

FOOT-AND-MOUTH DISEASE OUTBREAK: MODELLING ECONOMIC IMPLICATIONS FOR QUEENSLAND AND AUSTRALIA

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ABSTRACT: This paper estimates the extent of the economic impacts that a foot-and-mouth disease (FMD) outbreak could have in Australia. Due to Queensland's reliance upon the beef, and to a lesser extent, sheep industries, the net effects of an FMD outbreak in Queensland would be far greater than that for the rest of Australia. The livestock farming (mainly beef cattle, sheep, dairy and pig) and meat product manufacturing (mainly beef, sheep meat and pork) industries are not the only industries that would be adversely affected by an FMD outbreak. Over half of the losses in jobs and industry output would occur in non-agricultural industries. The national economy was forecast to recover thirteen years after the outbreak. Due to the economic conditions created by an FMD outbreak, several industries primarily associated with mineral exports could actually benefit as a result of the outbreak.

1. INTRODUCTION

There has not been an outbreak of foot-and-mouth disease (FMD) in Australia for 130 years. However, the issue has resurfaced in the aftermath of the recent outbreak in the United Kingdom (UK), where there was 2030 confirmed cases of FMD and over 4 million animals were slaughtered for disease control measures (Department for Environment, Food and Rural Affairs, 2002). HM Treasury has estimated that the FMD outbreak led to a 0.2% reduction in UK GDP in 2001, with the impact being more pronounced in more severely affected areas (Department for Environment, Food and Rural Affairs and Department for Culture, Media and Sport, 2002).

Livestock farming is a significant primary industry in Australia. In 2000–01 livestock slaughterings and livestock products had a gross value of \$15.7b and accounted for 46% of the total gross value of agricultural production. At the 2001 Population Census, there were 327 059 people employed in the Australian livestock farming industry.

The majority of Australian beef exports (around 90%) are sold to FMD-free countries, predominantly around the Pacific Rim. These markets accept meat exports from FMD-free countries only and, as a consequence, suppliers receive a price premium. An FMD outbreak in Australia would result in the immediate closure of these FMD-free export markets to Australian-sourced live cloven foot animals, as well as to beef, sheep meat and pork products.¹

Our knowledge of the likely economic impacts of an FMD outbreak in Australia has, to date, been limited to the direct/on-farm effects. The recent outbreak in the UK illustrated that, although the impacts of an FMD outbreak are significant on the livestock farming and meat processing industries, there are also significant impacts on other sectors in the economy (e.g. tourism) (Department for Environment, Food and Rural Affairs, and Department for Culture, Media and Sport, 2002).

The objective of this study is to ascertain the likely impacts in Australia and Queensland, that an outbreak would have on the directly affected "at risk"² livestock farming and meat processing industries, and the likely flow-on effects to other industries and the economy as a whole. The study also examines the impact of an outbreak on Queensland sub-state regions.

2. METHODOLOGY

The Centre of Policy Studies at Monash University was contracted by the Department of Primary Industries, Queensland, to undertake the economic modelling. The Department of Primary Industries, Queensland, identified the shock to be modelled, specified the input to the model and, with the help of Queensland Treasury and a technical reference panel, undertook the analysis and reporting.

Specifically, the Monash Multi-Regional Forecasting (MMRF) model was used³. MMRF is a complete bottom-up model of the Australian economy covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. As each region is modelled as a mini-economy, MMRF is ideally suited to determining the impact of region-specific economic shocks. For example, it has been used to address issues including: the economic impacts of various large construction/operational-phase projects; the effects of restructuring payroll tax arrangements; the impacts of improved productivity in

¹ It is expected that an FMD outbreak could also result in the closure of FMD-free markets to minimally processed dairy products.

² In this study it was assumed that the beef cattle, sheep, pig and dairy industries, and associated products, would be "at risk" from an FMD outbreak.

³ MMRF is a bottom-up regional model based, in part, on the national MONASH model (Dixon and Rimmer, 2002). It is solved using the GEMPACK software (Harrison and Pearson, 1996). A full technical description of MMRF is provided in Adams, Horridge and Wittwer (2002). MMRF has been used to analyse the economic implications of a wide range of environment problems and policies designed to address such problems (see for example, Pezzey and Lambie, 2001).

government enterprises; and the regional impacts of Regional Forestry Agreements.

An important feature of the model is that it is dynamic. MMRF can be used in year-to-year forecasting and for comparative dynamic analysis of policy issues. It contains equations linking periods via capital accumulation and recognises the sluggish responsiveness of factor markets. Another feature is its facility to disaggregate results for industry variables at the state and territory level down to sub-state regions (56 statistical divisions as defined by the ABS). This proved extremely helpful for the analysis reported in this paper.

2.1 A Hypothetical FMD Outbreak

A number of possible outbreak scenarios were modelled but, after reviewing previous studies, it was decided that the following worst-case scenario would be reported in this paper, namely — *an outbreak close to Brisbane that results in a long-term market closure to export markets*. The assumed outbreak would result in the loss of access to FMD-free export markets for six years for all Australian-sourced live cloven foot animals, as well as for beef, sheep meat and pork products.

2.2 The Assumed Livestock Industry Response

The effects of an FMD outbreak on Australian “at risk” livestock industries are discussed below and are based on previous work by Lembit and Fisher (1992), who examined the likely direct/on-farm effects of an FMD outbreak for broadacre agriculture.

Phase 1 (Year 1): The announcement of an FMD outbreak would result in the immediate closure of all FMD-free export markets to Australian “at risk” livestock and livestock products. These export market restrictions would effectively reduce the demand for Australian “at risk” livestock and livestock products, which would then push down the domestic price of livestock and livestock products. In the initial year of the outbreak, livestock producers would hold back their animals from slaughter in response to low prices.

Phase 2 (Years 2 and 3): Prolonged low prices would lead producers to increase their livestock turnoff and consequently the supply of livestock and livestock products would increase. Greater supply would cause the domestic price of livestock and livestock products to fall further.

Phase 3 (Years 4 to 6): The increased slaughterings in **Phase 2** would lead to a significant decline in the livestock herd size, and as a result the number of animals available for slaughter would decline. This would cause the supply of livestock and livestock products to fall, which would gradually place upward pressure on the domestic price. The higher price of livestock would encourage producers to withhold stock for breeding purposes. This would result in a further reduction in the supply of livestock and livestock products, and push domestic prices higher.

Phase 4 (Year 7): Once Australia was declared FMD-free, market access to FMD-free countries would be regained. Demand for Australian livestock and livestock products would be restored and the domestic price of livestock and

livestock products would increase. However the assumed slaughtering-out of livestock in Years 2 and 3, and the biological time lag involved when rebuilding herds, would mean the supply of livestock and livestock products would not be sufficient to satisfy the resumed demand. This would place further upward pressure on the domestic price of livestock and livestock products.

Phase 5 (Years 8 to 15): Livestock producers would respond to the prevailing high domestic prices by increasing herd sizes. However, there would be a biological time lag between when the decision was made to increase the herd and when the increase in the supply of livestock was realised. Therefore, once livestock numbers increased, producers would increase their slaughterings and the supply of livestock and livestock products would increase. As supply continued to increase, the domestic price would begin to fall, and approach its original position (other things being equal).

3. SIMULATION DESIGN

The modelling involved the simulation of the following two scenarios:

1. Basecase. The basecase is a projection for state economies, compiled on the assumption that there is no FMD outbreak.
2. Alternative. In this scenario, we assume that the hypothetical FMD outbreak occurs. This scenario shows the effects of the outbreak, with the state economies adjusting away from basecase trends to accommodate the exogenous changes.

In preparing the second scenario, the likely impact of the outbreak on the quantity of livestock and livestock products exported from each state was entered into the model. The assumed deviations in export volumes are shown in Table 1. These numbers are based on estimates of percentage change in export volumes of livestock and livestock products drawn from simulations of the by the EMABA model of the Australian Bureau Agricultural and Resource Economics (ABARE), some of which are reported in Lembit. and Fisher (1992).

We report the effects of the export changes embodied in the second scenario as deviations between the values of variables in that scenario and their values in the basecase scenario.

3.1 Other Assumptions

3.1.1 Labour Markets

At the national level, we assume that the deviation in the national real wage rate from its basecase level increases in proportion to the deviation in economy-wide employment from its basecase level. Eventually, the real wage adjustment eliminates the deviation in national employment. At the regional level, we assume that labour is mobile between state economies. Labour is assumed to move between regions so as to maintain inter-state wage and unemployment rate differentials at their basecase levels.

Table 1. Changes in the Export Volume of Livestock and Livestock Products (Percentage Deviations from Basecase).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
New South Wales	-18.1	3.7	9.4	-17.2	-30.5	-34.7	-33.7	-30.8	-25.8	-21.6	-17.3	-12.4	-7.5	-3.3	0.0
Victoria	-4.0	-0.6	0.3	-7.0	-8.4	-9.1	-7.1	-6.3	-5.3	-4.5	-3.6	-2.6	-1.6	-0.8	0.0
Queensland	-28.5	6.1	14.4	-22.0	-41.7	-48.8	-49.2	-45.4	-38.1	-31.8	-25.4	-18.2	-10.9	-4.6	0.0
South Australia	9.8	0.9	0.7	-4.9	-5.0	-3.6	-0.8	0.2	0.0	-0.2	-0.4	-0.5	-0.5	-0.7	0.0
Western Australia	1.8	0.7	1.9	-8.3	-11.1	-10.8	-8.0	-6.5	-5.5	-4.8	-4.0	-3.0	-2.0	-1.3	0.0
Tasmania	-17.0	3.4	8.1	-14.5	-25.9	-30.3	-29.9	-27.7	-23.2	-19.4	-15.5	-11.1	-6.7	-2.8	0.0

3.1.2 Public Expenditure, Taxes and Government Budget Balances

We assume that real consumption by the regional governments is indexed to real private consumption in the respective regions, and that real public consumption of the federal government is indexed to national real private consumption. We also assume no deviation in the paths of tax rates applying to commodity sales and applying to labour and capital income. Government budget balances are not allowed to deviate from basecase values. This is achieved via endogenous changes in regional other direct tax rates.

3.1.3 Consumption, Investment, Ownership of Capital and Measurement of Welfare

In each year of the deviation scenarios, aggregate real consumption in a region diverges from its basecase level by an amount reflecting the divergence in real income available to the residents of the region.

3.1.4 Rates of Return on Capital

In deviation simulations MMRF allows for short-run divergences in rates of return on industry capital stocks from their levels in the basecase. Such divergences cause divergences in investment and capital stocks. The divergences in capital stocks gradually erode the divergences in rates of return.

3.1.5 Production Technologies

MMRF contains many types of technical change variables. In the deviation simulations we assume that all technology variables have the same values as in the basecase simulation.

4. RESULTS

4.1 Effects on the National and Queensland Economy

4.1.1 National Effects

Phase 1 (Year 1): The Year of the Outbreak

In the first year of the outbreak, it was assumed that overseas demand for Australian livestock and livestock products would fall. The reduction in export demand was assumed to result in a reduction in export volumes of livestock (-9.7%) and livestock products (-14.6%).

The fall in demand for Australian livestock and livestock products was projected to translate into lower domestic incomes, which were projected to lead to a reduction in domestic demand (-0.1%). The model predicted that the fall in domestic demand would lead to a 0.1% fall in domestic prices (or a 0.1% smaller rise in prices than would have otherwise occurred).⁴ The fall in domestic prices was predicted to mitigate the fall in domestic output, implied by the direct effect of the fall in export demand for livestock and livestock products (-0.2% of GDP).

⁴ As it is assumed that world prices are unchanged by a policy shock in the MMRF model, lower domestic prices were projected to translate into an increase in the international competitiveness of Australian products. In Year 1 of the outbreak, Australia's international competitiveness was projected to be 0.7% above the basecase.



Figure 1. Real GDP and National Employment.

An increase in Australia's international competitiveness was projected to lead to a slight increase in the quantity of aggregate exports (less than 0.1% above the basecase) and a decline in the quantity of aggregate imports (0.3% below the basecase).⁵

Overall the value of Australian exports was projected to decline relative to the value of Australia imports and the balance of trade was projected to deteriorate to \$400m below the basecase in Year 1.

Real GDP was projected to be relatively stable (-0.05% below the basecase) in Year 1 of the outbreak because it is assumed in the model that there is a one-year lag before the quantity of capital stock adjusts to the reduction in investor confidence in response to the FMD outbreak. Demand for labour, however, is assumed to adjust in response to the external shocks, and employment was projected to decline slightly (-0.06% or 5300 jobs) in the first year of the outbreak as the real cost of labour increased.⁶

In this modelling, we assumed that real consumption moves in line with real income. The initial assumed decline in world demand for livestock and livestock products was projected to place downward pressure on domestic prices (-0.05%). This reduction and the consequential terms of trade deterioration coupled with the fall in employment (-0.06%) would cause factor income to fall, which in turn would lead to a reduction in consumption. The projected increase in the CPI

⁵ The predicted decline in import volumes was the combined effect of a substitution of domestic for imported products, and a decline in income levels.

⁶ The projected initial rise in the real cost of labour would arise from a combination of wage bargainers attempting to maintain real wage outcomes and the projected terms of trade deterioration. A terms of trade deterioration would increase the price of expenditure (e.g. CPI) relative to the price of output (e.g. GDP deflator). Thus, with nominal wages assumed to be "sticky" in the short term and effectively indexed to the CPI, a terms of trade deterioration would lead to an increase in the price of labour relative to the price of output.

relative to the GDP deflator, which would reduce the purchasing power of existing income, would exacerbate the fall in consumption caused by the reduction in employment. Due to the fall in domestic prices, particularly relative to imported investment goods, the return in capital was projected to fall, and consequently investment also declined. Investment was projected to be 0.20% below the basecase in the first year of the outbreak. Investment deviated more from the basecase than real GDP and private consumption. This was because the lack of flexibility in the quantity of capital meant that initially all the adjustment had to occur through changes in prices, which lead to relatively large deviations in investment.

Phase 2 (Years 2 and 3): Persistent Low Livestock Prices

In Year 2 and Year 3 of the outbreak, it was assumed the quantity of livestock and livestock products exported would increase. This was a result of an increase in the activity (real value added) of Australia's livestock farming and livestock products industries through the liquidation of the national herd to discounted markets. It was estimated that the projected increase in activity of these industries in Year 2 would lead to an estimated 0.1% direct increase in real GDP above the basecase. The model projected that overall real GDP would increase by 0.2% (\$1230 million) above the basecase in Year 2. The projected increase in real GDP was greater than the projected increase in employment (0.1% or 10 100 jobs)⁷ and capital stock (-0.01%).⁸ This reflects the ability of farms to turnoff extra animals with little additional factor inputs and that meatworks can increase their throughput by running additional shifts but not investing in additional capital stock.

In the second and third years of the outbreak, private consumption was projected to rise in line with real GDP. The increase in real GDP was driven by an increase in factor incomes, predominantly from the increase in employment and capital rentals, which more than offset the decline in the terms of trade. Investment was projected to rise above the basecase by more than real GDP and consumption because the increase in the productivity of the livestock farming and livestock product industries in Year 2 increased the rate of return on capital. In response to the higher rate of return on capital, investors increase investment; however the one-year investment lag meant that initially all the adjustment had to occur through changes in prices, which lead to relatively large deviations in investment.

In Year 2, international competitiveness was projected to be 0.1% above the basecase, but had fallen 0.6% compared to the projection for the previous year. This implies that domestic prices were still low relative to world prices, but the

⁷ National employment was projected to increase due to several factors including: (1) increased activity in the livestock farming and livestock products industries; (2) an easing of wage bargaining pressures due to the previous year's fall in employment and increases in domestic output prices to CPI; and (3) a fall in the price of labour relative to the rental price a capital.

⁸ It is assumed in the model that there is a one-year lag before the quantity of capital stock adjusts to changes in investor confidences in response to and external shock.

extent of the fall in domestic prices was projected to ease. In Year 3, international competitiveness was projected to return to the basecase. The predicted decline in the terms of trade in Year 1 was maintained in Year 2 and Year 3 (remaining at 0.6% below the basecase⁹).

Even though Australia's international competitiveness was projected to decline between **Phase 1** and **Phase 2** of the outbreak, Australia's export volumes increased. The projected increase in aggregate export volumes in **Phase 2** was encouraged by declining export prices, which were approximately 0.5% below the basecase. Aggregate import volumes were also projected to increase in **Phase 2**. The increase in imports was driven by the projected increase in investment in the economy. Overall, the value of aggregate exports was projected to improve relative to the value of aggregate imports, which resulted in an improvement in the balance of trade compared to the first outbreak year. Even though an improvement in the balance of trade was projected between **Phase 1** and **Phase 2**, the balance of trade remained approximately \$270 million below the basecase.

Phase 3 (Years 4 to 6): Herd-size Decrease

The assumed high levels of slaughterings in Year 2 and Year 3 would reduce the size of the national herd.

Compared to **Phase 2**, international competitiveness was projected to improve in **Phase 3** of the outbreak, indicating that domestic prices fell relative to world prices. The terms of trade remained approximately 0.6% below the basecase, reflecting that export prices were still low relative to import prices. The assumed supply contraction in the livestock farming and livestock products industries was projected to lead to a fall in real GDP between Year 4 and Year 6 of the outbreak.

Real wages would take time to adjust to the external shock, and employment was projected to fall below the basecase. Capital stock was also projected to decline and in Year 6, real GDP was projected to be 0.3% (\$1430 million) below the basecase and employment was projected to be 0.2% (16 700 jobs) below the basecase and capital was projected to return to the basecase level.

Throughout Phase 3 of the outbreak, consumption was projected to continue to move in the same direction as real GDP, and reach 0.3% below the basecase six years after the outbreak. Investment declined (-0.6%) by a greater proportion than real GDP and consumption. The decline in investment was caused by the assumed decrease in the activity of the livestock farming and livestock product industries which, with the assumed investment lag, decreased the rental price of capital.

National export volumes declined to approximately 0.3% below the basecase in **Phase 3**, which reflects the large decline in Queensland export volumes of livestock and livestock products. Aggregate exports from the rest of Australia increased in response to the projected increase in international competitiveness.

⁹ In Years 2 and 3, export prices were projected to decline below the basecase and import prices were projected to decline to basecase levels and the effect on the terms of trade was maintained.

The projected contraction in national export volumes coupled with steady export demand led to a projected rise in national export prices.

Australia's international competitiveness was projected to improve in **Phase 3**, which encouraged import replacement and consequently the volume of imports was projected to fall.

The model predicted that the value of exports would fall relative to the value of imports and consequently the balance of trade was projected to decline further below the basecase (\$485 million in Year 6).

Phase 4 (Year 7): Market Access Regained

In Year 7, market access would be regained to FMD-free markets, and demand for Australian livestock and livestock products, it was assumed, would return to its original level. This was projected to lead to an increase in the price of livestock and livestock product exports, and an improvement in the terms of trade as export prices improved relative to import prices. An improvement in the terms of trade, all other things held equal, would be expected to increase real GDP (through an increase in income). However, the assumed slaughtering-out of livestock in Year 2 and Year 3, and the biological time lag involved when rebuilding herds, meant that the supply of livestock and livestock products would not be sufficient to satisfy the resumed demand. The continued output contractions in the livestock farming and livestock products industries alone would be expected to lead to a direct decline in real GDP of 0.14% in Year 7. The model predicted that overall real GDP would decline by 0.45% (\$2400 million) below the basecase.¹⁰

The Department of Primary Industries, Queensland, estimated that this hypothetical FMD outbreak would incur total control costs of approximately \$500 million, which are only minor in comparison to the forecast \$2400 million loss in real GDP in Year 7 alone. The model also predicted that, in Year 7, activity of the national livestock farming industry would be approximately \$700 million below the basecase, while activity of the national livestock product industry was forecast to be approximately \$200 million below the basecase. These losses, when combined, would be less than 40% of the projected loss in real GDP (\$2400 million).

The decline in the productivity of the livestock farming and livestock product industries would lead to an increase in the price of livestock and livestock products, which would drive up prices economy wide. The increase in domestic prices would lead to a projected decline in Australia's international competitiveness.

National export prices were projected to increase, reflecting the assumed

¹⁰ Activity from livestock farming and livestock products was projected to decline by a greater proportion than their use of factor inputs. Reflecting that the livestock farming industry would still have to utilise labour and capital to build up their herds and the livestock products industry would withhold labour and capital for use when the supply of live animals resumed. The withholding of resources by these industries would mean that resources would not be freed up for use by other industries, restricting their output growth, which would therefore exacerbate the decline in real GDP.

increase in demand for Australian livestock and livestock product exports and the projected higher price for these exports. National aggregate export volumes would begin to increase but would be constrained due to the assumed supply constraints in the livestock farming and livestock products industries. The predicted decline in investment (0.8% below the basecase) would reduce the demand for imported capital equipment, and cause a decline in import volumes. This decline in import volumes was partially offset by the projected decline in Australia's international competitiveness. The net result of these trade movements was an improvement in Australia's trade balance.

In Year 7, national employment was projected to be -0.2% (21 800 jobs) below the basecase.

Phase 5 (Year 8 to 15): Herd-size Increase

Over time, the size of the national livestock herd would increase, and the activity of livestock farming and livestock product industries would increase and approach the basecase. Real GDP was projected to increase as the activity of these industries increased, and was forecast to return to the basecase in Year 13. National employment was projected to return to the basecase in Year 10.¹¹

Australia's international competitiveness was projected to continue to decline, implying that domestic prices were increasing relative to world prices. In Year 14, international competitiveness was projected to return to the basecase.

The terms of trade was projected to decline slightly between Year 7 and Year 8, to 0.2% below the basecase, indicating that export prices were projected to decline relative to import prices. The decline in export prices was driven by the decline (relative to basecase) of livestock and livestock products export prices as the output of these industries increased.

Aggregate export volumes were projected to increase and peak in Year 15 at 0.4% above the basecase.¹² National export prices were projected to decline as aggregate export volumes increased (0.3% below the basecase in Year 15).

Import volumes increased in response to a decline in Australia's international competitiveness and increased demand for imported capital equipment to rebuild capital stock.

The model projected that the FMD outbreak would lead to a permanent increase in aggregate export volumes and a decrease in export prices, while import volumes and import prices were projected to essentially return to the basecase. The net effect of these movements was a projected improvement in the balance of trade (reached the basecase in Year 12).

¹¹ The more moderate outcome for employment was caused by a reduction in the real wage rate. It is an assumption in the model that, over time, real wages adjust so that the effect of an external shock on employment is zero in the long term. Therefore, by assumption, the negative labour market effects of the FMD outbreak would be reductions in real wages rather than reductions in employment.

¹² This projected increase was due to: (1) increase activity in the livestock farming and livestock product industries, and (2) increased activity in export-orientated industries due to the general increase above the basecase in Australia's international competitiveness and resource reallocation within the economy to more profitable industries.



Figure 2. Queensland Real GSP and Employment.

4.2 Queensland Effects

The large size of the Queensland livestock farming and livestock product industries (approximately 50% of the national beef cattle herd is in Queensland), along with the large assumed changes in the export volumes (and subsequent decline in prices) of these industries, meant that the effect of the outbreak would be greater (in percentage terms) in Queensland than in the rest of Australia. Queensland real Gross State Product (GSP) was forecast to reach its lowest point relative to basecase in Year 7 (-2.8% or \$2340 million below the basecase). In the same year, employment in Queensland was projected to be 2.2% (33,900 jobs) below the basecase (see Figure 2).

While employment in Queensland was projected to decline in Year 7, employment in the Rest of Australia (ROA) was projected to increase 0.2% (12,000 jobs) above the basecase. It was assumed that, due to the differing compositions of each state's livestock farming and livestock product industries, Queensland livestock and livestock-product exports would be the greatest affected by the FMD outbreak. The smaller assumed deviations in the export volumes of other states, partly explains why the employment deviations in Queensland are larger than the ROA. The increase in employment in the ROA is explained by location of industries stimulated by the economic environment created by the outbreak. For example, Western Australia was predicted to have a 1% increase in employment in Year 7 of the outbreak. Western Australia has the largest non-iron ore mining, and aluminium/alumina and magnesium mining industries in Australia. These export-orientated industries were projected to increase their activity and employment (benefiting from the decline in domestic prices, devaluation of the exchange rate and resource reallocation within the economy).

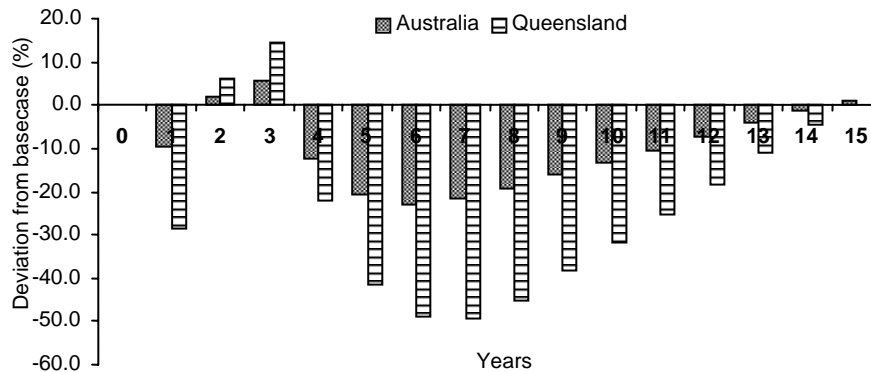


Figure 3. Livestock Farming Export Volumes.

4.3 Industry Effects – Australia Wide and Specific to Queensland

4.3.1 Livestock Farming and Livestock Product Industries

In 1999–2000, beef cattle constituted 53% of Queensland's livestock herd (number of animals) and 16% of the national livestock herd. It was assumed that the closure of FMD-free-export markets would have a greater impact on beef cattle and beef product exports than on other livestock and livestock product exports. Therefore, the assumed impact on Queensland livestock farming¹³ export volumes would be more pronounced than the impact on national livestock farming export volumes (see Figure 3).

As per the discussion in the assumed livestock industry response section of this paper, in the initial year of the outbreak, the volume of live animal exports would decline due to the closure of FMD-free markets. The closure of these markets would place downward pressure on livestock prices. It was assumed that as low prices continued in Year 2 and Year 3, producers would increase their turnoff and the quantity of live animal exports to FMD endemic markets would increase. By Year 4, livestock herds would be diminished and the volume of live animal exports would decline as producers withheld stock for breeding. Market access would be restored in Year 7, but assumed constraints on the supply of livestock would mean that the quantity of livestock produced (and exported) would only begin to recover in Year 8. It was assumed export volumes would reach the basecase in Year 15.

Output from the national and Queensland livestock farming industries (mainly beef cattle, sheep, dairy, pigs and poultry) was projected to deviate from the basecase in a similar way to the assumed export volume deviations (see Figure 4). However, projected declines in domestic meat product prices in the first four years after the outbreak would lead to an increase in the domestic demand for livestock farming output. Therefore, the negative deviations in

¹³ The livestock farming industry mainly includes the farming of beef cattle, sheep, milk cattle, poultry, pigs and commercial fishing.

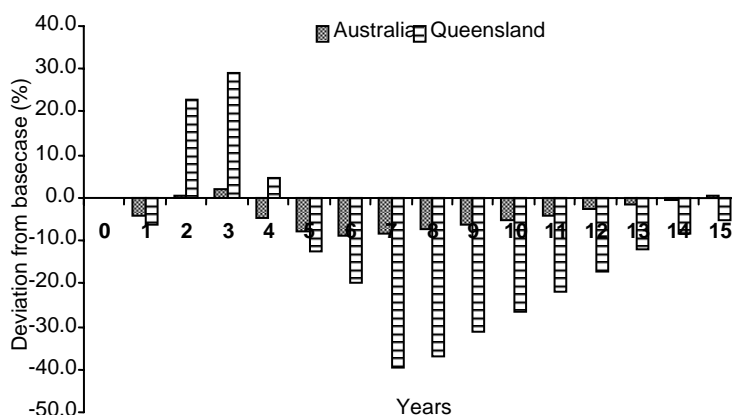


Figure 4. Livestock Farming (Beef Cattle, Sheep, Dairy, Pigs and Poultry) Activity (\$m).

activity were forecast to be more moderate than the assumed export volume deviations. Queensland livestock farming activity was projected to be 39.5% (\$770 million) below the basecase in Year 7, while national livestock farming activity was projected to be 8.3% (\$700 million) below the basecase.

Initially, the FMD outbreak was projected to cause unemployment in the livestock farming industry as price and output reductions increased the real cost of employing labour (see Figure 5). As livestock turnoff increased in the second and third years after the outbreak, employment was projected to increase. However, the severe supply contractions between the fourth and seventh year were projected to lead to a significant decline in employment. In Year 7, employment in Queensland livestock farming was projected to be 21.6% (13 000 jobs¹⁴) below the basecase, while employment in the national industry was projected to be 0.7% (1900 jobs) below the basecase.

The deviations in Queensland's livestock product¹⁵ export volumes were assumed to be identical to the changes in the State's livestock export volumes (see Figure 3). However, the national changes in livestock product export volumes were projected to be greater than the national changes in livestock export volumes (not shown). This reflects the concentration of livestock product industries in states that were assumed to be more affected by the outbreak (e.g. Queensland).

¹⁴ Changes in the number of jobs in each industry were estimated by multiplying the employment in the industry in 1999–2000 by the projected percentage impact on industry employment by the MMRF model.

¹⁵ The livestock product industry includes meat/meat product manufacturing, and dairy product manufacturing.

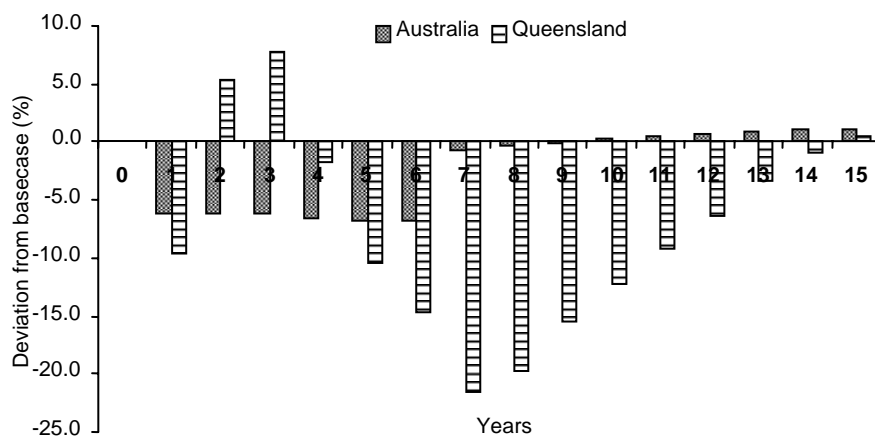


Figure 5. Livestock Farming (Beef Cattle, Sheep, Dairy, Pigs and Poultry) Employment (Hours Worked).

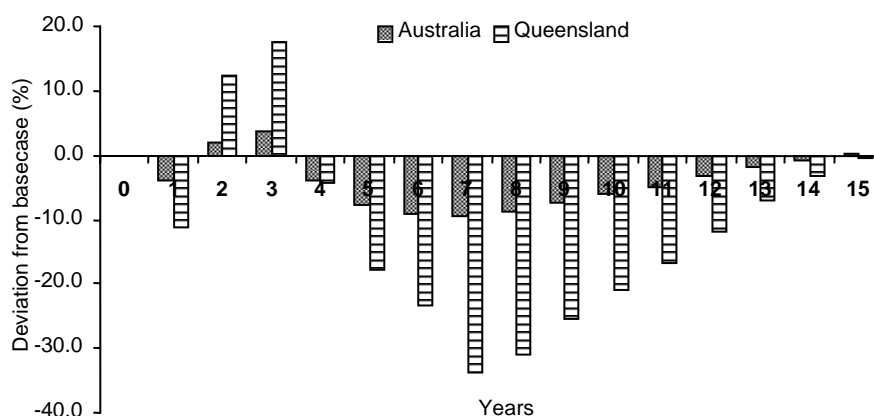


Figure 6. Livestock Product (Predominantly Meat Processing) Activity (\$m).

Similarly to the livestock farming industry, the negative deviations in the livestock product industry's activity were forecast to be more moderate than the assumed deviations in export volumes (see Figure 6). In Year 7, Queensland livestock product industry activity was projected to be 33.6% (\$184 million) below the basecase, while the national industry's activity was projected to be 9.5% (\$200 million) below the basecase.

Employment in the Queensland livestock product industry would follow a similar trend to employment in the Queensland livestock farming industry (see Figure 7). In Year 7, employment in the Queensland livestock product industry was projected to decline to 31%, or 4200 jobs, below the base, while

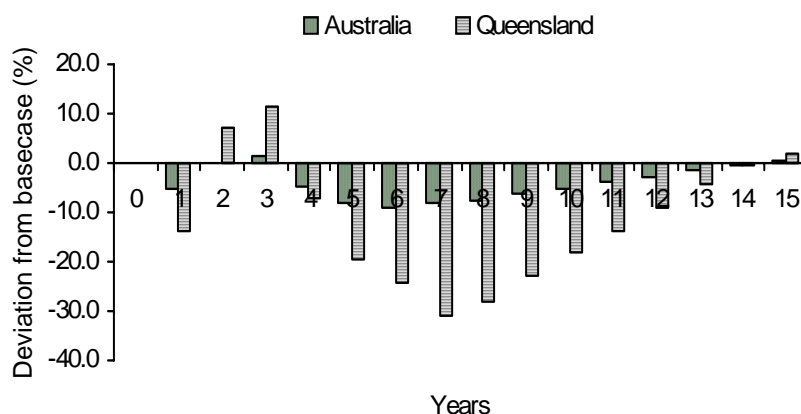


Figure 7. Livestock Product (Predominantly Meat Processing) Employment (Hours Worked).

employment in the national industry was projected to be 8.2%, or 5,100 jobs below the basecase.

4.3.2 Export-orientated Industries

Previously, the discussion has focused on the negative impacts that an FMD outbreak would have on the livestock farming and livestock product industries. However, as a result of the projected general increase in Australia's international competitiveness (arising from a currency depreciation) and resource reallocation within the economy toward more profitable industries, certain industries would benefit. Such industries include those that are highly exposed to international trade and have few direct linkages with the adversely affected livestock and food industries. Examples of export orientated Queensland industries are black coal mining,¹⁶ aluminium/alumina and magnesium mining,¹⁷ and air transport.¹⁸ Output from these industries is projected to generally increase above the basecase, with the extra output being internationally exported (see Figure 8).

Export volumes of each of these industries were projected to reach their highest point relative to basecase values in Year 7. Air Transport¹⁹ would have the largest percentage increase in export volumes (overseas travel) from basecase levels.

¹⁶ The black coal industry includes the mining of black coal (thermal and metallurgical).

¹⁷ The aluminium/alumina and magnesium industry mainly includes alumina production, aluminium smelting, and aluminium rolling, drawing and extruding.

¹⁸ The air transport industry mainly includes international and domestic air transport.

¹⁹ The projected increase in the export volumes and employment in air transport reflects the increase in Australia's international competitiveness and resource reallocation within the economy. This simulation did not examine the impact of a change in consumer tastes away from travelling to a country with an FMD outbreak, as was the case in the UK.

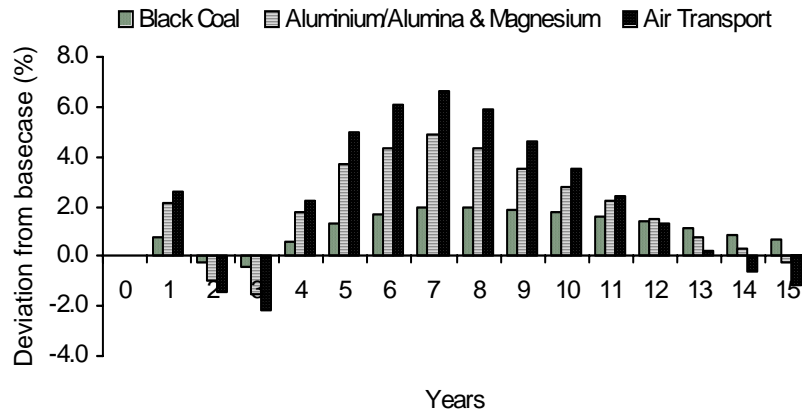


Figure 8. Export Volumes – Queensland Export-oriented Industries.

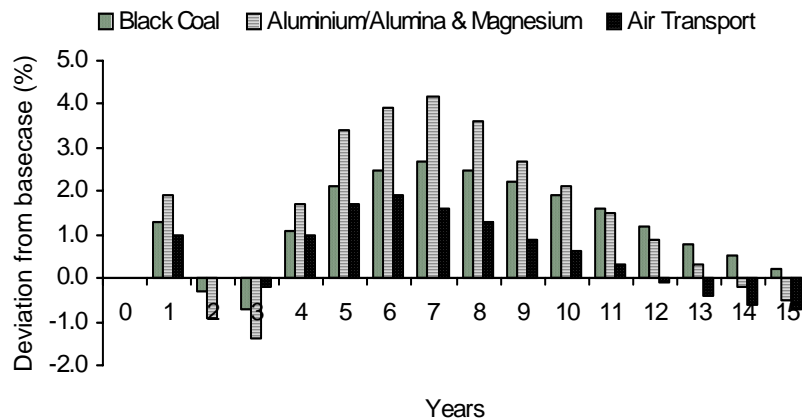


Figure 9. Employment – Queensland Export-oriented Industries (Hours Worked).

Employment levels were projected to change with output and exports in response to changes in the real cost of employing labour (see Figure 9). Employment in the Queensland black coal and aluminium/alumina and magnesium industries was projected to peak relative to basecase, seven years after the outbreak.

4.3.3 Service Industries

Service industries constitute around 70% of the Australian and Queensland economies (in terms of output value). Due to the large size of these industries, it is valuable to gain an understanding of the possible impact an FMD outbreak might have on them.

The activity of major Queensland service industries was projected to slightly decline in the first year of the outbreak, and then increase above basecase levels

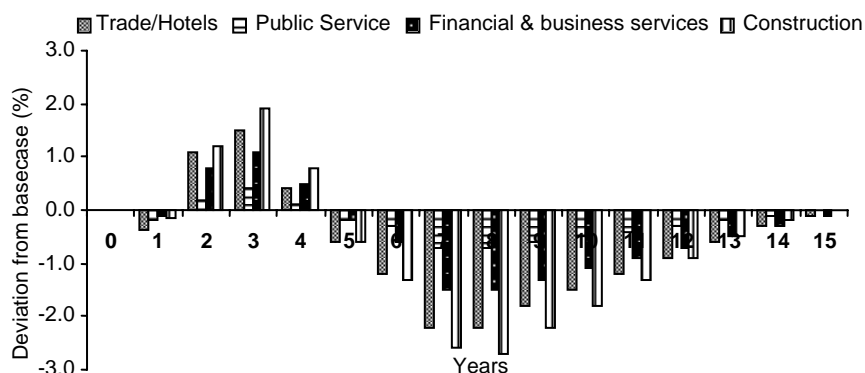


Figure 10. Activity – Queensland Service Industries (\$m).

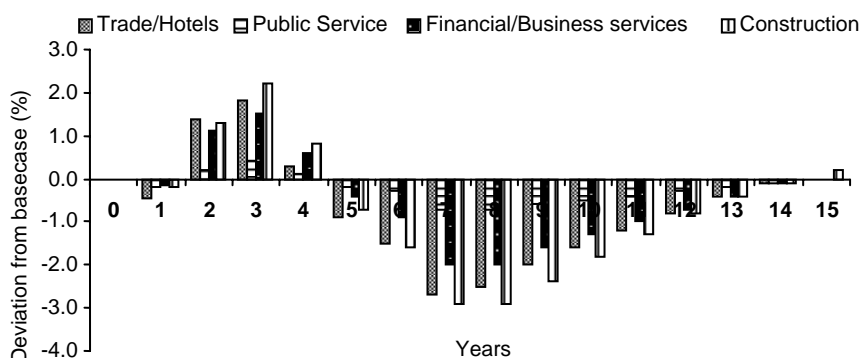


Figure 11. Employment – Queensland Service Industries (Hours Worked).

in the second and third years of the outbreak (see Figure 10).²⁰ The activity of these industries was then projected to decline between the Year 4 and Year 7 of the outbreak. It was then projected to recover to basecase levels by Year 15.

The Queensland construction²¹ industry would have the largest percentage output deviations from basecase values. Queensland construction's output troughed in the eighth year after the outbreak at 2.8% (or \$203.4 million) below basecase values.²²

²⁰ The projected increase in output above the basecase in Year 2 and Year 3 reflects the assumption that producers would increase their turnoff of livestock over this period in response to prevailing low prices, which in turn would increase the output of meat works.

²¹ The construction industry mainly includes the construction of houses, other residential buildings, non-residential buildings, roads and bridges.

²² The greatest impact on construction output was projected to occur in Year 8 because the assumed withholding of livestock between Years 4 and Year 7 would lead to a decline in the rates of return on capital. This would lead to a projected decline in investment to

Employment in Queensland's major service industries was projected to move in the same direction as the deviations in output (see Figure 11). Seven years after the outbreak, the deviations in employment in trade and hotels,²³ financial and business services,²⁴ and construction were greater than the deviations in output.²⁵

4.4 Effects on Queensland Sub-state Regions

The national impacts of the assumed FMD outbreak were generated using a 'bottom up' approach. That is, the MMRF model generated the impacts of the outbreak for each state and territory, and then aggregated the impacts to achieve the national results.

The impacts of the assumed outbreak on Queensland sub-state regions were generated using a 'top down' approach. That is, the impacts on the Queensland economy were apportioned to the sub-state regions using:

- * the projected industry impacts at a state level
- * data on the industrial composition of each sub-state region's economy

Employment in Queensland was projected to decline by 2.2%, or 33 900 jobs, below the basecase in Year 7, the year of greatest impact. Much of the employment loss in Queensland was projected to occur in the Brisbane and Moreton Statistical Divisions, where employment was 21 200 jobs below the basecase (see Figure 12). The projected high employment losses in South-East Queensland are due to the concentration of meatworks and industries that service the adversely affected livestock and food industries. There are also a sizeable number of livestock properties in South-East Queensland.

The Brisbane and Moreton Statistical Divisions were also projected to have the greatest loss in Gross Regional Product (GRP). Together, these regions were projected to lose around \$800 million in Year 7.

While, the greatest number of jobs was projected to be lost in South-East Queensland, regional economies in the South West and Central West were

Year 7, and because it was assumed that a one-year lag would exist between changes in investment decisions and changes in capital stock, construction output was projected to fall to Year 8.

²³ The trade/hotels industry includes wholesale trade, retail trade, accommodations, pubs, taverns and bars, cafes and restaurants, and clubs.

²⁴ The financial/business services industry includes financial institutions, insurance services, legal and accounting services, employment services, computer services, marketing and business management services.

²⁵ The projected declines in output from these industries would lead to reductions in the demand for capital and labour. The slow adjustment of capital stock for each industry accompanied by the rapid adjustment of wages (relative to the change in capital stock) and decreasing growth (relative to basecase) in the labour supply (partially offset by labour shedding in the livestock farming and livestock product industries) implies that the rental price of capital would decline relative to the wage rate. Businesses would therefore substitute capital for labour, explaining the greater projected decline in employment than output in Year 7.

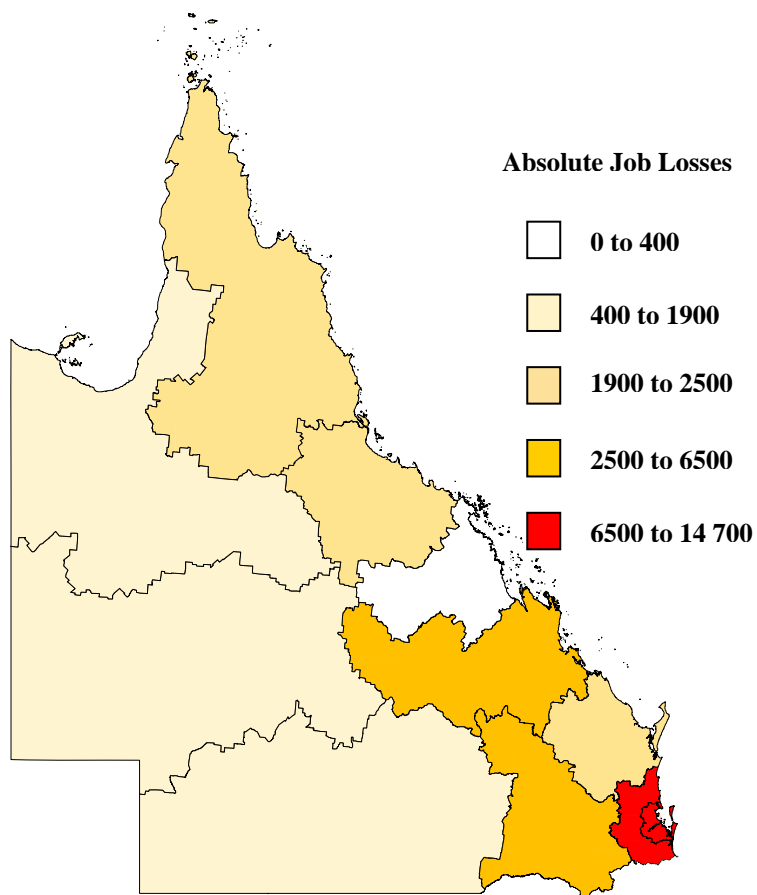


Figure 12. Queensland Employment: Absolute Change by Sub-state Region in Year 7.

projected to experience the greatest percentage loss in jobs (see Figure 13). Models are an accepted way to analyse complex issues, providing their limitations are understood. Employment in the South West Statistical Division was projected to be 6.1% (900 jobs) below the basecase in Year 7 and employment in the Central West was projected to be 5.6% (400 jobs) below the basecase. This reflects that the economies in these regions are highly reliant on the adversely affected livestock industries.

The South West and Central West Statistical Divisions were also projected to have the greatest percentage losses in GRP. The GRP of each of these regions was projected to be approximately 10% below the basecase in Year 7.

5. CONCLUSIONS

The MMRF model has been used to investigate the economic impacts of a wide variety of issues on Australia and its regional economies, including the

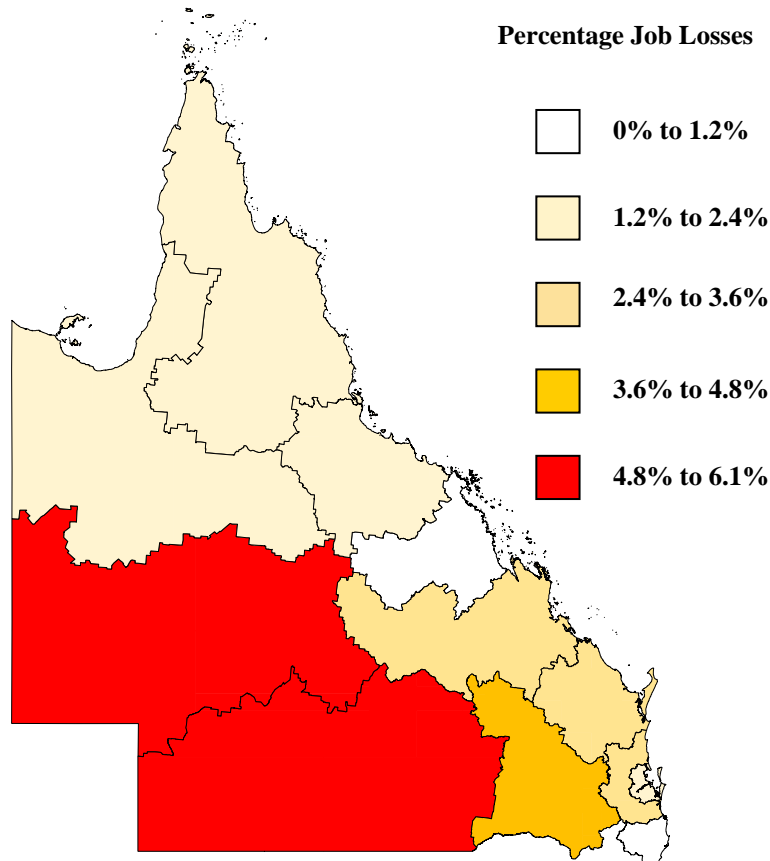


Figure 13. Queensland Employment: Percentage Change by Sub-state Region in Year 7

economic impacts of various large construction/operational-phase projects; the effects of restructuring payroll tax arrangements; the impacts of improved productivity in government enterprises; and the regional impacts of Regional Forestry Agreements. This paper discusses how the Department of Primary Industries, Queensland, used the MMRF model to examine the likely impact of an FMD outbreak in Queensland, on the Australian, Queensland and sub-state economies. The Department now plans to use the MMRF model to examine the economic impacts of a movement toward eco-efficient agricultural production and other issues.

The impact of the assumed FMD outbreak on Queensland, a major beef cattle state, was proportionally more severe than the national impact. Queensland employment was projected to be 33 900 jobs below the basecase and real GSP projected to be \$2340 million below the basecase in Year 7 alone. At a sub-state level, the greatest absolute losses occurred in the Brisbane and Moreton

Statistical Divisions, reflecting the concentration of meatworks and industries that service the adversely affected livestock and food industries. In percentage terms, the South West and Central West Statistical Divisions experienced the greatest losses, reflecting the reliance of these regions on livestock industries.

More than half of the impacts of the assumed FMD outbreak would occur in industries (e.g. construction, financial business service, retail trade and hotels) other than the "at risk" livestock farming and livestock product industries. In Year 7 alone, real GDP was projected to be \$2400 million below the basecase, while employment was projected to be 22 000 jobs below the basecase. These losses are far greater than the projected Year 7 losses in the national livestock farming industry (\$700 million and 1900 jobs) and the national livestock product (mainly meat processing) industry (\$200 million and 5100 jobs).

The Department of Primary Industries, Queensland estimated that this FMD outbreak would incur total control costs of approximately \$500 million. The costs of control appear significant, but are only minor when compared to the likely loss to the national economy.

The figures above are based on the assumption that a major FMD outbreak would result in the closure of FMD-free export markets to Australia for a period of six years. However, continuing low prices would prompt producers to increase slaughterings in an effort to maintain incomes. The increase in slaughterings would lead to a reduction in the size of the national livestock herd to such an extent that, when market access was regained in Year 7, there would be an insufficient supply of livestock and livestock products to satisfy the restored demand. It was assumed that it would take some time to rebuild the national herd, and it would not be until fifteen years after the outbreak that export volumes would return to the basecase level.

Our knowledge of the likely economic impacts of an outbreak of FMD in Australia has, to date, been limited to the direct/on-farm effects. However, this study highlights that it is not only the livestock farming and livestock product industries would be affected by an outbreak of FMD. A number of export-orientated industries, which have few direct linkages with the adversely affected livestock and food industries, would benefit from the projected general increase in Australia's international competitiveness, and the reallocation of resources within the economy toward more profitable industries.

ACKNOWLEDGMENTS

This study drew on expertise from various business groups within the Department of Primary Industries, Queensland, particularly Animal and Plant Health Services (Peter Black) and the Agency for Food and Fibre Science (John Hargreaves and Bob Armstrong).

The Office of Economic and Statistical Research, Queensland Treasury, provided valuable comments on the assumptions imposed on the MMRF model, and the interpretation of the results from the model. Greg Watts, in particular, extensively reviewed this report from a technical aspect and provided many useful comments.

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