Domestic support and border measures: some instruments to reduce vulnerability of food security to trade in developing countries

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DOMESTIC SUPPORT AND BORDER MEASURES: SOME INSTRUMENTS TO REDUCE VULNERABILITY OF FOOD SECURITY TO TRADE IN DEVELOPING COUNTRIES

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Abstract

The novelty of this paper is to use national rate of assistance (NRA) to assess the impact of domestic support on food security vulnerability to trade. We first build a theoretical framework linking the vulnerability of food security to trade and national policy intervention in agriculture. Second, we measure the impact of national policy responses to 2008 price surge using the NRA on importable food products for 42 countries over the period 1995-2010. Our results suggest that most developing countries have used their possibility to play with the NRA level to compensate the effects of the 2008 food price surge.

Keywords: national rate of assistance, food security, exchange rate, food trade.

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Introduction

Food security is a major concern, especially for developing countries where a large percentage of the population lives in rural areas and the agricultural sector represents a substantial weight in the economy. The food security issue has come to the fore in recent years with the 2007-2008 food crisis and agricultural price volatility. For decades before, the focus was more on producers with lower incomes due to lower agricultural price trends. The 2007-2008 price hike turned attention to poor consumers as food riots erupted in many developing countries. Low-income countries are particularly vulnerable to agricultural price surges. That is why the WTO Ministerial Conference of 7 December 2013 in Bali decided to raise a negotiation on an agreement for the issue of public stockholding for food security and, in the interim, authorised, for food security reasons and under conditions, developing countries to provide support for traditional staple food crops (WTO, 2013).

First coined in the mid-1970s, food security is a multi-dimensional concept as shown by the many attempts to define it (Maxwell, 1996; Smith, 1998; Clay, 2002). Food security has been analysed at many levels (individual, household, regional, national and global) over time, but food security at one level does not guarantee food security at another level. According to the FAO, “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life,” (World Food Summit, 1996). This definition includes four components: physical availability, economic access, stability and adequate utilisation. Von Diij and Meijerink (2014) raised a review of major global food security studies from 2000 to 2013. Thew show that the majority of the scenarios only deal with two of the four dimension of food security: food availability and food accessibility while food utilisation and stability are largely ignored.

Diaz-Bonilla et al. (2000) take the traditional definition of food security and propose a conceptual framework for food security, adapted from Smith (1998), which displays the multiple links and interactions between trade and food security at each level (from individual to global level). Diaz-Bonilla and Ron (2010) demonstrate the key role played in national food availability by: i) agriculture, a major sector in most developing countries where food security is at risk; ii) domestic agricultural and food trade policies prompting agricultural price deviations that have opposite effects on net buyer *versus* net seller households; and iii) trade policies in developed and developing countries that affect the domestic and foreign agricultural markets, since WTO regulations have little influence on the use of trade policy tools. They also suggest considering the positive effects on employment and poverty alleviation of suitable macroeconomic policies in other areas such as agricultural, financial, human and institutional concerns.

The world agricultural price surge in 2007-2008 showed that developing countries, particularly in Africa, are constantly at risk of chronic food crisis. Food riots, rocketing prices and concerns about the future effects of climate change have led some to claim that food security is improved by agricultural trade liberalisation, because only trade can offset local market shortcomings and provide consumers with commodities at low prices. Timmer (2010) suggests that the best way to prevent food crises in the long run is to invest in “agricultural productivity and policies on behalf of stable food production and prices” rather than “trying to cope afterwards with the food crisis impact on the poor."[1] To be more specific, agricultural and food imports play a key role in food security in low-income countries. Indeed, dependence on imports for food may raise some food insecurity in the case of sudden price hike putting up the national food bill. The national state of food availability in the form of food imports and domestic food production is therefore crucial information. Analysing the stability of food availability regards to domestic trade policies of importing countries is the core of the present paper.

Following Diaz-Bonilla et al. (2000), this contribution aims to shed light on the vulnerability of food security to trade at national level. Section 1 analyses the economic links between national vulnerability of food security and different forms of policy interventions in agriculture. Those relationships are simply formalized using the Bonilla index as indicator of vulnerability of food security to trade. Second, we confront this theoretical framework to empirical data in order to understand the importance of national policy responses to 2008 price surge. Hence section 2 presents both available data and the sample of developing countries that have been analyzed and the used method. The aim is to explain the behavior of developing countries in case of agricultural price surge that have largely used state intervention in agricultural sector, and particularly relative to importable commodities. Main results are reported in section 3 before concluding.

1 Agricultural assistance and food security

1.1. Effects of border and domestic measures on agricultural distortions

National trade policies cover border import and export taxes (tariffs) and subsidies. The effects of such trade policies on domestic supply, imports and the economic welfare of producers and consumers are well known (Krugman et al., 2012): these tools impact on the relative competitiveness of domestic production compared with the world market. A protective policy (high agricultural tariffs) has positive effects on domestic supply, but negative impacts on domestic consumers. Given that agricultural commodities are a food staple, such a policy applied to the agricultural sector is conducive to self-sufficiency, but may not promote food security where domestic supply is not sufficient or not suited to the domestic population's food needs. At the same time, applied tariffs (resp. subsidies) represent resources (resp. costs) for national budgets. This impact on government revenues may contribute to (resp. threaten) the funding of domestic policies that directly or indirectly promote an increase in household incomes and hence individual food security or that promote national investment in health and education. An open market (low or zero tariffs) is positive for urban consumers, but could discourage domestic producers from developing their production supply if they cannot compete with international competition. So an open market has a positive effect on food security in that it facilitates domestic access to international agricultural supply, but it can also have a negative impact on domestic supply and increase food dependence on imports, which becomes a serious problem in the case of high world food prices and price surges.

Agricultural domestic support measures are also taxes (if negative) or subsidies (if positive) applied to outputs or inputs. Like border measures, positive coupled domestic support (price support or production payments) introduces a gap between a higher domestic price and a lower world price. This is not the case with decoupled domestic support, which is not expected to have such a distortive effect on agricultural prices. As a result, positive domestic

[1] A third view defended by the food sovereignty movement is that long-term food security cannot depend on food imports, but must be built on the development of domestic production with enough barrier protection to shelter it from world price fluctuations and unfair trading (Laroche Dupraz and Postolle, 2013).

support, if coupled, has similar effects to border tariff protection, i.e. a positive impact on domestic supply and a negative effect on domestic demand. However, the impact on government revenue is not the same: price support is directly financed by domestic consumers, while subsidies are charged to the national budget.

Positive domestic support and tariff protection to encourage domestic supply may both have a negative distortive impact on the world price. This is why the use of border measures and domestic support measures has been regulated by the WTO in the agricultural sector since the Uruguay Round Agricultural Agreement (1994) in order to limit the negative impact of agricultural support on world agricultural prices. However, although WTO rules are binding on major developed countries, which have had to reform their agricultural policies to comply, most developing countries are not similarly bound for two reasons. First, most developing countries have known very low agricultural support levels (often even negative in the 1970s or 1980s). Second, WTO reduction commitments for developing countries are much lower than for the developed countries, and the recent WTO Ministerial Decision confirms this differential treatment at middle term for food security purposes (WTO, 2013). Note that WTO regulations are only designed to counter negative agricultural world price distortions. There are no rules to restrict support measures that have positive effects on world prices, such as export restraints or import subsidies.

1.2. Measuring global agricultural support

Agricultural support points to the impact of general government measures to support agricultural producers' earnings by raising domestic prices vis-à-vis world market prices (in the form of domestic price support and import tariffs) and by granting direct and indirect subsidies to the agricultural sector. There are a number of national agricultural support indicators. The OECD calculates annual Producer Support Estimates (PSEs) for OECD members. The PSEs measure the value of annual transfers to agricultural producers across all support policy measures.[2] PSEs have been assessed with great accuracy and are updated annually for the OECD countries and more recently for the emerging economies. Yet PSEs are calculated on the basis of agricultural policy only.

The World Bank has also estimated agricultural incentive distortions more broadly by assessing the rate of assistance for a large panel of countries. This calculation is fairly similar to the PSE in its consideration of agricultural policy, but it is also designed to factor in the indirect effects of other sector policies (e.g. industrial tariffs) and macroeconomic policies (e.g. exchange rate distortion) on the agricultural sector. Krueger et al. (1988) hence estimate the impact on agriculture of general and agricultural policies put in place by 18 developing countries in different geographic areas over the 1975-1984 period. The direct effect is measured by the difference between the producer price and the border price adjusted for transport, storage, distribution and other marketing costs. The indirect effect includes the impact of fiscal policies, industrial protection policies and the overvaluation of the exchange rate, which distort agricultural product prices compared with other product prices. The authors find that, in almost all cases, the combined direct effects are equivalent to a tax on exportable products (approximately 11% on average) and a subsidy for imports (approximately 20% on average). The indirect effects also tax agriculture (approximately 27%) and dominate the direct effects, even when these direct effects are directed towards helping the domestic

[2] The Aggregate Measurement of Support (AMS), on which WTO members' domestic support reduction commitments are based in agricultural negotiations (amber box), is inspired by the same logic as the PSE, but excludes from its calculation decoupled support and the minimum authorised support "*de minimis*" i.e. 5% of agricultural production for developed countries and 10% for developing countries. AMS is a political indicator decided on by WTO member states. To have an idea of the differences between PSE and AMS to assess agricultural support using the examples of United States, China and Brazil, see Tokgoz et al. (2014).

agricultural sector. Anderson (2009, 2010) coordinated a huge survey for the World Bank in 2009 to evaluate the nominal rate of assistance (NRA) trend in 75 developing and developed countries for a number of periods ranging from 1955 to 2006-2007. He notes that from 1975-1979 to 2000-2004, much progress was made by reducing the anti-agricultural and anti-trade biases of policy especially in Africa: substantial reforms reduced the burden of taxation on export cash crops in particular (cocoa, coffee and cotton), groundnuts, beef, rice and sugar. The last updated NRA data (Anderson and Nelgen, 2012) add six developed countries and three additional years (2008-2010), taking in the 2008 price surge year. In this updated database, the only exchange rate-induced indirect effect covered is the case where a government imposes and manages to maintain a different exchange rate for imports and exports that actually has an especially distortive effect on the agricultural sector. The "straightforward" overvaluation is disregarded, unlike in previous calculations, because the authors consider that such an overvaluation has a similar effect on imports and exports of all products and that the particular impact on agriculture is negligible.

However, the links between domestic policy and national food security indicators need to be analysed in order to understand how the determinants of food security interact, in particular by differentiating market context (falling, low *versus* rising, high agricultural prices) and national agricultural trade position (net food importer/exporter).

1.3. The Bonilla index and its determinants

Diaz-Bonilla et al. (2000) put that the ratio of national food import expenditure to the value of total exports is a useful indicator of national access to the world food supply (hereafter the Bonilla Index).

$$BI = \frac{m^{value}}{X^{value}} = \frac{m \cdot p_m}{X \cdot p_X} \qquad (1)$$

with m^{value}: value of food imports; X^{value}: value of total exports;

m: quantity of food imports; X: quantity of total exports;

p_m, p_X : domestic aggregated price (in local currency) for food imports (in foreign currency) and for total exports (in local currency).

This Bonilla Index (BI) is a consistent indicator of the national capacity to finance food imports from exports. In this regard, it is an interesting indicator of the vulnerability of food security to trade in developing countries, especially for net food importing countries. This index is sensitive to variations in:

- The volumes of food imports and total exports, because food imports point to national food needs not covered by domestic production and total exports are indicative of the country's trade performance and competitiveness;
- The value of food imports and total exports; these values depend on world price trends and their effect on the local currency via the exchange rate.

The Bonilla Index assessment finds that food security is less vulnerable to trade when the BI decreases and more vulnerable when the BI increases. Contrary to the food trade position (food net importer/exporter), the BI considers the relative food import bill to total export earnings, hence pointing up the role of international trade and its effects on national food security. In the following analysis, we focus on the food sector, assuming the relative stability, *ceteris paribus*, of the total export sector, at least in the short term.

In order to highlight world food prices in the equation (in foreign currency), we introduce the exchange rate. With the BI formula written this way, we can analyse the effects of food prices and exchange rate deviations on BI.

$$BI = \frac{m \cdot P_m \cdot E_I}{X \cdot p_X} \qquad (2)$$

with P_m: world price for food imports (in foreign currency);

E_I : nominal exchange rate, i.e. the number of national currency units needed for one unit of foreign currency: 1 foreign currency unit = E_I domestic currency units.

Border measures (export and import taxes and subsidies) and domestic support have direct impacts on the BI due to the gap between world and domestic food prices. The Nominal Rate of Assistance (NRA) index on importable food products, as calculated by the World Bank (Anderson, 2009; Anderson and Nelger, 2012), provides information on the effects of agricultural policy domestic support and border measures.

$$BI = \frac{m \cdot P_m \cdot (1 + NRA^m) \cdot E_I}{X \cdot p_X} \qquad (3)$$

with NRA^m: Nominal rate of assistance assessed for importable food products (in %)

This equation highlights the role of the several determinants of the vulnerability of food security to trade identified in previous sections: world price P_m (and its potential volatility), the level of national or trade policies applied to the food imports sector (NRA^m), and the exchange rate policy with the nominal exchange rate E_I.

1.4. Impact of NRA^m and E_I deviations on BI.

In the very short term, in an environment of relative agricultural price stability, we observe that:

- In the event of the depreciation (resp. appreciation) of the local currency to the foreign currency, E_I rises (resp. falls). The BI then automatically rises due to the increase (resp. decrease) in the cost of food imports expressed in the local currency, increasing (resp. decreasing) the vulnerability of food security to trade.

- If NRA^m increases (resp. decreases), for example due to higher (resp. lower) food import tariffs or domestic food production subsidies, the BI automatically increases (resp. decreases) due to the price rise for imported food, increasing (resp. decreasing) the vulnerability of food security to trade.

In the longer term, the estimated effects of E_I and NRA^m on food security vulnerability to trade are not so clear because other local currency depreciation (resp. appreciation) or an increase (resp. decrease) in agricultural support may improve (resp. undermine) domestic agricultural competitiveness and stimulate (resp. cut back) domestic food production, having a negative (resp. positive) impact on food import demand *m* and driving down (resp. driving up) the BI by reducing (resp. increasing) food dependence on imports.

1.5. Impact of price volatility on food security

In 2000, the downward trend in world agricultural prices started to shift. Global demand rose more sharply than supply, slowing the downward trend in agricultural prices from 2000 to 2007. Suddenly, agricultural prices spiralled in 2007-2008, triggering hunger riots in a number of developing countries in 2008.

The price volatility debate was reopened following the 2007-2008 price surge as farmers' earnings and consumer purchasing power suddenly looked uncertain, putting food security at risk. Recent years have seen two peaks in world prices for cereals and other major food commodities: once in 2007-2008 and a second time in 2010-2011. And prices have generally remained at a higher level than during the period from the 1980s to the early 2000s. There may be a number of reasons for this trend such as a growing imbalance between food demand and supply, the rise in oil prices, exchange rate movements and trade restrictions.

Price hikes can have mixed effects in terms of food security. High food prices could be viewed as an opportunity for producers. They could drive an increase in food production, improving the physical availability of and access to food and raising producers' incomes. Yet at the same time, the cost of consumption goes up such that, under the hypothesis of stable food aid, economic access to food is reduced (Diaz-Bonilla and Ron, 2010). This phenomenon is more of a concern in developing countries where a large proportion of household income goes on food. Households in these countries therefore face a drop in real income and greater uncertainty should agricultural prices suddenly shoot up. Moreover, many producers are net food buyers (being mostly small farmers, livestock producers and artisanal fishers in the developing countries). The main impacts of price volatility on producers and consumers are seen in the uncertainty surrounding income, investment decisions and access to food. International price fluctuations channel through to domestic markets in many ways, depending on the country (and its domestic policies) and the agricultural products concerned (Baffes and Gardner, 2003; Meyer and von Cramon-Taubadel, 2004; Greb et al., 2012). Price transmission from international prices to domestic prices can be limited for a number of reasons including previously analysed policies such as trade, exchange rate policy and other domestic policies, as well as other factors like infrastructure and transportation costs.

So rising prices may benefit producers by raising their profits, but be to the detriment of consumers by cutting their purchasing power. However, even in the case of producers, the opportunity depends on the producers' ability to really produce more. Developing countries suffer from a lack of agricultural productivity and weak infrastructures. They may face obstacles such as poor access to credit and low productivity.

The developing countries responded in different ways to the 2007-2008 price surge. Yet many chose, at least as a short-term emergency measure in response to rocketing domestic food prices and the threat to their cities' food supply, to raise imports by lifting tariffs (and even subsiding imports) and to restrict their exports with export taxes and bans (FAO, 2009). Although 2008 clearly showed that export taxes generally make food crises worse, which is why they are widely criticised by both developed and developing countries along with many international agencies (Lui and Bilal, 2009), it certainly strengthened the conviction of countries using such export taxes that it is in their best interests to retain the right to use them, in particular when the commodity is agricultural and when food security is at stake (Bouet and Laborde-Debucquet, 2010). Looking into WTO members' responses to structural food crises, Crump (2010) concludes that export restrictions would most certainly be used on a massive scale in response to cases such as climate change.

The theoretical framework presented in this section points clearly to the potential impact when a national government implements corrective policies. Changing the local currency value and/or the level of domestic support theoretically offsets the effects of an agricultural price deviation. Equation (3) actually shows that by rising (resp. reducing) E_I and/or NRA^m, it is theoretically possible to offset a fall (resp. rise) in P_m and keep BI stable. Our analysis in this paper focuses on NRA^m, although more research is needed to complete the analysis by studying the change in E_I further. The abovementioned policies adopted by importing countries in 2008 can be understood in this light: lifting import tariffs and reducing NRA^m

may offset the food price surge and limit the BI deviation so as not to damage food security vulnerability to trade. The following section analyses the 2008 food crisis in a panel of developing countries for which data are available precisely to assess the scale of using such corrective policies on importable agricultural commodities.

2 Data and method

2.1. Available Data

The World Bank's latest updated NRA data (Anderson and Nelgen, 2012) present the nominal rate of assistance (NRA) for 81 countries (including 42 developing countries) worldwide from 1955 to 2009 or 2010. The data do not cover the entire period for all developing countries, but the years 1995 (or 1996) to 2009 (or 2010) are well covered. A number of NRA aggregates are calculated (as weighted averages) such as NRA applied to tradable products, importable and exportable products, total NRA and its components: NRA due to domestic measures *vs.* NRA due to border measures. This study focuses especially on NRA applied to importable agricultural commodities (NRA^m).

The annual food import value (numerator) and total export value (denominator) are used to calculate the BI for each country. The BACI-92 database provides consistent trade data in US dollars (import and export values) at HS2, HS4 and HS6 from 1995 to 2010. The HS4 level is used to differentiate food commodities from other products so that we can calculate food import values.[3] Highly transformed products are excluded because NRA^m data are only given for agricultural products. In this paper, we consider chapters 1 to 12 of the HS4 classification (excluding chapters 5 and 6 and Code 1209[4]) as agricultural food commodities: "food imports" design agricultural food imports.Trade and NRA data are thus available for 42 developing countries from 1995 to 2010.

2.2. The Bonilla Index indicator

BI is computed from the BACI database using equation (1).

The numerator corresponds to the value of food imports, i.e. the food import bill. At this stage and using equation (3) expressed in local currency, we need to break down this food import bill into its two main components:

$$food\ imports\ bill = [m \cdot P_m \cdot (1+NRA^m) \cdot E_I] = [m \cdot P_m \cdot E_I] + [m \cdot P_m \cdot E_I \cdot NRA^m] \qquad (4)$$

Expressed in USD:

$$food\ imports\ bill = [m \cdot P_m \cdot (1+NRA^m)] = [m \cdot P_m] + [m \cdot P_m \cdot NRA^m] \qquad \text{with:} \qquad (5)$$

- ✓ $[m \cdot P_m \cdot (1+NRA^m)]$: taken directly from the BACI data on the value of food imports in USD. This term denotes the value of food imports in domestic prices (expressed in USD) potentially distorted by NRA^m, if any such exists;
- ✓ $[m \cdot P_m]$: calculated using (6) $m \cdot P_m = \dfrac{m \cdot P_m \cdot (1+NRA^m)}{(1+NRA^m)}$, with NRA^m given by the World Bank's database. The term $[m \cdot P_m]$ denotes the value of food imports in undistorted domestic prices (expressed in USD);

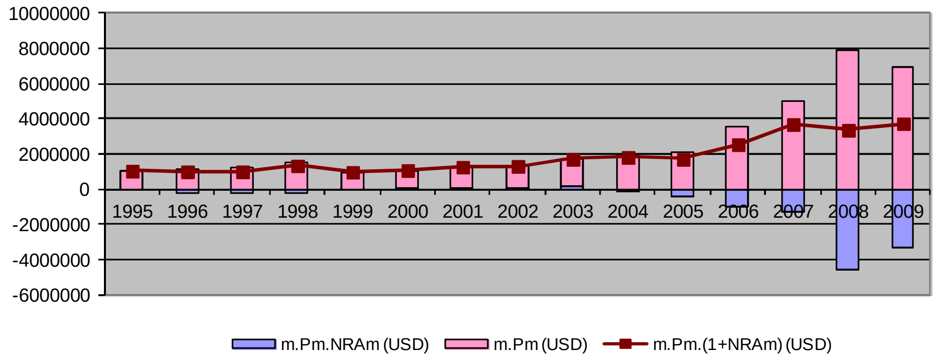
[3] The World Bank NRA database also computes the nominal exchange rate needed to convert USD trade data into local currency units, where necessary.

[4] Chapter 5 covers feathers and other animal products for non-food use, Chapter 6 covers ornamental plants and Code 1209 corresponds to seed for sowing.

- ✓ $[m \cdot P_m \cdot NRA^m]$ is then deduced using equation (5). It stands for: i) an increase in the import cost in the event of a positive NRA^m, which introduces a gap whereby the domestic price is higher than the world price, or conversely ii) a reduction in the imports bill in the event of a negative NRA^m.

These calculations are then used to compute a virtual BI that would be generated if NRA^m were zero, using $[m \cdot P_m]$ instead of $[m \cdot P_m \cdot (1+NRA^m)]$ as the numerator in the BI formula. Note that this calculation considers first that imports quantity is not modified by an NRA^m that is equal to zero, as if developing countries' import demand were totally inelastic. Second, this calculation is valid only if importing developing countries considered are small, ie. rather price takers, because in case of large importing countries, the intoduction of NRA^m would have a negative (resp. positive) effect on P_m if NRA^m is positive (resp. negative). In other words, if those one or both of those assumptions is/are not verified, calculated $[m \cdot P_m]$ overestimates the virtual food import bill without NRA^m (see annexe A).

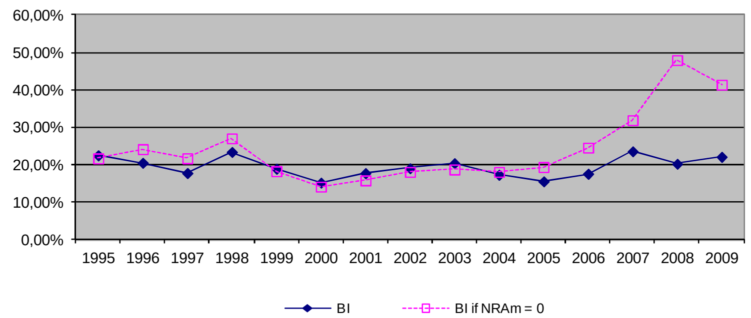
2.3. Example: the case of Bangladesh



Source: authors' calculations using World Bank and BACI data

Figure 1: Impact of NRAm on food import bill 1995-2009 in US$ thousands

In Figure 1, the red line shows Bangladesh's actual food import bill value. The pink bars indicate the value of food imports in undistorted domestic prices and the blue bars represent additional import cost if $NRA^m > 0$ or a reduction in the import bill if $NRA^m < 0$. In the case of Bangladesh, it can be seen that NRA^m is close to zero from 1995 to 2004. It is negative from 1996 to 1998 and slightly positive from 2000 to 2003 before becoming significantly negative from 2005 to 2009, especially in 2008. In this particular year, a negative NRA^m reduced the food import bill by more than half from USD 7.96 billion to USD 3.36 billion (Figure 2).



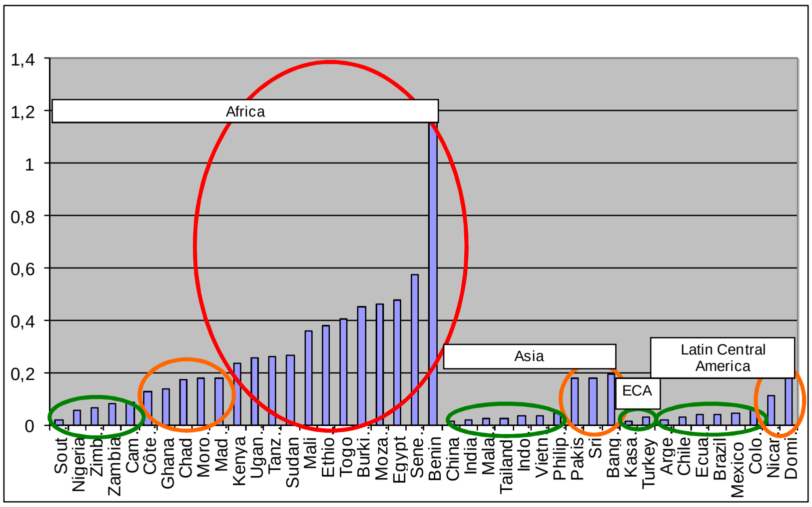
Source: authors' calculations using World Bank and BACI data

Figure 2: Bonilla index growth 1995-2009

It can be observed that the actual BI holds steady at 15.27% to 23.63% over the entire period. This relative stability is probably due to the corrective effect of NRA^m: if NRA^m had been zero throughout the period, the BI would have fluctuated between 14.18% and 47.94%, with this peak occurring precisely in 2008.

3 Results

Figure 3 presents the average BI level from 1995 to 2010 for the 42 developing countries classified by geographic area. Huge differences are observed at both inter- and intra-regional levels. Africa is found to have a large majority of countries with an average BI well above 20%[5], while other areas do not break the 20% mark and the majority of countries have a BI indicator of less than 10%.



Source: authors' calculations using World Bank and BACI data

Figure 3: 1995-2010 BI average

The case of Bangladesh is particularly striking: the use of NRA^m to offset price volatility and especially price surges seems to be effective for many developing countries. Table 1 sums up the impact of NRA^m on BI for each of the 42 developing countries across the 1995-2010 period and for 2008.

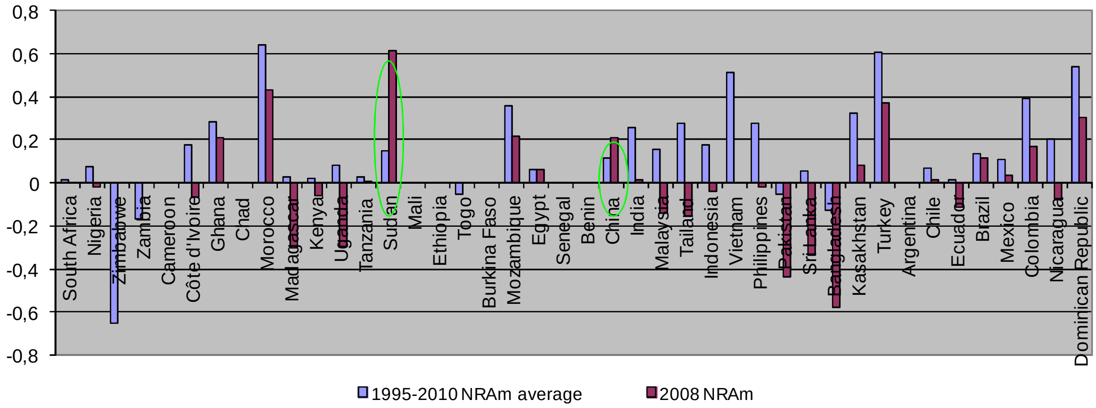
As shown by Figure 4, all countries – except Sudan and China – present a 2008 NRA^m below the 1995-2010 average NRA^m. This suggests that almost all developing countries for which data are available[6] took measures to cut their food bill by reducing the agricultural rate of assistance on importable agricultural products and even by introducing negative NRA^m, i.e. import border subsidies on agricultural commodities (Nigeria, Côte d'Ivoire, Madagascar, Kenya, Uganda, Malaysia, Thailand, Indonesia, Pakistan, Sri Lanka, Bangladesh, Ecuador and Nicaragua are in this case). For eight countries (Bangladesh, Madagascar, Pakistan, Sri Lanka, Uganda, Colombia, Malaysia and Thailand), the 2008 NRA^m is the lowest NRA^m of the 1995-2010 period, and is even negative with the exception of Colombia. For six of these seven countries with a negative 2008 NRA^m, if the 2008 NRA^m were zero, the calculated BI would be the highest of the period. In the case of the seventh country (Malaysia), it is close to the highest BI level.

[5] Note that African countries take part to custom unions like ECOWAS in West Africa. Trade integration generally aims to reduce the vulnerability of food security to trade at regional level. Analysing policy response at regional level would have more sense in such case that at national level and would merit further developments.

[6] 2008 NRA^m data are not available for Zimbabwe, Zambia and Togo.

Table 1: Summary statement of *NRA*^{m} impact on BI, 1995-2010 and year 2008 (Source: authors' calculations, from Word Bank and BACI data)

Country	1995-2010 NRAm minimum	1995-2010 NRAm maximum	1995-2010 NRAm average	2008 NRAm	deviation (%) NRAm 2008 compared to 1995-2010 NRAm average	1995-2010 BI minimum	1995-2010 BI maximum	1995-2010 BI average	2008 BI	deviation (%) 2008 BI compared to 1995-2010 BI average	2008 BI calculated if NRAm was zero	overcost versus reduction cost on 2008 food import bill due to NRAm (USD)
South Africa	-0,145	0,122	0,013	0,000	-100,00%	0,014	0,032	0,021	0,020	-6,53%	0,020	0
Nigeria	-0,277	0,456	0,076	-0,017	-122,17%	0,038	0,083	0,053	0,038	-29,77%	0,038	-57 700
Zimbabwe	-0,915	-0,339	-0,654	nd	nd	0,015	0,164	0,065	0,117	81,01%	nd	nd
Zambia	-0,490	0,046	-0,164	nd	nd	0,038	0,159	0,081	0,047	-42,30%	nd	nd
Cameroon	0,000	0,000	0,000	0,000	/	0,011	0,192	0,088	0,120	36,76%	0,120	0
Côte d'Ivoire	-0,069	0,668	0,175	-0,069	-139,60%	0,104	0,166	0,127	0,147	15,96%	0,158	-119 265
Ghana	0,046	1,108	0,285	0,212	-25,68%	0,069	0,261	0,135	0,145	7,14%	0,120	151 285
Chad	0,000	0,000	0,000	0,000	/	0,026	0,427	0,174	0,037	-78,67%	0,037	0
Morocco	0,429	1,010	0,640	0,429	-33,06%	0,147	0,222	0,178	0,192	7,87%	0,135	1 366 624
Madagascar	-0,300	0,448	0,028	-0,300	-1186,34%	0,124	0,286	0,180	0,271	50,51%	0,387	-190 888
Kenya	-0,256	0,219	0,021	-0,062	-398,23%	0,145	0,335	0,237	0,270	13,68%	0,287	-107 565
Uganda	-0,299	0,223	0,085	-0,299	-452,74%	0,153	0,437	0,258	0,268	3,77%	0,382	-232 061
Tanzania	-0,521	0,308	0,026	0,002	-90,99%	0,146	0,380	0,261	0,198	-24,44%	0,197	1 610
Sudan	-0,937	0,624	0,146	0,611	317,90%	0,119	0,570	0,268	0,150	-43,89%	0,093	736 471
Mali	0,000	0,000	0,000	0,000	/	0,181	1,972	0,356	0,210	-41,13%	0,210	0
Ethiopia	nd	nd	nd	nd	/	0,145	0,785	0,380	0,708	86,54%	nd	nd
Togo	-0,492	0,000	-0,053	0,000	-100,00%	0,206	0,734	0,406	0,320	-21,07%	0,320	0
Burkina Faso	0,000	0,000	0,000	0,000	/	0,232	0,641	0,453	0,558	23,22%	0,558	0
Mozambique	-0,052	0,694	0,357	0,215	-39,63%	0,145	1,177	0,463	0,167	-63,84%	0,138	131 025
Egypt	-0,161	0,292	0,060	0,060	-0,96%	0,255	0,723	0,479	0,315	-34,20%	0,297	646 363
Senegal	0,021	0,201	nd	nd	nd	0,480	0,702	0,573	0,672	17,37%	nd	nd
Benin	0,000	0,000	0,000	0,000	/	0,645	3,747	1,170	2,301	96,71%	2,301	0
China	0,011	0,233	0,117	0,212	81,92%	0,009	0,023	0,016	0,017	3,12%	0,016	1 154 831
India	-0,113	0,553	0,258	0,013	-94,76%	0,015	0,024	0,019	0,016	-16,24%	0,016	44 957
Malaysia	-0,140	0,445	0,152	-0,140	-192,17%	0,019	0,030	0,023	0,024	5,19%	0,028	-865 772
Tailand	-0,154	0,732	0,275	-0,154	-155,89%	0,020	0,029	0,025	0,025	-0,33%	0,029	-876 580
Indonesia	-0,210	0,731	0,173	-0,039	-122,24%	0,025	0,050	0,033	0,033	0,55%	0,034	-221 490
Vietnam	0,000	1,188	0,514	0,000	-100,00%	0,026	0,051	0,033	0,039	16,14%	0,039	0
Philippines	-0,146	0,596	0,274	-0,021	-107,48%	0,031	0,084	0,046	0,067	47,53%	0,069	-97 580
Pakistan	-0,436	0,232	-0,056	-0,436	683,16%	0,115	0,236	0,177	0,236	33,54%	0,418	-4 248 331
Sri Lanka	-0,334	0,466	0,054	-0,334	-713,91%	0,125	0,235	0,180	0,217	20,42%	0,326	-996 239
Bangladesh	-0,578	0,121	-0,125	-0,578	362,34%	0,153	0,236	0,195	0,203	3,92%	0,479	-4 595 805
Kasakhstan	0,059	1,159	0,327	0,082	-75,00%	0,012	0,025	0,017	0,015	-9,81%	0,014	69 645
Turkey	0,167	1,285	0,605	0,371	-38,67%	0,015	0,055	0,029	0,029	2,72%	0,021	1 146 022
Argentina	0,000	0,000	0,000	0,000	/	0,007	0,035	0,019	0,024	27,82%	0,024	0
Chile	0,009	0,149	0,066	0,015	-77,79%	0,019	0,045	0,030	0,029	-4,64%	0,028	27 996
Ecuador	-0,387	0,405	0,011	-0,117	-1166,39%	0,014	0,073	0,038	0,044	16,33%	0,050	-123 173
Brazil	0,037	0,303	0,134	0,118	-12,30%	0,017	0,085	0,042	0,025	-38,84%	0,023	553 760
Mexico	-0,065	0,312	0,106	0,035	-66,54%	0,038	0,055	0,044	0,051	15,36%	0,049	490 524
Colombia	0,172	0,666	0,389	0,172	-55,75%	0,029	0,107	0,059	0,050	-15,23%	0,043	310 083
Nicaragua	-0,075	0,522	0,206	-0,075	-136,33%	0,060	0,226	0,110	0,093	-15,23%	0,101	-20 080
Dominican Republic	0,040	0,943	0,542	0,304	-43,84%	0,161	0,301	0,206	0,289	39,96%	0,221	504 036

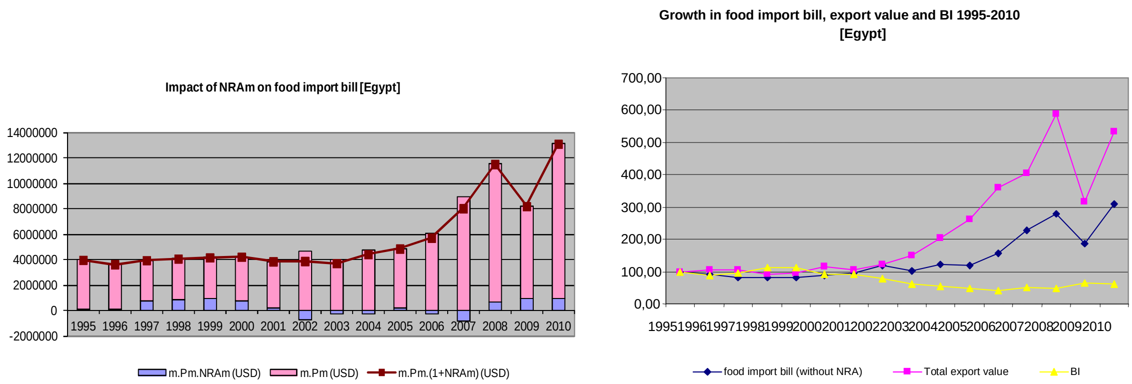


Source: authors' calculations, from World Bank and BACI data

Figure 4: 2008 NRAm compared to 1995-2010 NRAm average

Our sample includes several densely populated South East Asian countries with a sharply reduced 2008 food import bill due to NRA^m: USD 4.6 billion for Bangladesh, USD 4.2 billion for Pakistan, USD 1 billion for Sri Lanka and USD 0.9 billion for Malaysia and Thailand (Table 1). Note that this finding implies equally large costs for national revenue: the World Bank NRA data analysis actually confirms that a negative NRA^m is due to border measures. In other words, in practice, a negative NRA^m actually consists of subsidising agricultural food imports in order to reduce agricultural import prices, so it costs the government budget to maintain household purchasing power. A number of these countries (particularly Bangladesh, Pakistan and Sri Lanka) saw violent food riots in 2008, which may explain the high level of government intervention in response to political and social unrest.

From this point of view, Egypt, where particularly violent food riots erupted in 2008, is surprising in that NRA^m remained positive in 2008 and pretty much at the average NRA^m for the 1995-2010 period. Figures 5 sheds light on other elements that might explain such a paradox. The food bill rose steadily from 2000 onwards, but the Bonilla Index fell on the whole due to the fact that total export revenue increased proportionally more than the food import bill. Consequently, the BI did not leap up in 2008 compared with previous years. In the case of Egypt, the macroeconomic food security situation as reported on by the Bonilla Index was not significantly worse in 2008 than in previous years, but the food import bill was actually significantly higher than at any point previously. So if export revenues were not well redistributed to the population, this could explain the violence of the food riots in Egypt.



Figures 5: Food Security in Egypt, 1995-2010 – focus on several determinants

Conclusion

The main contribution of this paper is to shed theoretical and empirical light on the economic links between agricultural assistance, measured using the Nominal Rate of Assistance (NRA) and the vulnerability of food security to trade at national level, measured by using the Bonilla Index (BI). The novelty of this paper is to use NRA to assess the impact of domestic support on food security vulnerability to trade. We draw an overall picture of government border intervention in the agricultural sector for 42 developing countries over the 1995-2010 period and especially during the food price surge of 2008.

This paper assesses the importance to developing countries of being able to adjust the NRA level in order to moderate the BI volatility to stabilise domestic food availability, especially in the event of a food price surge. Import subsidies actually have a highly significant effect on the level of food security by sharply reducing the food import bill for households. But this kind of intervention weighs heavily on the national government's budget, possibly at the expense of other intervention policies (such as agricultural policy). This cost probably prevents poor countries from adopting a negative NRA^m. Poor countries may eventually reduce their NRA^m provided that the NRA^m is positive, but developing countries' NRAs are generally very low compared with developed countries. Moreover, as mentioned in the first part of this paper, a negative NRA drives up world agricultural prices, having a worse effect on the level of food security in poor net food-importing countries. This positive effect has not been factored into our calculations of the BI with NRA^m at zero, which consider that all developing countries were short-run price takers in 2008. Bear in mind that this assumption obviously slightly overestimates the corrective effect of a negative NRA^m on the BI.

Our findings also suggest that the NRA has to be low, if not negative, to limit national vulnerability of food security to trade. Yet our contribution absolutely does not say that. Our results refer solely to the developing countries and the very short-term perspective of the measures they put in place in response to the food price surge in 2008. Nothing is said about NRA over the long term: does (and how does) positive support to agriculture prevent from dependence on food imports and has it a positive effect on food security? This question is the core of a current econometrical work, but unfortunately results are not yet available at this time.

This work suffers from many other limits. In particular, the analysis of the food security level focuses on the BI numerator, i.e. the food import bill. So we only consider the assistance applied to importable agricultural products (NRA^m). This means that work is now needed on the BI denominator, i.e. total export value. Agricultural products account for a large proportion of total exports for most developing countries. So positive or negative assistance for exportable agricultural commodities (NRA^x) can have an effect on total export value if this share is significant. For example, during the 2008 food crisis, a number of countries introduced export bans or taxes on food commodities. These decisions will normally result in negative NRA^x being applied to exported agricultural products with a consequential positive effect on BI (and hence a negative effect on food security). Available World Bank (NRA) and BACI (trade) data could be used to complete this study by extending it to the BI denominator. Such a global analysis of the combined effects of NRA^m and NRA^x on BI could turn up clearer explanations of paradoxical situations (such as in Egypt) observed at this stage.

Moreover, analyse has to be extended at regional level to take into account economic integration like custom unions. Last but not least, the effect of the exchange rate has not been taken into account in this contribution. The combined effects of the exchange rate and NRA at short and long run will need to be analysed in the future.

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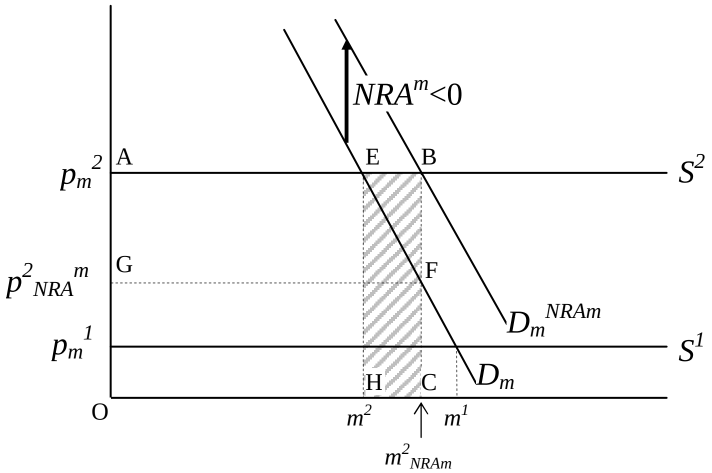
Annexe A: The limits of the calculation of virtual food import bill if NRA^m was zero

Figure A1: Limits of the calculation of virtual food import bill under the assumption of a *small* importing country



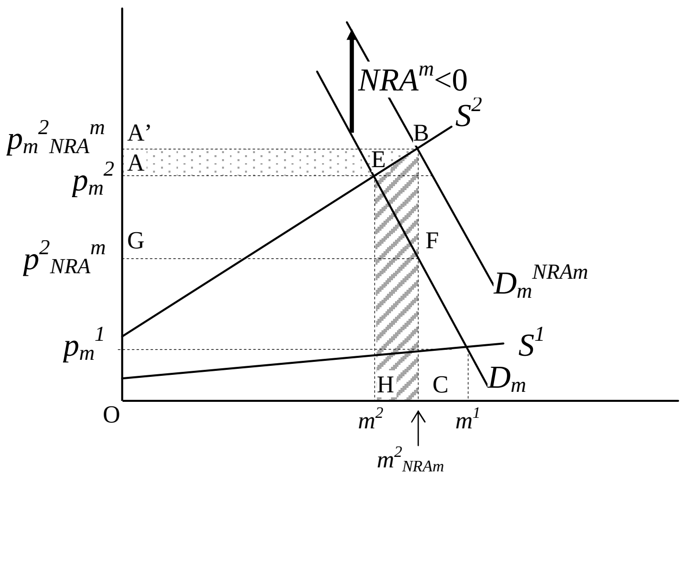
Suppose an extern chock raises the world price from p_m^1 to p_m^2. Under the assumption of small importing country with import demand D_m, imports will fall from m^1 to m^2. But if the importing country introduces a negative NRA^m (import subsidies of reduction of import tariff) to prevent from the negative effect of high world prices on domestic consumption, its new corrected import demand is represented by $D_m{}^{NRAm}$ and import quantity is $m_{NRAm}{}^2$.

BACI data give us the effective food import bill: $p^2_{NRA}{}^m \times m^2_{NRAm}$ represented by the area OGFC. Our calculation of the virtual food bill if NRA_m was zero gives: $p_m^2 \times m^2_{NRAm}$ represented by the area OABC. But actually if NRA^m was zero, imported quantity wouldn't be m^2_{NRAm} but $m^2 < m^2_{NRAm}$ and the food bill would in fact be $p_m^2 \times m^2$, represented by the area OAEH. **Hence our calculation over-estimates the virtual food import bill by the area EBCH**.

The volume m^2, which would be required to assess the level of the over-estimation, is not easily available because calculations use data aggregated in value, and corresponding disaggregated volumes of different food products can't be added together.

However, countries we consider in this paper are all developing countries and some of them are LDCs. It is not inconsistent to suppose that for most of them, their food import demands are quite inelastic (i.e., D_m quite vertical). Under this hypothesis, the import volume adjustment is negligible even in case of high prices differences, and corresponding error is minor.

Figure A2: Limits of the calculation of virtual food import bill under the assumption of a *large* importing country



BACI data give us the effective food import bill: $p^{2}_{NRAm} \times m^{2}_{NRAm}$ represented by the area OGFC. Our calculation of the virtual food bill if NRA^{m} was zero gives: $p_{m}{}^{2}{}_{NRA}{}^{m} \times m^{2}_{NRAm}$ represented by the area OA'BC. In the case of a large importing country, the over-estimation of the virtual food import bill put in light by figure A1, is still effective and is represented on figure A2 by the area EBCH. But in addition, the introduction of a negative NRA^{m} in a large importing country would distort the world price from $p_{m}{}^{2}$ to $p_{m}{}^{2}{}_{NRA}{}^{m}$. As a result, our calculation of the virtual food import bill present **an additional over-estimation represented by the area AA'B'E**.

Our calculation corresponds to both following simplified assumptions:

1. Each food importing developing country we consider is a small country in the world food market;
2. Food importing countries we consider present a quite inelastic food import demand.