Supplementary
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INQUIRY INTO ASPECTS OF AGRICULTURE IN NSW

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Macro-economics of Australian Agriculture

The recent Water Reforms and Native Vegetation legislation have been accompanied by vocal requests for assessment of socio-economic impacts of legislative changes. These calls generally relate to loss of income to the farming sector and loss of jobs within specific communities. However, socio-economics covers a much broader set of issues than just income and employment. Because of the global nature of trade in agricultural products, changes in one area resonate throughout the entire marketing system. Gains and losses are borne disproportionately within and across regions and nations. These gains and losses are reflected in an array of indicators of social wellbeing, including changes to services, infrastructure, demographics, employment patterns, travel, income distribution and community capacity to nominate just a few.

A drive down the main street of country towns quickly shows that not all have performed equally in response to changes in broad acre farming over the past 20 or 30 years. Empty shops, closed schools and police stations and decay of community infrastructure are some of the more obvious symptoms of socio-economic decline. In other towns and regions, the reverse may be happening. The true measure of the desirability of farming practice change is the **net** balance of the positive and negative outcomes and where the benefits and costs are distributed. At a policy level, active encouragement of farming practice change may need to be complimented by measures to ensure revenue neutrality to adversely affected communities.

Caroline Rasheed (Country Towns; Impact of farmers' expenditure on employment and population in Australian towns, ABARE Current Issues, 2000.4, October 2000), from a study of ABS Census data, drew the following conclusions;

- The economies of small rural towns are highly dependent on farm expenditure.
- Farm expenditure can represent more than a third of economic activity in small towns.
- Generally, the **greater** the reliance of a town's economy on expenditure by farmers, the **lower** the population growth.
- Small towns that are highly reliant on broadacre farming for their economic survival are most likely to be in decline.

Sinden (Sinden, J A, Who pays to protect native vegetation? Costs to farmers in Moree Plains Shire, NSW, Paper presented to 46th annual conference of AARES, Canberra, February, 2002, Page 17), using comprehensive individual farm data, estimated that Moree Plains farmers **lost** an average $54 per hectare under existing management practices.

Farmers operate in a confusing world, characterised by mixed messages from governments, lobby groups, advisers and peers and a decision making process built on culture rather than fact and logic. There are many reasons why apparently rational decisions at the farm level can lead to socio-economic decline across regional Australia. The purpose of this module is to explore methods for measuring and evaluating the true socio-economic impacts of decisions made by grain growers.

There are a number of general tools that can be used to assess macro-economic impacts. They are not complex and only require information that the industry should have readily available as a normal component of rational decision making. The following structure will be followed;

- Broad philosophy of economic analysis.
- Regional trade model as a method for assessing decisions at all levels.
- Demand curves and their role in determining the principles of socio-economic assessment.
    - Elasticity, total revenue and marginal revenue,
    - Determining profit and income maximisation, and
    - Consumer surplus and the distribution of benefits.

- Market failure and its impact on decision making.
- Profitability, sustainability and politics – the role of National Policy.
- Alternative methods of assessing socio-economic impact.
- Putting it all together – calculating who gains and by how much.
- Some concluding comments.

Philosophy

Economics is generally understood to be the science of efficiently allocating scarce resources to competing end uses. This is achieved through a market mechanism which allows all possible end users to compete for scarce resources, the price being determined by the highest bidder (the most efficient). Thus, economics also determines the optimal firm size in any productive process (economies of scale). Implicit is the assumption that product and information transfer are frictionless (no barriers to trade) and that participants have perfect knowledge (there are efficient markets for all inputs and outputs to provide appropriate price signals).

Does this look much like reality? The real world is different. There are barriers to the free movement of resources across country borders, resources do not necessarily convert immediately from one use to another, there are no markets for some of the inputs to and outputs from modern industry and reliable information about economic decisions can only be collected after the event. A market system does not allocate resources efficiently while one of the main drivers is market failure.

Economic theory considers two broad areas of rational decision making. Micro-economics studies the behaviour of firms. The term firm is used to define any single trading entity, ranging from the individual to the monopolistic corporation. Macro-economics is the study of group economic behaviour. It is the sum of the outcomes of economic decisions made by all firms whose activity impacts on "the economy".

Much of the economic theory surrounding farmer decision making is based on the perfectly competitive model. One of the main assumptions underpinning this model is that each producer is such a small part of total production that their individual decisions have no impact on the price of the commodity they produce. The demand curve for the product is a horizontal line and marginal revenue is equal to price. If one farmer decides to produce an additional 100 tonnes of grain, then that decision will not impact on the price received by all other producers and the industry will be better off by 100 t of grain multiplied by its price per tonne. By implication, 20 000 producers can decide to increase their production of the same grain by 100 t each without affecting its price to other producers.

While it is possible to believe that an additional 100 t will not affect prices noticeably, it is hard to believe that an additional 2 million t will not lead to lower prices. For this reason, gross margins or any other static form of cost/price analysis is a poor decision making tool. Shifts in technology or market conditions favouring one crop can lead to changes in production and prices that more than offset any perceived gains. In Australia, over the past 40 years, production has trebled for no real gain in the value of production. The reasons for this will be discussed in greater detail in the section on demand curves and how they impact on income and profitability. **Profitability is the driver of socio-economic outcomes.**

The above case exemplifies the classic conundrum that exists between micro- and macro-economic theories. At the macro level, if the nation is better off by $1 million then some person or people must be better off to the sum of $1 million. At the micro level, an individual can be better off by $1 million but national income remains unchanged if the $1 million is a transfer from somewhere else. This is the inherent problem when applying the results of on-farm research to an industry level. It also demonstrates why care should be taken when interpreting the results of comparative analysis. Not only is it mathematically impossible for all farms to be in the top 20%, but it may also be disastrous for that industry for all producers to try to emulate the top 20%.

Improvements in economic performance at a macro level unambiguously leave the nation better off. Improvements at the micro level may simply measure income transfer without any net national gains (it is theoretically possible for there to be a net national loss). Apparently rational individual decisions that imply improved profitability can lead to a loss of total profitability to the industry as a whole with negative socio-economic consequences. It is hard to believe that farmers have taken deliberate decisions to reduce the profitability of their enterprises and disadvantage their local communities, yet this has been the outcome.

This introduces the concept of **equity**. Equity may be vertical (between different sectors) or horizontal (between different producers in the same sector).

Changing cropping or grazing decisions may have positive consequences for those who change but negative consequences for other producers in the industry. However, if every producer makes the same changes, changes to quantities and prices may be such that all producers lose. How much can producers afford to pay to protect their current interests? Take the example of land clearing. Those clearing additional land for cropping believe that they will increase the profitability of their operation by doing so (it is irrational to clear if it is not more profitable). However, if the additional production from newly cleared land leads to a lower price for all existing producers, the industry may be worse off. There is a strong likelihood that income reduction will most seriously impact on those least able to afford it (those whose farm cash income is already low). It may be beneficial for all existing producers to pay a levy on their production and pay others **not** to clear more land if the levy is smaller than the likely price reduction due to increased production.

Research (Gardiner, unpublished) shows that the real gross value of agricultural production in Australia has remained unchanged for the past 40 years at about $28bn. This means that any additional real income earned by an individual farmer or industry has come from another farmer or industry. In the Australian case, income has transferred from grazing to cropping industries and from farmers in "old" cropping areas to those in "new" cropping areas. Over the same period, real GDP has quadrupled, implying a transfer of wealth from production to consumption.

Throughout this exercise, real prices are assumed. The real value of a financial variable reflects its purchasing power and allows comparison through time. Nominal data is converted to real data by dividing it by an index of its purchasing power. The two most common indices are the CPI and the farmers' index of prices paid. The data come predominantly from ABARE and ABS, who provide data that is already in real terms.

History shows that the only thing we learn from history is that we don't learn from history. There is a considerable body of historical data that allows us to assess the impacts of past decision making on farm performance (Gardiner, Aesop on Australian Agriculture). Here are some interesting (concerning?) numbers about grain production in Australia over the past 40 years. These are trend numbers and, as such, are independent of short term anomalies:

- Agricultural production has increased by 300%.
- Real gross income, in Australian dollars, has remained unchanged despite this increase in production.

- Real gross income, adjusted for currency fluctuations, from farm production has fallen by 50% from its mid-1970's peak.
- Real net value (profitability) of farm production has decreased by 67%.
- Number of producers has decreased by 50%.
- 50% of farm cash income is earned off farm.
- 70% of broad acre farms survive on off farm income and
- The average age of broad acre farmers is 8 years more than 40 years ago.

Within regional Australia, the above changes to agriculture have been accompanied by:

- A decrease in the proportion of the population living in regional areas.
- A concentration of regional population into larger centres where spending by farmers is a minor component of total business activity.
- An aging population structure.
- Losses of government (eg education) services.
- Losses of business and financial services.
- Loss of recreational facilities.
- Deteriorating infrastructure.
- On average, lower incomes.
- Higher unemployment.
- A net annual outflow of wealth to metropolitan Australia (including tax revenue) of about 3% p.a. and
- High suicide, divorce and accident rates that are related to the stresses of living in declining regional communities.

The above statistics are by no means all inclusive but are included to demonstrate the broad range of socio-economic indicators that can be used to measure the impact of "sustainable" farming decisions (systems need to be sustainable at environmental, economic and social levels). It is hard to believe that what is happening on farms and in regional communities is unrelated. The good thing is that, in a cash (or card) economy, most socio-economic outcomes are tied to the flow of money. In the most general terms, individuals, regions or nations who accumulate money prosper. This we now consider under the heading of the regional trade model.

The Regional Trade Model

Everybody trades to make a living. We all export and import goods and/or services for money. The beauty of the regional trade model is that the regions can be as small as the individual or as large as the nation and the outcomes remain the same. Those regions that are net exporters accumulate wealth. Those that are net importers lose wealth. The individual who exports labour cannot import goods and services in excess of the value of that labour for a prolonged period without financial consequences (going bankrupt). The same applies to towns, shires, states or nations. **Net exporters accumulate wealth.** This explains why all regions do not benefit equally from economic growth.

It is possible to supplement income with debt, but only up to the point where available income can repay that debt. Debt is an export of assets and its repayment is an import.

At any point in time, it is not possible for all regions to be net exporters. If one region is a net exporter, then, by definition, some other region must be a net importer (in total, exports must equal imports). Regional trade is seen as "good" because efficiency gains related to comparative advantage allow more consumption from the same amount of income. Inter- and intra-regional equity can only be maintained if the changes to exports and imports following a change to policy or practice sum to zero for all affected regions (by definition, individuals are also regions). This ensures that existing horizontal and vertical equity are maintained. If changes in the pattern of imports and exports transfer wealth from poorer to richer producers, sectors or regions, then programs to reinstate equity may be justified.

Changes in socio-economic wellbeing are tied to changes in equity (relative changes in exports and imports). At this point, another conundrum emerges. While all wealth derives from primary production, primary producers are rarely the beneficiaries from their increased production. The reasons for this will be outlined in the section on demand curves. Thus, wealth can be **generated** by one region but **accumulated** by another.

This explains the complex patterns of socio-economic growth and/or decay. As the balance of trade to farmers (price of imports relative to price of exports) deteriorates, they are forced to export their labour (off farm income) or their assets (sell or mortgage the farm). Every job that supports a farm is a job **not** supporting another family. This forces people to migrate (export their labour to another region) or accept a lower price for it (eg unemployment benefits). The net result is a loss of population. Services and infrastructure are population dependent. Loss of these leads to a further loss of population and lower average incomes (service providers are generally higher paid professionals). Because some groups within the community are more mobile than others (young and skilled), demographics change, often leading to a greater need for the services that are being withdrawn. The skills for community capacity building are also often lost in the process. The process continues so long as the region is a net importer.

Because the net value of trade is always zero (exports from one region are imports to another), some basic knowledge about demand curves allows us to develop a system to measure the regional socio-economic impacts of changing farm management decisions.

Demand Curves and the Measurement of Socio-economic Outcomes.

We shall spend some time considering demand curves because they determine how much income and profit will be derived from the production decisions of all producers of a particular commodity. Supply side economics is important at a national decision making level and will be dealt with later in the section on market failure. The rationality of farmer production decisions and the economic impacts of those decisions are determined by demand curves not supply curves.

Demand curves are continuously negatively sloped lines that measure the relationship between the quantity of a product consumed and its price. The logical leap of faith required to accept this premise is that there is some price for a product that is so high that nobody would buy it and some level of production so great that you couldn't give it away (see Figure 1).

A demand curve is strictly the relationship between quantity and price. They are not fixed in time and space because of factors other than price that shift the demand for a product. These factors include population, income, the price of other competing or complimentary products and tastes and preferences. Because these factors are relatively fixed in the short term, long term demand curves are likely to be more elastic than short term ones (see Figure 1). D1 is the long term demand curve and reflects shifts in demand through time. D2 and D3 are short term curves and reflect demand for a product at a single point in time. At the point of intersection of the long and short term demand curves, the short term demand curves will be more inelastic than the long term demand curve. This is true to the point where the long and short term demand curves share the same intercept on the quantity axis i.e. when price is zero.

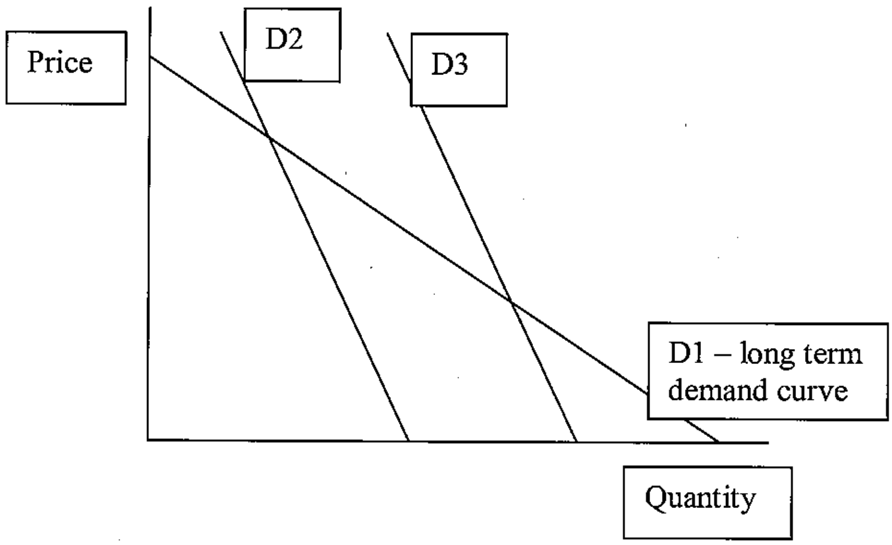

Figure 1: The demand curve and the relationship between long and short term demand

Demand curves fall into two broad groups – constant elasticity and variable elasticity. The shape of the demand curve is immaterial. So long as they are continuously negatively sloped, they must conform to one of these two broad groupings. Elasticity measures the change in quantity consumed (produced) associated with a known change in price. The elasticity of a demand curve at any point is calculated as the slope of the curve multiplied by the price divided by the quantity at that point. Because demand curves are continuously negatively sloped, elasticity is always negative. The important elasticity number to remember is -1.0. This is unit elasticity and means that a 1% increase in quantity will lead to a 1% decrease in price and vice versa. The importance of this concept will become apparent later.

If the absolute value for elasticity is greater than one, demand is said to be elastic and a 1% increase in price is accompanied by a less than 1% decrease in the quantity consumed. Conversely, if the absolute value is less than one then demand is said to be inelastic and a 1% increase in price is accompanied by a more than 1% decrease in quantity consumed. In an economic sense, market mechanisms equate supply and demand to determine the market clearing price. We can therefore use production and consumption interchangeably. Increased production must be offset by increased consumption which can only happen at a lower price, ceteris paribus.

Assumptions about the nature of the demand curve for agricultural products have important implications concerning industry total and marginal revenues and profit maximising levels of production. What does an assumption of constant elasticity imply about these factors?

If the demand curve for a product has constant unit elasticity, then total income remains the same irrespective of the level of production, marginal revenue is constantly zero and, so long as marginal costs are always positive, profit is maximised at one unit of production.

If it is constantly inelastic then total income falls constantly as production increases, marginal revenue is always negative and, again, profit is maximised at one unit of production. The converse applies if the demand curve is constantly elastic. Because marginal revenue is always positive, it may not be possible to achieve a profit maximising level of production.

An underlying theme in agricultural economics literature is the inelasticity of demand for agricultural products. A study by Gardiner (Gardiner, Aesop on Australian Agriculture) shows that change in real total income and the real net value of agricultural production in response to changes in production are not consistent with the constant elasticity scenario and especially not the constantly inelastic alternative i.e. the real gross value of agricultural does not continuously fall and marginal revenue is not continuously negative.

If demand curves for agricultural products are not constantly elastic, they must be of variable elasticity. The importance of establishing this concept will become apparent shortly.

Marginal concepts play an important role in economic theory. Marginal theory relates to the measurement of what happens as a result of an additional unit of input or output. For example, marginal revenue is the additional revenue made from the sale of an additional unit of production.

Let us now turn to the relationships between elasticity, total revenue, marginal revenue and profitability. If demand for a product is elastic, increasing production increases both total and marginal revenue and may increase profitability. If demand for a product is inelastic, increasing production reduces both total and marginal revenue and profitability. Total revenue is maximised when marginal revenue equals zero and elasticity is -1. This can be demonstrated mathematically, the formula derived being paramount in assessing socio-economic outcomes of changing farm output. This formula also more clearly shows the relationship between elasticity and total and marginal revenue.

Total revenue (TR) equals price (p) multiplied by quantity (q) or

$$TR = pq.$$

Marginal revenue (MR) can be calculated by fully differentiating TR.

$$MR = p + q\ dp/dq.$$

Factorising for p gives

$$MR = p(1 + q/p\ dp/dq).$$

But $q/p\ dp/dq$ is the inverse of price elasticity ($p/q\ dq/dp$). Therefore

$$MR = p(1 + 1/e),\ \text{where } e = \text{elasticity}.$$

Because e is always negative, 1/e is always negative. If demand is elastic, the absolute value of e is greater than 1, 1/e is negative and less than 1, 1 + 1/e is positive and MR is positive. If demand is inelastic the opposite occurs and MR is always negative. When elasticity is -1, 1 + 1/e equals zero and TR is maximised.

MR = p(1+ 1/e) measures the change in revenue due to a one unit change in quantity. If quantity changes by more than one unit then MR = p(1 + 1/e)q", where q" equals change in quantity. This now provides the basis for measuring industry scale outcomes from changes in production due to individual decisions.

Consider the data in the following table.

Table 1: Relationship between demand, total revenue, marginal revenue and elasticity.

Quantity	Price	Total Revenue	Marginal Revenue	Elasticity
0	6	0		-infinity
			5	
1	5	5	4	-5
			3	
2	4	8	2	-2
			1	
3	3	9	0	-1
			-1	
4	2	8	-2	-0.5
			-3	
5	1	5	-4	-0.2
			-5	
6	0	0		0

Table 1 provides data about the relationship between the price of a product and the amount of it that would be consumed at those various prices. As price falls from 6 to 0, the quantity consumed increases from 0 to 6 units. Plotting the price/quantity relationship on a graph will quickly show that the demand curve produced is negatively sloped and is described by the function q = 6-p. The slope of the demand curve is -1 (dq/dp = -1). The elasticity is calculated as the slope of the demand curve multiplied by the price over the quantity at each point e.g. when price is 3 and quantity is 3, elasticity equals -1x3/3 = -1.

As price falls and quantity consumed increases, total revenue at first increases until it reaches a maximum of 9 and then decreases. Marginal revenue, the additional revenue associated with the sale of an additional unit of production, is at first positive, is 0 around the point of maximum income and then becomes negative. The demand curve is elastic where total revenue is increasing and marginal revenue is positive, has an elasticity of -1 when total revenue is maximised and is inelastic where marginal revenue is negative and total revenue is falling.

Table 2 below demonstrates the data set that would accompany a demand curve with constant unit elasticity.

Quantity	Price	Total revenue	Marginal revenue	Elasticity
1	6	6		- 1
2	3	6	0	- 1
3	2	6	0	- 1
4	1.5	6	0	- 1
5	1.2	6	0	- 1
6	1	6	0	- 1

If the starting point is known, and elasticity is constant, it is possible to calculate the price and the total and marginal revenues from each unit change in quantity using the above MR formula. Assume a starting point price of 6 and an elasticity of -1.5 (constantly elastic). The MR associated with increasing quantity from 1 unit to 2 units is 6(1+1/-1.5) which equals 6(1-2/3) which is 6/3=2. Total revenue from the sale of 2 units would be 6 + 2 (MR) which equals 8 and the unit price would be 4. Because MR will always be positive, total revenue will continuously rise. Participants may satisfy themselves that this is true by doing the calculation for the next unit of production with a starting price of 4.

Profit maximisation is determined by another set of marginal conditions. To maximise profit (or minimise loss) production should occur at a point at which marginal revenue (MR) equals marginal cost (MC). As one of the laws of economics is that you get nothing for nothing, MC is always positive. Therefore, profit maximisation requires MR to be positive. This only occurs when demand is elastic so profit is always maximised before income, that is, at a lower level of production. From Table 1, if the marginal cost of production is 2 then profit is maximised at 2 units of consumption (production).

If profit is maximised when MR=MC, then it is possible to calculate the profit maximising demand elasticity from the above formula if MC and price are known. MC substitutes for MR and the formula reads; MC = p(1+1/e) and, by substitution, e = p/(MC-p). If p = \$200 and MC = \$100 then profit is maximised when e = 200/(100-200) and e = -2. This formula can be used to prove that the only condition under which income and profit are maximised at the same time is when MC = \$0. In the above example, elasticity at which profit is maximised is e = 200/(0 – 200) = -1, which is the same point at which income is maximised. **So long as there is a single cost of production, profit will be maximised before income.**

Table 3 below shows the situation for Australian farming for the period 1950 to1999. Data are grouped into decade lots and averaged to get rid of short term fluctuations and show broad trends

Years	Production Index (ABARE)	Real Gross Value	Real Total Cost	Marginal Revenue (MR)	Marginal Cost (MC)	Profitability Change (MR-MC)
1950-59	28	15525	10095			
1960-69	45	17900	12365	2375	2270	105
1970-79	55	18154	13418	254	1053	-799
1980-89	68	19486	16450	1314	3032	-1718
1990-99	89	18229	16105	-1239	-345	-894

Table 3: Relationship between production, real gross value of agricultural production and profitability of Australian farming in 1988-89 dollars. All figures are decade averages to smooth data.

These data show that production has increased steadily over the 50 years measured. Between the 1950's and 1980's, this increase in production was accompanied by a corresponding rise in real gross value of production as indicated by positive values for marginal revenue. However, between the 1980's and 1990's, the real gross value fell as indicated by a negative value for marginal revenue.

If these figures are adjusted to international parity by multiplying them by the trade weighted index of the value of the Australian dollar, the gross value of production peaks between 1970 and 1980, with a real 1988-89 dollar value of $20bn, falling to about $15.5bn by the decade of the 90's.

The relationship between production and profit is measured by the difference between marginal revenue and marginal cost. If the cost of generating extra income is greater than the extra income generated, profit will fall. In the above table, the change in profitability is measured by marginal revenue minus marginal cost. When the difference is positive, profit is increasing and, when negative, profit is falling. Between the 1950's and 1960's, increasing production was accompanied by increasing profit but since then profit has fallen in the face of increasing production.

Matter cannot be created or destroyed but we can change its location and form. Thus, the debate about sustainability is one about location and form. Systems that impact minimally on the location and form of matter are more likely to be sustainable. The entropy theory of resource use would suggest that sustainability measures the relationship between resource use and re-assimilation, sustainability being achieved when the rates of use and re-assimilation are equal. Closed systems, where all matter is returned from whence it came, are more likely to be sustainable than open systems, where matter is transformed and relocated as a regular activity. While some level of relocation and transformation may be desirable, increasing diffusion and/or accumulation of some elements is inherently non-sustainable. Regional trade may be instrumental in exacerbating the problem of non-sustainable resource use, with regions trying to accumulate additional wealth by transforming and relocating more matter. If existing use is not sustainable, it is highly unlikely that additional use will reverse this situation.

We can now diagrammatically (Figure 2) represent the three economic phases of production relative to the demand curve for the product. In phase 1, as production increases, both total revenue and profit increase. As production continues to increase into phase 2, total revenue continues to increase but profit falls. In phase 3, both total revenue and profit fall as production increases.

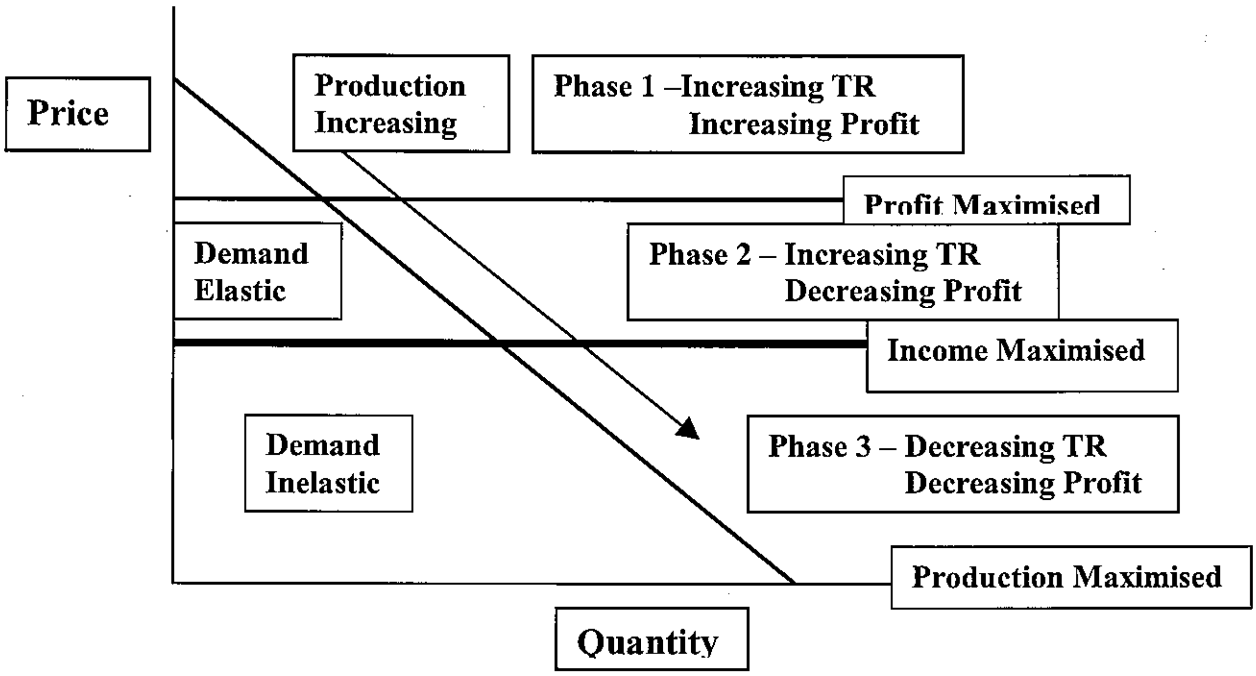

Figure 2: Relationships between Elasticity, Total Revenue and Profit

The important concepts to be drawn from Figure 2 are that profit is always maximised before income is maximised and income is always maximised before production is maximised.

Where market failure exists on the supply side, the "real" MC will be higher than the economic MC calculated above. To be sustainable, agriculture must account for these non-cash costs, implying that the truly sustainable level of production is achieved before economic profit is maximised.

The second important concept to note is that for every solution below the line representing income maximisation, there is a solution above the line that generates the same total income from a lower level of output. Check the data in Table 1 to show that this is true.

It is important to remember the following:

- Sustainability and profit maximisation will only be achieved concurrently if there are no hidden costs of production. **So long as there is a single cost attributable to production that is not met (e.g. the cost of greenhouse gas production), sustainability will be achieved before profit is maximised.**
- Income and profit are only maximised concurrently when the ratio of the price of inputs to the price of output is **zero.** This can only happen if the cost of all inputs is **zero. Provided there is a single cost attached to production, profit will be maximised before income. This is also a necessary condition for profit and production to be maximised at the same time.**
- Income and production will only be maximised concurrently if the demand for that product is continuously price elastic. **If demand can become price inelastic, income will always be maximised before production.**

It is critically important to recognise the sequential nature of the maximisation of these four key variables (sustainability, profit, income and production) if sustainability is to be achieved.

The above analysis is based on the relationship between price elasticity of demand, marginal revenue and marginal cost. The same outcome can be achieved by considering production economics. It is assumed that the production function for agricultural products displays diminishing marginal returns and that there is a combination of inputs that maximises production (the production function is strictly convex). Profit is maximised at a point at which marginal product (the slope of the production function) equals the ratio of the price of inputs to the price of output. If this price ratio is 0.9, each unit of inputs must produce at least 0.9 units of output to generate a profit. The following calculations prove that this analysis is identical to the marginal revenue/marginal cost methodology used previously.

- Marginal revenue (MR) equals marginal product (MP) multiplied by output price (Po)
- Marginal cost (MC) equals input price (Pi)
- MR = MC when MP*Po = Pi
- Dividing both sides by Po gives the profit maximising solution MP = Pi/Po.

Consider these three propositions:

- There are some costs to farming that are not accounted for by farmers in a financial sense e.g. soil loss.
- There are costs associated with the production of any agricultural product e.g. variable and fixed.

- The demand for agricultural products is price inelastic i.e. a 1% increase in production leads to a more than 1% decline in price.

The acceptance of these three propositions is sufficient to prove that sustainability happens first, followed by profit, income and production maximisation, in that order. Why is this so???

The implications of the first two propositions are demonstrated in the diagram below (Figure 3).

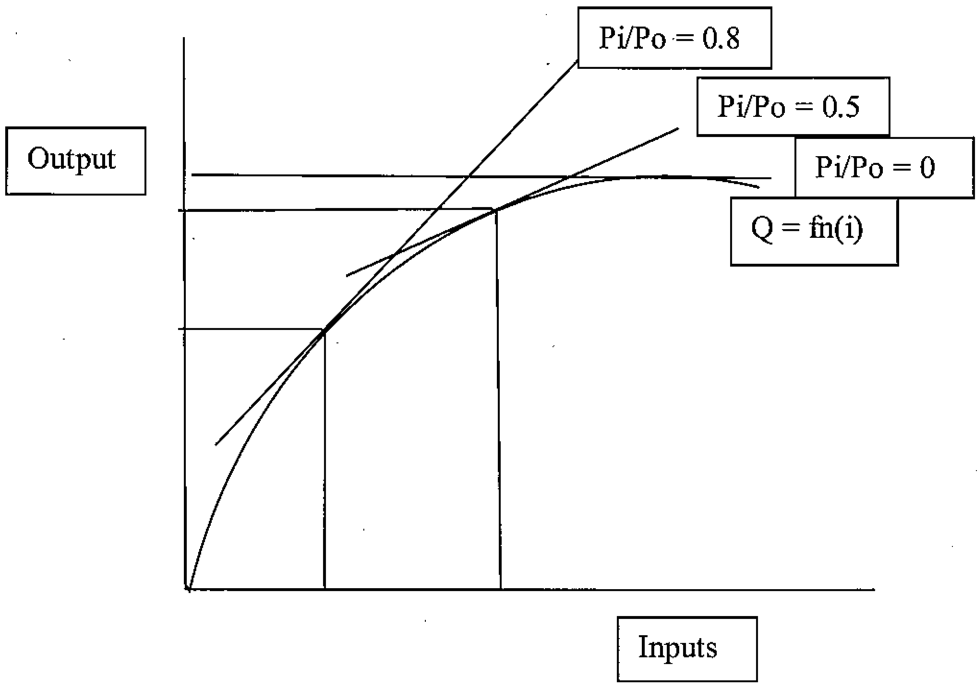

Figure 3 The relationship between the production function, input and output prices and profit maximisation.

Q = fn(i) is the functional relationship between the volume of inputs and the volume of output for a particular farm product. Pi/Po measures the ratio of the price of inputs to the price of output. Profit is maximised when marginal product (MP) equals this price ratio (where a line with slope Pi/Po is tangential to the production function). In the above example, when hidden costs are ignored, Pi/Po=0.5 and profit is maximised where the slope of the production function is also 0.5. When hidden costs are accounted for, Pi goes up and Pi/Po rises to 0.8, giving a new optimal solution with a lower use of inputs and a lower level of output. The optimal output for sustainable production is always lower than that which maximises economic profit. As hidden costs are accounted for in an economic sense, sustainable and profit maximising output coalesce at this lower level of production.

Acceptance of the second proposition must lead to acceptance of the premise that profit is always maximised before production. Production is maximised when marginal product is zero. For profit to be maximised at the same time, Pi/Po must equal zero. This can only happen when Pi equals zero or when all inputs are free (From the above equations, MR = MP*Po = 0. To maximise profit, MR = MC = 0, so MC = Pi = 0). This scenario is shown in the Figure 3 by the line Pi/Po = 0. So long as there is a single cost of production, profit will be maximised first. Combining the two propositions can only lead to the conclusion that sustainability is achieved before economic profit is maximised and profit is maximised before production maximisation. Thus farming systems aimed at maximising production or economic yield (without due regard to hidden environmental costs) cannot achieve sustainability.

Using data from ABARE indices of prices paid to prices received by farmers, the ratio of Pi/Po has changed from 0.45 in the 1960s to around 1 in more recent times, analogous to the situation described for the hidden cost scenario above. After adjustment for technological change (it took about 1.6 times as much input to produce one unit of output in the 1960s as it does now) which converts the current production function to its 1960s equivalent, the ratio of Pi/Po is still about 0.6, implying that, at current prices and costs, farmers today should probably be using a lower input/lower yield strategy than in the 1960s.

Acceptance of the third proposition implies that income is maximised before production. If demand is price inelastic, additional income derived from a 1% increase in production will be more than offset by a more than 1% decline in price. Conversely, income lost from a 1% decline in production will be more than offset by a greater than 1% increase in price. If income can rise as production falls then it is logical to conclude that income will be maximised before production.

Acceptance of these three propositions then clearly demonstrates that sustainability will be achieved at the lowest level of production, followed by profit, income and production maximisation in that order. Management practices which have a focus on maximising productive potential are unlikely to be sustainable in the long term. If achieving long term sustainability is a desirable outcome then those involved in all facets of agriculture will need to shift their focus from its current emphasis on production and productivity gain marketed on its ability to increase production to one where the natural resource is used within its productive capability.

The following table (Table 4) sets out some of the likely regional socio-economic impacts of farmers' decisions to maximise different objectives (profit, income or production). Again, it will be noted that individual, regional and national outcomes are not necessarily congruent (what benefits the nation does not necessarily benefit all the regions or individuals and vice versa)

Table 4: Socio-economic consequences resulting from the Maximisation of Different Objectives.

Effects of Decisions to Maximise Profit	**Effects of Decisions to Maximise Production**
More farmers	Less farmers
More regional jobs and services	Fewer regional jobs and services
More diverse regional communities	Less diverse regional communities
Less externally procured inputs	More reliance on external inputs
Lower reliance on technological advances	More reliance on technological advances
Better environmental outcomes	More environmental degradation
Less overall GDP	More GDP
Good for individuals and regions	National and global advantages

Which of the above scenarios looks most like agriculture in Australia at the present time? Which direction are current research, development, extension, policy and peer decision making pushing Australian farmers?

The above section demonstrates the linkages between production, income and profit at a farm level and socio-economic outcomes at a regional, national and global level. The next section looks at the concepts of producer and consumer surplus and the distribution of the benefits and costs that flow from production decisions. From this, we will be able to build a model to measure the flow on effects of an individual decision on other individuals, regions and nations. The model presented is general and can be used to assess the impacts of decision made at production and policy levels

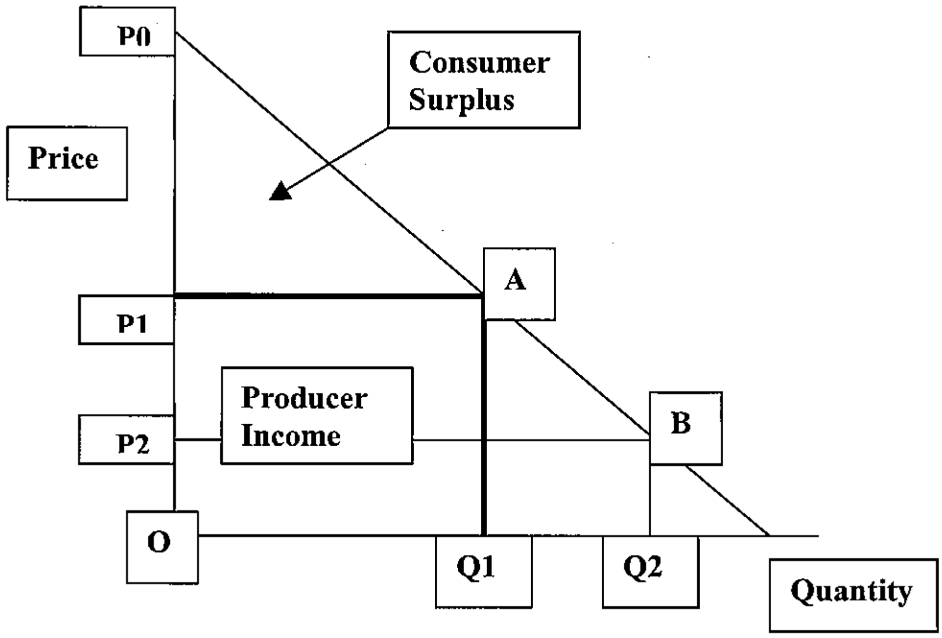

Figure 4; Relationship between a Demand Curve and Consumer Surplus and Producer Income.

Consumer surplus is a measure of the difference between what consumers would be prepared to pay for a product and what they actually pay because of open market conditions. From Figure 4, if each individual consumer could be forced to pay the maximum that they would be prepared to, then OQ1 volume of product would earn producers OQ1AP0 of total income. However, everybody can purchase the product for the lowest price that clears the market. Because of this, consumers "save" P1AP0 which is now available to purchase other products. Producers earn OQ1AP1. The total economic return from producing Q1 of a product is consumer surplus plus producer income.

If production increases to OQ2, the market clearing price falls to P2, consumers (consumer surplus) and the global economy (total economic returns) are unambiguously better off by P2BAP1. Are producers better or worse off? Producers lose (P2 – P1)*Q1 (the price effect) but gain (Q2–Q1)*P2 (the quantity effect). If the price effect is greater than the quantity effect, producers lose income and vice versa.

Regional trade increases consumer surplus through efficiency gains associated with comparative advantage.

Referring back to the section on demand curves, we can talk about the same three phases of increasing production. In phase 1, increasing production leads to increased consumer surplus, total economic returns and farm profitability. As production continues to increase through phase 2, consumer surplus, total economic returns and producer income all increase but profitability falls, commencing a transfer of wealth from producers to consumers. In phase 3, consumer surplus and total economic returns continue to increase but producer income falls, unambiguously transferring wealth from production to consumption.

So long as demand is price elastic and production is increasing, the quantity effect is greater than the price effect and gains to producer income are greater than gains to consumer surplus. If demand is price inelastic, the price effect is greater than the production effect and consumer surplus increases at the expense of producer income.

Is it possible to calculate the magnitudes of changes in consumer surplus and producer income that result from changes in production? Yes, providing we have some knowledge of the current price of the product (p) and the price elasticity of demand (e).

Let us consider an example for the wheat industry using the following information:
p = $240/t, e = -0.75 and q" = 1million tonnes.

The value for e is assumed for ease of calculation but is based on the following information:

- Changes in real gross and net values of wheat production suggest that e is inelastic.
- Data on the price elasticity of demand for wheat at wholesale indicates that e is inelastic at this level and should be more inelastic at farm gate.
- Because factors that shift demand have greater impact internationally, e for global trade will be higher than the -0.4 to -0.6 general estimates for agricultural products on the domestic market.
- ABARE estimates from the Outlook 2004 Conference state that a 2% increase in production in 2004-05 will lead to a 6% fall in price, an implied elasticity of -0.33.

Change in producer income (MR) = $240(1+1/-0.75)*1million.
= $240(1-1.33)*1million
=$240*-1/3*1million
= -$80million.

The decision to increase production by 1million tonnes actually costs producers $80million. For ease of calculation, assume that the additional 1million tonne of wheat raises production from 19million to 20million tonnes. Total producer income falls from $4.56 billion (19 million t * $240/t) to $4.48 billion ($4.56 billion - $80 million) and price falls from $240/t to $224/t ($4.48 billion/ 20million tonnes). Every producer loses $16/t whether they increased production or not. Producers gain from the quantity effect (1m tonnes by $224/t = $224m) and lose from the price effect (19m tonnes by $16/t = $304m), the net impact being -$80m.

Consumers gain $312 million made up of a saving of $16/t on the 19 million t they are already consuming plus $8/t on the additional 1million t produced and the economy as a whole benefits by $232 million ($312m increase in consumer surplus - $80 million loss in producer income).

It takes about $75-80 000 of income to create a job in regional Australia, so the decision to increase production would cost the regions 1 000 direct jobs (potentially 4 000 people, 2 000 children) and many more as a flow on effect eg100 teachers.

By the same logic, the net economic growth would create an additional 3 000 jobs somewhere else. Because producers are also consumers, they recoup some of the lost income from lower product prices through an increase in their surplus. As around 3% of the total population, farm families would benefit by about $10 million (3% of $312m) from increased spending power, leaving them with a net loss of $70 million. At current levels of farm cash income for broad acre grain producers this would be more than sufficient to send 1 000 farmers out of the industry, the $70 million reduction in the value of production leading to lower farm cash incomes.

The analysis is further complicated by global trade. Grain producers export about 60% of their production as unprocessed commodity. This means that 60% of consumer surplus is exported. From the above example, only $125 million of the created consumer surplus remains in Australia. The remainder ($187 million) ends up as benefits in importing countries. Importing countries gain $187 million of consumer surplus and save $192m in the cost of imported grain ($16/t multiplied by 12m tonnes (60% of 20m t) of imported grain). All wheat imports are cheaper by $16/t, not just the extra 1 million t in grain production.

Conversely, Australian exporters of wheat lose $48 million (60% of the $80m reduction in the gross value of production) to gain $125 million in consumer surplus, a net gain of $77 million. This should explain why countries that are heavily dependent on primary exports to generate income and encourage more production to overcome balance of trade problems become less prosperous while countries that are net importers of primary products tend to prosper. Japan is a classic example of the latter.

We now have a methodology for assessing the socio-economic impacts of changing production decisions at a regional level (from the regional trade model, the individual is also a region). Assuming that everyone benefits (loses) equally from changes in consumer surplus, regional benefit equals total consumer surplus multiplied by the proportion of the total population resident in the region. Regional cost (gain) from changes in production outcomes equals change in unit price (-$16/t in our example) multiplied by total production in each region plus change in production in each region multiplied by market clearing price ($224/t in our example). The net value of the price and quantity effects may thus be positive in some regions and negative in others. Using the above example, if all the extra production comes from a new region then that region benefits by the full value of the quantity effect or $224 million (1 million t*$224/t) plus its share of the increase in consumer surplus. From the above example and assuming that consumer surplus is equal for all consumers per capita surplus is $6.25 ($125million/20 million people). Regions with larger populations obviously benefit more than regions with small populations.

All other producing regions carry the price effect of -$304 million (19 million t*-$16/t) plus their share of consumer surplus (if 20% of the total population lived in these regions, consumer surplus would be $25 million or $125 million/5). This demonstrates the importance of an inter-regional approach to socio-economic assessment. Impacts are rarely confined to a single property, region, state or country. A regional socio-economic assessment would show that expanding the industry into this other region would have major benefits of additional income plus about 3 000 direct new jobs and should proceed. At the same time, the rest of regional Australia would lose $304 million and about 4 000 direct jobs.

From the perspective of equity, the above decision to increase production would have both horizontal and vertical effects. Income is transferred from existing to new producers and from producers to consumers. These changes may be desirable, but only if producers are better off than consumers and existing producers are better off than new producers. In the above example, even when exports are accounted for, consumers gain more than producers lose. If consumers are already better off than producers, they can clearly pay farmers up to $125 million and still be better off. Existing farmers could also pay new producers up to $80 million not to increase production and still be better off.

If the decision to increase production resulted from encouragement at a policy level to achieve other national goals (eg increased employment) as is often the case (even if not explicitly stated), the nation could raise taxes on consumption to compensate disadvantaged producers ($80 million) and still be better off than before by $45 million ($125million - $80 million).

The above demand side analysis demonstrates how money flows between regions as a result of production decisions. Socio-economic well-being is assumed to be directly related to income. Regions with higher incomes tend to have better social environments, more services and greater opportunities. Failure to recognise the interconnectedness of management decisions has led to a long term decline in the profitability of farming and a redistribution of wealth between regions.

Market failure on the supply side has exacerbated the problem for farmers. We shall now examine this issue in some detail.

Market Failure

As the term implies, there are some inputs into the production process for which there are no existing markets and, therefore, there are no price signals to alert producers to optimal levels of resource use. Market failure exists on both the demand and supply sides but, because of the importance of quantity in determining socio-economic impacts, we shall restrict the analysis to supply.

Supply curves measure the relationship between output (quantity) and cost. The cost of producing a product is dependent on its production function which measures the responsiveness of output to increasing quantities of inputs. Production functions have the general form shown in Figure 5 below. To start with, small increases in inputs have large impacts on output. As production approaches its maximum potential, increasingly greater amounts of inputs are required to produce an additional unit of output. Once this maximum potential has been achieved, additional inputs actually reduce the total amount of production.

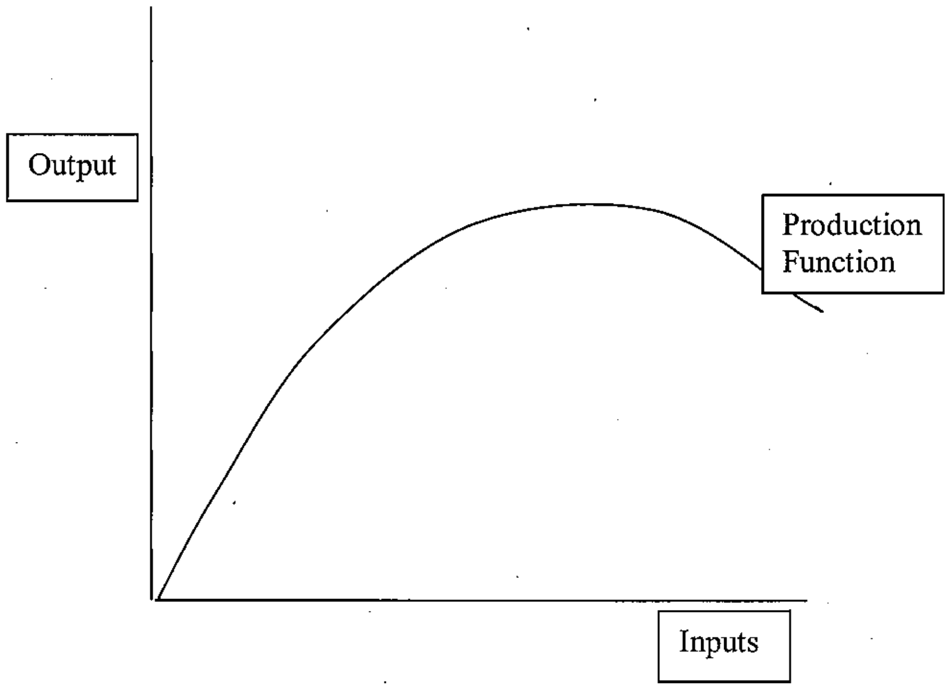

Figure 5: Relationship between increasing quantity of inputs and output.

Production becomes less and less responsive to inputs as they approach optimal levels. Take the example of N in crop production. If N is highly limiting, initial responses to applied N will be high. As N application approaches the maximum that the crop can utilise, the response to additional N declines. In excessive quantities, N can reduce yield.

The addition to output attributable to a 1 unit change in input is called its marginal product. Because of diminishing marginal product, each additional unit of output costs more to produce. Thus, supply curves are continuously positively sloped. They measure the average cost per unit of each additional unit of production. Market equilibrium price (market clearing price) is achieved where a supply curve cuts a demand curve (production equals consumption). Only producers whose costs are lower than the price they receive will continue to produce. This ensures that scarce resources are utilised by the most efficient (sic) producers.

Profit maximising production occurs at the point at which marginal product (the slope of the production function) equals the ratio of input cost to output price. If nitrogen is $600/t and wheat is $200/t, then nitrogen should be added up to the point at which 1 additional unit of N produces 3 units of wheat (1 kg of N produces 3 kg of wheat). The cost of the last unit of input is also its marginal cost while the additional units of output multiplied by its price is marginal revenue (or marginal value product). Again, profit is maximised when marginal revenue equals marginal cost.

This system is efficient so long as there is a market for every input into a productive process. Is it realistic to assume that there are efficient markets for all farm inputs? Think back to the section on economic theory. Efficient decisions rely on perfect knowledge, perfect transferability and the absence of barriers. Perfect knowledge implies that farmers are aware of the stocks and flows of all their inputs eg minerals and water and ensure that these are maintained at optimal levels. Perfect transferability implies that any piece of capital can be instantly converted in response to changing prices. Many pieces of capital are use specific and do not transfer easily.

Market equilibrium and profit maximising prices need not correspond. If the most efficient producers are prepared to accept a very low level of profit, they set the profitability of all other producers. In an economic sense and in the short term, production can continue to expand to the point where nobody makes any profit at all. The presence of market failure for a number of inputs into agricultural production means that farmers can even continue to produce in the face of negative returns.

A study of Australian agriculture shows that four factors have allowed farmers to survive in the face of declining terms of trade:

- Running down the natural resource base. This includes such factors as soil loss, soil structure decline, acidity, salinity, changing floristic composition of pastures and tree decline, etc.
- Working for nothing. Farmers do not pay themselves a wage commensurate with the hours they work and/or rely on off farm income.
- Depreciation. Many farm assets are utilised beyond the point at which they have depreciated to zero value. Because very few (if any) farmers pay money into a depreciation account, assets will have to be funded out of future earnings, rather than by income earned by the asset. Because it is not actually paid, current consumption and debt repayment can be funded out of depreciation, tax free.
- Capital gain. Increasing asset values allow farmers to convert equity to debt.

As well as the above examples that are explicit to agriculture, there are a number of other examples of market failure that are implicit to farming. These include greenhouse gas production, chemical resistance in weeds and insects, species extinctions and the residual effects of chemicals in the environment (groundwater pollution and genetic modification).

From a purely economic perspective, supply curves (and, by definition, production functions) faced by farmers are distorted by policy intervention e.g. preferential taxation policy, fuel rebates and subsidised costs of delivering some services. For example, the diesel fuel rebate was initially introduced because fuel excise was used on road construction and maintenance and on-farm use of this fuel had no impact on roads. Today, about 15% of fuel excise goes to roads and the rest is general revenue. Logically, farmers should only receive a 15% rebate on fuel excise. Heavy vehicles used to transport farm produce to markets are many (and often many thousands) times more damaging to roads than the average passenger vehicle but these differences are not fully accounted for in transport costs.

How does market failure impact on farmer decision making? Figure 5 shows how market failure impacts on production. The theory of demand can then be used to assess socio-economic impact.

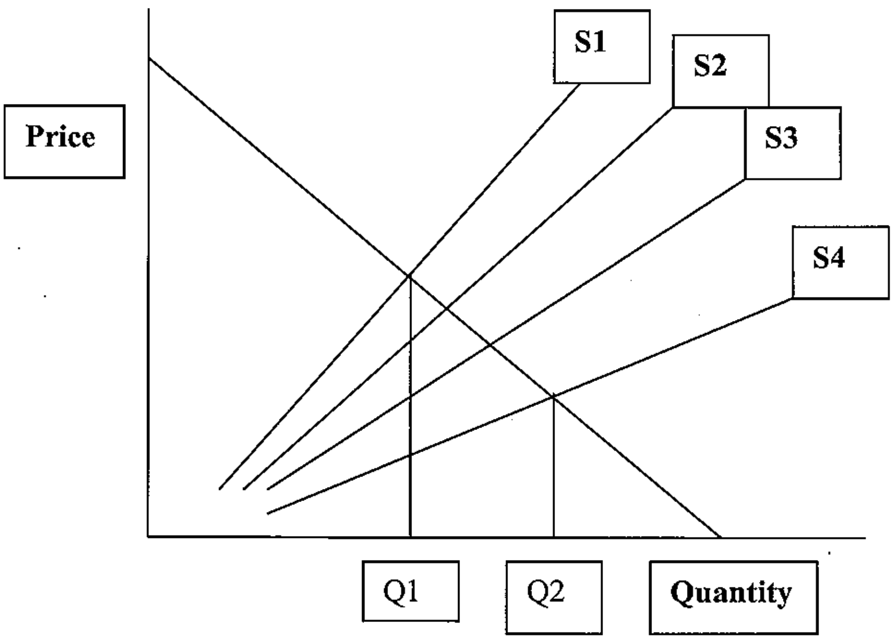

Figure 6: Relationship between market failure and optimal production decisions

In Figure 6, S1 is the supply curve for a product that reflects the "true" cost of producing it allowing for all the explicit and implicit factors of production and a reasonable level of profit. Accounting for all costs, producers would supply Q1 of that product.

If there is no market for an input (existing soil fertility is "free") or the producer does not have to pay for any of the adverse consequences of his productive process (off-site impacts), his supply curve moves to the right (it costs less to produce the product). Each cost that is ignored because of market failure moves the supply curve further to the right. From Figure 6, the producers' perceived supply curve ends up as S4, implying an optimal production decision of Q2 units of output. The inability of market forces to pass on information about the "true" cost of production always leads to a situation of overproduction (overproduction is used to define any situation where producers produce more than they should at full cost recovery).

The above provides another reason to be suspicious of gross margins analysis and comparative analysis. Within the short term (maybe less than 30 years), the S4 farmer will return better results than the S1 farmer, reinforcing a perception that non-sustainable practices are "good" (a recent study of Western croppers by Hassell and Associates showed that top 20% of farmers, as defined by profitability, used ¼ as much fertiliser as others. Is this a good message to be sending to farmers?).

Returning to the analysis of production functions and profit maximising decisions, each cost that is not accounted for reduces the price of inputs, the ratio of price of inputs to price of output falls, and profit maximisation occurs at a less responsive point on the production function (a higher level of production). If the true input costs require 5 units of output for each unit of input, optimal production will be lower than if inherent fertility is mined and the input/output ratio reduced to 3. In the face of declining terms of trade, farmers need to operate at more responsive points on their production functions, i.e. closer to the origin than the maximum.

Market failure, through the above mechanism, impacts on marginal cost and revenue. Failure to account for all costs means that the marginal costs calculated from financial data will be an underestimate of the true marginal cost of production and that the profit maximising level of production, in terms of sustainable resource use, will be lower than that based on purely economic considerations. This has implications for financial management.

Failure to account for the hidden costs of market failure always leads to overproduction.

Another important message that can be derived from this analysis is that the only time that profit and production are maximised at the same time is when all input costs are zero. So long as there is a single input cost, profit will be maximised before production.

Profitability, Sustainability and Politics

Returning to the demand analysis above, another anomaly arises. Total surplus (economic wellbeing) increases as the supply curve faced by producers move from S1 to S4. It is in the national interest to ignore long term environmental and social decline in agricultural regions in the interest of pursuing national growth (increasing consumer surplus is what funds jobs, etc in the growth model of economic development). It would seem that profitable, sustainable primary production is not in the national (or international) interest.

This again raises important issues of equity. Not only is wealth being transferred from producers to consumers and regional areas to metropolitan areas but the value of the national asset is being diminished. That this is desirable is reinforced by a system of national accounting that ignores a natural resource stock-take. We can lose 3 tonnes of soil per hectare per year at no cost to our natural resource base or economy. If that lost soil creates a problem, the cost of fixing it is **added** to GDP. From a national accounting perspective, massive degradation requiring massive remediation is a good thing. It is reassuring to know that, in the short term economic sense at least, it is better to be non-sustainable and produce more than sustainable and produce less. This can be shown diagrammatically (Figure 7).

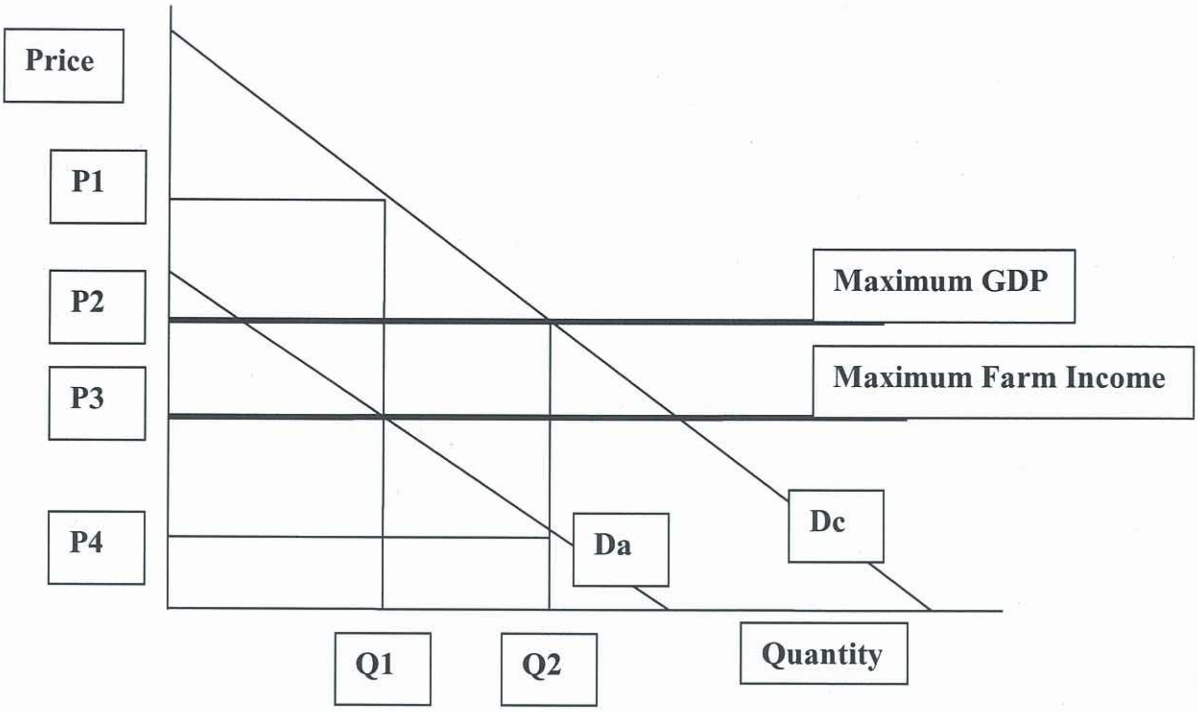

Figure 7: Relationship between policy objective to maximise GDP and farmer income.

Farmers maximise their income where the elasticity of the demand curve they face (Da) is -1, when price is P3 and quantity is Q1. However, the economy as a whole maximises GDP when final consumer demand (Dc) elasticity is -1 or when price is P2 and quantity is Q2. For quantity Q2, farmers receive price P4 and, because they are in phase 3, total farm income falls.

The difference between the price received by farmers (P4) and the price paid by consumers (P2) represents value added by processors and service providers. This converts to incomes in the secondary and tertiary sectors of the economy. As population grows, the gap between P2 and P4 has to get bigger to provide the wealth for additional jobs and income. Viewed from this perspective, National Competition Policy makes sense because industrial relations reform, lowering profit margins and stopping cross subsidisation of inefficient industries provides the potential for more jobs. Dc shifts to the right faster than Da, P2 rises and P4 falls, providing the additional layers of incomes necessary to increase employment.

There is some evidence to support this premise. In Australia in 1946 there were about 1million primary producers in a workforce of about 2.5 million. Each primary producer had to supply sufficient products to support 1.5 additional incomes (2.5 incomes in total) and primary production was about 40% of the economy (100/2.5 or P3/P1 from Figure 5). Currently we have about 500 000 primary producers in a workforce of 9 million. We now require 17 additional value added incomes and primary production has fallen to about 6% of the economy (100/18 = 5.6% or P4/P2 from Figure 6).

At a macro- scale, this raises another interesting conundrum – the less people are involved in primary production, the more productive they have to be, the smaller the share of wealth they receive, the lower their incomes and the more pressure there is to utilise non-sustainable farming practices. This cycle then repeats. Declining terms of trade and structural adjustment become self fulfilling prophesies within this scenario. The solution to regional socio-economic decline is to have more primary producers yet policy, extension, advice and economic reality are driving in the opposite direction.

An Alternative Method for Assessing Socio-economic Impacts.

The Department of Infrastructure, Planning and Natural Resources' assessment of the socio-economic impacts of water reforms and the Sinden (Sinden, J A, Who pays to protect native vegetation? Costs to farmers in the Moree Plains Shire, NSW, Paper to 46 Annual Conference of AARES, Canberra, 2002) study of the impact of native vegetation legislation on land values adopts a different methodology. Both rely on the assumptions of the perfectly competitive model in which the actions of any one individual are mutually exclusive of all others. A random group of farms (say 20) are assessed to determine the "average" gain or loss from the policy initiative at current production and price levels. This "average" is then multiplied by the total number of affected farms to derive a regional or global figure of gains or losses.

This method has some advantages in that it allows intensive scrutiny of a small number of subject farms and the collection of comprehensive data which may be able to address some of the market failure issues.

However it fails to recognise the interconnectedness of decisions and outcomes. The mere fact that one farmer is made worse off by a policy decision does not automatically mean that the industry or region is worse off. Micro-level assessment does not provide a sound basis for establishing either the magnitude or the recipients of global gains and losses. From an equity perspective, it is important to know whether wealth transfers that flow from production decisions favour the "right" group of farmers and are spread equitably between producers and consumers. In some instances, a levy on production may provide the best vehicle to maintain equity whereas, in others, a tax on consumption may be required. For example, if a group of farmers lose their groundwater allocation they will be worse off by the value of any lost production multiplied by its price. However, if demand is price inelastic, the price increase enjoyed by other producers will be proportionately greater than the loss of production. The industry will be better off by more than those who lose allocation will be worse off. A levy on production to compensate disadvantaged farmers would leave them as well off and all other producers still better off, arguably a good outcome.

Calculating Macro-economic Impacts.

This section provides a general formula for calculating gains and/or losses to producers and consumers that result from decisions to change production. The following notation will be used:

P = current price,
Q = current quantity,
e = price elasticity of demand
TR = Total Revenue = P*Q,
MR = Marginal Revenue,
Qn = Level of production following decision process,
Pn = (TR+MR)/Qn, the new market clearing price for all producers,
Yp = Change in total producer income
P" = P-Pn and
Q" = Qn-Q.

The first step is to calculate MR as MR = P(1+1/e)Q".

Pn = (TR+MR)/Qn. If demand is price inelastic, MR will be negative and Pn < P.

Calculate P" and Q" from the above formulas.

Change in Consumer Surplus (CS) = P"xQ+1/2Q"xP". If Q" is negative, P" will be negative and CS will be negative.

Change in producer income (Yp) = PnQn-PQ. This may be positive or negative. If demand is price elastic and Q increases, Yp will be positive and vice versa. For the individual producer, price elasticity is only important in that it is used to derive Pn at the industry level. Producers gain/lose from the quantity effect while consumers gain/lose from the price effect. Individual or regional changes in income from changes in production are simply PnQn-PQ, where Q and Qn are measured at the individual or regional level.

Per capita change in consumer surplus (CSc) = CS/population (assuming uniform distribution).

Change in regional CS = CSc x Regional population.

Total surplus (net national economic gain) = CS+Yp.

As it takes about $75 000 of total surplus to create one job, change in employment equals CS+Yp/75 000.

If we view the individual as a region of one, individual gains and/or losses can be calculated as PnQn-PQ+CSc. PnQn-PQ can be positive for some regions even though it is negative nationally if production does not change uniformly across all regions (we are still viewing the individual as a region of one).

The analysis to date has dealt with direct impacts only. These direct impacts generate flow-on effects which take additional time to work through the regional and national economies. These flow-on effects are known as multipliers. Input-output tables calculated from national accounts data indicate that the agricultural sector has a multiplier of about 2.3. This means that any direct impact arising from producer decisions can be multiplied by 2.3 to give its total effect. Referring to our example, the $80 million loss to producer incomes converts to a loss of $184 million in economic activity. Likewise, the $25 million increase in consumer surplus in cropping areas generates $57.5 million of economic activity. The net effect is -$126.5 million which would lead to the loss of approximately 1 800 jobs in regional Australia, about double the direct impact.

Some Concluding Remarks.

The following broad conclusions can be drawn from this analysis:

- Net exporters accumulate wealth.
- Profitability is the main driver of socio-economic well-being.
- If there is market failure on the supply side, the sustainable level of production will be achieved before profit is maximised in an economic sense.
- In an economic sense, profit is always maximised first, followed by income then production.
- Demand curves not supply curves determine farmers' income.
- Consumers and the national economy always benefit from increased production.
- Producers only benefit from increased production if demand is price elastic.
- Failure in input markets always leads to overproduction.
- Producers gain/lose from the quantity effect while consumers gain/lose from the price effect.
- Benefits and costs arising from changing production decisions are rarely distributed uniformly, raising questions of equity.
- Profitable, sustainable primary production is not in the interest of global economic growth.
- Farm management economics based on perfect competition is flawed.
- Because of their static nature, gross margins are not a good decision making tool.
- Benchmarking and comparative analyses need to be adjusted for market failure.