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The Cost to the Bali Beef Industry of the October 2002 Terrorist Attack [1]

I Gusti Agung Ayu Ambarawati ^a, Xueyan Zhao ^b, Garry Griffith ^{ac} and Roley Piggott ^a

a - School of Economics, University of New England, Armidale, NSW.

b - Department of Econometrics and Business Statistics, Monash University, Victoria.

c - NSW Agriculture Beef Industry Centre, University of New England, Armidale, NSW.

Abstract

The island of Bali is one of the main cattle producing areas for Indonesia. Bali is also known for its extensive tourist sector. Frozen and chilled beef are imported to fulfil the tourist demand. This imported beef, most of it from Australia, competes with the local beef in the tourist sector. The terrorist attack in October 2002 caused the tourist industry to collapse and this impact has been passed down to the demand for local and imported beef. The objective of this paper is to use an economic model of the Bali beef industry to assess the impact of this attack on the Bali beef sector. The results show that there is expected to be a significant welfare loss of Rp 5.43 billion (A\$ 1.09 million) to the Bali beef industry over the medium term. Of this, Bali cattle producers are expected to lose Rp 2.57 billion (47 per cent). The quantity of Bali beef demanded by the HRI markets is forecast to drop by about 5 per cent, while imported beef demand is forecast to reduce by about 2 per cent.

Introduction

The island of Bali (also the Province of Bali) is one of the main cattle producing areas for Indonesia. An indigenous Indonesian cattle breed, Bali cattle (*Bos sondaicus*), is kept pure on the island of Bali despite the wide dispersion of this breed throughout the country. Bali cattle are known for their desirable traits, such as good adaptation to arid conditions, high fertility and good meat production. They are highly efficient in producing lean beef (Masudana 1990). There are no cattle imported into Bali due to the absolute protection of the Bali cattle resource. However, Bali cattle are highly sought after outside Bali, especially in Jakarta. About 60 per cent of cattle traded in Bali are sent off the island (DPPB 2000).

Bali is also known for its extensive tourist sector. Frozen and chilled beef are imported to fulfil the tourist demand. This imported beef, most of it from Australia, competes with the local beef in the tourist sector. However the Balinese tourist sector has suffered a number of setbacks in recent years. The financial crisis in 1997 was a major and ongoing disruption to the tourist trade, while the terrorist attack in October 2002 was another major crisis but hopefully a short-lived one. The Bali bombings caused the tourist industry to collapse and this impact has been passed down to the demand for local and imported beef.

The objective of this paper is to use an economic model of the Bali beef industry to model the impact of the Bali bombings in October 2002 on the Bali beef sector. The impact of these changes on various industry groups such as small-holders, processors and consumers, is estimated in terms of their welfare changes. Such a study is considered to be important because Australia is a major supplier to the market and Australian exporters need to be aware of the expected longer-term impacts of these sorts of events. The paper proceeds by describing the Bali beef industry in general terms including the role of imports; next specifying a synthetic model of the industry which captures the major economic relationships and linkages; and then simulating this model to estimate the impact of the terrorist attack on the major participants in the market. A summary and conclusions completes the paper.

The Bali Beef Industry

The beef industry on the island of Bali involves multiple markets and marketing stages. The demand for beef in Bali is met from two different markets: the wet market, and the higher end market, also known as the HRI (hotel, restaurant and institutional) market. The demand for fresh beef at the wet market comes from the local population and is supplied entirely from domestically slaughtered cattle. The wet market comprises some 80 per cent of the total beef demand in Bali. On the other hand, the Bali HRI market is currently satisfied by both Bali beef and imported beef. The star-rated hotels, selected supermarkets and catering companies demand local beef, chilled and frozen imported beef, depending on their mix of customers. Before the financial crisis in mid 1997, imported beef dominated beef supply to the HRI market and Bali beef accounted for only a small amount of the total beef demand. However, since the financial crisis Bali beef has increasingly been accepted to fulfil demand from the HRI market. Bali beef is now a strong substitute for imported beef in the HRI market. However, imported beef is not a substitute for Bali beef in the wet market because of preference and quality differences.

Domestic beef production for the wet market

Beef processing for the wet market in Bali is undertaken at public abattoirs. Retailers at the wet market cut the carcasses and sell directly to final consumers. Beef cuts at the wet market are not well-graded as the consumers seem to be indifferent to beef quality. Carcass production from public abattoirs is derived solely from Bali cattle.

In terms of cattle requirements for slaughtering, there are no specific standards of cattle such as weight and age for carcass production at public abattoirs. However, the weight of cattle sold at cattle markets for this market is usually above 300 kg. There is no specification of a production system for cattle in Bali for different purposes such as for wet or HRI markets. Cattle are usually grazed on public fields or maintained under a shed by small-scale farmers. Cattle are sometimes fed with feed supplementation such as rice bran. Heavier cattle are usually selected for the higher end market and for the inter-island trade.

Domestic beef production for the HRI market

Bali beef production for the HRI market is a different process from the wet market production in terms of cattle selection, processing and marketing phases. Bali beef for the HRI market comes from carcass production from private slaughtering houses. The carcasses produced from private abattoirs are expected to be of higher quality to meet retailers' demand. Certain criteria are usually used for carcass production such as carcass weight and its composition (percentage muscle, bone and fatty tissue). Retailers and packers at the HRI market cut and trim the carcasses and sell to the consumers. Beef cuts at the HRI market are graded to meet consumers' requirements.

Although Bali cattle are sold to different markets, there are no specific cattle producers for each market. All cattle traded come from the same smallholder producers without any product specification. All cattle are valued based on their liveweights with the same price per kilogram live weight. Cattle are selected at the market by private abattoir operators to obtain higher quality carcasses. This selection is mainly based on physical appearance and cattle weight. The average cattle weight for the HRI market is 375 kg. Some private slaughtering houses have their own cattle contracts with farmers so they can control their cattle weight and quality. While carcasses produced from private abattoirs are mainly directed to the HRI market, by-products and off-cuts of these carcasses are sold to the wet market. It is estimated that 20 per cent of total carcass production from private abattoirs are sent to the wet market. The main difference between private abattoirs and the public abattoirs is in the processing facilities. Private abattoir operations are more mechanised than public slaughtering houses to meet certain grading criteria.

Imports of cattle and beef

During the first half of the 1990s the growth in demand for beef in Indonesia surpassed the growth in production capacity. Live cattle and frozen beef were imported to meet the increasing demand. The policy to import live cattle is in accordance with the aim to modernise beef production, which is traditionally based on low productivity of smallholders (DGLS 1998; Hadi *et al.* 2002). The amount of live cattle imports expanded more than ten-fold from 1993 to 1997, from 35,400 head in 1993 to 386,600 head in 1997. At the same time, beef imports increased from 3,000 tonnes to 23,200 tonnes (Table 1). However, the massive devaluation of the rupiah due to the financial crisis in mid 1997 made imports more expensive and highlighted the problem of heavy reliance on imports. Live cattle imports dropped sharply to 50,600 head and beef imports declined to 8,800 tonnes in 1998 (CBSI 2000; Riley *et al.* 2001). Across all of Indonesia, beef imports have since recovered lost ground, and cattle imports are approaching previous levels.

Table 1. Indonesian beef supply by source, 1990 - 2000

Year	Domestic production (kilo tonnes)	Live cattle imports (meat equivalent) (kilo tonnes)	Beef import (kilo tonnes)	Total supply (kilo tonnes)
1990	259.2	0	1.42	260.62
1991	262.19	0.50	1.87	264.56
1992	297.01	4.10	3.15	304.26
1993	346.28	8.00	3.05	357.33
1994	336.46	14.20	4.80	355.46
1995	311.97	50.50	7.26	369.73
1996	347.20	79.20	15.77	442.17
1997	353.65	87.20	23.22	464.07
1998	320.80	21.80	8.80	351.40
1999	280.90	27.90	10.50	319.30
2000	276.90	63.00	26.90	366.80

Source : DGLS (various issues); Hadi *et al* . (2002).

Australia is the major supplier (Table 2), with the majority of the live cattle trade and about half of the imported beef trade. The USA and New Zealand are the other suppliers with significant market share.

Table 2. Australian exports of beef, veal and live cattle to Indonesia, 1993-2000

Product	Year	1993	1994	1995	1996	1997	1998	1999	2000

Beef/veal	Volume (kt)	2.3	5.0	10.4	16.6	24.3	1.7	11.6	13.1
Value (\$Am)	1.6	17.5	30.8	40.5	59.4	6.1	33.3	40.8	
Live cattle	Volume ('000)	58.3	118.0	226.4	389.0	428.1	42.4	157.3	296.7
Value (\$Am)	29.1	64.5	141.2	212.7	212.6	18.4	37.9	143.1	

Source: Riley *et al.* (2001).

As noted above, Bali also imports frozen beef to fulfil the rapidly growing tourist demand for higher quality beef (Table 3). An average of 922 tonnes of frozen beef per year from 1993-97 was imported into Bali. These imports were valued at approximately US\$ 2.10 million. Beef import activity in Bali has also been affected significantly by the financial crisis. As a result, beef imports into Bali dropped by 91 per cent from 1997 to 1998 (DPPB 1998), although imports have partially recovered to 2000.

Table 3. Beef import into Bali, 1990-2000

Year	Beef imports (ton)	Import value (US\$ million)
1990	58	0.24
1991	43	0.13
1992	60	0.14
1993	436	0.88
1994	649	1.40
1995	1427	2.86
1996	1302	2.68
1997	918	1.44

1998	78	0.01
1999	166	0.24
2000	300	0.45

Source : Masudana (1997); DPPB (1998 & 2000).

This brief review of the Bali beef industry will assist the development of a conceptual model of the industry. A disaggregated model along both horizontal and vertical lines is required to capture the different supply chains occurring in the different markets and the extensive trade that occurs.

A Conceptual Model of the Bali Beef Industry

Based on the above discussion, a disaggregated model of the Bali beef industry containing both a horizontal and vertical structure is developed to examine the benefits of exogenous impacts that occur in various industry sectors and markets, as well as the distribution of these impacts among different industry groups [2]. Horizontally, the market is segmented based on the type of beef demanded: wet and HRI markets. Vertically, beef production and marketing are disaggregated into cattle supply, processing, marketing and consumption. Inputs other than the cattle input are treated as a general 'marketing input' in all sectors.

The demand for imported beef at the HRI market is included in this segmentation. The quantity of imported beef is treated as an endogenous variable in the model, but the price of imported beef is treated as an exogenous variable. As Indonesia is not a major player in beef imports in the world market, it is considered that the supply of imported beef into Bali is perfectly elastic. On the other hand, the demand for imported beef by Bali is assumed to be downward sloping.

The model also includes the rest of Indonesia (ROI) market in order to capture the impacts of inter-regional trade on Bali cattle production. It is believed that any changes in beef demand outside Bali will affect cattle production in Bali. The Bali geographical market and the ROI market are linked through the quantity of cattle traded and the cattle price. Any policy changes occurring in the ROI market are treated as an exogenous shifter to the Bali cattle production. [3]

Based on the industry structure reviewed above, the conceptual model of the Bali beef industry is specified in Figure 1 in Appendix 1. As shown in the figure, there are four production functions, represented by rectangles on the diagram. Each production function creates the demand and supply for a product represented by the ovals on the diagram. In each supply or demand schedule an exogenous shift may occur. The inclusion of the exogenous shifters in this model enables separate analyses of various policies at the farm level, processing stage and retail marketing. There are 13 factor or product markets involving 24 quantity and price variables. There are also two aggregated input and output index variables for the processing sector at private abattoirs. This gives 26 endogenous variables for the 26 equations and identities in the system. The full structural model of the Bali beef industry including definitions of all variables and parameters in the model is described in Ambarawati *et al.* (2003), or details can be obtained directly from the authors.

Methodology

This research is based on a synthetic model, often referred to as an Equilibrium Displacement Model (EDM). EDM has been frequently used in agricultural price and policy analysis (see for example Alston *et al.* 1995; Mullen *et al.* 1988, 1989; Zhao *et al.* 2000). The EDM involves the application of comparative static analysis to a structural model involving unspecified functional forms. The main strength is that it allows quantitative assessments to be made of the impacts on endogenous variables of small changes in exogenous variables in situations where there are no resources available or the data are too unreliable to engage in econometric modelling (Piggott 1992). In the EDM approach, the market is disturbed by a change in the value of an exogenous variable and the impacts of the disturbance are approximated by functions that are linear in elasticities and proportional changes. These functions

are obtained following total differentiation of the structural model and conversion to elasticities and proportional changes.

Data Requirements

Implementation of the EDM requires three different sets of information. Firstly, base price and quantity values are needed for all endogenous variables to portray the base equilibrium status of the system. Secondly, various elasticity values are needed. Finally, values for exogenous shifters are needed to quantify the impact of policy or other changes at different levels of the market. Given this information, impacts on endogenous variables can be estimated and these, in turn, can be used to estimate welfare impacts in terms of producer and consumer surpluses.

The availability of consistent price and quantity data for the Bali cattle and beef industry is very limited. The Central Bureau of Statistics of Indonesia (CBSI) and the Directorate General of Livestock Services (DGLS) provide annual data on beef production for all provinces in Indonesia, measured in kilotons carcass weight. However, there is no published information on final beef products such as the quantity of beef entering the wet and HRI markets, respectively. Information on the quantities of carcasses produced from public and private abattoirs is also lacking. Hence, assumptions are made on the proportion of carcasses produced at different abattoirs and beef produced for the wet and HRI markets based on the information provided by DGLS staff, Bali Regional Livestock Services staff and other industry agencies. Considerable effort has been made in this study to assemble a set of equilibrium quantities and prices at different stages. These include a survey of public and private abattoirs, hotels and restaurants in Bali to obtain the required information. A combination of published information and the survey information has been used to estimate the data required at the different levels and market segments.

Price and quantity values used in this study are based on the year 2000 assuming that the beef market situation in Indonesia had returned to normal after the 1997 financial crisis. There was a sharp increase in imported beef into Indonesia, from 10.5 kt in 1999 to 26.9 kt in 2000. Beef imported into the Bali HRI market increased from 165 tonnes in 1999 to 300 tonnes in 2000. This is a good indication that the economy is gradually recovering from the financial crisis. Values of base equilibrium quantities and prices for all endogenous variables including the cost and revenue shares for all sectors are presented in Ambarawati *et al.* (2003).

Market parameters required in the model include the elasticity values of various beef demand and input supplies, input substitution and product transformation. Parameter values are selected on the basis of economic theory, past studies of the beef industry and intuition. The values of market parameters are also presented in Ambarawati *et al.* (2003).

Impact of the Bali Terrorist Attack

The incidence of the Bali terrorist attack is modelled as an inward shift of the demand curve for beef at the HRI market. The October 2002 Bali bombings have caused a significant decline in tourists to Bali (Table 4), which has reduced the demand for beef.

Table 4. The number of tourists visiting Bali

Year	Direct arrival (million persons)
1995	1.01
1996	1.14
1997	1.23
1998	1.19

1999	1.35
2000	1.52
2001	1.45
2002	1.30
(Oct-Dec 2002)	0.18
2003 Jan-March*	0.13

Source : Bali CBS (various issues); Bali Tourism Board (2003).

The number of tourists visiting Bali after the bombing from January to March in 2003 shows a substantial decline compared to the same period in previous years (around 0.38 million). Another indicator is hotel occupancy rates. In Bali, there are currently 135 star-rated hotels with over 19,000 rooms available. The occupation rate after the bombing fell to 30 per cent from the average of 77 per cent before the bombing (Bali Tourism Board 2003).

These impacts are substantially greater than estimated by Erawan (2002) shortly after the attack. He estimated a drop of 14 per cent in tourist numbers. He estimated that the Bali bombing tragedy has caused a loss of Rp 10,889 billion (about A\$ 2,118 million) to the Bali economy. Before the tragedy, the tourist sector accounted for about 60 per cent of gross regional domestic product (GRDP), but the attack is estimated to have reduced the GRDP by 4 per cent. Sectors that are most affected by this tragedy are the trade, hotels and restaurants (36.14 per cent), manufacturing industry (21.58 per cent), agriculture (18.44 per cent) and transport and communication (11.89 per cent). Hence, the tragedy has impacted on more than 88 per cent of the Balinese economy. Consequently, the expected rate of growth of the Bali economy of 4.85 per cent in 2002 cannot be sustained in coming years. The growth of the Bali economy is now estimated at only 3.1 per cent. This will increase the unemployment rate by 1 per cent, from 2.88 per cent to 3.88 per cent.

The decline in tourists has affected the hotels and restaurants sector particularly and therefore the demand for hotel beef as part of the HRI market. Considering that 80 per cent of good quality Bali beef at the higher end market is consumed by the tourists and there is a lower estimate of a 14 per cent reduction in tourist numbers, the estimated initial reduction in demand for beef in the HRI market is about 11 per cent. This is the reduction in beef demand in the HRI market that is simulated.

The results (Table 5) show the welfare changes in the Bali beef industry after the market has adjusted to the initial shock, over a medium term adjustment period of 2-3 years. A significant welfare loss of Rp 5.43 billion (A\$ 1.09 million) to the Bali beef industry can be expected. Of this, Bali cattle producers are expected to lose Rp 2.57 billion (47 per cent of the welfare loss). The quantity of Bali beef demanded by the HRI markets is forecast to drop by 5.09 per cent, while imported beef demand is forecast to drop by 1.9 per cent. HRI consumers as a group are expected to lose about the same as Bali cattle producers. In fact all sectors lose with the exception of consumers in the rest of Indonesia. With the curtailment of the Bali market, more Bali cattle are shipped off the island and ROI consumers receive gains of Rp 1.46 billion.

Table 5. Economic surplus changes (Rp billion) and percentage shares of total surplus from the Bali bombing scenario

Industry Group	Bali bombing scenario
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	Rp billion	%
Bali cattle producers	-2.57	(47.33)
Public abattoirs	-0.05	(0.92)
Private abattoirs	-0.10	(1.84)
Wet market retailers	-0.01	(0.18)
HRI market retailers	-0.10	(1.84)
Sub total Producer surplus	-2.83	(52.12)
Wet market consumers	-1.52	(27.99)
HRI market consumers	-2.54	(46.77)
ROI market consumers	1.46	26.89
Sub total Consumer surplus	-2.60	(47.88)
Total surplus	-5.43	100

Note : Figures in brackets are the percentage loss to the total welfare loss

So some of the initial fall in demand of 11 per cent is regained over time as consumers and producers respond to the price changes generated in the market by the initial shock to HRI demand.

If the tourism industry starts to recover over the next couple of years, a 1 per cent increase in demand for Bali beef in the HRI market will provide gross benefits of Rp 0.46 billion to the Bali beef industry.

Summary and Conclusions

An attempt was made to estimate the impacts on the Bali beef industry of the October 2002 bombings. An estimate of an 11 per cent initial reduction in the demand for beef in the HRI market was used. The results show that over a 2-3 year time horizon, there is expected to be a significant welfare loss of Rp 5.43 billion (A\$ 1.09 million) to the Bali beef industry. Of this, Bali cattle producers could lose Rp 2.57 billion (47 per cent). The quantity of Bali beef demanded by the HRI markets is forecast to drop by 5.09 per cent, while imported beef demand is forecast to reduce by 1.9 per cent. Accordingly, more Bali cattle are expected to be shipped off the island and ROI consumers could receive gains of Rp 1.46 billion.

With Australia a major supplier to the Bali beef market, Australian exporters would be expected to also suffer some

losses, although those have not been measured in this study.

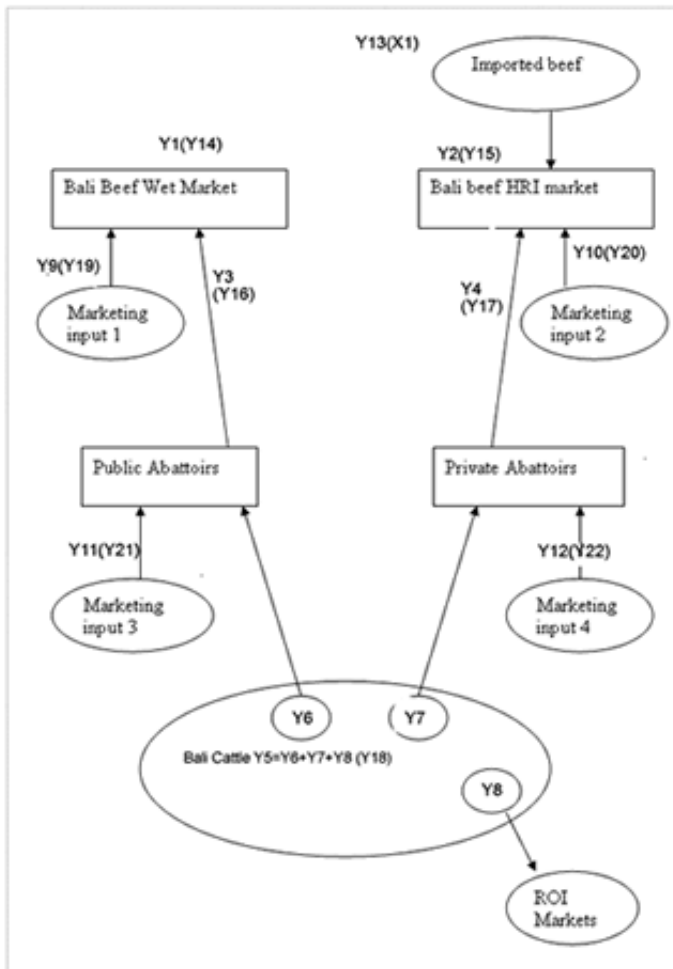
The model seems appropriate for examining other types of R&D and policy scenarios. For example, estimates of the cost savings from particular types of policies (see Ambarawati *et al.* 2002) can be used as inputs. However, since the base data are quite scarce and there is much uncertainty about some of the assumptions made, formal sensitivity analyses are required to ensure that the generated results are not highly dependent on particular assumed values.

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Appendix One.

Figure 1: The structural model of the Bali beef industry



[1] This is a revision of a paper presented at the 47 th Annual Conference of the Australian Agricultural and Resource Economics Society, Canberra, February 2003. The helpful comments of AARES conference participants are much appreciated.

[2] One of the main reasons for developing this model was to examine the economic benefits of various types of R&D on the Bali cattle industry (see Ambarawati *et al.* 2002, 2003).

[3] A larger version of the model is also available where the ROI sector is fully endogenous. However, given the relative sizes of the beef markets in the two geographic sectors, little extra information is provided by using this version.