Biofuel policies and the poor: an assessment of the impact of EU biofuel policies on food consumption and poverty in developing countries applying MIRAGE

Preliminary draft – please do not quote

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1. Introduction

Biofuel production has increased significantly in the last years, partly driven by developed economies policies to promote renewable energy use and reduce greenhouse emissions. While the impact of these policies on greenhouse emissions has been largely evaluated, the debate about the impact of biofuel production on food consumption, hunger and poverty in developing countries is more recent. Recent attention on this subject has been drawn by NGOs and international organizations, and the G20, in its ministerial declaration from June 2011, recognizes "the need to analyze all factors that influence the relationship between biofuels production and food availability" (G20, 2011).

The impact of an increase in biofuel production on poverty and income distribution is not straightforward. Different factors seem to be at stake, both from the demand and supply sides. As biofuel production competes for food crops with final consumers, final prices of some crops increase, such as vegetable oils. However, not all crops used for biofuel production are used for final consumption, so the effect on food prices will depend on the type of biofuel produced. On the other hand, oil prices might go down as biofuel supply increases –thus benefiting final consumers. Thus, the effect on consumers will not be homogenous, and it will depend on the share of food and energy in the households' consumption basket and the degree to which households are able to substitute goods in the consumption basket. As poor households usually spend a higher proportion of their consumption basket in food and face less substitution possibilities, they are more vulnerable to change in food prices. Volatility of food prices also has distributional impacts, as poor households have less capacity of storing goods when their prices are low.

On the income side, biofuel production benefits farmers, through an increase in agriculture production and in the remuneration of production factors, such as land and rural labor. However, the impact among producers is not homogenous, and again the gains are expected to be smaller for small holders, as their property rights on land are usually more badly defined, and their capacity to increase yields is constrained.

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Empirical evaluations to assess the net impact on the poor are still scarce. The few ones, mostly applying CGE models, vary in their conclusions, because the differences in the way they model the biofuel production sector and its linkages with other sectors and the scenarios they simulate. Most studies do find that while biofuels production benefits a segment of population, mainly agriculture farmers, it hurts urban population as crop prices tend to rise.

Hertel (2009) using the GTAP-POV module (more extensively presented in Hertel et al., 2011), analyze the impact of biofuel mandates in EU and US on poverty in 16 developing countries. As expected, the implementation of mandates boosts food prices and agriculture returns. This determines a differentiated impact on households according to their main sources of income. For households that perceive their income from agriculture self-employed activities and households with diversified income sources, poverty falls, but for wage, transfer and non-agriculture self-employed earning households, poverty rises, as the negative spending effect dominates. Between regions, the impact is also differentiated: poverty increases in most countries in Latin America and falls in Asia.

Cororator et al (2010) use a CGE model (ENVISAGE model) with a biofuel module and GIDD tool to trace impact on household surveys in 116 countries. They simulate an increase in biofuel targets in India, Thailand and the EU (in the baseline the targets for Brazil and United States are also increased substantially). They find an increase in food prices, which is higher for developing than for developed countries. Unskilled rural labor wages increase, which triggers migration to agriculture and rural sector. In spite of this, there is a slight increase in global poverty, explained mainly by increase of poverty in SSA and South Asia. Poverty falls in Latin America and East Asia.

Applying a single country dynamic CGE model for Mozambique combined with microsimulation, Channing et al. (2009) analyze the impact of biofuel production increase on poverty in this country, evaluating on one hand the increase in ethanol from sugarcane and on the other hand biodiesel from jatropha. The find that biofuel expansion is generally pro-poor, but the effects are different depending on the crop production expanding. Jatropha production is more intensive in the use of unskilled labor, so it has a stronger pro-poor effect. Their results highlight the need to analyze carefully the labor intensities of the production methods employed on biofuel crops.

This paper seeks to contribute to this debate, analyzing the effects of the EU biofuel policies on food security and poverty in developing countries. It assesses the overall impact of the biofuel policies on food availability and food prices, and it makes a special focus on how the feedstock crops used in the production of biofuel determines the outcomes. Indeed, as different feedstock crops are used for biofuel production, the impact on the poor may be also different. For example, in the United States (US), biodiesel is mainly produced from corn, which is used for human consumption and also as input in the livestock sector. Thus, the impact of an increase in the use of corn for biodiesel production in this country affects both poor and rich people, and the impact on poverty is less direct. On the contrary, we might expect a higher impact of EU biofuel policies on the poor, as the main feedstock crop used for production are vegetable oils, which are a staple food for the poor in developing countries. This fact underlines the importance of analyzing how the different feedstock crops have different consequences on poverty and the need of examining with higher detail the European case, as previous assessments of the US case may not be as relevant.

In order to evaluate the overall impact of the EU biofuel mandates, this paper applies the MIRAGE-Biof model, a dynamic general equilibrium model of the world economy with a focus on the energy sector. Then, in order to evaluate the impact of biofuel policies on poverty, we apply three different approaches. The first one is a top-down approach which feeds the results from the MIRAGE-Biof model into microdata for six developing countries: Brazil, Uruguay, Indonesia, Tanzania, Pakistan and Vietnam. The different countries are of interest because of their condition of net importers of food (Tanzania) or producers of feedstock crops (sugar for ethanol in Brazil, palm oil in Indonesia). The second approach is to combine the MIRAGE-Biof model with MIRAGE-HH model with household disaggregation. This second approach constitutes a major improvement in terms of modeling, and it is an important step to evaluate if there is a feedback effect that needs to be captured, e.g., if the reaction of households to changes in prices and available food supply has in turn an effect on prices, thus accentuating or reducing the impact on poverty.

2. Methodology

2.1 MIRAGE-Biof model

To be completed

2.2 Integration of poverty analysis to MIRAGE-Biof model

In order to analyze the distributional impact of biofuel policies on developing countries, we apply three different approaches, as presented next.

2.2.1 First approach: top-down methodology

The first approach is a top-down microsimulation, in which we feed household surveys for different developing countries with results obtained from the MIRAGE-Biof model. Specifically, we take changes in factor prices to adjust households' income, and changes in consumer prices, to assess the impact of biofuel policies on households' expenditure cost. The underlying assumption is that households do not modify quantities of consumption, so their initial consumption basket becomes more or less expensive according to change in prices. In order to make results consistent, in MIRAGE-Biof we also assume consumption quantities fixed. Thus, changes in prices are higher under this framework.

2.2.2 Second approach: estimation of demand functions for households

In the first approach we do not allow for changes in consumption quantities by households. This is an unrealistic assumption, as households react to change in prices of goods by substituting consumption. Thus, in our second approach we also apply a top-down approach, but allowing for changes in quantities, both in MIRAGE-Biof and in the microsimulation module. For doing so, we estimate demand for each household in the survey, using a LES-CES demand function, and we analyze how demand adjusts for each household as consumption prices change.

2.2.3 Third approach: integrating MIRAGE-Biof and MIRAGE-HH

This final step combines the MIRAGE-Biof model and MIRAGE-HH model (documented in Bouet, Estrades and Laborde; 2011, 2012). This version includes household disaggregation within the model. In a third approach, we combine results from the MIRAGE-Biof model with MIRAGE-HH model. This version incorporates household disaggregation within MIRAGE model, as presented in Bouet, Estrades and Laborde (2012). The representative agent in MIRAGE is split into a public agent and a varying number of private agents for some countries. In this case, we take results on good prices and factor prices from MIRAGE-Biof model, and we introduce them as exogenous changes in MIRAGE-HH. By doing this, we allow for further adjustments of the economy to changes in prices due to biofuel policies, which in turn might have an effect on households consumption, income and welfare.

2.3 Database

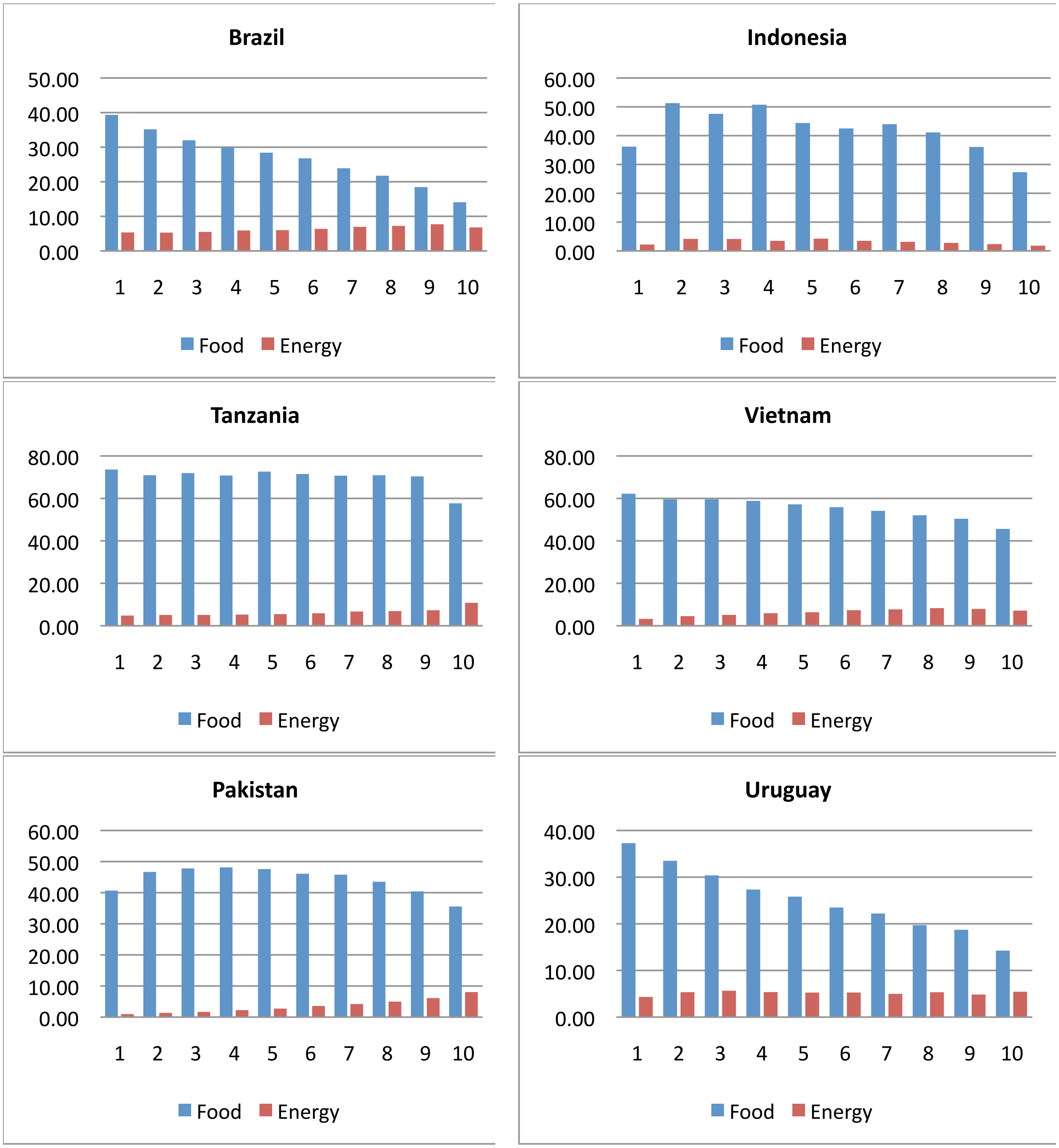
In order to analyze the impact on poverty, we consider six developing countries in the analysis: Brazil, Indonesia, Tanzania, Vietnam, Pakistan and Uruguay. The different countries are to a very different extent directly or indirectly involved in the production and consumption of biofuels. Brazil is one of the main world producers of ethanol and sugarcane for ethanol production. Indonesia is the main world exporter of palm oil and palm kernel oil, both used for production of biodiesel. Tanzania is a poor country, net food importer. Vietnam and Pakistan are also net food importers. Finally, Uruguay is a middle income country, net food exporter but not directly involved in the production of crops for biofuel production. Table 1 presents the information on the households surveys used in the analysis of poverty, for both the microsimulation approach and for disaggregating households in MIRAGE-HH model.

Table 1. Household surveys used in the analysis

Country	Household survey	Year	Source
Brazil	Pesquisa da Orcamentos Familiares	2008-2009	Instituto Brasileiro de Geografia e Estatistica (IBGE)
Pakistan	Social and Living Standards Measurement Survey	2005-2006	Federal Bureau of Statistics
Tanzania	Household Budget Survey	2000-2001	National Bureau of Statistics
Uruguay	Encuesta Nacional de Gastos e Ingresos	2006	National Statistics Institute (INE)
Vietnam	Household Living Standards	2006	General Statistics Office (GSO)
Indonesia	Indonesia Family Life Survey	2007	RAND

Figure 1 shows the proportion of total budget consumption destined to food and energy products by deciles of income in each of the six countries. In all cases, we can see the poorer households' food consumption represent a higher proportion of total budget. On the other hand, energy consumption – fuels, gas- represents a higher proportion of richest households' budget. However, the expenditure in energy is also significant for poor households, especially in middle income countries.

Figure 1. Food and energy consumption by deciles of income. Selected countries for the analysis.



Source: Author’s elaboration with data from Household Surveys

2.4. Baseline and simulations

To be completed

3. Results

To be completed

4. References

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