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AN INVESTIGATION INTO THE IMPACT OF POLICY REFORM ON THE LEVEL OF STRUCTURAL CHANGE IN THE AGRI-FOOD SECTOR OF IRELAND, DENMARK AND THE NETHERLANDS

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An investigation into the impact of policy reform on the level of structural change in the agri-food sector of Ireland, Denmark and the Netherlands[i]

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This paper conducts a detailed, micro-focused investigation on the implications of recent agricultural policy changes on the structure of production systems in Ireland, Denmark and the Netherlands in terms of farm numbers, system switching, specialisation, the role of economies of scale, on-farm investment, off-farm employment and economic viability. Given the close relationship between farm structure and agricultural production, the impact of the recent CAP reform on production decisions should give a good indication of the form agricultural structural change will take. Two competing hypotheses of post decoupling structural change are proposed; a 'production inducing effect' and an 'expectations effect'. Using Irish, Danish and Dutch micro-data, which are comparable due to their participation in FADN, a descriptive analysis of the key characteristics of production in the agri-food sectors in each country will be performed using key indicators of structural change. The results indicate that the 'expectations effect', which claims that producers may adopt a 'safety first' strategy and make only minimal changes to production plans in case future payments are reassessed and re-linked to production or an agricultural activity, seems to be prevalent.

Keywords: Policy Reform, Agricultural Structural Change, FADN

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1. Introduction

In response to the financial burden of an enlarging European Community, further pressure on the Common Agricultural Policy (CAP) budget and demands for more liberal world trade in agricultural markets, the Luxembourg Agreement on the reform of the CAP was ratified in 2003 (Hennessy et al. 2005). One of the main objectives of the reorientation of EU agricultural policy is the liberalisation of agricultural markets (Albisser and Lehmann 2007) and so this policy reform finally broke the link between payments to farmers and agricultural production by "decoupling" direct payments from farm products (Connolly 2008). Farmers are now encouraged to base their production decisions on market requirements, rather than attempting to maximise premium income (Carroll et al. 2008). This policy reform essentially allows farmers a greater freedom to switch among alternative systems, without reducing the value of their existing single farm payment entitlements (Clancy et al. 2009). Therefore, the decoupling of direct payments is expected to have major ramifications for aggregate agricultural production, farm practices and the structure of farming (Hennessy and Rehman 2006).

Although structural change is a traditional topic in agricultural economics and a vast literature already exists, research on the impact of policy reforms on farm structural change is less developed. Such knowledge is an essential precondition to predict and to govern structural change in terms of economic, environmental and social objectives (Odening 2009). In order to assess the impacts and sustainability of agricultural policies on all of the above objectives, it is desirable to identify and be able to project the impact of policy on structural change in agriculture. Therefore, the objective of this paper is to conduct a detailed, micro-focused investigation of the implications of recent policy reform on the structure of agricultural production systems in Ireland, Denmark and the Netherlands.

Using the Irish National Farm Survey (NFS) and Danish and Dutch micro-data, a descriptive analysis of the key characteristics of production in the agri-food sectors in each country will be performed using key indicators of structural change. The availability of a comparable survey (FADN[ii]) for the three countries presents a unique opportunity for the Irish experience to be compared to that of similar regions in Europe facing the same set of constraints but with significantly different sectors in terms of structure, organisation and the role of government

[ii] Farm Accountancy Data Network

supports. These differences result from complex interdependencies between sectoral support policies, original farm structure, land market institutions, non-agricultural employment opportunities, technological developments, etc. (Zimmermann et al. 2006).

Zimmermann et al. (2009) note that even recent studies that examine the effect of farm structural change are rather limited in scope and are typically restricted to a subset of farm types and one or very few regions. The Netherlands and Denmark are ideal case studies for regional comparison given their similarities to Ireland in terms of their size and recent economic performance (Carroll et al. 2008) as well as the relative importance of agriculture to their overall economy. These differentiated developments and their determinants are of high relevance for policy impact analysis at the regional level (Zimmermann and Heckelei 2008).

This study will provide valuable lessons for policy by deepening our understanding of the important issues facing the agri-food sector in Ireland at the micro level, such as the scale of farm enterprises (Department of Agriculture, Fisheries and Food 2009), and observing how the Irish experience compares to that of similar European regions. Previous research has indicated that Irish specialist dairy and tillage farms compare favourably in terms of productivity and competitiveness with their counterparts in other EU countries (e.g. Thorne 2005, Thorne and Fingleton 2006). The existence of well established productivity and competiveness indicators for these systems makes them the most appropriate systems for this analysis.

The paper is organised as follows. Section 2 introduces the concept of structural change and the importance of the concept for policymakers and the agricultural sector will be discussed. Section 3 identifies key indicators from the literature that may be used to measure structural changes and outlines the variables taken from the available datasets to conduct the analysis. Section 4 describes the data used in the analysis, while section 5 details the results. Section 6 summarises and concludes.

2. Structural Change

2.1 Definition of structural change

The definition of *structural change* varies depending on the underlying definition of the *agricultural structure* (Zimmermann et al. 2006). Essentially, there are two components: (1) productivity (e.g. Evenson and Huffman 1997, Oehmke and Schimmelpfennig 2004, Kim et

al. 2005) and (2) the structure of the industry (Boehlje 1992, Lin 1994, Hennessy and Rehman 2006). In many studies both are evaluated together, since farm structure is usually not independent of production relationships. The first component of structural change leads to time series and panel data analyses which are extensively covered in the branch of general economics. In agricultural economics, however, the focus of the discussion often lies on changes in the structure of the industry (Zimmermann et al. 2006).

The objective of this research is to provide a descriptive, rather than empirical, analysis of the effects of policy reform on agricultural structural change. Therefore, the component of structural change which relates to the structure of the industry will be focused on in this analysis. The main aspects of structural change analysed in the literature can be summarized under the headings of farm exits, farm growth, and shifts in systems of production. Thus, for the purposes of this analysis structural change is simply defined as the change in the number of farms in different farm types, as classified according to different sizes, systems of production, and degree of specialisation.

2.2 Structural Change and CAP Reform

Connolly (2008) noted that the 1992 MacSharry CAP reforms led to rapid growth in direct payments on Irish farms and a decline in the returns from the market place. The result of this was an increase in Irish farmers' reliance on payments as a source of income (Breen et al. 2005). This policy regime may have had the effect of slowing structural change in the agricultural sector, as it allowed unprofitable farmers to remain in production. These coupled payments also acted as a barrier to farmers switching systems due to the increased risk in foregoing payments from their existing system of production. The likely effect of this was a delay in the economic growth of the production based component of the agricultural sector.

Lin (1994) regarded economic growth as an aspect of the transformation of the structure of production that is required to meet changing demands and to make more productive use of both resources and technology. Given imperfect foresight and limits to factor mobility, structural changes are likely to occur under conditions of disequilibrium, and so the reallocation of inputs from less productive to more productive sectors can lead to economic growth (Lin 1994). It could be argued that the existence of direct payments had a distortionary effect on the European agricultural market, as farmers were basing their production decisions on maximizing their premium payments rather than market requirements (Dunne and

O'Connell 2002). Therefore, the recent CAP reform that introduced decoupling may lead to agricultural growth through loss making farmers exiting the sector, increased specialisation in production and greater economies of scale.

Given the close relationship between farm structure and agricultural production, the impact of the CAP reform on production decisions should give a good indication of the form agricultural structural change will take. While the production effects of decoupled payments are still somewhat of an enigma (Hennessy and Rehman 2006), *ex ante* analysis has focused on two competing hypotheses. Burfisher and Hopkins (2003) have reviewed research that suggests even fully decoupled payments have a 'production inducing effect' as they affect farmers' exposure to economic risk, their access to capital and their future expectations. Alternatively, Revell and Oglethorpe (2003) have explored the 'expectations effect', claiming that producers may adopt a 'safety first' strategy and make only minimal changes to production plans in case future payments are reassessed and again related to production or an agricultural activity.

These production effects may result in very different structural changes. A 'production inducing effect' may lead to larger farm sizes and greater specialisation as economically viable farmers seek to expand, while loss making farmers are likely to exit the sector. This scenario would result in a large structural change post decoupling, with similar levels of total output being produced by fewer, larger farms. If the CAP reform results in a 'safety first' approach being taken by farmers, structural change will continue along pre decoupling levels.

3. Indicators of Structural Change

In this section we propose a number of indicators which will be used to describe the process of structural change in Irish, Danish and Dutch farming, in an attempt to ascertain the extent to which the nature and pace of structural change has changed as a result of the recent CAP reform. Indicators can be thought of as statistical constructs which support decision making by revealing trends in data which subsequently can be used to analyse the results of policy actions (Dillon et al. 2007). We use the literature to identify a number of indicators of agricultural structural change, chosen according to the suitability and availability of data.

A key indicator of structural change in agriculture identified by the literature is **farm numbers** (e.g. Heady and Sonka 1974; Gebremedhin and Christy 1996; Weiss 1999; Frawley

and Phelan 2002; Hennessy and Rehman 2006; Connolly 2008). Farm exits are a precondition for the farm sector to change its structure since the resources of exiting farmers are reallocated among remaining farms (Weiss 1999; Hennessy and Rehman 2006). Therefore a reduction in farm numbers can serve as an indication that structural change is taking place.

The trend towards greater economic concentration in agricultural production (Heady and Sonka 1974) – fewer but larger farms – has been of considerable interest to agricultural researchers (e.g. Gebremedhin and Christy 1996; Frawley and Phelan 2002; Zimmermann et al. 2006; Connolly 2008). If farm numbers are in fact diminishing, the redistribution of exiting farmer's resources should lead to an increase in average **farm size**.

Although structural change is understood in a broad sense, it goes far beyond the change in the number and size of farms and encompasses factors such as changes in production structure and system (Odening 2009). Dillon et al. (2008) found that although the economic viability of Irish agriculture was generally in decline over the 1996-2006 period, when individual farming systems are taken into account, some are found to perform better than others. Since payments were coupled to production at this time, it was difficult for a farmer to leave/switch their system of production as they risked losing their premium. Under the Luxembourg Agreement this risk has been eliminated so it is hypothesised that there will be an increase in the degree to which farmers are **switching systems**.

The degree of specialisation on farms is a structural dimension that is heavily emphasized in the literature (e.g. Heady and Sonka 1974; Boehlje 1992; Evenson and Huffman 1997; Gebremedhin and Christy 1996; Zimmerman et al. 2006; Carroll et al. 2008). Changing economic and political conditions as well as dynamic processes within the agricultural sector lead to a continuous redistribution of resources between farms and to changes in production systems on farms over time. This type of structural change can be characterized by increased **specialisation** (Zimmerman et al. 2006).

The increased concentration of production in agriculture is partly as a result of economies of size (Gebremedhin and Christy 1996). Economic theory suggests that the decoupling of payments should reduce production levels to a level that would exist without subsidies. The production on farms making a market-based loss should therefore fall substantially unless significant cost management or efficiency gains are achieved (Hennessy and Rehman 2006).

Tweeten (1984) has observed that economic pressures on farming means that the size of farms in systems where increasing economies of scale still exist has increased and therefore there is a continual impetus for larger farms. It is hypothesised here that larger farms will benefit from **economies of scale** through better cost management and so may increase production in response to CAP reform.

Given that a period of low investment can lead to a weakening of the process of structural change whereby the old is replaced by the new (George et al. 1992), the level of **on-farm investment** can serve as an indicator of the degree of agricultural structural change taking place post decoupling. Hennessy and O'Brien (2007) found that farm investment increased in the 1995 – 2005 period despite decreasing farm incomes. Decoupled payments relax the household's capital constraint, lowering the cost of capital to the household, and so Andersson (2004) predicts that farm investment is likely to be greater post-decoupling.

The incidence of part-time farming in particular will require examination as it has become increasingly common in recent times (Weiss 1999). It has shaped, and will continue to influence, the course of structural change in the agricultural sector (OECD 1978). Indeed, off-farm employment by farm operators appears to be a feature of the permanent restructuring in farming throughout the developed world (Pfeffer 1989). However, Kimihi and Nachlieli (2001) note the natural process of structural change in farming is often inhibited as farmers choose to supplement low farm income with off-farm earnings rather than exit the sector.

The reliance of farm households on off-farm employment to supplement their income seems to be a growing phenomenon in Irish farming (Keeney and O'Brien 2008). Increasing non-farm wages and restricted farm incomes have affected the relative earnings from activities on and off the farm and thus have resulted in increasing numbers of farmers working off-farm (Keeney and Matthews, 2000). The implementation of agricultural policies may also affect farm incomes and may determine participation in the off-farm labour market (O'Brien and Hennessy 2006). Hennessy et al. (2005) suggest that the decoupling of direct payments is likely to result in a significant decline in the marginal value product of farm labour, which could possibly lead to a consequent shift of labour out of farming. The smaller attention to farming can reduce the farming motivation, the productivity of the farm and increase the probability of exit (Kazukauskas et al. 2009). Thus, **off-farm employment** can be used as an indicator of agricultural structural change.

The Agri-Vision 2015 (Department of Agriculture and Food 2004) report concluded that the number of economically viable farm businesses is in decline and that a large number of farm households are sustainable only because of the presence of off-farm income (O'Brien and Hennessey 2006). Dillon et al. (2008) suggest that the decoupling of payments from production raised questions regarding what the future holds for particular sections of Irish farming with the potential phasing out of payments in the long run. Therefore, it is important to analyse the effect that structural change has had on the **economic viability** of farms.

The indicators used to analyse agricultural structural change as a result of recent policy reforms are summarised in Table 1.

[INSERT TABLE 1 ABOUT HERE]

4. Data

The FADN is a European system of sample surveys conducted annually to collect structural and accountancy data on farms. According to Council Regulation 79/65/EEC (Office for Official Publications of the European Communities 1965), it has the aim of monitoring the income and business activities of agricultural holdings and evaluating the impact of the measures taken under the CAP. The micro-data from the individual countries is weighted to make the sample data representative of their national farming population. The FADN ensures that the micro-data from national surveys is harmonised by ensuring that the bookkeeping principles are the same in all countries.

The method of classifying farms into farming systems used in each survey is based on the EU FADN typology set out in the Commission Decision 78/463 (Projet de Decision de la Commission.1992) and its subsequent amendments. The farm system variable is broken down into six different categories as follows: Dairying, Dairying and Other, Cattle rearing, Cattle Other, Mainly Sheep and Tillage Systems. These system titles refer to the dominant enterprise in each group and another enterprise could also be present on the farm. Therefore the results presented for a given farm system should not be confused with those of individual farm enterprises.

It should also be noted that the FADN excludes micro farms, defined as less than a threshold Economic Size Unit (ESU), the scale of which varies by country depending on the underlying

structure. Specialised farms, which produce a small proportion of overall agricultural output, are also excluded, with the systems again depending on the country in question. Therefore, the total number of farms represented in this analysis is less than that reported in the individual countries Farm Structure Survey.

5. Results

5.1 Farm Numbers

The decline in farm numbers has been an on-going process contributing to the changing structure of Irish agriculture over the last century and is similar to trends in all developed economies (Connolly 2008). Figure 1 presents the total number of specialist dairy and tillage farms in Ireland, Denmark and the Netherlands during the period 2002 – 2006.

[INSERT FIGURE 1 ABOUT HERE]

This figure shows that total specialist dairy and tillage numbers in all three countries have declined in the period examined, with the exception of specialist tillage farms in Ireland. Although still large in number, the decrease in Irish specialist dairy farm numbers is the lowest in magnitude. The largest proportional decrease was experienced in Denmark. However, this can not be explained solely by the much smaller number of specialist dairy farms that existed in 2002 relative to Ireland and the Netherlands, as Denmark also had the largest fall in actual numbers.

The decline in numbers has not been as large on specialist tillage farms, with the decrease in Denmark in particular being relatively nominal. As highlighted, the exception to these decreases was the extremely large increase in the number of Irish specialist tillage farmers during the period examined. This is likely as a result of the extremely low number of farmers who were engaged in this enterprise in 2002.

As mentioned, farm exits are an important component of agricultural structural change since it leads to a reallocation of land among the remaining farms. The reduction in farm numbers in all three countries, particularly in the specialist dairy system suggests that this reallocation is occurring, although at a slower pace in Ireland. This may indicate that productivity enhancing reallocations may take longer to realise in the Irish agricultural sector than in the Danish or Dutch sectors. The movement of milk quota between Irish producers is relatively restricted

when compared to their counterparts in Denmark and the Netherlands, where a freer market for milk quota exists. Therefore, restrictive quota transfer policies may be one reason for the slow pace of structural change on Irish specialist dairy farms (Donnellan et al. 2009).

5.2 Specialisation

The share of total agricultural output in 2002 and 2006 that is attributable to each sector is detailed in Table 2.

[INSERT TABLE 2 ABOUT HERE]

Livestock and livestock products are by the far the most important components of Irish agriculture. Although still very significant, the proportion of total agricultural output from livestock and livestock products in Denmark and the Netherlands is still far below that of Ireland. By further disaggregating livestock, it is apparent that dairy and beef production are of particular importance to Irish agriculture. While dairy production was also a large contributor to total agricultural output in Denmark and the Netherlands in 2006, the share of dairy in overall output is declining in all three countries over the period examined. As dairy production is largely fixed given quotas, this fall in the sectors proportion of overall agricultural output may be due to a milk price effect rather than an increase in total output attributable to other sectors.

Crops and crop production contribute a far greater proportion to total agricultural output in Denmark and the Netherlands than they do in Ireland. However, this may be as a result of the greater amount of horticultural production in the Netherlands and Denmark, with the tillage crop sectors of roughly similar importance. Pig production, which is very important to Denmark and to a lesser extent the Netherlands, makes a minimal contribution to total agricultural output in Ireland.

5.3 System Switching

Figure 1 showed that there was a decline in the number and percentage of farms in all three countries specialist dairying systems. This may seem surprising given the generally large incomes that Irish dairy farmers in particular generate relative to drystock farmers. However, increased specialisation in the dairy sector may be playing a role here as, assuming the full milk quota allocation is filled, the same amount of output is being produced by fewer farmers. Therefore, this may be regarded as further evidence of increased specialisation rather than

system switching per se. The proportion of farmers engaged in crop production remained relatively static during the period examined. Given the limited amount of arable land available in all three countries, it may be the case that all areas suitable for crop production are already engaged in this system or a similarly high income generating enterprise.

Breen et al. (2008) discuss several reasons as to why loss-making farmers may not respond to decoupling by reducing or ceasing production. One such reason is that a demographic lag may exist, as the age structure of the beef farming population is skewed to the older side of the distribution. It is therefore possible that many older farmers may choose to continue their current production regime rather than changing at such a late stage of their lifecycle. A likely factor in the reduction in dairy numbers is the high overhead and sunk costs as well as the amount of labour required for dairy systems. Hennessy (2004a) found that traditionally there has been a very low incidence of cattle farmers switching into dairy farmers mostly due to the prohibitively high start up cost of acquiring quota and building milking facilities.

5.4 Role of economies of scale

The average size of specialist dairy and tillage farms in Ireland, Denmark and the Netherlands is considerably higher than the EU-25 average for both farm types of 15.8 ha and 20.2 ha respectively. The change in the number of specialist dairy and tillage farmers by farm size for Ireland, Denmark and the Netherlands during the period examined is presented in Table 3.

[INSERT TABLE 3 ABOUT HERE]

While there has been little movement in the proportion of Irish farmers in the different farm size categories there is some evidence of a general increase in the scale of operations with a greater proportion of farms with greater than 30 ha in 2006 compared with 2002. Coupled with this, however, we see a slight increase in the proportion of farms in the smallest size grouping (<10 ha) suggesting that as well as the scaling up of activities we are also observing some scaling down or even exits from farming. The shift towards larger farm sizes in Denmark and the Netherlands has been much more pronounced. Of particular note is the increase in scale witnessed in Denmark, despite the very high proportion of farms already of a large size in this country in 2002. We do not find any strong evidence to support a scaling down of activities in the Netherlands and only a very slight increase in the proportion of farms in the smallest size category was witnessed in Denmark.

In order to assess the role of economies of scale in the structural change of specialist dairy and tillage farms in Ireland, Denmark and the Netherlands, cost to output ratios are calculated and disaggregated by farm system and size. The hypothesis here is that farms with a lower cost to output percentage, which can be thought of as a partial productivity indicator, will be able to generate a greater income and so would be more likely to stay in agricultural production. The results for specialist dairy and tillage farms in all three countries are presented in Figure 2, with the breakdown of the results by farm size included in Table 4.

[INSERT FIGURE 2 ABOUT HERE]

The overall average cost as a percentage of output fell on both Irish and Dutch specialist dairy and on all three countries tillage farms in the period examined. In an Irish context, this result may reflect the findings of Carroll et al. (2008) who noted that higher levels of specialisation led to higher efficiency levels in the dairy and tillage sector. However, it is important to bear in mind that this decrease may be attributable to price movements. Therefore, it would be an improvement in profitability rather than an improvement in cost efficiency (Oude Lansink 2009). Denmark on the other hand experienced an increase in the average cost as a percentage of output on specialist dairy farms. This was surprising as these farms had a high ratio at the beginning of the period examined and so appeared to have much room for improvement.

[INSERT TABLE 4 ABOUT HERE]

The results in Table 4 indicate that there are indeed advantages to be gained from economies of scale in Ireland and the Netherlands. A higher cost to output ratio is evident on Irish specialist dairy and tillage farms in the smaller size categories. In particular, the extremely large increase in the cost to output ratio for the smallest farm size indicates that there may not be a viable future for farms of this size. The decrease in the percentage of costs to output in the largest size categories in both countries further emphasises the benefits from economies of scale that larger farm sizes can use to their advantage. Carroll et al. (2008) found that increasing returns to scale were prevalent in the Irish dairy and tillage sectors. This suggests that although economies of scale may exist in Irish agriculture, they are not being taken advantage of. This is highlighted by the fact that from 1996 – 2006, only the dairy sector showed notable improvements in scale efficiency (Carroll et al. 2008).

This analysis found little evidence of economies of scale on Danish specialist dairy and tillage farms, with an increase in the percentage of costs to output in every size category. This was

unexpected given the cost and scale efficiency improvements noted on organic dairy farms in Denmark from 2002 – 2004 (Sauer and Park 2009). Rasmussen (2007) points out that growth on Danish dairy and tillage farms has been limited by the EU milk quota as well as access to land and legal regulations concerning ownership of land. This restricted access to land resulted in a high elasticity of size, which indicates a high potential economic benefit from an increase in farm size. Therefore, it was highly surprising that this analysis did not uncover signs of economies of scale on specialist dairy and tillage farms in Denmark.

5.5 On-farm Investment

The FADN records both gross and net new investment. Net new investment is defined as investment (including both purchase and repair) in buildings, land improvements, machinery, and production quotas, less all sales, grants and subsidies. The net new investment measure does not include land purchases. It is a very suitable definition of farm investment as it excludes all grants and subsidies and therefore accounts for only 'actual' investment. Furthermore, the exclusion of investment in land purchases means that it does not include any potentially speculative investment, such as farmers buying land with the intention of re-selling for a profit (Hennessy and O'Brien 2007). Therefore, it is net new investment that is used as an indicator of agricultural structural change in this analysis.

The levels of investment as a percentage of gross output on specialist dairy and tillage farms in Ireland, Denmark and the Netherlands from 2002 – 2006 are presented in Figure 3.

[INSERT FIGURE 3 ABOUT HERE]

Although there was an increase in the level of investment over the time period examined, there is considerable variation in the year on year levels invested, with the Netherlands appearing particularly volatile. On Irish and Danish specialist dairy and tillage farms there was a roughly linear upwards trend in investment from 2002 to 2005 with an above average increase in 2006. This may be an indication that the introduction of the Single Farm Payment in 2005 had a positive effect on the decision of these farmers to invest, with changes being made in order to be prepared for the post decoupled era. However, this can only be clarified once additional years of data become available to see if these higher levels of investment are sustained or whether it was a once off increase.

It is apparent from Figure 3 that high levels of on-farm investment took place in the Netherlands during 2004 and 2005. Given that the majority of this investment was in the 'land improvement' category, a decrease in Dutch land prices of approximately 20% between 2001 and 2004 may have encouraged this higher level of investment (Oude Lansink 2009). However, given that this increased investment came at a time of decreased output for the Dutch tillage sector, it is difficult to explain this increase without a policy change factor. Therefore, the increased investment experienced may have been financed in part by the sale of sugar quota, which was rife during this period due to the impending revision of EU sugar policy post 2006 (Oude Lansink 2009).

5.6 Off-farm employment[iii]:

The level of off-farm employment by the farmer and/or his/her spouse on specialist dairy and tillage farms in Ireland and the Netherlands in the period examined is outlined in Table 5. By far the largest increases in off-farm employment occurred on Irish specialist tillage farms. Irish specialist dairy farms also experienced a large increase in off-farm employment during this period, which is unsurprising given that they had the lowest levels in 2002. Furthermore, there appears to be room for future increases with only half of Irish specialist dairy farms being supplemented by off-farm employment.

[INSERT TABLE 5 ABOUT HERE]

There was also an increase in the level of off farm employment on specialist dairy and tillage farms in the Netherlands over the period examined. Both specialist dairy and tillage in the Netherlands are almost at full capacity and so it is to be expected that the scope for further levels of increase is not as great as it is in Ireland. It is important to note that the restructuring of farm labour towards increased levels of off-farm employment is not just attributable to policy reform, but rather a combination of both push and pull factors. Diminishing margins, unaffordable expansion, rising living and production costs (Hennessy 2001), as well as the decoupling of payments (Hennessy 2004b), may push farmers to seek off-farm employment. Simultaneously, the lure of both higher and faster increases in off-farm incomes pulls farmers towards off-farm employment (Hennessy 2001). This was particularly true in Ireland as the period examined in this analysis coincided with a property boom, with a large percentage of farmers being employed in the construction sector (Behan and O' Brien 2008).

[iii] Denmark is omitted from this section of the analysis due to the unavailability of off-farm employment data

5.7 Economic Viability[iv]:

Based on the work of Frawley and Commins (1996), Hennessy (2004a) and Dillon et al. (2008), an economically viable farm is defined as having (a) the capacity to remunerate family labour at the average agricultural wage[v], and (b) the capacity to provide an additional 5 per cent return on non-land assets. Farms that are not economically viable but where the farmer and/or spouse participate in off-farm employment are classified as sustainable. Although these farms are not economically viable as businesses, the farm household may be sustainable in the longer term due to the presence of an off-farm income. Non-viable farms where neither farmer nor spouse is involved in off-farm employment are considered economically vulnerable. Due to the poor economic return on these farms and the lack of any other gainful activity, the farm business is unlikely to be sustainable in the longer term (O'Brien and Hennessy 2006).

The percentage of viable specialist dairy and tillage farms in Ireland and the Netherlands[vi] during the period examined are shown in Figure 4 below. There has been a substantial increase in the percentage of tillage farms being classified as economically viable over the examined period. In contrast the change in the percentage of economically viable specialist dairy farmers has been much smaller with the exception of 2005 when a significant increase was seen in both Ireland and the Netherlands. The largest level of increase was recorded amongst Dutch specialist tillage farmers. This may be as a result of the lower level of viability on these farms in 2002 compared to their Irish counterparts.

[INSERT FIGURE 4 ABOUT HERE]

6. Conclusion

Structural change in agricultural production as a response to economic and technological adjustments is not a temporary phenomenon (Gebremedhin and Christy 1996). The decline in

[iv] The economic viability and sustainability of specialist dairy and tillage farms in Denmark could not be calculated due to the unavailability of farm income and off-farm employment data

[v] In the absence of an average Irish agricultural wage, the minimum wage for agricultural workers as set by the Labour Court annually is used here

[vi] No agricultural minimum wage or specialist labour courts operate in the Netherlands, and so in their absence, the Dutch minimum wage was used

farm numbers in particular has been an on-going process in Ireland over the last century and is similar to trends in all developed economies (Connolly 2008). That structural change is taking place in agriculture is therefore not in doubt. Rather, the issue this paper aims to address is whether or not the nature and speed of structural change in agriculture has changed as a result of recent policy reforms.

The previous policy regime of direct payments may have had the effect of slowing structural change in the agricultural sector as it allowed unprofitable farmers to remain in production. These coupled payments also acted as a barrier to farmers switching systems or specialising in production due to the increased risk in foregoing payments from their existing system of production. The policy reforms implemented under the Luxembourg Agreement essentially encourages farmers to base their production decisions on market requirements, rather than attempting to maximise premium income (Carroll et al. 2008), and so is expected to have a major impact on agricultural structural change in the EU (e.g. Breen et al. 2005; Hennessy and Rehman 2006).

This analysis has found that the recent CAP reform has thus far had little effect on structural change on Irish, Danish and Dutch specialist dairy and tillage farms. Long run trends related to the changing structure of these systems have continued following decoupling with little evidence of a change in the nature or pace of these changes. This is in agreement with the results of Breen et al. (2005), who found from a survey of production plans post-decoupling that the majority of Irish farmers intend to continue with the same production patterns as before the policy reforms. Therefore the production effect of the recent policy reform hypothesized by Revell and Oglethorpe (2003) called the ‘expectations effect’ seems to be prevalent. This claims that producers may adopt a ‘safety first’ strategy and make only minimal changes to production plans in case future payments are reassessed and re-linked to production or an agricultural activity.

It should be noted, however, that our analysis is based on only two years of data post decoupling. It is possible that over time we may observe the types of changes in farm behaviour that economic theory suggests. It should also be acknowledged that other policy changes, along with external market factors such as high food prices, may have had an effect on farmer’s reactions to decoupling. For example, in Ireland the Farm Waste Management Scheme and Farm Improvement Scheme may have encouraged farmers to undertake long-

term capital investments, that they possibly would otherwise not have made, that may make them less likely to change behaviour in the short to medium term. Moreover, in this paper part of our focus is on specialist dairy farms, arguably the least likely to react to decoupling, given that they are generally the most profitable and had the smallest proportion of income coming from payments.

Although it does not appear that the CAP reform has resulted in an increase in the pace of agricultural structural change, it should be noted that significant changes continue to take place as part of a longer-term process. In particular, the continuing fall in farm numbers and increasing farm sizes and specialisation in all three countries proves that a reallocation of agricultural resources is occurring. The result of this has been an increase in the number of economically viable farms. This analysis finds that structural change is taking place at a slower pace in Ireland compared, at least, with Denmark and the Netherlands. This may serve as an indication that productivity improvements as a result of structural change may take longer to occur in the Irish agricultural sector than in the Danish or Dutch sectors.

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8. Tables and Figures:

Table 1: Indicators of Structural Changes

Structural Change	Indicator	Measurement Unit
Farm Exits	Farm Numbers	% reduction in total farm numbers
Production	Specialisation	% of gross output attributable to each system
Economies of Scale	Farm Size	% of farms in each size category
	Costs to Output	% input costs to total gross output
Investment	Income to Investment	% of farm income re-invested on the farm
Off-farm Employment	Off-farm Employment	% of farms with holder or spouse with off-farm employment
Economic Viability	Economic Viability	% of economically viable farms
	Economic Sustainability	% economically sustainable farms
	Economically Vulnerable	% of economically vulnerable farms

Table 2: Agricultural Specialisation 2002 – 2006, as measured by the percentage of total gross output contributed by each sector on all farms nationally

	Ireland		Denmark		The Netherlands	
	2002	2006	2002	2006	2002	2006
Gross Output €						
Crops	10.4	10.1	27.7	29.8	51.1	50.6
Dairy	42.3	37.6	20.3	16.2	20.4	17.9
Beef&Veal	30.4	37.6	3.6	3.9	1.8	2.8
Pig Meat	2.4	3.2	35.5	29.7	12.5	11.7
Sheep&Goats	9.4	7.6	0.0	0.1	0.5	0.4
Other Output	3.3	3.4	5.0	7.0	5.5	7.9

Source: FADN

Table 3: Farm Size Distribution 2002 – 2006, as measured by the number of farms in each size category (hectares)

		2002	2003	2004	2005	2006
<10	Ireland	723	777	1439	1137	1155
	Denmark	64	33	26	53	131
	Netherlands	20019	18757	13493	14309	13737
10<20	Ireland	3606	3284	2969	2406	2358
	Denmark	238	165	65	53	54
	Netherlands	14007	10715	12441	9490	9442
20<30	Ireland	4318	4304	4030	3584	3366
	Denmark	493	440	314	268	261
	Netherlands	12587	12151	12953	13015	10593
30<50	Ireland	7188	6925	7176	7057	7115
	Denmark	1544	1362	1068	794	850
	Netherlands	12701	14276	14167	14037	14403
50<100	Ireland	4582	4435	4899	5459	5732
	Denmark	5159	4805	4007	3574	3016
	Netherlands	8552	8103	9206	9071	9714
100+	Ireland	789	798	814	949	894
	Denmark	4605	4630	5296	4897	4872
	Netherlands	1544	1844	2185	2528	2293

Source: FADN

Table 4: Input Costs to Total Output 2002 – 2006, by Farm Size

		2002	2003	2004	2005	2006
<10	Ireland	73.1	74.2	74.0	77.3	81.9
	Denmark	87.9	91.9	90.5	77.7	79.2
	Netherlands	89.7	92.1	92.3	90.8	88.6
10<20	Ireland	68.9	63.8	63.0	58.3	71.6
	Denmark	79.8	107.1	89.9	105.1	76.9
	Netherlands	97.7	96.1	93.1	88.5	87.2
20<30	Ireland	61.7	64.2	64.2	68.6	70.4
	Denmark	80.5	94.6	83.4	93.5	85.9
	Netherlands	90.9	92.6	95.5	86.1	87.5
30<50	Ireland	66.3	63.5	62.5	59.2	63.6
	Denmark	84.1	81.3	94.4	89.7	89.2
	Netherlands	86.9	89.9	89.0	81.5	86.2
50<100	Ireland	69.7	67.7	65.1	63.3	64.9
	Denmark	82.1	81.9	86.0	84.7	83.8
	Netherlands	86.3	86.7	88.0	79.8	81.9
100+	Ireland	76.1	71.2	77.1	73.0	71.9
	Denmark	87.0	84.7	86.9	88.2	85.2
	Netherlands	85.4	82.5	89.1	82.5	74.3

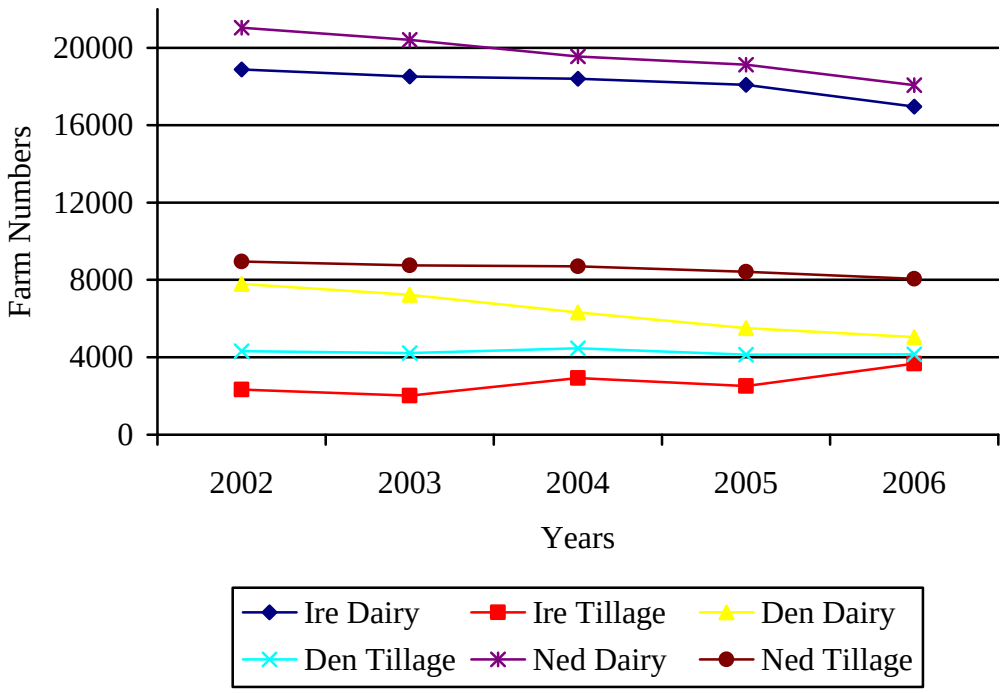
Source: FADN

Table 5: Off-farm Employment

	2002	2003	2004	2005	2006
Ire Dairy	38.6	45.1	50.5	48.9	49.9
Ire Tillage	52.9	72.8	73.8	63.2	73.7
Ned Dairy	86.1	90.7	88.8	88.9	94.0
Ned Tillage	79.5	82.7	89.7	93.8	92.7

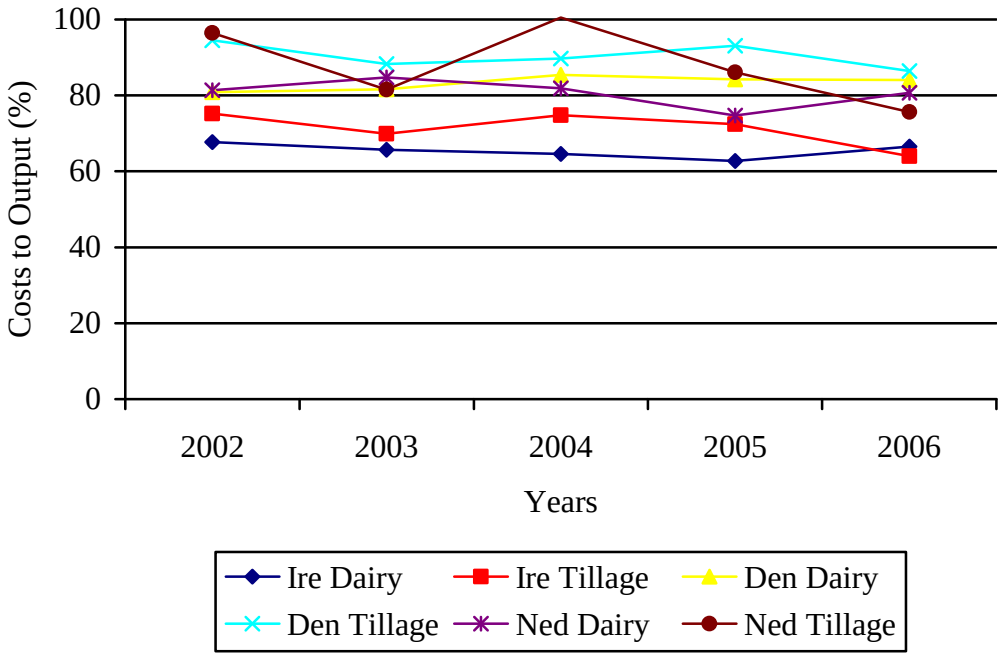
Source: FADN

Figure 1: Number of Specialist Dairy and Tillage Farmers



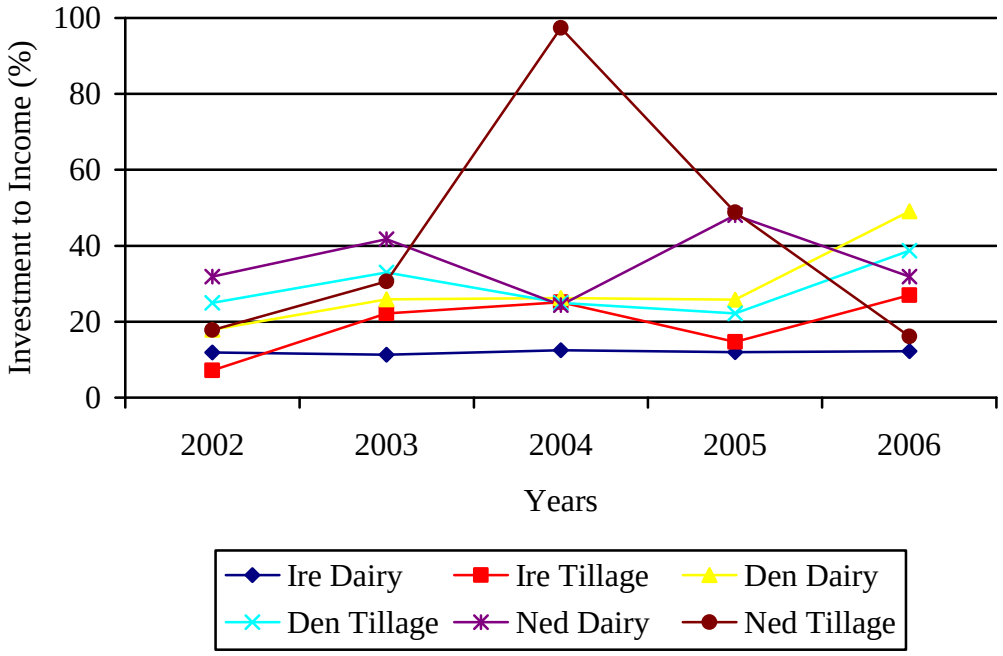
Source: FADN

Figure 2: Input Costs to Total Output by Farm Type



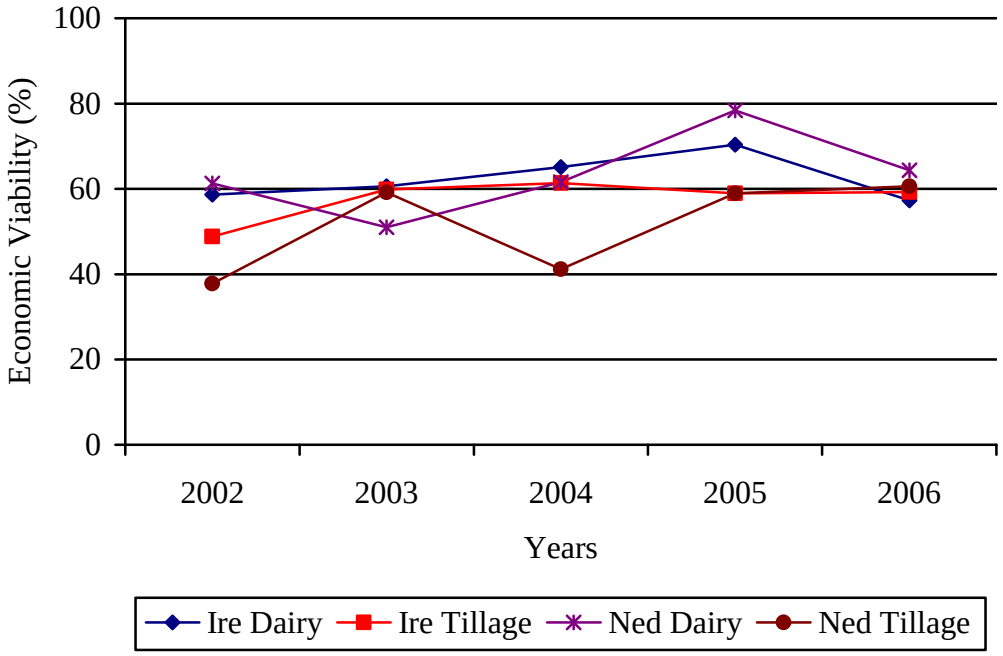
Source: FADN

Figure 3: Investment to Output Ratio



Source: FADN

Figure 4: Economic Viability



Source: FADN