

Implications for investment in and distribution of the net benefits from R&D

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Complexity

- Most farms are mixed broad-acre farms, so they have complex multiple-input, multiple-output production functions
- This implies complex isoquants and complex production possibilities curves
- Also implies, typically, non-zero input substitution and product transformation elasticities
- Off-farm, marketing systems are more complex and final products are more differentiated

Complexity

- The more complex the marketing system (or value chain) the smaller the share of total benefits from R&D accruing to producers
 - but conversely, the smaller the share of the cost of R&D paid by producers
- The more complex the production technology, the more that producer benefits are further shared with other input suppliers
- Benefits to producers from R&D depend on where the displacement from the R&D occurs

Share of benefits to cattle producers from R&D at different stages

- Weaner production 33.7%
- Grass-finishing 27.6%
- Feedlot-finishing 26.8%
- Processing 25.9%
- Domestic marketing 19.8%

Share of benefits to pig producers from R&D at different stages

Change in economic surplus to	Scenario 1 domestic pork adverting		Scenario 2 domestic bacon/ham advertising		Scenario 3 export pork advertising		Scenario 4 porker production R&D		Scenario 5 baconer production R&D	
	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%
pig producers	1.52	14.40	2.63	4.72	0.16	7.59	1.11	25.70	0.43	7.51
pork initial processors	0.15	1.38	-0.02	-0.04	0.02	0.85	0.11	2.53	-0.01	-0.24
bacon/ham initial processors	0.01	0.13	0.44	0.79	0.00	-0.11	-0.03	-0.63	0.04	0.69
pork primary processors										
bacon/ham secondary processors	1.11	10.52	-0.03	-0.05	0.03	1.60	0.43	9.90	-0.08	-1.50
overseas consumers	0.25	2.37	7.96	14.26	-0.04	-2.00	-0.49	-11.30	0.63	11.14
domestic consumers	0.22	2.10	-0.09	-0.17	1.79	83.13	0.35	8.20	-0.04	-0.62
	7.31	69.10	44.92	80.49	0.19	8.94	2.82	65.60	4.72	83.02
Total Surplus	10.58	100	55.81	100	2.15	100	4.30	100	5.69	100

Openness

- Most inputs used and outputs produced are traded inter-regionally, inter-state and/or internationally, so there is a substantial reliance on world markets for prices of both inputs and outputs
- Producers face a number of different marketing systems of varying complexity and length
- Broad-acre industries are net exporters and export demand elasticities are high

Openness

- R&D which attempts to increase the overall price level of the output is of little value to producers
- R&D which attempts to improve the quality of the output (the relative price) is of more value to producers, but still subject to the constraints imposed by complexity
- R&D which attempts to decrease costs or increase yields is probably of most value to producers
- 80:20 rule applies in beef R&D

Dynamics

- Farming systems are biophysical systems
- Characterised by a period of time required for germination or gestation, dependence on seed or mother, growth and maturity
- These periods of time vary for different enterprises and different activities

Dynamics

- There will be different time horizons for investments in different enterprises, different time horizons for those investments to take effect and different cash flows for different parts of the firm

Stochasticity

- There is extreme variability in
 - supply and demand conditions in world markets
 - climate and weather
 - the capacity for decision making
 - the quantity and quality of advice and DSSs available

Stochasticity

- Quantities, prices and qualities of both inputs and outputs will vary within firms, across firms and over time
- Some of this variability will be predictable, some will not
- There will be different levels of variability in prices and availability of inputs, in yields, and in prices and qualities of outputs

Adoption

- The decision about whether to adopt new technologies will be different for different enterprises because of the differences in the complexity, timeframes and expected variability of the production process and the availability, price and quality of inputs

Distribution of net benefits

- There will be different patterns of the incidence of costs and benefits from effective R&D across different industries because of the different types of value chains, different mix of domestic and international markets and different levels of access to types and qualities of inputs

Demand side issues

- Many outputs from broad-acre agriculture compete for consumer expenditure as well as for production resources
 - Beef and lamb

Cross-commodity impacts

- Dent et al 2003 found that the inclusion of cross-commodity relationships between beef and lamb does alter the effect that exogenous shifters have on the wholesale-farm price ratio for the beef industry and the lamb industry.
- Effects are small.
- Does not alter the directional influence an exogenous shifter has on the wholesale-farm price ratio, but does slightly increase the responsiveness of the wholesale-farm price ratio to an exogenous shifter.

Implications

- Need for rethinking of extension programs to focus more on innovation solutions (or a package of related information, tools and technologies) to solve particular problems in these complex systems, rather than the traditional linear model of here is a new technology now go and use it
- The Beef CRCs Beef Profit Partnerships approach is one such model

Implications

- If stochasticity is so important why don't we do more about it?
- More sensitivity analyses in R&D evaluations, not just of market parameters, but also of the expected effects of the technology in the biophysical system, and the range of market and environmental conditions likely over the investment period

Implications

- Given the prevalence of cross-commodity relationships in broad-acre agriculture, often calls for industry level R&D evaluation frameworks to be extended to cover multiple industries so that R&D spill-overs and spill-ins can be properly accounted for as well as tradeoffs between different enterprises in the one business.

Implications

- Alternatively, need for simpler R&D evaluation frameworks that have just enough of the right level of complexity, openness, dynamics and stochasticity.
- One way is to focus on the minimum level of return necessary to generate lower bound “satisfactory” ROI – ie breakeven analyses – the Freebairn et al approach