Quotas and emissions

Joint TEAGASC, NUIG and University of California research examined milk quota abolition, dairy expansion and greenhouse gas emissions.

Agricultural greenhouse gas (GHG) emissions are currently at the forefront of climate change policy in Ireland. The agricultural sector in Ireland generates a much larger proportion of the State's GHG emissions (35 %) compared to the EU average (9 %). The 2021 Climate Action Bill proposes a 51 % cut in GHG emissions by 2030, and agriculture will be subject to a sectoral target under this framework. While details are to be set during 2021, GHG reduction targets will dictate the direction of the sector to 2030.

A complicating factor in achieving agricultural emission reduction targets in Ireland is the major dairy herd expansion that has taken place around the abolition of the EU milk quota regime in 2015. Irish dairy farmers are in a particularly challenging situation as livestock numbers and chemical nitrogen (N) fertiliser are key drivers of agricultural GHG emissions. Both have increased since EU milk quota abolition, and more dairy cows and increased fertiliser application rates have led to higher absolute GHG emissions.

Irish dairy farmers have altered their production methods over time. For example, dairy farms are producing considerably more milk per farm now than before the milk quota abolition. These production increases are mainly due to larger dairy herd sizes and increased yields per cow. These production adjustments have led to changes in emission intensities per kg of milk produced. This research explores how changes in production methods have influenced GHG emission intensity of production during a time of significant policy change for the dairy sector.

Data and methodology

This analysis uses data from the Teagasc National Farm Survey (NFS) between 2000 and 2017 (inclusive) for dairy farms, and is based on 5,639 observations (Dillon *et al.*, 2018). The data include detailed information on farm and farmer characteristics, as well as farm-level GHG emissions. This includes both absolute GHG emissions and GHG emission intensity of production. GHG emissions are calculated following the Intergovernmental Panel on Climate Change (IPCC) methodology. For this, activity data derived from the NFS data are multiplied by emission factors (Buckley *et al.*, 2019). We used statistical methods to estimate total factor productivity and then measured the relationship between productivity, farm size and GHG emission intensity of milk production over an 18-year period that included milk quota abolition.

Declining GHG emission intensities

Our results indicate that average GHG emission intensity per kg of milk produced decreased by 13 % between 2000 and 2017 (from 0.84 to 0.73 CO_2eq/kg of milk; **Table 1**). This means that dairy farmers are now producing each kg of milk with considerably fewer emissions than 20 years ago.

We also find that, on average, absolute GHG emissions have increased by 86 % per farm over the same period. While this increase in absolute GHG emissions per farm is significant, average milk output per farm has increased by much more (123 %). This suggests that without improvement in environmental efficiency of production, farm-level emissions would have increased to a greater extent.

These figures have to be interpreted in the context of the general development of the national dairy sector.

For example, the number of dairy farms in Ireland has been reducing steadily since milk quota introduction in 1984. Between 2005 and 2016, the number of dairy farms in Ireland reduced by 17 %. The numbers remained relatively stable at 18,000 between 2010 and 2016; some of this was driven by new entrants to the industry (Kelly *et al.*, 2020). Conversely, dairy cow numbers have increased by over one-third and milk deliveries by over 50 % since 2008 based on Central Statistics Office data.

Productivity and milk quota abolition

Our results indicate an inverse relationship between productivity improvements and GHG emission intensities per kg of milk produced. Hence, as productivity increased, emission intensities of milk production declined. We also find that this important effect gets stronger with increasing farm size, indicating economies of scale.

Table 1: GHG emission and farm characteristics – specialist dairy farms in Teagasc National Farm Survey.

	2000	2006	2012	2015	2017	% change
Emission intensity (kg CO_2eq/kg milk)	0.84	0.80	0.77	0.74	0.73	-13.1
Total farm emissions (tonnes CO_2eq)	271.2	323.7	423.2	466.1	503.9	85.8
Total farm emissions/ha (tonnes CO_2eq)	7.39	7.33	7.69	8.26	8.60	16.49
Milk output (litres per farm)	194,281	255,115	326,021	397,144	433,856	123.31
Milk yield/cow (litres)	4,677	5,000	4,975	5,428	5,390	15.25
Number of dairy cows (per farm)	39.98	49.17	63.52	70.88	77.25	93.21
Utilisable agricultural area (hectare)	37.1	44.5	55.5	57.6	58.9	58.92

Data are weighted to represent the Irish dairy population; weighted averages are reported.
Source: own calculations from NFS data.

When we explored the implications of milk quota removal, our results revealed that increasing productivity had a stronger effect on GHG emission intensities in the quota removal soft landing phase (i.e., between 2008 and 2014), when compared to the quota phase (i.e., from 2000 to 2008, based on our data).

This suggests that milk quota expansion did play a role in reducing GHG emission intensity of production due to increases in productivity. However, the considerable growth in milk production in Ireland after quota abolition led to higher absolute GHG emissions, despite achievements in reducing GHG emission intensities.

It is important to be aware of the difference between reducing emission intensities and reducing absolute emissions. While lower emission intensity will result in lower total GHG emissions when milk production is constant, this link gets more complicated when milk production increases, as has been the case in Ireland over the last decade.

Research implications

Results from this study indicate that further reductions in GHG emission intensities can be achieved by increasing farm productivity. However, pushing productivity growth as a mitigation option for GHG emissions from the dairy sector is not a panacea. For instance, if dairy farms expand output through greater use of chemical fertiliser or imported purchased feeds, this could lead to productivity gains, but at the same time increased emission intensity, and consequently higher total GHG emissions. The same could be said for farmers entering dairying from a different sector (livestock or tillage), as these tend to have lower farm-level emissions.

Hence, in order to reduce emission intensity, productivity gains need to be achieved through pathways that reduce GHG emissions, such as those identified in the Teagasc GHG MACC Report (Lanigan *et al.*, 2018). This means that productivity growth needs to be complemented with further mitigation measures to directly reduce absolute GHG emissions. The Teagasc Signpost Programme, a new initiative to lead climate action in agriculture, directly aims to address this issue.

References

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