Australasian Agribusiness Review - Vol. 13 - 2005

Paper 19
ISSN 1883-5675

The Payoff from Generic Advertising by the Australian Pig Industry: Further Results Relative to the Payoff from R&D

S.W. Mounter, G.R. Griffith, R.R. Piggott and J.D. Mullen

Stuart Mounter is a PhD student in the School of Economics, University of New England, Armidale

Garry Griffith is a Principal Research Scientist with the NSW Department of Primary Industries, Armidale and an Adjunct Professor in the Graduate School of Agricultural and Resource Economics, University of New England, Armidale

Roley Piggott is the Executive Dean of the Faculty of Economics, Business and Law, University of New England, Armidale

John Mullen is a Principal Research Scientist with the NSW Department of Primary Industries, Orange and an Adjunct Professor in the Faculty of Rural Management, University of Sydney, Orange

Author contact: smounter@une.edu.au.

This paper draws on material previously published in Mounter *et al.* (2005) and Zhao, Griffith and Mullen (2001).

The authors are grateful to Glynn Wittwer for comments and suggestions that have markedly improved the present paper.

Abstract

Australian Pork Limited collects producer levies and matching contributions from the Federal government (on some of the levy income), and uses these funds to invest in R&D, domestic and export marketing campaigns and strategic policy development. In 2003/04, more than $18 million in funds were available. Levy payers and other stakeholders want to know that these funds are being well spent to generate positive net returns to the industry. This issue is particularly important at present, with the Australian pig meat industry competing in a global market environment, producing significant quantities of pork exports but also facing significant quantities of pork imports for further processing.

An equilibrium displacement model of the Australian pig meat industry, described in an earlier paper in this Review (Mounter *et al.* 2005), was used to estimate the potential annual returns to producers and other industry sectors from different hypothetical R&D and advertising scenarios. The results indicated that pig producers receive the largest potential returns from effective bacon/ham advertising and from effective pork advertising that increases the domestic demand for these products by 1 per cent, and from effective R&D that reduces the cost of production of porkers by 1 per cent. Other investment scenarios generated substantially lower returns. However these results do not say anything about the cost of achieving the hypothetical 1 per cent shifts in demand or supply curves, so we cannot say which investments have the highest net returns. We can say though that investing in porker production R&D always provides the greatest share of total benefits to pig producers. We can also say, based on past empirical evidence, that it is very difficult to demonstrate any positive demand response to domestic pig meat advertising.

1. Introduction

Australian Pork Limited (APL) is the industry agency that provides policy, R&D and marketing services for the Australian pig meat industry. APL is funded by statutory levies and government contributions. Domestic producers currently pay a levy of $2.43 per head on every pig slaughtered for human consumption, of which APL receives $2.35. Of this amount, $1.65 is allocated to marketing and $0.70 to R&D (APL 2005). Total levy funds for the 2003/04 financial year amounted to $13.5 million and the Federal Government contributed an additional $4.6 million for R&D purposes (APL 2004). Some $9.2 million was spent on R&D, $4.9 million on domestic marketing, $0.9 million on export marketing and some $1.3 million on policy development and other corporate activity (APL 2004).

In the R&D area, most of the expenditure is on on–farm competitiveness and environmental issues, with smaller expenditures on product integrity and product innovation issues. In the marketing area, APL mainly undertakes generic advertising of fresh pork in Australia, either individually or in conjunction with retail outlets. Brand advertising of processed pig meat such as bacon and ham is more likely to be undertaken by a specific manufacturer. APL launched a major national marketing campaign in March 2003 aimed at increasing domestic pork consumption.

Efficient allocation of pig industry R&D and advertising dollars is essential to achieve the highest possible return at any time, but more so in the current difficult trading environment. The structure of the Australian pig meat industry has changed significantly over the last fifteen years - producers now compete in a global market and face direct competition from subsidised lower-priced imports. This change in trade status of the Australian pig industry has been documented in Griffith and Chang (2000) and Mounter *et al.* (2005). Further, the industry currently faces higher production costs as a result of the recent drought.

The aim of this paper is to assess the relative economic impacts of effective R&D and advertising campaigns on the returns to pig producers, so as to provide some guidance as to where the industry should be investing its levy funds. It provides a further set of results to those focussing solely on advertising already published in the companion paper by Mounter *et al.* (2005).

2. Model and Data

This paper uses an equilibrium displacement model (EDM) of the Australian pig meat market as described in detail in the earlier paper in this Review (Mounter *et al.* 2005). It is the same type of model as was developed by Zhao, Griffith and Mullen (2001) for examining R&D and advertising scenarios in the Australian beef industry. The model used here has the same base price and quantity values and the same base elasticity estimates as in Mounter *et al.* (2005) - the only differences are the particular demand and supply shifters for the various R&D investment scenarios.

Demand and supply shifters

Based on the way the model is structured, there are six possible exogenous supply shift variables (representing porker production research, baconer production research, initial pork processing research, initial bacon/ham processing research, primary pork processing research and secondary bacon/ham processing research) and three possible

exogenous demand shift variables (domestic pork advertising, domestic bacon/ham advertising, and export pork advertising). The aim of this study is to determine and compare the returns to the whole pig industry and to pig producers from different R&D and generic advertising scenarios. This involves simulating a separate, hypothetical 1 per cent vertical, parallel shift (or displacement) of the supply curve in each of the markets in which the R&D is assumed to occur (where the supply shift represents a 1 per cent decrease in the variable cost of producing the product due to the R&D); and a separate, hypothetical 1 per cent vertical, parallel shift of the demand curve in each of the markets in which the advertising is assumed to occur (where the demand shift represents a 1 per cent increase in consumers' willingness to pay due to the advertising)[1].

3. Comparing Advertising and R&D Scenarios

The percentage changes in the price and quantity variables for each of the nine advertising and R&D scenarios are obtained by solving the EDM with the relevant demand shifter set at 0.01 or the relevant supply shifter set to -0.01 (Table 1). The associated changes in producer surplus and consumer surplus at the different market levels are calculated using standard formulae (Alston, Norton and Pardey 1995).

Price and quantity changes for each of the endogenous variables for each of the scenarios are reported in Table 2, and producer and consumer surplus changes (calculated from the relevant price and quantity changes for each of the scenarios) are reported in Table 3.

Table 1: Exogenous Shift Variables for Various Advertising and R&D Investment Scenarios

Scenario 1. Domestic Pork Advertising Increase in the 'willingness to pay' by domestic pork consumers due to pork advertising or changes in taste in the domestic market.
Scenario 2. Domestic Bacon/Ham Advertising Increase in the 'willingness to pay' by domestic bacon/ham consumers due to bacon/ham advertising or changes in taste in the domestic market.
Scenario 3. Export Pork Advertising Increase in the 'willingness to pay' by export pork consumers due to pork advertising or changes in taste in the overseas market.
Scenario 4. Porker Production Research Cost reduction in porker production resulting from any breeding or farm technologies that reduce the cost of producing porkers.

Scenario 5. Baconer Production Research Cost reduction in baconer production resulting from any breeding or farm technologies that reduce the cost of producing baconers.
Scenario 6. Initial Pork Processing Research Cost reductions in pork processing due to new technologies or management strategies in the initial pork processing sector.
Scenario 7. Initial Bacon/Ham Processing Research Cost reductions in bacon/ham processing due to new technologies or management strategies in the initial bacon/ham processing sector.
Scenario 8. Secondary Bacon/Ham Processing Research Cost reductions in bacon/ham processing due to new technologies or management strategies in the secondary bacon/ham processing, domestic marketing or retailing sector.
Scenario 9. Primary Pork Processing Research Cost reductions in pork processing due to new technologies or management strategies in the initial pork processing, domestic marketing or retailing sector

Table 2: Percentage Change in Prices and Quantities for Alternative Advertising and R&D Investment Scenarios (%)

Variable	**Scenario 1 domestic pork advertising**	**Scenario 2 domestic bacon/ham advertising**	**Scenario 3 export pork advertising**	**Scenario 4 porker production R&D**	**Scenario 5 baconer production R&D**	**Scenario 6 initial pork processing R&D**	**Scenario 7 initial bacon/ham processing**	**Scenario 8 primary pork processing R&D**	**Scenario 9 secondary bacon/ham processing**

							R&D		R&D
Quantities:									
Exported pork	0.516	-0.220	0.156	0.819	-0.082	0.213	-0.023	-0.392	0.414
Domestic pork consumption	0.755	-0.030	0.026	0.325	-0.061	0.084	-0.022	-0.386	0.635
Domestic bacon/ham consumption	0.026	0.866	-0.005	-0.055	0.079	-0.014	0.035	0.627	-0.098
Pork initial processing inputs	0.656	-0.095	0.082	0.488	-0.067	0.225	-0.022	-0.379	0.502
Bacon initial processing inputs	0.026	0.864	-0.005	-0.054	0.077	0.014	0.132	0.545	-0.097
Wholesale pork for primary processing	0.742	-0.056	0.032	0.398	-0.065	0.103	-0.022	-0.396	0.560
Wholesale baconer for primary processing	0.017	0.860	-0.006	-0.062	0.144	-0.015	0.064	0.547	-0.103
Pork primary processing inputs	0.761	-0.019	0.024	0.292	-0.059	0.076	-0.021	-0.381	0.668
Bacon secondary processing inputs	0.027	0.866	-0.005	-0.053	0.069	-0.014	0.030	0.644	-0.097
Porkers	0.651	-0.128	0.081	0.585	-0.073	0.127	-0.023	-0.398	0.503
Baconers	0.013	0.858	-0.006	-0.065	0.175	-0.016	0.034	0.547	-0.106
Pork imports	0.033	0.896	-0.004	-0.051	0.031	-0.013	0.013	0.562	-0.096
Prices:									

Exported pork	-0.103	0.044	0.169	-0.164	0.016	0.043	0.005	0.078	-0.083
Retail domestic pork	0.213	0.112	-0.022	-0.270	0.008	-0.070	-0.001	-0.030	-0.534
Retail domestic bacon	0.018	0.174	0.000	0.000	-0.086	0.000	-0.039	-0.704	-0.010
Pork initial processing inputs	0.131	-0.019	0.016	0.098	-0.013	-0.955	-0.004	-0.076	0.100
Bacon initial processing inputs	0.005	0.173	0.000	-0.011	0.015	-0.003	-0.974	0.109	-0.019
Wholesale pork for primary processing	0.348	0.372	-0.080	-1.000	0.051	-0.262	0.005	0.071	0.209
Wholesale bacon for secondary processing	0.093	0.211	0.009	0.063	-0.661	0.013	-0.296	0.091	0.041
Pork primary processing inputs	0.152	-0.004	0.005	0.058	-0.012	0.015	-0.004	-0.076	-0.866
Bacon secondary processing inputs	0.005	0.173	0.000	-0.011	0.014	-0.003	0.006	-0.871	-0.019
Farm gate porker	0.179	0.309	0.019	-0.870	0.050	0.027	0.007	0.003	0.092
Farm gate baconer	0.132	0.229	0.014	0.096	-0.963	0.020	0.005	-0.084	0.068

Table 3: Economic Surplus Changes ($ million) and Percentage Shares of Total Surplus Changes (%) to Various Industry Groups from Alternative Advertising and R&D Investment Scenarios

Change in economic surplus to	**Scenario 1 domestic pork advertising**	**Scenario 2 domestic bacon/ham**	**Scenario 3 export pork advertising**	**Scenario 4 porker production**	Scenario 5 baconer production R&D	**Scenario 6 initial pork processing**	**Scenario 7 initial bacon/ham**	**Scenario 8 primary pork processing**	**Scenario 9 secondary bacon/ham**

			advertising				R&D				R&D		processing R&D		R&D		processing R&D	
	$m	%	$m	%	$m	%	$m	%	$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	0.23	20.91	0.06	2.50	0.95	2.10	0.78	10.66
Pork initial processors	0.15	1.38	-0.02	-0.04	0.02	0.85	0.11	2.53	-0.01	-0.24	0.05	4.50	-0.01	-0.18	-0.08	-0.18	0.11	1.54
Bacon/ham initial processors	0.01	0.13	0.44	0.79	0.00	-0.11	-0.03	-0.63	0.04	0.69	-0.01	-0.61	0.07	2.63	0.28	0.60	-0.05	-0.67
Pork primary processors	1.11	10.52	-0.03	-0.05	0.03	1.60	0.43	9.90	-0.08	-1.50	0.11	9.93	-0.03	-1.23	-0.55	-1.20	0.98	13.36
Bacon/ham secondary processors	0.25	2.37	7.96	14.26	-0.04	-2.00	-0.49	-11.3	0.63	11.14	-0.12	-11.15	0.28	10.91	5.91	12.88	-0.88	-12.12
Overseas consumers	0.22	2.10	-0.09	-0.17	1.79	83.13	0.35	8.20	-0.04	-0.62	0.09	8.24	-0.01	-0.37	-0.17	-0.37	0.17	2.44
Domestic consumers	7.31	69.10	44.92	80.49	0.19	8.94	2.82	65.60	4.72	83.02	0.76	68.18	2.17	85.74	39.56	86.17	6.20	84.79
Total Surplus	10.58	100	55.81	100	2.15	100	4.30	100	5.69	100	1.11	100	2.53	100	45.90	100	7.31	100

General Comments about the Results

First, the results relate to equal 1 per cent, hypothetical, exogenous shifts in the relevant demand and supply curves. The question of how much money is required to bring about the 1 per cent demand shifts or cost reductions in the relevant sectors is not addressed here. Previous studies that have addressed this issue include Lemieux and Wohlgenant (1989), Scobie, Mullen and Alston (1991), Mullen and Cox (1995) and Cox, Mullen and Hu (1997). Thus, the monetary returns from the alternative scenarios reported in Table 3 are only directly comparable under the assumption of equal investment efficiency, in the sense that the investment costs of the 1 per cent shifts in all sectors are the same.

Second, although the same amount of monetary investments at different points of the industry may result in supply or demand shifts of different magnitudes, and although the actual returns in dollar terms are dependent on the magnitudes of the initial shifts, the distribution of the total benefits among industry groups for a particular scenario is independent of the size of the initial shift (Zhao 1999, p160). For example, the producers' percentage share of the total benefits from initial pork processing technology (i.e.

20.9 per cent for Scenario 6 in Table 3) is the same regardless of whether the technology reduces the processing cost by 1 per cent or 10 per cent. Therefore, comparison of benefit shares among alternative investment scenarios is always meaningful even without knowledge of the efficiency of research investments. This result follows from the assumed competitive structure of the pig meat industry and the assumed parallel supply and demand shifts.

Given these qualifications, consider now the total welfare gains from the alternative scenarios reported in Table 3. For the same 1 per cent exogenous shift, the size of the total welfare change from a scenario is predominantly determined by the gross revenue of the market where the exogenous shift occurs. Consequently, as can be seen from the last row of Table 3, for equal 1 per cent shifts in the relevant markets, the largest changes in total surplus result from Scenario 2 (almost $56 million annually) involving a 1 per cent exogenous shift in the retail demand curve for bacon/ham, and from Scenario 8 (almost $46 million annually) involving a 1 per cent exogenous shift in the supply curve for inputs into secondary bacon/ham processing. Based on the data available and the assumptions made, the processed pig meat industry is considerably larger and has a higher retail value than the pork industry, and a significant component of the final cost of bacon/ham is added at the secondary processing stage.

Two other general comments about the results are worth noting. First, in all but Scenario 1, there are sectors of the pig meat industry that lose from the particular R&D or advertising scenario being modelled. In the bacon/ham advertising and R&D scenarios, pork initial and primary processors and overseas pork consumers always lose; while in the pork advertising and R&D scenarios, bacon/ham initial and secondary processors almost always lose. Pork and bacon/ham are substitutes in the minds of consumers, so changes in prices brought about by advertising or R&D in one industry has an adverse effect on economic activity in the other industry. However, pig producers and domestic consumers of pig meat always win from effective advertising or R&D.

Second, in all but Scenario 3, the great majority of the benefits from the scenarios examined here accrue to domestic pig meat consumers. In those eight scenarios, the minimum share to domestic consumers is almost 66 per cent and in five of the cases the share is more than 80 per cent. The elasticity of domestic demand for pork and bacon/ham is considerable less than the elasticity of export demand and the elasticity of supply of pigs, and this implies a greater share of any benefits to domestic consumers relative to export consumers and domestic producers. In Scenario 3, overseas consumers receive some 83 per cent of the total benefit from export pork advertising, because exported pork is considered to be different to domestic pork.

Advertising Scenarios

As noted above, the largest changes in total surplus and in surplus accruing to pig producers result from Scenario 2 involving a 1 per cent exogenous shift in the demand curve for bacon/ham. The total industry benefit from effective domestic bacon/ham advertising is almost $56 million and the gain to pig producers is $2.63 million, annually. Surplus changes associated with a 1 per cent exogenous shift in the domestic demand for pork (Scenario 1) reveal that the industry as a whole benefits by almost $11 million and producers would receive $1.52 million, while only $2.15 million accrues to the industry from a 1 per cent exogenous shift in export demand (Scenario 3), of which producers receive $0.16 million. While exports are a relatively small part of the total industry, Australian pork is considered to be different from pork from other suppliers in the major markets so export demand is not perfectly elastic. Domestic advertising is therefore not just a re-allocation of product from export to domestic markets with no influence on export or domestic prices (as evident in some other studies of domestic advertising – see Piggott 1998).

In terms of shares to producers, domestic pork advertising returns some 14.4 per cent, while domestic bacon/ham advertising returns only 4.7 per cent.

On-farm R&D Scenarios

Research into new technologies in porker or baconer production (Scenarios 4 and 5), are regarded as 'traditional' on-farm research. Examples include genetic research increasing litter size and weaning percentage, nutrition research increasing feeding efficiency, environmental and animal welfare programs, or education initiatives improving producers' farm management.

The total benefits from baconer production R&D (Scenario 5) at $5.7 million annually are greater than the total benefits from porker production R&D (Scenario 4) at $4.3 million annually, but the actual benefits accruing to producers are the other way around due to the substantial differences in the producer shares of total benefits. Pig producers receive 25.7 per cent of the benefits from porker production R&D but only 7.5 per cent from baconer production R&D. In both cases, the majority of the total benefits accrue to domestic consumers while, as also noted above, pork processors lose from baconer R&D and bacon/ham processors lose from porker R&D.

Off-farm R&D Scenarios

Off-farm research is R&D beyond the farm gate. In the model, cost reductions in initial processing (Scenarios 6 and 7), pork primary processing (Scenario 9) and bacon/ham secondary processing (Scenario 8) relate to off-farm R&D investments.

Later stage processing R&D (Scenarios 8 and 9) generates greater total returns than either early stage processing R&D (Scenarios 6 and 7) or on-farm R&D. Secondary bacon/ham processing R&D in particular generates the second largest total return of some $46 million, due to the large value added to baconer carcases during this process. However returns to producers are actually of a similar magnitude to the returns to producers from on-farm R&D because of the extremely small share of total benefits that gets back to producers in Scenario 8 (just 2.1 per cent). The total benefits from 1 per cent cost reductions in the early stage processing sectors (primarily slaughtering) are much smaller (less than $2.5 million) due to the small value added to the pig meat products in these sectors, and the supply curves of other inputs in these sectors are assumed to be highly elastic (with an elasticity value of 5). For the same reason, the shares of total benefits to these sectors in the other scenarios are quite small, and can be negative. However, the producers' share of pork initial processing R&D is quite high at 20.9 per cent.

In summary, across all three sets of scenarios, the results from the present model are consistent with the previous literature in concluding that, in terms of the shares of total benefits, farmers should prefer on-farm R&D to R&D in the processing and domestic marketing sectors and to advertising. However, in terms of aggregate benefits, the largest returns result from advertising bacon/ham, and from off-farm R&D in secondary bacon/ham processing.

4. Further Considerations

The above comparison among alternative R&D and advertising investments has focused mainly on the percentage shares of the total benefits to individual groups. As the information on the costs involved in bringing about the same 1 per cent shifts in the various markets is unavailable, the conclusions that can be drawn from comparing the actual dollar returns from alternative investment scenarios are limited.

As noted above, one way around this is to make an assumption of equally efficient investments in all sectors (same $ investment for same % shift). For example, if the R&D investments in later stage processing research were equally efficient in the two processing sectors, producers would prefer secondary bacon/ham processing research ($0.95 million) to primary pork processing research ($0.78 million), even though the shares of total benefits give the opposite preference (2.1 per cent for the former and 10.66 per cent for the later). Or, from a different perspective, investment in primary pork processing research needs to be about 22 per cent more efficient (0.95/0.78 is 1.22) as investment in secondary bacon/ham processing research in order for pig producers to be indifferent about investing in the two processing sectors.

The rankings of preferences to pig producers among the nine alternative investment scenarios, in terms of their percentage shares of total benefits and in terms of their absolute monetary benefits respectively, are given in Table 4. The ranking in the first column is always true even though the information on the investment costs involved in the initial 1 per cent shifts is unavailable. The ranking in the second column is conditional on the assumption of equal investment efficiency across the nine scenarios. Obviously, the ranking of preferences in the two columns is rather different, although Scenario 1 and Scenario 4 are in the top three in each ranking.

Table 4: Rankings of Preferences to Pig Producers Among the Alternate Advertising and R&D Investment Scenarios

Rank	In terms of % share of total benefits (%)	In terms of absolute benefits ($m)
1	Scenario 4 (25.7)	Scenario 2 (2.63)
2	Scenario 6 (20.9)	Scenario 1 (1.52)
3	Scenario 1 (14.4)	Scenario 4 (1.11)
4	Scenario 9 (10.7)	Scenario 8 (0.95)
5	Scenario 3 (7.6)	Scenario 9 (0.78)
6	Scenario 5 (7.5)	Scenario 5 (0.43)
7	Scenario 2 (4.7)	Scenario 6 (0.23)
8	Scenario 7 (2.5)	Scenario 3 (0.16)
9	Scenario 8 (2.1)	Scenario 7 (0.06)

Another way of presenting these data (Table 5) is to list the initial percentage shifts required in all scenarios that are necessary to achieve the same dollar benefits as that from Scenario 4. For example, in order for pig producers to receive the same monetary benefit of $1.11 million as from a 1 per cent cost reduction in porker production, costs in initial pork processing need to be reduced by 4.83 per cent (Scenario 6), or costs in secondary bacon/ham processing need to be reduced by 1.17 per cent (Scenario 8). Similarly, in order for pig producers to be indifferent about investing in domestic pork advertising (Scenario 1) or in primary pork processing research (Scenario 9), the cost of creating an advertising campaign that increases the demand for pork by 0.73 per cent needs to be the same as the cost of the R&D investment that reduces primary pork processing costs by 1.42 per cent. Thus, which of the two investment scenarios is preferable to producers is dependent upon the investment costs in bringing about the demand and supply shifts respectively in these two sectors.

Table 5: Required Percentage Shifts Necessary to Provide the Same Benefits to Pig Producers as from Scenario 4

	Scenario 1 domestic pork advertising	Scenario 2 domestic bacon/ham advertising	Scenario3 export pork advertising	Scenario 4 porker production R&D	Scenario 5 baconer production R&D	Scenario 6 initial pork processing R&D	Scenario 7 initial bacon/ham processing R&D	Scenario 8 primary pork processing R&D	Scenario 9 secondary bacon/ham processing
Returns to pig producers ($ million)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Initial % shifts required (%)	0.73	0.42	6.94	1.00	2.58	4.83	18.5	1.17	1.42

Finally, the impact of levies paid to fund advertising and R&D is not discussed – in this analysis, a lump sum funding mechanism is assumed. In a competitive industry, the industry equilibrium will be displaced as a result of the imposition of a levy. For example, a levy on pig producers would be regarded initially as an increase in pig production costs. However, through the interaction with other sectors in the production and marketing chain, this cost is ultimately shared with processors and consumers. Hence, producers do not bear the levy burden alone even if the levy is collected from them initially. There is also symmetry between how the benefits from technology are distributed between the different sectors in the pig meat industry and how the incidence of levies imposed to fund R&D and promotion are shared between the different sectors. A levy on the producers of porkers is distributed in exactly the same way as the benefits of new technology in growing porkers – these producers pay 25.7 per cent of the levy and gain 25.7 per cent of the benefits. However if the levy is used to fund primary pork processing research for example, they still pay 25.7 percent of the levy but receive only 10.66 per cent of the benefits. Primary pork processing research may still be a profitable investment for porker producers but the rate of total returns to investments in this area will have to be higher than from porker R&D to give the same net returns to porker producers. These issues are examined more fully in Alston and Mullen (1992), Piggott (1998) and Freebairn, Goddard and Griffith (2005), and an example in relation to pig meat advertising is given in Mounter *et al.* (2005).

Sensitivity to Market Elasticity Values

The results presented above are based on a particular set of market-related elasticities that were chosen from published estimates, economic theory and the authors' subjective judgement. For some parameters, there are relatively more empirical studies available and the possible values of the parameters can be narrowed down to small ranges. However, for others, and in particular given the level of disaggregation in this study, very little empirical evidence is available. Specification of these parameter values in the base model has had to rely substantially on subjective judgement. Thus, it is essential to study the sensitivity of model results (see for example Zhao *et al.* 1999) and their policy-related conclusions to changes in values of parameters, and this is being taken up in future work.

The results are also dependent on assumptions made about the price and quantity data, (or the points of equilibrium from which displacements occur), and the sensitivity of these results to such assumptions is similarly essential. In particular, data were not readily available to enable the calculation of retail carcass weight equivalent prices for pork and bacon/ham. The retail prices used were obtained from official ABS data but they relate to particular cuts or packs, not a weighed average of the retail value of the whole carcase. It is a major exercise to estimate retail carcase weight equivalent prices (see for example the calculations reported in Griffith, Green and Duff 1991). Even in

its recently released report on the pigmeat industry, the Productivity Commission (2005, especially Appendix B) did not attempt to calculate retail carcase weight equivalent prices - it used the same retail prices as we have.

The implication of using retail prices for just one cut is that the revenues or total sector values for the pork and bacon/ham retail-sectors are over-estimated and the cost shares associated with the other processing inputs used in the pork primary processimg and bacon/ham secondary processing sectors are also over-estimated. This leads to over-estimation of the returns to advertising and secondary bacon/ham processing R&D.

To illustrate the impacts of different assumptions about the retail prices, two further scenarios (2a and 5a) were run where the retail prices were halved. Scenario 2 is domestic bacon/ham advertising, where the impacts should be large, and Scenario 5 is baconer production R&D, where the impacts should be small. The impact of these changes in the retail prices on the total level of benefits and the distribution among the market participants is reported in Table 6.

Table 6: Economic Surplus Changes ($ million) and Percentage Shares of Total Surplus Changes (%) to Various Industry Groups from Scenario 2 and Scenario 5 with Retail Price Estimates Halved

Change in economic surplus to	**Scenario 2a domestic bacon/ham advertising (retail prices halved)**		**Scenario 5a baconer production R&D (retail prices halved)**	
Pig producers	$m	%	$m	$m %
pork initial processors	2.50	8.95	0.54	9.49
bacon/ham initial processors	-0.04	-0.14	-0.03 2	-0.52
pork primary processors	0.44	1.60	0.08	1.40
bacon/ham secondary processors	-0.04	-0.16	-0.05	-0.90
overseas consumers	3.18	11.41	0.50	8.92
domestic consumers	-0.12	-0.44	-0.06	-1.12
	21.99	78.78	4.71	82.72
Total Surplus	**27.91**	**100**	**5.69**	**100**

For Scenario 2a, as expected for an advertising scenario, total surplus halved because total retail value halved. All component values were smaller, but mostly that to domestic consumers (down by $22m) and to pig producers (down nearly $5m). However, the share to pig producers rose from 4.72 per cent to 8.95 per cent. In contrast, for Scenario 5a, a farm level R&D scenario, total surplus was unchanged. However, due to the different cost shares, benefits to producers rose to $0.54m and the share to producers also rose, to 9.49 per cent.

Thus, while different assumptions about elasticity values influence the distribution of benefits from R&D and advertising, and leave total benefits unchanged, different assumptions about prices and quantities influence both total benefits and their shares.

5. Conclusions and implications

In this paper, an existing economic model of the Australian pig meat industry was used to study the annual returns to producers and other industry sectors from different hypothetical R&D and advertising scenarios. The results indicate that pig producers receive the largest **potential** annual returns from effective bacon/ham advertising ($2.6 million) and from effective pork advertising ($1.5 million) that increases the domestic demand for these products by 1 per cent, and from effective R&D that reduces the cost of production of porkers by 1 per cent ($1.1 million). Other investment scenarios return substantially lower returns to pig producers. However these results do not say anything about the cost of achieving the hypothetical 1 per cent shifts in demand or supply curves. The results also indicate that investing in porker production R&D always generates the greatest share of total benefits to pig producers (25.7 per cent), followed by pork initial processing R&D (20.9 per cent) and by domestic pork advertising (14.4 per cent).

These results are conditional on the price and quantity values and the parameter values used in the analysis. Comments made above about the uncertainty associated with some of these values, and the probable over-estimation of the retail prices of pork and bacon, and consequent over-estimation of the returns to advertising and secondary bacon/ham processing R&D, should be borne in mind when assessing these results. In particular, it was shown above that the benefits from advertising are very dependent on having accurate estimates of the retail prices for a carcase equivalent quantity.

More general though, and associated with the discussion about equal investment efficiency, is our knowledge about the relative effectiveness of R&D versus advertising in shifting supply and demand curves respectively. While most R&D evaluation studies have produced reasonably high benefit-cost ratios or internal rates of return (see for example, Alston, Norton and Pardey 1995, Mullen and Cox 1995), based on past empirical evidence, it is extremely difficult to demonstrate any positive demand response to domestic advertising in the Australian pork market. All previous studies using Australian data (Piggott *et al.* 1996, Zhang and Goddard 1999) and all but one study using North American data (Brester and Schroeder 1995, Duffy and Goddard 1995) have estimated generic pork advertising elasticities not significantly different from zero. In such a case there would be no benefit from advertising and producers would incur a loss equal to the amount of the advertising expenditure. Mounter *et al.* (2005) showed that the Australian elasticity of demand response to generic pork advertising would have to exceed 0.035 for pig producers to gain from a generic advertising program for domestic pork, funded by a lump sum. This value is toward the upper end of any previously estimated values for the demand response to generic advertising. See also Freebairn, Goddard and Griffith (2005) for a more general treatment of the conditions under which generic advertising is likely to be cost effective to producers.

6. References

Alston, J.M. and J.D. Mullen (1992), 'Economic effects of research into traded goods: the case of Australian wool', Journal of Agricultural Economics 43(2), 268-78.

Alston, J.M., G.W. Norton and P.G. Pardey (1995), Science Under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting, Cornell University Press, Ithaca and London.

APL (2004), Australian Pork Limited, Canberra. www.apl.au.com/index.cfm?menuid=E6780FAA-B0D0-36D2-5CEB4493CC31D2E7

APL (2005), Australian Pork Limited Annual Report 2003-2004, Australian Pork Limited, Canberra.

Brester, G.W. and Schroeder, T. C. (1995), 'The impacts of brand and generic advertising on meat demand', American Journal of Agricultural Economics 77 (4): 969-979.

Cox, T., J. Mullen and W. Hu (1997), "Nonparametric measures of the impact of public research expenditures on Australian broadacre agriculture", Australian Journal of Agricultural and Resource Economics 41(3), 333-60.

Duffy, R. and Goddard, E. (1995), 'The benefits to Canadian hog producers of generic vs. brand advertising of pork', in Kinnucan, H.W., Lenz, J.E. and Clary, C.R., (eds.), Economic Analysis of Meat Promotion: Proceedings from the NEC-63 Conference, National Institute for Commodity Promotion Research and Evaluation, Cornell University, Ithaca.

Freebairn, J.W., Goddard, E.W. and Griffith, G.R. (2005), "When can a generic advertising program increase farmer returns?", Australasian Agribusiness Review, (submitted and under review)).

Griffith, G.R. and H-S. (Christie) Chang (2000), "Do Canadian pork imports influence New South Wales pigmeat prices?", Review Paper No. 5, Volume 8 in Australasian Agribusiness Review, [Online]. Available: http://www.agribusiness.asn.au//Agribusiness Review/ 00Griffith.htm

Griffith, G.R., Green, W. and G.L. Duff (1991). "Another look at price levelling and price averaging in the Sydney meat market", *Review of Marketing and Agricultural Economic*s 59(2), 97-109.

Lemieux, C.M. and M.K. Wohlgenant (1989), "Ex ante evaluation of the economic impact of agricultural biotechnology: the case of porcine somatotropin", American Journal of Agricultural Economics 71(4), 903-14.

Mounter, S.W., Griffith, G.R. and Piggott, R.R. (2005), "The payoff from generic advertising by the Australian pig industry, in the presence of trade", Australasian Agribusiness Review, Volume 13, Paper 4 (listed February 22, 2005). Available at: http://www.agrifood.info/Publications_Review/Mounter_Griffith_Piggott.htm

Mullen, J. D. and T. L. Cox (1995), "The returns from research in Australian broadacre agriculture", Australian Journal of Agricultural Economics 39(2), 105-28.

Piggott, N., Chalfant, J., Alston, J. and Griffith, G. (1996), 'Demand response to advertising in the Australian meat industry', American Journal of Agricultural Economics 78(2): 268-79.

Piggott, R.R. (1998), Spending the Pastoralists' Levy Dollars: Promotion vs Research, Inaugural Public Lecture, University of New England, Armidale, 11 September.

Productivity Commission (2005), Australian Pigmeat Industry, Report no. 35, Productivity Commission, Melbourne.

Scobie, G.M., J.D. Mullen and J.M. Alston (1991), "The returns to investment in research on Australian wool production", Australian Journal of Agricultural Economics 35(2), 179-95.

Zhang, L. and Goddard, E. (1999), "Revisiting Australian pork sales response to advertising 1985-1997", paper presented at the 43rd Annual Australian Agricultural and Resource Economics Society Conference, Christchurch, New Zealand, January.

Zhao, X. (1999), The economic impacts of new technologies and promotions on the Australian beef industry, unpublished PhD thesis, University of New England, Armidale.

Zhao, Xueyan, Griffith, Garry and Mullen, John (2001), "Farmer returns from new technologies in the Australian beef industry: on-farm research versus off-farm research", Review Paper No. 1, Volume 9 in Australasian Agribusiness Review, [Online]. Available: http://www.agribusiness.asn.au/review/2001v9/Griffith_Beef_Research

/Zhao_Griffith_Mullen.htm

Zhao, X., Griffiths, W.E., Griffith, G.R. and Mullen, J.D. (1999), 'Probability distributions for economic surplus changes: The case of technical change in the Australian wool industry', Australian Journal of Agricultural Economics 43(4): 479-502.

---

[1] In the advertising scenarios reported here, exported Australian pork is assumed to exhibit some degree of heterogeneity from pork originating in other countries (the pork export demand elasticity is set at -5 instead of a much larger value). In the results reported in Mounter *et al.* (2005), various other advertising scenarios were examined including different assumptions about the trade status of the Australian pig meat industry and different assumptions about how the advertising expenditure was funded.

Date Created: 03 June 2005
Last Modified: (none)
Authorised By: Assoc. Prof. Bill Malcolm, Agriculture and Food Systems
Maintainer: Nanette Esparon, Agriculture and Food Systems
Email: webmaster@landfood.unimelb.edu.au