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UNDERSTANDING FARMERS' INCENTIVES TO INNOVATE IN DIFFERENT BUSINESS ENVIRONMENTS

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Abstract

A number of drivers of innovation in rural areas have been identified by different researchers. However, the robustness of these drivers through different business environments (i.e. stable vs. turbulent business environments) has not fully been explored so far. The objective of this article is to fill this gap by analysing farmers' incentives to innovate before and after a policy shock referred to as the Sugar Regime reform. For this purpose, a probit econometric model was adopted and run with data obtained from a questionnaire supplied to ex-sugar beet farmers in Shropshire, UK. The results revealed that drivers of innovation may change under different business environments. Based on this result it is proposed in this article that farmers reach a steady state in stable environments where they have few incentives to innovate in order to favour long run goals. In contrast, in turbulent business environments this steady state is broken and short run drives of innovation are triggered.
Keywords: *Innovation; Economic Environment; Agricultural Policies; Sugar Beet.*
Jel Codes: *L26 Q12 Q18*

1. Introduction

The issue of innovation in dynamic business environment has been explored by a number of researchers who argue that the capacity to innovate in these environments allows firms create wealth and competitive advantage (Lawson & Samson, 2001; Protogerou, Caloghirou, & Lioukas, 2012; Wang & Ahmed, 2007). Traditional research in this area has identified a number of drivers of innovative capacity in turbulent business environments such as participation in social and commercial networks; participation in collaborative alliances; and individuals' willingness to change; among others (Delmas, 2002; Harryson, Dudkowski, & Stern, 2008; Macpherson, Jones, & Zhang, 2004; Metselaar, 1997; Morgan, 1986; Wang and Ahmed, 2004; Wang and Ahmed, 2007).

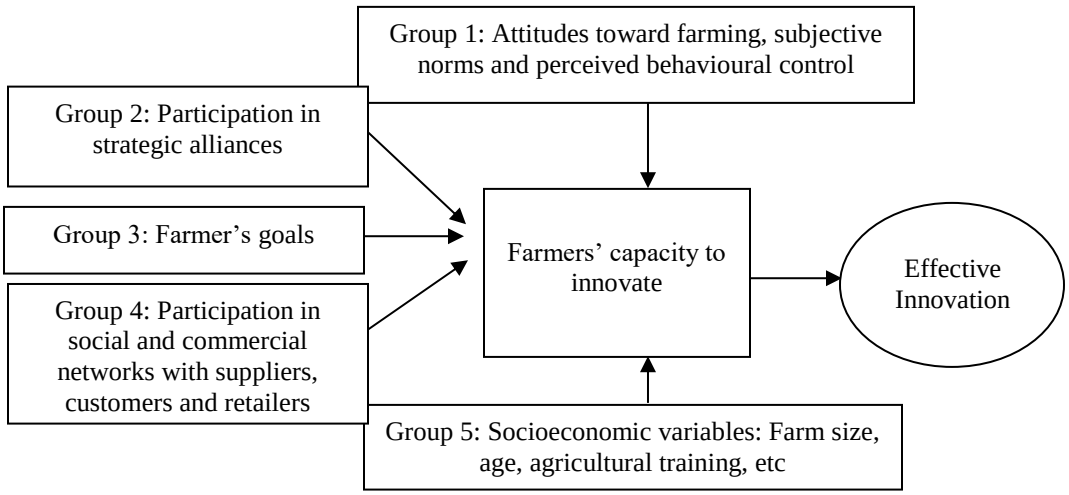
In spite of this research, the study of innovation in agriculture has in general not considered the type of business environment where farmers operate. That is, the traditional research on farmers' innovation has focussed mainly on the relationship between farmers' ability to innovate and participation in commercial networks (Boahene, Snijders, & Folmer, 1999; Virkkala, 2007); farmers' participation in tactical alliances (Hagedoorn & Duysters, 2002; Stiles, 1995); farm size (Boahene et al., 1999); and farmers' level of education (Knight, Weir, & Woldehanna, 2003), among others. An exception is found in May, Tate, & Worrall (2011) who analysed farmers' incentives to innovate in turbulent business environments. Three main contributions are identified in the work of these researchers. Firstly, it appears that

the work developed by these researchers is the first one that explicitly addresses the issue of farmers' incentive to innovate in turbulent business environments. Secondly, this academic work differs from the traditional research in that the later considers the dynamic of the business environment caused by new manufacturing processes and technological improvements (see for example Burgelman, 1996; Eisenhardt & Martin, 2000; Eisenhardt & Tabrizi, 1995; Teece, Pisano, & Shuen, 1997). In contrast, May et al. (2011) consider the dynamic of the business environment caused by policy changes because this is the main source of turbulence that normally affects the rural sector. Finally, these researchers contributed in introducing behavioural aspects of farmers' decision making. That is, these researchers included social-psychological factors explaining farmers' incentives to innovate.

The aim of this article is to extend the work by May et al. (2011) with the purpose of proving that drivers Influencing farmers' incentives to innovate through different business environments are not robust.

2. Material and methods

The methodology adopted in the current investigation is based on a conceptual framework that is presented in Figure 1. This framework is an adaptation of the framework developed by May et al. (2011) in which the relevant behavioural variable considered by these researchers (i.e. dynamic capabilities and the ability to adjust in turbulent environments generated by policy reforms) have been generalised to any type of environment. That is, the relevant behavioural variable considered in the current investigation is "effective innovation". According to this model, effective innovation depends on farmers' capacity to innovate. Farmers' capacity to innovate, in turn, depends on a number of drivers that belong to five different groups.



Source: Adapted from May, Tate, and Worrall (2011)

Figure 1. Multivariate model of innovation.

The first group (i.e. Group 1) includes social-psychological drivers and is based on the Theory of Planned Behaviour. This theory was proposed by Ajzen (1985) and

establishes that intention is a good predictor of behaviour, and that intention is determined by attitudes, subjective norms and perceived behavioural control. That is, a person will have an intention (motivation) to behave in a particular way when she/he has a positive attitude towards this behaviour (i.e. attitudes), when the people who are important to him/her think that he/she should perform this behaviour (i.e. subjective norms), and when the person has the conviction that she/he will successfully execute a behaviour leading to a particular outcome (i.e. perceived behavioural control). Researchers have used the theory of planned behaviour to identify the underlying determinants of farmers' behaviour (Beedell & Rehman, 2000; Zubair & Garforth, 2006). In the case of innovation, it is possible that farmers' decisions on adopting innovative strategies also depend on attitudes towards different aspects of the farming activity, perceived behavioural control, and subjective norms.

The second group of drivers (i.e. Group 2) includes drivers of innovation related to farmers' participation in strategic alliances. According to Hagedoorn and Duysters (2002), these alliances can help firms to increase negotiation power. This, in turn, allows these individuals to enter in new markets and to obtain the information that is needed to innovate. Alliances can also help farmers to innovate in activities that demand high capital expenditure because these alliances allow farmers to spread the risk of this form of investment (Stiles, 1995).

The third group includes drivers associated with farmers' (long run) goals and is based on the seminal research by Gasson (1973). This researcher showed that some of the variables considered by farmers when making their decisions constitute goals (i.e. long ran ends or states related to what the individual desires to be or what they wish to accomplish) and values (i.e. any aspect of a situation, object or event that has a preferential implication of being good or bad, right or wrong). The author, based on her empirical findings, identified four types of value orientations. They were (i) instrumental in which farmers view farming as a means of obtaining income; (ii) social in which farmers farm for interpersonal reasons; (iii) expressive in which farming is considered as a means of self-expression; and (iv) intrinsic in which farmers value farming as an activity in its own right.

The fourth group includes drivers related to farmers' participation in social and commercial networks. This is based on the contributions of Boahene et al.1999 and Virkkala (2007) who found evidence revealing that farmers' participation in these networks helps farmers to obtain useful information for innovative activities.

Finally, Group 5 includes socio-demographic factors that have been identified as drivers of innovation in rural areas (see Knight et al., 2003).

The advantage of the proposed framework presented in Figure 1 is that it is a holistic multivariate model that can be used to develop equivalent econometric models. The same strategy has been adopted by related academic works such the one by Bergevoet et al. (2004).

The holistic multivariate model presented in Figure 1 was applied to a sample of ex-sugar beet farmers of the West Midlands region of the UK (ESBF). The reason for using this study case is because these farmers suffered an important policy reform introduced in 2006 referred to as the Sugar Regime reform. As a consequence of this policy change, the sugar factory at Allscott was closed implying that farmers did not have a market where to sell sugar beet after the reform. This study case is suitable to study farmers' incentives to innovate in both stable and unstable business environment. This is because before the reform the business environment was stable as farmers were paid an a priori agreed price for sugar beet. In contrast, the business

environment became very unstable after the reform because the ESBF had to adjust to this important reform.

Data on the farmers' incentives before and after the implementation of the Sugar Regime Reform were used in an attempt to identify economic and non-economic drivers that explained the farmers' incentives to innovate after the closure of the sugar factory, and to examine whether these were different to the drivers operating pre-closure.

According to DEFRA (2010) statistics, the number of ex-sugar beet farmers in the West Midlands region in 2005 was 592. 48 ESBF were sampled which correspond to 8.1 per cent of this total and had a 100% response rate. This sample was collected in a period of six months starting in January 2008. Farmers were visited in their working place and were asked to fill a questionnaire during the visit. The data collection method was based on a combination of cluster, stratified and snowball sampling techniques. The reason for using them was that there was not a list of ESBF available in the public domain. Before adopting these techniques, different unsuccessful attempts to obtain a random sample were made. The first attempt was to send a letter to the British Sugar Corporation requiring a list of ESBF. However, this Corporation did not reply. A second attempt was to approach the British Sugar Corporation by email requiring the list of ESBF. Since no reply was obtained, it was decided to look for other sources. One of them was the National Farm Union (NFU) located in Telford. This Union did not have a list of ESBF. However, the head of the NFU send an extensive invitation to the members to participate in the project by means of the NFU newsletter. Unfortunately no farmer responded the invitation. Finally, it was estimated the cost of sending an invitation to all the farmers of the West Midlands Region. Since the number of farmer holdings in this region is approximately 27,200, it was found that the cost of this strategy was prohibitively high given the budget of the project.

The sample cluster was selected considering the most relevant counties of the West Midlands region in terms of the number of ESBF. They corresponded to the counties of Shropshire, Worcestershire, Herefordshire, Staffordshire and surrounding areas accounting for 48%, 15%, 14%, 12% and 11% of the total sugar beet farm holdings in 2005, respectively. The sample considered relatively similar proportions for these counties in terms of the number of farmers that participated in the investigation accounting for 46%, 15%, 13%, 15% and 13%, respectively. A similar approach was adopted by the Rural Business Unit of the University of Cambridge and The Royal Agricultural College (2004) but in terms of regions rather than counties.

The sample stratification was made considering the size of the farm in terms of the number of hectares. It was not possible to find official statistics on this variable. Nonetheless, a criterion was established based on the opinions of the 10 farmers that formed the pilot sample. The precaution was taken to include a balanced number of farmers to the classes defined by this measure.

The snowball technique was developed separately in each relevant county. As a result, it was possible to find a number of ESBF that is consistent with the sample cluster strategy defined above. Given the difficulty of gathering data from primary sources, given the small population of ESBF, and given the limited budget supporting the present research, the sample used in this study was considered as appropriate in this context.

A questionnaire was used to collect the relevant data on: (i) farmers' capacity to innovate before and after the incorporation of the Sugar Regime reform (SRR); (ii)

the importance that farmers attributed to tactical alliances as tools to reduce market risk before and after the SRR; (iii) the importance that farmers attributed to tactical alliances as tools to increase negotiation power before and after the SRR; (iv) the importance that farmers attributed to different statements on farmers' goals, attitudes toward farming, perceived behavioural control, and subjective norms before and after the SRR; (v) socioeconomic variables including farmers' education (i.e. formal agricultural training such as Bachelor degrees or diplomas obtained from either colleges of universities), and farm's size measured as area of the farm in hectares; and (vi) farmers' participation in networks before and after the SRR. A five point Likert scale was used for questions included in groups (ii), (iii) and (iv). A dummy variable was used to reflect farmers' education. Likewise, a dummy variable was adopted to reflect farmers' participation in networks.

A probit analysis was used to identify the drivers that explain farmers' capacity to innovate. These individuals were explained by the author of this article the meaning of innovation used in the research. This meaning was based on the definition provided by Wang and Ahmed (2007): The capacity to innovate or innovative capacity (IC) is defined as "a firm's ability to develop new products and/or markets, through aligning strategic innovative orientation with innovative behaviours and processes (p. 38)". Using this definition, farmers had to report that they were able to innovate if they developed at least one of the five interlinked areas described by these authors. The author of the present article ensured that all participating farmers applied the same definition of innovation during the survey.

Two probit models were developed, one for the *before the SRR* case; and one for the *after the SRR* case. Farmers who responded that they had the capacity to innovate either before or after the implementation of the SRR were assigned a value equal to one. In contrast, farmers who responded that they were not able to innovate were assigned a value equal to zero. The variable p_{ij} summarises this information. That is, $p_{ij} = 1$ for farmer i in case j (i.e. before the SRR case, or after the SRR case) means that this individual responded that he/she had the capacity to innovate in case j. Conversely, $p_{ij} = 0$ for farmer i means that this individual responded that she/he did not have the capacity to innovate in case j. The probit model is presented as follows (see Davidson & Mackinnon, 1993; Dougherty, 2007):

$$p_{ij} = \int_{-\infty}^{Z_j} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}Z_i^2} dZ \tag{1}$$

where Z_j is a linear combination of farmers' goals in case j (G_{ij}), farmers' attitudes toward farming in case j (A_{vj}), perceived control in case j (P_{kj}) , subjective norms in case j (N_{lj}), importance that farmers attributed to tactical alliances as tools to reduce market risk in case j ($TA1_j$); importance that farmers attributed to tactical alliances as tools to increase negotiation power in case j ($TA2_j$); socioeconomic variables (SE_n); and farmers' participation in networks in case j (Net_j). Considering all these variables, the linear combination Z_j is defined as:

$$Z_j = \beta_0 + \sum_i \beta_{ij} G_{ij} + \sum_v \beta_{vj} A_{vj} + \sum_k \beta_{kv} P_{kj} + \sum_l \beta_{lj} N_{lj} + \beta_{SA1\,j} TA1_j + \beta_{SA2\,j} TA2_j + \sum_n \beta_n SE_n + \beta_{Netj} Net_j \tag{2}$$

The probit model was estimated using Maximum Likelihood.

3. Results and Discussion.

Of the farmers in the sample, 27% responded that they had the capacity to innovate in the stable business environment (i.e. before the Sugar Regime reform) and 73% responded that they didn't have this capacity. In contrast, 40% responded that they had the capacity to innovate in the turbulent business environment (i.e. when the Sugar Regime reform was incorporated) and 60% of these farmers responded that they did not have this capacity.

In order to identify drivers of innovation that explain these differences, the probit model described in equations 1 and 2 was estimated. For this purpose, a bank of questions regarding each group of variables (i.e. farmers' goals; attitudes towards risk; perceived behavioural control; subjective norms; tactical alliances; socioeconomic variables; and participation in networks) were utilised. The estimated models for each case are presented in Table 1.

The results presented in this table revealed that drivers of innovation in stable and turbulent business environments are in general not the same. The only exception is the statement *I regularly negotiate with suppliers and buyers* suggesting that negotiation and participation in the supply chain plays a key role in innovation independently of the degree of turbulence of the business environment. According to May et al. (2011), this result suggests that it is not network participation itself what provides individuals the capacity to innovate, but the intensity by which these individuals interact with different actors of the supply chain. It appears that the information that is needed to innovate can be obtained easily when this intensity is high, and this ability is relevant in any type of business environment.

In relation to the other drivers of innovation in the before-SRR condition, it is interesting to notice that most of them correspond to farmers' goals suggesting that long term objectives are more relevant in explaining the ability to innovate in stable business environments. According to the results presented in Table 1, the goals *Produce a good and safe product* and *Belonging to the farming community* have a negative effect on farmers' perception on their capacity to innovate. A possible interpretation for this result is that farmers are less interested in developing innovative activities in stable business environment because these environments seems to reflect a type of steady state where non-economic goals are the dominant drivers of behaviour. That is to say, in stable business environments available resources are used to achieve social aspects such as involvement with the farming community and the production of safe agricultural goods rather than innovation. This interpretation can also explain why the rate of response of the farmers who said that they had the capacity to innovate in the stable condition was lower. It appears that these individuals are less motivated to carry out innovative activities when they have reached a steady state.

Table 1. Regression Model for Innovative Capability

Variables	**(a) Before the SRR (*n* = 48)**	**(a) After the SRR (*n* = 48)**
Intercept	1.28 (0.37)	-17.51** (-2.41)
Produce a good and safe product	-1.45** (-2.41)	
Belonging to the farming community	-1.65*** (-2.71)	
Have independence and freedom from supervision	1.66*** (2.42)	
I regularly negotiate with suppliers and buyers	1.20*** (2.58)	3.93** (2.53)
I don't have the productive efficiency to enter profitable markets	-0.61** (-1.96)	
I don't make plans because they don't work out in reality		-2.32*** (-2.70)
The increasing amount of regulation interferes with my plans		1.07** (1.97)
Collaborative alliances to reduce market risk		-2.42** (-2.13)
Collaborative alliances to increase negotiation power		1.95** (2.12)
Farmers' level of education		3.90** (2.46)
Farm's size		-0.01*** (-2.77)
McFadden R^2	0.54	0.60
S.E. Regression	0.31	0.33

Notes: *$P < 0.1$, **$P < 0.05$, *** $P < 0.01$, *z*–ratios in parenthesis.

An exception to this theoretical rule in the case of stable business environments is the goal *Have independence and freedom from supervision* which had a positive effect on farmers' perception on their capacity to innovate. While this finding does not contradict the theory of steady state, it suggests that farmers who enjoy freedom from supervision may eventually be involved in innovation because they probably can react quickly in response to opportunities arising in stable business environments.

Finally, only one perceived behavioural control driver was significant in the before the SRR case which correspond to the statement *I don't have the productive efficiency to enter profitable markets*. According to this result, farmers who are unable to satisfy the standards required to enter to profitable markets are less inclined to develop innovative activities implying that lack of productive efficiency is an inhibitor of innovation in stable business environments.

In relation to the after the SRR condition (i.e. the turbulent business environment), on the other hand, the results revealed that short run behavioural factors and socio-demographic variables are more relevant in explaining farmers'

incentives to innovate in turbulent business environments. This finding suggests that when the theoretical steady state is broken, farmers place lower weights to long run goals and they employ short run drivers in order to adjust to turbulent conditions, probably until a new steady state is reached. In this context, the perceived behavioural control driver *I don't make plans because they don't work out in reality* acts as an inhibitor of innovation and the subjective norm driver *The increasing amount of regulation interferes with my plans for the future* acts as promoter of innovation. According to May et al. (2011), the first behavioural driver reflects farmers' lack of control over resources that prevent them from making plans that are needed to carry out innovative activities, and the second suggests that farmers who had faced increasing regulation had developed the skills to overcome this barrier by means of innovation.

According to the results, other drivers of innovation that are relevant in turbulent business environment are participation in collaborative alliances suggesting that this well known result (see for example Stiles, 1995; Hagedoorn & Duysters, 2002) is mainly valid in non-stable environments. In particular, the results revealed that collaborative alliances can either negatively or positively affect farmers' capacity to innovate depending on whether they are formed to reduce market risk or to increase negotiation power, respectively. According to May et al. (2011), a possible explanation for the first case is that farmers who face capital constraints are in general unable to invest in innovative activities, even when reducing market risk by means of the formation of strategic alliances. As a consequence, the formation of these alliances does not favour innovation. In contrast, the formation of strategic alliances with the purpose of gaining negotiation power helps farmers to enter in new markets and obtain the information that is needed to innovate. This was indeed verified by some farmers in the sample. For example, a farmer in the area of Worcestershire was able to replace sugar beet with beans and peas by forming an alliance with a group of farmers located in the same area.

Finally, the results revealed that farmers' education and farm's size are both drivers of innovation in turbulent business environments. In relation to the first driver, Knight et al. (2003) found that education affects farmers' attitudes toward risk. As a consequence, it is possible that farmers who received formal agricultural educational training were more willing to innovate in the turbulent condition generated by the SRR because they were less risk averse. In relation to farmers' size, on the other hand, the results revealed that this driver negatively affects farmers' ability to innovate. While this finding is counterintuitive, a possible explanation proposed by May et al. (2011) is that larger farms in the sample were more profitable growing the traditional crops and, therefore, faced less pressure to innovate than smaller farms.

4. Conclusions

The objective of this article is to provide evidence suggesting that drivers of innovation are not the same under different business environments. In particular, this evidence revealed that long run farmers' goals play a key role in explaining farmers' incentives to innovate in stable business environment. It appears that farmers in these environments have fewer incentives to innovate because they operate in a steady state condition where non-economic long run objectives such as engagement with the farming community are given higher weight. In contrast, short run drivers seems to be more relevant in dynamic turbulent environments suggesting that when a steady

state is broken, farmers consider short run strategies to adjust in turbulent and unfavourable conditions.

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