The Employment Effects of Food Harvest 2020 in Ireland

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Abstract

This paper examines the job creation potential of the four main growth targets in the Food Harvest 2020(FH2020), namely the growth targets for milk, beef, sheep and pigs. The agri-food sector is predominantly rural based and growth in this sector is important for the economy as a whole. As well as the direct employment that would be created from an increase in activity in the agriculture sector, there would be a knock on benefit for the rest of the economy arising out of the linkages between agriculture and other economic sectors, and the spending of those employed in the agri-food sector on goods and services produced in the economy. Commonly this is described as the multiplier impact. Two scenarios are simulated using different assumptions to see how employment will respond to increased output: Scenario 1 shows the effects of the four shocks using average employment intensities; Scenario 2 shows the effects of the four shocks using the marginal employment intensities calculated using an econometric model to capture the unobserved characteristics of the four main agricultural sectors over time. The results of the second scenario are believed to be more accurate in simulating the employment potential of the FH2020 targets.

Keywords: social accounting matrix analysis, employment elasticity, econometric analysis, agriculture, Ireland

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1 Introduction

The current economic crisis has had a greater negative impact on the Irish economy compared to other countries. Between 2007 and 2010, GNP per head fell by 14.7 per cent while there was a similar fall in GNI per head. This brought GNP and GNI per head back to their 2000 levels. Prior to the economic crisis, Ireland's unemployment rate was around 4 per cent while in 2011 it is over 14 per cent (NESC, 2011). Government policy recognises that Ireland's economic recovery must be export-led, and recent export performance in goods and services has been encouraging particularly in pharmaceuticals, medical equipment, food, computer services and business services. Nonetheless, growth in exports does not necessarily translate, at least in the short run, into growth in jobs, in part because many of the export sectors have relatively low linkages with the rest of the economy.

The agri-food sector is an exception in that previous research indicates it has both high forward and backward linkages with other sectors in the economy (Riordan, 2008). The government has set ambitious targets for growth in this sector in its Food Harvest 2020 report. These include: (i) an increase in the value of primary output in the agriculture, fisheries and forestry sector by 33 percent compared to the 2007-2009 average; (ii) an increase in the value-added in the agri-food, fisheries and wood products sector by 40 percent compared to 2008; (iii) and an increase in exports by 42 percent compared to the 2007-2009 average (Department of Agriculture, Fisheries and Food, 2010). However, the extent to which achieving these targets would contribute to additional employment is an empirical question which requires further analysis.

This paper investigates the economic effects of the Food Harvest 2020 (FH2020) (DAFF, 2010) specific set targets for growth in the Irish agriculture sector relative to the size of the sector in the period 2007-09. The FH2020 objective is to achieve these growth targets by 2020. The agri-food sector is predominantly rural based and growth in this sector is particularly important for the rural economy, but is also important for the economy more widely given the importance of the agri-food sector at the moment. The actual impact of FH2020 on the wider economy would depend on, among other things, the size of other economic sectors in 2020. The size of these sectors in 2020 cannot be easily determined, but the impact of FH2020 can be simulated on the basis of the existing economic structure. In practical terms, this means using a model which is representative of the economy in 2005, since this is the most recent date for which all the required data are available.

The calculation of input-output multipliers to capture the direct and indirect effects of changes in final demand began in Ireland with the early work of Henry and Copeland (1975). Multiplier analysis has been widely applied to assess the economic importance of particular industries (for example, tourism: Norton, 1982; O'Hagan and Mooney, 1983; Failte Ireland 2008, marine sector: Morrissey and O'Donoghue, 2012, or energy sector, Sustainable Energy Authority of Ireland,2012, etc.). Indeed, the widespread use of multi-

pliers to expand our understanding of the economic importance of a sector in consultancy studies and by lobby groups seeking to stress the importance of their industry to the economy and to justify receiving special incentives, has brought multiplier analysis into a state of disrepute. During the brief period of full employment in the Irish economy in the mid-2000s the assumption of unemployed resources necessary to justify the use of multiplier estimates to influence investment allocation clearly did not apply. The disrepute attached to multiplier analysis is only partially justified, however. Multiplier estimates properly interpreted can give important insights into the structure of the economy and the 'embeddedness' of different sectors. They are also useful in helping to trace the total impacts of changes in the structure of the economy. For example, O'Doherty and Tol (2007) developed an environmental input-output model to estimate the short-run response of emissions and resource use to changes in consumption and production patterns in Ireland.

The relationship between economic growth and employment has been the focus of many researchers over time. Wang (2010) uses several econometric models to estimate employment elasticity by sector for China. He then uses an input output model and these empirically estimated employment elasticities to analyse the impact of the decrease in China's exports due to the U.S. sub-prime crisis on China's employment. The results suggest that using average employment intensities together with an input-output model overestimates the employment effects of changes in final demand compared with the econometric models. Kapsos (2005) estimates country, regional and global employment intensities of economic growth using a cross country data set for 160 economies. Their findings suggest large gains in labour productivity and sustained employment growth in Asia and the Pacific countries, while at a global level there is a decline in employment intensities of growth.

In this paper we calculate employment marginal coefficients and introduce the results into a social accounting matrix multiplier analysis to simulate the impact of FH2020 agriculture targets on employment in the economy. This analysis focuses on the four main growth targets in FH2020, namely the growth targets for milk, beef, sheep and pigs. The 2005 AgriFood-SAM for Ireland used in this study consists of 180 sectoral accounts, of which 150 accounts represent the supply and use of domestic goods and services in the economy (Miller et al.,2011b).

Two sets of results are obtained: 38,430 jobs and 16,045 jobs will be created if the FH2020 targets are met, using average and marginal employment coefficients, respectively. The employment potential identified from the analysis with marginal employment coefficients, of over 16,000 jobs, should be seen as the plausible outcome if the FH2020 targets are met.

The rest of the paper is organised as follows. The methodology, data and shocks implemented in the model are presented in section 2, the scenarios and results are discussed in section 3 and section 4 concludes.

2 Methodology, Data and Shocks

This paper uses a 2005 AgriFood-SAM for Ireland and a multiplier analysis to assess the impact of the Food Harvest 2020 targets on the wider economy. The AgriFood-SAM (Miller et al.,2011a) has 12 primary agricultural sectors and 10 food processing sectors, plus another 53 manufacturing and services sectors. The SAM can be manipulated to examine the impact of an expansion of a particular sector on the wider economy and it then becomes a model capable of examining the impact of an initiative such as FH2020. Using the disaggregated AgriFood-SAM and a multiplier analysis, employment changes are calculated as a result of implementing the FH2020 targets.

The AgriFood-SAM used in this model is based on 2005 data when sugar production was still represented in the agricultural sector in Ireland. This does not significantly influence the results as sugar has little input into any of the four sectors shocked in the model.

2.1 Shocks

The FH2020 targets are a mixture of sectoral value growth targets (beef, sheep and pigs) and a specific sectoral volume growth target (for milk) to be achieved by 2020 compared with the average level of 2007 to 2009 production. The four main targets set in the FH 2020 are as follows: (i) 50 percent increase in the volume of milk production; (ii) 20 percent increase in cattle output value; (iii) 20 percent increase in sheep/lamb output value; and (iv) 50 percent increase in pig output value.

In order to implement those shocks in the SAM multiplier model the results of the FAPRI-Ireland 2012 partial equilibrium model are used to simulate the sectoral activity level associated with the Food Harvest 2020 targets. This simulation interprets the value and volume targets set out in Food Harvest 2020 so that volume shocks for four of the main agricultural sectors can be defined for this paper. The FAPRI simulation assumes that for three of the main targets set in the FH2020 (cattle, sheep and pigs) the value growth targets are met as well as the milk output target.

Table 1 provides the shocks implemented in the model. The FH2020 shocks target the output levels of the primary agricultural commodities. In a SAM multiplier model the exogenous (shock) variable is the final demand, hence the FH2020 shocks are translated into the changes in final demand in the relevant processing sectors consistent with the targeted output increases in primary agriculture (i.e. change in cattle output is modelled as a change in the final demand for beef products).[1] This reflects an assumption that all of the additional primary production is processed and not exported in raw or live form which is a reasonable assumption in current Irish circumstances. To obtain a 50 percent increase in the milk sector (€800 million) requires a final demand shock of €1,369 million transmitted though an increase in dairy processing output; a €250 million increase in

[1]The method used to estimate the final demand shocks is detailed in Miller et al.,2011a

cattle output requires a final demand increase of €442 million in beef processing; a €16 million decrease in sheep output requires a final demand decrease of €39 million in sheep processing; and a €90 million increase in pigs output requires a final demand increase of €374 million in pig processing.

Table 1: The volume shocks implemented in the model

Sector	Volume Shock 2020 relative to 2007-2009 (%)	Value shock (€millions)	Final demand shock (€millions)
Milk Output	+50	+800	+1,369
Cattle Output	+9	+250	+442
Sheep Output	-7	-16	-39
Pig Output	+30	+90	+374

Source: Authors' calculation

2.2 Direct employment coefficients

In order to calculate the changes in employment in the agricultural and food sectors the initial employment figures for those sectors are calculated. The base year for the SAM for Ireland is 2005 and the FH2020 base period for the simulated shocks is the average level of production between 2007 and 2009. Hence, more up to date employment figures present an advantage in estimating the impact of FH2020 targets on employment. Eurostat 2008 data are used to obtain the number of employees and output in the food processing sectors for 2008. For the agricultural sectors the Annual Review and Outlook for Agriculture, Fisheries and Food (DAFF, 2009/2010) and the Management Data for Farm Planning (Teagasc, 2005) are used to allocate the 2008 employment numbers between the 12 agricultural sectors. The method used is the same one used in the construction of the 2005 AgriFood-SAM described in Miller et al.,2011a. The Output, Input and Income in Agriculture (OIIA, 2010) is used to generate the output for the 12 agricultural sectors for 2008. A detailed presentation of the method is provided in Miller et al.,2011a for 2005 and used for 2008 estimates as well.

The direct employment coefficients are calculated as the ratio of employment to output for each individual sector in the matrix. Table 2 contains the direct employment coefficients, employment numbers and the output for the 22 agricultural and food sectors for 2008. For the remaining 53 sectors, the most recent employment and output data refer to 2005.[2] The output and employment numbers for the 53 sectors are taken from the 2005 Input Output Tables (CSO, 2009) and from the Census of Industrial Production, 2005, respectively.[3]

[2] 2008 is the most recent year for which data are available on both employment numbers and output for all 12 primary agricultural and 10 food processing sectors.

[3] A detailed description of the data source and method used is available in Miller et al.,2011b.

Table A 1 in the Appendix provides the direct employment coefficients for the 53 sectors in the economy for 2005 plus the 22 agriculture and food sectors for 2008.

Table 2: Employment Coefficients per €1 million domestic output, 2008

NACE CODE	SECTORS	Employment coefficient per €1 million domestic output	Employment Numbers	Total Output
1	Milk	15.72	30,740	1,956
	Cattle	20.82	68,337	3,282
	Sheep	22.69	4,710	208
	Pig	3.42	1,178	344
	Poultry	5.57	1,073	193
	Horses	7.34	1,556	212
	Cereals	17.94	4,888	273
	Fruit and Vegetable	1.09	306	280
	Sugar	0.00	0	0
	Potatoes	9.08	684	75
	Other Crops	3.46	244	71
	Fodder Crops	1.11	1,082	979
	Total		114,800	7,872
15	Beef meat	3.16	7,762	2,456
	Pig meat	3.21	3,326	1,038
	Poultry meat	3.09	1,802	582
	Sheep meat	3.24	970	300
	Fish and other fishing products	4.98	1,793	360
	Fruit and vegetable	6.78	1,658	245
	Dairy products	1.52	4,995	3,288
	Animal feed	1.80	1,770	982
	Other food products	1.26	11,286	8,984
	Beverages	1.70	5,130	3,023
	Total		40,492	21,258

Source: Authors' calculation

2.3 Calculation of marginal employment intensities

Typically multipliers are a measure of the average knock on (multiplier) impact of the expansion or contraction of a sector. In general, multipliers tend to be more valid for modelling the impact of small changes in production and become less reliable as the scale of the change in the economic activity being modelled becomes larger. Also, multipliers may change over time as technology changes. Technology change can occur at a different pace in one sector compared with another. Related to this issue is a limitation of multiplier analysis which usually assumes fixed proportion production functions. In other words, if milk output grows by 50 percent then the level of input usage is assumed to grow by 50 percent. Similarly, employment and income are assumed to increase in the same proportions. The reality may be somewhat different. For example, the growth in Irish milk production is envisaged to involve production efficiencies which mean that each unit of milk requires fewer purchased inputs and less labour on the farm (a larger number of cows are managed per farm worker). Underemployment, where the labour allocated to production at farm level is less than is required for the actual level of production, must also be considered, since it is a feature of some parts of Irish agriculture. This means that

if expansion in the output of the sector is deemed to take place it need not necessarily lead to an immediate increase in the numbers employed. Instead it could result in an increase in output per worker of those already engaged in the sector. The marginal employment impact of the expansion of a sector will tend to be smaller than the average, so using the direct (average) employment coefficients will have a tendency to overstate the knock on impact in this context.

Employment elasticities represent a useful tool to capture the relationship between output and employment growth and, in this paper, are calculated for most of the sectors in the social accounting matrix using three methods: (i) a fixed effects model using farm enterprises micro data; (ii) a fixed effects model using unbalanced panel; and (iii) non-econometrically by averaging arc elasticities calculated using a rolling window of eight years of data.[4]

Data are collected using the historical series of the Census of Industrial Production 2008a and of the Economic Agricultural Accounts 2008b, the Compendium of Irish Agricultural Statistics 2008 and the National Farm Survey Teagasc. Two data sets are constructed and used in this paper: (i) a micro farm level data set using the NFS 1984-2010 is used to calculate employment elasticities for four of the main agriculture sectors in Ireland: milk, cattle, sheep and crops; and (ii) an unbalanced panel for 1995-2008 is used to calculate both arc employment elasticities and the employment elasticity for each sector.

An arc employment elasticity is the elasticity between two points in time. The following equation is used to calculate the arc elasticity of employment, ϵ_i:

$$\epsilon_i = \frac{\Delta E/E}{\Delta Y/Y} \tag{1}$$

where E is the sectoral employment and Y is the sectoral output. The arc elasticity is interpreted as the percentage point change in sectoral employment if there is one percentage point change in sectoral output. This elasticity formula is very simple and easy to apply, but it omits the long-term relation between employment and output.

The employment elasticity focuses only on the demand side; the faster the growth in labour the faster the increase in output. It does not account for technology changes, or capital-labour intensity shift in production process. For example, using a rolling window approach goes some way to addressing this shortcoming. A longer window approach is preferable in terms of capturing these types of changes. An unbalanced panel of 14 years, between 1995 and 2008, that was constructed for this analysis, and a rolling window approach to calculate the employment elasticity for each sector using eight years of data,

[4]Due to data availability, elasticities for some sectors cannot be calculated using any of the methods.

is used, i.e. the estimation sample subsequently changes by one year, with the first sample 1995-2002, the second 1996-2003 and so on until the last estimation sample 2001-2008. The set window of eight years allows for seven sectoral estimated elasticities for this period and avoids the instability introduced by only looking at year to year changes. In estimating the seven employment elasticities for each sectors a 3-year average of each variable, at the beginning and end of the period is used to further try to reduce the effect of volatility in the data series.

Table 3 presents the marginal coefficients as an average of the rolling window arc elasticity for the 22 agri-food sectors using an yearly unbalanced panel for 1995-2008. The magnitude of the marginal coefficients are close to zero for most of the agriculture and food sectors which indicates that an increase in sector's output is not associated with increased labour inputs for the 22 agriculture and food sectors.

In a second approach, the NFS can be used to calculate employment elasticities for some agriculture sectors. The employment variable is constructed using the reported hours worked on the farm and the output variable is the output reported for each activity on the farm. The sample output values are corrected for inflation and measured in constant 2000 prices using commodity-specific price indices.

A fixed effects log-log model with employment as the dependent variable and output as the independent variable is calculated for the four main primary agriculture sectors in Ireland: milk, cattle, sheep and crops.[5] The fixed effect least square dummy variable model estimated is described in equation 2:

$$\Delta \ln E_{ft} = \alpha_0 + \beta_i \sum_{i=1}^{4} \Delta \ln Y_{it-1} + \delta D_t + \nu_f + \epsilon_{it} \tag{2}$$

where $\Delta \ln E_{ft} = \ln E_{ft} - \ln E_{ft-1}$ is the farm employment, $\Delta \ln Y_{it-1} = \ln Y_{it-1} - \ln Y_{it-2}$ is the activity specific output on the farm, D is a year dummy which has $t-1$ entities included in the model and ν_f is the farm fixed effect. Subscript i denotes the activity on the farm: milk, cattle, sheep and crops, and t denotes time.

This fixed effects model controls for time invariant farm specific unobserved heterogeneity. Potential reverse causality is treated by using the lag of the output variable in the model. The first difference for employment and lag output is used in the regression, after testing for a unit root using the Augment Dickey-Fuller (ADF) test. The employment elasticities and marginal coefficients are presented in Table 3. The marginal employment coefficients are derived for each of the four activities from the estimated elasticities using eq 1.

[5]The estimated elasticity for crop products is not statistically significant and not reported/used

Table 3: Employment Elasticity and Marginal Employment Coefficients

Sectors	Arc Marginal Coefficient (per €1 million output) (1995-2008)	Employment Elasticity	Marginal Coefficient (per €1 million output) NFS(1984-2010)	Employment Elasticity	Marginal Coefficient (per €1 million output) (1995-2008)
Milk	0.000	0.047	3.911	0.238	6.018
Cattle	0.000	0.042	5.694	0.258	11.279
Sheep	0.000	0.012	10.743	0.244	10.664
Pigs	0.000			0.256	4.615
Poultry	0.000			0.258	4.653
Horses	0.000			0.269	1.204
cereals	0.000			0.277	1.242
Fruit & Veg	0.000			0.229	1.729
Sugar	0.341			0.257	1.938
Potatoes	0.000			0.229	2.917
Other Crops	1.971			0.300	3.821
Fodder Crops	0.032			0.256	3.870
Beef meat.	0.000			0.256	0.086
Pig meat	0.222			0.289	0.619
Poultry meat	0.237			0.294	0.630
Sheep meat	0.000			0.262	0.289
Fish and other fishing products	1.334			0.235	0.259
Fruit and vegetable	0.000			0.263	2.954
Dairy products	0.000			0.230	2.587
Animal feed	0.041			0.229	1.937
Other food products	0.072			0.249	2.103
Beverages	0.000			0.254	1.933

Source: Authors' calculation. Employment Elasticity and significance levels for the rest of the sectors are reported in Appendix, Table B 2 and C 3

As a third approach, a fixed effects model described by equation 3 is used to calculate the employment elasticity for each sector for the period 1995-2008 using annual data measured in constant 2006 prices using commodity-specific price indices.[6] A selection of the results are reported in Table 3 in the fourth column. The magnitude of the elasticity for most of the sectors is small so it can be inferred that the increase in output is due to other factors such as capital investment or technological changes rather then increases in the labour input.

$$\Delta \ln E_{it} = \alpha_0 + \beta_i \sum_{i=1}^{57} \Delta \ln Y_{it-1} + \delta S_i + \epsilon_{it} \tag{3}$$

where $\Delta \ln E_{it} = \ln E_{it} - \ln E_{it-1}$ is the sectoral employment, $\Delta \ln Y_{it-1} = \ln Y_{it-1} \ln Y_{it-2}$ is the sectoral output and S is a sector dummy, subscript i and t denotes the sector and time, respectively. The elasticity for each sector is calculated by adding δ to β_i.

in the analysis.

[6] After testing for unit root using Augment Dickey-Fuller (ADF) test, the first difference for employment and lag output is used in the regression. We also control for heteroskedasticity. The complete regression results for this specification are presented in C 3.

The results from both regressions are used to calculate marginal coefficients for each sector represented in the 2005 AgriFood-SAM for Ireland. An average employment to average output ratio is calculated for each sector in the sample and used to obtain the marginal coefficients for each sector using equation 1. Marginal coefficients for the 22 agriculture and food sectors are presented in Table 3. The estimated marginal coefficients for the three main agricultural sectors using the NFS micro data and the 1995-2008 unbalanced panel are of similar orders of magnitude.

3 Scenarios and results

3.1 Employment effects of changes in output

Two scenarios are simulated using different assumptions to see how employment will respond to increased output: Scenario 1 shows the effects of the four shocks using average employment intensities based on 2008 employment intensities for the 22 agricultural and food processing sectors and 2005 employment intensities for the remaining sectors in the economy; Scenario 2 shows the effects of the four shocks using the marginal employment intensities calculated in Section 2.[7]

Table 4 shows the results based on Scenario 1. The output changes arising from FH2020 targets and the final demand change are presented in columns 2 to 9 of Table 4. Column 10 describes the average jobs coefficients calculated as the ratio of the numbers of workers to output in each sector which in the case of Table 4 are the same figures as in Table 1. Columns 11 to 14 give the total change in employment given the final demand shock by multiplying the direct employment coefficient with the change in output for each sector. The last column presents the sum of generated employment in each sector. For example, an expansion in milk output by 50 percent will lead to an increase in the numbers engaged in milk production at farm level by 12,575 workers. This will also have an indirect effect through the increase in the numbers of workers in the dairy food processing sector by 2,110 workers plus 7,337 workers in the other sectors of the economy.

Table 5 reports the results of Scenario 2, using the estimated marginal employment coefficients in Table 3. The differences between the two scenarios are significant. A 50 percent increase in the milk output will only generate 4,814 jobs in the primary sectors and will indirectly generate 2,922 jobs through the dairy processing sector and another 1,766 in other sectors of the economy. Overall, a total of 10,147 jobs are created in the economy if the FH2020 milk output target is met.

[7]This paper builds on the report prepared for the Department of Agriculture, Fisheries and Food (2012), *The Economy Impact of Food Harvest 2020 on employment in Ireland*. In this report three scenarios are simulated assuming different employment marginal changes for the primary agricultural sectors. The results show the marginal impacts are still too high compared with the results of the empirical analysis in this paper.

Table 4: Scenario 1. Employment effect of the FH2020 targets using average employment intensities

	Output changes arising from FH2020 targets								Direct	Total employment change				
Sectors	50% increase in milk output volume	Change in output (€m)	9% increase in cattle output volume	Change in output (€m)	7% decrease in sheep output volume	Change in output (€m)	30% increase in pigs output volume	Change in output (€m)	employment coefficient per €1 million domestic output	50% increase in milk output volume	9% increase in cattle output volume	7% decrease in sheep output volume	30% increase in pigs output volume	Total Changes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Milk		**800.00**		30.48		-0.21		1.45	15.72	12,575	479	-3	23	13,074
Cattle		4.89		**250.00**		-0.14		0.99	20.82	102	5,206	-3	21	5,325
Sheep		0.88		0.42		**-16.00**		0.14	22.69	20	10	-363	3	-330
Pigs		1.14		0.59		-0.03		**90.00**	3.42	4	2	0	308	314
Poultry		0.97		0.52		-0.03		0.17	5.57	5	3	0	1	9
Horses		0.31		0.13		-0.07		0.09	7.34	2	1	-1	1	3
Cereals		18.71		18.16		-0.49		9.98	17.94	336	326	-9	179	832
Fruit & Veg.		5.16		3.71		-0.16		1.22	1.09	6	4	0	1	11
Sugar		2.03		0.88		-0.04		0.27	0.00	0	0	0	0	0
Potatoes		1.36		0.73		-0.04		0.22	9.08	12	7	0	2	21
Other Crops		8.66		15.56		-0.16		0.11	3.46	30	54	-1	0	84
Fodder Crops		29.63		44.40		-1.22		17.21	1.11	33	49	-1	19	100
Beef meat.		7.26	**441.78**	3.77		-0.20		1.31	3.16	23	1,408	-1	4	1,434
Pig meat.		6.30		3.23		-0.17	**374.33**	1.01	3.21	20	10	-1	1,203	1,233
Poultry meat		3.67		1.90		-0.10		0.60	3.09	11	6	0	2	19
Sheep meat		1.76		0.91	**-38.57**	-0.05		0.29	3.24	6	3	-125	1	-115
Fish & fishing products		2.68		1.32		-0.07		0.42	4.98	13	7	0	2	22
Fruit & Vegetable		4.50		2.39		-0.13		0.71	6.78	31	16	-1	5	51
Dairy products	**1,369.13**	20.10		10.73		-0.58		3.96	1.52	2,110	16	-1	6	2,132
Animal Feed		88.00		57.49		-3.15		34.80	1.80	159	104	-6	63	319
Other Food products		101.76		43.34		-2.15		12.45	1.26	128	54	-3	16	195
Beverages		11.10		6.47		-0.45		2.07	1.70	19	11	-1	4	33
Other Sectors		1,384.99		741.68		-45.74		450.83		7,408	3,822	-253	2,690	13,667
Total all sectors		**2,506**		**1,239**		**-71**		**630**		**23,052**	**11,597**	**-772**	**4,552**	**38,430**

Source: Authors' calculation

Table D 4 provides a more detailed picture, including the results for the non-agriculture sectors, for each of the four shocks and its employment impact on the entire economy.

In summary, based on the results described in Table 4 and Table 5 38,430 jobs are created in the economy if direct employment coefficients are used and only 16,045 if the estimated marginal employment coefficients are used in the model. The two scenarios report a difference of over 22,000 jobs. This considerable overestimation of job creation using a SAM multiplier approach with the two different coefficients is to be expected. The estimated marginal coefficients capture changes in the employment-output relation over time, while the direct coefficients fail to capture any changes in the structure of employment and output over time. Marginal coefficients tend to be much lower then direct coefficients. The results suggest that 16,045 jobs will be created in the economy if the FH2020 targets are met.

3.2 Employment effects of higher prices

FH2020 expects a value increase in each of the four sectors, but this increase is made up in the FAPRI partial equilibrium model simulation of a change in volume and increased prices, only the primary agricultural sheep sector has a decline in the volume of output. Hence, in addition to the effect of the change in employment due to the change in final demand, we would expect to see a change in employment also due to the change in prices. The SAM multiplier model is a fixed price model and does not account for the change in prices forecast by the FAPRI model. In other words, if the final demand goes up by 10 percent and this is all due to a change in price, then the model cannot capture the employment effects on the economy as this is not an increase in output volume. The spending behaviour of households can influence the size of multipliers. The greater the extent to which households consume goods and services from the local economy, the greater the induced multiplier effect will be. This multiplier impact forms the economic argument for initiatives such as buy Irish campaigns. Consequently, an increase in prices of the four main commodities for which growth targets are set in FH2020, is translated into an increase in farm household income and the impact of this increase in household expenditure on employment is simulated.

To capture the respending of higher household incomes due to the price increase, the price changes for the four primary agricultural sectors and some of the inputs provided by FAPRI (Table 6) are used to calculate the change in farm income arising from the changes in the values of each output and input in the 2005 AgriFood-SAM.[8] The output value share is reduced for each of the four primary agricultural sectors by the value of output sold on the domestic market, as this is only a reshuffling of domestic expenditure with no net employment increase. This approach allows the calculation of the change

[8] The FAPRI model only provides estimates for the price change for the four main agricultural products and three of the inputs used in agriculture. Therefore we assume no change in price for the rest of the eight agricultural sectors and remaining inputs used in the agricultural sectors.

Table 5: Scenario 2. Employment effect of the FH2020 targets using marginal employment intensities

	Output changes arising from FH2020 targets								Marginal	Total employment change				
Sectors	50% increase in milk output volume	Change in output (€m)	9% increase in cattle output volume	Change in output (€m)	7% decrease in sheep output volume	Change in output (€m)	30% increase in pigs output volume	Change in output (€m)	employment coefficient per €1 million domestic output	50% increase in milk output volume	9% increase in cattle output volume	7% decrease in sheep output volume	30% increase in pigs output volume	Total Changes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Milk		**800.00**		30.48		-0.21		1.45	6.018	4,814	183	-1	9	5,005
Cattle		4.89		**250.00**		-0.14		0.99	11.279	55	2,820	-2	11	2,884
Sheep		0.88		0.42		**-16.00**		0.14	10.664	9	5	-171	2	-155
Pigs		1.14		0.59		-0.03		**90.00**	4.615	5	3	0	415	423
Poultry		0.97		0.52		-0.03		0.17	4.653	5	2	0	1	8
Horses		0.31		0.13		-0.07		0.09	1.204	0	0	0	0	1
Cereals		18.71		18.16		-0.49		9.98	1.242	23	23	-1	12	58
Fruit & Veg.		5.16		3.71		-0.16		1.22	1.729	9	6	0	2	17
Sugar		2.03		0.88		-0.04		0.27	1.938	4	2	0	1	6
Potatoes		1.36		0.73		-0.04		0.22	2.917	4	2	0	1	7
Other Crops		8.66		15.56		-0.16		0.11	3.821	33	59	-1	0	92
Fodder Crops		29.63		44.40		-1.22		17.21	3.870	115	172	-5	67	348
Beef Proc.		7.26	**441.78**	3.77		-0.20		1.31	0.630	5	281	0	1	286
Pig Proc.		6.30		3.23		-0.17	**374.33**	1.01	0.289	2	1	0	108	111
Poultry Proc.		3.67		1.90		-0.10		0.60	0.259	1	0	0	0	2
Sheep Proc.		1.76		0.91	**-38.57**	-0.05		0.29	2.954	5	3	-114	1	-105
Fish Proc.		2.68		1.32		-0.07		0.42	2.587	7	3	0	1	11
Fruit &Veg. Proc.		4.50		2.39		-0.13		0.71	1.937	9	5	0	1	14
Milk Proc.	**1369.13**	20.10		10.73		-0.58		3.96	2.103	2,922	23	-1	8	2,952
Animal Feed		88.00		57.49		-3.15		34.80	1.933	170	111	-6	67	342
Other Food		101.76		43.34		-2.15		12.45	1.711	174	74	-4	21	266
Beverages		11.10		6.47		-0.45		2.07	0.887	10	6	0	2	17
Other Sectors		1369.89		735.88		-45.31		446.96		1,766	904	-66	851	3,455
Total all sectors		**2,491**		**1,233**		**-71**		**626**		**10,147**	**4,687**	**-372**	**1,583**	**16,045**

Source: Authors' calculation

in farm income arising only from a change in prices of exported output and inputs. The expenditure generated by the assumed change in farm income (allowing for household savings and taxes) is then allocated over the 53 sectors in the economy in accordance with the expenditure shares in the 2005 AgriFood-SAM, and used as a second set of shocks to final demand.

Table 6: Input and Output price changes, FAPRI model

Sectors	FAPRI Price change Outputs (%)	Export Value shock (€millions)	Sectors	FAPRI Price change Inputs (%)
Milk	+ 16	+ 217	Animal Feed	-2
Cattle	+ 22	+ 325	Chemical	+ 19
Sheep	+ 42	+ 70	Energy	+ 46
Pigs	+ 2	+ 2		
Additional farm export income		€374		

Source: Authors' calculation

Table 7 presents the results of the extra income respent in the economy as an effect of the increased prices in primary agricultural products. The results of the two scenarios described in previous section are presented. An increase in farm household income of €374 million could generate 2,161 jobs in the economy, Scenario 1 compared with only 313 jobs in Scenario 2. This arises because the differences in the scenarios focus on different coefficients, average and marginal coefficients for all the sectors. In addition to the 16,045 jobs, another 313 jobs will be created in the economy due to the change in prices, if the FH2020 targets are met.

4 CONCLUSION

In this paper a SAM multiplier analysis is used to investigate the employment impact of the main four targets in the FH2020. The model simulates results for two scenarios based on average and marginal employment response to the shocks. The first scenario projects a maximum numbers of jobs that can be created given the shocks. The second scenario is based on marginal employment coefficients and provides a lower estimate of the change in employment after implementing the shock in the model.

Two scenarios are used which make a variety of assumptions about how output growth relates to employment and these have been applied to a model of the Irish economy. Of the two scenarios examined, the employment potential identified in Scenario 2 should be seen as the one which is closest to the likely actual outcome that could arise if FH2020 were achieved. The second scenario makes use of an econometric model to captures the unobserved characteristics of the four main agriculture sectors over time, which direct

Table 7: Employment effect of the FH2020 targets assuming increase prices for agricultural sectors output

		Scenario1		Scenario2				Scenario1		Scenario2	
Sector	Income Change	Direct Employment coefficient per €1 million domestic output	Change in employment	Marginal Employment coefficient per €1 million domestic output	Change in employment	Sectors	Income Change	Direct Employment coefficient per €1 million domestic output	Change in employment	Marginal Employment coefficient per €1 million domestic output	Change in employment
A_AMIK	0	15.72	0	6.018	0	A_MEMA	1	6	8	3	3
A_ACATL	0	20.82	0	11.279	0	A_MAEQ	2	5	13	1	1
A_ASHP	0	22.69	0	10.664	0	A_OFMA	1	1	1	1	0
A_APIG	0	3.42	0	4.615	0	A_ELMA	1	4	6	1	1
A_APOL	1	5.57	3	4.653	3	A_RATV	2	2	4	1	2
A_AHOR	0	7.34	0	1.204	0	A_MEDI	0	4	2	1	0
A_ACER	0	17.94	0	1.242	0	A_MOTO	31	6	175	0	0
A_AFRVE	4	1.09	5	1.729	7	A_OTTR	0	8	3	1	0
A_ASUG	0	0.00	0	1.938	0	A_RECY	0	5	0	0	0
A_APOT	1	9.08	13	2.917	4	A_ELGA	6	2	13	0	3
A_AOTCR	0	3.46	0	3.821	0	A_WATE	0	9	1	1	0
A_AFOCR	0	1.11	0	3.870	0	A_CONS	0	6	1	5	1
A_FORE	0	4.96	1	3.372	1	A_TRAD	2	14	35	5	12
A_FISH	1	4.67	6	0.088	0	A_WHSL	1	8	5	5	3
A_CPUM	3	3.45	10	0.086	0	A_RETS	1	21	12	7	4
A_MING	0	3.65	0	0.619	0	A_HORE	48	14	649	0	0
A_MBEF	4	3.16	11	0.630	2	A_LATR	5	8	34	0	0
A_MPIG	4	3.21	14	0.289	1	A_WATR	0	11	1	0	0
A_MPOL	2	3.09	6	0.259	0	A_AITR	1	1	2	2	3
A_MSHP	1	3.24	5	2.954	4	A_OTTRS	8	4	35	2	17
A_MFSH	1	4.98	5	2.587	2	A_POTL	15	4	62	2	31
A_MFRVE	4	6.78	25	1.937	7	A_FISE	10	2	19	1	7
A_MDARY	8	1.52	12	2.103	17	A_INSE	17	3	43	1	17
A_MANFE	0	1.80	0	1.933	0	A_OFISE	1	3	3	0	0
A_MOTFO	24	1.26	31	1.711	42	A_REES	17	1	22	0	0
A_MBEV	3	1.70	6	0.887	3	A_RESE	3	2	6	0	0
A_TABA	6	1.72	11	0.606	4	A_COSE	0	2	0	0	0
A_TEXT	3	9.19	23	0.657	2	A_RESH	0	5	0	0	0
A_FURS	17	7.62	127	1.248	21	A_OTBU	1	8	10	3	4
A_LETH	3	7.47	25	1.059	3	A_PUAD	0	9	3	2	1
A_WOOD	1	5.54	5	1.083	1	A_EDUS	11	16	176	0	0
A_PAPE	3	5.69	15	0.000	0	A_HEAS	11	12	134	0	0
A_PRME	7	1.10	8	1.141	8	A_SEWA	1	0	0	0	0
A_PEMP	41	3.25	134	1.140	47	A_MNEC	5	0	0	0	0
A_CHIM	9	0.81	7	1.162	11	A_RECS	10	8	81	0	0
A_RUBB	4	6.19	22	2.362	9	A_OTSE	4	20	71	0	0
A_NOME	1	4.56	6	2.404	3	A_PRHO	0	0	0	0	0
A_BAME	0	3.11	0	2.813	0	**Total**	**374**		**2161**		**313**

Source: Authors' calculation
The names for each sectors can be found in the Appendix Table A 1

employment coefficients fail to capture. Hence, the results of the second scenario will be more likely to capture the FH2020 job creation potential.

It is found that a 50 percent increase in milk output due to a final demand increase of €1,369 million in dairy products could generate a maximum of 12,575 jobs in the milk production at farm level, an additional 2,110 jobs in the dairy processing sector and an overall maximum increase of 23,052 jobs in the economy. Similarly, a 7 percent decrease in the sheep output due to a decrease in final demand for sheep meat products of €39 million creates a loss of a maximum 363 jobs in the sheep sector, an extra loss of 125 jobs in the sheep meat sector and an overall loss of 772 jobs in the economy.

In this paper we also simulate the effects of farm households respending the extra income generated by the expected increase in prices over the period to 2020. Hence, an increase in the price of the four main growth commodities in FH2020, generates an increase in farm household income of €374 million. The respending out of this increased income will generate a maximum of 2,161 jobs in the entire economy.

Using the two different employment intensity scenarios it is found that a lower estimate of 16,045 jobs and a higher estimate of 38,430 jobs could be created in the economy as a result of achieving the four main targets in the FH2020. Adding the extra jobs created as an increase in farm household income, the model predicts a minimum of 16,385 jobs and a maximum of 40,591 jobs for the entire economy.

Multiplier analysis assumes that prices are static and that resources are freely available. These assumptions imply that if a sector grows the additional demand it generates for labour and inputs does not generate inflation in the price of these inputs or in wages. In the current high unemployment environment in Ireland this is probably a reasonable assumption in the case of labour, but the assumption could be a weakness in the case of inputs. The expansion of Irish agriculture of itself is not likely to generate inflation in the case of imported inputs (because demand from Ireland is small in a global context) but it could generate inflation in the price of domestically produced inputs such as replacement animals and land rent etc.

The second scenario is based on calculating marginal employment coefficients. This approach has its limitation as well and further work is necessary. Such an analysis will benefit from a larger sample and further improvement in the model by identifying additional influences on employment intensities, particularly regarding labour productivity, unemployment rates, etc. In summary, the use of marginal employment intensities and a social accounting model can give a better reflection of the economic impacts of a policy change, but more research is needed to better integrate the two approaches.

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Appendix

Table A 1: Employment Coefficients per €1 million domestic output, 2005 and 2008

NACE Codes	Sectors Codes	Sectors Name	Direct employment coefficient per €1 million domestic output	
			2005	2008
1	A_AMIK	Milk	18.07	15.72
	A_ACATL	Cattle	23.12	20.82
	A_ASHP	Sheep	19.07	22.69
	A_APIG	Pig	3.68	3.42
	A_APOL	Poultry	5.49	5.57
	A_AHOR	Horses	6.40	7.34
	A_ACER	Cereals	26.44	17.94
	A_AFRVE	Fruit and Vegetable	1.18	1.09
	A_ASUG	Sugar	26.12	0.00
	A_APOT	Potatoes	8.06	9.08
	A_AOTCR	Other Crops	3.71	3.46
	A_AFOCR	Fodder Crops	1.33	1.11
2	A_FORE	Products of forestry, logging and related services	4.96	4.96
5	A_FISH	Fish and other fishing products; services incidental of fishing	4.67	4.67
10to13	A_CPUM	Coal, peat, petroleum and metal ore extraction	3.45	3.45
14	A_MING	Other mining and quarrying products	3.65	3.65
15	A_MBEF	Beef meat	3.34	3.16
	A_MPIG	Pig meat	3.59	3.21
	A_MPOL	Poultry meat	3.62	3.09
	A_MSHP	Sheep meat	3.95	3.24
	A_MFSH	Fish and other fishing products	9.31	4.98
	A_MFRVE	Fruit and vegetable	9.72	6.78
	A_MDARY	Dairy products	2.57	1.52
	A_MANFE	Animal feed	2.96	1.80
	A_MOTFO	Other food products	1.41	1.26
	A_MBEV	Beverages	0.66	1.70
16	A_TABA	Tobacco products	1.72	1.72
17	A_TEXT	Textiles	9.19	9.19
18	A_FURS	Wearing apparel; furs	7.62	7.62
19	A_LETH	Leather and leather products	7.47	7.47
20	A_WOOD	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	5.54	5.54
21	A_PAPE	Pulp, paper and paper products	5.69	5.69
22	A_PRME	Printed matter and recorded media	1.10	1.10
23&36	A_PEMP	Petroleum and other manufacturing products	3.25	3.25
24	A_CHIM	Chemicals, chemical products and man-made fibers	0.81	0.81
25	A_RUBB	Rubber and plastic products	6.19	6.19
26	A_NOME	Other non-metallic mineral products	4.56	4.56
27	A_BAME	Basic metals	3.11	3.11
28	A_MEMA	Fabricated metal products, except machinery and equipment	6.29	6.29
29	A_MAEQ	Machinery and equipment n.e.c.	5.31	5.31
30	A_OFMA	Office machinery and computers	0.87	0.87
31	A_ELMA	Electrical machinery and apparatus n.e.c.	4.27	4.27
32	A_RATV	Radio, television and communication equipment and apparatus	1.85	1.85
33	A_MEDI	Medical, precision and optical instruments, watches and clocks	3.85	3.85
34	A_MOTO	Motor vehicles, trailers and semi-trailers	5.56	5.56
35	A_OTTR	Other transport equipment	7.64	7.64

Continued on Next Page...

Table A 1 – Continued

NACE Codes	Sectors Codes	Sectors Name	Direct employment coefficient per €1 million domestic output	
			2005	2008
37	A_RECY	Secondary raw materials	4.82	4.82
40	A_ELGA	Electrical energy, gas, steam and hot water	2.07	2.07
41	A_WATE	Collected and purified water, distribution services of water	8.66	8.66
45	A_CONS	Construction work	5.87	5.87
50	A_TRAD	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel	14.26	14.26
51	A_WHSL	Wholesale trade and commission trade services, except of motor vehicles and motorcycles	7.83	7.83
52	A_RETS	Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	20.77	20.77
55	A_HORE	Hotel and restaurant services	13.63	13.63
60	A_LATR	Land transport; transport via pipeline services	7.52	7.52
61	A_WATR	Water transport services	10.51	10.51
62	A_AITR	Air transport services	1.43	1.43
63	A_OTTRS	Supporting and auxiliary transport services; travel agency services	4.28	4.28
64	A_POTL	Post and telecommunication services	4.20	4.20
65	A_FISE	Financial intermediation services, except insurance and pension funding services	1.97	1.97
66	A_INSE	Insurance and pension funding services, except compulsory social security services	2.56	2.56
67	A_OFISE	Services auxiliary to financial intermediation	2.86	2.86
70	A_REES	Real estate services	1.31	1.31
71	A_RESE	Renting services of machinery and equipment without operator and of personal and household goods	2.19	2.19
72	A_COSE	Computer and related services	2.26	2.26
73	A_RESH	Research and development services	4.52	4.52
74	A_OTBU	Other business services	7.62	7.62
75	A_PUAD	Public administration and defence services; compulsory social security services	9.07	9.07
80	A_EDUS	Education services	15.51	15.51
85	A_HEAS	Health and social work services	11.82	11.82
90	A_SEWA	Sewage and refuse disposal services, sanitation and similar services	0.01	0.01
91	A_MNEC	Membership organisation services n.e.c.	0.01	0.01
92	A_RECS	Recreational, cultural and sporting services	8.38	8.38
93	A_OTSE	Other services	20.21	20.21
95	A_PRHO	Private households with employed persons	0.00	0.00

Source:Authors' calculation

Table B 2: Fixed effects regression results

	(1) ln_empl	(2) ln_empl	(3) ln_empl	(4) ln_empl
ln_milk_outP	0.0468***			
	(3.35)			
ln_cattle_outP		0.0419***		
		(3.95)		
ln_sheep_outP			0.0123*	
			(1.67)	
ln_crops_outP				0.00697
				(0.92)
_cons	7.313***	7.332***	7.615***	7.628***
	(49.51)	(77.01)	(130.81)	(114.63)
N	12872	31166	13002	16937

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C 3: GLS random effects regression results

D.ln_employment							
A_AMIK	0.238***	A_MPIG	0.0510***	A_PRME	0.00686	A_TRAD	0.413***
	(-4.5)		(-24.59)		(-1.53)		(-52.03)
A_ACATL	0.0196***	A_MPOL	0.0558***	A_CHIM	0.0199***	A_WHSL	0.118***
	(-17.22)		(-23.19)		(-3.3)		(-84.39)
A_ASHP	0.00556*	A_MSHP	0.0239***	A_RUBB	0.0136***	A_RETS	0.104***
	(-1.7)		(-125.49)		(-13.75)		(-58.73)
A_APIG	0.0181***	A_MFSH	-0.00347***	A_NOME	0.0184***	A_HORE	0.0202***
	(-77.82)		(-11.88)		(-5.21)		(-3.8)
A_APOL	0.0202***	A_MFRVE	0.0245***	A_BAME	0.0262***	NACE 60to64	0.127***
	(-89.24)		(-11.45)		(-7.86)		(-21.55)
A_AHOR	0.0307***	A_MDARY	-0.00809***	A_MEMA	0.0309***	A_REES	0.114***
	(-6.79)		(-17.05)		(-9.96)		(-14.27)
A_ACER	0.0392***	A_MANFE	-0.00866***	A_MAEQ	0.00616***	A_RESE	0.0466***
	(-70.06)		(-28.83)		(-3.14)		(-7.26)
A_AFRVE	-0.00856***	A_MOTFO	0.0110***	A_OFMA	-0.00872***	A_COSE	0.0564***
	(-6.23)		(-3.2)		(-2.92)		(-4.58)
A_ASUG	0.0191***	A_MBEV	0.0159***	A_ELMA	-0.0295***	A_RESH	0.147***
	(-17.03)		(-1559.74)		(-9.63)		(-10.48)
A_APOT	-0.00888***	A_TABA	-0.0133***	A_RATV	0.00534**	A_OTBU	0.265***
	(-3.15)		(-2.91)		(-2.36)		(-27.17)
A_AOTCR	0.0621***	A_TEXT	-0.0536***	A_MEDI	0.0550***	A_RECS	0.124***
	(-41.63)		(-16.60)		(-8.63)		(-29.77)
A_AFOCR	0.0178***	A_FURS	-0.112***	A_MOTO	0.00744**	A_OTSE	0.0565***
	(-10.89)		(-16.70)		(-2.56)		(-10.96)
NACE 02,05	-0.0151***	A_LETH	-0.0936***	A_OTTR	0.00978***	_cons	-0.0360***
	(-5.85)		(-7.96)		(-3.84)		(-16.55)
NACE 10to14	0.0242***	A_WOOD	0.0365***	A_ELGA	-0.0369***		
	(-8.76)		(-12.16)		(-7.41)		
A_MBEF	0.0180***	A_PAPE	0.00129	A_CONS	0.0964***		
	(-81.35)		(-1.2)		(-12.63)		
N	636						

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D 4: Scenario 1. Employment effect of the FH2020 targets using average employment intensities-all sectors

	Output changes arising from FH2020 targets								Direct	Total employment change				
Sectors	50% increase in milk output volume	Change in output (€m)	9% increase in cattle output volume	Change in output (€m)	7% decrease in sheep output volume	Change in output (€m)	30% increase in pigs output volume	Change in output (€m)	employment coefficient per €1 million domestic output	50% increase in milk output volume	9% increase in cattle output volume	7% decrease in sheep output volume	30% increase in pigs output volume	Total Changes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
A_AMIK		**800.00**		30.48		-0.21		1.45	15.72	12,575	479	-3	23	13,074
A_ACATL		4.89		**250.00**		-0.14		0.99	20.82	102	5,206	-3	21	5,325
A_ASHP		0.88		0.42		**-16.00**		0.14	22.69	20	10	-363	3	-330
A_APIG		1.14		0.59		-0.03		**90.00**	3.42	4	2	0	308	314
A_APOL		0.97		0.52		-0.03		0.17	5.57	5	3	0	1	9
A_AHOR		0.31		0.13		-0.07		0.09	7.34	2	1	-1	1	3
A_ACER		18.71		18.16		-0.49		9.98	17.94	336	326	-9	179	832
A_AFRVE		5.16		3.71		-0.16		1.22	1.09	6	4	0	1	11
A_ASUG		2.03		0.88		-0.04		0.27	0.00	0	0	0	0	0
A_APOT		1.36		0.73		-0.04		0.22	9.08	12	7	0	2	21
A_AOTCR		8.66		15.56		-0.16		0.11	3.46	30	54	-1	0	84
A_AFOCR		29.63		44.40		-1.22		17.21	1.11	33	49	-1	19	100
A_FORE		1.27		0.66		-0.04		0.26	4.96	6	3	0	1	11
A_FISH		13.83		5.13		-0.40		3.61	4.67	65	24	-2	17	104
A_CPUM		16.98		10.11		-0.49		3.56	3.45	59	35	-2	12	104
A_MING		4.74		3.96		-0.16		0.78	3.65	17	14	-1	3	34
A_MBEF		7.26	**441.78**	3.77		-0.20		1.31	3.16	23	1,408	-1	4	1,434
A_MPIG		6.30		3.23		-0.17	**374.33**	1.01	3.21	20	10	-1	1,203	1,233
A_MPOL		3.67		1.90		-0.10		0.60	3.09	11	6	0	2	19
A_MSHP		1.76		0.91	**-38.57**	-0.05		0.29	3.24	6	3	-125	1	-115
A_MFSH		2.68		1.32		-0.07		0.42	4.98	13	7	0	2	22
A_MFRVE		4.50		2.39		-0.13		0.71	6.78	31	16	-1	5	51
A_MDARY	**1369.13**	20.10		10.73		-0.58		3.96	1.52	2,110	16	-1	6	2,132
A_MANFE		88.00		57.49		-3.15		34.80	1.80	159	104	-6	63	319
A_MOTFO		101.76		43.34		-2.15		12.45	1.26	128	54	-3	16	195
A_MBEV		11.10		6.47		-0.45		2.07	1.70	19	11	-1	4	33
A_TABA		12.72		6.90		-0.37		2.11	1.72	22	12	-1	4	37
A_TEXT		5.87		3.31		-0.17		1.04	9.19	54	30	-2	10	92
A_FURS		20.32		11.02		-0.59		3.29	7.62	155	84	-4	25	259
A_LETH		4.23		2.31		-0.12		0.73	7.47	32	17	-1	5	53
A_WOOD		6.07		3.09		-0.18		1.38	5.54	34	17	-1	8	57
A_PAPE		33.48		13.31		-0.97		8.71	5.69	190	76	-6	50	310
A_PRME		12.61		6.68		-0.39		2.94	1.10	14	7	0	3	24
A_PEMP		90.10		59.07		-2.50		19.25	3.25	292	192	-8	62	538
A_CHIM		69.63		55.07		-2.24		17.72	0.81	56	44	-2	14	113
A_RUBB		25.41		10.99		-0.74		6.21	6.19	157	68	-5	38	259
A_NOME		9.81		4.99		-0.29		2.17	4.56	45	23	-1	10	76

Source:Authors' calculation

Table D 4: Scenario 1. Employment effect of the FH2020 targets using average employment intensities-all sectors

	Output changes arising from FH2020 targets								Direct	Total employment change				
Sectors	50% increase in milk output volume	Change in output (€m)	9% increase in cattle output volume	Change in output (€m)	7% decrease in sheep output volume	Change in output (€m)	30% increase in pigs output volume	Change in output (€m)	employment coefficient per €1 million domestic output	50% increase in milk output volume	9% increase in cattle output volume	7% decrease in sheep output volume	30% increase in pigs output volume	Total Changes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
A_BAME		9.01		4.56		-0.27		2.16	3.11	28	14	-1	7	48
A_MEMA		21.66		13.65		-0.68		4.47	6.29	136	86	-4	28	246
A_MAEQ		19.75		13.72		-0.64		3.77	5.31	105	73	-3	20	194
A_OFMA		6.79		3.43		-0.21		1.64	0.87	6	3	0	1	10
A_ELMA		5.20		2.83		-0.16		1.12	4.27	22	12	-1	5	38
A_RATV		10.37		5.52		-0.31		2.25	1.85	19	10	-1	4	33
A_MEDI		3.65		2.09		-0.11		0.82	3.85	14	8	0	3	25
A_MOTO		29.30		15.75		-0.85		4.74	5.56	163	88	-5	26	272
A_OTTR		2.26		1.06		-0.07		0.58	7.64	17	8	-1	4	29
A_RECY		1.15		0.46		-0.03		0.31	4.82	6	2	0	1	9
A_ELGA		47.47		25.36		-1.44		10.55	2.07	98	53	-3	22	170
A_WATE		1.89		1.02		-0.06		0.43	8.66	16	9	-1	4	28
A_CONS		18.72		12.32		-0.60		3.70	5.87	110	72	-3	22	200
A_TRAD		5.40		3.31		-0.17		1.07	14.26	77	47	-2	15	137
A_WHSL		36.68		14.31		-1.09		10.56	7.83	287	112	-9	83	473
A_RETS		0.94		0.50		-0.03		0.16	20.77	19	10	-1	3	33
A_HORE		81.05		42.61		-2.38		15.61	13.63	1,105	581	-32	213	1,866
A_LATR		43.31		18.11		-1.26		10.88	7.52	326	136	-9	82	535
A_WATR		2.01		0.95		-0.06		0.47	10.51	21	10	-1	5	35
A_AITR		18.96		8.74		-0.57		4.94	1.43	27	12	-1	7	46
A_OTTRS		27.05		13.91		-0.80		5.78	4.28	116	60	-3	25	196
A_POTL		48.37		25.49		-1.48		11.23	4.20	203	107	-6	47	351
A_FISE		104.45		55.15		-3.21		24.86	1.97	205	108	-6	49	357
A_INSE		60.74		34.44		-1.85		12.46	2.56	156	88	-5	32	271
A_OFISE		23.34		11.85		-0.72		5.80	2.86	67	34	-2	17	115
A_REES		80.08		43.84		-2.34		14.64	1.31	105	57	-3	19	178
A_RESE		12.22		6.03		-0.37		2.94	2.19	27	13	-1	6	46
A_COSE		17.77		8.76		-0.59		6.36	2.26	40	20	-1	14	73
A_RESH		11.24		6.20		-0.36		3.36	4.52	51	28	-2	15	92
A_OTBU		203.02		88.76		-10.24		189.90	7.62	1,548	677	-78	1,448	3,594
A_PUAD		8.33		5.67		-0.28		2.10	9.07	76	51	-3	19	143
A_EDUS		20.12		10.90		-0.58		3.38	15.51	312	169	-9	52	525
A_HEAS		32.56		21.22		-1.00		5.34	11.82	385	251	-12	63	687
A_SEWA		9.15		4.21		-0.27		2.23	0.01	0	0	0	0	0
A_MNEC		7.48		4.38		-0.22		1.29	0.01	0	0	0	0	0
A_RECS		16.88		9.14		-0.50		3.14	8.38	141	77	-4	26	240
A_OTSE		8.69		4.33		-0.26		1.89	20.21	176	88	-5	38	296
A_PRHO		0.88		0.48		-0.03		0.15	0.00	0	0	0	0	0
Total all sectors	**1,369**	**2,506**	**442**	**1,239**	**-39**	**-71**	**374**	**630**		**23,052**	**11,597**	**-772**	**4,552**	**38,430**

Source:Authors' calculation