The Impact of the Removal of Milk Quotas on the Viability of Irish Dairy Farms from 2007-17

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"The dairy farming industry in Ireland has evolved through significant changes in recent decades. Robert Tolan examines the impact on Irish dairy farmers' income of removing quotas on milk production. Quotas were an established element of EU agriculture policy before their removal in 2015. Now, Glanbia seeks to utilize quotas during peak months of dairy production. Tolan discusses the heterogeneities between farm types and outlines how the differences between farms may affect the growth of farmers' income after the removal of quotas. He concludes by highlighting that the Irish government should intervene to prevent the implementation of Glanbia's quotas in the interest of Irish farmers."

Introduction

The liberalisation of the Irish dairy industry in 2015 after thirty years of production quotas was one of the most important events in Irish agriculture since the country's accession to what was the European Economic Community (EEC), now European Union (EU) (Leavy, 1991). The goal was to allow farmers to expand and achieve economies of scale to improve economic and environmental sustainability (O'Connell, Egeraat, Enright, & Pitts, 1997). This paper seeks to add to the existing research by combining Teagasc, the semi-state body responsible for agriculture, data compiled in the National Farm Survey (NFS) with Central Statistical Office (CSO) data. To date, the literature regarding the NFS has focused on one year at a time. This paper expands this reach to ten years, namely 2007-2017, at a time when the industry faces another crossroads: the possible return of quotas set by milk processors (O'Donnell, Glanbia milk supply management 'first step to new quota' – IFA, 2021). To contextualise results, CSO manufacturing milk price data, the price paid to farmers, as well as CSO data on total milk sales are combined with the microeconomic data the NFS provides. To the author's knowledge, this study is

the first to combine the NFS with other surveys in order to test whether the viability of dairy farming increased in a free market.

Literature Review

The study is motivated by a family background in dairy farming in remote areas. The last two hundred years of the family's farm have seen the development of Irish farming from a disparate collection of mixed farms, focused on raw material exports to the British empire, to a highly specialised industry concentrated on high value exports of food products (Bell & Watson, 2014). In the 1980s, the farm switched to dairy farming shortly after Ireland's accession to what was the EEC, now EU, in pursuit of the stable income stream promised by milk quotas. Quotas were introduced in member states to ensure a stable supply of milk and other agricultural products in the EEC so that inflation could be tamed and agricultural self-sufficiency eventually achieved. In 2012, the EU announced that the quota system would be wound down over the next three years (Petit, et al., 2012). In 2015, the dairy industry was liberalized to allow all farmers to fully pursue their business ambitions. Today, the industry is examining the effects of removing quotas particularly in the context of Glanbia, one of the country's primary milk processors, deciding to introduce a temporary quota system during the peak months of May to August for its suppliers (O'Donnell, 2021).

There is a fear among farmers such a move could become permanent thereby depriving the industry of maximising returns to scale. For these reasons, the removal of milk quotas presents an opportunity to fully examine whether the profitability of Irish dairy farms increased and if heterogeneities exist in how different farm types fared. The author speculates that younger farmers with larger farms with good soil saw the highest increase in income levels after the removal of quotas. Hennessy and Moran's (2015) examination of the viability of Irish farming industry based on the NFS results from 2015 is typical of the existing literature. Viability is measured in terms of on-farm income to ensure results are not biased by additional jobs held by farmers in areas with poor soil. The study is conducted across dairy; tillage, cattle and sheep and location are examined on a regional basis. The model itself classifies location by region rather than soil type thus losing some of the differences in soil quality within counties.

Hyland et al (2018) consider Irish farms in terms of profitability and environmental sustainability in the context of the removal of milk quotas. They find, using cluster analysis, that considerable heterogeneity exists as to how farms responded to the withdrawal of quotas. In Less Favoured Areas (LFAs) i.e., farms with low productivity land, economic or environmental sustainability did not improve. In all other farm areas, profitability increased and emissions decreased as increased profitability led to investment in environmentally friendly technology. However, this study is limited to farms in the NFS

2012 data set meaning it only captures farms when quotas were being gradually eased.

Empirical Approach

Based on the existing literature, the approach taken is to regress income against farm size, labour, investment, herd size, grants, total costs and the gross margin. Farmers are confronted with three decisions: the size of the herd, average number of labour units used (measured in people) and how much to invest on an annual basis. They have no control over grants and subsidies, termed grants for the remainder of the paper, and feed prices and fuel expenses, the majority of total costs. Gross margin captures gross profit minus direct costs which serves as a very specific measure of farm profitability. Using family farm income, termed income, as the dependent variable has the advantage of accounting for the interplay between expanding work hours on the farm or in a part-time job.

In any farm, land is the main input. The larger the farm, the more opportunities there are to achieve economies of scale and thus higher incomes. Hours worked is a measure of the effort put into the farm. For older farmers, this should be lower due to the infirmities of old age but it should also be lower for those with second jobs. Investment increases the efficiency at which land and animals are turned into profit. Grants is another aspect of income for farmers. Those in LFAs received additional grants which increase their income despite the poor quality of the land. Total costs accounts for non-investment expenditure, this will be higher for larger herds due to additional feed costs, a possible disincentive to expand. Gross margin is gross profit minus total costs, a measure of the efficiency at which the farmer converts income into profit, a measure of management expertise. Note, this indirectly captures the current price and has been chosen over including the price directly to measure management expertise. This leads to a baseline income equation of the form:

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + u_i \quad (1)$$

In contrast to Hennessy and Moran (2015) as well as Hyland et al (2018), further variables are added to the income function in order to test their significance and to investigate what heterogeneities exist, if any. A dummy variable for year based on the introduction of quotas, equaling 1 if 2015 or later and 0 otherwise, is added to measure whether market dynamics changed after full market liberalisation.

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + u_i \quad (2)$$

Herd size and investment are the most easily changed inputs and so there is likely some interaction between them and the removal of quotas, a contrast to the significance between them and the introduction of quotas as described in Keane (1991).

$$\beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + \beta_9(Herd * Year)_i + \beta_{10}(Investment * Year)_i + u_i \quad (3)$$

To further investigate heterogeneities in the data, (2) is expanded to include price from the CSO data to investigate whether farmers reacted directly to the primary means of conveying market information, prices.

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + \beta_9(Price)_i + u_i \quad (4)$$

The interaction between price and herd size is controlled for in (5) to measure whether farmers are more sensitive to price changes rather than the removal of quotas.

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + \beta_9(Price)_i + \beta_{10}(Herd * Price)_i + \beta_{11}(Price * Year.Dummy) + \beta_{12}(Herd * Year.Dummy) + \beta_{13}(Herd * Price * Year.Dummy) + u_i \quad (5)$$

Farmers may react differently to market changes based on herd size; a larger herd may mean there is less room to expand. For this reason, a dummy variable for herd size, either large or small, is introduced.

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + \beta_9(Herd.Dummy)_i + u_i \quad (6)$$

Similarly, older farmers may be unresponsive to change and so a dummy variable defined at the current retirement age of 66 was defined. The ageing demographic of Irish dairy farmers has been of particular concern from a policy perspective. Older farmers are believed to be less likely to adopt new, more efficient techniques (Moran, 2018).

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + \beta_9(Age)_i + u_i \quad (7)$$

A dummy variable is defined at this point to examine whether small and large farms differ in their approach to the removal of quotas.

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Year)_i + \beta_9(Land.Dummy)_i + u_i \quad (8)$$

To analyse whether these results differ across location, soil is introduced as a proxy. The NFS denotes soil groups 1 and 2 as ranging from high quality land to good land best for dairy farming while group 3 is poor land. The last group can be assumed to be comprised of Less Favoured Areas (LFAs) which consists of most land on the western seaboard. To analyse this data, soil has been added to (1) as a dummy variable equalling 1 if the soil group is 1 or 2 and 0 otherwise. Soil Time has also been added which equals 1 for good soil after 2015 and 0 otherwise to investigate if returns to good soil changed due to quotas.

$$Income_i = \beta_0 + \beta_1(Land)_i + \beta_2(Labour)_i + \beta_3(Investment)_i + \beta_4(Herd)_i + \beta_5(Grants)_i + \beta_6(TotalCosts)_i + \beta_7(GrossMargin)_i + \beta_8(Soil)_i + \beta_9(SoilTime)_i + u_i \quad (9)$$

The aim is to test the author's hypothesis that farms with good soil saw the largest increase in income after the removal of quotas. Thus, the effects of quotas on a location basis are captured.

Description of the Dataset

The NFS began on an annual basis in 1972 with the goal of collecting financial and physical data pertinent to formulating agricultural policy. The study, administered by Teagasc, offers a rich glimpse into the 1,200 farms that comprise the nationally representative sample. Participation is voluntary and anonymised. In this way, the results lend themselves to panel data analysis which has been used to construct a multiple regression model for the determinants of farm income as well as decomposing how different farm types responded to the end of quotas (Teagasc, 2021).

The data markers pulled from the survey include farm code, year, land (hectares), soil type, labour units, investment, comprised of investment in buildings, machinery and livestock, gross margin, gross profit minus direct costs, income, herd size, grants and subsidies and farmer's age from 2007-17. The farms chosen are dairy farms though a small amount are dairy mixed farms with some investments in arable and beef farming

which yields roughly 350 farms in each year giving a sample size of 3,459 farms once datapoints containing farms with no dairy herds are removed. This is often caused by farmers deciding to switch out of dairy farming into another sector but they remain in the dataset for the remainder of the year. The CSO portion of the dataset is composed of annual data on total milk sales in the state as well as the average annual manufacturers' milk price, the price paid to farmers (CSO, 2021). In this way, a novel dataset that combines key measures of farm performance as well as the factors that influence it is created.

The dataset hinges on 2015, the year in which milk quotas were removed. Dummy variables are defined using this point. Average incomes increased from 2008-10 which is striking in the context of the broader Irish economy. According to Carroll et al. (2007) a reason may be that fact farmers, particularly dairy farmers, are low carriers of debt. When the broader Irish economy was highly leveraged during the Celtic Tiger, the farming community continued to practice fiscal prudence. Indeed, the existence of supply controls such as quotas may have sheltered dairy farmers from this leveraging process.

Empirical Results

Farmers with large, labour intensive herds on good soil gained the most income from market liberalisation. Returns on investment increased marginally across all farms. Contrary to the original hypothesis, older farmers saw the largest increase in income. Classifying farms into whether they are large or small finds a statistically insignificant relationship between farm size and the removal of quotas. These insights suggest farm supports should be targeted towards younger farmers in LFAs as they have fared the worst from the removal of milk quotas. The most representative model of farm income is (5) as it captures 93.5% of the data.

Figure 1

Determinants of Farm Income (1) and (2)

	Income			Income		
Predictors	*Estimates*	*std. Error*	*CI*	*Estimates*	*std. Error*	*CI*
(Intercept)	6943.14 ***	602.80	5761.26 – 8125.03	6221.74 ***	613.87	5018.14 – 7425.34
Land	-115.83 ***	11.60	-138.57 – -93.08	-115.81 ***	11.55	-138.46 – -93.17
Labour	-4173.37 ***	422.60	-5001.95 – -3344.79	-4005.81 ***	421.79	-4832.80 – -3178.82
Investment	-0.04 ***	0.00	-0.04 – -0.03	-0.04 ***	0.00	-0.04 – -0.03
Herd	175.18 ***	13.49	148.74 – 201.63	167.33 ***	13.50	140.86 – 193.80
Grants	0.14 ***	0.02	0.10 – 0.19	0.17 ***	0.02	0.12 – 0.21
Totalcosts	-0.35 ***	0.01	-0.36 – -0.34	-0.35 ***	0.01	-0.36 – -0.34
Gmargin	0.93 ***	0.01	0.92 – 0.95	0.93 ***	0.01	0.92 – 0.94
Year.Dummy				2781.84 ***	498.37	1804.70 – 3758.99
Observations	3375			3375		
R2 / R2 adjusted	0.932 / 0.932			0.933 / 0.933		

** p<0.05 ** p<0.01 *** p<0.001*

The baseline model is very representative of the income equation. As income increases by €175.18 for every additional cow, it suggests farmers should strive for increasing returns to scale to maximise returns. However, this is not logical as it suggests infinite returns to scale exist. Including year as a regressor has marginally improved the fit of the model confirming that the removal of milk quotas had some impact. According to (2), increasing land by 1 hectare reduces farm income by €115.81 and hiring an additional unit of labour reduces farm income by €4,005.81, ceteris paribus. Increasing the herd size by 1 cow increased income by €167.33, ceteris paribus. This suggests large herds yield the most income.

Figure 2

Determinants of Farm Income (3), (4) and (5)

	Income			Income			Income		
Predictors	*Estimates*	*std. Error*	*CI*	*Estimates*	*std. Error*	*CI*	*Estimates*	*std. Error*	*CI*
(Intercept)	6832.28 ***	658.23	5541.71 – 8122.84	-9297.66 ***	1928.86	-13079.51 – -5515.81	5455.60	3423.58	-1256.91 – 12168.11
Land	-115.09 ***	11.50	-137.63 – -92.54	-105.83 ***	11.49	-128.36 – -83.30	-99.96 ***	11.45	-122.41 – -77.52
Labour	-3947.76 ***	420.18	-4771.60 – -3123.92	-3594.32 ***	420.23	-4418.26 – -2770.38	-3352.17 ***	418.93	-4173.56 – -2530.79
Investment	-0.04 ***	0.00	-0.05 – -0.04	-0.03 ***	0.00	-0.04 – -0.03	-0.03 ***	0.00	-0.03 – -0.02
Herd	182.05 ***	14.90	152.84 – 211.25	193.01 ***	13.70	166.15 – 219.88	-70.50	45.97	-160.64 – 19.63
Grants	0.17 ***	0.02	0.13 – 0.22	0.21 ***	0.02	0.17 – 0.26	0.23 ***	0.02	0.18 – 0.27
Totalcosts	-0.35 ***	0.01	-0.36 – -0.33	-0.36 ***	0.01	-0.37 – -0.35	-0.37 ***	0.01	-0.38 – -0.36
Gmargin	0.93 ***	0.01	0.91 – 0.94	0.90 ***	0.01	0.88 – 0.91	0.89 ***	0.01	0.87 – 0.90
Year.Dummy	657.34	966.19	-1237.04 – 2551.71	3963.54 ***	512.53	2958.65 – 4968.44	-763.91	7335.03	-15145.49 – 13617.66
Herd * Year.Dummy	-55.82 **	20.59	-96.19 – -15.46				180.61 *	80.25	23.26 – 337.95
Investment * Year.Dummy	0.02 ***	0.00	0.01 – 0.03						
Price				44049.49 ***	5196.14	33861.59 – 54237.39	1042.40	10117.72	-18795.10 – 20879.91
Herd * Price							790.23 ***	137.04	521.53 – 1058.92
Price * Year.Dummy							3339.99	22749.94	-41265.13 – 47945.11
(Herd * Price) * Year.Dummy							-397.31	246.17	-879.96 – 85.35
Observations	3375			3375			3375		
R^2 / R^2 adjusted	0.934 / 0.933			0.934 / 0.934			0.935 / 0.935		

** p<0.05 ** p<0.01 *** p<0.001*

According to Figure 2, the interaction between the removal of quotas and the herd size and level of investment is significant in (3). After the removal of quotas, increasing the herd size by 1 cow decreased income by €55.82 less than before the removal, ceteris paribus. After the removal of quotas, the effect of increasing investment by €1, increased income by €0.02 more than before the removal of quotas, ceteris paribus. Model (4) is a better fit than the baseline, it suggests a 1 cent increase in milk price received will increase income by €440.50 indicating that price is ultimately the main determinant of

income rather than the farmer's skill at converting price and costs into gross profit. Taking (5), the interactions between herd and price as well as herd and the year dummy are significant. The relationship between price and the year dummy as well as herd, price and the year dummy are not significant. This suggests the removal of milk quotas did have a statistically significant effect on the returns to increasing the herd. However, the removal of milk quotas did not have an effect on the price's relationship with income. In this way, the removal of quotas did not impact the dairy industry at the most fundamental level, the price and income relationship.

Figure 3

Determinants of Farm Income (6),(7),(8)

	Income			Income			Income		
Predictors	*Estimates*	*std. Error*	*CI*	*Estimates*	*std. Error*	*CI*	*Estimates*	*std. Error*	*CI*
(Intercept)	6067.67 ***	621.60	4848.92 – 7286.41	6119.84 ***	613.11	4917.73 – 7321.95	6161.97 ***	615.05	4956.07 – 7367.88
Land	-116.01 ***	11.55	-138.66 – -93.37	-114.74 ***	11.53	-137.34 – -92.14	-116.38 ***	11.55	-139.03 – -93.73
Labour	-3924.13 ***	424.92	-4757.26 – -3091.00	-4358.61 ***	430.38	-5202.43 – -3514.79	-3999.99 ***	421.73	-4826.86 – -3173.12
Investment	-0.04 ***	0.00	-0.04 – -0.03	-0.04 ***	0.00	-0.04 – -0.03	-0.04 ***	0.00	-0.04 – -0.03
Herd	165.84 ***	13.53	139.31 – 192.37	171.68 ***	13.52	145.18 – 198.19	166.69 ***	13.50	140.22 – 193.17
Grants	0.17 ***	0.02	0.12 – 0.21	0.17 ***	0.02	0.13 – 0.22	0.17 ***	0.02	0.12 – 0.21
Totalcosts	-0.35 ***	0.01	-0.36 – -0.33	-0.35 ***	0.01	-0.36 – -0.34	-0.35 ***	0.01	-0.36 – -0.34
Gmargin	0.93 ***	0.01	0.91 – 0.94	0.93 ***	0.01	0.91 – 0.94	0.93 ***	0.01	0.91 – 0.94
Herd.Dummy	800.18	511.60	-202.89 – 1803.26						
Year.Dummy	2783.75 ***	498.27	1806.81 – 3760.68	2707.84 ***	497.67	1732.08 – 3683.59	2791.86 ***	498.32	1814.81 – 3768.90
Age.Dummy				3005.16 ***	765.39	1504.48 – 4505.84			
Land.Dummy							749.98	499.13	-228.64 – 1728.60
Observations	3375			3375			3375		
R2 / R2 adjusted	0.933 / 0.933			0.933 / 0.933			0.933 / 0.933		

** p<0.05 ** p<0.01 *** p<0.001*

Whether the herd is small or large as well as whether a farm is small or large are not statistically significant. Whereas whether a farmer is below retirement age is statistically significant at the 1% level. Each additional year after retirement increases income by €3,005.14, ceteris paribus, contrary to the prevailing belief that an ageing demographic is making dairy farms less efficient (Moran, 2018). Whether a farm is small or large may be insignificant because both groups have been operating at capacity regardless of quotas. It is possible a large-scale farm may not be able to buy more land and is operating as intensively as possible whereas a small farm may be similarly operating as intensively as possible.

Figure 4

Determinants of Farm Income (9)

	Income		
Predictors	*Estimates*	*std. Error*	*CI*
(Intercept)	5988.20 ***	643.61	4726.29 – 7250.11
Land	-123.27 ***	11.73	-146.28 – -100.26
Labour	-4067.56 ***	423.06	-4897.05 – -3238.07
Investment	-0.04 ***	0.00	-0.04 – -0.03
Herd	170.70 ***	13.54	144.15 – 197.25
Grants	0.15 ***	0.02	0.11 – 0.20
Totalcosts	-0.35 ***	0.01	-0.36 – -0.33
Gmargin	0.93 ***	0.01	0.92 – 0.95
Soil.Dummy	1554.47 **	499.20	575.69 – 2533.24
SoilTime	1669.36 *	763.94	171.51 – 3167.20
Observations	3359		
R^2 / R^2 adjusted	0.933 / 0.933		

** p<0.05 ** p<0.01 *** p<0.001*

Figure 4 says good soil earns €1,554,47 more than poor, ceteris paribus. After the removal of quotas, good soil earned €1,669.36 more than before, ceteris paribus. Farmers in fertile locations gained the most from the liberalisation of the dairy industry.

Conclusion and Possible Extensions

Dairy farm incomes increased markedly after the removal of quotas in 2015 even amidst the market adjusting to its new structure. There is considerable heterogeneity across how dairy farms fared in the liberalized market. Nonetheless, the removal of quotas has had a generally positive effect on dairy farm incomes. For this reason, the government should prevent the introduction of Glanbia's quota. Earlier versions of the NFS were more limited in the type of data collected concerning investment levels. However, the approach taken in this paper could be extended to 1972-2020 if pre-2000 copies of the NFS can be accessed and the last three years are released. Due to the data available in the dataset constructed, a Cobb-Douglas production function could be constructed to quantify returns to scale in the sector and whether or not these increased with the removal of quotas. To investigate whether the heterogeneities found in the study are country specific, it is critical to expand this analysis to all EU member states. This will shed light on the dairy market structure in Europe which will lead to more effective policy-

making at EU level.

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