Intensify, diversify, opt-out: testing farmer stated intentions to past and future CAP reform scenarios

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Abstract

A series of studies have explored the future intentions of farm households to reforms of the Common Agricultural Policy (CAP). This paper explores the intentions of Scottish livestock farmers under proposed reforms and, using the path dependency model, estimates the effect of past decisions on determining future intentions. A large representative telephone based survey of livestock farmers was conducted over the Summer of 2013. This yielded a response rate of 1,764 observations from livestock based holdings in Scotland. A multinomial logistic regression was used to estimate the influence of various factors on either increasing or decreasing activity in agricultural and non-agricultural related areas.

Whilst hypothesised increases in payment will lead to an intention to increase activity, a reduction in payment, in some cases, also leads to stated increases in activity both in agricultural and non-agricultural enterprises. We find that the most powerful predictors of change are response to past reform, farmer age and the identification of a successor within the farm household. This latter variable is highly significant and may negate concerns over uncertainty within short-term policy planning scenarios. Overall we argue for more appreciation of longer term trajectories of change at the farm level.

Key words: Farmer intentions; Common Agricultural Policy; Path Dependency; Multinomial logistic regression

JEL code Q18; Q15; D81;

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1.0 Introduction

The Common Agricultural Policy (CAP) is currently undergoing a period of reform. Indications are that further conditions are required for farmers to receive a payment and a tightening of cross-compliance may incur restrictions on grassland management and crop planning (HCEFRAC, 2012). Whilst ambitions for a more ecological focus have been explicit in the reform documentation for a number of years (European Commission, 2013), the consequences of adoption and translation to the national level are still to be understood. For the bulk of its existence the CAP has tended to continue along a pathway of support for output expansion (Skogstad and Verdum, 2008; Burrell, 2009). The "MacSharry Reforms" reflected a greater desire to constrain excess supply and this has developed into a more explicit aim to support multifunctional activities. The most recent change, in 2003, the "Fischler Reform", proposed a payment model which could be 'fully decoupled' from production related activity. Payment was calculated on a reference period and eligibility criteria were established for farmers to receive the Single Farm Payment.

Releasing farmers from the requirement to produce led to a range of studies focused on the possible response of farmers (Rickard, 2004; Tranter et al., 2007; Sorrentino et al., 2011), with the emphasis on intentions to reduce agricultural production (Gorton et al., 2008; SAC, 2008) or to exit from the industry itself (Breen, 2005; Maye et al., 2009; Bougherara and Latruffe, 2010). Generally these studies find a strong influence of CAP reform on future pathways for the industry. This is not surprising given the high average proportion of total farm income which comes from EU support (EC, 2014). Accordingly, uncertainty from the reform process and future payment rates must affect decision-making (Dibden and Cocklin, 2005, Lobley and Butler, 2010). The current reforms should be no different, especially as the basis of payment, away from historic reference periods, would be the most tangible output of CAP payment administration.

Uncertainties from policy reform must be contrasted with the range of external and internal influences which affect farmer decision-making (Beal 1996; Fleisher 1990; Hardaker, Huirne and Anderson 1997; Ahearn *et al.,* 2005; Harrington, 2005; Gallerani *et al*., 2008; Viaggi *et al*., 2011). The farm planning horizon is therefore affected by the whole spectrum of social networks, information provision and regulation, in addition to other short-term uncertainties centred on the weather, economic shocks and disease management (Binswanger and Sillus, 1983; Backus *et al*., 1997; Smit and Skinner, 2010; McRoberts *et al*., 2011; Kristensen & Jakobsen, 2011; Barnes and Toma, 2012; Islam *et al*., 2013).

Nested within these uncertainties are the farmer pathways and the influence of direct support payments on shifting planning pathways (Kay, 2003; Wilson, 2007). A number of studies provide conceptual models for the influence of various factors on enabling change within agriculture, whereas others have explored farmer intentions to CAP reform (e.g. Lobley and Potter, 2004; Bougherara and Latruffe, 2010; Latruffe *et al*., 2013). The purpose of this paper is to explore the influence of subsidies on future intentions, contrasted against a range of internal and external factors. This is conducted through a survey of livestock farmers within Scotland conducted with respect to the reform of the CAP in 2014. These future intentions range from intensifying and expanding production, to off-farm investment and selling up.

Accordingly, this paper is structured as follows. The conceptual approach is presented in the next section to outline the basis of past studies and how it informs this exercise; then the process of data collection and analysis is presented, this is followed by results and discussion of the implications. We conclude with implications for future research and policy.

2.0. Conceptual Framework

Farmers have the option of a range of management trajectories which may remain within or steer them away from the present farming business environment. A number of authors have conceptualised the transition process in farm planning (Kay, 2003; Wilson, 2008; Sutherland *et al*., 2012). Wilson (2007) argued that transition "is non-linear, heterogeneous, complex and inconsistent, and therefore somewhat unpredictable", whereas Sutherland *et al.* (2012), argue for smoother levels of transition which are dictated by the influence of past decisions, namely path-dependency.

The purpose of this paper is not to empirically test these frameworks but to explore the influence of a range of factors, or enablers, in determining the magnitude of change within a planning trajectory. Consequently, stated intentions may be an option for investigating the influence of various factors on changing trajectories. Studies have explored farmer stated intentions towards policy change (Gorton *et al,* 2003; Tranter *et al*., 2007; Gorton *et al*., 2008; Lobley and Butler, 2010) using survey based techniques and then applied econometric modelling approaches to understand the magnitude of influences.

Intentions can include intensifying or extensifying present agricultural activity (Breen *et al*., 2005; Brady *et al*., 2009; Bougherara *et al*., 2010); diversifying agricultural and non-agricultural activities (Lobley and Potter, 2004; Meert *et al*., 2007; Maye *et al*., 2009; Tate et al., 2012; Clancy *et al*, 2011), changing investment or allocation of land into ecosystem services (Schmid and Sinabell, 2003; Schmid *et al*., 2007; Ribeiro *et al*., 2014; Bartolini and Viaggi, 2013) or even withdrawal from agricultural or land based activity itself (Gallerani *et al.*, 2008; Latruffe *et al*., 2013; Brady *et al*., 2009; Mishra *et al*., 2010; Viaggi *et al*., 2011). Table 1 identifies the range of options for farmer pathways, which classifies a number of major options of behavioural responses.

Table 1: Categories of observable activity choices within farmer pathways

Enabling factors, such as access to capital, training and information, as well supply chain relationships will determine the parameters of the trajectories on the farm. Consequently, it is difficult to disentangle the effect of the Common Agricultural Policy on transition change from other events, such as the introduction of new enabling technologies and national regulatory change in, for example land tenure (Baldcock *et al*., 2002; Giannoccara and Berbel, 2013). However, an extensive range of factors have been explored to explain transition change and activity choices within farming. The majority include socio-economic, age and education status (Gorton *et al*., 2008; Raggi *et al*., 2013; Lobley and Butler, 2010; Defrancesco *et al*., 2008), farm size (Raggi *et al*., 2013; Latruffe *et al*., 2013), land tenure status (Maye *et al*., 2009; Bartolini and Viaggi, 2013), membership of agri-environmental schemes (Wilson and Hart, 2000; Guillam and Barnes, 2012), biophysical and regulatory factors (Douarin *et al*., 2007; Barnes *et al*., 2009; Latruffe *et al*., 2013) and identification of succession (Iibery, 1978; Potter and Lobley, 1996; Errington, 1998; Wilson, 2008; Burton and Walford, 2005; Lobley *et al*., 2010).

Only a limited amount of literature has aligned policy reform with future intentions (Gorton *et al*, 2003; O'Donnel *et al,* 2011; Lautruffe *et al.,* 2012) and the previous Fischler Reforms in 2003 provide a precedent for the impact on how farm trajectories have been affected by instituted reforms. In addition, the effect of changing levels of payment have only merited a nominal number of studies, for instance only Latruffe *et al*. (2013) and Giannocaro and

Berbel (2013) explored the influence of complete payment removal on the intention to exit the industry.

The majority of studies outlined above have focused on analysing the stated intentions of farmers. However, this is recognised as a contentious area by a number of authors, as these stated intentions under hypothetical scenarios may not lead to the same behavioural outcomes (Viaggi *et al*., 2011; Latruffe *et al*., 2013). Gorton *et al*, (2008) offer compelling evidence from follow-up surveys, which match those of farmer stated intentions (Tranter et al., 2007). However, these reflect only a short time frame, and studies with longer planning horizons may be expected to have an increased variance between stated intentions and actual behaviour. Accordingly, following the discussion above concerning farm pathways, we would expect responses to past reform to be a predictor of future intentions as it reflects some form of policy 'lock-in' (Kay, 2003; Wilson, 2008; Sutherland *et al*., 2012). This study therefore extends the literature by firstly testing the influence of past reform on future intentions and explores a range of farming and non-farming options, as well as the influence of payment reform on these options. The next section outlines the survey instrument and date collected and describes the analysis method chosen.

3.0 Data and methods

3.1. Data

A telephone based survey of Scottish agricultural holdings was conducted over the Summer of 2013. A spatially representative sample of 10,000 holdings was selected using information from the June Agricultural Census on region, activity, size and farming enterprise. For a large scale survey this data source is the most appropriate as it gives national level coverage and detailed information on activity for ensuring representativeness, however it, like most Government agricultural data, has limits in terms of minimum size requirements of holding represented (SG, 2012). Business holdings with less than 0.5 standard labour requirements are discounted from the Census. Whilst this does not historically reflect those affected by CAP payment regimes, some reform scenarios for the 2014-2020 period have proposed extending the criteria for eligibility to include these smaller units (EC, 2013). Consequently, whilst we are confident that we can capture the majority of future intentions, there may be some bias with respect to under representation from farms classified as 'very very small'. However, inclusion of these marginal units is also a wider issue for Government and European data collection agencies if the CAP were to increase eligibility for these holdings.

The basis of the questionnaire was developed from past surveys conducted within the Scottish sector (Barnes et al., 2009; Barnes and Toma, 2012). The questionnaire had a number of sections, namely i) socio-economic and demographic factors; ii) farm related structural factors; iii) current levels of activity and payment levels; iv) proposed intentions in 2020; v) hypothetical subsidy scenarios, namely increasing payment by 25% and decreasing payment by 25%. A further scenario related specifically to farmers not currently receiving a subsidy and their activity and intentions if they were to receive payment. Finally, attitudes towards the ease of changing activities were explored.

The four behavioural responses outlined in Table 1 were further translated into 12 possible intentions related to exiting the business, changing the size of the business, the commodities produced, the intensity of production, the level of labour, as well as the levels of diversification, land use and pluriactivity categories, such as tourism, forestry and biofuels. With respect to these questions, farmers were asked along a 3 point scale, i.e. whether they intended to decrease, increase or remain stable with respect to these activities (Giannoccaro and Berbel, 2013).

The survey was administered throughout the Summer of 2013 (May – July). Overall, this yielded a response rate of 1,764 observations from livestock based holdings. These were then matched with June Agricultural Census data to provide further information on activity levels, such as size, economic size units, main activities and regions. Table 2 shows descriptive statistics for the main variables matched within the JAC. Statistical comparison, conducted through t-tests, was found to give no significant differences between key identifiers in the sample and the census.

Table 2. Survey respondents by NUTS2 region classification, mean and standard deviation

The majority of respondents were owner-occupiers (62%), 22% were tenanted, with the remainder mostly claiming some mixture of the two. Finally, table 3 shows the average spread of income from agriculture and the relative levels of type of subsidy received, indicating that 63% of the sample had more than 50% of their income from agriculture, 51% had less than 25% of their total income from the single farm payment, but 34% had between 25 to 50%, the remaining 15% stated that more than 50% of their income came from the single farm payment.

Table 3. Average distribution of income, percentage of total sample

3.2. Estimation strategy

As responses were categorical a logistic regression approach was applied to the data. One intention related to selling up the business and this was handled as a straight binary variable (y | 0,1), with 1 reflecting the intention to sell up. For the remainder, the intentions statements were along a 3-point scale (decrease, stable, increase) and multinomial logistic regression was used. This is appropriate when categorical responses exceed a binary outcome and responses are not ordered in any way. Hence, in equation 1 let *J* be the number of nominal outcomes and *m* the class of y (that is, (0) stay the same, (1) increase, and (2) decrease). Thus, considering the range of outcomes (*y*) with n_0, n_1 and n_2 observations respectively, the predicted probability of the i-*th* farmer choosing a nominal outcome (y = 0,1,2) is:

$$\Pr(y_i = m|x_i' = \frac{\exp(x_i'\beta_m)}{\sum_{j=1}^{J}\exp(x_i'\beta_j)} \qquad (1)$$

Where $\beta_0 = 0$

This provides indications of the probability of a change in the independent variable (x) affecting membership of one of the three classes. The base outcome class of staying the same, (y=0), was estimated for referencing change. For ease of interpretation these were converted to relative risk ratios (RRR) which indicates the change in the relative risk when an independent variable increases. An RRR greater than 1 means that the risk increases as the independent variable increases. Table 4 shows the range of independent variables used for the estimation

Table 4. Description and abbreviations for the independent variables used

Estimation was conducted within Stata 12.1 (Stata Corp, 2011). In total 12 regressions were performed to represent the different intentions, with a fixed set of independent variables.

4.0. Results

4.1. Descriptives

Table 5 shows the general frequencies for the farmer intentions in 2020 under the assumption of continuation of present economic and policy conditions Much like other studies (Tranter *et al.,* 2007; Gorton *et al.,* 2008; Lobley and Butler, 2010) the bulk of farmers propose to stay the same. However, around 20% of the sample claimed they would increase levels of activities, with a much smaller percentage claiming they would decrease levels of activity.

Table 5. Frequencies of farmer intentions towards 2020 under present economic and policy conditions, percentage

4.1 Intention to sell up

Table 6 shows the results from the binary logistic model for selling up the business. Where polytomous variables were recoded as dummies and estimated a reference class, which in all cases related to where response has been coded as a 0. This occurred for the ownership variable, where RRRs are relative to owner-occupied status, and region, where RRRs compare against the North East region of Scotland.

No observations were related to past activity (i.e. selling up the business), or responding to an increase in payment levels. Naturally, a reduction in payment rates would lead to increase risk, relative to staying the same, of selling up the business. Specifically, a proposed reduction of payment of 25% on current levels would quadruple to chances of selling the business. Raggi *et al*. (2013), in a survey of 9 EU countries, found a sharp increase in the number of households stating they would exit in the event of CAP removal. Latruffe *et al.* (2013) also found around a fifth of farmers would exit the business in the long-term, if the if CAP payments were removed. Both of these studies found age to be significant, though of different signs. That is Latruffe *et al.* (2013) found that increasing age led to an increasing probability to exit the industry, whereas Raggi *et al.* (2013) found a negative influence, arguing that as farmers get older they are more attached to the land. We find a slight effect of age, that is marginally above 1, though this is minimal and it is difficult to infer any effect. However, few other factors are significant, whereas both other studies found an influence of size on the decision to exit. Notably, the identification of a successor generates a low relative risk ratio of below 1. That is identifying a successor would lead to an intention to stay the same rather than exit the industry.

Table 6. Relative risk ratios of intentions to sell up, compared to stay the same

4.2. Intentions to increase or decrease activity

Tables 7 and 8 shows the results of the multinomial logistic regressions with respect to the intention to increase and decrease activity respectively. Those intentions related to increasing agricultural activities (namely size of the business, intensification and on-farm investment) are strongly related to past activity response and changes in payment rates. For most of these intentions, increasing the level of activities in response to the Fischler Reforms in 2005 are positive, i.e. above 1, and significant predictors that farmers intend to continue along this trajectory. Of these, increasing off-farm investment generates the highest odds, and this could reflect the economies of scope to have the confidence to continue with this activity.

Generally changes in payments tend to behave as would be expected, that is relative risk ratios above 1 indicate increasing willingness to increase activity relative to staying the same for payment increases, and below 1, decreasing activity relative to staying the same for payment decreases. However, significance levels vary between the intention to increase or decrease activity. A payment increase would lead to increasing the level of intensity,

employing more labour, diversifying, investing in tourism and off-farm investment. A decrease in payment would decrease the intention to intensify, employ more labour and invest in off-farm investment. This may highlight a number of issues around the effect of subsidy payment itself and instead of total removal, a reduction in payment may encourage development of non-core farm related activities.

Other factors which prove significant are age, that is older age groups of farmers are less likely to be willing to increase in activity. Age of farmer is a typical variable and the findings here aligns with a number of other studies who find age to be a predetermination of changing behaviour within the farm (Morgan Davies *et al.,* 2012; Latruffe *et al*., 2013; Douarin **et al**., 2007; Giannocaro and Berbel, 2013). In addition, being educated above school level, also tends to infer a positive response with respect to increasing numbers of agricultural and non-agricultural activities (Willock *et al.,* 1999; Gorton *et al*., 2008; Barnes *et al*., 2009; Guillam *et al.,* 2012).

Similarly, the amount of regular employed labour is a positive determinant for increasing activity also for most activities. Labour was used to infer physical capacity as farm labour use is a significant constraint to undertaking farm related activities, especially in countries with a high remoteness profile such as Scotland (Stott et al., 2005). Generally size has been inferred by Economic Size Units (Gorton *et al.,* 2008), or land area (Latruffe *et al*., 2013; Giannocaro and Berbel, 2013; Raggi *et al*., 2013) and hence this is not strictly comparable. However, these latter studies found less likelihood of exit from larger farmers which, to some extent, echoes the findings here.

Regional factors are not significant within the estimation, aside from the intention to increase the amount land rented out (Forbord *et a*l., 2014). Relative to the North East of Scotland, which has significant area dedicated to beef production, these RRRs are all strong and at least double in the other regions of Scotland. Consequently, willingness to rent out land which is less focused on livestock production would be expected. Other studies have included region as an identifier, but are either much higher spatial scales, for instance Giannocaro and Berbel (2013) took clusters of countries within the EU, Gorton *et al,* (2008) and Viaggia *et al*. (2013) estimated at the country level, where Lautruffe *et al*. (2013) and Morgan-Davies *et al.,* (2012) at smaller regional scales.

The influence of inheritance of the farm tends to be nominal and, in most cases insignificant. This contrasts to the identification of a successor which generates positive, highly significant RRRs for agricultural related activities (size, intensity, employed labour, diversification), though less so for non-agricultural related activities (only tourism). A range of studies have explored the importance of succession (Iibery, 1978; Errington, 1998; Lobley *et al*., 2010). For all three agricultural activities the identification of a successor is strongly related to these intentions.

Designation as an LFA and membership of AES tends to influence non-agricultural intentions, as farm LFA designation, which significantly predicts an intention to intensify. LFA has not been explored in much detail within these studies, though Lautruffe *et al*. (2013) found that LFA designation led to less likelihood of farmers selling off land. These findings reflect the limited agricultural usage of LFA land which may be embedded within farmer decision-making and, consequently leads to seeking oppourtunities outside of the traditional agricultural production frame. AES membership was explored by Giannocaro and Berbel (2013) with respect to intentions to reduce agricultural input usage, but did not find it to be a significant predictor of change.

Finally, the intention to intensify is strongly reflective of whether the farm is a specialist dairy enterprise or not. Dairy farmers are 3 times more likely to intensify in the future and twice as likely to employ more labour. Notably, this variable generates strong predictors related to

non-agricultural activities, in particular increasing off-farm activity, forestry and diversification. The dairy sector is generally seen as more progressive and intensive compared to other sectors within Scotland and as such, provide a proxy for the most agriculturally innovative farmers (Withers, 2013; Barnes et al., 2011).

Table 7. Relative risk ratios of intentions to increase activity, compared to staying the same

Table 8. Relative risk ratios for intentions to decrease activity, compared to staying the same

Table 8 shows the converse to Table 7, the influences that determine an intended decrease in agricultural or non-agricultural activities. Less significant variables could be found, reflecting the lower observations of farmers who stated they would decrease activity. However, there is still an influence of past behaviours on theses intentions. Decreasing size, intensity, the level of employed labour, diversification, the level of land rented or contracted and decreasing AES participation all reflect a similar response in the past. This tends to confirm that past activity is a significant predictor and has been overlooked to a large degree by other studies. In addition, both age and identifying a successor are the opposite to Table 7. That is if a successor is identified farmers would be more likely to stay the same than decrease activity. The intentions to reduce both size and activities towards diversification and agri-environmental schemes (AES) are related to a decrease in payments. Certainly, the effect of reduction in pillar 1 payments leading to a decrease in AES activity may be reflective of the cost-foregone model and, may even suggest an element of cross-subsidisation of these activities. It may also reflect the attitudes of farmers towards environmental, as oppose to agricultural, production (Guillam *et al*., 2012).

Notably payment decreases in other agricultural and non-agricultural areas are not significant. This may infer a more robust response to payment decreases than expected from policy makers. However, the LFA variable also generates some high RRRs with respect to agricultural activity, namely to decrease intensity levels and perhaps reflects the trends identified by SAC (2008) with respect to destocking activity in biophysically disadvantaged areas.

5.0. Discussion and conclusions

A number of studies have been conducted on farmer stated intentions were conducted for the previous reform of the CAP in 2003. Most of these were based on what farmers would do under proposed reforms and very few provide evidence during actual reform (Lobley and Potter, 2010). However, understanding the role that CAP reform plays by informing decision-making and farming change is an essential way to benchmark response against the overly prescriptive results of modelling exercises (Moss, 2002; Breen, 2005; Tranter et al., 2007; Genius, 2008).

Recent climate and weather fluctuations may have increased uncertainty for future farm planning. The addition of reform of the Common Agricultural Policy will add another layer to decision-making uncertainties or may reflect Weber's (1997) contention that we operate within a 'finite pool of worry' and CAP reform is too distant to consider for farmer decision-making.

In addition, like all surveys of future intent, the responses may have some built in bias which is reflective of present agricultural conditions. In Scotland at the time of the survey, farmers were recovering from severe wet weather incidents which led to the loss of stock in more remote areas on the farm. Consequently, we would have expected less optimism in the responses, that is more farmer's declaring to reduce activity or sell up and this may provide

evidence of the robustness of the survey instrument in polling farmer opinions towards the future of their industry.

What is noticeable is the lack of any declaration to change with the majority of farmers and this aligns with previous studies (Tranter *et al.,* 2007; Gorton *et al.,* 2008; Latruffe *et al.*, 2012). However, when hypothetical support regimes are introduced the majority behave as would be expected, that is the effect of increasing payment would induce more activity, there are some robust responses to decreasing payment rates, for both agricultural and non-agricultural activities. The reduction in payments may lead to increased likelihood of selling up, especially for farmers have not identified a successor for the business. In addition, it may engender some response to diversify into both traditional agricultural diversification activities (Maye et al., 2009) or perhaps reduce the area of land directly managed (Latruffe et al., 2013; Viaggi et al., 2013). This is important in Scotland as recent statements have highlighted that by the end of 2019, Scottish farmers may be receiving some of the lowest payments per ha across the EU (Scottish Government, 2013).

The rationale behind support for farmers is to negate uncertainties in prices and raise oppourtunities for capital investment. Notably both on-farm and off-farm investments are more likely when payments increase but show no influence when payments decrease. A growing tranche of funding has been focused on the non-market benefits which could be engendered from agricultural production as well. Notably, when pillar 1 payments increase it seems that the only activity to decrease will be AE schemes. The abolition and utilisation of set-aside land for production may be an example of how farmer priorities are focused and how they may be influenced by payments to produce (Burton et al., 2008).

There is a degree of homogeneity in the factors which affect increasing activity. The most significant indicator seems to be the identification of a successor. This is positive and mostly significant across the 11 options, aside from selling up where, as expected this is negative. Age is also strongly significant. Other socio-economic variables, such as education and holding status performed less well in predicting increasing activity. This places the farmer within a wider trajectory than CAP reform on influencing change and argues for a longer term approach to understanding the factors behind decision-making. Hence, decision-making studies need to consider longer time frames, and the development of farming over time may be less erratic and unpredictable as Wilson (2007) contends.

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References

Ahearn M.C., Yee J., Korb P. (2005) Effects of differing farm policies on farm structure and dynamics. *American Journal of Agricultural Economics* 87,1182-1189.

Bartolini, F. and de Viaggi, D. (2013). The common agricultural policy and the determinants of changes in EU farm size. *Land Use Policy* 31, 126-135.

Backus, G.B.C., Eidman, V.R. and Dijhuizen, A.A.,1997. Farmer decision-making under risk and uncertainty. *Netherland Journal of Agricultural Science*, 45, 307-328.

Barnes, A.P. and Toma, L. (2012). A typology of dairy farmer perceptions towards climate change. Climatic Change 112(2), 507-522

Barnes, A.P., Willock, J. Hall, C. and Toma, L. (2009). Farmer perspectives and practices regarding water pollution control programmes in Scotland. Agricultural Water Management, 96, pp. 1715-1722.

Beal, D.J. (1996). Emerging Issues in Risk Management in Farm Firms, *Review of Marketing and Agricultural Economics* 64(3): 336-347.

Binswanger, H, and Sillers, D.A., 1983. Risk aversion and credit constraints in farmers' decision-making: A reinterpretation. *The Journal of Development Studies*, 20, 5-21.

Brady M., Kellermann K., Sahrbacher C., Jelinek L. (2009). Impacts of Decoupled Agricultural Support on Farm Structure, Biodiversity and Landscape Mosaic: Some EU Results. *Journal of Agricultural Economics* 60:563-585.

Breen, J.P., Hennessy, T.C., Thorne, F.S., (2005). The effect of decoupling on the decision to produce: An Irish case study. *Food Policy* 30:2, 129-144

Bougherara, D., Latruffe, L. (2010). Potential impact of the EU 2003 CAP reform on land idling decisions of French landowners: Results from a survey of intentions. *Land Use Policy* 27:4, 1153-1159.

Burrell, A. (2009). The CAP Looking Back, Looking Ahead. *Journal of European Integration* 31:3, 271-289.

Burton, R.J.F. and Walford, N. (2005). Multiple succession and land division on family farms in the South East of England: A counterbalance to agricultural concentration? *Journal of Rural Studies* 21:3, 335-347.

Clancy, D.; Breen, J.; Moran, B.; Thorne, F.; Wallace, M.(2011). Examining the socio-economic factors affecting willingness to adopt bioenergy crops. *Journal of International Farm Management* 5: 4, 25-40.

Defrancesco, E., Gatto, P., Ford, R. and Samuele, T. (2008). Factors Affecting Farmers' Participation in Agri-environmental Measures: A Northern Italian Perspective. *Journal of Agricultural Economics* 59:1, 114-131

Dibden, J. and Cocklin, C.,(2005). Sustainability and agri-environmental governance. In: Higgins, V., Lawrence, G. (Eds.), Agricultural Governance: Globalisation and the New Politics of Regulation. Routledge, London.

Douarin, E., Latruffe, L., Bailey, A., Davidova, S., Gorton, M. (2007). Structural, Location and Human Capital Determinants of Farmers' Response to Decoupled Payments. IDEMA Working Paper.

European Commission (2013). Overview of CAP Reform 2014-2020. Agricultural Policy Perspectives Brief N°5/ December 2013. Avalible at: http://ec.europa.eu/agriculture/policy-perspectives/policy-briefs/05_en.pdf

European Commission (2014). Share of direct payments and total subsidies in agricultural factor income (2010- 2012 average). CAP post-2013: Key graphs & figures, European Union, Brussels. 2014

Errington, A.J. (1998). The intergenerational transfer of managerial control in the farm-family business: A comparative study in England, France and Canada. *Journal of Agricultural Education and Extension*, 5, 123–36

Forbord, M., Bjørkhaug, H., and Burton, R.J.F. (2014). Drivers of change in Norwegian agricultural land control and the emergence of rental farming. Journal of Rural Studies 33, Pages 9-19.

Gallerani V., Gomez y Paloma S., Raggi M., Viaggi D. (2008). Investment behaviour in conventional and emerging farming systems under different policy scenarios, JRC Scientific and technical reports, EUR 23245 EN – 2008.

Genius, M., Karagiannis, G., Tzouvelekas, V. (2008) Assessing European farmers intentions in the light of the 2003 CAP reform. 109th European Association of Agricultural Economists (EAAE) Seminar, Viterbo, Italy.

Giannoccaro G. and Berbel, J. (2013). Farmers' stated preference analysis towards resources use under alternative policy scenarios. *Land Use Policy* 31, 145– 155

Gorton, M. Douarin, E., Davidova,S., Latruffe,L. (2008). Attitudes to agricultural policy and farming futures in the context of the 2003 CAP reform: A comparison of farmers in selected established and new Member States, *Journal of Rural Studie* 24(3), 322-336

Guillem, E.E. and Barnes, A.P. (2012). Farmers perceptions of bird conservation and farming management at a catchment level. Land Use Policy 31, 565-575

Guillem, E.E., Barnes, A.P., Rounsevell, M. and Renwick, A. (2012). Refining perception-based farmer typologies with the analysis of past land use change. Journal of

Environmental Management 110 (15), 226-235Hardaker, J.B., R.B.M. Huirne and J.R. Anderson (1997). *Coping with Risk in Agriculture*, CAB International, Wallingford.
Harrington D.H. (2005). Agricultural Structural Adjustments to U.S. Policies: Discussion Paper. *American Journal of Agricultural Economic*s 87, 1198-1199
House of Commons Environment, Food and Rural Affairs Committee (HCEFRAC) (2012) Greening the Common Agricultural Policy. First Report of Session 2012–13. HMSO, London.
Iibery, B.W. (1978). Agricultural Decision-Making: A behavioural perspective. *Progress in Human Geography* 2, 448-466.
Islam et al (2013)
Kay, A. (2003). Path dependency and the CAP. *Journal of European Public Policy* 10:3, 405-420
Kristensen, E. and Jackobsen, E.B, 2011. Challenging the myth of the irrational dairy farmer; understanding decision-making related to herd health. *New Zealand Veterinary Journal* 59, 1-7.
Latruffe, L., Dupuy, A., Desjeux, Y. (2013). What would farmers' strategies be in a no-CAP situation? An illustration from two regions in France. *Journal of Rural Studies* 32, 10-25.
Lobley, M and Potter,C. (2004). Agricultural change and restructuring: recent evidence from a survey of agricultural households in England. *Journal of Rural Studies* 20:4, 499-510
Lobley, M. and Butler,A. (2010). The impact of CAP reform on farmers' plans for the future: Some evidence from South West England. *Food Policy* 35:4, 341-348.
Lobley, M., Baker, J.R., Whitehead, I. (2010) Farm succession and retirement: Some international comparisons. *Journal of Agriculture, Food Systems, and Community Development* 1:1, 49.
McRoberts, N., Hall, C., Madden, L.V. and Hughes, G. (2011), Perceptions of Disease Risk: From Social Construction of Subjective Judgments to Rational Decision Making. *Phytopathology* 101: 6, 654-665.
Manos,B., Bournaris,Th.,Chatzinikolaou,P., Berbel,J., Nikolov,D. (2013). Effects of CAP policy on farm household behaviour and social sustainability, *Land Use Policy* 31,166-181.
Maye, D., Ilbery, B., Watts, D., 2009. Farm diversification, tenancy and CAP reform: results from a survey of tenant farmers in England. *Journal of Rural Studies* 25, 342.
Meert,H., Van Huylenbroeck,G., Vernimmen,T., Bourgeois,M., van Hecke,E. (2005). Farm household survival strategies and diversification on marginal farms, *Journal of Rural Studies* 21:1, 81-97.
Mishra A.K., Raggi M., Viaggi D. (2010). Determinants of farm exit: a comparison between Europe and the United States. *114th European Association of Agricultural Economists (EAAE) Seminar*. Berlin, Germany
Morgan-Davies, C., Waterhouse, T. and Wilson R. (2012). Characteristion of farmers' responses to policy reforms in Scottish hill farming areas. *Small Ruminant Research* 102, 96-107.
Moss, J., McErlean, S., Kostov, P., Patton, M., Westhoff, P., Binfield, J., 2002. Analysis of the Impact of Decoupling on Agriculture in the UK. Queens University, Belfast.
O'Donnell, S., Horan,. B., Butler, A.M. and Shalloo, L. (2011). A survey of the factors affecting the future intentions of Irish dairy farmers*. Journal of Agricultural Science*, 149, 647–654
Potter, C. and Lobley, M. (1996). The farm family life-cycle, succession paths and environmental change in Britian;s countryside. *Journal of Agricultural Economics* 47, 172-190.
Raggi, M., Sardonini, L., Viaggi, D. (2013). The effects of the Common Agricultural Policy on exit strategies and land re-allocation. *Land Use Policy* 31, 114-125.
Ribeiro, P.F., Lima Santos, J., Bugalho, M.N., Santana, J., Reino, L., Beja, P. and Moreira, F. (2014). Modelling farming system dynamics in High Nature Value Farmland under policy change, *Agriculture, Ecosystems & Environmen,* 183, 138-144.

Rickard, S., 2004. CAP reform, competitiveness and sustainability. Journal of the Science of Food and Agriculture 84, 745e756.

SAC (2008). Response from the Hills. SAC, Edinburgh

Schmid, E., and Sinabell, F. (2007). On the choice of farm management practices after the reform of the Common Agricultural Policy in 2003. *Journal of Environmental Management* 82:3, 332-340.

Schmid, E., and Sinabell, F and Hofreither, M.F. (2007). Phasing out of environmentally harmful subsidies: Consequences of the 2003 CAP reform. *Ecological Economics* 60: 3 596-604.

Scottish Government (2012). Final Results of the June Agricultural Census. Edinburgh, Scotland.

Scottish Government (2013) CAP Budget negotiations – the facts. Accessible at: http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/CAP/CAPEurope10112012. Accessed on the 13th March 2014.

Skogstad, G. and Verdun, A. (2009) The Common Agricultural Policy: Continuity and Change, *Journal of European Integration,* 31:3, 265-269

Smit, B. and Skinner, M.W., 2002. Adaptation options in agriculture to climate change: a typology, *Mitigation and Adaptation Strategies for Global Change* 7:1, 85-114

Sorrentino, A, Henke, R and Severini, S.(eds) (2011). The Common Agricultural Policy after the Fischler Reform. Ashgate Publishing, Surrey.

Stott, A.W., Milne, C.E., Goddard, P. and Waterhouse, A. (2005). Effect of alternative management strategies on profit and animal welfare in extensive sheep production system in Great Britain. *Livestock Production Science* 97, 161-171.

Sutherland, L.A.; Burton, R.J.F.; Ingram, J.; Blackstock, K.L.; Slee, B.; Gotts, N., (2012) Triggering change: towards a conceptualisation of major change processes in farm decision-making, *Journal of Environmental Management,* 104, 142-151.

Tate, G., Mbzibain, A and Shaukat Ali, (2012). A comparison of the drivers influencing farmers' adoption of enterprises associated with renewable energy. *Energy Policy* 49, 400-409.

Tranter, R.B., Swinbank, A.,Wooldridge, M.J., Costa, L., Knapp, T., Little, G.P.J. and Sottomayor, M.L. (2007). Implications for food production, land use and rural development of the European Union's Single Farm Payment: Indications from a survey of farmers' intentions in Germany, Portugal and the UK. *Food Policy*, Volume 32:(5–6), 656-671.

Viaggi D., Raggi M., Gomez y Paloma S. (2011). Farm-household investment behaviour and the CAP decoupling: Methodological issues in assessing policy impacts. *Journal of Policy Modeling* 33, 127-145.

Weber, E. U. (1997). Perception and expectation of climate change: Precondition for economic and technological adaptation. In M. Bazerman, D. Messick, A. Tenbrunsel, & K. Wade-Benzoni (Eds.), Psychological Perspectives to Environmental and Ethical Issues in Management (pp. 314-341). San Francisco, CA: Jossey-Bass.

Withers, J. (2013). Scottish Dairy Review: "Ambition 2025". Report & Recommendations. Report to the Scottish Government. Available at: http://www.scotland.gov.uk/Resource/0043/00434082.pdf. Accessed on 13th March 2014.

Willock, J., Deary, I., McGregor, M., Sutherland, A., Edwards-Jones, G., Morgan, O., Dent, B., Grieve, R., Gibson, G. and Austin, E.(1999). Farmers' attitudes, Objectives, Behaviours, and Personality Traits: The Edinburgh Study of Decision Making on Farms, *Journal of Vocational Behaviour* 54, 5-36.

Wilson, G.A. (2007). *Multifunctional agriculture: a transition theory perspective*. New York (Oxford University Press) and Wallingford (CAB International), 384 pp.

Wilson, G. A. (2008). From 'weak' to 'strong' multifunctionality: Conceptualising farm-level multifunctional transitional pathways, *Journal of Rural Studies* 24:3, 367-383.

Wilson, G.A. and Hart, K. (2001). Farmer participation in agri-environmental schemes: towards conservation-oriented thinking? *Sociologia Ruralis* 41:2, 254-274.

Table 2: Categories of observable activity choices within farmer pathways

Activity choice	**Farmer pathways**
Agricultural Activity	Productivity land use change; Efficiency transition
Labour Change	Management transition
Diversification & Pluriactivity	Production transition
Agri-Environment	Dedicated land use for non-food ecosystem services
Selling up	Retiral from farming, no succession

Table 2. Survey respondents by NUTS2 region classification, mean and standard deviation

Scottish Region	n	Standard Gross Margin (£)	Economic Size Unit*	Livestock (No)	Area (Ha)
Eastern	295	50,082.7	41.7	141.1	393.6
SD		*65,803.6*	*54.8*	*177.4*	*641.9*
Highlands & Islands	712	19,205.8	16.0	69.8	426.1
SD		*28,979.0*	*24.1*	*116.0*	*1,937.8*
North Eastern	145	35,749.8	29.8	124.1	128.2
SD		*55,619.9*	*46.3*	*205.3*	*342.0*
South Western	600	63,900.4	53.3	211.8	200.5
SD		*82,468.4*	*68.7*	*338.9*	*355.2*

** Measured as standard gross margin divided by 1200 Euros*

Table 3. Average distribution of income, percentage of total sample

	Less than 25%	25-50%	Over 50%
Income from Agriculture *(% total income)*	22%	14%	63%
Income from SFP *(% total Income)*	51%	34%	15%
Income from Non-SFP Grants *(% total income)*	92%	6%	2%

Table 4. Description and abbreviations for the independent variables used

Code	Description	Coding
RESP	*Response to past CAP reform (2005)*	*0=stay same,* *1=increase,* *2=decrease*
RINC	*Response to payment increase by 25%*	*0=stay same,* *1=increase,* *2=decrease*
RDEC	*Response to payment decrease by 25%*	*0=stay same,* *1=increase,* *2=decrease*
AGE	*Farmer Age*	*0 = <44;* *1=45-64;* *2=65+*
EDU	*Education*	*0=school educated,* *1=higher than school*
OWN	*Land Ownership*	*0=owner,,* *1=tenanted,* *2=mixed;* *3=manager*
LAB	*Labour employed*	*0=none,* *1=1-3 persons,* *2=more than 3 persons*
REG	*Region*	*0=NE,* *1=NW,* *2=SE,* *3=SW*
AES	*Member of a Agri-environmental Scheme*	*0=no,* *1=yes*
INH	*Whether the business was inherited*	*0=no,* *1=yes*
SUC	*Whether a successor has been identified*	*0=no or too early to say,* *1=yes*
LFA	*Farm in a less favoured area*	*0=no,* *1=yes*
DAIRY	*Farm is a specialised dairy farm*	*0=no,* *1=yes*

Table 5. Frequencies of farmer intentions towards 2020 under present economic and policy conditions, percentage

Intention	Stay Same	Increase	Decrease
Size	71%	23%	6%
Intensity	66%	24%	10%
Employed labour	59%	29%	12%
Diversify	81%	13%	5%
Family labour	77%	19%	3%
Tourism	86%	10%	4%
On-farm investment	69%	29%	2%
Off-farm investment	85%	13%	3%
Forestry	66%	31%	2%
A-E activity	82%	15%	3%

Table 6. Relative risk ratios of intentions to sell up, compared to stay the same

	Sell Up
RDEC	3.960***
AGE	1.001**
EDU	0.941
l.Tenanted	0.607
l.Mixed	1.016
l.Manager	0.522
LAB	0.991
l.NW	1.187
l.SE	2.264
l.SW	1.776
AES	0.652
INH	0.912
SUC	0.170***
LFA	1.092
DAIRY	1.149
N	1737
ll	-249.53
df_m	15
aic	531.06
bic	618.419

Table 7. Relative risk ratios of intentions to increase activity

1=Intentions to increase relative to stay the same

	Size	Intensity	Emp. labour	Diversify	land out	Family lab.	Tourism	On-farm invest.	Off-farm invest.	Forestry	AE activity
Activity (2005)	1.843***	1.409***	1.346***	1.222**	1.243**	1.147	1.124**	1.057	3.066***	1.713***	1.291
Payment (+25%)	0.333	1.482***	1.428***	1.183*	1.023	1.091	1.141*	1.039	1.312***	1.086	1.163
Payment (-25%)	1.016	0.800**	0.756***	0.951	1.085	1.058	1.097	1.144	0.877*	1.039	1.157
Age	0.404***	0.542***	0.469***	0.438***	0.614***	0.561***	0.662***	0.595***	0.912	0.622***	0.696**
l.College	1.543	1.518**	1.669***	1.444*	1.775***	1.109	1.492**	1.545*	1.043	1.261	1.429*
l.Tenanted	0.685	0.896	0.898	0.655	0.562**	0.802	0.451***	0.587*	0.986	1.037	0.895
l.Mixed	0.948	1.046	0.984	0.985	1.084	1.020	0.814	1.137	1.138	1.011	1.004
l.Manager	1.042	0.686	0.705	0.916	1.471	0.738	0.950	1.290	0.770	1.121	0.841
Size	1.280	1.579***	1.270*	1.548**	1.337*	1.401*	1.726***	1.503**	1.440***	1.804***	1.513**
l.NW	0.775	0.841	0.815	1.205	2.082*	0.629	0.887	3.060*	1.145	0.901	0.703
l.SE	1.352	1.165	1.053	1.222	2.210*	0.831	1.075	2.359	1.128	1.016	0.970
l.SW	1.219	0.971	1.047	1.957	2.638**	0.943	1.376	2.674*	1.383	1.314	1.101
A-ES	0.789	0.965	1.103	1.405*	1.957***	1.758**	1.681***	1.900***	1.075	1.235	1.662**
Inherited	1.411	0.935	0.831	0.863	1.048	1.302	0.700*	1.376	0.958	0.782	0.669*
Successor	2.264***	1.884***	1.779***	1.506*	1.234	1.065	1.580***	0.899	1.109	1.374*	0.991
LFA	0.610	1.798**	1.074	1.569	0.896	1.210	1.779**	1.426	4.453***	1.503	1.324
DAIRY	1.363	3.335***	1.951*	2.717**	0.641	2.025	1.773*	0.924	7.414***	2.353**	1.206
N	1737	1757	1757	1757	1757	1757	1757	1757	1757	1757	1757
ll	-249.53	-513.961	-734.293	-815.769	-489.15	-386.056	-729.831	-364.771	-734.647	-783.586	-525.695
df_m	15	17	17	17	17	17	17	17	17	17	17
aic	531.06	1063.923	1504.586	1667.538	1014.299	808.112	1495.662	765.542	1505.295	1603.172	1087.39
bic	618.419	1162.407	1603.07	1766.022	1112.784	906.597	1594.147	864.027	1603.779	1701.656	1185.875

Table 8. Relative risk ratios for intentions to decrease activity relative to stay the same

2=Intentions to decrease relative to stay the same											
	Size	Intensity	Emp. labour	Diversify	land out	Family lab.	Tourism	On-farm invest.	Off-farm invest.	Forestry	AE activity
Activity (2005)	1.711**	1.969***	1.957***	1.331**	1.425**	1.201	1.043	0.989	0.513	1.549	2.258***
Payment (+25%)	1.246	0.999	0.946	0.942	1.099	1.253	1.019	1.053	0.961	1.363	1.195**
Payment (-25%)	1.846*	1.106	1.126	1.313**	1.189	0.899	1.272	1.269	1.347	0.983	1.547***
Age	1.048	1.937***	1.618***	1.666*	1.711*	2.037**	4.478***	2.292*	3.375**	2.738**	1.639
l.College	1.003	1.310	1.378	1.374	0.756	1.010	0.986	0.696	0.837	1.209	0.930
l.Tenanted	0.854	0.998	0.977	1.174	0.504	1.018	1.118	0.840	1.076	0.869	0.908
l.Mixed	1.681	1.440	1.441	1.662	0.788	0.906	1.071	1.566	0.983	1.014	0.823
l.Manager	0.000	0.938	1.106	2.318	1.472	1.764	2.273	5.131*	2.044	1.276	2.552
Size	0.941	0.925	0.938	1.513*	1.325	1.127	0.930	1.161	1.057	1.263	1.325
l.NW	3.561	1.540	1.341	1.284	5.341	0.784	5.67e+05	3.850	3.798	0.756	1.355
l.SE	3.991	1.012	1.214	1.047	4.379	0.662	4.94e+05	4.784	1.958	0.864	1.406
l.SW	3.971	1.544	1.558	2.008	5.052	1.479	7.01e+05	1.580	2.439	0.946	1.010
A-ES	1.366	0.968	1.173	0.976	0.685	0.746	0.509	1.143	0.776	0.849	1.109
Inherited	0.885	0.770	0.732	0.438**	0.473	0.823	0.355	0.773	0.600	0.460	0.829
Successor	0.551*	0.429***	0.530***	0.487**	0.458*	0.393**	0.152**	0.244**	0.254**	0.219***	0.361**
LFA	4.199	4.418***	3.169**	2.579	5.381*	1.003	2.952	2.535	4.000	5.053*	5.737*
DAIRY	1.986	2.906	2.332	3.921*	6.640*	0.935	4.194	8.971*	5.995	6.989*	8.162*
N	1737	1757	1757	1757	1757	1757	1757	1757	1757	1757	1757
ll	-249.53	-513.961	-734.293	-815.769	-489.15	-386.056	-729.831	-364.771	-734.647	-783.586	-525.695
df_m	15	17	17	17	17	17	17	17	17	17	17
aic	531.06	1063.923	1504.586	1667.538	1014.299	808.112	1495.662	765.542	1505.295	1603.172	1087.39
bic	618.419	1162.407	1603.07	1766.022	1112.784	906.597	1594.147	864.027	1603.779	1701.656	1185.875