

## **A Century of Irish Agriculture: A Policy Driven Sector<sup>1 2</sup>**

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**Abstract:** In this paper we have assembled a time-series of agricultural statistics over the past century to describe many of the important trends of what has been an important sector in Ireland over the course of the past century. The paper explores trends in land use trade-offs between tillage and pasture and describes growth in animal numbers, the substitution between different types of animals. Over the century the Irish agricultural sector has moved from a sector with a high subsistence dimension with up to 40% of output consumed on farms to a modern international exporting sector, much less reliant on the traditional trading partner the UK. The paper tracks mechanisation of the sector and the huge reduction in labour and significant restructuring over the century. We emphasise the importance of public policy, not just in relation to price and income supports, but also importantly in relation to trade and production restrictions. The century perspective highlights some recurring trends where export restrictions have seen resilience and recovery after they are eased.

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**Keywords:** agricultural economics, agricultural history, development

**JELs:** Q18, O13, N54

### **1. INTRODUCTION**

As the dominant economic sector for much of the last century, the agricultural sector has received a lot of attention by economists and economic historians. Much of the agricultural history literature concentrates on the pre-independence period (Ó Gráda, 1990). Arguably however the changes that have occurred within the century 1922-2022 have been as varied as those that occurred within the previous 100 years, albeit nothing compares with the impact of the Famine. Most of the more recent analyses focus on specific issues or specific periods such as the pre-war and wartime era (Johnston, 1951), the post war period (Bailey and Sheehy, 1971), the milk quota era (Donnellan, 2016). Crotty (1966) took a multi-century approach. In this paper we develop a number of time series of agricultural economic data to explore some of the main changes that have occurred over this period.

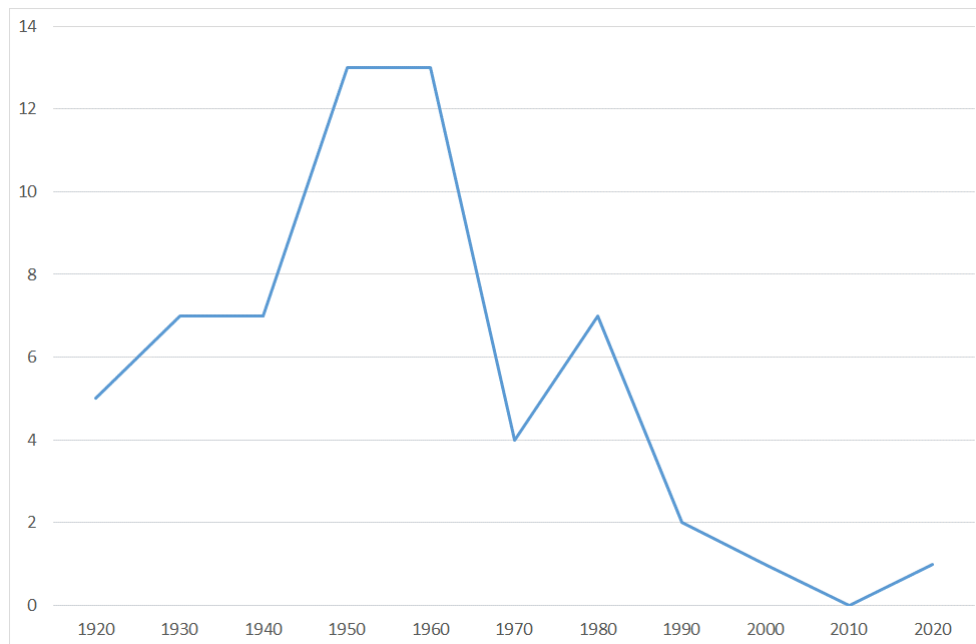
An advantage of this approach is that while the current (at the time) economic analyses have typically focused on single decades, individual business cycles or at most periods of up to 3 decades, a historical lens of a century can provide a different perspective. It can enable one to look beyond time specific norms, to consider recurring themes and to see things from a different perspective. Items of current importance may slip into insignificance in a century long overview.

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**Figure 1. Number of Papers on Agriculture, Farming and Land Use in the Journal of the Statistical and Social Inquiry Society of Ireland**



The Statistical and Social Inquiry Society of Ireland, given its long history and given its interest in agriculture over the period considered in this paper, is a good starting point in this reflection. The number of publications in its journal highlight to some extent the importance of the sector to the economy over time and also the research capacity that developed over time. Reviewing the period since the foundation of the state in the appendix to this paper, the number of publications peaked in the 1950's and 1960's, with at least one agri-food paper nearly every year from 1946 to 1969. In the decade of 2010 there wasn't a single paper with an agricultural focus and only a single paper in the 2000's (See Figure 1). Although common place across the history of the journal, by the 1990's most papers that incorporated agriculture related to its wider contribution to a broader question such as the environment (Lyons et al., 2007; Tol, 2008; Curtis and Morgenroth, 2012), comparative advantage (Thornhill, 1983) or rural development (O'Donoghue et al., 2013).

The breadth of topics covered is substantial, reflecting the multi-faceted nature of the sector and mirroring interests and concerns of the present (Table 1). Charting the long term broad brush trends in the agricultural sector and drawing policy conclusions has been a regular interest of the Society, with Eric Attwood (1961, 1962, 1966, 1969) of the ESRI and AFT and Trinity Professors Joseph Johnston (1941, 1947, 1950) and Alan Matthews (1988, 1999, 2005) being the most frequent contributors. Johnston's (1951) volume incorporates very many of the contributions made by him at the society.

Contrasting with high level future strategies of the sector (Kennedy, 1937), another area of frequent interest, but with a micro focus has been farm management issues. Quite a number of papers reported the results of local case study farm level surveys, particularly Michael Murphy (1938, 1939, 1941, 1943) of UCC series of farm accounts reported on a pilot basis in Cork and Limerick during the 1930's and 1940's and Bob O'Connor of the ESRI (1948, 1949), with his survey of Roscommon farms. In parallel a number of studies conducted a deeper analysis of issues at a sub-sectoral level such as cattle and dairying (Johnston, 1930; Kennedy, 1947; O'Connor, 1969; Loughrey et al., 2021), pig production (Senior, 1948; O'Connor, 1953) grassland (O'Connor, 1959) and tillage issues (Oldham, 1920; Duncan, 1933; Costello, 1953).

Understanding how Ireland fared relative to other countries and learning lessons from practice and policy elsewhere was a regular feature with Denmark (Beddy, 1943; Senior, 1948; Staehle, 1950), Britain (Fitzgerald, 1946), Northern Ireland (Attwood, 1966) and New Zealand (Symons, 1960) visible as comparators. While a common comparator in the 1940's, it is rare that Denmark with its different climate conditions is used as a comparator in the present, with New Zealand one of the most frequent. While most of the papers in the society since 1922 concentrated on the Republic of Ireland, there were occasional forays into Northern Ireland (Smith, 1948; Alexander, 1964) or North South comparisons (Attwood, 1966).

**Table 1. Number of Articles by Thematic Area in the Journal of the Statistical and Social Inquiry Society of Ireland 1922-2022**

<i>Area of Analysis</i>	<i>Number of Articles</i>
Sector-wide and policy	17
Farm Management	15
Sub-sectoral	13
Statistical and Indices	8
Comparative	7
Northern Ireland	6
Value Chain	5
Forestry and Land Use	5
Historical	5
Environmental	4
Rural Development and Spatial	4

Sources Archive of the Journal of the Statistical and Social Inquiry Society of Ireland

There was a strand of papers with an interest in measurement and statistical techniques (Geary, 1942, 1945; Boyle, 1986). Reflecting the relative importance of issues around the wider value chain, a number of papers have analysed issues in related areas such as the distribution of value and food marketing (Armstrong, 1958; O'Connell, 1978). Kelly, A. and Kevany (1980) consider the end of the agri-food value chain with a focus on nutrition. Johnston (1927) compared the stickiness of food retail prices compared to more volatile agricultural producers and wholesale prices, mirroring a source of frequent discussion in current public debate about the distribution of value across food value chains.

This paper takes a broad perspective, mainly drawing upon aggregate data to consider trends in output, prices, land use, labour, trade and incomes. We ignore distributional issues and farm scale issues using farm survey data, research we will return to in later research. The paper is divided as follows. Section 2 provides some theoretical background to the analyses, describing the economic structure and policy developments. Section 3 describes the data used. Section 4 presents the results of the paper, with section 5 concluding.

## 2. THEORETICAL FRAMEWORK: ECONOMIC STRUCTURE AND PUBLIC POLICY

In understanding the trends in the structure of Irish agriculture, we define in this section a theoretical framework that will inform the analyses undertaken later in the paper (See Figure 2). We define family farm income or operating surplus as the income derived from farming and related subsidies in a year such that the asset base is maintained. This represents the returns from farming to labour, land and capital. Therefore, Family Farm Income ( $Y_F$ ) can be defined as the sum of market gross output ( $Y_M$ ) plus subsidies ( $Y_S$ ) minus variable costs ( $C_V$ ) minus overhead costs. It is important to note however that it does not include income from non-farm sources:

$$Y_F = Y_M + Y_S - C_V - C_O \quad (1)$$

Agricultural land use ( $D$ ) sector contains a number of different land use types, including pasture ( $D_P$ ) and other crop based land uses ( $D_C$ ):

$$D = D_P + D_C + D_F$$

The sector is also closely related to forestry land-use ( $D_F$ ) as much of the land planted for forestry came from agricultural land uses.

Directly using pasture there are different animal based subs-sectors, namely dairy ( $Y_D$ ), cattle ( $Y_{CT}$ ), sheep ( $Y_S$ ) and horses ( $Y_H$ ) and also non pasture based livestock systems such as Pigs ( $Y_P$ ) and Poultry ( $Y_{PO}$ ):

$$Y_L = Y_D + Y_{CT} + Y_S + Y_H + Y_P + Y_{PO}$$

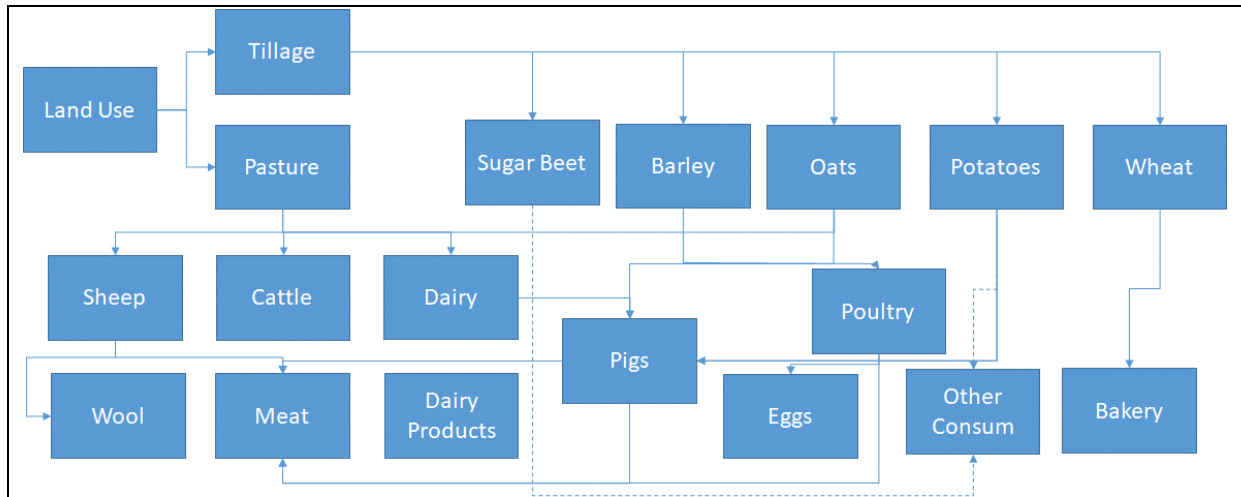
Crop output can be divided into cereal sectors (Wheat, Oats, Barley (Malting and Other)), other root based crops such as Potatoes ( $Y_{PT}$ ) and Sugar Beet ( $Y_{SB}$ ) and the Horticulture sector incorporating mushrooms ( $Y_{MU}$ ), fruit and vegetables ( $Y_{FV}$ ).

$$Y_C = Y_W + Y_O + Y_{BM} + Y_{BO} + Y_{PT} + Y_{SB} + Y_{MU} + Y_{FV}$$

Market gross output ( $Y_M$ ), which can be defined as the sum of the product of the price ( $p_m$ ) and the volume of output ( $V$ ) per sector  $i$ :

$$Y_M = \sum_i p_M^i \cdot V_M^i \quad (2)$$

**Figure 2. Theoretical Framework: Substitutions and Value Chains**



There are a number of vehicles by which production can change in the short run. Firstly, for a given land base, animals can be purchased or sold, thereby changing the stocking intensity or the area of land planted. Secondly yield can vary, either in the long run through breeding, considered here via purchasing animals of different genetic merit, or in the short run varying feed or fertiliser etc.

As a highly inter-connected sector, where output from one sub-sector like crops and pasture influence outcomes in another such as cattle or sheep, where land quality is important and where public policy incentives and constraints have been such significant drivers, it is difficult to formulate clear models of drivers of agricultural activity.

Staeble (1951) analysis of trends in the previous century form a useful comparator for this paper. He notes the relatively complex value chains over time with cattle being used for meat and dairy products, sheep for meat and wool, poultry for eggs and meat, with pigs having a single value chain. He also notes the competition for pasture between cattle, sheep and horses, with pasture competing where the land is of sufficient quality with cereals. While historically pigs when reared in an extensive setting competed with humans for potatoes and using by-products of dairy production like buttermilk, they are increasingly fed on grains. Staeble analysed the impact of product prices on the number of animals finding a strong relationship between the price of ewes and the number of lambs the following spring. For cattle the price of store cattle had a greater influence. Nineteenth century butter prices and milch cow numbers however had no relationship, indicating that butter production was a by-product of the primary focus on breeding cattle for meat rather than a primary driver of production. However, within the cattle sector, the growth in cattle numbers over the nineteenth century saw a shift in the balance between store cattle and fattened cattle, with the former reducing, thus reducing the demand for cereals such as oats and barley for fattening, replaced by winter fodder such as hay, relying on cereals on British finisher farms to finish the animals. Baker et al. (1973) argue that relationship between beef prices and cattle numbers is very complex, resulting from the long production period and the interaction with a separate dairy value chain noted by Staeble (1951).

### Public Policy

Since the Cattle Acts in 1666, the structure of Irish agriculture has been strongly influenced by public policy decisions. The Land Acts of the late 19<sup>th</sup> century and early 20<sup>th</sup> century informed the pattern of land ownership that existed at the foundation of the state (Johnston, 1951).<sup>3</sup> In the early years of the Irish Free State, there was a

<sup>3</sup> Subsequent Land Acts of 1923 and 1933 transferred land from the landlords to tenants and to distribute land from large farms purchased by tenants more widely.

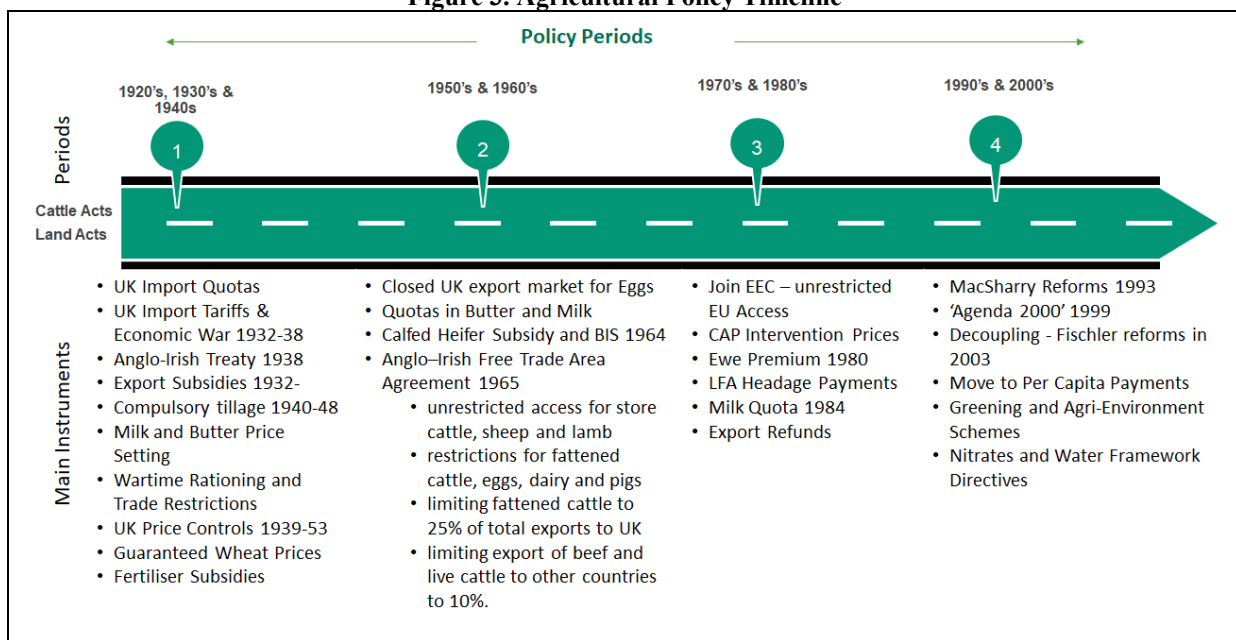
focus on developing export markets and limiting agricultural protection, (Meenan, 1971). After independence, the first major interventionist policy initiative took place when Fianna Fail took power in 1932 was to promote a move from cattle to tillage. The strategy was multi-faceted, combining an appeal to patriotism vis advertising, additional tillage instruction quotas required by millers and a wheat bounty paid to farmers from a higher consumer price (Daly, 2002). There were also quotas for the use of minimum proportions of home grown inputs into animal feed at this time. These quotas were supported by government buying and storage of grains. State investment in four sugar beet plants created an incentive to convert land to sugar beet production.

The Department of Agriculture set the price of butter and determined the level of export subsidies which had existed since 1932. Export subsidies dominated expenditure. Subsidies were introduced to promote the greater use of lime and of phosphate fertiliser in 1938 (Daly, 2002).

The Economic War or Anglo-Irish trade war (1932-38) resulted from the Irish government refusing to pay land annuities that arose from loans to pay for land transfers under the Land Acts. The British government countered by levying an import duty of 20% on Irish agricultural exports. In late 1932 a tax on live animals was raised to 40% and other produce to 30% (Johnston, 1934). This converted to a flat per head tariff in 1933 (Johnston, 1951). Import quotas were also introduced on fat cattle or cattle that were ready to be slaughtered. The UK had also implemented a policy of applying a higher price for domestically fattened cattle (Meenan, 1971). The combination of UK tariffs and Irish export subsidies had quite a differential impact on individual sector, with export subsidies on butter higher than the tariffs, subsidies on eggs being in total equivalent to the tariffs, with tariffs on pig products marginally higher than the export subsidies, with the brunt of the tariffs being born the by the live cattle exports (Johnston, 1951).

The Economic War ended with the Anglo-Irish Treaty of 1938, however there were limited opportunities to take advantage of improved export conditions due to the onset of the Second World War the following year. WW2 brought restrictions in relation to imports due to wartime conditions. To improve food security in wheat for bread, the Irish government introduced compulsory tillage policy which existed between 1940 and 1948 (Evans, 2011). A target of 20-25% of arable land on farms of over 10 acres was set, extended to 5 acres subsequently. Although farmers were free to plant their choice of tillage crop, guaranteed prices were paid to incentivise wheat production (Daly, 2002). Later in the war, restrictions were introduced in the use of oats and barley for animal feed, and for a time the use of barley for brewing was suspended. Price guarantees were also introduced for oats, barley and sugar beet. In relation to the main export market, the British Ministry of Food was the sole purchaser of food at controlled prices until British rationing ended in 1953-54.

**Figure 3. Agricultural Policy Timeline**



In the post war period, the focus of public policy returned to exports and in particular the export of foods of a high protein nature such as meat, eggs and dairy produce (Meenan, 1971).

Export opportunities for dairy and pig products was uncertain in the 1960's as the UK introduced quotas in butter and bacon and closed export markets in eggs when it joined EFTA in 1960 (Meenan, 1971). The UK introduced deficiency payments or price supports for farmers in 1953 to support guaranteed prices, particularly when world agricultural commodity prices fell in the early 1960's (Foster, 1971).

Prior to the introduction of the bovine tuberculosis eradication scheme in 1954 and indeed for some years afterwards dry cattle producers received no State support of any kind from the Irish Government. A scheme of guarantee payments was introduced in July 1960 in respect of fat cattle and carcass beef in order to provide farmers with an outlet for untested and reactor cattle which could not be exported as stores. The 1960's saw the introduction of the Calved Heifer Subsidy Scheme between 1963 and 1968<sup>4</sup>, replaced in 1969 by the Beef Incentive Scheme<sup>5</sup>.

The Anglo-Irish Free Trade Area Agreement (AIFTAA) in 1965 and coming into operation in 1966, initiated a process that abolished tariffs on trade in manufactured goods between the two countries (Meenan, 1971). In agriculture, the agreement was not quite as generous with unrestricted access only for store cattle, sheep and lamb, with existing restrictions for fattened cattle, eggs, dairy and pig products. There remained a goal of limiting fattened cattle to 25% of total exports to Britain (Foster, 1971). In addition, Ireland committed to limiting the export of beef and live cattle to other countries to 10%.

#### *The Common Agricultural Policy*

Article 39 of the Treaty of Rome established the Common Agricultural Policy and was signed by the 6 original member states of the European community in 1957. In the 1950s western European food supplies could not be guaranteed as societies had been damaged by years of war and the agriculture sector had been crippled. In order to ensure a certain level of food production an EEC wide target price was set for most farm commodities. If a commodity's price fell below what was termed an intervention price (usually 5-10% below the target price) then the EU would simply purchase and store the surplus produce thereby preventing further falls in price (Fennell, 1997). In addition, variable levies were charged on foodstuffs from non-member countries to help protect prices of agricultural commodities within the EU.

The CAP had a major impact on farming and by extension the EU budget. As Ackrill (2008) notes, while the instruments of price support generated some revenues through a variable levy on imports, they generated a significant budgetary cost through the need to keep surplus quantities of commodities off the EU Market to maintain high prices. The culture adopted in Ireland as in other countries with regard to farming was one of 'farming the subsidy' where farmers adapted farming practices to maximise their receipt of direct payments rather than fulfilling any consumer needs per se. Under this system the more farmers produced the more subsidy payments they received. By the 1980s the EU had to contend with huge surpluses of major farm commodities, some of which were exported with the help of export subsidies, many others of which were simply stored or disposed of within the EU.

One mechanism that aimed to keep prices high, but also to reduce the cost of maintaining these prices to the taxpayer was a system of national quotas for the milk sector. Although initially a temporary measure, the mechanism has been extended and was abolished in 2015. The quotas were initially set at 1981 production levels plus 1%. These quotas were set for individual producers; in Ireland in the form of Co-ops. One of the knock on consequences of the introduction of milk quotas was an expansion in beef production as many dairy farmers moved into beef production as they were precluded from expanding their dairy system.

#### *CAP Reform*

By the late 1980s policymakers increasingly became more cognisant of the fact that the CAP in its current formulation was unsustainable. Specifically, while milk quota helped to ease the budgetary pressure on dairy supports, the cost of supporting the beef sector increased as dairy farmers converted more of their land to beef production (Oskam et al., 2011). Furthermore, there was ever increasing pressure from other agricultural exporters placed on the EU to reduce what they saw as highly protectionist and market-distorting agricultural policies. As a result of these pressures significant reforms (known as the MacSharry reforms) were implemented in 1992.

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<sup>4</sup> Paying £15 per head, where an animal produced a calf.

<sup>5</sup> Paying between £16 and £20 on every cow that does not produce milk for a creamery

The Macsharry reforms centred on shifting some farm support away from measures that increased market prices towards paying them direct income aids that came from the EU budget. The payments were still based on farmers' declarations of their hectares planted and livestock numbers held and slaughtered in the current period. However, these incentives for current production were not open ended in that regional ceilings were fixed to limit the total payments. These reforms began the process of breaking the link between production and direct aids and encouraged farmers to look more closely at the marketplace in determining their levels of agricultural production.

This shift of emphasis took a further big step in 1999 with the agreement of the so called 'Agenda 2000' reforms. These reforms further reinforced the move away from linking payments to production and sought to make farmers more reliant on the market. Under this reform, support for the dairy sector was moved from measures that increased prices for consumers towards direct income aids. The dairy sector had been left out of the MacSharry reforms in 1992 as the EU milk supply was limited by a system of national quotas and thus the budget costs of dairy support were considered to be under control (Burrell, 2004). This reform also created what has been referred to as the Second Pillar of CAP support, namely a rural development policy. Here resources are being targeted towards measures addressing the multifunctional agenda of farming activity.

The Fischler reforms in 2003, known as the CAP Midterm Review, perhaps brought about the most significant change in European agricultural policy to date by allowing for the decoupling of farm support payments from production. The central motivation for these reforms was to strengthen the EU's position in the World Trade Organisation (WTO) negotiations. Under this new system, member states agreed to implement a system of single farm payments (SFP) which were decoupled from production as these were felt would reduce the trade-distorting and inefficiency effects of the CAP (Oskam et al., 2011 and Daugbjerg, 2006). The budget available to the CAP was set out for the period 2000 to 2006, and was also capped to reassure taxpayers that CAP costs would not escalate. More emphasis was placed on agricultural practices that are environmentally sound as through cross-compliance obligations, eligibility for the main direct payments is conditional on achieving environmental and welfare goals.

### 3. METHODS AND DATA

This paper draws heavily upon data collected by the Irish Central Statistics Office (CSO), which is responsible, in cooperation with the Department of Agriculture, for collecting and compiling agricultural statistics.

Much of the data used in this study draws upon the national accounts information for agricultural outputs and inputs, both in volume and value terms and for associated prices. The first available data of agricultural output produced by the Irish Government was for 1926/7 by the Statistics Branch of the Department of Industry and Commerce, with the next set of statistics produced in 1929/30 and again for 1934/5 and subsequently produced on an annual basis. (O'Connor, 1971).<sup>6</sup> O'Connor and Guiomard (1985) did however fill in some of the gaps using available physical data, trade statistics and prices, subsequently revised and extended by O'Connor and Henry (1995) for 1924/5 1926/7 and for a number of years in the 1930's, building upon a rich history of historical agricultural national accounting for the nineteenth century (Solow, 1971; Vaughan, 1980; Ó Gráda, 1984; Solar, 1987; Turner, 1987).

One of the challenges in making comparisons over the century relate to changes in definitions. Some of the principle changes include:-

- Value of livestock changes were dropped in 1936/7 and not included again until the 1955 estimates (See Agricultural Statistics 1934-56).
- The choice of whether turf is included in the value of output
- The treatment of forage crops in the national accounts, which have been included since 1990 both as an output and as an input
- Metrification: changes in metrics from hundred weight to kilos and tonnes, from acres to hectares
- The broadening of the extent of inputs from a narrow set of the main direct inputs or farm materials (feed, fertiliser and seed) to a broader measure in the 1960's and subsequent revisions to the present day.<sup>7</sup>
- Broadening the coverage of depreciation from only machinery and buildings and the subsequent move from depreciation to Gross Fixed Capital Formation
- Changes in the definition of wages and salaries resulting in a step change in 1990
- The treatment of contract costs since the 1990's as both an input and an output
- The treatment of interest, land rental and taxation since 1990

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<sup>6</sup> The first official estimate was for 1908 produced by the Department of Agriculture and Technical Instruction (O'Connor and Henry, 1995).

<sup>7</sup> O'Connor and Henry (1995) and Cullen (1995) made a simplifying assumption that other expenses amounted to 11% of total output in their work on agricultural incomes around the time of Independence.

Geary (1925) evaluated use of sampling when nationwide enumeration broke down in the 1920's during the War of Independence and the Civil War. Geary (1945) emphasised the sensitivity of agricultural price indices to choice of weight.

Another important source of data are the Census' of Agriculture, which were conducted annually between 1847 and 1953, and every five years from 1960 to 1980. The 1985 Census was cancelled on budgetary grounds, the 1991 Agricultural Census was considered to be the first full census conducted since 1980. The 1991 Agricultural Census saw the replacement of the traditional agricultural enumeration system by a more cost-effective Postal sampling method. Further Census' were collected in 2000, 2010 and 2020. In between Census of Agriculture years, the Farm Structures Sample Surveys is used to supplement structural information about the survey. It was collected in Ireland since 1975 and is collected, except for Census or Census neighbouring years every two – three years

Chart (1912) reports a variety of statistics relating to Agriculture from 1695-1905 including exports, land use and output. Barrington (1927) drawing upon Cowper Commission and British Parliamentary Papers plotted agricultural commodity price indices from 1840-1925, albeit critiqued in Solar (1998). Oldham (1924) on the perplexities of Irish Agricultural Statistics critiques the poor documentation and methodological descriptions associated with the release of early statistics and limited commentaries on statistics published. Staehle (1951) analysed the shift from cereals to livestock production over the post famine period to the eve of the First World War, with a particular focus on the relationship with population decline. Attwood (1982) after the income crisis in the late 1970's and 1980's described trends in the agricultural outputs and inputs and compared resulting farm income per labour unit against non-agricultural wages.

This paper primarily focuses on aggregate data from the national accounts, trade statistics, agricultural censuses and Census' of population. We do not consider farm level distributional characteristics from various farm surveys, starting with local pilots reported in this society (Murphy, 1938, 39), the CSO's National Farm Survey's in the mid-1950's and the National Farm Survey collected by Teagasc and its forerunner An Foras Taluntais since 1972.

#### 4. RESULTS

##### *Land Use Decisions*

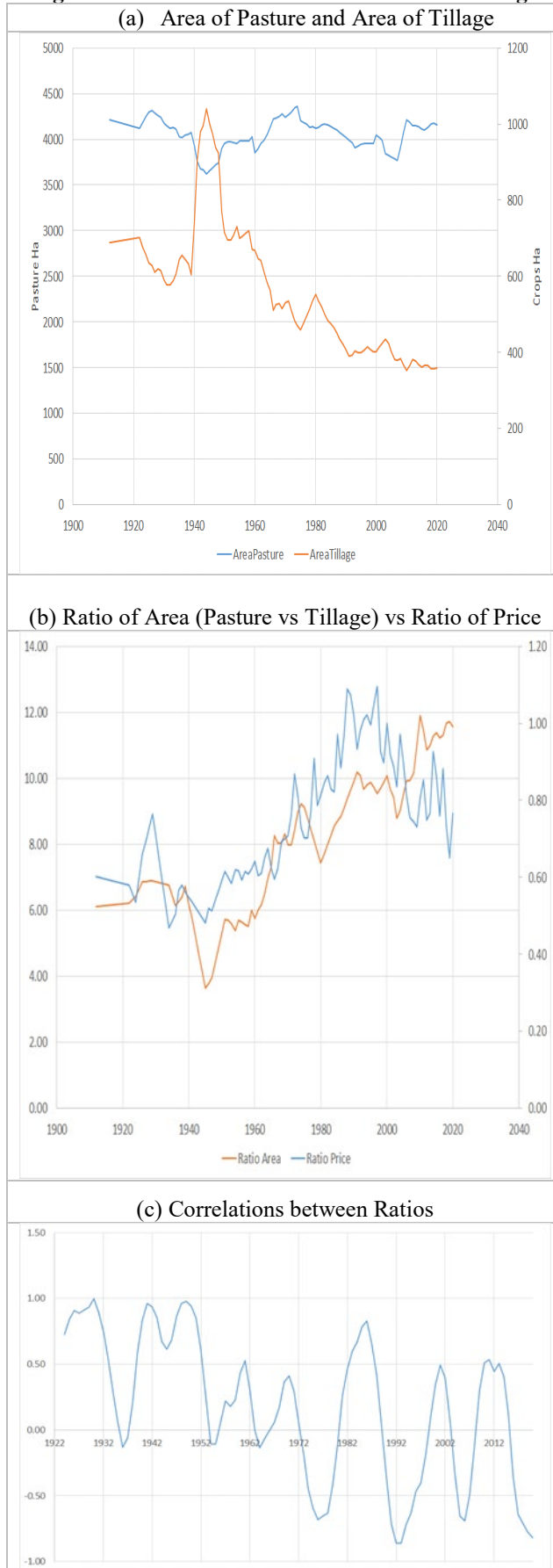
One of the key drivers of the structure and outcomes of the agricultural sector is the nature of the land use over time, particularly the share of land that is used for tillage compared with pasture. There were a number of definitional issues between series between Census' of Agriculture, Farm Structure Surveys and Crop and Livestock Surveys relating to inclusion and definitions of rough grazing and commonage in livestock grazing areas. We have amended the series to be as consistent as we could, albeit we were unable to identify the change in definition of agricultural land between 2007 and 2008 that saw an increase of about 10%, visible also in the Farm Structures Survey between 2007 and 2013, visible also in the Census of Agriculture between 2010 and 2000.

Figure 4.a documents the share of land used in tillage relative to pasture, using CSO data. There are two stand-out trends, the steady decline in tillage area and the spike in tillage during the second world war. Plotting the ratio of land use between tillage and livestock and the price ratio (based upon the livestock and livestock products (LLP) and the crops gross output price indices) in Figure 4.b, we see the broad relationship between the two series, indicating that the increases in the relative price of LLP, in general saw a relative increase in land for grazing. There are however a few exceptions or exaggerations, namely during the second world war where pasture and forage crops land fell by more than the relative prices, again in the late 1970's and in the 2000's.

Charting the correlation between the two series in Figure 4.c, we see that the moving average correlation between the two series was positive up until 1950. This means that as the relative price for cattle increased, the share of land in pasture increased. The correlations remained positive in the 1960's, but less strong, but moved quite strongly negative for periods in each of the following decades as other factors (such as subsidies) become more important in relation to land use decisions. Key policy factors relevant to these latter periods include the Calved Heifer Subsidy Scheme and the Beef Incentive Scheme, the major adjustment to relative prices after joining the EEC in 1973, the introduction of income supports through Headage Payments and the MacSharry reforms in respectively the late 1980's and early 1990's, the move to decoupled payments from production in 2005 and the introduction (1984) abolition (2015) of milk quota.



**Figure 4. Substitution between Pasture and Tillage**



### Cattle Numbers

As a predominantly pastoral agriculture country, the trend in the number of cattle is a key indicator of the activity of the agricultural sector over time. The century between 1855 and 1955 saw a similar number of breeding cows on the land in Ireland (Figure 5). A similar pattern was found in the number of sheep and horses, reflecting the subsistence nature of much of Irish agriculture with 1.5 cows providing the milk needs of a family (Johnston 1951). The biggest change over this period resulted from an increase in the share of other cattle as more calves and older animals survived and were reared for meat, primarily for export as live animals to the UK.

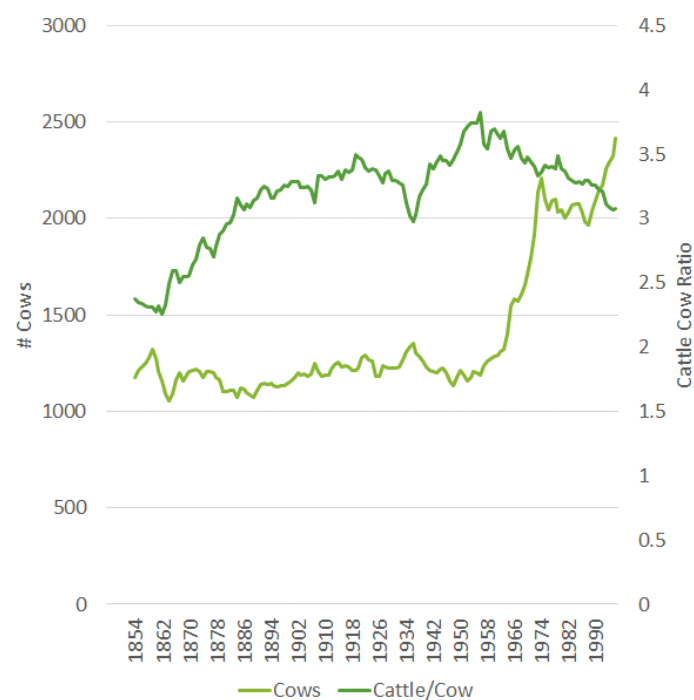
Looking in more detail at the century 1922-2021, Figure 6 describes the trend in the main aggregates, total cattle and cows and the number of dairy and other cows. Total cattle numbers declined after the foundation of the state in 1922 by about 10% to a low point in 1948, not reaching the same numbers until 1954. Although total cattle remained relatively static during the economic war, breeding cow numbers increased until 1936. After the Anglo-Irish Agreement in 1938, there was no noticeable recovery due to the onset of the Second World War, with numbers declining further after the war, with a recovery not beginning until 1949.

After blips in 1957 and 1968 total cattle numbers more or less rose each year until peak cattle numbers in 1975 after joining the EEC. The Calved Heifer Subsidy Scheme was an important policy driver during the late 1960's in advance of the higher supported price within the EEC from 1973 and anticipated beforehand. While cattle numbers rose in the 1960's, feed crops did not keep pace, so that bad winter of 1965-66, required additional concentrate feed, resulting in lower cattle the following two years. (O'Connor, 1971)

This was followed by a bumpy decline from 1974 to 1984, with slight recovery before a lower point in 1988 from a peak of 7.41m to a low point of 6.46m, a decline of nearly a million animals. After a peak in 1979, dairy cow numbers fell slightly to 1981, before increasing again to a slightly lower peak in 1984 when milk quota was introduced. With milk volumes fixed and rising milk yields, the number of dairy cows began a rapid decent to a low point of just over a million in 2005 or a fall of over half a million cows, approximately one third of the herd. Dairy farmers replaced dairy cows with beef cows, but at a lower rate, so that the total number of breeding cows declined at a similar rate to all cattle to 1988.

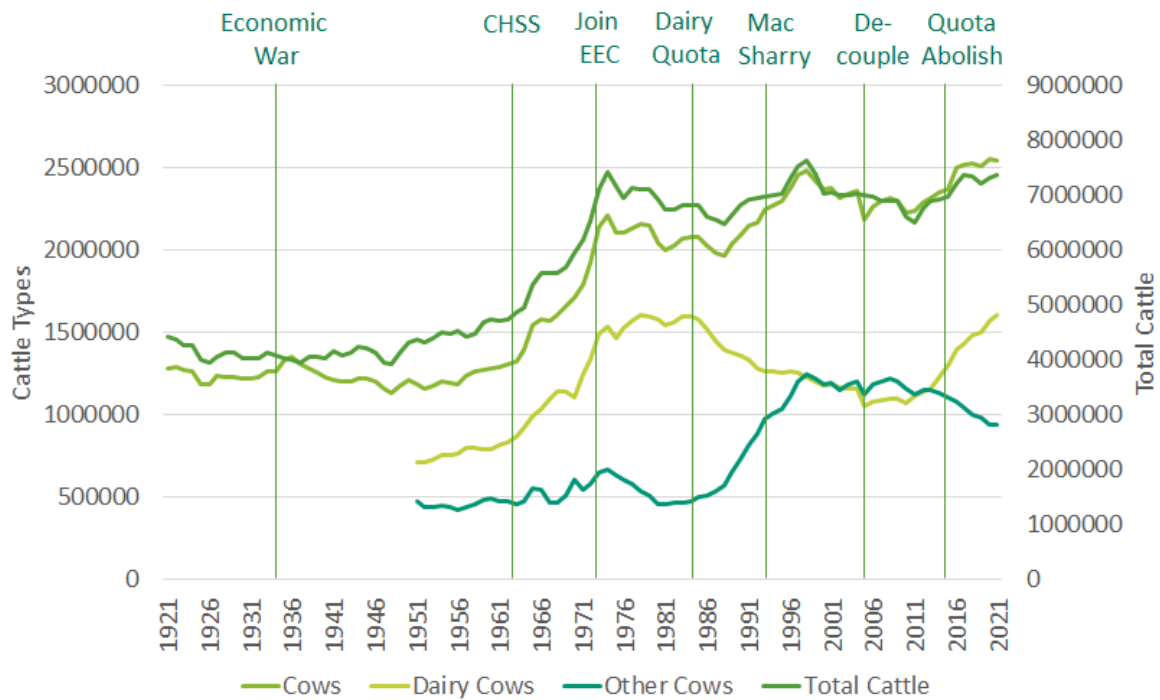
There was steady growth numbers after 1988 until a new peak of 7.64million cattle was reached in 1998. Cows increased at more or less the same rate as total cattle until 1993, when the rate of cattle grew faster. The composition of cows however changed radically as the number of dairy cows fell as beef cows grew, so that the new norm for the next decade and a half was there were similar numbers of dairy and beef cows of about one million each.

**Figure 5. Numbers of Breeding Cows and Cattle to Cow Ratio from Famine until end of 20<sup>th</sup> Century**



Source: CSO Census of Agriculture

**Figure 6. Cattle Numbers 1922-2021**



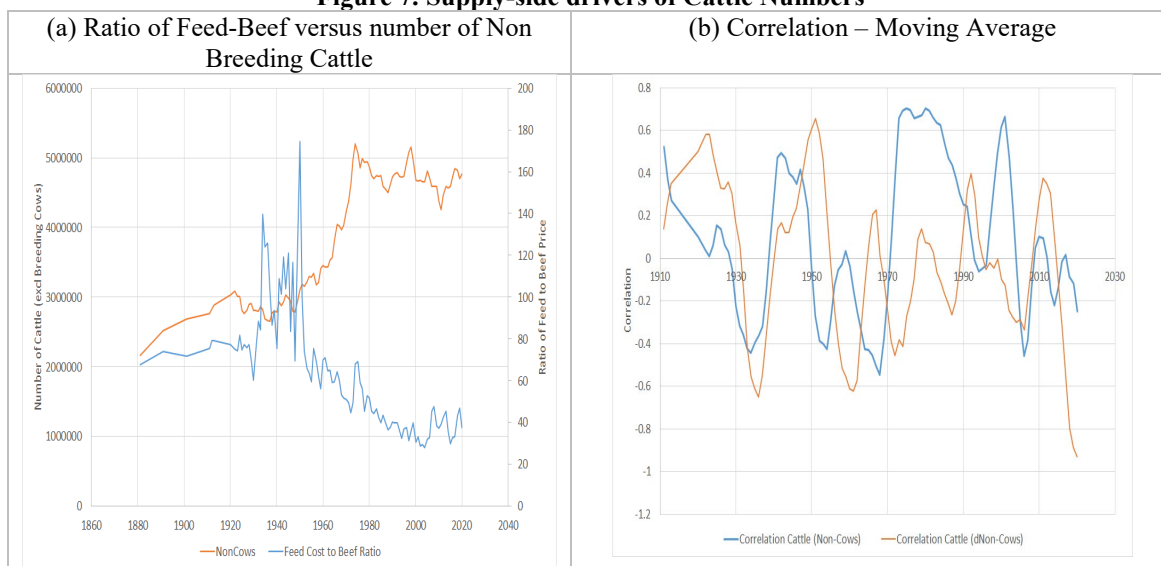
Source CSO Census of Agriculture, CSO Livestock Surveys and Buttimer (1972)

However, despite the number of beef cows staying relatively flat, total cattle began a downward trend again to a near low point of 6.49m in 2011. The CAP Health Check in 2008, with a gradual increase in quota until its abolition in 2015, saw a gradual growth of dairy cows to 2015 and a rapid rise afterwards, so that the number of dairy cows in 2020 were near the peak in 1979, or 28% above pre quota levels. On the other hand, beef cows decreased at a lower rate of 13% over this period.

Prior to the price and income supports of the 1960's to the 2000's, Johnston (1951) developed a relatively simple model relating the ratio of feed to animal price to the number of animals used for meat (cattle, pigs, poultry). Staehle (1951) however notes that volume of supply may also impact, for example a poor potato harvest may reduce the supply of pigs. Drawing upon the work of Johnston (1937, 1951) we investigate the supply side drivers of cattle numbers (Figure 7).<sup>8</sup> Johnston, emphasising the need for winter feed ration utilised a ratio of the quoted price of oats, the dominant farm based animal feed in the early part of the century with the price of beef, multiplied by 7 as an animal would require 7 times the deadweight in oats. We extend Johnston's analysis up until 2020. A high ratio, means that feed is expensive relative to the price of beef. After the relative stable price ratio prior to the economic war (bar the decline in 1930), the ratio rose rapidly during the economic war, combining with export tariffs to put downward pressure on non breeding cattle. The ratio falling back when the Anglo-Irish Treaty was signed in 1938, before rising again with the onset of the Second World War and remaining high until British food price controls were lifted in 1952.

<sup>8</sup> We say relatively little about the internal workings of the cattle sector in terms of prices. While Crotty (1966) and O'Connor & Keogh (1975) attempted to analyse calf, store cattle, the complexity of the cattle trade is left for another time.

**Figure 7. Supply-side drivers of Cattle Numbers**



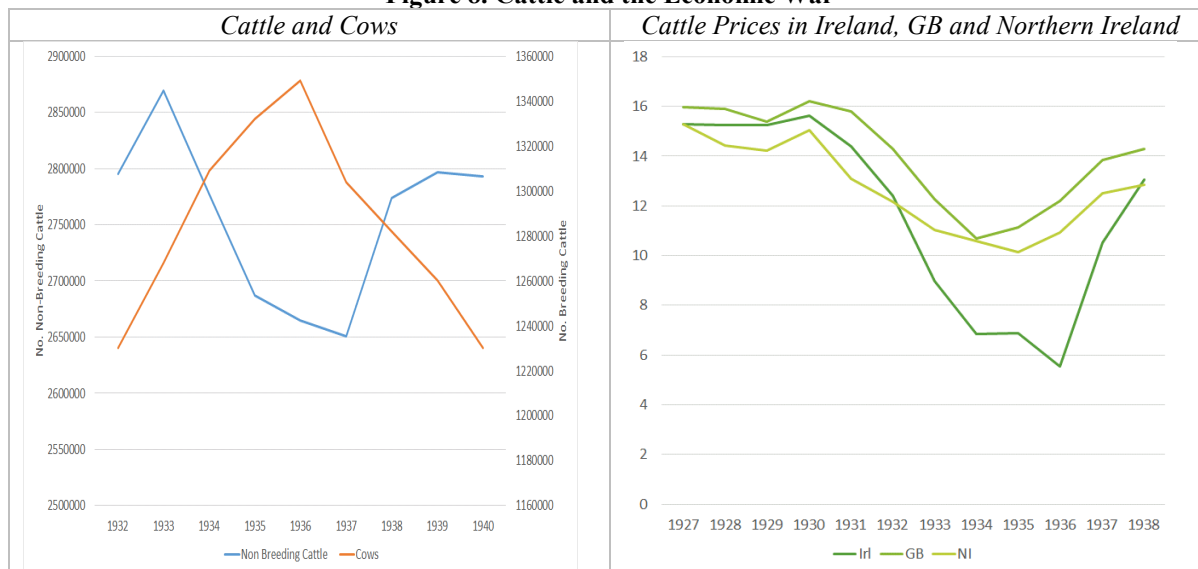
Source: CSO Statistical Abstract; Census of Agriculture

Figure 8 highlights in finer resolution the trend and price of cattle during the economic war, reporting data provided in an economic analysis by Neary and Ó Gráda (1991). The number of non-breeding cattle fell by over 200000, with farmers partially substituting them for breeding animals during this period, with a net fall of 182000 animals. Incomes were particularly impacted as in addition to the fall in the volume of animal sales, store cattle prices fell to about half that of the Great Britain and Northern Ireland prices, reflecting the duties imposed by Britain (Neary and Ó'Gráda, 1991). Over this period, the number of non-breeding cattle, rose again with the Anglo-Irish Treaty. In parallel to this decline, Johnston however noted that similar countries such as New Zealand and Northern Ireland saw very significant increases in respectively cows and pigs/poultry in the periods before the Second World War. The relatively high price of oats was sustained during this period due to import restrictions on substitutes for oats such as maize, seeing falls in imports of two thirds and an increase in tillage area by about 15% versus pasture.

The substitution from cattle to tillage during the economic war facilitated improved self-sufficiency of cereals during the war, necessary because of the unavailability of imported cereals. Indeed, FAO statistics in 1952 reveal that Irish post war nutrition levels in terms of calories and protein were higher than most European countries and had hardly declined over the war period, in contrast to Germany where calorie intake reduced by 13% on average and animal protein by 21%.

Johnston (1951) highlighted that state export subsidies or bounties in the 1930's fully counter balanced the impact of UK tariff increases for dairy products, but not for cattle exports. Thus the increase in breeding cows facilitated the resulting increase in milk exports. The increase in tillage was also impacted by the increasing demand for feed by these extra cows (Crotty, 1966).

**Figure 8. Cattle and the Economic War**



Source: CSO Census of Agriculture and Neary and Ó Gráda (1991)

The relationship between the feed-beef ratio and cattle numbers did not follow the price trend during the Second World War. Cattle numbers were reasonably flat, despite a rise in relative cereal prices due greater domestic demand for human consumption during the war. Increased rearing of cattle off grass, identified in the higher cattle to cow ratio in figure 5 meant that cattle farmers were able to substitute in part grass for oats. However this was not possible for the poultry and particularly the pig sectors, with numbers of both declining heavily during the war (Johnston, 1951). Crotty (1966) highlighted that the relatively primitive and unproductive cattle sector was “particularly suited to withstand the effects of adverse conditions at home and of upheavals abroad”.

The immediate aftermath of the war saw a significant reduction in cattle numbers. Controlled prices and quotas remained for the primary export market in the UK (Foster, 1971), while relatively high tillage prices put pressure on total cattle numbers. When cattle prices recovered in 1947, cereal prices grew more rapidly. It wasn't until 1948 that cereal prices returned to a lower level, with cattle prices rising again.

For fifty years after the Second World War, beef prices grew relative to feed prices, with a sustained growth in cattle numbers until 1975. O'Connor (1971) describes the trend. The correlation between non-breeding cattle numbers and the feed price ratio remained negative during this period as cattle numbers grew as the ratio fell. The correlation changes slightly when non-breeding cattle numbers fell during the economic downturn in 1958 and 1959, despite lower feed prices. This was driven, as we see below by a demand side decline in exports of live cattle to Britain of 40% during these years, with beef price falls in Ireland coinciding with expenditure reductions in Britain, the main consumer of Irish beef (O'Connor and Keogh, 1975).

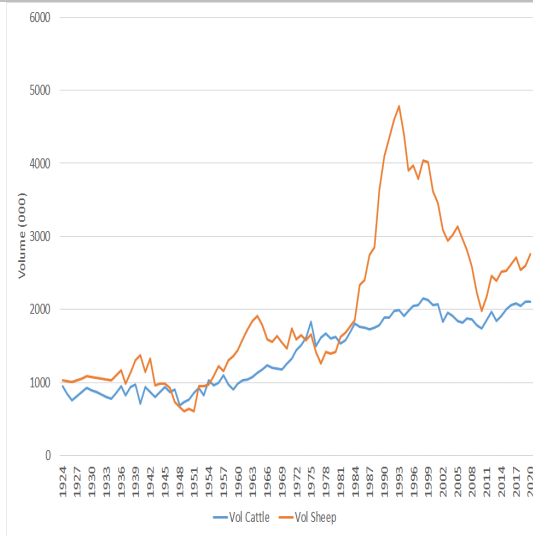
The 1960's saw the introduction of the Calved Heifer Subsidy Scheme and a return to the supply-side growth with higher cattle prices relative to feed prices. Joining the EEC saw an immediate price rise as a result of the intervention system, with real cattle prices increasing by 37% between 1970 and EEC entry in 1973, a nominal price increase of 80% over this period. However, beginning at the end of 1973, a cattle incomes crisis arose. The oil crisis in 1973 put pressure on household incomes in Britain and Ireland. While intervention pricing for fattened cattle and for dairy producers limited losses for these sectors, prices for calves fell £42 per head in October 1973 to £7 per head in October 1974. Cattle weight 200-250 kg fell from £70-80 to £20-30 in that period.

O'Connor and Keogh (1975) attributed the crisis to a number of factors. Price reductions resulted both from the policy induced increase in demand over this period, which exceeded market demands, resulting in supply outpacing demand. EEC production increased by 14% alone between 1973 and 1974. In addition, a sharp correction in prices that resulted from a deteriorating macro-economic climate in terms of price growth and balance of payments issues reduced demand for beef. Between 1957 and 1973, British self-sufficiency in beef grew from 52% to 81.6% and further to 92.4% at the end of 1974 as a result of incentives to increase British beef production and declining consumption (ibid.). In the domestic market at farm level, fodder shortages put pressure on farmers to sell their cattle before the winter. Also due to capacity constraints in processors, abattoirs were unable to handle the extra supply that was available.

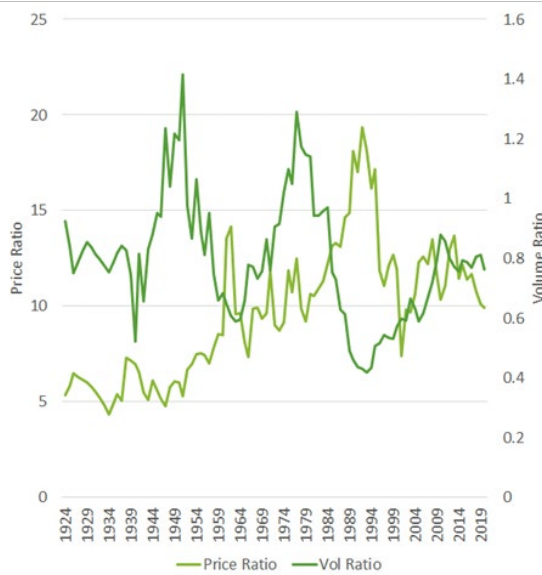
Despite a recovery in beef prices and a reasonably good feed price ratio, non-breeding cattle continued to decline almost on an annual basis until 1988, driven by a reduction in beef breeding cows that accompanied an increase in dairy cows. The correlation between numbers and the feed ratio went positive for much of this period.

The turn-around in non-breeding animals followed a rise in the number of breeding cows, resulting from land made available from the introduction of milk quota restrictions, an improved feed ratio, and increases in the suckler cow premium (which nearly doubled between 1985 and 1988). There was a nearly doubling the less favoured area headage payments in 1987 also improved the returns to holding beef cattle, increasing non-breeding cattle by nearly 300000 in this period. Moving from price supports to income supports in the MacSharry Reforms in 1993 saw a further expansion in non-breeding cattle, peaking at 5.2 million in 1998, with total cattle reaching the highest point ever seen to this day.

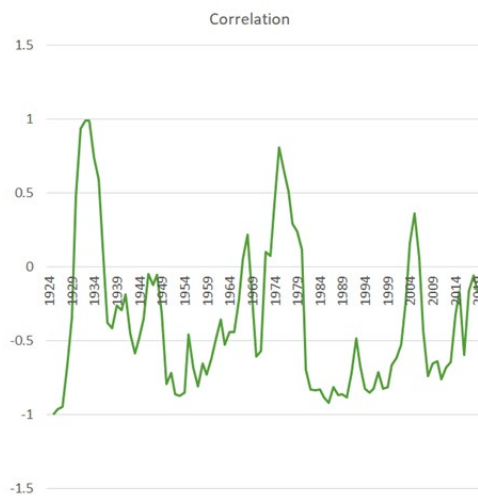
**Figure 9. Substitution between Cattle and Sheep**  
**Numbers of Cattle and Sheep**



**Ratio of Numbers (Cattle and Sheep) vs Ratio of Price**



**Correlations between Ratios**



The Agenda 2000 reforms saw the value of Direct Payments fall due to payment timing issues (Burke and Roche, 2000), combined with a fall in beef prices saw numbers of non-breeding cattle fall from the peak. The correlation between the feed ratio and total non-breeding cattle was positive, however the correlation with the change in non-breeding cattle was negative, reflecting the improving returns slowing the reduction in cattle. After that initial steep decline, the numbers of non-breeding cattle declined at a moderate for much of the decade. The Foot and Mouth Disease crisis of 2001 had over a limited overall impact on numbers (O'Toole et al., 2002). There was a particular fall after the reduction in breeding cattle that occurred when direct payments were decoupled from production in 2005 and again with a very steep decline following the economic crisis in 2009-2010. Following the increase in dairy cow numbers after the CAP Health Check in 2008, the trend in non-breeding cattle has decoupled from the numbers of beef cows, with an increasing share of beef cattle now coming from the dairy herd. This removal of the constraint on milk production saw the correlation between non-breeding cattle and the feed ratio return negative.

### *Sheep production*

Sheep production is on the face of it a potential substitution for beef. Both are pastoral based meat producing sectors. The price of sheep meat is typically higher on a per volume basis than beef. Labour requirements for sheep are however higher given that there are more animals per unit of output.

Figure 9 describes the potential substitution between beef and sheep over time. Part (a) reports the trend in sheep and cattle output volumes, while part (b) chronicles the trend in the ratio of the cattle to the sheep price index and the ratio of volumes. Part (c) reports the moving average correlation between the two ratios. While exhibiting a similar long run trend, the trend in sheep volumes is more volatile than for cattle. Particular points of divergence are in the 1940's, late 1950's/1960's, 1980/90's, 2010's, where there was spikes in sheep volume output relative to beef. The first differential growth period corresponded to the start of the Second World War, with large increases in Western counties, largely in upland areas. Also there was a reduction in cattle numbers during the Second World War and due to an outbreak of foot in mouth in 1941 (Meenan, 1971). The relative growth in the late 1950's and early 1960's was disproportionately in lowland areas. It is hard to draw market conclusions about the former period as the War had significant and hard to predict impacts. For the latter period, as sheep volumes grew on land that is easily substitutable for cattle and where sheep prices grew less than cattle prices, it is likely that demand side issues relating to trade restrictions was the biggest driver. After the Anglo-Irish Free Trade Agreement in 1965, cattle volumes and exports rose more quickly until EEC membership, despite greater price growth for sheep, questioning the direct substitutability.

From 1977 to 1993, sheep volumes trebled, while cattle volumes increased by 10%, despite cattle prices doubling, a higher price growth than for sheep. Walsh (1989) attributes the growth initially to the opening of French markets after a bilateral trade agreement in 1977 and most importantly as a result of the development of a both a sheepmeat Common Marketing Organisation within the EEC in 1980 and the introduction of a Ewe Premium also in 1980. By 1986, the Ewe Premium and the Headage payments in Less Favoured Areas accounted for 80% of the gross margin (ibid.).

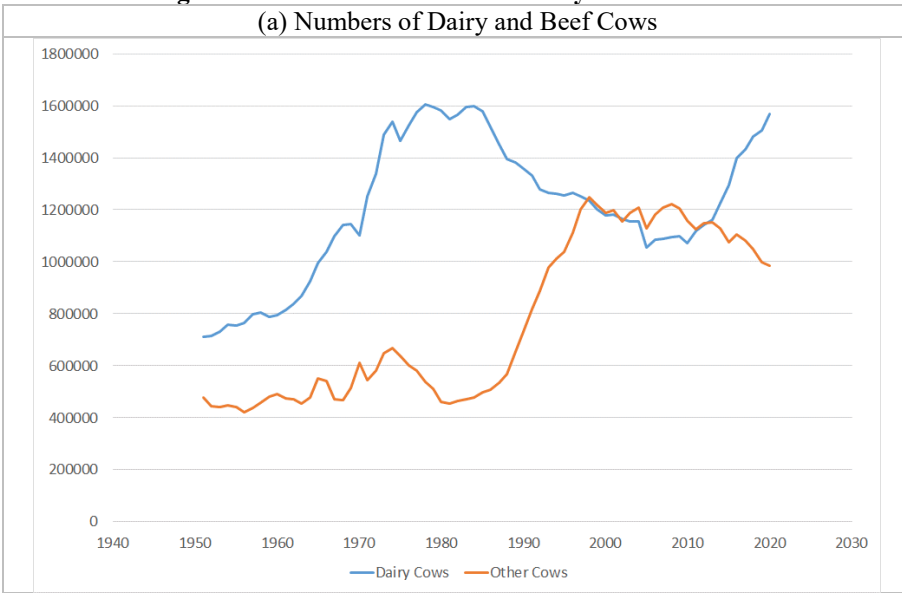
Milk quota restrictions also freed up land for sheep expansion, particularly as they are a natural complement for dairy cows in relation to pasture management. While growth occurred across the country, by the end of the period there were more than a million sheep in County Galway and over half a million in Counties Donegal, Mayo, Kerry, Cork, Wicklow and Wexford.

Sheep numbers fell rapidly after this peak as costs ate into margins. Sheep prices had already fallen by nearly 50% between 1988 and 1993 when the numbers turned. The policy based supports at this point were not sufficient to insulate against the costs increases, with sheep volumes falling relative to cattle volumes until 2011. There was some recovery after this period.

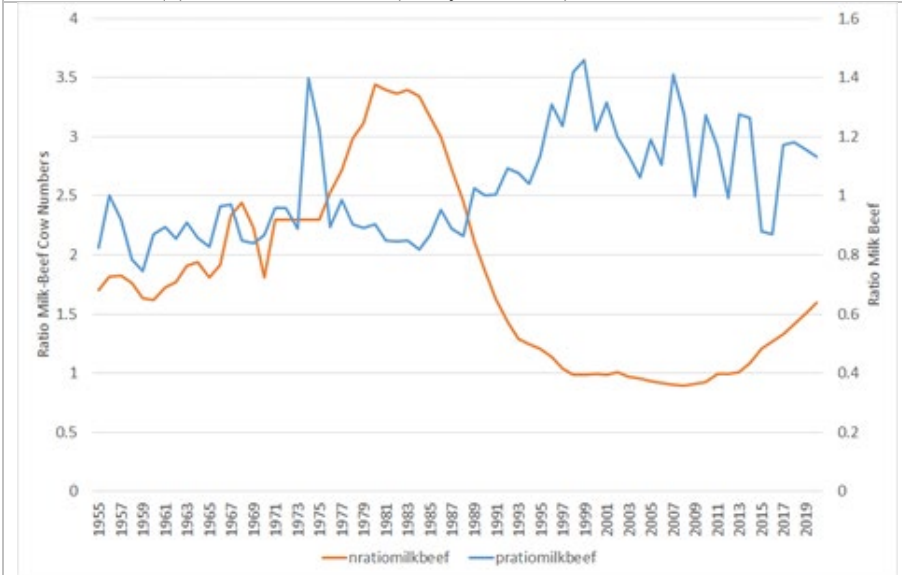
In summary, although ostensibly a substitute relative sheep and cattle volumes for nearly the entire century have run counter to the economic drivers, relating to a large extent to various policy incentives.

**Figure 10. Substitution between Dairy and Beef Cows**

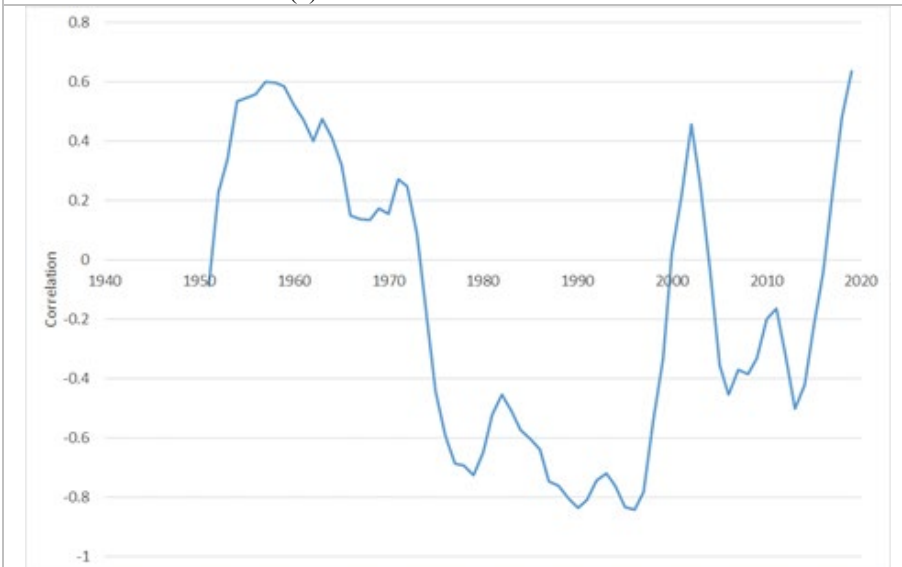
(a) Numbers of Dairy and Beef Cows



(b) Ratio of Numbers (Dairy and Beef) vs Ratio of Price



(c) Correlations between Ratios





### *Dairy versus Beef Cows*

Dairy farming is the next biggest use of pastoral land after cattle farming. Although there does not exist a series where dairy and beef cows are separated over the whole century, Buttimer (1970, 1972) uses data reported by the Department of Agriculture in relation to the “Number of Cows kept by creamery suppliers” as a proxy for the dairy herd. However this may under-estimate the number of cows, given the different structure of the sector that applied prior to joining the EEC.

Figure 10.a details the trend in dairy and other cows or cows that primarily produce progeny for the beef herd. Dairy cows also of course produce progeny for the beef herd as very few males calves become dairy breeding bulls and not all of the female calves are used as replacements for breeding animals. The number of dairy cows grew more rapidly between 1951 and the Anglo-Irish Free Trade Agreement in 1965. Milk and dairy exports to Britain had been more restricted during the earlier period and as new markets were found for dairy exports the total number of dairy cows grew. The Bovine Tuberculosis Eradication Scheme, which saw nearly half a million cattle slaughtered between 1958 and 1963, mainly in dairy areas (Buttimer, 1972) had a limited impact on the trend.

Both dairy and beef cows grew at a similar rate of 10% from this point to eve of EEC entry in 1970, whereupon, dairy cow numbers grew by 35% in the 3 years before entry. Until the farm income crisis from 1979, dairy cows had grown in number by 46% from 1970, while beef cows declined by 12%. Other cows, by comparison only grew by 5% during this period. Thus the glut in non-breeding cattle during the cattle crisis came from progeny from growth in the dairy herd. Even if the cattle crisis arose from the growth in calves during expansion of the dairy sector, the impact was to see the significant contraction in the specialist cattle sector, with the number of other cows declining by over 25% by the time dairy quota restrictions were introduced in 1984. Dairy cows grew by just over 7%, with most of this occurring by 1978.

Limiting milk production to 1984 levels, combined with increasing milk yields as the breeding quality of dairy herd grew resulted in a steady decline in the dairy herd. In 1984, there were 3 times as many dairy cows as beef cows; far from the rule of thumb of similar numbers of dairy and beef cows that had existed in the early 2000s. However the dairy cow numbers fell from a peak of 1.6m in 1984 to a low point of 1.05m in 2005 to a parity with beef cows.

The loosening of milk quota restrictions after the CAP Health check and the complete abolition in 2015, saw dairy cow numbers take off, with an increase of 46% between 2010 and 2021. This coincidentally is the same figure as the growth during the last major growth phase between 1970 and 1979, with dairy cows in 2021 slightly below the numbers in 1979. Beef cows on the other hand reduced by 19% between 2010 and 2021 (by 23% since the local peak in 2008) after the introduction of the Suckler Welfare Scheme. Although the decline in beef cows is proportionally lower than in the previous dairy growth phase (12%), after 3 decades of policy incentives, there are 428000 more beef cows in 2021 than there were in 1979. There are also 125000 more non-breeding cattle.

Figure 5.b and 5.c describe relative market drivers, comparing the ratio of prices for milk to beef with the ratio of the numbers of dairy to beef cows. Until the early 1970's the numbers ratio moved with price ratio as increases in the relative price of milk led to higher number of dairy cows. This changed radically with EEC entry, with dairy cows rapidly expanding relative to beef cows, despite the price ratio worsening. It highlights the constraining effects of trade restrictions with the UK prior to entry, with dairy produce moving into a free-trade environment within the EEC and in particular with the UK.<sup>9</sup> The correlation between numbers and prices remained negative throughout the 1980's and 1990's as another policy related feature dominated, milk quota. After a brief foray into a positive correlation in the early 2000's the correlation remained negative until milk quota was abolished in 2015, where again the relative price of the outputs between the two types of cow returned to being primarily market driven.<sup>10</sup>

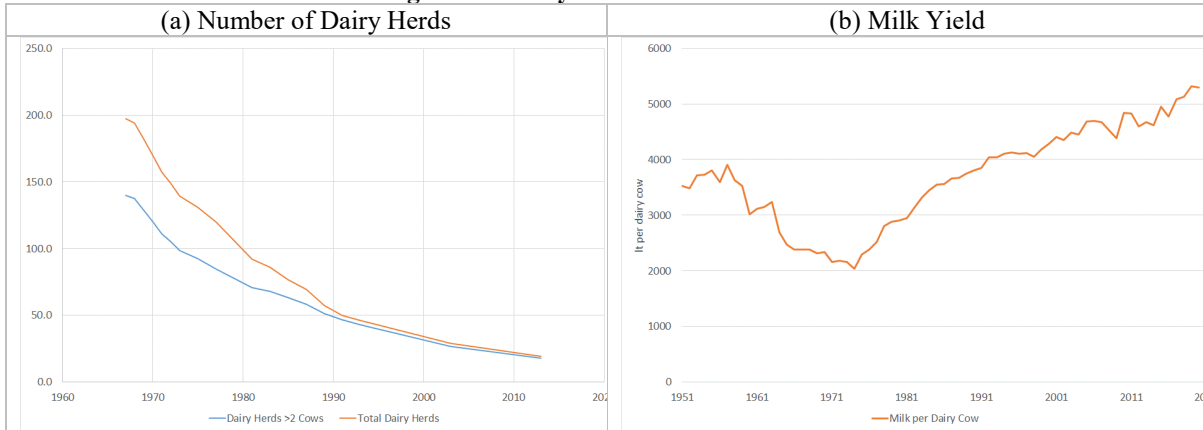
The large growth in dairy cows has been accompanied by a major restriction of the dairy herd, with reduction in the number of dairy herds. In 1967 there were 120000 (Keane, 1976) creamery milk supplying dairy herds in 1967, plus at least 45000 micro dairy herds of 1-2 cows (Keane, 1991), falling to just 18000 in 2013 (Figure 11.a). By 1991 there were negligible numbers of micro-dairy herds (Keane, 1991). It highlights the move from very many small scale milk production, often for own-consumption in subsistence farms, to an industrial scale enterprise.

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<sup>9</sup> While the relative price of dairy and beef cows takes the wrong sign, Cuddy (1982) finds that the price elasticity of the primary output of the dairy cows, milk, is responsive to price changes and that the price elasticity increased after EEC entry as there were more opportunities for sales.

<sup>10</sup> Although dairy-beef as a by-product of the dairy sector, it is mitigated by the live export trade into continental veal markets. Live exports have increased significantly after milk quota abolition and so the Irish beef market is not as strong an influence as it might be without this release valve.

**Figure 11. Dairy herds and Milk Yields**



Source: Keane, 1976, 1991; CSO Statistical Abstract

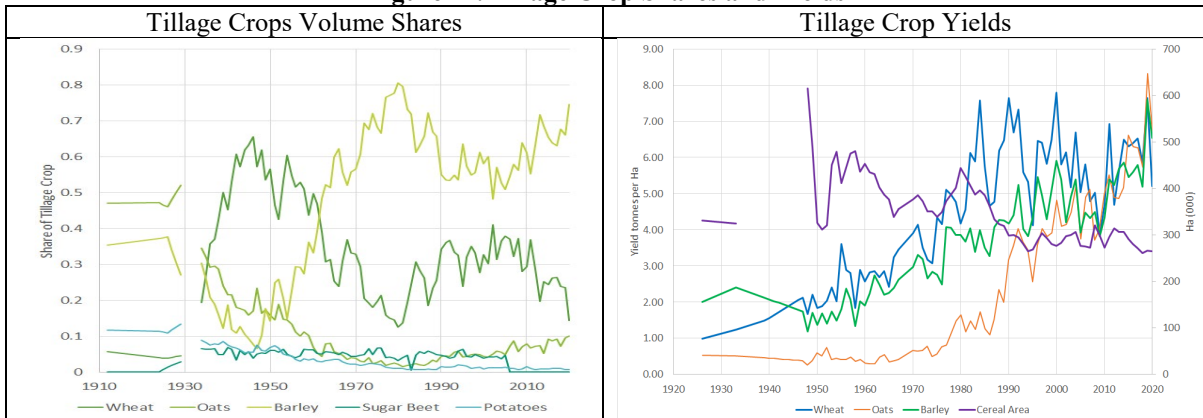
Figure 11.b outlines the trend in the milk yield. It is produced by combining the volume of milk from the annual CSO statistical abstract with the number of dairy cows from our series. Given the imputations used for the period pre EEC entry, there may be some doubt as to the consistency. Milk yields seem to have decreased in the 1960's. While this may be attributable to low yielding beef cows being converted to dairy and lower concentrate feeding due to the relatively higher feed price, the scale of decline seems implausible. Regardless we see a difference in the trend after EEC, with steady yield growth as dairy farms become more specialised, increased scale and as concentrate inputs increased with relatively lower feed costs. The greater specialisation, combined with availability new technologies such as artificial insemination, enabled radically improved genetics. As a result, the average yield growth since 1970 averaged 1.7 per cent per annum; as cows increased by 42%, milk increased by 222%, an increase per cow by 126% over the period. The opening up of markets initially and at the end of the period and the ongoing improved technology over the period enabled a huge shift in the nature of the dairy herd.

*Tillage Shares*

Although there was a shift from tillage to pasture over the century, bar the compulsory tillage period in the 1940's, there was quite significant change within the sector during the period (Figure 12.a). The policy of self-sufficiency in the 1920's and 1930's saw the development of a state owned sugar company and the growth of the beet as input into the manufacture of sugar, rather than merely as a fodder crop. The sugar beet sector lived and died by state intervention, supplying a policy incentivised crop to state companies, with later EEC production quotas until a European Union incentivisation to focus EU sugar production in productive countries closed the sector in 2006.

The other early story was the huge increase in wheat from the 1930's through to the end of the Second World War to improve self-sufficiency in wheat for domestic baking, as a result of a policy of protection (Crotty, 1966). It was supported by wheat bounties, and intervention mechanisms such as state quotas, purchase and storage Crotty questions whether these protection policies resulted in a net gain for the economy, arguing there was a potentially net welfare loss. However general equilibrium analysis along the lines of O'Rourke (1991)

**Figure 12. Tillage Crop Shares and Yields**

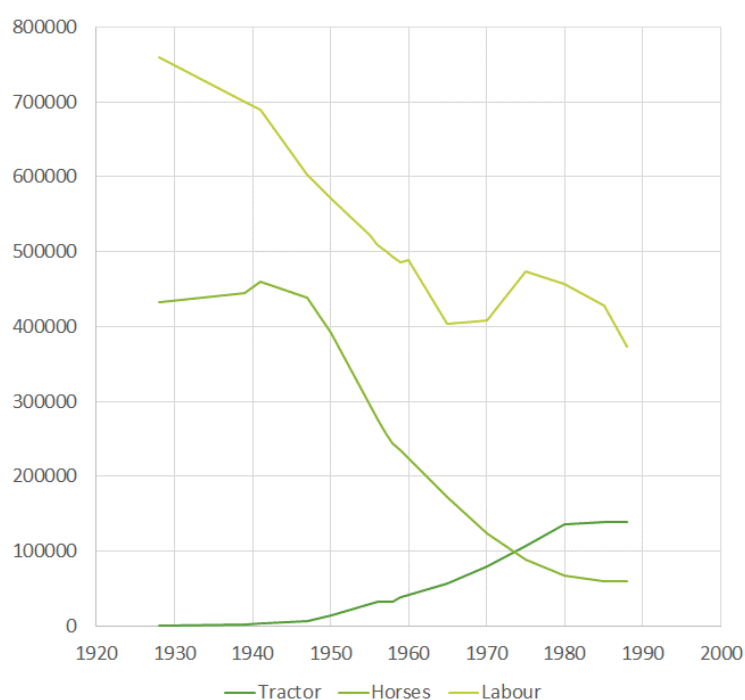


After the war, with the decline in tillage for pasture, the area planted by wheat fell back rapidly being replaced by more protein rich imported wheat. Oats, which had been historically the main animal feed source experienced a

large decline. It was driven in part by specialisation on farms between animals and tillage, greater use of purchased feed and the shift in the tillage land use to barley. Barley as a share of tillage volume increased from a low point of 7.5% in 1947, to 80% in 1980. The expansion of barley planting was driven in part by a strategy to support pig production in the 1960's, combining export subsidies for bacon and guaranteed prices for feeding barley (Attwood, 1968). The volume share of wheat production increased again after EEC membership and as moved in a counter trend with barley since then. The share of wheat has declined since the decoupling of CAP direct payments in 2005 and with the increased demand for animal feed since 2010.

The change in land use has also been accompanied by changes in yields (Figure 12.b). As in the case of milk yields, improved genetics, farm practices, uses of fertiliser and specialisation has seen a steady improved in crop yields since the 1950's. This is particularly evident in the wheat and barley crops grown by specialist tillage farmers, which increased earlier. We do not see the same trend in oats until the mid 1980's. With oats being grown extensively on animal focused farms and relatively poorer land yield growth potential was limited. Increased demand demand for oats in human consumption has seen more oat production on specialist tillage farms, resulting in a catch up in average yields. A particular point to note in tillage farming is the variation in yields. Yields are highly weather dependent in a country like Ireland, meaning a greater volatility in incomes than for other agricultural sectors.

**Figure 13. Mechanisation – Move form Plough to Tractor**



Source: Walsh (1992), CSO Statistical Abstract.

Note: W - Wheat; O – Oats; B – Barley.

**Table 2. Location of Cereal Area Changes**

	Prop. Change 1920-1970			Prop. Change 1945-1970			Share 1920			Share 1945			Share 1970		
	W	O	B	W	O	B	W	O	B	W	O	B	W	O	B
Leinster	9.29	-0.85	0.93	-0.48	-0.83	1.95	0.39	0.33	0.71	0.51	0.30	0.55	0.76	0.26	0.52
Munster	1.63	-0.83	3.20	-0.79	-0.82	2.36	0.44	0.29	0.24	0.38	0.29	0.36	0.22	0.26	0.39
Connacht	-0.67	-0.74	2.00	-0.95	-0.75	0.50	0.17	0.19	0.04	0.08	0.22	0.09	0.01	0.26	0.04
Ulster	0.00	-0.80		-0.83	-0.78		0.06	0.19	0.00	0.02	0.19	0.00	0.01	0.21	0.04
State	4.28	-0.81	1.61	-0.65	-0.80	2.10									

There were important spatial differences in the location of tillage in the country as the sector restructured over time (Table 2). The decline in oat production saw also a large shift in the location from a relatively even spread across the country to a concentration on better land in the South and East. On the other hand, while barley has increased, it is less concentrated than in the early part of the state. At this point when it was relatively unimportant,

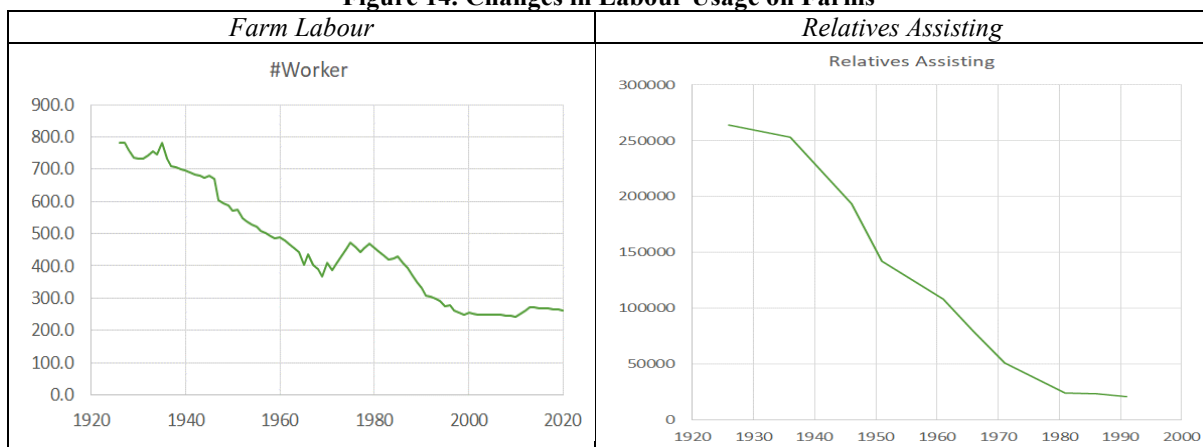
it was more concentrated in the better soils of Leinster and Munster. Over the period 1920-1970 most of the growth occurred in South and East. Wheat on the other hand has become even more concentrated. These trends highlight the growing specialisation of the tillage sector from horse drawn small scale tillage production across the country to mechanised tillage production on larger farms with well drained soils in the South and East.

One of the main enablers of specialisation and efficiency in the tillage sector has been the trend in mechanisation. Figure 13 charts the steady substitution of the use of horses and labour on farms with tractors over the middle part of the century. Walsh (1992) in a spatial analysis of this diffusion process identified a number of influences including areas with a high share of commercial tillage, the use of hired labour and the scale of the operator. Access to suppliers was important, particularly around the border and the availability of second-hand machines since mechanisation had commenced earlier there. The number of tractors used over this period is negatively correlated with labour at -0.93 and with horses at -0.76, indicating a very high substitution. On average each tractor substituted 2.7 people and 2.8 horses, during a time that output grew. The reduction in horses also released land that would have been required to feed them.

#### *Farm Structures and Labour*

The most visible trend in all the sectoral changes described in the paper thus far is the change in labour utilisation. As noted in Boyle (1987) the quantification of farm labour is challenging with different definitions. Strangely as it sounds in the present, many of the series recorded the only the number of males working in agriculture. In quantifying trends in farm labour, we do not go into the detail of Boyle, who separately identified farm labour by different ages, to account for labour productivity (associated with their minimum agricultural wage), we attempt to adjust this series to account for female labour (typically spouses), combining historical Census data that looked all those who declared farming as their occupation in the household with the traditional series in Figure 14. The farm structure survey also quantifies labour slightly differently.

**Figure 14. Changes in Labour Usage on Farms**



In the 1926 Census, 672100 people declared farming as their primary occupation. At the same time, there were 602600 male workers on farmers. There are many potential differences in how these numbers are arrived at. Some farmers with another occupation will be under-reported in the total. For example in 1930, there were 338000 farm holdings, but only 268900 declared farmers (in 1926). Some differences may result from a single farmer farming multiple holdings. It also ignores underemployment, the notion that the number of labourers does not equal the amount of labour. We make the very crude assumption that the differences represent spouses working on the farm. For the period from 1926 until the EU Farm Structures Survey was published in 1975, we amend the trend in farm workers to incorporate spouses.

Figure 14 highlights the decline in labour 435600 people over the century, a decline of two thirds, driven in part by mechanisation, by pull factors of higher wages off farmer and push factors of a lower standard of living on farms. This is particularly evident for the category Relatives Assisting, a particularly precarious part of the labour market. Including spouses, there were over a quarter of a million relatives assisting on farms in 1926. By the 1986 Census this group had declined by 90%. The other major change in agricultural labour was in hired labour, declining from 139100 in the 1926 Census to 15200 in the 1986 Census; a similar percentage decline.

**Table 3. Average growth rate in the decline in the number of farm holdings**

1860	0.000
1870	-0.011
1880	-0.016
1890	0.001
1900	0.003
1910	-0.050
1920/30's	-0.060
1940	-0.024
1950	-0.013
1960	-0.048
1970	-0.024
1980	-0.023
1990	-0.058
2000	-0.013
2010	0.012

In parallel to the decline in labour, there has also been an important restructuring of the size distribution, with the number of holdings declining from 338000 in 1930 to 135000 in 2020 (Figure 15.a). Averaging the decline by 10 year period, the pre-war period before independence had the largest decline in farm holdings with an average annual decline of 6% (Table 3). The pre-war strategic goal of increasing tillage to promote employment did little to stem the loss of labour from the land and the consolidation of small holdings into larger ones (Crotty, 1966). The 1960's and the 1990's had declines of about 5%.

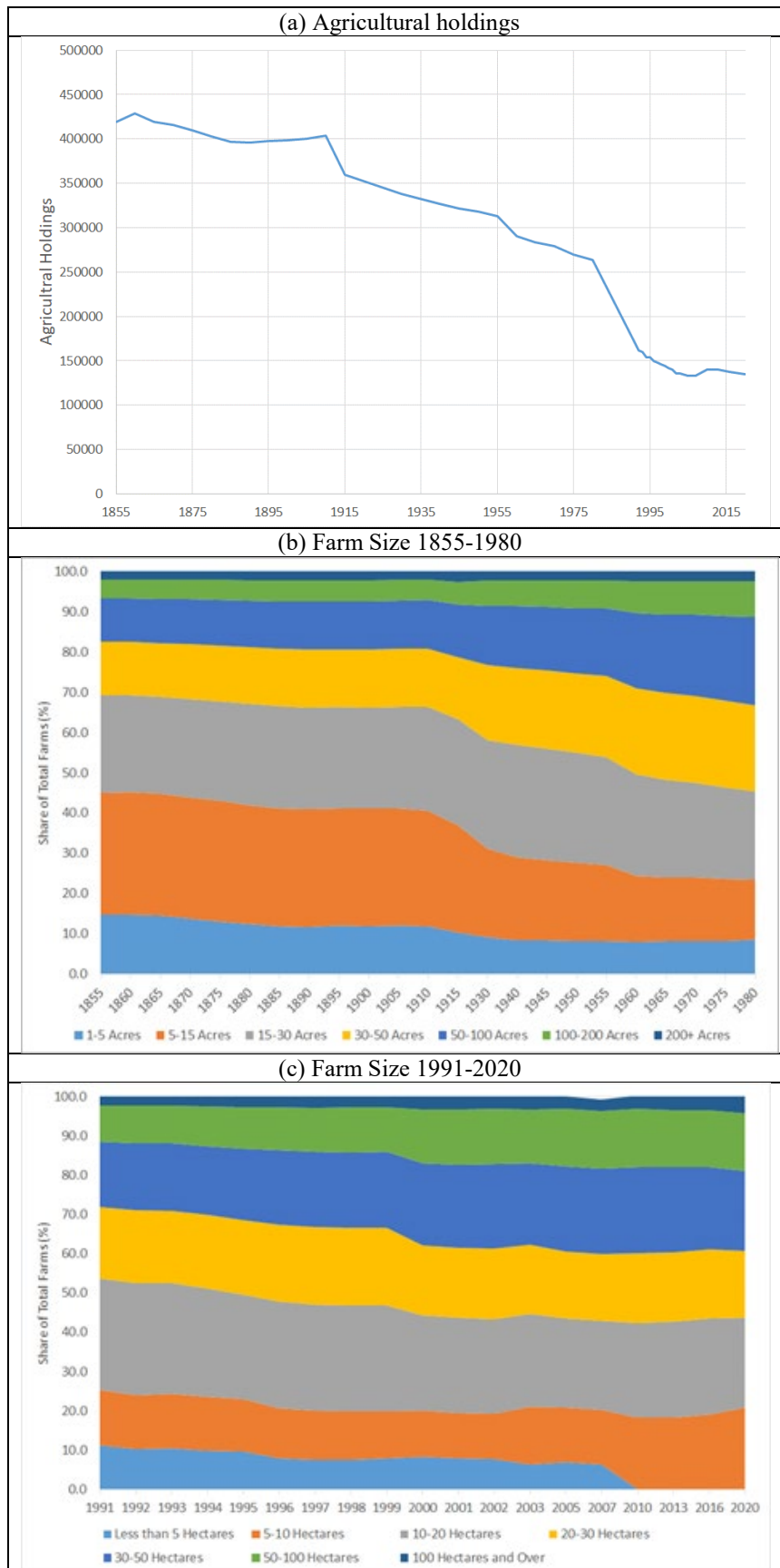
Reporting two separate CSO series classified by acres for the earlier period (1855-1980) and hectares for the later period, we note the disproportionate decline in small farms, where the push factor of lower standards of living dominate. Attwood (1962) highlighted significant periods of change in relation to farm size in the 1920's and late 1950's with a reduction in the number of small farms, particularly in the poorer land in Connaught, coinciding with periods of high emigration (Freeman, 1945). Elsewhere farms structural changes were more static, with a gradual increase in scale for tillage and cattle finishing farms.

Hannon and Commins (1992) linking farm size restructuring with labour in examining changes 1971-1986, found that the labour loss was mainly concentrated in smaller farms, with farmers of less than 50 acres declined by 50%, but with only land holders only decreasing by 8%. The decline was driven by a loss of relatives assisting, farm labourers and more farmers working off-farm. Off farm employment became more important from the 1980's but is visible throughout the century given the large difference in people whose primary occupation is a farming land holder and the number of land holdings.

#### *Comparative Analysis*

After independence Denmark and the UK were common comparators of Irish agriculture, due the latter's proximity and the former's experience of Co-operatives and dairy production. However more recently the Netherlands (Läpple & Sirr, 2019) and particularly New Zealand has been a regular point of comparison, particularly in relation to dairy production. The National Economic and Social Council (NESC) conducted an extensive comparison of Agriculture in Ireland and the Netherlands in the 1970's (Murphy 1977), while in the 2000's nearly every National Dairy Conference would have a reference to the situation in New Zealand, given the latter's liberalisation in the 1980's and its grass based system.

**Figure 15. Trend in Farm Size**



**Table 4. Comparative Analysis: Annualised Growth in Agricultural Output Volume in Ireland, New Zealand and the Netherlands**

	Ireland	Netherlands	New Zealand
1953-1961	1.7	4.5	
1961-1973	1.0	3.0	2.3
1973-1984	3.7	3.3	1.5
1984-2005	0.1	-0.2	1.4
2005-2014	1.0	1.4	1.9
2014-2019	3.3	0.6	0.4
1953-2019	1.4	1.8	
1961-2019	1.4	1.4	1.6

Source: FAOStat; Murphy (1977)

The NESO report undertook a very detailed comparison with the Netherlands, which is beyond the scope of this paper. Table 4 therefore undertakes a simpler aggregate comparison, describing the average annualised growth for a number of periods, utilising comparable FAO data. Between 1953 and 2019 in the case of Ireland and the Netherlands with data supplemented from Murphy (1977) and 1961 for New Zealand.

Comparing across the three countries in the period 1961 to 2019, there is a surprisingly similar annualised volume growth rate, with the Netherlands and Ireland having the same annualised growth rate at 1.4% and New Zealand having a slightly higher annualised growth rate of 1.6%. However, an annualised growth rate ignores the quite different starting position (Feng, 1998). Extending the analysis back to 1953, we see that prior to this period, the Netherlands had exhibited very high growth an annualised 4.5% in the period 1953-1961, period of extraordinary growth.

Growth however occurred at different rates at different periods. Most of the Dutch growth occurred before 1984, with the country reaching environmental limits. In general, the 1973-1984 period was a period of high growth for each of the countries. Prior to joining the EEC, Ireland had lagged the other two countries, operating in a more restrictive trade environment.

Although growing at a slower rate than in the period prior to 1984, New Zealand had the highest volume growth rate in the period 1984-2005, with EEC dairy producing countries constrained to 1984 levels and with New Zealand liberalising its Agricultural sector (Johnson et al., 1989). It further extended its relative growth during the 2005-2014 period.

The post decoupling era saw faster growth in Ireland and the Netherlands, with the latter expanding more rapidly. Lastly, Ireland has experienced the highest relative growth of the three countries since 2015 as a result of the increase in milk volumes, with the other two countries relatively stagnating. Much of Ireland's relative growth over the 65 years results from this period.

#### *Value Chains and External trade*

Ireland for centuries has been a net exporter of food (Crotty, 1966). However, this situation has not always been the same. Drawing upon various input-output tables from research papers from McGilvray (1964), Geary (1962, 1963), Henry (1973, 1980, 1988, 1993), and Curtis and Fitz Gerald (1993) and from CSO Input-Output tables since the 1990's, together with data from CSO Statistical Abstracts for the period pre 1956, we assemble in Figure 16.a the share of total agri-food used in final use that is exported.

The current narrative of Ireland as primarily a producer of food for export can be challenged. At the height of the policy favouring agricultural export trade in the 1920's exports peaked at 50% (Meenan, 1971). This ratio declined during the Economic War and during the Second World War to one third by the by the 1950s. However, with disruptions after independence, export restrictions, the economic war and then the Second World War, the share of exports steadily decline to a low point of less than 20% in the 1940's. Exports as a share of total output returned to pre-war levels by 1954 and remained reasonably flat until the Anglo-Irish Free Trade Agreement (AIFTA). The AIFTA saw an increase in this share, with the share growing rapidly until 1985 after EEC entry and after a slight dip in 1990 and 1993, continued the rise to 94% in the 2015 CSO Input-Output Table. A key part of this export strategy has been a shift away from a reliance on Britain as a destination for exports. Prior to the economic war, in 1930, over 85% of exports went to Britain. This gradually reduced in a non-linear way to 72% on entry to the EEC, with the British export share falling below 50% in 1980 and remaining below for the next 40 years. After a period below 40% in the early 1990's, the share returned to 40-50%, declining again to 38% in 2020 as a result of a post BREXIT export diversification strategy, particularly in dairy.

**Figure 16. Trend in Agri-Food Exports**



Source: CSO Trade Statistics



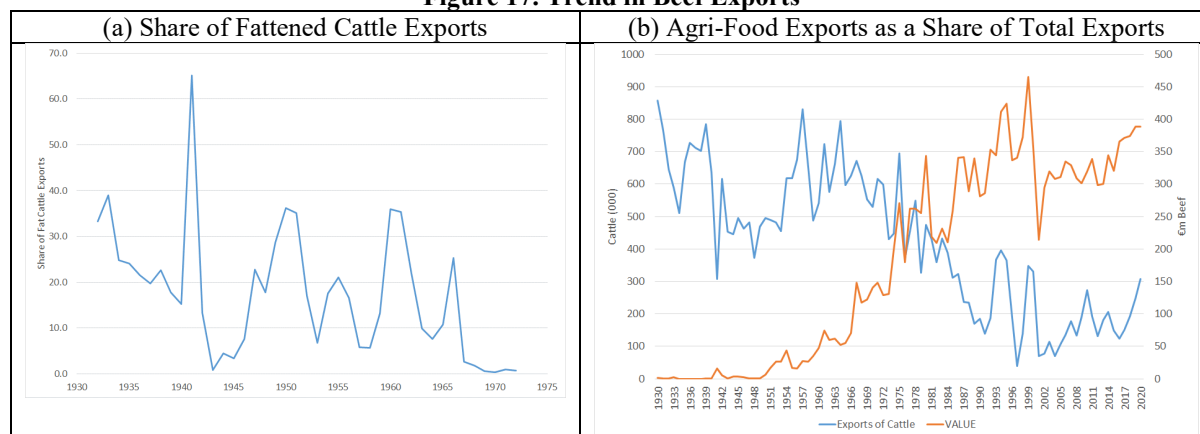
While the share of agri-food final use increased, the share of total exports by the sector declined (Figure 16.c). Successive industrial strategies from the gain of manufacturing under a tariff barrier during the economic war in the 1930's (Neary and Ó'Gráda, 1991), through the external focused industrial strategy from Whitaker's Economic Development in 1958 and the more recent development strategies after EEC entry, saw a continuous reduction in the export share of the Agri-Food sector relative to total exports. The comparative advantage of exports shifted in the 1970's from low-skill, labour intensive, resource-intensive industries like the agri-good sector exports to high-skill, capital intensive sectors, driven by foreign direct investment and outward looking trade policy (Thornhill, 1983).

The overall export figures mask differences between sectors. Cattle can be exported as store cattle at ages 1-3 to be fattened before finishing, as already fattened cattle or as processed meat. (Baker et al., 1973) The dominant trend in the beef sector has been a reduction in the reliance on live exports, with a move up the value chain from primarily live exports to processed meat. The live export trade, with a particular focus on younger store cattle, had been the dominant export model for the beef sector. For much of the century British import restrictions favoured younger store cattle, rather than finished cattle, let alone the importation of processed meat.

In the Spring of 1965 prices for store cattle were exceptionally high and the meat factories found difficulty in purchasing cattle in competition with the live exporters. To enable the factories to compete with the live trade there was introduced in February 1965 a temporary scheme of payments to carcase beef exporters for good quality fat bullocks and heifers slaughtered by them and exported to the United Kingdom. It was intended that this scheme would cease on 30th June 1965 but it remained in operation throughout the year and continued in operation until the coming into effect of the Free Trade Area Agreement on 1st July, 1966 (O'Connor, 1970)

The Anglo-Irish Free Trade Agreement was far from free with quotas lifted for Store Cattle, but with restrictions on other segments. Indeed Ireland was limited to only 10% of its produce which could be exported outside Britain. Explorations in non-EU meat exports and the lifting of all EEC barriers on entry facilitated the expansion of the meat processing sector, with the live export trade diminishing to one mainly of surplus calves from the dairy herd. Walsh (1991) found that export refunds (Monetary Compensation Amounts) were particularly important drivers of exports, more important than intervention prices in relation to the amount of beef carcass.

**Figure 17. Trend in Beef Exports**



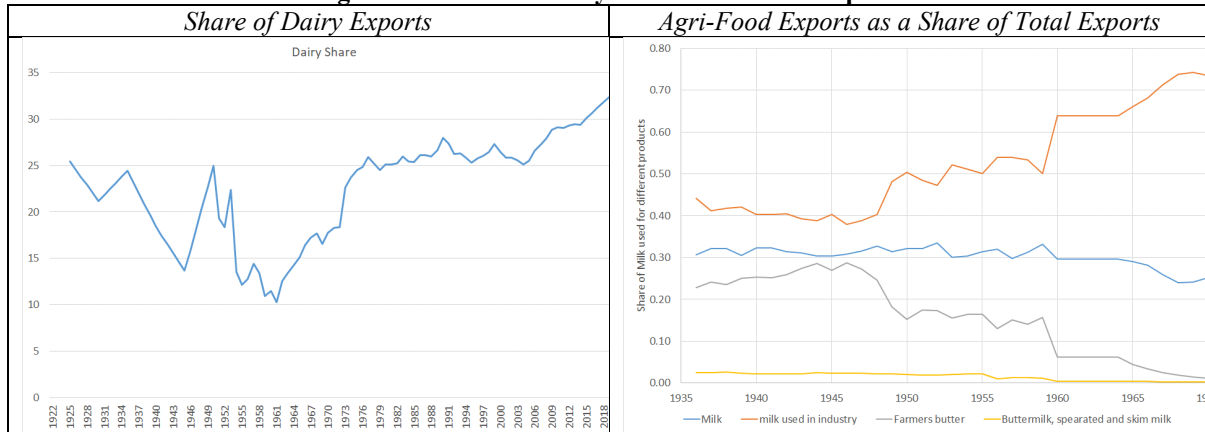
Source: Baker et al. Cattle and Beef Industry; CSO

The dairy sector had a relatively low export trade for much of the century, with British export restrictions limiting exports to, with regard to dairy products, the intervention system is very often blamed for the failure to a little over 10% in 1961. In 1966, Ireland exported 23000 tons of butter to the UK, virtually the same as in the 1930's, with cheese exports negligible (Foster, 1971). Figure 18.b highlights the diversification from farmer domestic production and move up the value chain in the 1950s and 1960s. Liquid milk production remained relatively static destined primarily for a domestic market. The gradual exit from a subsistence and farm produced butter sector to a more productivist creamery co-op led sector over these decades, saw a rapid fall in the share of milk being used to produce farmhouse butters into milk processed by creameries as butter, cheese and skimmed milk powders, with a higher export focus.

Efforts to reach non-UK markets through marketing initiatives like Kerrygold butter when the Irish Dairy Produce Board (An Board Bainne) was established in 1961 saw the export share rise to 17% on EEC, entry, with an almost

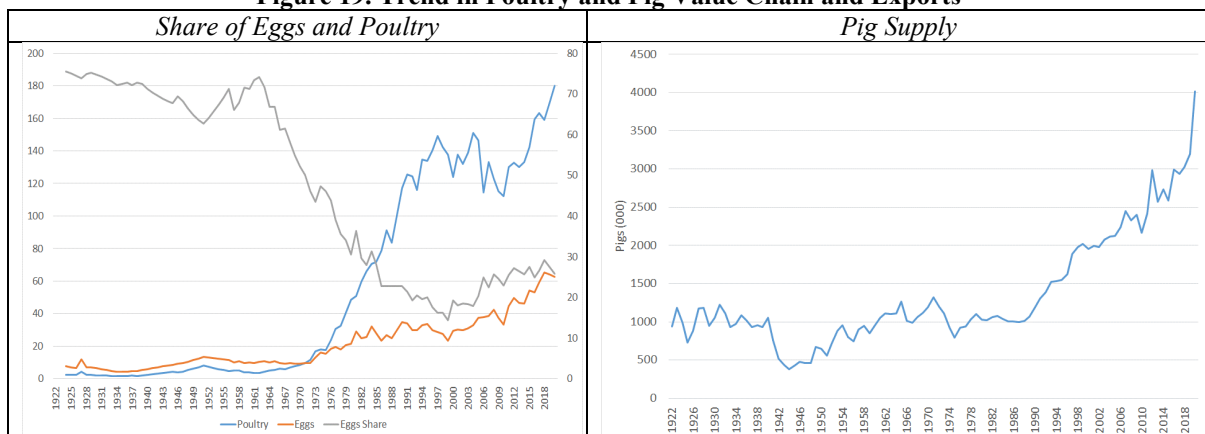
immediate increase back to the 25% share the sector had at independence by 1977. This share remained relatively constant as dairy cow numbers levels plateaued in the late 1970's and milk production plateaued after milk quota restrictions. During this time, O'Connor et al., (1983) queried the continued reliance on butter and skim milk powder which give the lowest return of all milk produce. However strategic moves by the sector to diversify into Infant Milk Formula and dairy ingredients has seen an increase in the share of higher value processing and exporting in the sector (Donnellan et al., 2015). The Dairy sectors share of outputs has risen further off the back of the increased milk production post milk quota abolition.

**Figure 18. Trend in Dairy Value Chain and Exports**



Although relatively minor sectors relative to the livestock sectors, both the poultry and the pig sectors have also seen a move from a domestic, subsistence sector. The largest output in the poultry sector for much of the century was in the form of eggs. These were often minor on-farm enterprises for farm wives sold in local markets, with some destined for export. In particular periods such as the 1920's, they were an important export sub-sector. The closure British markets for Egg exports post war did not help the development of this sector. However, EEC entry transformed this, with a move to industrialised chicken production targeting the production of poultry meat, with egg production declining to below 30% of total value. The pig sector, which was hit severely during the Second World War as it could not compete for grains relative to human consumption remained also a farm household based minor sector often producing for domestic consumption or selling to local butchers. EEC entry, too facilitate a rapid expansion in the number of pigs and a move towards industrial scale farming.

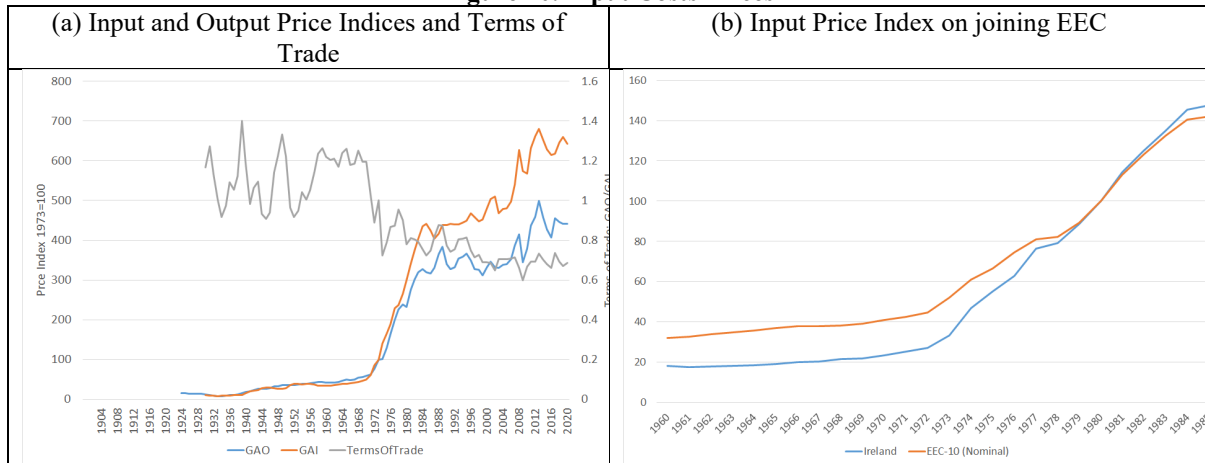
**Figure 19. Trend in Poultry and Pig Value Chain and Exports**



### Inputs

Incomes depend not only upon the outputs, but also upon inputs. As noted above there have been significant definitional changes over time, making it difficult to develop a consistent long term series. We do not pursue the same degree of harmonisation of O'Connor and co-authors Guimard and Henry in relation to the period around independence, nor of the work of Boyle in the 1960-1982 period. Our harmonisation has concentrated on streamlining the definitions used and minor simplifications. Although, it may have been possible to extend the definition of total farm inputs back to the 1920's, we limit ourselves here to utilising this comprehensive measure back to 1948 (input 2), relying on the simpler farm materials measure back to the 1920's (input 1).

**Figure 20. Input Costs Prices**



The growth in prices over the 1970's and early 1980's dominate the whole period, reflecting the price growth across all dimensions in this period (Figure 20.a). The terms of trade measures which is the ratio of the two price indices, makes it easier to understand (Sheehy and O'Connor, 1985). In the low price growth period to the early 1970's, the terms of trade bounced around a flat or slightly decreasing trend, however in the run up to joining the EEC, the terms of trade started to worsen with input prices growing at a faster rate than output prices. This period saw a catch-up in input prices relative to EEC peers. This trend reversed in the first year of joining the EEC, but worsened in 1974 during the cattle crisis, improved over the middle of the decade and worsened again during the second oil crisis in 1979. For the next two decades, this cost-price squeeze gradually eroded the terms of trade as input prices continued to grow faster than output prices (O'Donoghue and Hennessy, 2015). The low price growth environment in the new Millennium, particularly after the introduction of the Euro has seen the terms of trade remain relatively flat, except for the economic crisis in 2009, which recovered in following years. As of late 2021, global price inflation had not seen a reduction of the terms of trade for agriculture late in the COVID crisis, albeit there seems to be some signs of change.

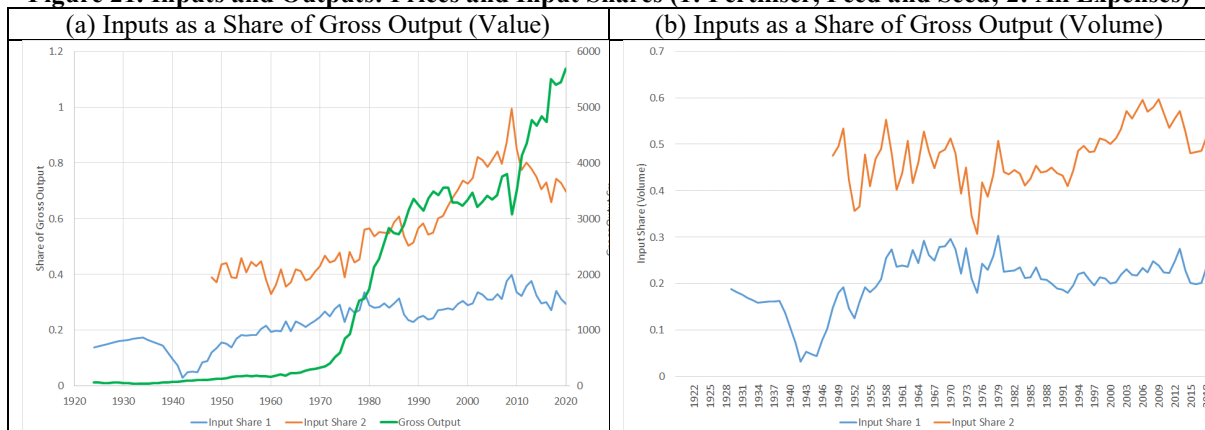
Figure 21 compares inputs with outputs in two dimensions:

- Input Shares as a Share of Gross Output in Value Terms
- Input Shares as a Share of Gross Output in Volume Terms

Figures 21.a and 21.c chart agricultural inputs as a share of gross output in respectively value and volume terms. Input share 1 refers to direct costs associated with feed, fertiliser and seed, the longest running series in the CSO statistical abstract, as a share of gross output. Input share 2, refers to an estimate of total input costs, described above, as a share of gross output.

In value terms, input share 1, rose gradually over the century to 1980. The main change to this trend occurred during the Second World War. While Gross Output remained reasonably constant during the War despite the upheavals resulting a realignment of agricultural activity for a greater tillage harvest the input share fell quite significantly with the inability to purchase fertilisers and machinery (Crotty, 1966). Input share 1 was relatively flat for much of the period 1980-2020. In volume terms, there was a gradual rise to the mid 1960's with increased use of fertiliser and purchased feed. The reduction in input volumes during the Second World War is very evident. The share was reasonably steady at around 20% after the volatility of the 1970's.

**Figure 21. Inputs and Outputs: Prices and Input Shares (1: Fertiliser, Feed and Seed; 2: All Expenses)**



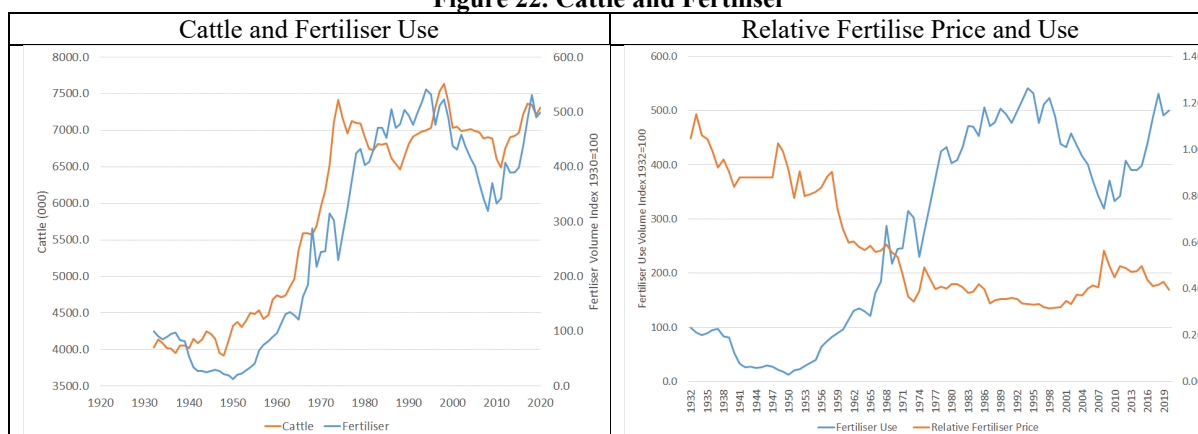
Source: O'Connor (1971) and CSO Statistical Abstract

In terms of total expenses, input share 2 has grown at a faster rate than farm materials over time increasing in value terms from about 40% in the late 1940's to 85% in the 2000's and an exceptional 99% in 2009. In volume terms, although exhibiting significant annual variation, the trend was reasonably flat until the 1990's, with a major decline in the mid 1970's. The biggest drivers of the volume reduction came as a price response to variable costs like feed, labour, land rental and other costs. Both the value and volume share rose over the 1990's and early 2000's, across all segments, but in particular feed, energy, veterinary expenses, contracting and investment (especially buildings). The period post 2005 has seen a decline in input volumes relative to output volumes across most categories, reflecting in part the sector operating at below potential prior to the abolition of milk quota.

The use of fertiliser is a key input, both as a cost as itself, but on the one hand a driver of plant growth and on the other a potential driver of negative environmental outcomes, both in terms of water quality and climate change. Figure 21 details trends in fertiliser in a number of dimensions, firstly tracking the volume of fertiliser used relative to the numbers of cattle and secondly relative to fertiliser prices (as a percentage of the agricultural input price index).

Fertiliser use has typically tracked cattle numbers directly and relative price inversely. However import restrictions during the Economic War and the Second World War resulted in a major decline.<sup>11</sup> It is likely that this saw depletion of soil fertility, reflected in part through a fall in crop yields (Crotty, 1966), although this will have been driven in part by non-specialist farms planting tillage crops during the compulsory tillage policy.

**Figure 22. Cattle and Fertiliser**



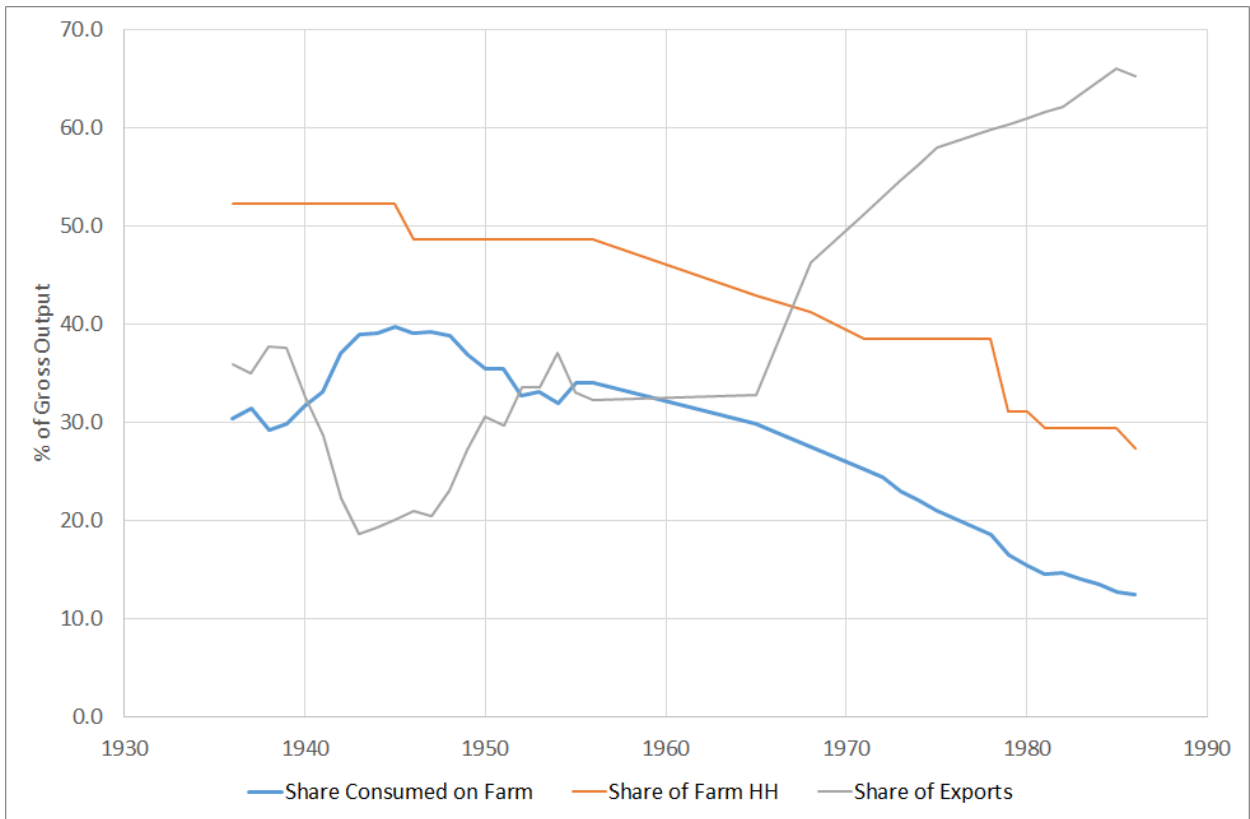
### Incomes

Combining output and inputs gives an estimate of incomes. An important part of both outputs and inputs is the share of output consumed on farms themselves both as an input into production and as a source of domestic farm household consumption. There was an early series in the CSO Statistical Abstract that reported the destination of outputs including the share consumed by farm households. Combining a later CSO series “Farm Produce and Fuel consumed in farm households without sale”, the export share reported above, the consumption by households in Ireland of agri-food outputs and the share of households that are farm households enables an estimation of the share of output consumed on farms.

The household consumption share rose initially as the export share declined over the 1920's and 1930's, driven both the increasing share of exports, with a 40% consumed by the farmers. This stayed low during the 1940's before declining with a recovery of exports in the post war period. The share declined over time, as a result initially of the decline in the share of farm households and from the mid-1960's as a result of the rapid growth in the export share down to about 12% by the mid 1980's. These trends again reflect the move from the subsistence nature of much of agriculture to a more outward facing sector.

<sup>11</sup> Wartime reduction in fertiliser use, due in initially to a reduction in reserves because of the phosphate subsidy in 1938 (Daly, 2002) and subsequently through an inability to imported from the Mediterranean.

**Figure 23. Share of Total Farm Output Consumed on Farms**



**Figure 24. Farm Income Growth compared with Price and Wage Growth**

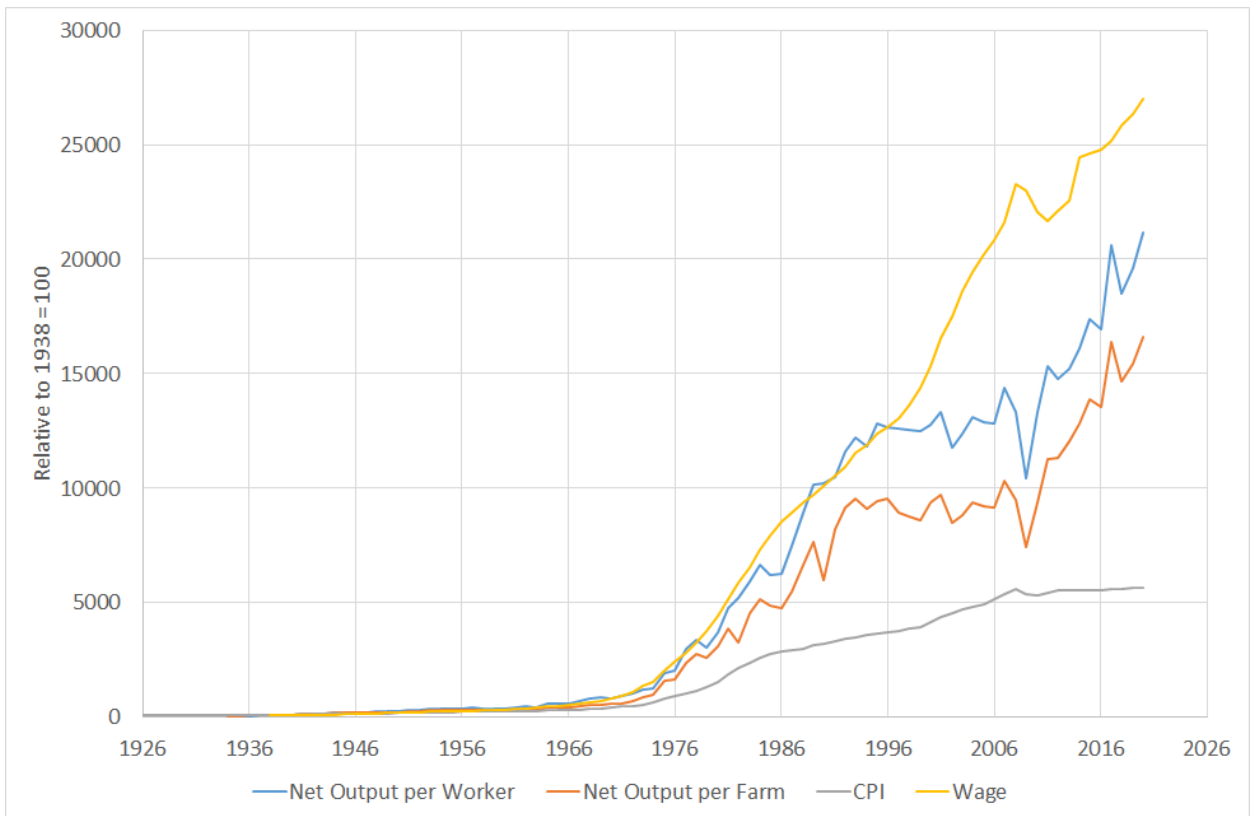


Figure 24 charts the trend in farm income growth over time. In broad terms, farm incomes have exceeded growth in prices, so that purchasing power has increased over time, but that it has lagged wage growth, resulting in a lower standard of living relative to other sectors over time, driving changes in farm viability (Loughrey et al., 2022). This gap widened particularly between 1994 and 2010 as a result of relatively stagnant farm incomes, while the country experienced the exception Celtic Tiger growth phase. These statistics report incomes from farming, while the growth in off-farm employment will have mitigated this trend somewhat. The chart ignores own consumed farm output, which has in any case declined over time. Differences in the trend between farm income per farm and per farm worker are reported, highlighting the restructuring that resulted in the loss of farm labour over time has had an important impact in reducing the gap with wage growth. Income growth as a result of dairy expansion has seen the trend in farm income per worker, again keep pace with wages in the 2010 decade.

**Figure 25. Farm Incomes relative to Wage Rates**



As the chart is dominated by price changes in the 1970's, higher resolution graphics for two specific periods are provided in figure 25. The post war period saw farm incomes per worker track wage growth. Part (b) reports the income impacts that resulted from entry to the EEC (Cox et al., 1982). Incomes initially rose relative to wages, with higher output. However, this reversed back to trend rapidly in 1974 during the Cattle Crisis resulting from higher input prices and land rental prices due to the inflationary environment (O'Connor and Keogh, 1975). A shortage of winter feed in 1974, which hadn't kept pace with growth in cattle numbers, exacerbated the income problems and significant mortality issues in some parts of the country due to exposure and malnutrition (ibid.). Farm incomes recovered in 1975 and exceeded wage growth until 1978. However, the second Oil crisis and resulting worsening terms of trade highlighted in figure 20, while wage rates continued to rise, saw farm incomes fall back to a relative position lower than when Ireland joined the EEC.

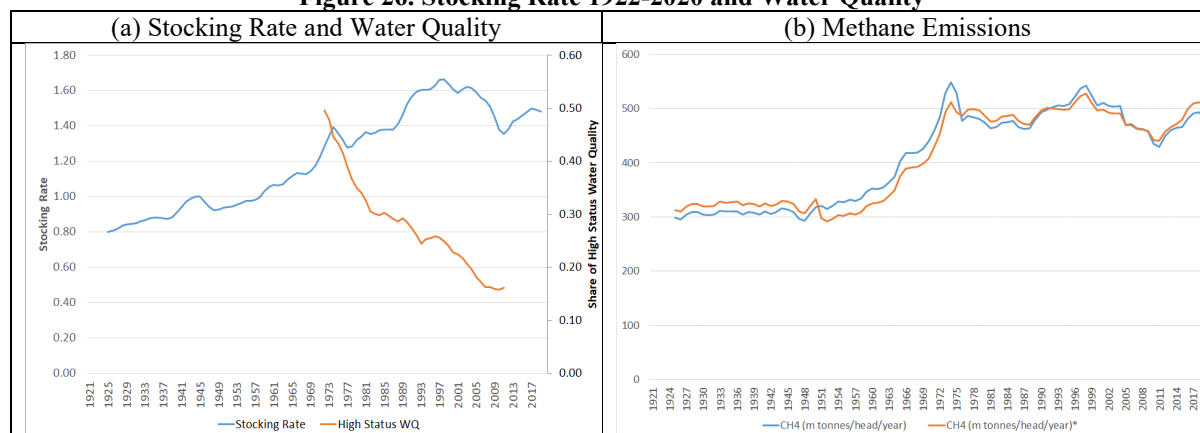
### Environment

The environmental implications of agricultural change are well documented, particularly in recent years (Ryan et al., 2016). However, the issue has been largely ignored in historical analyses. A detailed analysis is beyond the scope of this paper. However, Figure 26 reports two environmental trends. Figure 26.a charts the increase in stocking rate over time, noting that although land moved from tillage to pasture, the overall stocking rate has increased from less than 1 livestock unit per hectare in the 1920's to a peak of over 1.6 at the end of the 1990's. There are some issues in relation to the comparability of the overall land area, but the qualitative story of an increasing stocking rate is clear.

Overlaying the EPA measure of high status water quality, there is a dramatic decline since joining the EEC from over half of all river bodies having high status water quality on joining the EEC decline to about 15% in 2010. Although there are many factors influencing water quality, agriculture as one of the main land uses is a key influencer. Falling stocking rates since 2000 was associated with a lower impact on water quality, while agri-environmental investments have reduced environmental impact of a given level of farm activity (O'Donoghue et al., 2021). There is a risk that a rising national stocking rate post milk quota abolition will exacerbate challenges in this area

Figure 26.b charts the growth in Methane emissions using separately the aggregate emissions factors used in current national reporting and the animal age group specific measures used by O’Mara et al., (2007). Both however display the same broad trend of increasing methane to the 1998 peak, a decline and subsequent rise post milk quota abolition.

**Figure 26. Stocking Rate 1922-2020 and Water Quality**



## 5. DISCUSSION AND CONCLUSIONS

When one looks at the agricultural sector, it seems that the sector is making a transition from cattle to dairy from a situation where beef and dairy cows have parity, where the sector exports a majority of its exports to a global market, where the power of meat processors is dominant and where the sector is relatively static, making relatively few changes. However, in examining the structure of the sector over the long arc of the last 100 years, we have seen major changes in the sector. The question, we ask in this paper, is to what extent these changes resulted from economic pressures from market forces and how much resulted from policy interventions in Ireland and overseas.

In this paper we have assembled a time-series of agricultural statistics over the past century, combining online sources with statistical series currently available only in print form in certain libraries. While not beset by the inaccuracies of early statistics described by Solar (1998) or the so much by the unavailability of documentation described by Oldham (1924), there are significant challenges in linking the series together. Output series are more coherent in aggregate, while input series vary substantially. Even data points with ostensibly the same title have changed definition over time.

We do not engage in the detailed cross-referencing and cross-validation of data points suggested by Solar (1998) in relation to data in the nineteenth century. To some extent, the quality of the data collected by the Central Statistics Office and by its predecessors is of higher quality, given the significant state resources and authority used in the collection of data, stemming in part from the important role of public policy in the sector. On the other hand, on looking at a broad sweep over a century in trends within the sector, the large changes are relatively self-evident. In finer resolution analyses, specific events such as seemingly high mortality during the wet winter of 1924 (O’Connor and Guimard, 1985), the impact of a poor potato harvest on pig supplies in 1960’s (O’Connor, 1953) or the impact of the fodder crisis in 2013 seem relatively insignificant (Green, 2019). Even relatively large events such as the Foot and Mouth outbreak of 2001 seem relatively unimportant when looking at the sector through a century lens.

Table 5 summarises some of the key private and public sector drivers identified in this paper. In summary across most sectors, farms responded in a way that followed prices. Transitions between tillage and pasture reflected these differences. For much of the period supply side differences influenced the beef sector. Sometimes however the potential substitution effect was lower than might be expected as between beef and sheep. However, this paper would argue that public sector drivers had the biggest influence on changes. Price controls and subsidies were important at various stages in incentivising at various stages, wheat, cattle and sheep.

**Table 5. Private and Public Sector Drivers of Change in Agricultural Sector**

	<i>Private</i>	<i>Public</i>
1920	Market dominated land use decisions 1920-1970	
1930		Subsidies for Wheat & import restrictions British Import Tariffs Irish Export Bounties State dominated sugar sector throughout century
1940	Relative increase in human consumption of grains. Fewer pigs and poultry	War and limited imports (Fertiliser and Compulsory Tillage) British food price controls
1950	Post-war recovery in exports	British food price controls lifted Import Restrictions into UK
1960		Role of subsidies in driving cattle and tillage Anglo-Irish Free Trade Agreement
1970	Cattle Crisis in 1974 Input Price growth in both Oil Crises	Intervention Prices on EEC Entry Free trade for Dairy, Fattened Cattle and Meat.
1980	Cost price Squeeze across 1980-2010	Milk quota for Dairy Ewe Subsidy for Sheep
1990		McSharry Reforms (price→Income supports) Environmental Directives and Schemes
2000		Decoupled Payments
2010+	Greater market influence post abolition of milk quota	Dairy Quota Abolition

However, export restrictions in the first half century and milk quota restrictions were hugely important, particularly in the Dairy sector. Anglo-Irish Free Trade Agreement was a relative misnomer for much of the agricultural sector, with export restrictions continuing for dairy, meat and fattened cattle until joining in the EEC, where dairy expanded at a rate much faster than the relative growth in prices, reflecting the untapped potential of the sector during these export constraints. Almost exactly the same expansion occurred again after 2015, when milk quotas were abolished. Since joining the EEC, import prices have also eroded income gains from output price growth.

The experience of Ireland over the century has mimicked the experience of many developing countries. Over the century the Irish agricultural sector has moved from a sector with a high subsistence dimension with up to 40% of output consumed on farms to a modern international exporting sector, much less reliant on the traditional trading partner the UK. Ireland has experienced disadvantageous bilateral trade agreements that restricted opportunities for higher value added production, maintaining a low value added status quo. Multi-lateral trade agreements and organisations like the EEC/EU have hugely facilitated the development of the sector. At the same time as Ireland has developed, agriculture and agricultural exports have declined in importance as the rest of the economy has modernised.

Thus, although cultural influences and the non-benefits of farming are important, where that maximising profit may not be the most important thing in farmers' lives (Vanclay 1992, Kantelhardt, 2006), broadly trends within the sector have followed market trends within constraints. What is clear however has been the importance of policy, for good and for bad over the century. We have seen that when restrictions were eased, whether after the Second World War or on joining the EEC or when milk quotas were abolished that activity can take off. We have seen the incentivising of particular sectors such as the artificial growth in the beef herd in the 1990's. Farmers have responded well to these incentives.

The challenge as we look into a second century as a Republic is to deal with both the environmental and economic implications of the sector. Cattle numbers again are close to the highest number of animals seen in a century. Recent government strategies have been successful in promoting sectors with higher carbon emissions such as dairy and beef, but have been less successful in sectors with low or negative carbon emissions such as aquaculture and forestry. While some of the tools are available such as environmental Directives and agri-environmental Schemes, they are typically not sophisticated enough or nuanced enough yet to deliver the goals required.



What is striking however is the enormous structural changes and innovations that have occurred over the century in a seemingly sunset industry. The norms and myths that are often used in short-hand, sometimes to dissuade change are not valid when one looks at a century perspective. While this century will throw up many hurdles to be overcome (starting with BREXIT), the story gives us hope that we can find solutions for many of changes that are necessary and hopefully do so in a way that is less disruptive than some of the changes that have occurred over the past century.

## References

- Attwood, E. A. (1982). The nature and causes of the farm income problem. *Journal of the Statistical and Social Inquiry Society of Ireland*, Vol. XXIV, Part IV, 217.
- Baillie, I. F., & Sheehy, S. J. (1971). Irish agriculture in a changing world. *Irish agriculture in a changing world*. Edinburgh: Oliver and Boyd.
- Baker, Terence J., Robert O'Connor and Rory Dunne (1973). A Study of the Irish Cattle and Beef Industries. General Research Series Paper No. 72. Dublin: Economic and Social Research Institute.
- Barrington, T. , (1927). " Review of Irish Agricultural Prices", *Journal of the Statistical and Social Inquiry Society of Ireland*, V o l . X V , pp. 249-280.
- Boyle, G. E. (1987). How Technically Efficient is Irish Agriculture?: Methods of Measurement. Department of Agricultural Economics, Rural Economy Research Centre, An Foras Taluntais.
- Burke, T. and M. Roche (2000) National Farm Survey 1999. Dublin: Teagasc
- Buttimer, D. J. (1972). Supply response in the Irish dairy and beef herds, 1953-1970: an econometric exercise. *Irish Journal of Agricultural Economics and Rural Sociology*, 55-75.
- Chart, D. A. (1912). Two centuries of Irish agriculture-a statistical retrospect, 1672-1905. *Journal of the Statistical and Social Inquiry Society of Ireland*. Vol. XII, Parts LXXXVII to XCII.
- Cox, P.J., J. Higgins, B. Kearney (1982) Farm incomes analysis and policy. Report number: 65 Dublin NESC Council Reports
- Crotty, R. D. (1966). Irish agricultural production its volume and structure. Irish agricultural production its volume and structure. Cork: Cork University Press.
- Curtis, J., & FitzGerald, J. D. (1993). *The Changing Structure of the Irish Economy: As Reflected in the 1985 Input-Output Table*. Economic and Social Research Institute.
- Cuddy, M. P. (1982). Response of Irish creamery milk supply to price changes. *European Review of Agricultural Economics*, 9(2), 221-231.
- Cullen, L. M. (1995). *Irish national income in 1911 and its context*. ESRI Working Paper No. 63, October 1995
- Daly, M. E. (2002). The first department: a history of the Department of Agriculture. Institute of Public Administration.
- Donnellan, T., Hennessy, T., & Thorne, F. (2015). The end of the quota era: A history of the dairy sector and its future prospects. *Agricultural Economics and Farms Surveys Department, Teagasc*.
- Evans, B. (2011). Coercion in the Irish countryside: The Irish smallholder, the state, and compulsory tillage 1939–45. *Irish Economic and Social History*, 38(1), 1-17.
- Feng, H. (1998). *Agricultural development in the Netherlands: An analysis of the history of Dutch agricultural development and its importance for China* (No. 491). Landbouw-Economisch Instituut (LEI-DLO).
- Foster, H.G., Ireland's Trade with Britain in Baillie, I. F., & Sheehy, S. J. (eds). Irish agriculture in a changing world. *Irish agriculture in a changing world*. Edinburgh: Oliver and Boyd.
- Geary, Robert C. (1925) 'Methods of sampling applied to Irish statistics'. - Dublin: *Journal of the Statistical and Social Inquiry Society of Ireland*, Vol. XIV No. 3, 1923-1925, pp61-81
- Geary, R. C. (1962). An Experimental Input-Output Decision Model for Ireland. ESRI Memorandum Series No. 11 1962 (?).
- Geary, R. C. (1964). Towards an input-output decision model for Ireland. Dublin: *Journal of the Statistical and Social Inquiry Society of Ireland*, Vol. XX No. 2 67-119
- Hannan, D., & Commins, P. (1992). The significance of Small-scale Landholders in Ireland's Socio-Economic Transformation in JH Goldthorpe and CT Whelan Goldthorpe, J. H., & Whelan, C. T. (ed.). The development of industrial society in Ireland. *Proceedings of the British Academy*, Volume 79
- Hennessy, T.C., F.S. Thorne (2005) How decoupled are decoupled payments? The evidence from Ireland. *Eurochoices*, 4(3), 30-35.
- Henry, E. W. (1973). An input-output model of the Irish economy. *Long Range Planning*, 6(3), 64-73.

- Henry, E. W. (1980). Irish Input-Output Structures, 1976. *Economic and Social Research Institute (ESRI) Research Series*.
- Henry, E. W. (1988). *A Basic Input-Output Model of Capacity Growth, with Recursive Solution and Numerical Illustration* (No. ME177).
- Henry, E. W. (1993). *Irish 1990 Input-Output 13-Sector. Approximate Structure, with Derived Multipliers for Employment, GNP and Imports* (No. TP09).
- Johnson, R. W. M., Schroder, W. R., & Taylor, N. W. (1989). Deregulation and the New Zealand agricultural sector: A review. *Review of Marketing and Agricultural Economics*, 57(430-2016-31375), 47-74.
- Johnston, Joseph (1927). 'Some causes and consequences of distributive waste'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XIV No. 4, 1925-1927, pp353-383
- Johnston, J. (1930). A plea for winter dairying. *Journal of the Statistical and Social Inquiry Society of Ireland*, 15, 33.
- Johnston, J. (1934). The Purchasing-Power of Irish Free State Farmers in 1933. *The Economic Journal*, 44(175), 453-459.
- Johnston, J. (1937). Price Ratios in Recent Irish Agricultural Experience. *The Economic Journal*, 47(188), 680-685.
- Johnston, J. (1951). Irish agriculture in transition. Dublin: Dublin University Press.
- Kantelhardt, J. (2006) Impact of the Common European Agricultural Policy (CAP) reform on future research on rural areas. *Outlook on Agriculture*, 35(2), pp. 143-148.
- Keane, M. (1976). Projections of change in creamery supplier structure. *Irish Journal of Agricultural Economics and Rural Sociology*, 177-184.
- Keane, M. (1991). Changes in the size structure of Irish dairy farms. *Irish Journal of Agricultural Economics and Rural Sociology*, 67-74.
- Läpple, D., & Sirr, G. (2019). Dairy intensification and quota abolition: a comparative study of production in Ireland and the Netherlands. *EuroChoices*, 18(3), 26-32.
- Loughrey, J., O'Donoghue, C., & Conneely, R. (2022). Alternative measures of Family Farm Viability—Incorporating gap measures. *Journal of Rural Studies*, 89, 257-274.
- McGilvray, J. (1964). The Stability of Coefficients in an Irish Inter-Industry Model. *Journal of the Statistical and Social Inquiry Society of Ireland*, 21(Part III), 1965.
- McGilvray, J., & Simpson, D. (1973). The commodity structure of Anglo-Irish trade. *The Review of Economics and Statistics*, 451-458.
- Meenan, J. (1971), Irish Agricultural Policies in the Last Twenty Years in Baillie, I. F., & Sheehy, S. J. (eds). Irish agriculture in a changing world. *Irish agriculture in a changing world*. Edinburgh: Oliver and Boyd.
- Murphy, J.A (1977). A Comparative Study of Output, Value-Added and Growth in Irish and Dutch Agriculture. December 1977 Report number: 24 Types: NESI Council Reports
- Neary, J. P., & Gráda, C. Ó. (1991). Protection, economic war and structural change: the 1930s in Ireland. *Irish Historical Studies*, 27(107), 250-266.
- O'Connor, R. (1953) 'A study of factors which determine the supply of pigs'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, Part II, 1953/1954, pp58-88
- O'Connor, R. (1970). An analysis of recent policies for beef and milk. *Journal of Statistics. Social Inquiry Society of Ireland*, 23(2), 28-80.
- O'Connor, R. (1971) Implications of Irish Agricultural Statistics in I.F. Baillie and S.J. Sheehy (eds) *Irish Agriculture in a Changing World*. Edinburgh: Oliver Boyd.
- O'Connor, R., & Henry, E. W. (1995). Estimates of Gross and Net Output and Income Arising in Agriculture in All Ireland and in the Free State Area in Selected Years Between 1908 and 1926/27. ESRI WP58. April 1995.
- O'Connor, R., Guiomard, C., & Devereux, J. (1983). A Review of the Common Agricultural Policy and the Implications of Modified Systems for Ireland. *Economic and Social Research Institute (ESRI) Research Series*.
- O'Connor, R., & Guiomard, C. (1985). Agricultural output in the Irish Free State area before and after independence. *Irish Economic and Social History*, 12(1), 89-97.
- O'Connor, R., & Keogh, P. (1975). *Crisis in the Cattle Industry. Economic and Social Research Institute (ESRI) Research Series Broadsheet No. 13*.
- O'Donoghue, C., & Hennessy, T. (2015). Policy and economic change in the agri-food sector in Ireland. *The Economic and Social Review*, 46(2, Summer), 315-337.
- O'Donoghue, C., Buckley, C., Chyzheuskaya, A., Green, S., Howley, P., Hynes, S., ... & Ryan, M. (2021). The spatial impact of rural economic change on river water quality. *Land Use Policy*, 103, 105322.

- Oldham, C.H. (1924) 'Some perplexities in regard to the agricultural statistics of Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XIV No. 3, 1923-1925, pp1-15
- O'Mara, F., Ryan, M., Connolly, J., O'Toole, P., Carton, O., Lenehan, J. J., ... & Hawkins, M. (2007). Climate Change—Estimation of Emissions of Greenhouse Gases from Agriculture and Strategies for their Reduction (2000-LS-5.1. 1).
- O'Rourke, K. (1991). Burn everything British but their coal: the Anglo-Irish economic war of the 1930s. *The Journal of Economic History*, 51(2), 357-366.
- Oskam, A., Meester, G., & Silvis, H. (2011). EU policy for agriculture, food and rural areas. Wageningen Academic Publishers.
- Oskam et al., 2011nk, A., Daugbjerg, C. (2006) The 2003 CAP Reform: Accommodating WTO Pressures, *Comparative European Politics*, 4 (1) 47-64.
- O'Toole, R., Matthews, A., & Mulvey, M. (2002). *Impact of the 2001 foot and mouth outbreak on the Irish economy*. Department of Economics, Trinity College.
- Ryan, M., Hennessy, T., Buckley, C., Dillon, E. J., Donnellan, T., Hanrahan, K., & Moran, B. (2016). Developing farm-level sustainability indicators for Ireland using the Teagasc National Farm Survey. *Irish Journal of Agricultural and Food Research*, 55(2), 112-125.
- Sheehy, S. J., & O'Connor, R. (1985). *Economics of Irish agriculture*. Institute of Public Administration in association with Allied Irish Banks.
- Solar, P. M. (1987). *Growth and distribution in Irish agriculture before the famine* (Doctoral dissertation, Stanford University).
- Solar, P. M. (1998). The pitfalls of estimating Irish agricultural output for post-famine Ireland. *Irish Economic and Social History*, 25(1), 152-156.
- Solow, B. L. (1971). *land question and the Irish economy, 1870-1903*. Cambridge, Mass. Harvard University Press
- Staehle, H. (1951). Statistical notes on the economic history of Irish agriculture, 1847-1913. *Journal of the Statistical and Social Inquiry Society of Ireland*, 18, 444.
- Thornhill, D. J. (1983). The revealed comparative advantage of Irish exports of manufactures 1969-1982. *Journal of the Statistical and Social Inquiry Society of Ireland*, 25, 91.
- Tielu, A., Roberts, I. (1998) Farm Income Support: Implications for Gains From Trade of Changes in Methods of Support Overseas, in ABARE Current Issues, 98 (4) 4-5.
- Turner, M. (1987). Towards an Agricultural Price Index for Ireland 1850–1914. *Economic and Social Review*, 18(2), 123-36.
- Turner, M. (1996). *After the famine: Irish agriculture, 1850-1914*. Cambridge University Press.
- Vanclay, F. (1992). Barriers to adoption: a general overview of the issues. *Rural Society*, 2(2), 10-12.
- Vanclay, F. (2004) Social principles for agricultural extension to assist in the promotion of natural resource management. *Australian Journal of Experimental Agriculture*, 44 (3) 213-222.
- Vaughan, W. E. (1980). Agricultural outputs, rents, and wages in Ireland, 1850–1880'. *Ireland and France, 17th–20th Centuries (UMI Monograph Publishing Co., Ann Arbor, MI)*.
- Walsh, J. A. (1989). Enterprise substitution in Irish agriculture: sheep production in the 1980s. *Irish Geography*, 22(2), 106-109.
- Walsh, J. A. (1992). Adoption and diffusion processes in the mechanisation of Irish agriculture. *Irish Geography*, 25(1), 33-53.
- Walsh, T., Ryan, P. F., & Kilroy, J. (1952). A half century of fertiliser and lime use in Ireland. *Journal of the Statistical and Social Inquiry Society of Ireland*, 19, 104.
- Whitaker, T. K. (1958). *Economic Development*, Dublin: Stationery Office.

## APPENDIX

### Journal of Statistical and Social Inquiry Society Articles on Agriculture

- Alexander, D. J. 'Farm land mobility and adjustments in farming in Northern Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part III, 1964/1965, pp1-14
- Armstrong, D. L. 'Some aspects of the marketing of milk in Northern Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XX, Part II, 1958/1959, pp79-92
- Attwood, E. A. 'Agriculture and economic growth in western Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XX, Part V, 1961/1962, pp172-195
- Attwood, E. A. 'Trends in agricultural development in Europe and Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Pt. I, 1962/1963, pp31-49
- Attwood, E. A. 'Some economic aspects of land use policy in Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part III, 1964/1965, pp143-165
- Attwood, E. A. 'Agricultural developments in Ireland, north and south'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part V, 1966/1967, pp9-34
- Attwood, E. A. (1968). Some Aspects of Pig/Grain Price Support Policy in Ireland. Irish Journal of Agricultural Economics and Rural Sociology, 293-301.
- Attwood, E. A. 'The development of an agricultural incomes policy'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXII, Part II, 1969/1970, pp100-119
- Barrington, Thomas. 'A review of Irish agricultural prices'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XIV No. 4, 1925-1927, pp249-280
- Beddy, J. P. 'A comparison of the principal economic features of Eire and Denmark'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVII No. 2, 1943/1944, pp189-220
- Bourke, P. M. Austin. 'The extent of the potato crop in Ireland at the time of the Famine'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XX, Part III, 1959/1960, pp1-35
- Bourke, P. M. A. 'The use of the potato crop in pre-famine Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part VI, 1967/1968, pp72-96
- Boyle, G. E. 'Agricultural volume index numbers and the choice of aggregation formula: an empirical investigation for the member states of the EC'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXV, Pt. IV, 1986/1987, pp41-87
- Byrne, J. J. (1957). Some provincial variations in Irish agriculture. Journal of the Statistical and Social Inquiry Society of Ireland, 20, 60.
- Costello, M. J. 'Some aspects of production costs in Irish agriculture, as illustrated by the cost of producing sugar beet'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, Part II, 1953/1954, pp114-131
- Cunningham, E. P. 'The genetic improvement of the Irish cattle population'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part IV, 1965/1966, pp99-130
- Curtis, John; Morgenroth, Edgar. 'Estimating the effects of land-use and catchment characteristics on lake water quality: Irish lakes 2004-2009'. - Dublin: Statistical and Social Inquiry Society of Ireland, Vol. XLII, 2012-13, pp64-80
- Duncan, G. A. 'The determination of demand curves in relation to wheat'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XV No. 4, 1933/1934, pp43-60
- Embleton, F. A. 'Developments in the structure of Irish agriculture, 1960-75 with special reference to the situation in 1975'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIII, Part V, 1977/1978, pp29-74
- Fitzgerald, Kevin C.. 'A personal account of minor activities in the British agricultural war effort with some speculations on the application of British technique in Irish agricultural conditions'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVII, 1946/1947, pp565-578
- Freeman, T. W. 'Emigration and rural Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVII, Part 3, 1945/1946, pp404-422
- Geary, R. C.. 'Some thoughts on the making of Irish index numbers'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVII, Part 3, 1945/1946, pp345-380
- Geary, R. C. 'Variability in agricultural statistics on small and medium-sized farms in an Irish county'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVIX, Part V, 1956/1957, pp1-36
- Gray, H. J. 'The economics of Irish forestry'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part II, 1963/1964, pp18-44

- Green, S. (2019). *Investigation into the bio-physical constraints on farmer turn-out-date decisions using remote sensing and meteorological data* (Doctoral dissertation, University College Cork).
- Harnett, P. 'The significance of veterinary science in the national economy'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, 1955/1956, pp122-149
- Harrison, Harold. 'Quantitative planning and decision-making techniques (with particular reference to agricultural applications)'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXII, Part I, 1968/1969, pp15-29
- Heavey, John F. 'The Farm Management Survey 1966 to 1969'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXII, Part IV, 1971/1972, pp143-155
- Hussey, F.P. 'The use of statistical methods in agricultural experiments'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XV No. 7, 1936/1937, pp1-18
- Jack, W. H. 'Factors relevant to planning an economic forestry policy'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part II, 1963/1964, pp45-54
- Johnston, Joseph. 'A plea for winter dairying'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XV No. 1, 1930/1931, pp33-44
- Johnston, Joseph. 'Aspects of the agricultural crisis at home and abroad'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XV No. 5, 1934/1935, pp79-96
- Johnston, Joseph. 'The capitalisation of Irish agriculture'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVI No. 5, 1941/1942, pp60-87
- Johnston, J. 'An economic basis for an Irish rural civilisation'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part I, 1947/1948, pp13-24
- Johnston, J. 'Raw materials for Irish animal husbandry'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part II, 1950/1951, pp392-402
- Kelly, A. and Kevany, J. 'A food and nutritional surveillance system for Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIV, Part III, 1980/1981, pp135-169
- Kennedy, Henry. 'Our dairying and cattle industries'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVII, 1947/1948, pp705-716
- Kennedy, Henry. 'Future possibilities of Irish agriculture'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVI No. 1, 1937/1938, pp43-54
- Kilroy, J., Ryan, P. F. and Walsh, T. 'A half century of fertiliser and lime use in Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, Part V, 1956/1957, pp104-136
- Lee, J. 'An analysis of land potential for grazing in Ireland with particular reference to farm size relationships'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIII, Part I, 1973/1974, pp149-182
- Loughrey Jason, Declan O'Connor, Trevor Donnellan, Thia Hennessy, Fiona Thorne, 'Income Volatility on Dairy Farms in Ireland', 2021, Journal of the Dublin Statistical Society;, Vol. [No.], [Year];
- Lyons, Sean, Mayor, Karen and TOL, Richard S. J. (2007) 'Environmental accounts for the Republic of Ireland: 1990-2005'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol.37
- Mathews, Alan. (1988) 'Common agricultural policy reform and national compensation strategies'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVI, Pt. I, pp1-43
- Mathews, A. (1999) 'Productivity growth in Irish agriculture'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, , pp317-367
- Mathews, Alan. 'Symposium on Ireland;s policy to Africa: trade and aid - Improving coherence between Irish trade and development policy from an African perspective'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXXV, 2005/2006, pp179-188
- McCoy, Daniel A. 'Barrington lecture 1992/1993: Sustainable development - the challenge for Irish economic policy-makers'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVI, Pt. 5, 1992/1993, pp55-91
- Murphy, M. 'Financial results on mixed dairy farms in 1937-'38'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVI No. 2, 1938/1939, pp105-130
- Murphy, M. 'Financial results on 93 mixed dairy farms in 1938-'39'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVI No. 3, 1939/1940, pp90-93
- Murphy, M. 'Financial results on sixty-one West Cork farms in 1940-'41'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVI No. 5, 1941/1942, pp60-87
- Murphy M. 'Financial results on mixed dairy farms in 1942-43 as compared with 1938-'39'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XVII No. 2, 1943/1944, pp369-308

- O'Connell, John J. 'Measurement and growth of the food production and distribution in Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIII, Part IV, 1976/1977, pp229-269
- O'Connor, R. 'Financial results on twenty-five farms in mid-Roscommon in 1948-1949'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part III, 1949/1950, pp270-292
- O'Connor, R. 'Financial results on twenty farms in mid-Roscommon in 1945-46'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part II, 1948/1949, pp79-108
- O'Connor, R. 'A study of factors which determine the supply of pigs'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, Part II, 1953/1954, pp58-88
- O'Connor, R. 'The economic utilisation of grassland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XX, Part III, 1959/1960, pp71-96
- O'Connor, R. 'An analysis of recent policies for beef and milk'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXII, Part II, 1969/1970, pp28-80
- O'Connor, R. and Kearney, B. 'Economic issues in Irish forestry'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVI, Pt. 5, 1992/1993, pp179-209
- O'Hanlon, G. and Treacy, J. 'An analysis of Irish farming in 1980 based on the community typology of agricultural holdings'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXV No. 2b, Year 1984/1985, pp71-124
- O'Donoghue, Cathal; Geoghegan, Cathal; Heanue, Kevin; Meredith, David. 'The economic structure of towns in Ireland'. - Dublin: Statistical and Social Inquiry Society of Ireland, Vol.43, 2013-14 , pp114-135
- Ó'Gráda, C. (1990). Irish Agricultural History: Recent Research Work in Progress. *The Agricultural History Review*, 165-174.
- Oldham, C.H. 'The development of tillage in Ireland during the World War'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XIV No. 2, 1920-1923, pp209-210
- Oldham, C.H. 'Some perplexities in regard to the agricultural statistics of Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XIV No. 3, 1923-1925, pp1-15
- Scully, John J. 'The pilot area development programme'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXI, Part VI, 1967/1968, pp51-71
- Senior, B. J. 'Agricultural education and research'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, Part I, 1952/1953, pp23-41
- Sheehy, S. J. 'Co-responsibility and the future of Irish agriculture'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIV, Part V, 1982/1983, pp1-32
- Smith, L. P. F. 'Recent developments in Northern Irish agriculture'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part II, 1948/1949, pp143-160
- Staehle, H. 'Statistical notes on the economic history of Irish agriculture, 1847-1913'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part IV, 1950/1951, pp444-471
- Symons, L. 'Hill land utilisation in Ulster'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXIX, 1955/1956, pp58-81
- Symons, Leslie. 'The pastoral economy of New Zealand and some comparisons with Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XX, Part IV, 1960/1961, pp94-131
- Thomas, D. E. L. 'Economic aspects of forestry in Northern Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XX, Part V, 1961/1962, pp196-219
- Thornhill, Donal, J. 'Barrington prize lecture 1986/1987: the revealed comparative advantage of Irish exports of manufactures 1969-1982'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXV, Pt. V, 1987/1988, pp91-146
- Tintner, G. 'Scope and method of econometrics: illustrated by applications to American agriculture'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVIII, Part II, 1948/1949, pp161-177
- Tol, Richard S. J. et al. (2008) 'Towards regional environmental accounts for Ireland'. - Dublin: Journal of the Statistical and Social Inquiry Society of Ireland, Vol.38

#### **VOTE OF THANKS BY EMERITUS PROFESSOR ALAN MATTHEWS, TRINITY COLLEGE DUBLIN**

Professor Cathal O'Donoghue has performed an immensely valuable service by pulling together and assembling these consistent long term statistical series for Irish agriculture over the previous century. Taking account of the changes in definitions over time to make the series as consistent as possible is a significant contribution in itself. The wealth of data available for Irish agriculture over such a long period compares favourably with the exercise by the UK House of Commons Library which assembled UK agricultural statistics over a similar 100 year period (Zayed and Loft 2019). It is also appropriate to recognise the key role of the statisticians in the Central Statistics Office who, together with the Department of Agriculture, have been responsible for producing and maintaining these series over the time period considered. Additional contributions of the paper include an assessment of trends in the discussion of agriculture, farming and land use issues in papers to the Society, as well as a short but comprehensive account of policy changes affecting Irish agriculture over the past century.

Cathal draws two main messages from his historical investigation. He argues, first, that the agricultural sector has been highly responsive to changes in incentives, whether arising from market prices or policy interventions. Second, he underlines the importance of policy interventions in explaining some of the trends he documents. The role of policy also helps to explain why relationships between physical variables, such as output or animal numbers, do not always seem to respond in the expected direction given observed changes in relative prices. Usually, the explanation can be found in a policy intervention that disturbs this relationship.

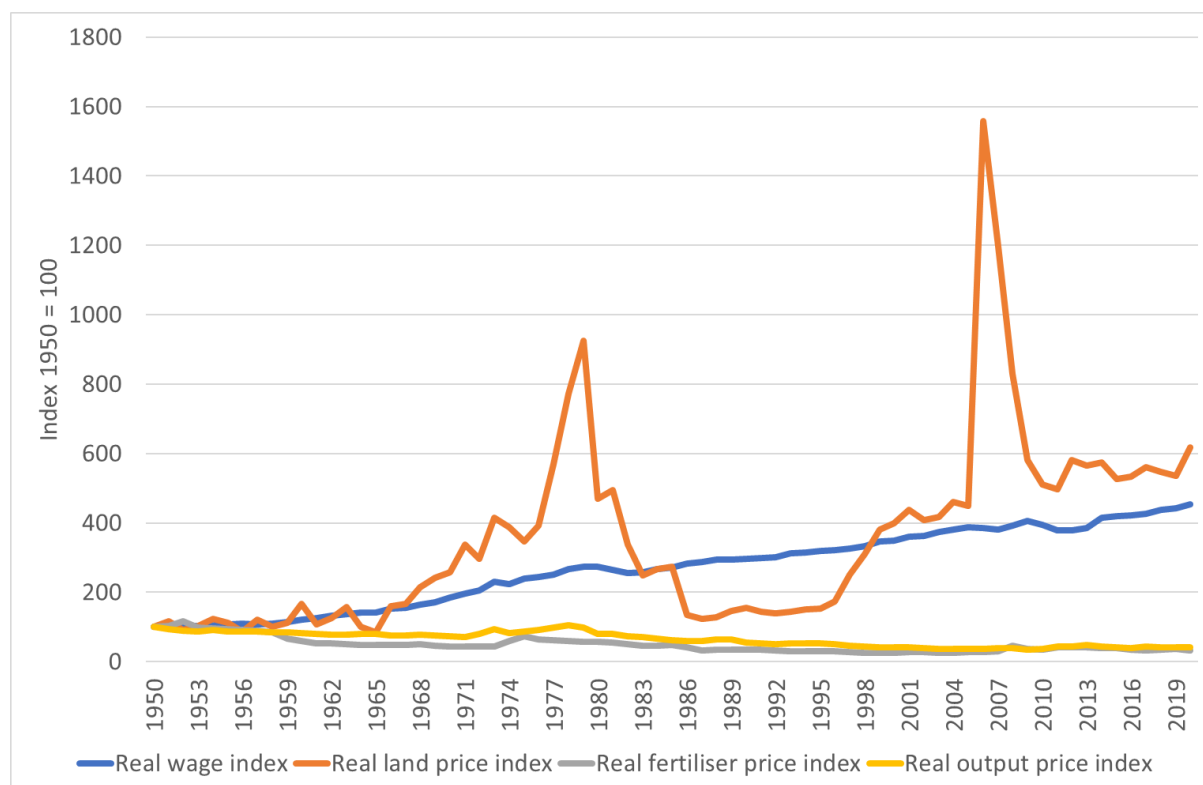
This influence of the role of policy in determining the trends identified in the paper shows up in several of the comparisons made in the paper. For example, examining the allocation of land between tillage and pasture, the paper shows that an increase in the relative price of livestock and livestock products compared to the crops gross output price index in general saw a relative increase in land for grazing. But there have been periods when this relationship broke down, for example, during the second world war when a policy of compulsory tillage was introduced, and, more recently, due to the growing importance of subsidy schemes favouring livestock production as well as the removal of the milk quota in 2015.

The role of policy is also clear in looking at the trends in cow and cattle numbers. Total cattle numbers varied around 4.5 million for the first third of the century between 1921 and 1956 but then increased to 7.5 million driven by an increase in dairy cow numbers over the next 27 years until EU accession in 1973. This reflected partly an increase in the relative price of milk but also the role of the Calved Heifer Scheme. Perhaps contrary to conventional wisdom, cow numbers and total cattle numbers fell during the first decade of EU membership. Nonetheless, dairy cow numbers expanded relative to beef cows, despite the price ratio worsening. Cathal attributes this to the constraining effects of trade restrictions with the UK prior to entry, with dairy produce moving into a free-trade environment within the EU and in particular with the UK.

Following the introduction of the milk quota in 1984 dairy cow numbers fell despite a favourable milk-beef price ratio as the fixed quantity of milk could be produced by higher-yielding cows, but this was more than compensated by an increase in beef cow numbers. Both total cow numbers and total cattle peaked in 1998 with roughly equal numbers of dairy and beef cows. With the ending of the milk quota dairy cow numbers have since surged while beef cow numbers have fallen though not by as much, so total cow and cattle numbers have been increasing in recent years. Growth in relative numbers once more reflects the relative price of outputs between the two types of cow.

I found the paper's assessment of the structural changes in Irish agriculture over the past century and the drivers of this change of particular interest. It is salutary to be reminded that in 1970, on the eve of EU membership, 40% of all households in Ireland were farm households. The paper highlights the important restructuring of the size distribution of farms, with the number of holdings declining from 338,000 in 1930 to 135,000 in 2020. It highlights the disproportionate decline in small farms, where the push factor of lower standards of living dominates. The paper presents several interesting graphs comparing trends in farm income growth to price and wage growth in the general economy. While comparing the level of farm and nonfarm incomes is fraught with difficulties, a simple comparison of family farm income per worker and average earnings suggests that the former fluctuated around 85% of the latter in the post war period with greater volatility in the post-EU accession period. Nonetheless, the growth in farm incomes kept pace with non-farm incomes from EU accession until 1994. Farm incomes then stagnated until 2010 when the rest of the country entered the Celtic Tiger phase. Cathal highlights that the restructuring that resulted in the loss of farm labour over time has had an important impact in reducing the gap with wage growth.

These are important points. They suggest that, although policy can play a role in influencing the composition and even the level of agricultural output, longer term structural changes are driven primarily by underlying market forces. In the following chart, using data taken from the paper, I sketch the underlying market forces at work.



All data in the chart are in real prices to base 1950. The underlying assumption is that structural change is driven by differences in the returns to labour in farm and non-farm activities. The price farmers received for their output fell slightly in real terms between 1950 and 1971, there was an increase in the 1970s associated with accession to the high-priced EU market, but the fall in real prices resumed after 1978 with some stabilisation evident after 2011. In fact, real agricultural output prices in 2020 were only 40% of their level in 1950. Yet real wages in the non-farm sector rose 350% over the same period.

Given these market-driven trends, farmers had to increase their labour productivity in order to maintain parity in the growth in labour income. They could do this either by intensifying their use of capital and other intermediate inputs, or by increasing their scale of farming and thus farming more hectares per person. In practice, farm labour productivity has increased through both routes.

The greater use of intermediate inputs was encouraged by the fall in their real price relative to labour. The case of fertiliser whose price is closely linked to the price of energy is one example. Fertiliser prices also fell in real terms since 1950, and even more rapidly than the price of output for most of the period, although energy prices and thus fertiliser prices have increased in real terms since around 2000. Fertiliser and output prices had virtually the same ratio in 2020 as in 1950 (these data predate the war in Ukraine in 2022 and its impact on energy and fertiliser markets). Not surprisingly, Cathal’s paper shows a more than 10-fold increase in the use of fertiliser between 1950 and 1990 which closely mirrors the growth in cattle numbers over this period.

Increased use of mechanisation documented in the paper was also a route to increased farm labour productivity and also facilitated the farming of larger areas by an individual farmer. This encouraged a steady increase in the demand for farmland whose price has risen by even more than nonfarm wages, but with much greater volatility with peaks in 1979 and 2006, reflecting the very narrow market for land in Ireland.<sup>1</sup>

Cathal concludes his story of agricultural adjustment in Ireland over the past century by noting that trends within the sector have broadly followed market trends within constraints. He emphasises the importance of policy, for

<sup>1</sup> Land prices are taken from the Institute of Professional Auctioneers and Valuers publication ‘Land prices in Ireland 1901-2020’, available at [https://www.ipav.ie/sites/default/files/land\\_prices\\_in\\_ireland\\_1901\\_to\\_2020.pdf](https://www.ipav.ie/sites/default/files/land_prices_in_ireland_1901_to_2020.pdf).



good or bad, over the century. Policy has played a critical role when it comes to the composition and even the level of output in the sector. However, when it comes to long-term structural change, it is hard to underplay the importance of the economic forces that have shaped the sector. Many observers regret the loss of farmers and the shrinking of farm numbers and call for additional policy support for smaller farms to reverse this trend. However, policy is unlikely to be effective as long as the fundamental economic forces at work in the sector remain unchanged.

The thanks of the Society are due to Professor O'Donoghue for this very insightful and valuable contribution to understanding the history of Irish agriculture over the previous century. It will undoubtedly stimulate further reflections and research in the years to come.

## Reference

Zayed, Y., and P. Loft. 2019. *Agriculture: Historical Statistics*. Briefing Paper No 3339. London: House of Commons Library.

### **SECOND VOTE OF THANKS BY DR CIARA WHELAN, UNIVERSITY COLLEGE DUBLIN**

I would like to propose a vote of thanks to Professor Cathal O' Donoghue (NUIG) for his very interesting paper and presentation of 'A Century of Agriculture – A Policy Driven Sector'. This is a fitting contribution for the 175<sup>th</sup> session of SSISI. As pointed out in the paper, the Agricultural sector was the most important sector for over half of the period since 1922. In the 100 years since the foundation of the State, Agriculture has undergone significant changes and, as concluded by the paper, public policy has played an important role in driving many of these changes. My points for discussion come from a comparative perspective with the evolution of the Irish industrial sector over the same period, links between the sectors, and a note on the importance of ensure effective current policy for future development.

#### ***On the similarities of policy drivers in the Agricultural and Industrial sectors: the early decades.***

It is evident from the paper that the evolution of the agriculture sector over the past 100 years has been shaped by many and varied policy interventions, and individual responses to these – and that these interventions in turn have been influenced by a mix of domestic conditions, political considerations, and international developments.

This is evident in the change in policies that came about in the 1930s. This period saw the fallout from the 1929 Wall Street crash and the subsequent Great Depression, the coming to power of Fianna Fail and De Valera and the drive for self-sufficiency, and the decision to renege on Land Annuities and the subsequent Economic War. This was followed by resolution of the Economic war, but the occurrence of World War II which continued until 1945. These forces shaped policy that impacted the Agricultural sector, as outlined in Figure 3: decades characterized by mixes of restrictions on agricultural trade, price interventions, production and fertilizer subsidies. Similar forces shaped the evolution of the industrial sector over this period, as policy interventions set Ireland on a path of industrialization through import substitution in a period of high levels of protectionism – fostering inefficient domestic industry – which lasted for the best part of three decades. Moreover, alongside high protectionist measures, the Control of Manufactures Acts 1932 and 1934 endeavoured to ensure Irish control of new industries.

#### ***Divergence in the nature of policies driving the evolution of Agriculture and Industrial sectors.***

There was a seismic shift in the thrust of industrial policy evident coming into the 1960s, as Ireland embarked on a new path of industrialization. Policy interventions saw the gradual dismantling of protectionist measures along with incentives (through taxes, grants and supports) to encourage exporting in manufacturing and encourage Foreign Direct Investment (FDI). This policy thrust was enhanced by EEC membership in 1973, with immediate benefits for trade within the EEC trading bloc, and the benefits of EEC market access in attracting FDI in Ireland. While the evolution of the industrial sector was and continues to be shaped by an emphasis on free trade and the development of an efficient manufacturing exporting base, this contrasts with the experience in the Agriculture sector. As discussed in the paper, EEC membership brought the CAP to the Irish agriculture sector – price supports and subsidies which provided a level of protection to this sector and induced distortions in the market. This played a big role in dictating the evolution of the agricultural sector.

It was not until the 1990s that a series of CAP reforms as outlined in the paper, endeavored to reduce these distortions. These policy interventions were designed to ultimately move toward a model where production decisions incorporate market considerations (by decoupling the link between 'production' and 'direct aids'), thereby reducing distortionary effects of the CAP.

### ***The Agricultural sector is important for the Irish economy, particularly for indigenous firms***

Over the past century the size of the Agricultural sector with respect to output and employment shares, has declined dramatically. However, the sector has evolved to one which has important linkages to industry and services. The Agri-Food business is important for Ireland, and particularly for indigenous firms (it counts for almost 2-fifths of total exports by indigenous firms, and more than 3-fifths of manufacturing exports by indigenous firms).

### ***Some 'Food for thought'***

The evolution of both Industrial and Agricultural sectors has led to a high degree of specialization. The sectors demonstrated some degree of resilience (to varying degrees) to the exogenous shocks of Covid, and indeed Brexit. Climate change and climate action is now an important external force that will require more policy interventions, which will lead to the inevitable transformations of both Agriculture and industrial sectors. Just as we have seen how over the past 100 years the response to various policy interventions have dictated the structure and outcomes in the both sectors, this indicates the importance of effective and targeted policies to tackle production (and indeed consumption) to ensure a future evolution of agriculture and industry that is fit for purpose in terms of sustainable development.

Many thanks once again to Professor Cathal O'Donoghue for his perceptive analysis of the Agricultural sector over the past century.

## **DISCUSSION**

**Pat Crowley:** If you look at a longer historical period commencing from the early 18<sup>th</sup> century it confirms Cathal O'Donoghue's thesis of the adaptability of Irish Agriculture. Work by David Dickson<sup>1</sup> charts in significant statistical data the dramatic transformation of sectors of Irish Agriculture to an export focus centred on Cork. He graphs the efforts of Cork Merchants, Protestants and Catholics in opening up diverse markets. The Protestants relying on their links forge ties to supply the East India Company, The British Armed forces, and the Colonies. Dickson<sup>2</sup> quotes Bishop Berkeley brisling with indignation at the emergence of the opulence of the Cork Catholic Merchants. The Catholic Merchants with their long standing networks stretching historically for the Spanish Netherlands, France and Iberia enabling trading of provision there into the West Indies and as far away as Brazil. As an aside Denmark had a small colony in the West Indies growing sugar but lacked a marketing outlet. The Cork Catholic merchant diaspora came on board and controlled this trade.

Farming adapted to the changing market with the emergence of families such as the Tipperary Scully family conducting cattle drives of thousands from Tipperary to the Cork abattoirs like the American West. That family was prominent in banking and politics in the 19<sup>th</sup> century and among their descendants' number Hugh Geoghegan, late Supreme Court Judge.

Cathal O'Donoghue highlights the development of dairying in Ireland after the lifting of milk quotas so Ireland has been able to exploit its comparative advantage in grass fed dairying. This repeats the process from the mid-18<sup>th</sup> century<sup>3</sup> when the Cork Butter Market was the centre of the world butter trade. As the butter trade expanded it brought benefit to the most remote townlands of west Munster through a network of butter merchants and the butter roads. Unfortunately, the strict quality controls that characterised the Cork Butter market lapsed so that by the 1840 it has lost its preeminence to Denmark.

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<sup>1</sup> *Old World Colony, Cork and South Munster 1630-1830*, 2005, Cork University Press and *The First Irish Cities: An Eighteenth-century Transformation*. 2021. Yale University Press

<sup>2</sup> *The First Irish Cities: An Eighteenth-century Transformation*. 2021. Yale University Press

<sup>3</sup> Dickson, *South Munster*, 'The Ascendancy of Grass', p.215