p^D))|$

➔ If $\alpha^C = 1$ and $\gamma^c = 1$

$$|D(p^D)| \geq |(D(p^D) - S(p^D))|$$

$$|D(p^D)| \geq |D(p^D)| \ -|S(p^D)|$$

$$|S(p^D)| \geq 0$$

➔ If $\alpha^C = 1$ and $\gamma^c = 0$

$$|D(p^D)| \geq 0$$

➔ If $\alpha^C = 0{,}5$

$$|0.5D(p^D) - 0.5S(p^D)| \geq |0.5\ (\gamma^c + \gamma^p)(D(p^D) - S(p^D))|$$

$$|0.5(D(p^D) - S(p^D))| \geq |0.5\ (D(p^D) - S(p^D))|$$

Case 2:

Suppose that a country is subsidizing exports. This means that exports are larger than imports and that the domestic price must be higher than the international price. Since the domestic price is higher than the international price, we know that in our model the producer lobby must be stronger than the consumer lobby.

➔ $|\sigma| \geq |\tau|$

➔ $|\alpha^C D(p^D) - \alpha^P S(p^D)| \geq |[\alpha^c \gamma^c + \alpha^p \gamma^p](D(p^D) - S(p^D))|$

➔ If $\alpha^p = 1$ and $\gamma^p = 1$

$|-S(p^D)| \geq |(D(p^D) - S(p^D))|$

$|S(p^D)| \geq |D(p^D)| - |S(p^D)|$

Since exports are larger than the imports we know that $S(p^D) \geq D(p^D)$

$|S(p^D)| \geq 0 > |D(p^D)| - |S(p^D)|$

➔ If $\alpha^p = 1$ and $\gamma^p = 0$

$|-S(p^D)| \geq 0$

$|S(p^D)| \geq 0$

➔ If $\alpha^p = 0{,}5$

$|0.5D(p^D) - 0.5S(p^D)| \geq |0.5\ (\gamma^c + \gamma^p)(D(p^D) - S(p^D))|$

$|0.5(D(p^D) - S(p^D))| \geq |0.5\ (D(p^D) - S(p^D))|$

Data Appendix

Rice	Domestic price
Bangladesh	Dhaka, Rice (coarse), Wholesale, (USD/Kg)
Benin	Cotonou, Rice (imported), Retail, (USD/Kg)
Brazil	National Average, Rice (paddy), Wholesale, (USD/Kg)
Burkina Faso	Dori, Rice (imported), Wholesale, (USD/Kg)
Burundi	Bujumbura, Rice, Retail, (USD/Kg)
Cambodia	Phnom Penh, Rice (Mix), Wholesale, (USD/Kg)
Cameroon	Douala, Rice, Retail, (USD/Kg)
Chad	N'Djamena, Rice (imported), Retail, (USD/Kg)
China	Hunan, Rice (Indica, first quality), Wholesale, (USD/Kg)
Djibouti	Djibouti, Rice (Belem), Wholesale, (USD/Kg)
Gabon	Libreville, Rice, Retail, (USD/Kg)
Ghana	Accra, Rice (imported), Wholesale, (USD/Kg)
India	New Delhi, Rice, Wholesale, (USD/Kg)
Mauritania	Nouakchott, Rice (imported), Retail, (USD/Kg)
Mongolia	Ulaanbaatar, Rice, Retail, (USD/Kg)
Mozambique	Maputo, Rice, Retail, (USD/Kg)
Nepal	Kathmandu, Rice (coarse), Retail, (USD/Kg)
Niger	Niamey, Rice (imported), Wholesale, (USD/Kg)
Pakistan	Karachi, Rice (basmati), Retail, (USD/Kg)
Rwanda	Kigali, Rice, Wholesale, (USD/Kg)
Senegal	Dakar, Rice (imported), Retail, (USD/Kg)
Sri Lanka	Colombo, Rice (white), Retail, (USD/Kg)
Thailand	Bangkok, Rice (5% broken), Wholesale, (USD/Kg)
Togo	Lomé, Rice (imported), Retail, (USD/Kg)
Tunisia	National Average, Rice, Retail, (USD/Kg)
Uganda	Kampala, Rice, Wholesale, (USD/Kg)

Wheat	Domestic price
Afghanistan	Kabul, Wheat, Retail, (USD/Kg)
Argentina	Buenos Aires, Wheat, Wholesale, (USD/Kg)
Bangladesh	National Average, Wheat, Wholesale, (USD/Kg)
Brazil	National Average, Wheat, Wholesale, (USD/Kg)
India	New Delhi, Wheat, Wholesale, (USD/Kg)
Pakistan	Karachi, Wheat, Retail, (USD/Kg)
South Africa	Randfontein, Wheat, Wholesale, (USD/Kg)

Maize	**Domestic price**
Benin	Cotonou, Maize (white), Retail, (USD/Kg)
Brazil	National Average, Maize (yellow), Wholesale, (USD/Kg)
Burundi	Bujumbura, Maize, Retail, (USD/Kg)
Cameroon	Douala, Maize, Retail, (USD/Kg)
Chad	N'Djamena, Maize, Retail, (USD/Kg)
Ethiopia	Addis Ababa, Maize, Wholesale, (USD/Kg)
Ghana	Accra, Maize, Wholesale, (USD/Kg)
Kenya	Nairobi, Maize, Wholesale, (USD/Kg)
Mozambique	Maputo, Maize (white), Wholesale, (USD/Kg)
Nigeria	Kano, Maize, Wholesale, (USD/Kg)
Philippines	National Average, Maize (yellow), Wholesale, (USD/Kg)
Rwanda	Kigali, Maize, Wholesale, (USD/Kg)
South Africa	Randfontein, Maize (white), Wholesale, (USD/Kg)
Thailand	Bangkok, Maize, Wholesale, (USD/Kg)
Uganda	Kampala, Maize, Wholesale, (USD/Kg)
United Republic of Tanzania	Dar es Salaam, Maize, Wholesale, (USD/Kg)
Zambia	National Average, Maize (white), Retail, (USD/Kg)
Zimbabwe	Harare, Maize, Retail, (USD/Kg)