Research Stimulus Fund

Final Report

An Examination of the Productivity of Irish Agriculture in a Decoupled Policy Environment

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End date: 31/10/08

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Other Principle Collaborating Researchers: Dr. Carol Newman, Dept. of Economics, TCD and Mr. James Carroll, Dept. of Economics, TCD

Please tick below the appropriate area on the research continuum where you feel this project fits

BASIC/FUNDMENTAL → APPLIED/PRE COMMERCIAL

X

Key words: (max 4) Productivity, efficiency, decoupling, econometrics
1. **Rationale for Undertaking the Research**

As a result of recent successive reforms of the Common Agricultural Policy (CAP), agricultural policy has been moving in a more market orientated direction. In particular, the Luxembourg Agreement argued that ‘*agricultural production must be more orientated to the products and services that the public wants and not to artificially created price incentives or product-specific aids*’ (European Commission, 2003). In addition, as a result of the current Doha round of agricultural trade negotiations under the auspices of the WTO, it is anticipated that EU agriculture will be further exposed to market pressures due to considerable reductions in import tariffs and export subsidies lowering the level of protection for EU agriculture over time (Newman and Matthews, 2004).

Given these reforms the ability to compete in a market-based environment has become increasingly important for agricultural producers. In a protected market environment where high support prices are combined with limits on what farmers can supply, there is no need to worry about productivity and competitiveness. But if Irish farmers will be asked to compete at close to world market prices in the future, it is important to gain an understanding of how competitive Irish producers might be in such a situation. Therefore, understanding how competitive Irish agricultural producers are and what factors affect relative competitiveness are increasingly relevant issues. Previous research has gone some of the way in addressing these issues, for example, Thorne (2004) initiated the measurement of cost competitiveness on an on-going basis and Newman and Matthews (2004) observed the history and evolution of productivity in the Irish agricultural sector over the last decade, but not far enough.

Furthermore, Newman and Matthews (2004) pointed out that ‘*over any time period other than the very short run, the main reason for divergent trends in cost competitiveness over time is differences in the rate of productivity growth across countries. Therefore, tracking Ireland’s productivity growth is essential to understanding why agriculture’s competitiveness changes over time*’ (pp.16-17). Divergent. This issue was highlighted by the Agri-Vision 2015 Committee which made the recommendation ‘*that research be carried out on the socio-economic determinants of the productivity performance of Irish agricultural production so to inform our understanding of the sector’s competitive potential. Such research should be in addition to research on benchmarking the competitive performance of Ireland’s key agricultural enterprises against international competitors*’ (p.51).

In direct response to this recommendation, this research examined (i) the effect of decoupled direct payments on the productivity of Irish agriculture thus directly measuring and (ii) the productivity of Irish agriculture compared to other EU member states by providing inter-country indicators of total factor productivity.
2. **Research Approach**
This research employed Stochastic Frontier Analysis (SFA) for the construction of Total Factor Productivity (TFP) indices for each of the main farming types in Ireland, using National Farm Survey data from 1996 to 2006. Annual changes in TFP were also decomposed into changes in technical change, technical efficiency change and scale efficiency change. In addition to changes in TFP and its components, determinants of technical efficiency were also explored using the same dataset.

Data Envelopment Analysis (DEA) was used to examine the TFP of the dairy and cereals sector within the EU 25. This approach determined the relative productivity of the Irish dairy and cereal sectors. This approach used data from the European Commissions Farm Accountancy Data Network.

This project provide RERC with additional expertise in the area of Total Factor Productivity analysis. We have applied no new methods in this project but have employed the most recent developments available in stochastic frontier analysis (models by Greene (2005)). Such models are a major addition to the literature and can potentially remove the biases in standard methodologies. Empirical applications of such models are few and the present research will add to the general understanding of different approaches.

3. **Research Achievements**
A number of stochastic frontier models for panel data were employed in this analysis. These models are divided into standard approaches (Pitt and Lee, 1981 and Battese and Coelli, 1992) and also a newer set of models recently proposed by Greene (2005) which are designed to remove unobserved heterogeneity from the technical inefficiency estimates (True Fixed and Random Effects models). The main difference in these models is in their underlying assumptions regarding the inefficiency component: The Pitt and Lee model assumes that inefficiency is time-invariant while the Battese and Coelli model assumes that all farms follow an identical inefficiency trend. Both True Effects models allow inefficiency to vary freely through time but also attempt to separate and remove any time-invariant unobserved heterogeneity from the inefficiency term.

Despite considerable differences in the underlying inefficiency assumptions, these models generally depict similar overall trends in TFP for the period. Technical change and scale efficiency change are also very similar across models. Although technical efficiency change contributes only slightly to overall TFP, considerable differences are evident across models in
each sector. In an effort to uncover the most appropriate model, the theoretical consistency (violations of first and second-order conditions) of the production function in each is explored. In all but the Cereals sector, the True Random Effects model is the more theoretically consistent (all models perform well in the Sheep sector). In the Cereals sector, the True Fixed Effects model performs significantly better.

TFP growth was highest in the Cattle Rearing sector followed by the Dairy, Cattle Finishing, Sheep and Cereals sectors. Average annual TFP growth rates are 2 per cent, 1.4 per cent, 0.9 per cent, 0.4 per cent and -0.2 per cent respectively. The Cattle and Dairy sectors show broadly similar trends for the period. In general, 1998 and 2002 appear to show TFP declines in all sectors while improvements are evident in 2000 and 2004.

TFP fluctuations can largely be attributed to the weather, and in this regard, trends in individual sectors give a reasonable approximation of prevailing conditions in individual years. to the NFS data and included in the production function.

The determinants of technical efficiency were also explored. It was found that efficiency levels were positively correlated with extension use/contact with advisory services (although only significant in the dairy system), soil quality and the level of intensification (livestock systems). The use of artificial insemination was also explored in the dairy and cattle rearing systems but is only significant in the dairy system. The incidence of off-farm employment was not significant in any system and as such has no significant negative effect on farm efficiency levels.

This model also included a dummy variable for farms that are surveyed in either 2005 and/or 2006 alongside the usual efficiency inputs to further explore the effects of decoupling. In the cattle rearing, cattle finishing and sheep systems, the coefficient was of the hypothesised negative sign which would suggest that decoupling has lead to improvements in efficiency. In the dairy and cereals systems, the coefficient was positive which is contrary to the hypothesis (implying mean efficiency has in fact declined in these years). However, only in the dairy system was the effect significant. Although predominantly insignificant, these results are again suggestive. The production effects of decoupling are expected to be larger in the both cattle and sheep systems where the reliance on direct payments is considerably higher. Given that only these systems display the expected relationship (despite insignificance) may suggest a possible causal relationship. However, notwithstanding the above evidence, the overriding hypothesis has in general not been realised – it appears decoupling has not brought significant system-wide improvements in technical efficiency. The results may help highlight the underlying motives of farmers.

The importance of the scale of operations is of particular interest and the results highlight that larger farms are more efficient. This finding presents a serious challenge for policy makers and for those involved in planning the future of Irish agriculture, which at present is characterised
by relatively small scale operations (internationally). The degree of specialisation will also be an important issue for the competitive future of Irish farming. It is evident that higher levels of specialisation are associated with higher efficiency levels in the dairy, cereals and cattle finishing systems but to lower efficiency levels in the cattle rearing and sheep systems (not significant in the cattle systems).

4. **Impact of the Research**

The results of the research help highlight the underlying motives of farmers. The hypothesis of this research rests heavily on the assumption that farms are critically weighing up their market costs and revenues and then use this information to form their production decisions, including whether or not to continue farming. As the SFP is unrelated to the level or existence of production, it should no longer enter this decision process. Given that many farms are making market based losses, it is reasonable to assume that they will cease production post decoupling (particularly if the marginal costs of labour and capital are considered). However, Breen, Hennessy and Thorne (2005) demonstrated that most farmers did not intend to change production levels with the introduction of the SFP, despite unviable operations. The authors highlight the existence of many ‘hobby’ farmers in Ireland that remain in production despite continuous losses and conclude that profit may not be the highest priority in a farmer’s utility functions. A similar insight is outlined by Hennessy and Thorne (2005), who find that the decision to maintain herd size and level of cereal production is not significantly affected by current profitability and that production decisions may be guided by ‘habit or some other non-pecuniary motivation’. If such motivations are indeed correct, farmers may in fact be use the SFP to subsidise unprofitable production and remain in the sector. (a similar conclusion is outlined by Harvey and Coleman, 2003). The results of this thesis display no major change in production behaviour and are therefore consistent with these interpretations.

Results of this nature are extremely relevant to the industry – tracking the efficiency and productivity effects of major policy changes will lead to more relevant and informed policy choices in the future. Results suggest that there has not been any major change in the components of TFP in 2005 or 2006 as the results of decoupling. It is expected that the effect of decoupling may take a number of years to change the production patterns of farmers.

We have applied no new methods in this project but have employed the most recent developments available in stochastic frontier analysis. Such models are a major addition to the literature and can potentially remove the biases in standard methodologies. Empirical applications of such models are few and the present research will add to the general understanding of different approaches.

The overall empirical question – the effects of decoupling on TFP – has not been investigated by previous research and this project will add greatly to theories relating to decoupling and various
market support mechanism, all of which could be applied to any industry (for example, see OECD (2005)). Furthermore, a critical comparison of TFP indexes resulting from the many models, to the best of our knowledge, not been attempted by previous research.

5. Exploitation of the Research

N/A

6. Summary of Research Outputs

(a) Intellectual Property applications/licences/patents
1. N/A
2.
(b) Innovations adopted by industry
1. N/A
2.
(c) Number of companies in receipt of information
1
(d) Outcomes with economic potential
n/a
(e) Outcomes with national/ policy/social/environmental potential
1. The presentation which James Carroll made in March 2007 in TCD, provided an overview of the technical performance pre and post decoupling. This model will be useful to policy makers to determine the potential impact of the switch to decoupled direct payments.

2. The presentation which James Carroll made in May 2008 in TCD, provided an overview of the impact of decoupling on productivity performance. This model will be useful to policy makers to determine the potential impact of the switch to decoupled direct payments.

3. The presentation which James Carroll made in April 2008 in DAF, provided an overview of the impact of part time farming on productivity performance. This model will be useful to policy makers to determine the potential impact of the trend in part time farming on productivity performance.

(f) Peer-reviewed publications, International Journal/Book chapters.


(g) Scientific abstracts or articles including those presented at conferences


(h) National Report


(i) Popular non-scientific publications

(j) Workshops/seminars/ open days at which results were presented (excluding those in (g))


5. Carroll, J (2007) The Effects of Decoupling on TFP in Irish Agriculture, 5th October 2007, presentation to the University of Oviedo Efficiency Seminar, Oviedo, Spain


7. **Permanent Researchers**

<table>
<thead>
<tr>
<th>Institution Name</th>
<th>Number of Permanent staff contributing to project</th>
<th>Total Time contribution (months)</th>
<th>Average time contribution per permanent staff member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teagasc</td>
<td>1</td>
<td>4.39</td>
<td></td>
</tr>
<tr>
<td>TCD</td>
<td>1</td>
<td>3.96</td>
<td></td>
</tr>
<tr>
<td>Teagasc*</td>
<td>1 (contract staff member – not funded by RSF; maternity leave cover)</td>
<td>.06</td>
<td></td>
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</tbody>
</table>

**Total** 2 8.41 4.16
8. **Researchers Funded by RSF**

<table>
<thead>
<tr>
<th>Type of Researcher</th>
<th>Number</th>
<th>Total Time contribution (months)</th>
<th>Average time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Doctorates</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Contract Researchers</td>
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<td>29.5 months</td>
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<tr>
<td>PhD postgraduates</td>
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<tr>
<td>Masters postgraduates</td>
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<tr>
<td>Temporary researcher</td>
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<tr>
<td>Other</td>
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<tr>
<td><strong>Total</strong></td>
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<td>29.5</td>
<td>29.5</td>
</tr>
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9. **Postgraduate Research**

Total Number of PhD theses: 

Total Number of Masters theses: 1


10. **Project Expenditure**

Total expenditure of the project: €172,387.74

Total Award by RSF: €175,432 (initial award amount)

Other sources of funding (specify): €1

11. **Future Strategies**

RERC will update and maintain and intra country TFP and inter country TFP models.

12. **Industry Collaboration**

N/A