Paper prepared for the 122nd EAAE Seminar
"EVIDENCE-BASED AGRICULTURAL AND RURAL POLICY MAKING: METHODOLOGICAL AND EMPIRICAL CHALLENGES OF POLICY EVALUATION"
Ancona, February 17-18, 2011

Measuring the impact of trade policy reform in Ireland: A disaggregated analysis of household impacts

Miller C.[1], Matthews A.[2], Boysen O.[3], Donnellan T.[4], and O'Donoghue C.[5]

1 Department of Economics and Research Student Associate at the Institute for International Integration Studies, Trinity College Dublin, Ireland
2 Emeritus Professor of European Agricultural Policy, Department of Economics and Research Associate of the Institute for International Integration Studies at Trinity College Dublin, Ireland
3 Post-doctoral Research Fellow at the Institute for International Integration Studies at Trinity College Dublin, Ireland
4 Principal Research Officer at the Rural Economy Research Centre, Teagasc, Ireland
5 Director of the Rural Economy Research Centre, Teagasc, Ireland

millerac@tcd.ie

Measuring the impact of trade policy reform in Ireland: A disaggregated analysis of household impacts

Miller C., Matthews A., Boysen O., Donnellan T.and O'Donoghue C.

Abstract

The purpose of this paper is to assess the impacts of further trade liberalisation on the agricultural sector in Ireland. In addition to evaluating the aggregate impacts on agricultural production as well as the spill-over effect of this on the non-agricultural sector and for overall Irish GDP, we evaluate the effects for different types of households. In order to capture economy-wide impacts of the policy reform, a CGE model was formulated and implemented using a social accounting matrix constructed for Ireland for the year 2005. Household effects are captured using representative households. The simulation results suggest a positive impact on the Irish economy as well as on the representative households. Many agricultural sectors contract in the process but a more efficient reallocation of resources into manufacturing and services sectors more than compensates those losses.

Keywords: Trade policy, CAP reform, CGE model, Macro and welfare effects

JEL Classification: F13, D58, I3

1. INTRODUCTION

The purpose of this paper is to introduce a model which allows *ex ante* assessment of proposed policy changes affecting Irish agriculture and the Irish economy both at aggregate economy-wide and disaggregated household levels. Current models for *ex ante* evaluation of policy changes affecting Irish agriculture are either partial equilibrium or farm level models (for example, the FAPRI Ireland model maintained by Teagasc). The agri-food sector remains important in the Irish economy accounting for 10% of GDP and 10% of employment (DAFF, 2010). It is thus important to take into account the strong interdependencies between activity levels in both the agricultural and non-agricultural sectors in undertaking policy analysis.

Recent government policy has set challenging targets for the contribution of agriculture to Ireland's economic recovery (DAFF, 2010). But although agriculture and the food industry have growth potential, they also face enormous vulnerabilities. Agriculture is primarily grass-based, with beef and dairy products the major output. These are among the EU agricultural products with the highest levels of protection (for some individual Harmonised System lines for these products tariff ad valorem equivalents exceed 100%) and thus are vulnerable to tariff reductions negotiated in a Doha Round agreement. Agricultural incomes are heavily dependent on direct payments. For some activities (beef, sheep, cereals) the Single Farm Payment accounts for nearly all family farm income. Thus the sector is heavily exposed to reform of the EU budget and CAP farm payments which might lead to a reduction in EU transfers. Furthermore, Ireland faces very stringent targets for reducing GHG emissions under the EU's Effort Sharing Directive. Most agricultural emissions come from the livestock herd, and there are few technical

mitigation options, apart from reducing livestock numbers, to lower these emissions. Given these challenges, there is a need for a policy tool which can provide simulation results of different policy options in the trade, agricultural policy and climate change areas to support decision-making.

At the same time, analysis of the distributional effects of policy changes is increasingly important and necessary as agricultural policy moves away from sectoral interventions (tariffs, export subsidies, product-related subsidies) to targeted instruments (green payments, payments related to characteristics on individual farms). A desirable feature of a policy evaluation model is thus to be able to evaluate the impact of changes in both farm and non-farm policies on both farm and non-farm households, to contribute to understanding the distributional impacts of policy reforms. A further advantage of such distributional analysis is that it allows a better understanding of the likely winners and losers from reforms, allowing the more efficient design of compensatory policies where this is deemed desirable.

This paper uses a computable general equilibrium (CGE) model based on a social accounting matrix for Ireland for policy evaluation. As CGE models by themselves provide only details of income changes of one representative household, recent literature has devised a range of methods to augment CGE models for income distribution and poverty analysis. These can be broadly divided into two main directions. First, CGE model results are used in a subsequent step to feed a microsimulation model, built on the basis of a household survey dataset, which simulates the impacts on household income and consumption to derive a detailed post-shock income distribution. The second direction aims at building a holistic CGE model by disaggregating the representative household of the model, also on the basis of a household survey, into several representative household groups. Households are expected to respond differently to the policy shocks between groups but homogenously within each group. In the ultimate, this approach allows integrating the entire set of households from the survey into the CGE model. For a detailed overview of the different approaches and their advantages and disadvantages, see, for instance, Bourguignon, da Silva, and Bussolo (2008) or Bussolo and Cockburn (2010).

In this study, we are interested in the differential impacts of trade policy reform on different household types within farming. In the spirit of the second approach, we disaggregate the representative household into a set of households differentiated by farming system as well as two non-farming rural and urban households. This allows us to infer impacts on the mean income within each of these household groups and changes in distribution between those groups.

Our model incorporates a number of innovations:

- Construction of a new social accounting matrix (SAM) database for Ireland calibrated to the base year 2005 and with a large element of disaggregation of the agricultural and food sectors;
- Incorporation of all households in the sample underlying the household budget survey into the SAM

- Incorporation of CAP policy instruments and subsidies in the specification of the CGE model.

We illustrate the use of the model with a multilateral trade liberalisation scenario in which both agricultural and non-agricultural tariffs are reduced. Liberalisation would mean lower producer prices for Irish farmers but also lower prices for consumers. At the same time, the Doha negotiations cover the liberalisation of manufacturing and services where Ireland already has a very open economy and would expect to benefit from improved market access to third country markets. Matthews and Walsh (2006), using a stylised liberalisation scenario, found that Ireland's welfare would increase as a result of further trade liberalisation, with positive gains from industrial and service trade liberalisation, but a negative impact from agricultural liberalisation.. As well as revisiting their result, we are interested to observe the distributional effects between households as a result of further multilateral trade liberalisation.

For a small open economy like Ireland, the main effects of trade liberalisation are not the direct effects of changes in the country's own tariffs, but rather the terms of trade effects caused by liberalisation in other countries. As we are using a single country CGE model, these terms of trade effects must be provided exogenously. Ultimately, we intend to use the results of a multilateral liberalisation conducted by Baltzer et al (2008) for this purpose. In this paper, we use a hypothetical scenario for illustrative purposes.

The rest of the paper is organized as follows. The setup of the model and data is presented in section 2, the empirical analysis and results are discussed in section 3 and section 4 concludes with some reflections on the value and limitations of this modelling tool as a basis for evidence-based policy making.

2. MODEL AND DATA STRUCTURE

2.1. Constructing the social accounting matrix

The CGE model is calibrated to a 2005 AgriFood SAM for Ireland (Miller et al, 2010). The construction of the Irish AgriFood SAM involved a three-step process: (i) Building a macro-SAM: The macro-SAM resembles the structure described in Pyatt and Round (1985) but at a highly aggregated level. The primary information source for the macro-SAM is the national accounts. (ii) Generating the SAM: the macro-SAM is disaggregated by splitting each cell into a matrix of accounts. For example, the activity account is initially disaggregated into 55 activities producing 55 commodities, according to the 2005 Input-Output Table. We then further disaggregate the agriculture, hunting and related services (NACE code 01) and manufacture of food and beverages (NACE code 15) sectors using information from a variety of national sources.[1] For the newly formed agricultural sectors labour is split between paid and family

[1] In 2005 Ireland was still producing sugar and therefore the AgriFood SAM accounted for the production of sugar. As a result of the EU sugar reform, production of sugar ceased in 2006. As production in 2005 only amounted to

labour as well as introducing the return to land as another factor of production for these sectors. This process of disaggregation results in a complete but unbalanced SAM. (iii) Balancing the SAM: To this end, we employ the information theory-based cross-entropy approach implemented by Robinson and Al-Said (2000) and Robinson et al (2001). The estimation procedure is to minimize the Kullback-Leibler (1951) cross-entropy measure of the distance between prior coefficients and the new estimated coefficients, given a choice of constraints imposed on the basis of prior knowledge from the SAM.

Some features of the disaggregation of the single agricultural sector in the 2005 Input-Output table should be noted. We distinguish a separate fodder production activity which uses inputs to produce grass fodder (silage and hay). In turn, dairy, cattle and sheep activities use land directly (for grazing) but also consume fodder produced by the fodder activity. We introduce the commodity 'calves' to take account of the interdependency between dairy and cattle production in Ireland. Both dairy and milk activities produce calves which are used in the two sectors as inputs. The valuation of family-owned resources used in agricultural production raises particular issues. Land has been valued at a single rental rate derived from the National Farm Survey with no distinction between different types of land. Family labour input has been valued at the minimum agricultural wage, and the return to capital in each sector is then derived as a residual. Sales of agricultural contracting services were allocated across the newly formed agricultural sectors according to their share in gross output.

To analyse issues of income distribution in a CGE model, we disaggregate the household sector. This exercise is facilitated by the link between the Household Budget Survey 2004-2005 and the National Farm Survey (2004), in that 620 farm households interviewed in the latter are also part of the former. The HBS 2004-2005 contains 6,884 households, of which 66% are urban households, 25% rural non-farm households and 9% rural farm households. Both surveys are representative for Ireland and we merge the two datasets giving a total of 6,866 households which are used to replace the household account in the AgriFood SAM.

It is a non-trivial exercise to match the expenditure categories used in the household budget survey with the economic sectors distinguished in the input-output table. The farm and household survey data were allocated to the SAM expenditure accounts using three concordance systems, CPC Ver. 2, ISIC Rev. 4 and NACE Rev. 1.1.2. Each product in the consumption category in the HBS 2004-2005 was first identified in the CPC Ver. 2 at a five digit level using the United Nations Statistical Division website, which also provides code correspondence with the CPC Ver. 1.1 and ISIC Rev. 4.3 Then, using a correspondence between ISIC Rev. 4 and NACE Rev. 1.1 each good/service consumed by the households was translated into its corresponding NACE Rev 1.1, two digit code, used by the Central Statistics Office Ireland in

---

1.2% of total agricultural output, sugar beet production was included in the 'other crops' sector and sugar refining was included in 'manufacturing of other food products'.

constructing the 2005 Input-Output Table for Ireland (CSO, 2009). The final step is to bring those values to the national level by using the weights provided in the HBS 2004-2005.

For the purposes of this paper, we aggregate households into nine representative household types as follows: urban households, rural non-farm households, rural dairy farm households, rural dairy and other farm households, rural cattle rearing farm households, rural cattle and other farm households, rural mainly sheep farm households, rural tillage farm households and rural other farm households.[2] The income and expenditure of the last type of farm household, which includes pigs, poultry and other farms not represented in the NFS, are calculated and distributed as a residual. Those representative households replace the single household sector in the SAM, providing a new AgriFood SAM with representative households.

2.2. The CGE model

The CGE model used in this paper builds on the IFPRI Standard CGE model (Lofgren et al, 2002). It is a static, non-monetary model which describes a single country open economy with 23 production sectors producing 24 commodities, nine representative consumers, a public sector, one enterprise account and two external accounts, EU and ROW. The production sectors include 10 agricultural sectors producing 11 commodities and 10 food manufacturing sectors. In equilibrium three sets of conditions are satisfied simultaneously: zero profit conditions in all activities; market–clearing in all goods and capital markets assuming that all representative agents optimise rationally; and income balances for all institutions plus the macroeconomic closure represented by a set of constraints.

Production is based on combining intermediate inputs and sectoral value added according to a Leontief function. Intermediate inputs are combined according to a Leontief function and value added is determined by combining primary factors according to a constant elasticity of substitution (CES) function. Each activity produces one or more commodities according to a fixed yield coefficient and the profit-maximization condition of producers is fulfilled by the first order condition that each factor's marginal productivity equals its return. Commodities are allocated to domestic and export sales assuming imperfect transformability using a constant elasticity of transformation (CET) function. Consumers regard the commodities produced and sold on the domestic market as imperfect substitutes to imported commodities as well as imports from different regions. First, imports from the EU and the ROW are aggregated to a single imported commodity using a second-level CES (Armington) function. Then, another CES function combines imported and domestic goods into a final composite good. Domestic demand is the sum of demands from households, government consumption, investment and intermediate inputs and transaction inputs, i.e. transport and trade. Demand and supply on different commodity markets are required to equilibrate through price adjustment.

[2] As all Irish households are individually represented in the SAM, it is easy to aggregate to alternative groupings of representative households, for example, distinguishing households by education or income levels.

The Institutions are represented by government, enterprise, nine representative household and the rest of the world accounts. Households receive their income from ownership of the factors of production as well as transfers from government and the rest of the world. They consume commodities according to a linear expenditure system (LES). The government receives income from taxes and from transfers from the rest of the world. It consumes a fixed quantity of private and public services and transfers a CPI-indexed amount to households and enterprises. The rest of the world accounts receives payments from exports, spends on imports, invests and transfers amounts to other institutions. The difference between the rest of the world income and spending corresponds to foreign savings. Income is required to equal expenditures for all institutions.

Since the model contains more variables than equations, some macroeconomic constraints are introduced to reduce the number of variables. Government savings are allowed to change as the government expenditure and the tax rates in the model are fixed. The current account is balanced by changes in the exchange rate keeping foreign savings constant. The marginal propensities to save of households and enterprises are assumed to adjust to the changes of the domestic value of the rest of the world savings and price changes of investments to keep investment constant in real terms. As we are investigating impacts in the long-run, all factors are assumed to be fully mobile while employment levels are kept constant so that factor markets balance through changes in their returns. Land is only used in the agricultural sectors. The CPI is fixed and serves as the numeraire of the model.

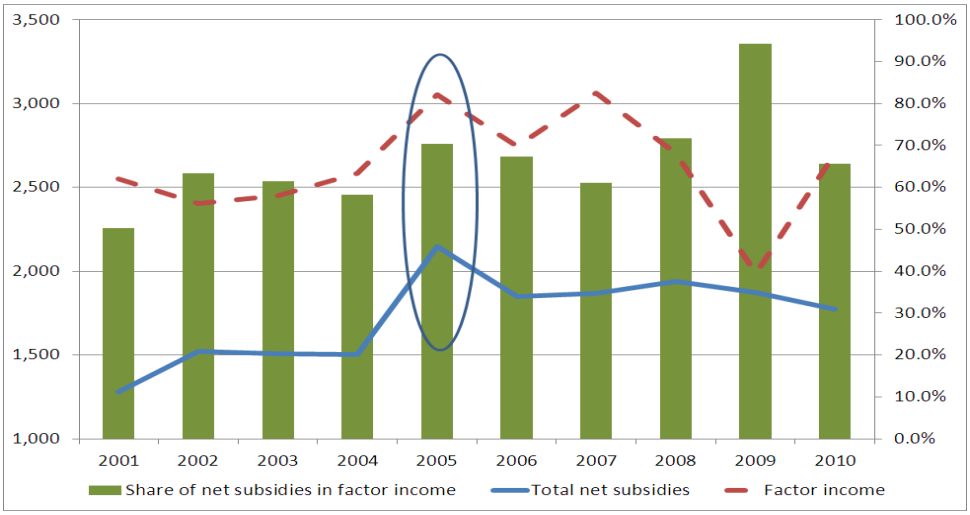
2.3. Treatment of the CAP

The tax and subsidy accounts are of great importance for the agricultural sectors. The National Accounts System (CSO, 2009a) differentiates between subsidies and taxes on products and other subsidies and taxes on production. Subsidies and taxes on products are included in the calculation of output. Other taxes and subsidies are not included in the calculation of output. These other subsidies include the Single Payment Scheme (SPS), Area-based Compensatory Allowance Scheme (DACAS), the Rural Environmental Protection Scheme (REPS) and a small residual category of Other Subsidies not related to products.

Under the 2003 CAP reform, in 2005 Ireland opted for full decoupling of production-related subsidies using the historic basis for the Single Payment Scheme. The payment received by each farm approximated to the value of premium claims made under the previous coupled livestock and arable aid schemes in the three year reference period 2000-2002, adjusted for the introduction of the dairy premium intended to compensate for the reduction in intervention milk prices after 2004. The 2005 base year for the SAM was the first year of implementation of the new Single Farm Payment (SFP). Direct payments were unusually high in 2005 because some coupled premium payments from 2004 were paid in 2005 in addition to the new SFP entitlements. The SFP payment mirrored the level of activity on farms some years previously. We assume that, in 2005, farmers had not yet had time to adjust to the decoupling of their premium payments and that the level of agricultural activity in 2005 still reflected the coupled

nature of these payments. We thus introduce the payments in 2005, including the SFP, in the SAM as payments coupled to output. We then perform a pre-experiment intended to reflect the decoupling of direct payments before we run the trade liberalisation scenario.

Figure 1. Net subsidies and factor income in Irish agriculture, 2001-2010, € million



Source: Own calculations based on CSO Database Direct.

Table 1: The allocation of subsidies in the Irish agricultural accounts, € million

	Milk	Cattle	Sheep	Pigs	Poultry	Cereals	Horticulture	Potatoes	Other crops	Fodder crops	Total
Gross Output	1384	2166	219	307	188	195	246	83	160	769	5,717
Subsidies on products	1	439	11	0	0	2	0	0	0	0	453
SFP	29	772	135	0	0	120	0	0	2	0	1059
DACAS	40	150	41	0	0	0	0	0	0	0	231
REPS	49	184	50	0	0	0	0	0	0	0	283
Other Subsidies	3	3	1	0	0	1	0	0	0	0	7
Total Subsidies	122	1548	238	0	0	123	0	0	2	0	2033
Coupled payments as % of gross output	*2.2*	*55.9*	*66.7*	*0.0*	*0.0*	*62.6*	*0.0*	*0.0*	*1.3*	*0.0*	*26.4*
Taxes on production	12	9	1	2	1	2	1	1	1	4	33
Factor Income	875	1264	182	38	26	100	115	45	84	330	3059
Intermediate Inputs	502	1286	267	343	200	194	152	45	106	639	3734
Gross Value Added	882	880	-48	-36	-11	2	94	38	55	129	1984

Source: Authors' calculation using AgriFood SAM 2005 for Ireland

The allocation of the three main subsidies on production, as described in the national accounts, is done in three stages. First, the SPS subsidies are allocated between the agricultural sectors on the basis of historical information, using survey information provided by NFS 2004. In the second stage the REPS and DACAS payments are fixed and allocated across farms using the NFS 2005 data and the share of forage area that each farm uses. Therefore the REPS and DACAS are allocated as a subsidy payment to land.

The huge importance of subsidies to factor income in agriculture of €3,059m is shown in Table 1. Overall, gross value added at market prices contributed €1,984m to factor income, while subsidies contributed a further €2,033m. The importance of the assumed coupled subsidies (including the SPS payment in this definition) differs across activities. For dairy, coupled subsidies are small comprising the relatively new dairy premium. But coupled subsidies contribute very substantially to factor income in the cattle activity – a total of €1,211m out of estimated factor income of €1,264m. For the sheep activity, the coupled payment of €146m also accounts for most of factor income of €182m. We thus expect significant reallocation of resources within the agricultural sector as a result of the pre-experiment transferring coupled to decoupled payments.

3. SCENARIOS AND RESULTS

We first run a pre-experiment intended to reflect the decoupling of direct payments. We do this by removing the equivalent to the Single Farm Payment attached to each activity in 2005 and paying this as a lump sum transfer from the government to households. The assumption behind this approach is that the SFP is, indeed, fully decoupled. There is evidence that Irish farmers do not treat the SFP as fully decoupled. However, the focus of this paper is on trade policy changes rather than changes in domestic subsidies so we maintain this fully decoupled assumption for this simulation. The result of this pre-experiment is the starting point for the trade policy simulation.

We illustrate the model with a trade policy simulation intended to capture the latest draft modalities from the WTO negotiations. For this version of the paper, in the absence of a formal link with a multi-regional model, we construct a set of hypothetical policy shocks based on values found in the literature (Bouët et al, 2006; Binfield et al, 2008). The key features of these shocks (set out in Table 2), are the following:

- Export subsidies applied by Ireland on extra-EU exports are set to zero. The transfers from the EU to the Irish institutions are reduced by the same amount. Note, a large share of other crops is sugar which attracts an exceptionally high export subsidy.
- For agricultural products, we assume a uniform 70% tariff reduction in all agricultural and food sectors. There are no tariffs on intra-EU imports.
- No change in domestic subsidies is assumed as a result of the Doha Round.
- Non-agricultural tariffs which are already very low are set to zero.

- Irish extra-EU import and export prices for livestock products are assumed to increase by more than extra-EU import prices for arable products. Irish intra-EU import prices for livestock are assumed to decrease by more than extra-EU imports prices for arable products.
- Irish import and export prices for both extra- and intra-EU trade in manufactured goods and services are assumed to rise by 1%.
- Irish import and export prices for services trade assumed to increase by 1%.

Table 2: Policy shocks applied to represent Doha Round liberalisation

Sector	Base Tariff %	Base Export subsidy %	Tariff reduction %	Export Subsidy reduction %	Change import prices EU	Change import prices Rest of World	Change export prices EU	Change export prices Rest of World
Milk	0.0%		70%		-10%	+5%	-10%	+5%
Cattle	6.4%		70%		-20%	6%	-20%	6%
Sheep	0.0%		70%		-20%	5%	-20%	5%
Pigs	0.0%		70%		1%	1%	1%	1%
Poultry	0.0%		70%		-10%	+5%	-10%	+5%
Cereals	0.5%		70%		-5%	+5%	-5%	+5%
Horticulture	0.0%		70%		+5%	-5%	+5%	-5%
Potatoes	0.0%		70%		0%	0%	0%	0%
Other crops	0.0%	293.1%	70%	100%	-5%	+5%	-5%	+5%
Fodder crops	0.0%		70%		0%	0%	0%	0%
Forestry	0.0%		70%		0%	0%	0%	0%
Fishing	0.0%		70%		0%	0%	0%	0%
Beef	29.1%	2.2%	70%	100%	-20%	6%	-20%	6%
Pig meat	3.1%		70%		1%	1%	1%	1%
Poultry meat	0.8%		70%		-10%	+5%	-10%	+5%
Sheep meat	62.4%		70%		-20%	5%	-20%	5%
Fish products	0.0%		70%		0%	0%	0%	0%
Processed fruit & vegetable	0.0%		70%		+5%	-5%	+5%	-5%
Dairy	11.5%	4.0%	70%	100%	-10%	+5%	-10%	+5%
Animal feed	0.4%		70%		-5%	+5%	-5%	+5%
Other food Products	11.7%	0.7%	70%	100%	-2%	+2%	-2%	+2%
Manufacturing	0.1%		100%		1%	1%	1%	1%
Services	0.0%		0%		1%	1%	1%	1%

Ireland is an open, trade dependent economy with the value of exports at 81% of GDP exceeding the value of imports by about 18%. Agrifood products account for about 8% of exports while they account for about 5% of imports. Although overall extra-EU import tariffs are small (the trade weighted average import tariff for Ireland is 0.3%), there are a number of agricultural and food sectors with considerable import protection. Those above 1% are, in decreasing order, sheepmeat (62%), beef (29%), other food products (12%), dairy (12%), cattle (6%), and pig meet (3%). In addition, four sectors are protected through export subsidies where dairy (4%) and beef (2.2%) are the most significant (other crops has a high unit subsidy but a small share in total exports). At the same time, cattle and dairy together with other food products are largest agricultural and food sectors. For these three, more than 50% of domestic

output is exported. Moreover, Ireland imports significant shares of their domestic demand. We thus expect a large shock on the Irish agriculture and in particular to the sectors connected to beef and dairy from the proposed import and export trade liberalisations.

But while the trade liberalisation will likely have a negative impact on Irish agriculture and intra-EU prices are expected to fall, world prices for many agricultural and food products are forecasted to increase and might mitigate some of the effects. Manufacturing and services sectors will likely profit from the dismantling of trade distortions in trading partners so that the overall economic outcome remains ambiguous without quantitative analysis. The same applies to the impacts on household level which will depend on the implications for income as well as for consumer prices.

3.1. Results

We present the empirical results of three scenarios: the baseline scenario (Base), a pre-experiment where the SFP is cut and transferred as a lump sum to households (SFP) and a trade liberalization Doha scenario (Doha). The results of those two scenarios are presented in Tables 3 through 6 and indicate the percentage deviation from the base values (SFP and Doha scenario columns) and the percentage deviation of the Doha from the SFP scenario (Doha impact compared SFP scenario column). The focus of our analysis is on the impact of the Doha trade liberalisation starting from an economy with decoupled SFP payments, as shown in the last column of the tables.

Table 3 presents the macroeconomic impacts. The Irish economy as a whole will benefit from the hypothesised Doha scenario as indicated by a GDP increase of 1.4%. Imports decrease and, under constant foreign savings, exports are required to match this decrease through quantity and exchange rate adjustments. The dismantling of trade distortions leads to reallocation of productive factors to more efficient sectors so that losses in the negatively affected agricultural sectors are overcompensated through expansion of the manufacturing and services sectors (which increase production by 1.8% and 1.1%, respectively). Households appear to gain strongly as their consumption increases by 2.8% on average.

Table 3: Macroeconomic impacts

	Base 2005	SFP scenario	Doha scenario	Doha impact compared SFP scenario
	€m	%	%	%
Labour	65,468	-0.45	1.25	1.71
Land	781	-81.60	-95.83	-77.35
Capital	74,733	-0.27	1.18	1.45
Private consumption	72,168	0.69	3.45	2.75
Exports	131,342	0.12	-0.60	-0.72
Imports	-111,390	0.14	-0.91	-1.05
GDP at market price	162,212	0.31	1.68	1.37

Source: Authors' calculation. The columns represent 'base scenario': values in €m, 'SFP' and 'Doha scenario': percentage change compared to the base year, and 'Doha impact compared SFP scenario': percentage change of the Doha compared to the SFP scenario.

Overall, imports and exports change very little in the decoupling scenario as this shock applies only to agriculture sectors and the share of those imports and exports is small. The increase of both imports and exports in the decoupling scenario is expected as the stimulus for production in major agricultural sectors is reduced which leads to substantial price increases and reduced exports of those sectors detailed in Table 5. The Doha scenario induces a reduction in both Irish imports and exports through cutting of tariffs on imports by 70% and export subsidies by 100% combined with the import and export price changes reported in Table 2. Again, the most affected sectors by the cuts in tariffs are the agricultural and food sectors which together represent 8.50% of the total Irish exports but only 5% of imports.

Table 4: Changes in output levels

Sectors	Base 2005	SFP scenario	Doha scenario	Doha impact compared SFP scenario
	€m	%	%	%
Milk	1,366	21.96	-24.49	-38.09
Cattle	1,802	-35.94	-50.28	-22.38
Sheep	210	-54.29	-81.04	-58.51
Pigs	387	-4.62	-26.27	-22.70
Poultry	226	-16.37	-32.70	-19.52
Cereals	147	-71.37	-87.75	-57.20
Horticulture	266	-1.43	-0.74	0.69
Potatoes	90	2.34	0.98	-1.32
Other crops	187	8.69	-11.09	-18.20
Fodder crops	941	-18.06	-33.56	-18.92
Forestry	328	1.01	2.34	1.32
Fishing	444	-1.82	0.79	2.65
Beef	2,563	-36.46	-51.57	-23.78
Pig meat	856	-3.90	-26.84	-23.87
Poultry meat	433	-15.15	-36.22	-24.83
Sheep meat	322	-28.41	-68.14	-55.49
Fish products	306	-0.36	1.31	1.68
Processed fruit & vegetable	153	0.95	6.77	5.77
Dairy	2,910	19.03	-26.00	-37.83
Animal feed	894	-9.82	-18.28	-9.39
Other food products	7,110	-8.10	-38.78	-33.39
Manufacturing	131,690	0.94	2.72	1.77
Services	170,259	0.36	1.49	1.13
Transport and distribution	16,873	3.59	1.12	-2.39

Source: Authors' calculation. The columns represent 'base scenario': values in €m, 'SFP' and 'Doha scenario': percentage change compared to the base year, and 'Doha impact compared SFP scenario': percentage change of the Doha compared to the SFP scenario.

Table 4 reports the results for the changes in domestic production activities. Cattle and sheep are the most affected sectors in the decoupling scenario as these sectors have the highest share of coupled payments as reported in Table 1. The production of the cereals sector drops by 71% following the decoupling of the SFP as this sector is highly connected with other agricultural sectors, such as cattle, sheep and food sectors in general. As a result of the drop in agricultural production, the food sectors register a similar proportionate reduction. The milk sector registers a 22% increase in production as this sector is highly decoupled and the SFP represent a small share in its direct payments (we assume the post-2015 situation of no milk quota). A reduction of the cattle sector allows for an expansion of the milk sector as their main inputs are highly substitutable and decrease in price. In the Doha scenario, most agricultural and food sectors experience a drop in output. In the main scenario, there are again huge contractions of the agrifood sectors but also some gains most noteworthy in processed fruit & vegetables (5.8%), fishing (2.7%), and fish products (1.7%) . The most important gains are in the manufacturing (1.8%) and services sectors (1.1%) as these last two represent the bulk of economic activity.

Table 5: Changes in exports and imports

Sectors	Exports				Imports			
	Base 2005 exports	SFP scenario	Doha scenario	Doha impact compared SFP scenario	Base 2005 imports	SFP scenario	Doha scenario	Doha impact compared SFP scenario
	€m	%	%	%	€m	%	%	%
Milk	0	0.00	0.00	0.00	101	-15.76	-68.17	-62.21
Cattle	256	-43.10	-57.10	-24.61	67	-14.20	-29.34	-17.66
Sheep	103	-67.28	-88.20	-63.93	29	58.87	-9.39	-42.96
Pigs	76	-6.36	-22.90	-17.67	8	0.27	-34.89	-35.06
Poultry	33	-16.78	-29.17	-14.89	17	-1.21	-21.48	-20.52
Cereals	8	-44.91	-35.44	17.19	179	24.45	-14.43	-31.24
Horticulture	9	1.34	-4.99	-6.25	235	-1.51	-4.29	-2.82
Potatoes	1	4.54	3.24	-1.25	145	-1.69	-3.12	-1.46
Other crops	11	17.88	-73.93	-77.89	106	-18.39	-18.04	0.44
Fodder crops	0	0.00	0.00	0.00	9	-62.83	-75.28	-33.50
Forestry	29	1.06	1.73	0.65	59	0.60	3.56	2.93
Fishing	175	-3.29	-0.12	3.28	8	2.94	3.24	0.29
Beef	1,577	-32.44	-44.68	-18.12	92	140.70	337.01	81.56
Pig meat	404	-4.23	-17.17	-13.51	140	5.44	150.61	137.69
Poultry meat	251	-15.77	-37.37	-25.64	256	7.29	19.85	11.71
Sheep meat	299	-23.33	-44.03	-26.99	8	122.38	1904.55	801.43
Fish products	27	-1.87	0.37	2.28	28	3.44	3.75	0.30
Processed fruit & vegetable	49	0.94	7.89	6.88	475	0.82	1.50	0.67
Dairy	2,048	21.02	-15.18	-29.91	364	-26.22	149.32	237.90
Animal feed	324	-8.97	-16.91	-8.72	1415	-9.58	-13.62	-4.47
Other food products	5,590	-8.65	-38.82	-33.02	1578	3.17	53.69	48.97
Manufacturing	80,323	1.26	2.68	1.41	47711	-0.51	-0.30	0.22
Services	39,910	0.16	2.03	1.87	58651	0.74	-0.40	-1.13

Source: Authors' calculation. The columns represent 'base scenario': values in €m, 'SFP' and 'Doha scenario': percentage change compared to the base year, and 'Doha impact compared SFP scenario': percentage change of the Doha compared to the SFP scenario.

Table 6: Household level impacts of trade liberalisation

Households	Base 2005	SFP scenario	Doha scenario	Doha impact compared SFP scenario
	€m	%	%	%
Urban	52,698	0.09	2.92	2.83
Rural non-farm	16,683	0.12	2.99	2.87
Rural dairy-farm	668	2.26	4.41	2.10
Rural dairy& other-farm	362	21.45	23.58	1.75
Rural cattle-farm	675	32.18	33.98	1.36
Rural cattle & other-farm	468	4.73	6.48	1.68
Rural sheep-farm	407	8.16	9.65	1.37
Rural tillage-farm	136	20.40	21.79	1.15
Rural other-farm	71	15.40	17.62	1.93

Source: Authors' calculation. The columns represent 'base scenario': values in €m, 'SFP' and 'Doha scenario': percentage change compared to the base year, and 'Doha impact compared SFP scenario': percentage change of the Doha compared to the SFP scenario.

The link between aggregate changes in economic activity in the economy following a trade liberalisation shock and household welfare is mediated through changes in factor returns (on the income side) and changes in the prices of consumption goods (on the expenditure side). Thus, households are affected differently by economic shocks because they own different shares of labour, capital and land and receive different levels of transfers (including agricultural subsidies). The particular sector from which a household derives its income from does not influence the long-run returns to the resources that the household owns.

Table 6 shows a general increase of consumption for all of the nine representative household groups by between 1.2 and 2.9%. This is due, on the one hand side, to strong consumer price decreases in the most important agrifood sectors, first of all with prices for dairy decreasing by 28%, while manufacturing and services prices increase by 1 to 2%. This will benefit in particular poorer households which have a higher share of food in their total consumption basket and all but the urban households see their individual consumer price index falling. On the other hand, this is a result of the changes in factor returns. Returns to labour and capital rise by 1.7 and 1.5%, respectively. In contrast, land returns slump by 77.4%. However, as land accounts for less than 0.1% of total factor incomes the overall impact of this is rather limited but not insignificant on a household level. Rural farm households derive between 9 and 18% of their income from land returns, with rural other- at the low and rural tillage-farm households at the high end. Additionally, under the assumption of fixed real investments, with rising incomes households need to save a smaller share of their income to finance the investments which again increases consumption expenditure. Overall, urban and rural non-farm households will benefit the most while rural tillage-farm the least from a Doha liberalisation.

4. CONCLUSION

In this paper, we present work in progress using a single country CGE model of the Irish economy with strongly disaggregated agricultural and food activities for the *ex ante* evaluation of policy changes affecting both agricultural and non-agricultural sectors. A feature of our model is the disaggregation of the single representative household in the standard CGE model using information from the Irish household budget survey which is a representative sample of Irish households, thus allowing the distributional consequences of policy changes as well as their aggregate impacts to be evaluated.

The work to date has focused on the construction of a disaggregated AgriFood SAM for Ireland based on the latest 2005 input-output table for Ireland and the disaggregation of the household sector. A standard CGE model has been specified and particular attention is paid to the modelling of agricultural subsidies. In this preliminary version of the paper, we have demonstrated the current version of the model with an illustrative trade liberalisation scenario. In future work, we intend to link our single-country model with the output of a multi-regional trade liberalisation experiment along the lines suggested by Horridge and Zhai (2005).

Further work will focus on increasing the realism of the model (relaxing the assumption of fixed factor supplies for land and labour, allowing forestry to compete with agriculture for

land) as well as on improving the specification of agricultural subsidies (we intend to better distinguish between subsidies coupled to output, subsidies coupled to land and decoupled subsidies as well as take into account the fact that the bulk of subsidies are paid from the EU CAP budget rather than the Irish government budget).

The outcomes from a CGE simulation of a hypothetical Doha trade liberalisation scenario suggest a positive impact on the Irish GDP as well as on household consumption on an aggregate as well as on a more disaggregated household group level. Shifts of resources from previously strongly protected agricultural and food sectors into more efficient uses result in strong gains for the economy. Many of the agricultural and food sectors contract as expected as the currently remaining import and export protection almost exclusively occurs in those sectors. These contractions are overcompensated by expansions of the manufacturing and services sectors. Household consumption increases in aggregate but also for each of the household groups differentiated in isolation. These gains are mediated through higher returns to the factors labour and capital.

ACKNOWLEDGMENT

This research has been funded under the Teagasc Walsh Fellowship programme which has supported the principal author Corina Miller in her PhD studies. The authors also wish to acknowledge financial support received from the "New Issues in Agricultural, Food and Bio-energy Trade (AGFOODTRADE)" Small and Medium-scale Focused Research Project, Grant Agreement no. 212036), funded by the European Commission. The views expressed in this paper are the sole responsibility of the authors and do not necessarily reflect those of the Commission or Teagasc.

REFERENCES

Baltzer, K., Jensen, H. and Lind, K. (2008), Short Note on the Falconer Draft on Modalities in the WTO Agricultural Negotiations, University of Copenhagen, Institute of Food and Resource Economics, mimeo.

Binfield, J., Donnellan, T., Hanrahan, K. and Westhoff, P. (2008). FAPRI-Ireland 2008 WTO reform analysis: Potential impact on EU and Irish agriculture, Rural Economy Research Centre, Teagasc.

Bourguignon, F., Bussolo, M. and da Silva, L. A. P. (eds) (2008). *The impact of macroeconomic policies on poverty and income distribution: macro-micro evaluation techniques and tools*, The World Bank and Palgrave MacMillan.

Bouët, A. (2006). What can the poor expect from trade liberalization?: opening the "black box" of trade modelling, MTID discussion papers 93, International Food Policy Research Institute (IFPRI).

Bussolo, M. and Cockburn, J. (2010). Macro-micro analytics: A guide to combining Computable General Equilibrium and Microsimulation modelling frameworks, *International Journal of Microsimulation* 3(1).

Central Statistics Office (2005a). Economic Accounts for Agriculture.

Central Statistics Office (2005b). Household Budget Survey 2004 2005.

Central Statistics Office (2009). Supply, Use and Input-Output Tables for Ireland, 2005.

Department of Agriculture Fisheries and Food (2008). Compendium of Irish Agricultural Statistics, 2008.

Department of Agriculture Fisheries and Food (2010). Food Harvest 2020. A vision for Irish Agri-Food and fisheries.

Horridge, J.M. and Zhai, F (2005), "Shocking a Single-Country CGE Model with Export Prices and Quantities from a Global Model" annex to Chapter 3, in T.W. Hertel and L.A. Winter (eds.) *Poverty and the WTO: Impacts of the Doha Development Agenda*, Palgrave Macmillan, pp. 94-103.

Kullback, S. and Leibler, R. A. (March 1951). On information and sufficiency, The Annals of Mathematical Statistics 22, No. 1: 79–86.

Löfgren, H., Harris, R. L. and Robinson, S. (2002). A standard computable general equilibrium (CGE) model in GAMS, Microcomputers in Policy Research 5, International Food Policy Research Institute (IFPRI).
Matthews, A. and Walsh, K., 2006, The Economic Consequences of the Doha Round for Ireland, Economic and Social Review, Vol. 37, No. 1, pp. 47-69.
Miller, A., Matthews, A., Donnellan, T. and O'Donoghue, C. (2010). A 2005 AgriFood Social Accounting Matrix for Ireland, Trinity College Dublin, IIIS Discussion Paper No.
Pyatt, G. and Round, J. I. (1985). Social Accounting Matrices: A Basis for Planning, Washington, DC. The World Bank.Robinson, Sherman & El-Said, Moataz (2000). GAMS code for estimating a social accounting matrix (SAM) using cross entropy methods (CE), TMD discussion papers 64, International Food Policy Research Institute (IFPRI).
Robinson, S., Cattaneo, A., and El-Said, M. (2001). Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods, *Economic Systems Research*, 13 (1), pp. 47-64.
Teagasc (2004). National farm survey.
Teagasc (2005). National farm survey.