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Agriculture reform and food crisis in Syria: Impacts on poverty and inequality

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ABSTRACT

The paper pursues a twofold objective. From a methodological viewpoint it shows how to carry out an impacts evaluation of exogenous shocks on poverty and inequality in a context characterised by out-of-equilibrium, poorly-adjusting markets, as it is the case in many developing countries, using a social accounting matrix framework. From an empirical viewpoint it provides an assessment of how the cereal price spikes of 2007–2008 and the global recession of 2008–2009 have impacted the welfare of Syrian households and how did they compound with the on-going agricultural sector liberalisation implemented by the Government of Syria since mid 1990s. This will contribute to shed some lights on the economic background behind the spreading of unrest across the country over the last couple of years or so.

The results show that liberalisation impacts are very different and largely affected by the adopted budget closure rules. While reforms aiming at reducing agricultural market distortions (such as production subsidies and price support for strategic crops) could generally have a positive effect on growth, poverty and inequality, the elimination of food security interventions (such as food stamp schemes) determines an adverse distributional impact against rural household and an increase of poverty. The recent macroeconomic shocks (food price crisis and the global recession) determined a generalised poverty increase and showed an income distribution bias against rural households.

Three fundamental policy implications can be drawn by this study. First, the liberalisation of agricultural sector shows a significant growth potential and is likely to determine positive effects on poverty through a generalised increase of incomes as well as public budget savings that could be used for pursuing other policy goals. Second, in the short-run there is a structural trade-off between equity improvements and poverty alleviation: the policy options that will more likely reduce absolute poverty show undesirable distributive biases (both on overall inequality and on rural households vis-à-vis urban households). Third, the reform should include a careful design of the use of budget savings, mainly to address equity goals that are likely to be generated, in the short-run, by liberalisation.

Introduction

Exogenous shocks, such as the recent food price spikes or the global recession, and policy reform, such as market liberalisation, have differentiated impacts on households' welfare according to the household level of poverty and livelihood strategy. Therefore, any study aiming at assessing those impacts must be able to capture the transmission mechanisms of those shocks to different income and livelihood groups. This is particularly relevant in middle-income countries that are already on their own way towards modernisation and economic diversification.

A suitable framework for this exercise is represented by the social accounting matrix (SAM), that is 'a comprehensive, flexible and disaggregated framework that elaborates and articulates the generation of income by activities of production and the distribution and redistribution of income between social and institutional groups' (Round, 2003: 162). A first, methodological objective of this paper is to propose an analytical framework to carry out a SAM-based assessment of exogenous shocks and policy impacts on poverty and inequality in a context featuring out-of-equilibrium poorly adjusting markets, as is the case in many developing countries.

Syria is a good example of such conditions. It is a lower-middle income country with a quite diversified economy (agriculture accounting for 22.9% of GDP, industry for 30.6% and services for 40.5% in 2009) (NAPC, 2007b; World Bank, 2011), a relatively unequal income distribution (the Gini index was 0.374 in 2004, but the bottom 20% of population accounted for only 7.2% of Syria total

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expenditure, while the richest 20% consumed more than 40%) and a poverty headcount ranging between 10% and 33% of total population (according to the extreme or standard national poverty line, respectively), but with significant differences across regions (El Laithy and Abu-Ismail, 2005).

Since mid 1990s Syria entered a process of economic reform aiming at transforming a centrally planned economy into a so-called 'social market economy', that is a market economy characterised by an active role by the Government. This process has accelerated over the last five years or so and also agriculture is on its way to liberalisation. This process of policy reform and structural transformation has been recently impaired by the political crisis caused by the unprecedented wave of protests spreading out across the country since early 2011 and eventually resulted in an open conflict between the Government of Syria and various opposition groups. However, before the onset of protests Syria had been hit by two major economic shocks, namely the 2007–2008 price crisis and the 2008–2009 global recession. Thus it would be interesting to assess how those shocks have impacted the welfare of Syrian households and how did they compound with the on-going policy reform process. This will contribute to shed some lights on the economic background behind the spreading of unrest across the country over the last two years or so.[1]

The paper is organised as follows. The following section puts the study in perspective, summarising the main findings of the literature on agricultural sector liberalisation and its outcomes in terms of poverty and inequality. Section 'The Syrian economy: Background and recent economic developments' provides some background information on the Syrian economy and its recent developments. Section 'Methodology' describes data sources, modelling approach and simulation strategy of the study. Simulation results are discussed in section 'Simulation results' . Finally, section 'Concluding remarks' summarises the main findings of the paper.

Poverty and distributive impacts of agricultural sector liberalisation

Development strategies and agricultural liberalisation

Development strategies implemented after World War II have for a long time neglected the potential role of agriculture as an engine of growth. According to the then dominant structuralist view, agriculture was a low productivity sector, seen as a mere pool of resources (both human and financial) to be extracted at low cost for the development of non-agricultural sectors (Lewis, 1954). Not surprisingly import-substitution industrialisation became the dominant development strategy until early 1980s (Schiff and Valdés, 2002; Panagariya, 2005). As a result, policies in most developing countries were harming their farmers, either directly through taxes on agricultural exports or indirectly by way of manufacturing protection or overvalued exchange rates (Krueger et al., 1988). Furthermore, agriculture in developing countries was harmed also by competition in world markets from high-income countries pro-agricultural policies (Anderson, 2010).

As pointed out by Krueger et al. (1991) this bias against agriculture can be summarised in a few stylised facts. Until mid 1980s the poor countries have generally taxed, while rich countries subsidised, their agriculture, although this must be qualified recalling that almost all countries tended to protect their import-competing sectors and to tax their exporting sectors. The major reasons for agriculture taxation were to help the urban sector, mostly the politically influential upper and middle income groups rather than the urban poor, and/or industry, through the impacts on the wages of urban workers. Moreover, the international price instability forced developing countries into intervening with agricultural prices in order to stabilise their domestic markets, although the same objective could have reached with different, less costly instruments (e.g. stockpiling).

Looking at the historical evolution of interventions in agricultural markets, a common pattern emerges: countries have tended to gradually change from taxing to subsidising agriculture increasingly relative to other sectors in the course of their economic development. Hence at any point in time farmers in poorer countries tended to face depressed terms of trade relative to product prices in international markets, while the opposite was true for farmers in richer countries, with the exception of rich countries with an extreme comparative advantage in agriculture (e.g. Australia and New Zealand).

In short, during the first four decades after the World War II agricultural markets in developing economies have been targeted by a complex and intertwined set of policies, both sector and economy-wide, that heavily affected the efficiency and profitability of the farming sector as well as household's welfare. By and large, these interventions have reduced national and global economic welfare, inhibited economic growth, and increased inequality and poverty because most of poorest people in the world have been dependent directly or indirectly on farming for their livelihoods (World Bank, 2007).

The last two or three decades have been marked by a sharp change in favour of a 'free market, free trade, laissez-faire' policy environment that led to the globalisation of world markets and to more liberalisation-oriented policies at national level. As a result, the anti-agricultural bias has been gradually removed in most developing countries, while agricultural protectionism and export subsidies in developed economies has been sensibly reduced or re-oriented towards less distorting instruments (such as decoupled direct payments to farmers). According to Anderson et al. (2010) the rate of assistance to farmers relative to producers of non-farm tradables has fallen by one third in high-income countries since the late '80s (from 51% to 32%), while in developing countries this relative rate of assistance has risen from minus 41% in the early 1980s to 1% in 2000–2004. Nevertheless, distortions in agricultural markets are still relevant: the contribution of farm and food policies to the welfare cost of global distorting policies in developing countries alone is estimated at 83%, of which one third generated by the policies of developing countries themselves (Valenzuela et al., 2009). As emphasised by Anderson et al. (2010: 5) in a recent comprehensive World Bank research 'while it is true that recent studies indicate that agricultural policies are responsible for the majority of the global welfare costs of the remaining distortions to goods markets, removing these policies could affect national poverty levels either negatively or positively'.

Agricultural liberalisation impacts

Despite the received economic wisdom maintains that liberalisation by enhancing economic efficiency is also likely to reduce poverty, the wide differentiation of country-specific contexts as well as well as the variable success of agricultural reform experiments actually determined a mixed evidence record. For example, Gardner (1996) analysing seven agricultural policy reform case studies[2] found that in only four countries the real commodity price

[1] However, it should be emphasised that the protests were only partially related to economic reasons, such as the impact of global recession on the poor, but more basically to political reasons.

[2] The seven countries analysed by Gardner are five developing countries (Chile, Mexico, Madagascar, Ghana and Indonesia), one transition economy (Hungary) and one developed country (New Zealand). In assessing Gardner's results, it should be kept in mind that the case studies are all success stories, while failed or incomplete agricultural policy reforms generally outnumber the successes.

increased significantly in the post-reform as compared to the pre-reform period, in six out of seven countries the agricultural output grew in the post-reform as compared to the pre-reform period, in five out seven countries the overall real GDP per capita grew and the multifactor productivity grew faster after the reform than before in each country, notably in a period when there was no acceleration of agricultural productivity growth in the world generally. However, Gardner stressed also that agricultural policy reforms could easily be stymied in an adverse macroeconomic environment.

Gardner's assessment was quite simple, using only a post-reform vs. pre-reform comparison of a few aggregate indicators, and did not take into account the impact of reform on poverty and inequality. More recent studies have addressed these issues, either ex post or ex ante (that is using simulation techniques).

The ex post empirical evidence is quite controversial. Harrison (2007) showed that globalisation (interpreted as a process increasing liberalisation of economic activities and trade) generates winners and losers among the poor, with poverty being more likely reduced whenever complementary policies are implemented. According to McMillan et al. (2007: 228) OECD agricultural policies 'are not correlated with the poverty rate or with income' in developing countries. Conversely, at least in the short run, developing countries that are net food importers and have a large share of net food buyers among the poor, are likely to benefit of international prices depressed by subsidised export from developed countries (Panagariya, 2005; McMillan et al., 2007). Another controversial effect has been detected with reference to labour mobility. Ex post evidence shows that 'the poor in countries with abundance of unskilled labour do not always gain from trade reform' (Harrison, 2007: 3), mainly due to barriers in inter-sector factor mobility. This evidence is at odds with the results of economy-wide ex ante simulations, showing that trade liberalisation and the removal of support provided to farmers in developed countries 'would raise the real earnings of unskilled labourers in developing countries, most of whom working in agriculture' (Anderson et al., 2010: 37). Indeed, the poorest are often suppliers of unskilled labour but are also less likely to migrate, due to severe capital constraints (Skeldon, 2002); furthermore they are also less likely to take advantage of the opportunities generated by a diversification of the rural economy (Waddington and Sabates-Wheeler, 2003).[3]

In more recent years most of literature assessed the potential impacts of agricultural reform on poverty and inequality impacts from an ex ante perspective using sophisticated economy-wide national and global models. A recent, comprehensive study at the World Bank (Anderson et al., 2010) addressed those issues carrying out micro-simulation exercises based on household survey data, in conjunction with economy-wide computable general equilibrium models. The specific research question addressed by Anderson et al. (2010: 5)) is 'how much scope is there to reduce poverty and inequality in the world and in specific developing countries by unilaterally or globally eliminating the distortions in the incentives affecting the producers and consumers of tradable goods?' In this case also the evidence is quite controversial: despite a positive impact on overall poverty, extreme poverty may be increased in many countries; besides a positive effect on rural–urban inequality, a more controversial impact on inequality within rural and urban sectors emerges as well.

The main policy lessons from empirical analyses are that liberalisation alone is not enough and the sequence of reforms matter in addressing poverty through liberalisation, both in macroeconomic policy and in agricultural sector (Schiff and Valdés, 2002; Harrison, 2007; Brooks, 2010). Moreover the distributive effects are likely to be highly asymmetric between and within social groups, calling for complementary social policies (Brooks, 2010).

[3] Despite some studies on livelihood strategies show a positive correlation among agricultural productivity, per-capita income and off-farm income share (Ellis and Freeman, 2004).

Modelling issues

Most of the models used in ex ante analysis are static and assume competitive markets and full flexibility in the adaptation of the economy to exogenous and policy-driven shocks. Those are unrealistic hypotheses that do not take into account the structural asymmetries and rigidities affecting developing countries' economies. As emphasised by Taylor and von Arnim (2006: 42), 'especially in developing countries (with historically trade deficits, huge debt problems, and large informal economy with underemployment in modern sector), fixing the current account, the government deficit and employment makes no sense'. This is likely to imply a bias towards too optimistic estimates of liberalisation effects.

A good example of these drawbacks is represented by three recent computable general equilibrium studies on Syria (Lucke, 2001; Minot et al., 2007; Bibi, 2009). Despite some rigidities in the exchange rate adaptation (taken into account by two studies, namely Lucke, 2001 and Bibi, 2009) and in the labour market (taken into account only by Bibi, 2009) all these studies assume profit maximising firms, utility maximising households, competitive markets and perfect labour mobility among sectors. Finally, the disaggregation of production sector is generally poor. Not surprisingly simulations yield quite trivial results such as a generalised increase in poverty after the economic downturn in the global economy (Bibi, 2009), or positive welfare effects affecting only the highest income decile of total population generated by the removal of subsidies to wheat production (Minot et al., 2007).

The simulation strategy adopted in our study is different, being designed to mimic as much close as possible the situation really existing in the Syrian economy, marked by structural rigidities and still largely controlled markets. Given the objective of the study (that is assessing the poverty and distributive impacts of agricultural liberalisation and exogenous shocks), a considerable effort has been devoted to develop a highly disaggregated model, taking into account the diversified nature of Syrian agriculture as well as various household income levels (NAPC, 2008; cf. section 'Data'). Moreover, a short-run, linear (keneysian) model specification was preferred in representing the still largely planned, out-of-equilibrium Syrian economy conditions (cf. section 'SAM Modelling'). Finally, to increase simulation realism, in designing scenarios alternative options of liberalisation in the agricultural policy were combined with different macroeconomic constraints affecting the Government budget (cf. section 'Policy scenarios and simulation approach' '4.3').

The Syrian economy: Background and recent economic developments

Over the last two years, Syria has witnessed an unprecedented wave of protests which eventually precipitated into the current open conflict. The economic impact of the crisis already appears to be significant, with the tourism, financial and trade sectors affected the most (World Bank, 2011). There are also indications that foreign direct investment dried up, forcing the Syrian authorities to take costly measures to defend the stability of the Syrian Pound and to prevent capital flight. However, prior to the recent crisis, which is the period of interest for this study, Syria's economic reform efforts have helped to strengthen its growth performance.

Despite the global financial crisis adversely affected Syria's macroeconomic performance, the per capita income in 2010 peaked at 2750 US$ (5120 PPP international $, Table 1). Between

Table 1
Syria selected indicators, 2010. *Source*: World Bank (2012).

Land area (sq. km) (thousands)	183.6
Population, total (millions)	20.4
Population growth (annual %)	2.0
GDP (current US$) (billions)	59.1
GDP growth (annual %)	3.2
Inflation, consumer prices (annual %)	4.4
Agriculture, value added (% of GDP)[b]	22.9
Unemployment, total (% of total labour force) [a]	8.4
Merchandise trade (% of GDP)	51.4
GNI, Atlas method (current US$) (billions)	56.3
GNI per capita, Atlas method (current US$)	2750
GNI, PPP (current international $) (billions)	104.6
GNI per capita, PPP (current international $)	5120
Life expectancy at birth, total (years)[b]	75.6
Mortality rate, under-5 (per 1000)	16.0
Fertility rate, total (births per woman)[b]	3.0
Literacy rate, adult total (% of people ages 15 and above)[b]	84.2

[a] Year 2007.
[b] Year 2009.

1960 and the turn of the century, Syria experienced a fairly high rate of growth (on average 4.6% per year), which however did not exceed much the population growth rate (3.3% per year) over the same period. Over the last decade the economy of Syria has been growing at a healthy pace: between 2000 and 2010 the GDP grew by 4.9% annually in constant terms while population growth rate was 2.5% per year. By international comparisons, these are quite satisfactory figures and suggest a continuous process of real income growth for the average Syrian.

The national absolute poverty declined from 14.3% in 1996–1997 to 11.4% in 2003–2004 (El Laithy and Abu-Ismail, 2005). Over the same period in rural areas overall poverty declined from 22.6% to 11.1% (despite a 2% increase in North-eastern region), while in urban areas poverty declined from 14.8% to 9.0%. Most of the poor (61.2%) still live in rural areas. The Syrian poverty profile also shows significant regional disparities. Inequality in Syria remains quite high. The unequal distribution of the growth dividend resulted in an increase of percapita expenditure Gini index from 0.337 to 0.374 between 1996–1997 and 2003–2004. Only in Rural Southern and Urban Coastal regions the economic growth resulted in a less unequal distribution.

The dynamics of GDP per capita has been influenced over the last decades mainly by the performances of the oil sector and agriculture. Agriculture has traditionally been Syria's main industry (Sarris, 2003). However, in the 1970s trade followed by mining and to a lesser extent industry started to grow at higher rates than agriculture. Nevertheless, agriculture is still an important sector of the Syrian economy, contributing one-fifth to country's GDP in 2010. Furthermore, agriculture plays a strategic role in generating foreign exchange, or saving foreign exchange through import substitution, as well as for implementing domestic welfare policy as far as food subsidies are concerned.

Syria's growth performance has strengthened over the last decade, reflecting not only the hitherto favourable external environment for oil-producing countries, but also the country's own reform efforts. Indeed, the new globalisation drive, regional competition for access to global markets, and internal socio-economic challenges prompted a debate within the government to initiate drastic economic reforms. This process started at the turn of the century but was officially endorsed in the tenth Five Year Plan (2006–2010) with the objective of implementing the transition to a 'social market economy', which is a market oriented economy where the government still plays a crucial role in creating a favourable environment for free activities and competitiveness, while ensuring that market players behave responsibly. This change determined greater openness and flexibility, including cutting lending interest rates, opening private banks, consolidating multiple exchange rates, raising prices on some subsidised items (e.g. gasoline and cement), and establishing the Damascus Stock Exchange. In addition the Government of Syria issued decrees to encourage corporate ownership reform, and to allow the Central Bank to issue Treasury bills and bonds for government debt. This implied a greater openness to private initiatives and foreign economic relations[4] and paved the way for an easier adaptation of the Syrian economy to the fast evolving domestic and international context. Nevertheless, the economy remains largely controlled by the government.

Syria's macroeconomic performance over the last decade has been affected by on-going external and domestic shocks, particularly the impact of the global financial crisis and a prolonged drought that has been affecting agricultural output (IMF, 2010). While inflation reached 15.2% in 2008, reflecting Syria's high dependence on imports of food and fuel combined with a three year drought and the removal of some subsidies, inflationary pressures were contained through prudent macroeconomic policies going down to 2.9% in 2009. Yet, inflation increased again to 4.4% in 2010 as a result of commodity prices recover and fuel prices rise. Foreign assets remain high, but their coverage of imports is declining. Although debt remains moderate, the recourse to debt to finance budget deficit increased with the progressive decline in oil revenues. Moreover, in a move to appease popular discontent, over the last months the Syrian Government has partially rolled back economic reforms enacted over the last years, re-introducing some fiscally unsustainable agricultural and energy subsidies and raising public sector salaries. As a result the growth slowed by only 1 percentage point in 2009 as compared to 2008 and the Syrian economy did continue to grow at a rate of 4% in the midst of the global crisis. However, Syrian GDP grew only 3.2% in 2010.

Over the short and medium term, Syria's recovery will ultimately depend on the outcome of the ongoing popular uprising and the scope of political reforms. Even with a successful political transition, in incoming years Syria will face the dual challenges of: (i) keeping strong growth and developing non-oil sectors to cope with still important demographic pressures and with the decline in oil production, and (ii) maintaining fiscal sustainability while providing social protection to a growing number of young unemployed and to climate change affected areas (World Bank, 2011). To sustain long-run growth, Syria will need to further develop and diversify its economy away from the oil sector, improve private sector development and exports. Economic constraints include declining oil production, high unemployment, rising budget deficits, and increasing pressure on water supplies caused by heavy use in agriculture, rapid population growth, industrial expansion, and water pollution.

Methodology

Data

The impact assessment of agriculture policy reforms, commodity price spikes and global recession has been carried out using a social accounting matrix of Syrian economy estimated by the National Agricultural Policy Centre of Damascus with reference to year 2004 (NAPC, 2008). The matrix includes 123 accounts, providing a highly disaggregated representation of agriculture and food

[4] The country has important relations with neighbouring countries and concluded a set of bilateral or regional trade agreements such as the Arab Free Trade Area Agreement. Moreover, Syria significantly increased its trade with the EU, especially the agricultural trade that in 2008 accounted for 36% of Syrian exports and 29% of imports (IMF, 2010). Before the recent political crisis, Syria had also decided to move outward and to seek WTO accession.

Table 2
Poor headcount ratios and poverty elasticities. *Source*: Authors' own calculation.

Deciles	Poor within groups (%)	Poor on total population (%)	Poverty elasticities
Urban households			
1st	97.28	28.56	−0.25
2nd	67.12	19.87	−4.34
3rd	11.36	3.52	−8.19
4th	0.04	0.01	−10.00
Rural households			
1st	93.21	28.17	−0.56
2nd	57.79	17.34	−4.57
3rd	8.80	2.52	−8.48

production (36 activities and 45 commodities). Despite the lack of a complete urban–rural disaggregation of accounts, a regional criterion has been used in the classification of households' accounts according to where they live. Moreover, given the objective of the study (that is assessing impacts on poverty and inequality), households are also classified by deciles of per capita equivalent expenditure. These two criteria have been applied hierarchically: first households were ranked according to consumption expenditure deciles of total population; then, they were classified as urban/rural. Therefore the resulting twenty groups represented in the SAM do not include the same number of households, the population included in each group depending on the relative importance of rural–urban areas in each decile of total population.[5]

The analysis of the impacts of exogenous shocks on poverty was carried out building on a household budget dataset made available by the Syrian Central Bureau of Statistics, which is suitable to be used for living standard measurement studies (Grosh and Glewwe, 2000). In fact in 2004 a nationally representative sample of 29,800 households were asked to fill two questionnaires on the composition of households' expenditure and on household characteristics (composition by sex and age, education attainment, occupation, sources of income, owned assets). Individual poverty lines had been estimated for each observed household, according to the household size and composition (affecting consumption needs) and the region where the household lives (affecting the cost of living) (El Laithy and Abu-Ismail, 2005).

In our study these poverty lines have been used to estimate household member-specific poverty lines (elderly, adult male, adult female and child) and for each region. Then, according to their composition, all households included in the sample have been reclassified as poor and non-poor, with the poor resulting concentrated in the lower four deciles and mostly in the first two (Table 2). Finally, we estimated the household-specific poverty elasticities[6] to be used for simulations: as expected poverty elasticities are larger in higher consumption expenditure deciles.

SAM modelling

The first step in SAM modelling is the identification of endogenous and exogenous accounts. Usually, for small economies and for policy analysis purposes, the government and the rest of the world are considered as exogenous, that is the model does not explain the behaviour of those accounts. The process of capital formation could be considered as exogenous whenever the research question does not focus on dynamic impacts, as is the case in our study. Therefore these three accounts are considered as exogenous.

Using micro-data from El Laithy and Abu-Ismail (2005), good-specific expenditure elasticities have been estimated for each population decile and then used to substitute the resulting marginal propensities to final consumption expenditures for the average ones directly derivable from the SAM, as originally suggested by Pyatt and Round (1979).[7]

A standard SAM linear model assumes perfect elasticity of supply in all sectors, which means that output changes are fully demand-driven and any increase in the exogenous demand for commodities/activities is perfectly matched by an increase in output, according to *fixed price* multipliers. This assumption is generally considered unrealistic for developing countries agriculture, where the output level is largely determined by policy interventions. For instance, in Syria this is the case of the so-called 'strategic crops', which are cotton, tobacco and sugar beet.[8] The presence of supply side constraints in one or more sectors can be taken into account in a linear model calculating a so-called 'mixed multiplier matrix' (Lewis and Thorbecke, 1992).

Simulations of the distributive impacts of alternative agricultural policy reforms in Syria have been carried out using a fixed price, mixed multiplier model, assuming different hypotheses about supply constraints, (cf. section 'Policy scenarios and simulation approach' below). First, the matrix of mixed multipliers has been used to assess the impact on output and incomes of different policy scenarios. Two further analyses have been carried out to better understand the distributive impacts of simulations. The first is a particular transformation of the multipliers matrix (cf. Roland-Host and Sancho, 1992) to show the changes in the *relative* position in income distribution of different household groups. A second analysis was carried out to assess the potential impacts of reforms on poverty, following the approach originally proposed by Pyatt and Round (2006).

Policy scenarios and simulation approach

The simulations carried out with the SAM of the Syrian economy refer to two major sources of changes in the policy and economic environment, namely the liberalisation of the agricultural sector and the major shocks that have hit the Syrian economy over the last years, that are the food price crisis and the global recession.

Policy reforms are simulated as a vector of exogenous shocks, which mimics the recent evolution in Syrian policy environment, namely:

(a) dropping production subsidies,[9] which will turn out into an increase in production costs. These direct impacts on production sectors will also affect households' welfare through an economy-wide increase in commodity prices.[10] This vector of price changes was then multiplied by the (SAM-derived) matrix of expenditure shares of households to obtain an equivalent decrease of income in real terms, which is the exogenous shock vector eventually used to simulate this policy change;
(b) reducing by 20% the supported price of the 'strategic crops' whose only buyer is the Syrian Government (cotton, tobacco and sugar beet). Assuming intermediate costs and wages as

[5] Further details on SAM the structure are provided in Appendix A.
[6] More precisely we estimated the partial elasticity of poverty to changes in the average income (Pyatt and Round, 2006), which corresponds to Bourguignon's (2003) 'growth effect' on poverty. The overall elasticity for total population is 2.19, a value consistent with the relatively unequal distribution of income in Syria.
[7] Details on the estimation of expenditure elasticities are provided in Appendix B.
[8] These crops are considered 'strategic' by the Government of Syria because they are a source of foreign currency from export (cotton) and/or intensively use constrained natural resources such as water. The cultivated area is planned at the central level by the Government that supplies the farmers with required inputs and buys the whole planned production (NAPC, 2007a).
[9] Subsidised activities whose accounts are included in the SAM are: soft wheat, cotton ginning, milling, sugar industry and sugar refinery.
[10] Indeed, assuming the transpose of the multiplier matrix as a Leontief model in prices, it is possible to transform an output cost increase as an equivalent commodity price increase (Roland-Host and Sancho, 1995; Dietzenbacher, 2002).

Table 3
Budget savings from agricultural reforms. *Source*: Authors' own calculation.

	Elimination of subsidies to agriculture	Price support reduction for strategic crops	Elimination of PSA
Budget savings (Mln SP)	45,775	5912	21,600
% of output			
– Subsidised activities	44.0	5.7	20.8
– Total agriculture and food	7.2	0.9	3.4
% of Gvnt current expenditure	24.3	3.1	11.5
% of Gvnt transfers to households	317.9	41.1	150.0

fixed in the short-run, the reduction of output prices can be mimicked by a decrease in incomes accruing to 'other factors' (capital, self-employed labour). Therefore, a first component of the exogenous shock vector was defined as a reduction of incomes distributed to households by 'other factors', according to shares accruing to each household group. At the same time, an offsetting increase in real incomes, resulting from the deflationary impact of previously subsidised commodities, was added;[11]

(c) dropping the existing food stamp scheme (that is the so-called 'Price Stabilization Fund', PSF).[12] The direct effect of the elimination of food consumption subsidies was distributed among households groups as a real income decrease, according to shares in expenditures for subsidised products resulting from households budgets in the El Laithy and Abu-Ismail (2005) sample.

Moreover, each of the above policy options was considered along with different 'closure rules', that is effects on Government budget. By and large the selected policies would result in a substantial reduction of public expenditure. The economic relevance of the three policy changes can be assessed looking at figures in Table 3. The elimination of subsidies to agriculture yields the largest savings for the Government budget: 44,775 Mln SP, equivalent to 44% of total subsidies on agricultural output of activities and about 7% of total agriculture and food sector output value. In two cases, namely dropping agricultural subsidies and suppressing the food stamp scheme, the saving resulting from liberalisation exceeds the size of current Government transfers to households, while in the case of strategic crops price reduction they would be able to provide resources for a substantial increase of Government transfers to households (+41.1%). Compared with the current expenditure of Government the amount of savings ranges between 3.1% (price reduction for strategic crops) and 24.3% (agricultural subsidies elimination).

The Government can use these savings according to alternative budget strategies, each having different distributive effects. Three alternatives have been hypothesised, namely:

(i) a Government deficit reduction, which translates into an increase of previously crowded-out private investments (Rose et al., 2001). This alternative is mimicked through an exogenous injection in the final demand for investment goods (according to SAM shares) equal to the amount of Government expenditure saving resulting from policy reform;

(ii) a Government expenditure increase equal to the amount of money saved as a result of policy reform, modelled as an exogenous inflows to SAM accounts according to Government expenditure shares (both for public final consumptions and for transfers to institutions);

(iii) an increase of transfers to households according to shares in the original SAM. This budget rule is to some extent similar to the compensative payments introduced by the Syrian Government with the institution of the Agricultural Support Fund (IMF, 2010).

In summary, the combination of the three policy options for agriculture and food and the three closure rules for Government budget yields nine policy mixes whose impacts are simulated in section 'Impact of liberalisation policy reforms'.

On top of these domestic policy changes, over the last five years the macroeconomic dynamics at the global level heavily affected output, incomes and poverty in Syria. In order to assess the impacts of these shocks mixed scenarios have been simulated including alternatively the effect of a 100% cereal price increase and the effect of the 2009 recession scenario on Syria. The preliminary estimates included in the IMF Staff Report for the 2009 Article IV consultation (IMF, 2010) record a 16% decrease in exports of goods and a 4% decrease in workers' remittances from abroad: these changes were applied to SAM totals to estimate a vector of exogenous shocks.[13]

Finally, it should be emphasised that all simulations were carried out taking into account also a set of policy-driven constraints on the supply side, using different matrices of mixed multipliers. First of all, production activities for the three strategic crops were considered as supply-constrained under scenarios (a) and (c) where production decisions are assumed as still taken at the Government level. Conversely, the constraint does not operate under scenario (b) assuming that the reduction in price support was combined with a liberalisation of production decisions for strategic crops. A second constraint was included for the public administration sector. Despite general services managed by Government are usually modelled as an activity in a SAM framework, the figures in the relevant column/row are generally determined by the policy maker. Indeed, in National Accounts the output value of public administration is conventionally set equal to its production cost (cf. United Nations et al., 1993). As a result, modelling public administration as a supply-constrained sector can be interpreted as a policy-driven effort towards efficiency in the sector activities. The changes induced by exogenous shocks are computed assuming that in the short-run the public administration could support the overall economy without changing the nominal value of its output. According to financial stabilization goals stated by the Syrian Government this seems to be a reasonable assumption. The introduction of supply-side constraints is expected to reduce the multiplier effect generated by exogenous shocks on the economy: indeed, indirect and induced effects cannot be transmitted to the rest of the economy through the constrained sectors.[14]

[11] In fact a general decrease of prices is expected, through input-output linkages, as a result of the price reduction of previously subsidised commodities. This component was calculated following the same procedure used for scenario a).

[12] The balance of PSF revenues and expenditures was estimated applying shares derived from Lucke (2001) to the total value of PSF expenditures projected for 2007 (cf. IMF, 2007).

[13] The simulated impact of this scenario on total output is consistent with the actual slow down of Syrian GDP (IMF, 2010).

[14] A sensitivity analysis carried out to assess the effect of the removal of supply-side constraint on public administration showed an average increase of output multiplier of about 20%.

Table 4
Output multipliers and shares resulting by an increase in final demand of selected industries. *Source*: Authors' own calculation.

Industries	Output multiplier	Agriculture (% of total)	Food industry (% of total)	Other activities (% of total)
Agriculture	2.04	58.0	5.9	36.1
Food beverage and tobacco	2.97	10.4	58.1	31.5
Other manufactures	2.28	8.3	8.5	83.3
Utilities	2.48	5.7	5.3	89.0
Building and construction	2.17	5.3	4.9	89.8
Services	1.86	7.0	5.9	87.1
Public administration	2.01	8.1	6.8	85.1

Table 5
Households income multipliers resulting by an increase in final demand of selected industries. *Source*: Authors' own calculation.

Industries	Total Syria	Urban			Rural		
		All households	1st decile	10th decile	All households	1st decile	10th decile
Agriculture	0.737	0.440	0.012	0.134	0.297	0.014	0.058
Food beverage and tobacco	1.020	0.608	0.016	0.185	0.411	0.019	0.080
Other manufactures	1.014	0.605	0.016	0.184	0.409	0.019	0.079
Utilities	0.809	0.483	0.013	0.147	0.326	0.015	0.063
Building and construction	0.656	0.392	0.010	0.119	0.265	0.012	0.051
Services	0.801	0.478	0.013	0.146	0.323	0.015	0.063
Public administration	0.984	0.587	0.016	0.179	0.397	0.018	0.077

Simulation results

Multiplier analysis

Simulation results strictly depend on production structure. Therefore, output multipliers generated by exogenous shocks on demand for production activities provide information that can prove useful in interpreting policy simulation results (Table 4).[15]

Output multipliers are good indicators for the growth potential of the Syrian economy and prove the important role played by policies aiming at increasing final demand. As expected the lower the share of intermediate costs on output value (agriculture, services) the smaller the output multiplier. 'Food, beverage and tobacco' is the industry with the highest multiplier.[16] Table 4 shows also how the output increase is distributed across different industries. While 'Agriculture' and 'Food, beverage and tobacco' activities are able to generate an output increase also in other industries through backward linkages, the opposite is not true: output growth in non-agro-food sectors does not stimulate growth in 'Agriculture' and 'Food, beverage and tobacco' sectors.

A first assessment of the effects on distribution effects can be carried out looking at income multipliers, that is multipliers accounting for increases in incomes distributed to households as a result of final demand increases (Table 5).

Manufacturing activities (both food and non food) typically show a higher capacity to increase incomes of Syrian households as a whole. Comparing urban vs. rural multipliers, a common pattern emerges: the multiplier effect on incomes of urban households is significantly larger than that for rural households (at least 50% larger). Furthermore, the impacts are larger on incomes of richer households, with a ratio between the top and bottom deciles that ranges from four in rural areas to ten in urban areas. However, the multiplier analysis of effects on income should be considered only a *prima facie* assessment of distributive impacts. Indeed, the multipliers are affected by a scale effect depending on the share of total population included in each household group. As explained in the paragraph 4.1 household groups do not include the same number of units. Therefore, in the following paragraphs will be used a transformation of the multiplier matrix based on a normalised measure of income shares accruing to each household group.

Table 6
Impacts of selected policies. *Source*: Authors' own calculation.

Policies	Percentage impact on		
	Output	Households income	Poverty
Elimination of subsidies to agriculture			
Deficit reduction	3.10	2.00	−0.20
Public expenditure increase	1.11	0.78	−0.08
Transfers to households increase	2.07	6.43	−0.85
Price support reduction for strategic crops			
Deficit reduction	0.43	0.32	−0.04
Public expenditure increase	0.16	0.16	−0.02
Transfers to households increase	0.30	0.90	−0.12
Elimination of PSF			
Deficit reduction	0.56	−1.99	0.49
Public expenditure increase	−0.38	−2.57	0.55
Transfers to households increase	0.08	0.10	0.19

Impact of liberalisation policy reforms

Table 6 shows the results of simulations carried out according to the policy scenarios as defined in section 'Policy scenarios and simulation approach'. The impacts are presented as a percentage change in the value of output, income and poverty.

Both the elimination of production subsidies and the reduction of price support to strategic crops show a potential positive effect on Syrian economy. Whatever the budget closure, the multiplicative effect exceeds the direct negative impacts caused on household incomes by the exogenous shocks (that is the decrease of incomes in real terms because of the adverse change in prices and of the reduction in income accruing to factors). Specifically, the elimination of subsidies to production activities

[15] The final demand directed towards a given production activity is the weighted average of the demand for each commodity produced by the activity itself net of leakages (imports and relevant taxes).

[16] However, it should be stressed that this sector includes activities like 'Sugar refinery' and 'Milling' that are mainly publicly owned and/or heavily subsidised. As a result, the ratio between intermediate costs and the value of output in the input-output block of the SAM is higher than it would be without policy interventions.

Table 7
Redistributive impacts of selected policies (percentage shares). *Source*: Authors' own calculation.

Quintiles	Elimination of subsidies to agriculture and food industry			Price support reduction for strategic crops			Elimination of PSF		
	Deficit reduction	Public expend. increase	Transfer increase	Deficit reduction	Public expend. increase	Transfer increase	Deficit reduction	Public expend. increase	Transfer increase
Urban households									
1st	−3.16	12.26	28.97	6.06	17.22	29.37	−14.04	−13.55	−0.47
2nd	4.47	15.60	29.79	9.25	17.69	29.89	−8.66	−8.21	5.20
3rd	1.46	16.01	29.87	1.60	14.26	29.55	−1.76	−1.12	12.41
4th	12.65	11.27	2.76	−11.46	−6.52	0.99	8.63	8.82	9.76
5th	69.92	44.86	3.47	−63.09	−51.49	−6.08	68.77	69.27	69.95
Rural households									
1st	−14.48	−9.45	−0.56	23.72	18.45	2.26	−23.23	−23.43	−23.62
2nd	−19.05	−12.33	−1.16	21.99	17.48	1.81	−25.29	−25.50	−25.88
3rd	−27.78	−25.30	−15.65	22.43	11.90	−11.90	−18.67	−19.10	−25.73
4th	−25.35	−28.20	−26.49	12.87	0.86	−23.52	−7.20	−7.72	−19.23
5th	1.31	−24.72	−51.00	−23.38	−39.83	−52.38	21.45	20.55	−2.39
Total absolute impact (Mln SP)	473	660	7102	72	97	927	7198	7122	7020

determines the largest increases on output and income. These overall impacts result in a reduction of poverty (holding population constant).[17] The multiplier effect is larger for closure rules aiming at increasing transfers to households and reducing the Government deficit.

The impacts generated by the third policy scenario (elimination of PSF) show mixed evidence. The positive effect of a deficit reduction on output (+0.56%) is not large enough to offset the real term decrease of households' income due to the elimination of food stamps (−1.99%). Even worst would be the impacts of an increase in public expenditure (output contraction of −0.38%, income decrease equal to −2.57%). Only reallocating financial resources to households through transfers minimises the adverse effects of this policy on income distribution. The elimination of food consumption subsidies generates an increase of poverty whatever the adopted budget rule. Even in the case of the third 'closure rule' the resulting direct support to households' income is not large enough to generate, through the multiplier effect in the whole economy, an expenditure increase offsetting the direct cut of real incomes: the overall impact is a 0.19% increase in the poverty headcount ratio.[18]

Table 7 shows the impacts on inequality implied by alternative policy scenarios as percentage changes comparing the after and before situation in each income decile.[19] Redistribution resulting by the implementation of each policy is modelled as a zero sum game: the winners show a positive value while the losers show a negative value, but the sum of the percentage changes in income shares across population deciles is equal to zero. The magnitude of the total redistributive effect in absolute terms (last row) obviously depends on the different amount of financial resources allocated to the three alternative policies (cf. section 'Policy scenarios and simulation pproach'). Nonetheless, the choice of the budget rules has a significant impact on redistribution under each policy. As expected, allocating financial resources to household transfers sharply increases the total redistributive effect of the first two policy options (elimination of production subsidies and reduction of strategic crops price).

Furthermore, the redistributive profiles are different under alternative policy scenarios. The strategic crops price reduction is the most equitable policy determining an improvement in the relative position of poorer households and rural households. Vice versa, the first and the third policy options negatively affect the relative position of rural households in income distribution whatever the adopted budget rule. Not surprisingly the worst redistributive impact is determined by the elimination of PSF. In this case, the redistribution of financial resources as a transfers to households, positively impacts urban households (including most of lower urban quintiles), but negatively affects almost all rural households[20]; the other two budget rules leads to adverse effects on urban poor too. The redistributive impacts generated by the elimination of PSF appear even more adverse when looking at the size of impacts relative to the initial situation of each group (redistributive elasticities[21]): the largest impacts positively affect the richer household and negatively affect the poorest ones (irrespective of where do they live). These results clearly call for a careful targeting of transfers to households to prevent adverse distributive effects.[22]

The overall poverty impact of policy reforms is small (Table 8). The first two policy options reduce poverty whatever the closure rule adopted for Government budget. The elimination of production subsidies with an equivalent increase in transfers to households is the most effective alternative in terms of poverty reduction (−0.85%). Conversely the elimination of food stamps may increase poverty up to 0.55% (in the case the public expenditure increase budget rule would be adopted). The transformation of PSF budget into transfers to households almost offsets this negative effect but with different outcomes on different household groups. Indeed, poverty is reduced only for relatively less poor deciles in the urban areas, while the rural poor are all negatively affected.

Impact of cereal price spike and global recession

The impacts on income distribution of the three simulations mimicking the exogenous shocks are assessed computing two indi-

[17] Details on how to compute the changes in the poverty headcount are provided in Appendix B.

[18] In fact, the initial shocks (increase of direct transfers less real income reduction due to the elimination of food subsidies) negatively impacted one half of households, mainly in rural areas.

[19] The adopted transformation of the multiplier matrix overcomes the scale effect problem (as implied in standard multiplier analysis) by looking at the changes in the *relative* position of each household group in the income distribution. See Appendix B for further details.

[20] Only the highest *decile* gets a positive redistributive impact.

[21] Details on calculation and figures on redistributive elasticities are provided in Appendix B, Table A.5.

[22] Simulations were carried out assuming that transfers were distributed among households groups according to the SAM shares.

Table 8
Impacts on poverty of selected policies (percentage changes). *Source*: Authors' own calculation.

Deciles	Elimination of subsidies to agro-food sector			Price support reduction for strategic crops			Elimination of PSF		
	Deficit reduction	Public exp. incr.	Transfer increase	Deficit reduction	Public exp. incr.	Transfer increase	Deficit reduction	Public exp. incr.	Transfer increase
Urban households									
1st	−0.01	0.00	−0.04	0.00	0.00	−0.01	0.02	0.02	0.00
2nd	−0.10	−0.04	−0.48	−0.02	−0.01	−0.07	0.21	0.23	0.02
3rd	−0.23	−0.11	−1.13	−0.04	−0.02	−0.15	0.36	0.42	−0.06
4th	−2.78	−1.30	−13.66	−0.46	−0.26	−1.86	3.99	4.69	−1.14
Rural households									
1st	0.00	0.00	−0.01	0.00	0.00	0.00	0.01	0.01	0.01
2nd	−0.11	−0.04	−0.38	−0.02	−0.01	−0.06	0.33	0.37	0.20
3rd	−0.37	−0.13	−1.32	−0.07	−0.04	−0.19	1.09	1.20	0.64
4th	−2.56	−0.89	−8.37	−0.49	−0.26	−1.24	6.76	7.55	4.02
Total	−0.20	−0.08	−0.85	−0.04	−0.02	−0.12	0.49	0.55	0.19

Table 9
Redistributive impacts of macroeconomic shocks (percentage shares). *Source*: Authors' own calculation.

Quintiles	Cereals price +10%	Transfers from abroad −10%	Export −10%
Urban households			
1st	3.52	3.01	11.06
2nd	−21.16	22.40	−10.29
3rd	−1.66	1.73	12.74
4th	11.38	−10.70	12.76
5th	59.15	40.33	−44.89
Rural households			
1st	3.13	−6.40	7.18
2nd	3.22	−10.95	12.05
3rd	−5.72	−13.97	8.76
4th	−12.44	−22.47	12.71
5th	−39.40	−2.99	−22.09
Total absolute impact (Mln SP)	80	500	162
Equity bias	34.4	26.1	21.8
Equity balance	−11.3	8.1	20.0
Rural bias	64.2	73.7	35.7
Rural balance	−0.5	−56.8	18.6
Poverty headcount	0.04	0.07	0.33

cators: the policy scenario 'balance' is just the sum of positive and negative impacts as percentage to total redistributive impact (last row of Table 7); the policy scenario 'bias' is instead the absolute value of the sum of negative impacts (as percentage to total redistribution) accruing to a given group of households. In short, the 'balance' indicator shows how gains and losses offset each other across households, while the 'bias', focusing only on negatively affected households, provides a measure of concentration of losses: a value higher than 50% means that the negative redistributive impacts are larger than positive impacts within the considered household groups (either poor households, irrespective where they live, or rural households). These indicators are computed with reference to two targeting groups of households: 'equity' indicators refer to the first four deciles of total population, which include all poor households (cf. Table 2); the 'rural' indicators refer to all rural households.

The impacts on the Syrian households are quite differentiated. In Table 9 the 'redistributive profiles' of different exogenous shocks due to changes in the global economy are presented simulating a 'conventional' change of 10% in the relevant variable. From an equity point of view all shocks imply redistribution, with negative impacts accruing mainly to richer households, especially in the case of the two global recession shocks (i.e. reduction in transfers and exports). A decrease in exports is the worst situation for richer households: more than 70% of negative impacts accrues to households in higher deciles of population, although the absolute redistribution implied by this shock is only one third of the other one (162 vs. 500 Million SP). In the case of an increase of cereal price, the balance between gains and losses in the redistributive game is negative for poorer households as a whole (−11.3%): the negative impacts on urban poor are not offset by positive effects on rural poor.

Another significant asymmetric effect of these exogenous shocks refers to the rural–urban bias. The relative position of rural households in income distribution is clearly worsened by a price crisis (more than 64.2% of negative effects accruing to rural households, while in terms of balance the value is only slightly negative) as well as in the case of a 10% decrease of transfers to households from abroad (rural bias equal to 73.7% and rural balance equal to −56.8%); vice versa, the export contraction determines a relative improvement in the distributive position of rural households (rural bias less than 50%, and a positive balance).

All shocks imply an increase of the poverty headcount. The larger impacts on poverty are determined directly by the increase of cereals' price (+0.39%, through a larger reduction in real income of poorer households) and indirectly by a reduction of export (+0.33%, through the resulting slow down of domestic production). Quite surprisingly, the reduction of workers' remittances does not affect too much poverty.

How did the adverse changes in the global scenario of the last years likely affect the outcomes of agricultural policy reforms considered in section 'Impact of liberalisation policy reforms'? Table 10 contrasts the impacts of mixed scenarios for all policy options including the effects of different exogenous shocks[23] vis-à-vis those computed in absence of these changes.

The pure (i.e. without agricultural reform) exogenous scenarios lead to a relative inequality improvement, but characterised by a slight increase in poverty and a significantly adverse rural bias. The first two liberalisation reform options would be able to alleviate the effects of adverse global changes on poverty and equity. However, there is a trade-off between poverty reduction and equity improvement: the best result in terms of poverty alleviation is achieved by the elimination of support to production activities coupled with an equivalent transfer to households, while the

[23] In Table 10 the impacts of 'actual' rather than 'conventional' shocks (as it was the case in Table 9) are assessed. Specifically, Table 10 reports the impacts of shocks of the same magnitude of the ones really occurred, i.e. a 100% cereal price increase, a 16% decrease in export and 4% contraction of transfers from abroad. The two latter shocks are coupled into a single scenario called '2008–2009 recession' in Table 10.

Table 10
Impacts of alternative policy scenarios. *Source*: Authors' own calculation.

Scenarios	Poverty headcount (% change)			Equity bias (% shares)			Rural bias (%shares)		
	No exogenous shock	Cereals price spike[a]	2008–2009 recession[b]	No exogenous shock	Cereals price spike[a]	2008–2009 recession[b]	No exogenous shock	Cereals price spike[a]	2008–2009 recession[b]
Pure scenarios	–	0.39	0.58	–	34.39	10.86	–	64.19	52.08
Mixed scenarios									
Elimination of subsidies to agriculture									
Deficit reduction	−0.20	0.19	0.38	37.11	25.66	30.26	95.94	87.45	100.00
Public exp. increase	−0.08	0.31	0.50	21.77	13.52	24.26	100.00	99.43	100.00
Transfer increase	−0.85	−0.46	−0.27	1.82	1.92	1.84	94.96	100.00	94.21
Price support reduction for strategic crops									
Deficit reduction	−0.04	0.36	0.55	0.00	20.46	22.17	23.38	77.63	41.14
Public exp. increase	−0.02	0.37	0.57	0.00	18.14	21.50	41.99	81.93	48.28
Transfer increase	−0.12	0.27	0.47	0.00	2.12	7.44	87.80	100.00	82.97
Elimination of PSF									
Deficit reduction	0.49	0.88	1.07	71.22	68.89	71.12	74.39	74.07	74.84
Public exp. increase	0.55	0.94	1.13	70.70	68.38	72.41	75.76	75.36	76.23
Transfer increase	0.19	0.57	0.76	51.35	48.73	51.18	98.16	97.89	98.20

[a] In this scenario a 100% increase in the cereal price is simulated: this price change is of the same order of magnitude of what actually happened in the 2007–2008 price crisis, when cereal price roughly doubled on international markets.
[b] This scenario includes the combined effect of the two exogenous shocks related to global recession, i.e. a 4% reduction of transfers from abroad and 16% decrease in export, mimicking what actually occurred to Syrian economy as a result of the 2008–2009 global recession (cf. IMF, 2010).

liberalisation of strategic crops (price reduction plus removal of policy-driven supply constraints) shows the lowest equity bias (even null in absence of macroeconomic changes).

Looking at the rural bias, the only policy option able to offset the effect of adverse global scenarios is the liberalisation of strategic crops coupled either with a reduction of Government deficit or with a proportional increase of public expenditure.

Finally, the elimination of the PSF leads to the worst impacts in terms of poverty and equity, showing at the same time a very large adverse rural bias (more than 74% irrespective of the adopted budget closing rule). This result clearly shows that without a careful targeting of transfers to households, the positive achievement in terms of growth would be socially controversial.

Concluding remarks

This study shows that liberalisation reforms aiming at reducing the distortions generated by agricultural policy in Syria (such as production subsidies and price support for strategic crops) could generally have a positive effect on both growth (output and incomes) and poverty, while a controversial impact would be generated by the elimination of food security interventions (such as the food stamp scheme financed by the Price Stabilization Fund), implying a poverty increase even in presence of growth. While the elimination of price support results in the best redistribution profile, improving the relative position of the poor both in urban and rural areas, the reduction of production subsidies and the elimination of the food stamp scheme show an adverse distributive bias towards rural households. Furthermore, the elimination of food stamps is likely to generate a poverty increase no matter what budget rule is adopted: only increasing the transfers to households may partially offset this negative effect, but just in urban areas.

The analysis also clearly shows that the outcomes of agricultural liberalisation cannot be properly assessed looking at the sector policy alone. The reforms should be always assessed considering sector policy changes within the overall framework of fiscal and development policies. This was made running simulations under three alternative closure rules featuring different use of budget savings generated by agricultural reforms. The redistributive profiles of alternative policy scenarios are very different and critically depend on the adopted budget closure rules. While the simple reduction of budget deficit is likely to increase the impact on growth though worsening equity, the use of savings for substituting direct transfers seems to be the best option to reduce regressive effects on income distribution.

Relevant changes in the global macro-economic scenario affected poverty as well as inequality in Syria: simulations show that the cereal price spikes and the global recession had a *relative* positive equity impact, but increased poverty and had an adverse bias against rural households. Should the liberalisation reforms be in place at the moment of these shocks, the overall impact of food price spikes and global recession would be less negative, while the elimination of food security measures (that is the Price Stabilization Fund) would make their impacts worse.

Three fundamental policy implications can be drawn by this study. First, the agricultural sector liberalisation shows a significant growth potential and is likely to determine positive effects on poverty through a generalised increase of incomes. Second, in the short-run there is a structural trade-off between equity improvements and poverty alleviation: the policy options that will more likely reduce absolute poverty show undesirable distributive biases (both on overall inequality and on rural households vis-à-vis urban households). Third, the elimination of measures such as subsidies to agricultural production and price support for strategic crops would reduce public expenditures, making available budget

resources that could be used for pursuing other policy goals. Therefore any reform should include a careful design of the use of these resources, mainly to address equity goals that are likely to be generated, in the short-run, by liberalisation. These results are consistent with the most recent debate on agricultural policy reform options in developing countries.

In terms of modelling strategy, despite the linear nature of the social account matrix model, the adopted flexible modelling approach allowed the simulation of a variety of scenarios characterised by a mix of supply side constraints and alternative interventions resulting from liberalisation budget savings. These adaptations have increased the degree of realism of the model, providing useful policy insights through the assessment of the impacts on poverty and inequality. One may wonder whether a non-linear model, such as a computable general equilibrium model, would do better in terms of simulation results. However, as emphasised by Rose (1995), assuming an approach as intrinsically superior to another is nonsense without carefully considering the specific issues to be addressed in modelling. The generally out-of-equilibrium conditions of the Syrian economy, where the system is still largely policy-driven and several constraints limit the adjustment of economic activities, would probably not be properly modelled by using the equilibrium framework of a CGE model. The purpose of the analyses carried out in this paper is rather to show how impacts spread across sectors in the short-run, highlighting the distributive asymmetries that are likely to come along with policy reforms as well as macroeconomic shocks.

Lastly, we acknowledge that the SAM-based policy impact assessment could be further improved. For example, a complete rural–urban classification of production activities accounts would make possible a complete representation of structural asymmetries between the two regions and the estimation of spill over effects between rural and urban areas. Referring to modelling, further improvements could be achieved through the adoption of 'optimisation' rules (that is according to some desirable distributive rules) in designing policies financed by liberalisation budget savings. Finally, in a transition economy such as Syria, a dynamic approach to modelling would surely do better in mimicking alternative paths towards a market economy.

Appendix A. The Syrian economy through the social accounting matrix

The original SAM includes a total of 123 accounts, of which 116 were considered as endogenous: 51 commodities, 41 production activities, 2 factors of production, and 22 institutions (20 households groups, firms and an account summarising inter-households domestic transfers). In the following tables the structure of some relevant flows represented in the SAM are summarised, providing the reader with the more relevant features of the Syrian economy.

Table A.1 summarises the distribution of total output among different production activities.

Table A.1
Activity shares in total output Syria, 2004 – Percentage. *Source*: Authors' own calculations.

Agriculture	18.8
Food industry	8.7
Other industries	28.1
Utilities	2.6
Building and constructions	8.4
Trade and other services	25.7
Public administration	7.7

The summary figures in Table A.1 hide the SAM highly disaggregated representation of agriculture (31 commodities and 28 activities) and food sector (15 commodities and 8 activities), which makes possible detailed policy change modelling and simulations.

The distribution and composition of households' income sources resulting from the original SAM is reported in the Table A.2. The distribution of income among deciles shows the expected inequality, with a the richest 10% of population accounting for an income share more than seven times higher than that of the poorest decile. Urban households earn about 60% of total incomes. Overall, the lowest deciles are more depending on transfers (accounting for 11% of total income in the case of the first decile). Conversely the share of wages and mixed income (from self-employed labour and capital assets) increases as households become richer. Rural households receive a slightly higher share of their incomes as transfers from abroad.

Finally, the percentage composition of final expenditure is summarised in Table A.3. Overall, food is still the most important consumption good for Syrian households, accounting for more than 38% of the total final expenditure.

Appendix B. The SAM model

From the endogenous accounts of the original SAM can be derived a matrix **A** of accounting coefficients with the following structure:

$$\mathbf{A} = \begin{bmatrix} & \mathbf{D} & & \mathbf{G} \\ \mathbf{B} & & & \\ & \mathbf{E} & & \\ & & \mathbf{F} & \mathbf{H} \end{bmatrix}$$

where

$\mathbf{B_{41\times 51}}$ (activities × commodities) is the matrix of activities' shares in the domestic supply of commodities.

$\mathbf{D_{51\times 41}}$ (commodities × activities) is the matrix of intermediate consumption shares.

$\mathbf{E_{2\times 41}}$ (factors x activities) is the matrix of distribution shares of value added to factors.

$\mathbf{F_{22\times 3}}$ (institutions × factors) is the matrix of distribution shares of factor incomes to institutions.

$\mathbf{G_{41\times 22}}$ (commodities × institutions) is the matrix of final expenditure shares.

$\mathbf{H_{22\times 22}}$ (institutions × institutions) is the matrix of inter-institutions transfers shares.

Using micro-data from a survey on households' budgets (El Laithy and Abu-Ismail, 2005), good-specific expenditure elasticities have been estimated for each population decile and then used to modify the sub-matrix **G,** replacing average (accounting) propensities with marginal ones. The elements of the modified matrix $\mathbf{G}^*$ are calculated as follows:

$$g_{ij} = \eta_{ij} a_{ij}$$

where η_{ij} is the expenditure elasticity of sector j towards sector i.

Two different estimates carried out using both OLS and Tobit estimators supplied very similar results. Table A.4 displays the results of the OLS estimation of expenditure elasticities by income decile for 4 large group of commodities. The elasticities were assumed as invariant between the urban and the rural context.

The modified matrix of expenditure coefficient **C**, including the sub-matrix $\mathbf{G}^*$ with marginal propensities, can be used to calibrate a linear model as follows:

$$\mathbf{y} = (\mathbf{I} - \mathbf{C})^{-1}\mathbf{x} = \mathbf{M}_c\mathbf{x} \qquad (A.1)$$

Table A.2
Shares and composition of households' income by income decile and rural–urban residence Syria, 2004 – Percentage. *Source*: Authors' own calculations.

	Share of total income	Composition of income by income source				
		Wages	Mixed income	Transfers from government	Other domestic transfers	Transfers from abroad
Decile 1	3.5	51.9	36.7	2.7	2.7	6.0
Decile 2	5.1	53.8	38.0	2.2	1.6	4.4
Decile 3	6.0	53.9	38.0	2.1	1.6	4.4
Decile 4	6.8	54.1	38.2	2.1	1.4	4.3
Decile 5	7.8	53.8	38.0	2.1	1.7	4.4
Decile 6	8.8	53.5	37.8	1.5	1.3	5.9
Decile 7	9.9	53.6	37.9	1.4	1.2	6.0
Decile 8	11.8	54.1	38.2	1.2	1.1	5.4
Decile 9	14.6	54.3	38.3	1.4	0.8	5.2
Decile 10	25.6	55.4	39.1	1.2	0.6	3.8
Urban	59.6	54.3	38.3	1.9	1.2	4.3
Rural	40.4	54.1	38.2	1.0	1.1	5.6
Total	100.0	54.2	38.3	1.6	1.1	4.8

Table A.3
Final expenditure composition Syria, 2004 – Percentage. *Source*: Authors' own calculations.

Raw crop products	9.8
Raw livestock products	7.9
Processed food	20.3
Other industries products	16.2
Water, electricity, gas	0.8
Building and construction	0.2
Trade and other services	34.3
Public administration	10.5

Table A.4
Expenditure elasticity for groups of goods and deciles of total population Syria, 2004. *Source*: Authors' own calculations.

	Food	Beverages and tobacco	Other manufactured goods	Building and constructions, services
Decile 1	0.890	0.799	1.873	0.942
Decile 2	0.896	0.790	1.738	0.939
Decile 3	0.892	0.768	1.634	0.939
Decile 4	0.890	0.742	1.565	0.940
Decile 5	0.887	0.732	1.524	0.940
Decile 6	0.882	0.720	1.471	0.940
Decile 7	0.877	0.695	1.440	0.941
Decile 8	0.872	0.674	1.397	0.940
Decile 9	0.860	0.643	1.354	0.942
Decile 10	0.837	0.516	1.308	0.945

where $\mathbf{M}_c$ is the matrix of *fixed price* multipliers (Pyatt and Round, 1979). The system in Eq. (A.1) may be used as a basis for policy analysis simulations as follows:

$$d\mathbf{y} = \mathbf{M}_c d\mathbf{x} \tag{A.2}$$

where $d\mathbf{x}$ is a vector of changes in exogenous injections, representing different policy scenarios. However, model (A.1) assumes perfect elasticity of supply in all sectors. This assumption is generally considered unrealistic for developing countries agriculture. The presence of supply side constraints in one or more sectors can be taken into account in a linear model calculating a so-called 'mixed multiplier matrix' (Lewis and Thorbecke, 1992). Suppose to identify k (out of n) sectors that are supply-constrained. The matrix $\mathbf{C}$ can be partitioned as follows:

$$\mathbf{C} = \begin{bmatrix} \mathbf{C}_{nc} & \mathbf{Q} \\ \mathbf{T} & \mathbf{C}_c \end{bmatrix} \tag{A.3}$$

where the $\mathbf{C}$ blocks with subscripts nc and c identify the marginal expenditures propensities of non supply-constrained and supply-constrained sectors, with dimensions $[(n-k)\times(n-k)]$ and $[k\times k]$ respectively; $\mathbf{T}$ is the $[k\times(n-k)]$ matrix of expenditure propensities of factors, institutions and non supply-constrained sectors on supply-constrained sectors; $\mathbf{Q}$ is the $[(n-k)\times k]$ matrix of supply-constrained sectors expenditures on factors, institutions and non supply-constrained sectors output. The matrix of mixed multipliers can be calculated as follows:

$$\mathbf{M}_m = \begin{bmatrix} (\mathbf{I}-\mathbf{C}_{nc}) & 0 \\ -\mathbf{T} & -\mathbf{I} \end{bmatrix}^{-1} \begin{bmatrix} \mathbf{I} & \mathbf{Q} \\ 0 & -(\mathbf{I}-\mathbf{C}_c) \end{bmatrix} \tag{A.4}$$

where $\mathbf{I}$ and $\mathbf{0}$ are the identity and null matrices with appropriate dimensions. The mixed multiplier matrix can substitute matrix $\mathbf{M}_c$ in Eq. (A.2).

The redistributive effects have been analysed using a particular transformation of matrix $\mathbf{M}_m$ proposed by Roland-Host and Sancho (1992) to show the changes in the *relative* position in income distribution of different household groups. According to these authors, the change in a normalised measure of income shares $\hat{\mathbf{y}}$ induced by an exogenous injection $d\mathbf{x}$ is given by

$$d\hat{\mathbf{y}} - [\mathbf{I}'\mathbf{Y}]^{-1}[\mathbf{I}-\hat{\mathbf{Y}}\mathbf{I}']\mathbf{M}^{inst}d\mathbf{x} = \mathbf{R}d\mathbf{x} \tag{A.5}$$

where $\mathbf{M}^{inst}$ is the $(n\times m)$ submatrix of $\mathbf{M}_m$ corresponding to income multipliers of the n institutions considered for m different exogenous shocks (on sectors, factors and institutions). According to (A.5) the matrix of *absolute* (that is, non normalised) values of redistributive effects is given by

$$\mathbf{R}^* = \mathbf{I}'\mathbf{y}\mathbf{R} = [\mathbf{I}-\hat{\mathbf{y}}\mathbf{I}']\mathbf{M}^{inst} \tag{A.6}$$

Eq. (A.6) yields the value of the redistribution induced by an additional unit of exogenous inflow while total income is held constant at its initial level. In other words, $\mathbf{R}^*$ is a sign-preserving transformation of $\mathbf{R}$ where the elements of each column sum to zero, as in the case of the original matrix, since only redistributive effects are accounted for. The redistribution matrix $\mathbf{R}^*$ shows the changes of income that each group would perform if only the redistributive effects of exogenous impacts were taken into account, excluding output/income changes due to exogenous shocks. This means that the impact of an exogenous shock is modelled as a redistributive zero-sum game among different socio-economic groups (cf. Rocchi et al., 2005; Rocchi, 2009). Dividing each element of matrix $\mathbf{R}^*$ by

Table A.5
Redistributive impacts of selected policies (elasticities). *Source*: Authors' own calculations.

Quintiles	Elimination of subsidies to agriculture and food industry			Price support reduction for strategic crops			Elimination of PSF		
	Deficit reduction	Public expend. increase	Transfer increase	Deficit reduction	Public expend. increase	Transfer increase	Deficit reduction	Public expend. increase	Transfer increase
Urban households									
1st	−0.7	3.6	90.7	0.2	0.7	12.0	−44.6	−42.6	−1.4
2nd	0.6	3.0	61.8	0.2	0.5	8.1	−18.2	−17.1	10.7
3rd	0.3	5.0	99.8	0.1	0.7	12.9	−5.9	−3.7	41.0
4th	3.2	3.9	10.3	−0.4	−0.3	0.5	32.8	33.2	36.2
5th	13.3	11.9	9.9	−1.8	−2.0	−2.3	198.8	198.2	197.2
Rural households									
1st	−3.8	−3.5	−2.2	1.0	1.0	1.2	−93.3	−93.1	−92.5
2nd	−5.2	−4.7	−4.8	0.9	1.0	1.0	−105.3	−105.1	−105.1
3rd	−7.7	−9.7	−64.7	0.9	0.7	−6.4	−78.2	−79.2	−105.2
4th	−7.4	−11.5	−116.6	0.6	0.1	−13.5	−32.1	−34.1	−83.6
5th	0.3	−8.1	−179.1	−0.8	−1.9	−24.0	76.4	72.4	−8.3

the total absolute impact (sum of positive elements of the relevant column) yields the matrix of redistributive *shares* (presented in the main text). A further transformation of matrix **R** can be carried out computing the *elasticities* of distributive impacts, *i.e.* the importance of a given impact relative to the initial position of each household group. The elasticity of *i*th household group is the ratio of the percentage change in its income to the percentage change of exogenous inflows to the household account. The elasticities for the nine scenarios of agricultural policy reform are provided in Table A.5.

A second analysis was carried out to assess the potential impacts of reforms on poverty, following the approach proposed by Pyatt and Round (2006). Given a measure of poverty S based on the definition of a poverty line, we can assume that the measure itself is additively decomposable across groups of households. Therefore

$$S = \sum_i S_i \tag{A.7}$$

where i is a generic household group. Defining the number of people included in a socio-economic group, n_i, and the proportion of poor in the same group, P_i, we can write:

$$S_i = n_i P_i \tag{A.8}$$

and the change in the poverty measure for each group is

$$dS_i = n_i dP_i + P_i dn_i \tag{A.9}$$

Ignoring the effect of population growth (that is the second term on the right hand side) the change in the proportion P_i of people that are poor will depend on changes in the average income as well as on changes in prices able to differentially move poverty lines across socio-economic groups. As changes in prices cannot be represented in a fixed-price model, the analysis will account only for the effect on poverty due to changes in the scale of incomes within each household group. Pyatt and Round (2006) show that the change in the number of poor in a generic socio-economic group is given by

$$\frac{dS_i}{S} = (1 + |\epsilon_i|)\frac{dn_i}{n_i} - \frac{|\epsilon_i|}{y_i}\mathbf{z}_i'\mathbf{M}_{ml}d\mathbf{x} \tag{A.10}$$

where

ε_I is the partial elasticity of P_i to changes in the average income within the ith group (poverty elasticity).

y_i is the total income of the ith household group.

$\mathbf{z_i}$ is a vector with the ith element equal to 1 and all the other elements equal to 0.

$\mathbf{M}_{ml}$ is the sub-matrix $(g \times n)$ of income mixed multipliers for households groups where g is the number of households groups and n is the number of rows/columns of matrix $\mathbf{M}_m$.

x is the vector of inflows from the exogenous sectors in the original SAM.

Eq. (A.10) implies that the number of poor in a socio-economic group decreases only if the increase in the average income resulting from economic growth (that is the second term of the right hand side) offsets the negative effect of population growth on poverty. Poverty elasticities estimated in Table 2 have been used to calculate the second term of the right hand side of Eq. (A.10), that is the effect of exogenous changes on poverty with population held constant.

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