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THE ECONOMIC VALUE OF BREASTFEEDING IN AUSTRALIA

Julie P Smith, Lindy H Ingham, Mark D Dunstone

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INTRODUCTION

In recent years a substantial body of research has focussed on extending conventional measures of the economy such as Gross Domestic Product or National Income to include the household economy, including unpaid work, or the costs of environmental degradation and depletion of natural assets. Such estimates can be important to provide a more meaningful and accurate basis for public policy, and better appreciation of the relative contribution of individuals to community welfare.

Including human milk in measures of economic production would make this politically invisible food visible, and would assist in promotion of breastfeeding. It is also positive recognition of one of women's unique contributions to society.

As human milk production is excluded from GDP, while artificial formula is included, increased breastfeeding reduces measured economic growth. This is clearly nonsense and misleads policymakers. As this paper shows, there are substantial economic gains to the community from breastfeeding, and huge economic losses from artificial feeding. Omitting human milk production from measures of national output and Gross Domestic Product (GDP) is also inconsistent with the United Nations System of National Accounting (UNSNA).

This paper considers the issue of the economic value of breastmilk and breastfeeding. Our objectives were to:

- estimate the actual food production value of human milk in Australia, and the value under different breastfeeding scenarios, such as meeting World Health Organisation (WHO) breastfeeding targets;
- incorporate time and commodity cost and health implications of alternative infant feeding methods, to estimate the economic value of breastfeeding in Australia;
- explore how to integrate estimates of the economic value of human milk production into a national accounting framework and GDP, viewing national breastfeeding potential as a natural (human capital) resource asset yielding economic income flows over time.

The first section surveys the literature on the economics of breastfeeding, while the second section estimates human milk production in Australia for 1972 and 1992, and under different scenarios for breastfeeding prevalence. The third section incorporates these estimates into a broad economic framework, which includes the time, goods, and health cost implications of alternative infant feeding methods, and the fourth section explores the implications for national accounting practices.

In conclusion, we speculate on the implications of human milk production for the economic reform priorities of Australian governments, and suggested strategies for increasing the extent and economic value of breastfeeding in Australia.

BREASTFEEDING ECONOMICS AND "BREASTFEEDING ECONOMIES"

> *"An unusual depletion in the crude oil reserves of an oil producing country of Asia or Latin America would be termed a crisis. Its economic and social implications would be so apparent that actions to reverse the trend would be awarded high priority. Yet a comparable crisis, involving a valuable natural resource and losses in the hundreds of millions of dollars, is going virtually unnoticed in many of the poor countries of the world. The resource is human breast milk, and the loss is caused by the dramatic and steady decline of maternal nursing in recent decades".*

Writing in 1973, Alan Berg drew attention to the economic value of breastfeeding in *The Human Nutrition Factor* (p89). Most research on breastfeeding since then has remained focussed on nutritional and health impacts.[1]

This is as it should be. Breastfeeding cannot be reduced to its economic aspects alone. Breastfeeding is a complex physiological, emotional, and social relationship between mother and child, which is in turn intricately related to the mother's family and the community or society she lives in. Economics is ill-equipped to deal with these aspects. Indeed, traditional economic models and social welfare optimums rely on concepts of scarcity, selfishness and competition between individuals. These concepts do not fit well where the predominant factors determining resource availability and allocation are altruism, dependency, and breastfeeding knowledge or skills, and where externalities exist in both consumption and production. Indeed, it would not be surprising for some women to resent attempts to place a market value on human milk production or breastfeeding (Greiner, Almroth et al. 1979, 120).

Nevertheless, estimating the economic value of breastfeeding can:

- emphasise the extent of breastfeeding and its value;
- give positive recognition of one of women's unique contributions to society;
- highlight its importance to economic welfare and the necessity of public policy intervention to protect it from replacement with inferior but commercially promoted infant foods; and
- contribute to more accurate public policy analysis, and more soundly-based economic, as well as health policies, based on more comprehensive knowledge of the nature and locus of economic activity.

Placing a dollar value on an asset, albeit a "priceless" one, can make this unique contribution to the community's economic well being more visible to those who would otherwise be blind to it. Protecting the breastfeeding resource rests in the realm of public policy because there is no profit motivation to promote breastfeeding, and a strong commercial incentive to undermine it. It cannot be left to the market.

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[1] Popkin (1978) examined breastfeeding in a formal economic model somewhat similar to the individual-household model of breastfeeding behaviour being developed by Butz (1978, 1981) and later Akin, Griffith et al.(1984). This model assumes "utility-maximising behaviour" of households, relating the "demand" for breastfeeding in developing countries to parental desires for healthy children and child spacing, and the "supply" of breastfeeding to constraints set by a mother's resources of time and available nutrients.

A comprehensive economic perspective includes the value of time resources as well as the public and private health costs of alternative feeding methods, and the goods cost. Most previous studies of the "economics of breastfeeding" merely compare the goods cost of formula with costs of food supplements for lactating women. Most focus on developing countries, with very limited research of the economic impact of breastfeeding in developed countries.

- Berg's pioneering work calculated that the national cost of declining breastfeeding in selected developing countries was equal to two thirds of the national health budget (1973, 90).[2] Berg estimated the monetary value of breastmilk by valuing the milk estimated to be needed during the first two years of a child's life and applying this to national infant population statistics.
- Greiner, Almroth et al. (1979) were the first to consider breastfeeding in a comprehensive economic framework, at the national level. This study evaluated both individual and national impacts, including public and private health costs, and incorporated extensive definitions of commodity and time costs. It also used survey data to measure costs of breastfeeding, whereas virtually all other research on time and goods costs of infant feeding is entirely hypothetical (Popkin, Lasky et al. 1984, 191-4).
- Most recently, human milk production has been incorporated in a country's food supply statistics (Oshaug and Botten 1994). By estimating the population of breastfeeding mothers, and deriving volumes of milk production from data on breastfeeding duration and average milk output, researchers estimated the total annual volume of Norway's human milk production. Using the market value of expressed breastmilk (EBM), the monetary value of national human milk production was also derived. No other country has followed Norway's lead in publishing such statistics regularly.

BREASTMILK IN NATIONAL FOOD PRODUCTION: AN AUSTRALIAN ESTIMATE

Placing human milk on national food balance sheets is relatively simple and accurate - breastmilk is "the only food commodity for which production equals consumption, that is, there are no "post-harvest losses" or "plate waste" (Greiner, Almroth et al. 1979). Indeed since 1993, human milk output has been included in annual reports on national food production by the Norwegian National Nutrition Council (Oshaug and Botten 1994).

The main variables in such estimates of human milk production are:

- the number of infants of the relevant age,
- breastfeeding rates by age of infant,

[2] The 375 litres of breastmilk consumed during the first two years of life was estimated to cost US$65 or $140 at then prevailing prices for cows milk or dried milk formulas respectively.

- daily volumes of breastmilk produced, and
- the price of human milk.

The study by Oshaug and Botten (1994) is the only study of human milk production in national food supply statistics. However, other studies (eg Berg 1973; Rohde 1974; Jelliffe and Jelliffe 1978a; Greiner, Almroth et al. 1979) use similar methods to estimate household and aggregate national costs of artificial feeding. This section examines the methodology and key assumptions of such studies in order to make comparable estimates of the volume and value of human milk production for Australia for 1992.

Assumptions in Overseas Studies

Calculations of the volume of national breastmilk production typically use data on estimated daily breastmilk production by individual mothers. These milk "yields" are then applied to estimates of the population of breastfeeding mothers using data on breastfeeding or weaning rates.

To estimate the cost of replacing human milk from declines in breastfeeding, Berg (1973) assumed milk production of 850 ml per day for the first 6 months of exclusive breastfeeding, 500 ml per day until 18 months, and 200 ml a day from 19-24 months. Following McKigney (1971), the energy-equivalent in milk formula and bovine milk of the 375 litres of human milk received in the first two years of life was assumed to be 58.3 kg of milk formula. This was priced at $240 per ton. Berg calculated national losses from declines in breastfeeding in Chile, Kenya, Singapore, and the Philippines, using data on changes in the proportion of mothers breastfeeding between a previous date and the present.[3] Estimates did not include the additional food cost of lactation, or additional equipment and sterilisation costs or additional medical expenses arising from artificial feeding.[4]

Rohde (1974) highlighted the economic and nutritional significance of breastmilk in the second year of life in his study for Indonesia. Assuming daily breastmilk production in the second year of breastfeeding averaging 250 ml, or 90 litres a year, Rohde used available data on breastfeeding prevalence to estimate that in Indonesia the avoided cost of purchasing cows' milk for 1-2 year olds was equal to 80% of the country's health budget and 1/4 of a per cent of the country's per capita GNP.

Similarly the study by Greiner, Almroth et al. (1979) demonstrates the potential economic importance of extended breastfeeding. Even where breastfeeding rates were very high, annual savings from increasing and extending breastfeeding were substantial. Greiner, Almroth et al. base their milk production values on Wallgren (1945) which they considered the best designed

[3] The implied "breastfeeding" rate includes both fully and partially breastfeeding. The weaning rate used in the calculations is the percentage of mothers who have completely ceased breastfeeding during a particular time frame (Berg, 1973, 229) The implied "breastfeeding" rate therefore includes both fully and partially breastfeeding mothers.

[4] The net cost of artificial formula feeding would be somewhat lower if additional food costs were taken into account, but higher if it included costs of equipment and other costs involved in artificial formula feeding (91-92, 249).

study of those surveyed (p19). Based on surveys in developing countries, the mean daily volume for the first 4 months of life averaged 722 ml. Mean daily outputs of breastmilk of 600 ml were assumed for the 4-12 month age group, 400 ml for 12-24 months, and 300 ml for 24-36 months (p23). Total national production volumes were calculated based on cumulative percentages of infants weaned up to 2 years of age. The authors estimated the "commodity" cost of a switch to artificial feeding in Ghana and the Ivory Coast, and therefore the amount saved nationally by breastfeeding, as the cost of replacing current human milk production with low solute formula and bovine milk providing equivalent calorie value to breastmilk to 2 years of age (p57). This was priced at the average local cost of available artificial formula supplies.

Oshaug and Botten (1994) follow a broadly similar methodology in their estimate of the value of human milk production in Norway for 1991. In spite of several studies measuring the volume of human milk production in the early 1990s, the volume per child remained uncertain (p480). They therefore assumed daily milk intake per infant as set out in Table 1.[5] These are conservative estimates, especially for well nourished mothers in developed countries, implying milk consumption during the first 2 years of life of 326 kg or litres of milk per infant, compared to conventional assumptions of adequate intake of 375 litres (Berg 1973).[6]

Data on breastfeeding rates in 6 Norwegian counties at ages 3, 6, 9, and 12 months were then used to extrapolate breastfeeding prevalence at each monthly interval.[7] The population of infants living in 1992 is approximated from national data on children born in 1991. Total national breastmilk production was valued at the price the main hospital in Oslo sold human milk to private persons or other hospitals, 344 Norwegian Kroner or $US50 per litre in 1992.

[5] The authors appear to equate 1 litre with 1 kg. This is not strictly true: 1 litre of milk has a mass of 1.031kg.

[6] If milk production averaged 388 g/day (400ml/day in the second year, as assumed by Greiner, Almroth et al (1979), total milk intake over two years would average 367 litres per infant.

[7] No reliable data were available on breastfeeding infants older than 12 months of age so the authors estimated total breastfeeding months of children over 12 months from oral reports by maternity and child health centres. This may underestimate extended breastfeeding in cultures where it is not the norm, as mothers might not readily disclose it other than to close family members.

Table 1. Daily Milk Yields for 24 Months

Age (months)	*Average per infant per day (g)*
Initiating	600
1	600
2	700
3	800
4	800
5	700
6	700
7	700
8	600
9	600
10	500
11	500
12	400
13	300
14	300
15	300
16	300
17	300
18	300
19	300
20	300
21	300
22	300
23	300
24	300

Source: Oshaug and Botten 1992

Human Milk Production in 1992: An Estimate for Australia

Using the methodologies of overseas studies measuring human milk production, we now estimate human milk production in 1992 for Australia under three scenarios:

- actual achieved in 1992;
- if Australia's national targets for increased breastfeeding rates were achieved; and
- if "optimal" breastfeeding patterns according to the World Health Organisation were achieved.

This is compared with estimates for the early 1970's, when breastfeeding rates bottomed in Australia.

Number of Infants

There were 264,151 live births in Australia during 1992, and approximately 257,247 babies born in 1991 who entered their second year of life in 1992. For simplicity we assume this is the

number of infants aged 0-2 living throughout 1992.[8] Corresponding numbers for 1972 are 264, 969 and 276,362 respectively

Prevalence of Breastfeeding

Australia remains one of the very few western countries without comprehensive or reliable national statistics on the prevalence of breastfeeding (Morrow and Barraclough 1994; NHMRC 1985), a situation unfortunately left unaddressed by the ABS 1989-90 National Health Survey data on breastfeeding (Bundrock 1990).

In a recent publication on food and nutrition in Australia, Lester (1994, 192-196) surveys the evidence of breastfeeding trends, and discusses difficulties with existing studies of breastfeeding rates.

- There are varying definitions of "breastfeeding" which create problems for interpretation and analysis. In particular, most studies do not distinguish between full and partial breastfeeding.[9]
- There is no ongoing collection of data at the national level. The only national data on prevalence and duration of breastfeeding are provided by Palmer (1985) for 1983, and the retrospective 1989-90 National Health Survey (ABS 1991) which has significant difficulties of reliability and interpretation, Lund, Adams and Heywood 1996).
- There have been only sporadic collections at the state level, in Western Australia (Hitchcock, McGuiness et al. 1982; Hitchcock and Coy 1988), Tasmania (Tasmania 1952; Tasmania 1966; Coy, Lewis et al. 1970; Coy, Longmore et al. 1976; Coy and Lowry 1980; Hitchcock and Coy 1988), South Australia (Boulton and Coote 1979; SA 1987), Queensland (Qld 1976; Evans, Townsend et al. 1985), and NSW (Lawson, Mays et al. 1978; Allen and Heywood 1979). More recently there has been a small survey by the Brotherhood of St Laurence in 1992 (Gilley 1993), a study in Newcastle NSW (Redman, Booth et al. 1992), and in Queensland between 1982 and 1985 (Siskind, Del-Mar et al. 1993; Landers, Swanson et al. 1995).
- The only data on long term trends are those that compiled for Victoria by the Nursing Mothers' Association of Australia on breastfeeding prevalence at hospital discharge, 3 months and 6 months of age (NMAA 1993; NMAA 1995). Mein Smith (1991) found that during the 1920s, around 70% of Victorian babies attending health clinics were breastfeeding at three months, with around 60% still fully breastfed at six months, and 55% at nine months.
- Virtually all studies limit data collection to breastfeeding on discharge, and at 3 months and 6 months, with only sporadic data on breastfeeding at 9 months, 12

[8] In principle, the number of deaths for each annual cohort should be deducted.

[9] This may not be of great practical significance. Where separate data are collected for both full and partial breastfeeding, it suggests only a very small percentage, 2-5%, partially breastfeed (NMAA 1993).

months or beyond (eg Coy and Lowry 1980; Hitchcock, McGuiness et al. 1982; Evans, Townsend et al. 1985; Hitchcock and Coy 1988; ABS 1991; Jain 1996).

The most recent data on breastfeeding prevalence are provided by Scott, Binns et al. (1997). Based on surveys in Melbourne and Perth, this study indicates breastfeeding rates in 1993-94 of 84% on discharge, 61% at 3 months and 49% at 6 months.

Assuming perfect knowledge and informed choices by consumers about nutritional and health impacts,[10] and no "externalities", the market would therefore price artificial formula at a much lower value, reflecting its inferior nutritional quality and health costs. Using the price of artificial formula milk as a shadow price for breastmilk Table 2 shows our estimates of breastfeeding prevalence for age's 0-24 months for 1972 and 1992. These are derived from NMAA (1993), (Jain 1996) and unpublished National Health Survey data reported in Lester (1994).[11]

[10] The "consumer" is the baby, and hence one also has to assume that the mother as the agent for the baby, properly reflects the infant's feeding preference.

[11] Where there are no observations available for a monthly interval, data points have been graphically interpolated on the assumption of a linear trend.

Table 2. Breastfeeding prevalence in Australia,

AGE	*1972*	*1992*	*National Health Target levels of breastfeeding*	*Optimal (WHO) levels of breastfeeding*
months	%	%	%	%
Initiating	**60**	**76**	90	95
1	47	70	90	95
2	35	64	90	95
3	**21**	**58**	80	95
4	18	53	80	95
5	15	48	80	95
6	**11**	**44**	80	95
7	10	39	39	95
8	9	35	35	95
9	8	33	33	95
10	7	27	27	95
11	6	24	24	95
12	5	**20**	20	95
13	5	18	18	95
14	4	15	15	95
15	4	12	12	95
16	3	9	9	95
17	3	8	8	95
18	2	**6**	6	95
19	1	6	6	95
20	1	5	5	95
21	1	5	5	95
22	0	4	4	95
23	0	4	4	95
24	0	**3**	3	95

a) Bold font refers to survey-based data (NMAA 1993; Lester 1994; Jain 1996), other observations are linear interpolations.

b) Estimates for 1972 assume same ratio of mothers breastfeeding at 12 months as in 1992 continue to 18 months.

Volumes

Our calculation of human milk production in Australia uses the daily breastmilk milk production levels assumed by Oshaug and Botten (1994) for Norwegian women. These average 650 g/day (670 ml/day) for the first year, and 300 ml/day (309 ml/day) for the second (Table 1). These assumptions are also reasonably consistent with recent studies of milk yields for well

nourished Dutch, British and Australian women[12] (Goldberg, Prentice et al. 1991; Raaij, Schonk et al. 1991; Hartmann, Sherriff et al. 1994; Cox, Owen et al. 1996).

Price of Human Milk

It is necessary to use a "shadow price" to value human milk production because most human milk production is not supplied or acquired in the market.

Many studies of the economic value of breastfeeding estimate the "cost avoided" or "savings" from current breastfeeding by calculating what it would cost to replace breastmilk with artificial formula milk. However, the price of artificial formula is an unsatisfactory "shadow price" for human milk because human milk and artificial formula milk are not equivalent products (Minchin 1985, 7-36). As Newman (1997) comments

> *"... even modern formulas are only superficially similar to breastmilk. Fundamentally they are inexact copies based on outdated and incomplete knowledge of what breastmilk is. Formulas contain no antibodies, no living cells, no enzymes, no hormones. They contain much more aluminum, manganese, cadmium, and iron than breastmilk. They contain significantly more protein than breastmilk. The proteins and fats are fundamentally different from those in breastmilk. Formulas do not vary from the beginning of the feed to the end of the feed, or from day 1 to day 7 to day 30, or from woman to woman or from baby to baby."*

While breastmilk is adapted to the individual needs of a particular baby, formulas are not. Formulas might make babies grow satisfactorily. But there is no evidence that this has no adverse long term health or nutritional consequences (Lester 1994). Indeed, as discussed below, the evidence shows the opposite.

Assuming perfect knowledge and informed choices by consumers about nutritional and health impacts[13] and no "externalities", the market would therefore price artificial formula at a much lower value, reflecting its inferior nutritional quality and health costs. Using the price of artificial formula milk as a shadow price for breastmilk is therefore only correct if the price is adjusted for the superior health and nutritional qualities of breastmilk.

There are several conventional economic methods for valuing unmarketed products.

[12] Yields for Australian women tend to be at the high end of estimated ranges of milk production during the first year of life (Cox, Owen etal.1996; Hartmann, Sherriff etal.1994), a result which Hartmann Kulski etal. (1985) attribute to the Australian practice of demand feeding as advocated by the Nursing Mothers Association of Australia. Hartmann Kulski etal.(1985) found that milk production by well nourished Australian women feeding single babies is well below biological potential yields, as evidenced by volumes of milk produced by mothers' breastfeeding twins. Levels were well above the range 0.7-0.9 kg/day that is generally indicated as a maximum for human lactation (Jelliffe & Jelliffe 1978).

[13] The "consumer" is the baby and hence one also has to assume that the mother as the agent for the baby, properly reflects the infant" feeding preference.

Our preferred approach is to use that followed by Oshaug and Botten (1994) of using the market value of expressed breastmilk. Unlike in Europe or the US, where some hospitals maintain human milk banks to provide for premature babies or other infants who cannot receive their own mothers' milk, there are presently no human milk banks in Australia.[14] For this reason we have taken the market price of human milk in Norway ($US50 or A$67 per litre) as the "shadow price" for breastmilk in Australia.[15] This is the "market alternative" approach. It is the approach most consistent with the "output method" used by the ABS to value market production and is appropriate at the macroeconomic level for comparing with national accounting aggregates (ABS 1992).

An alternative approach, used for example, to value human blood or sperm is to price human milk at the "opportunity" or time cost of extracting it. Blood products are a good parallel because like breastmilk only a small amount is actually traded, although "supply" and "demand" is very large. If we assume that to express 150 ml of breastmilk might take a donor mother approximately 1/2 hour, plus say, 1/2 hour in travelling costs, and apply wage rates used (ABS 1992, 23) for valuing women's unpaid work ($11-13 per hour), the shadow price for donated human milk would be conservatively around A$80 per litre. This is the "opportunity cost" approach.

Again, there have been times in the past, when breastfeeding has been a commercial activity. Commercial wetnurses were employed by hospitals and clinics to provide milk for infants, with milk yields reported of around 3 pints (1.875 litres) per day each (Wickes 1953). Assuming that human milk production capacity on a commercial basis is comparable across time and across countries, one might estimate the replacement cost of a breastfeeding mother's time by the cost of employing wetnurses.[16] If wetnurses were employed for an 8 hour working day to produce an average daily milk yield of 1.875 litres per person, at a wage equal to the 1992 wage for, say, childcare workers, the approximate cost per litre of the human milk obtained would be around A$51. This is effectively a "replacement cost" approach.

[14] In some cases milk is donated free by mothers, in other cases donors receive small gifts such as stationary as recompense for their effort. In some countries mothers receive payment. Milk banks vary in their approach to ensuring the safety of donor milk. Pasteurisation is known to prevent the transfer of HIV and related viruses, and is practised by UK and US milk banks. However, some vitamins and immunological properties are lost through pasteurisation. Breastmilk from women with positive blood tests for HIV or Hepatitis cannot be used in donor milk bank programs. Where there is a known donor and low risk of AIDS, the use of unpasteurised milk is acceptable. Norwegian milk banks screen donors, and test initial milk samples, using unpasteurised milk. Milk samples are also randomly tested.

[15] Converted at $A1 = $US.75. In 1997, human milk sells in the US for $US2.50 ($A3.33) per ounce, around $US83 ($A111) a litre.

[16] For a detailed history of wetnursing, see Fildes (1988).

Scenario (a): Actual Production of Human Milk in Australia for 1992
In Australia in 1992 production of human milk for infants up to 2 years old was approximately 33 million kg (Table 3).

This was worth $2.2 billion at a shadow price of A$67 per litre, equivalent to around 0.5% of GDP, or 15% of public spending on health. It is also equal to around 6% of private final consumption expenditure on food (ABS 1993).

Table 3. Human milk production in Australia, 1992

Age in months	*Infants breastfeeding at start of period (%)*	*Infants living (avge)*	*Infants breastfed each month*	*Breastmilk pr infant pr day (kg)*	*Estimated kg pr month pr infant*	*National Production of breastmilk (kilotonnes)*
0-1	76	264151	200755	0.60	18	3.67
1-2	70	264151	184906	0.60	18	3.38
2-3	64	264151	169057	0.70	21	3.60
3-4	58	264151	152415	0.80	24	3.71
4-5	53	264151	140000	0.80	24	3.41
5-6	48	264151	126792	0.70	21	2.70
6-7	43	264151	114906	0.70	21	2.45
7-8	39	264151	103019	0.70	21	2.19
8-9	35	264151	92453	0.60	18	1.69
9-10	33	264151	87170	0.60	18	1.59
10-11	27	264151	71321	0.50	15	1.09
11-12	24	264151	63396	0.50	15	0.96
12-13	20	257247	51449	0.40	12	0.63
13-14	18	257247	46304	0.30	9	0.42
14-15	15	257247	38587	0.30	9	0.35
15-16	12	257247	30870	0.30	9	0.28
16-17	9	257247	23152	0.30	9	0.21
17-18	8	257247	20580	0.30	9	0.19
18-19	6	257247	15435	0.30	9	0.14
19-20	6	257247	15435	0.30	9	0.14
20-21	5	257247	12862	0.30	9	0.12
21-22	5	257247	12862	0.30	9	0.12
22-23	4	257247	10290	0.30	9	0.09
23-24	4	257247	10290	0.30	9	0.09
					Total (kt)	33.23
					Value (A$bn)	2.22
					For 1-2 yo	0.19

Source: Statistical Appendix, available on request

Using the replacement cost approach, with a shadow price of A$51 per litre, human milk production was worth A$1.7 billion, while using the opportunity cost approach, with a price of $80 per litre, human milk production in 1992 was A$2.7 billion. Thus a plausible range for the gross value of human milk production in Australia in 1992 was $1.7 to $2.7 billion, our preferred estimate being $2.2 billion (Table 4).

Table 4. Alternative valuations of Australian human milk production, 1992

Valuation method	*$ billion pa*
Market alternative	2.2
Opportunity cost	2.7
Replacement cost	1.7

Scenario (b): National Health Target Breastfeeding Levels

In 1986, the Australian government set a national target for breastfeeding by the year 2000 (Better Health Commission 1986). The target is for 90% of babies to be breastfeeding on discharge from hospital, 60% fully breastfeeding and 80% at least partially breastfeeding up to 3 months of age, and 50% fully and 80% at least partially breastfeeding at 6 months of age. The policy does not specify a target for older babies so we assume no increase from 1992 rates of breastfeeding by babies beyond 6 months.[17]

Increasing Australian breastfeeding rates in accordance with the National Health Target for breastfeeding would raise breastmilk production by over $600 million pa (Table 5). Achieving the breastfeeding target would raise the value of national human milk production from $2.2 billion to $2.9 billion, representing a 32% increase.

Table 5. Gross value of human milk production in Australia

	1972	*1992*	*National Health Target levels of breastfeeding*	*Optimal (WHO) levels of breastfeeding*
Human milk volumes	14 kilotonnes	33 kilotonnes	43 kilotonnes	84 kilotonnes
Gross value of human milk production[18]	$920 million	$2.2 billion	$2.7 billion	$5.7 billion

Source: Statistical Appendix, available from the authors on request

[17] This will underestimate breastfeeding prevalence beyond 6 months of age, as higher breastfeeding rates in early infancy would likely flow on to higher breastfeeding rates for the later months.

[18] Valued at A$67 per litre.

Scenario (c): World Health Organisation (WHO) optimal

The optimum breastfeeding scenario may be defined by the WHO/UNICEF *Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding*, signed in 1990 by representatives from 30 countries which stated:

> *"all infants should be fed exclusively on breast milk from birth to four to six months of age. Thereafter, children should continue to be breastfed while receiving appropriate and adequate complementary foods for up to two years of age or beyond."*

Only 1-5% of women in industrialised countries are physiologically incapable of sustaining breastfeeding (WHO 1991). Hence, "optimal" breastfeeding, by the 95-99% of women physiologically capable of it, would involve exclusive breastfeeding until 4-6 months of age, and then continued breastfeeding for up to two years of age and beyond.

Breastfeeding prevalence in Australia is well below these levels. If breastfeeding had been at optimal levels in Australia in 1992, the value of human milk production would have been $3.4 billion higher, with a potential volume of production estimated of nearly 90 kg pa. The total market value of production would have been $5.7 billion. This is potentially worth around 1.3% of GDP or some 40% of public sector spending on health. Alternatively, it represents around 17% of private final consumption expenditure on food (ABS 1993).

Breastfeeding continues to provide substantial nutritional, immunological and other benefits into the second year of life and beyond. The economic significance of extended breastfeeding is demonstrated by Rohde (1974) and Greiner, Almroth et al. (1979).

In Australia, breastfeeding into the second year is not common. However, one in five infants are breastfeed at 12 months of age, around 5% of infants at 18 months and perhaps 3% at 24 months (ABS (1991), reported in Lester (1994); Jain 1996).

Milk production in the second year is potentially significant. Breastmilk production for infant's aged 1-2 years old could add $1.8 billion of the $3.4 billion potential increase, even though daily production volumes are assumed to drop to 300 ml in the second year. This highlights the potential economic importance of extending breastfeeding duration, and the extent of the production loss implicit in the present Australian practice of sub-optimal early weaning.[19]

1972 Production of Human Milk

During the 1960s and 1970s, breastfeeding rates declined dramatically, reaching an all time low during 1970-1972 before returning to 1950s levels by the late 1980s. Australian breastfeeding rates for 1972 can be used to estimate the annual losses in national human milk production due to breastfeeding declines during these years.

[19] No estimate is made of gains from breastfeeding beyond 2 years as the WHO/UNICEF optimal level suggests.

Total production of breastmilk in 1972 was around 14 million kg, worth $920 million pa at 1992 prices. This is around 30 million kg lower than if National Health Target breastfeeding rates had prevailed in 1972, and 19 million kg lower than actual achieved levels of 1992. It represents an annual loss of human milk worth $2 billion or $1 billion compared to 1992.

Compared to the feasible WHO optimum, the annual production loss during those years was even greater, at 73 million kg or around $4.8 billion pa.

THE ECONOMIC VALUE OF BREASTFEEDING

"Externalities" or Spillover Effects and the Level of Analysis

Many studies of "the economics" of breastfeeding merely compare private financial costs of artificial formula feeding with additional food expenses of breastfeeding. However, the costs and benefits of breastfeeding do not necessarily accrue just to the mother, the baby, or even just the family.

Artificial formula feeding makes demands on national resources that breastfeeding does not. It has economic consequences at various different levels, sectors and institutions - nations, governments, health care organisations, and families (Levine and Huffman 1990).[20] The method of infant feeding affects public sector spending for example, on health or remedial education.

That is, the social costs and benefits of different infant feeding methods will differ from private or individual costs and benefits. For example, the health benefits of breastfeeding accrue only partly to a breastfeeding family. Benefits will also will accrue to the public sector or employers, as reduced public health costs and less absenteeism or higher productivity by parents.

Similarly, an individual may perceive benefits in artificial feeding, for example, to facilitate early return to work and reduce lost earnings from having a baby. However, the costs of such a decision, for example in the poorer health status of the baby, will be shared more widely, falling on the public sector, employers, and the community.

Despite the important effects on the public sector and the use of economic resources these "external" effects will not necessarily be counted in individuals' or families decisions about breastfeeding.

[20] This model was applied by Meershoek (1993) to Morocco. See also CPCM (1990).

The Value of Breastfeeding - An Economic Model

Greiner, Almroth et al. (1979) were the first to set out a comprehensive model of the economic value of breastfeeding, with the incremental value of breastfeeding, that is, its net economic benefit, said to comprise:[21]

- the avoidance of the expenses of the goods necessary for artificial feeding (G_{af})[22]
- the health producing effects of breastfeeding (H_{bf})
- the avoidance of disease producing or harmful effects of artificial feeding (D_{af})
- the avoidance of the time spent in artificial formula feeding, (T_{af})

minus

- the cost of food necessary to produce the required quantities of breastmilk (G_{bf})[23]
- the forgone health producing effects of artificial feeding (H_{af})
- the disease producing or harmful effects of breastfeeding (D_{bf})
- the mother's time in breastfeeding (T_{bf})

Goods Costs or Benefits of Breastfeeding

Artificial feeding costs avoided (G_{af})

Overseas studies of the financial cost of artificial formula feeding, and breastfeeding usually compare the goods cost of artificial feeding with the financial cost of additional foods needed by the lactating mother (for a survey of such studies see Greiner, Almroth et al. (1979, 2)). Earlier studies excluded the costs of utensils for artificial feeding and made extravagant assumptions about the food costs of breastfeeding. The most recent estimate of the cost of formula feeding in Australia is Bundrock (1992).

Using average prices of formula from a survey of 38 retail outlets in Melbourne during late 1991-early 1992, Bundrock estimated the basic cost of formula feeding according to the

[21] The value of breastfeeding (BFi) is the difference between the costs and benefits of breast or bottlefeeding, that is, $(B_{bf}-C_{bf}) - (B_{af}-C_{af})$, where the benefits of each method of feeding B_{bf} and B_{af} are its beneficial effects (H) minus its harmful or disease producing effects (D) and the costs (C_{bf}) and (C_{af}) are the sum of the goods (G) and time (T) costs to produce each form of feeding.

[22] The cost of artificial feeding (C_{af}) is the sum of all costs needed to feed artificially (eg milk, and utensils such as feeding bottles, sterilising fuels, equipment) that is, $(G_{af}) = (G_{aff})+(G_{afu})$, plus the value of the time of each person participating in the process of artificial feeding (T_{af}). Hence $C_{af} = G_{aff} + G_{afu} + T_{af}$

[23] Hence the cost of breastfeeding (C_{bf}) is the additional food costs needed by the mother (G_{bf}) to produce the breastmilk plus the mother's time in breastfeeding (T_{bf}). That is, $C_{bf} = G_{bf} + T_{bf}$.

manufacturer's instructions for the first year at between $476 and $975. The range depended on assumptions about the costs of equipment ($29-$167), artificial formula milk[24] ($427-$671), and sterilisation, preparation and washing costs ($20-$136).[25] No allowance was made for wastage or mothers' tendency to over-concentrate formula (Bennett and Gibson 1988; Lilbourne, Oates et al. 1989).

Using Bundrock's financial cost estimates of formula feeding, and assuming daily consumption of cows milk or equivalent at 450 ml/d for infants who are not breastfeeding in the second year, the approximate aggregate financial cost avoided by breastfeeding in 1992 (G_{af}), was between $60 to $110 million (see Table 6 below). We estimate that in 1992, $110-190 million was spent on breastmilk substitutes and associated products for infants under two, most of this, perhaps $135 million on artificial formula.[26] Achieving Australia's National Health Targets for breastfeeding would reduce consumption of artificial milk formulas and bovine milk by around $20-40 million pa, to $90-150 million.

Optimal breastfeeding practices would reduce consumption of breastmilk substitutes for under two year olds to around $10-20 million pa, saving the Australian economy between $100 and $170 million in the cost of breastmilk substitutes and associated products for infants under two.

Additional food costs of breastfeeding (G_{bf})

The goods cost of breastfeeding is essentially the additional food needed for the lactating mother.

Early studies were based on recommendations for additional food for lactating mothers of 500 - 1000kcal/day (McKigney 1971; Jelliffe and Jelliffe 1978b). The latter's recommendation was adopted by the US National Research Council (NRC 1980) and the WHO/FAO (WHO 1983), and is the basis for the current Australian recommended daily intake (RDI).

However such recommendations have come under challenge with better understanding of energy balance in human lactation, including in well-nourished women (Prentice 1980; Prentice, Paul et al. 1986; Prentice and Prentice 1990; Hames and Ralph 1991). Recent studies show a substantial contribution to the energy cost of lactation from reduced maternal activity

[24] A number of reasons were also noted (3) why a mother might not purchase the cheapest brand formula.

[25] Hansen (1996) uses a similar approach to Bundrock to derive similar estimates for New Zealand. Hansen finds the basic financial costs of formula feeding to range from NZ$573-$984 during the first year.

[26] ABS data are not sufficiently detailed to identify actual manufacture and expenditures on artificial formula. However, manufacture of milk based health, invalid and baby preparations was estimated at around $142 million in 1993-94, while 1991-92 imports of "infant food preparations of flour, meal, starch or malt extract, or dairy produce", were around $3 million. Retail sales of "other goods" in the "milk vending or specialised food retailing, n.e.c., which includes artificial formula, were around $50 million. Australia exported around $25 million of "baby foods of milk or cream" in 1991-92, mostly to developing countries in Asia and the South Pacific. The apparent difference between manufacture for the Australian market, and retail sales may reflect the significance of supply to hospitals and institutions.

(Goldberg, Prentice et al. 1991; Raaij, Schonk et al. 1991), use of stored reserves (Ohlin and Rossner 1990; Brewer, Bates et al. 1989; Dewey 1993), and increased metabolic efficiency during lactation (Illingworth, Jung et al. 1986).

The current recommendation for additional energy intake during lactation is likely to exceed the energy cost of milk synthesis for most Australian women (Hartmann, Sherriff et al. 1994).

We therefore assume an additional energy intake of 1260-1280 kJ/d (300-400kcal/day).[27] Scaling down Bundrock's "low cost" estimate based on an intake of 1680kJ/d, we find the 1992 food cost of lactation for Australian women to be $2.31 per week. This totals around $101 for the first year and $73 for the second year food intake costs.[28] In aggregate terms, a realistic commodity cost of breastmilk production in Australia in 1992 is therefore around $15 million pa.[29] Achieving National Health Target breastfeeding rates would cost about $20 million pa. Similarly, to produce WHO optimum levels of human milk worth $5.7 billion would cost $45 million in additional food for lactating mothers.

The goods cost of breastfeeding of $15 million pa in 1992 compares with artificial feeding costs avoided by breastfeeding of around $60-110 million (Table 6). This confirms other recent research showing the goods cost of artificial feeding exceeds that of breastfeeding by an order of magnitude of at least three (Levine and Huffman 1990; Meershoek 1993).

Table 6. Goods costs of infant feeding

	1992	National Health Target levels of breastfeeding	Optimal (WHO) levels of breastfeeding
Goods cost of artificial feeding	$60-110 million	$90-150 million	$ 100-170 million
Goods cost of breastfeeding	$15 million	$19 million	$44 million

Source: Statistical Appendix, available from the authors on request

[27] In a study for New Zealand, Hansen used 300-400 kcal/d (1260-1280 kJ/d), apparently based on Raaij, Schonk et al (1991).

[28] We assume milk intake during the second year to be around 60% of intakes during weeks 42-52, and commensurately scale down our food cost estimates, derived from Bundrock, for the second year.

[29] On Bundrock's "low cost" estimate, the aggregate cost of producing the 33 million kg of breastmilk in 1992 would be around $20 million. Her "high cost" estimate of $515 pa per mother implies aggregate additional food costs of $78 million pa.

Health Implications

The most critical element in the economic value of breastfeeding is the health cost implications. However, it is also the most difficult to value, partly because research on the cost implications of artificial feeding is in its infancy, and partly because the full health implications of artificial feeding are not fully known.[30]

The infant health risks of artificial feeding are widely documented (Lawrence 1989; Cunningham 1991). Even in developed countries like Australia, "formula" fed babies are significantly more likely to be hospitalised than breast-fed infants (Howie, Forsyth et al. 1990; Cunningham 1979). Popkin, Lasky et al. (1984) concluded that artificially fed infants suffered twice as much illness as breast-fed infants even after controlling for confounding variables such as socioeconomic status. A controlled study by the National Health Strategy (NHS 1992) found children fed artificial milk for at least three months were 12-31% more likely to suffer serious chronic illness. Breastfeeding reduces both the incidence and severity of infectious diseases (Cunningham, Jelliffe et al. 1991).

"Formula' fed babies in **developed** countries have substantially increased risk of:

- necrotizing enterocolitis (NEC), a significant cause of illness and death of premature babies
- neonatal sepsis
- SIDS
- lower respiratory tract infection and middle ear infection
- diarrhoeal disease, gastrointestinal illness, and rotavirus gastroenteritis
- H Influenza Bacteraemia (HIB) and meningitis

Longer term breastfeeding reduces risks of:

- allergy (such as asthma and eczema)
- multiple sclerosis and other auto-immune diseases
- juvenile insulin-dependent diabetes mellitus (IDDM)
- Crohn's disease and ulcerative colitis in adulthood, and coeliac disease
- childhood lymphoma
- heart disease

Breastfeeding contributes significantly to better speech and jaw development and reduces the risk of malocclusion and tooth decay. Breastmilk also contains fatty acids assisting visual and

[30] An eminent Australian scientist Professor R Short, reportedly described artificial formula feeding of infants as the biggest uncontrolled experiment in human history (Short 1994).

central nervous system development, and which are important for brain development. This has measurable implications for IQ of primary school age children.

Recent work clearly signals the economic significance of current breastfeeding and artificial formula feeding rates. Riordan (1997) estimates the costs of not breastfeeding in the US were over $1 billion pa: from higher rates of infant diarrhoea ($291 million); respiratory syncytial virus ($225 million); otitis media ($660 million); and insulin dependent diabetes mellitus (IDDM)($10-125 million).

In Australia, Drane (1997) estimates the public hospital costs of illness statistically attributable to formula feeding. For just three common infant illnesses, and assuming a breastfeeding prevalence of 60% at 3 months of age, the minimum attributable costs of artificial feeding totals $18 million (Table 7).[31]

Table 7. Estimated public hospital costs of selected infant illnesses

Illness	*Cost attributable to artificial feeding*	*Potential cost savings from breastfeeding (National Health Targets)*
NEC	$7.7 million	$3.8 million
Gastroenteritis	$7.5 million	$3.7 million
Eczema	$1.9 million	$1.1 million
IDDM	na	$2.7 million

Source: Drane 1997

- Increasing breastfeeding rates from 60% to 80% at three months in accordance with National Health Targets for breastfeeding would reduce costs of treating NEC, gastrointestinal illness, upper respiratory tract infection, diabetes and eczema, by a **minimum** of $11.3 million pa, an average saving of 33%, through lower prevalence of these illnesses (Table 7). Also, national hospitalisation costs of treating IDDM are around $5.3 million pa (Sutton, Plant et al. 1990). Reducing the prevalence of IDDM by 16% through avoiding cow's milk based formula's in the diet for the first 3 months would save at least $2.7 million pa nationally in hospitalisation costs.
- There is also an established link between formula feeding of preterm infants and lower IQ scores at age 8 (Lucas, Cole et al. 1992). Drane estimates artificial feeding accounts for $5.4 million of the estimated $18.8 million cost of special education for an assumed breastfeeding prevalence of 60% at 3 months. Increasing breastfeeding rates among premature babies from 60% to 80% at three months would thus save $2.7 million pa or 14% in special education costs.

[31] As the prevalence of breastfeeding among premature babies is much lower, the actual attributable cost will be much higher.

Hospitalisation costs are only a component of public and private health costs associated with illness in infants. The above estimates exclude private financial and economic costs associated with post hospital consultations with GPs and pediatricians, pharmaceutical and nursing costs, household disruption and productivity losses, and long term morbidity costs.

There are also significant economic and public cost implications from the other costs of infant illness such as days off work, days off school, or other days of reduced activity. For example, mothers in the paid labour force who artificially feed their babies have higher absenteeism than breastfeeding mothers (Cohen, Mrtek et al. 1995; Jones and Matheny 1993). Nursing a sick child also disrupts unpaid household work (worth 60% of GDP according to the ABS (1992)).

Women who breastfeed are also significantly less likely to get:

- osteoporosis,
- breast cancer,
- cervical cancer, and
- ovarian cancer.

Such illnesses are very costly to treat, and become more so as the population ages. Even small reductions in the incidence of such chronic or severe illnesses from greater breastfeeding prevalence could have very high net economic returns.

Foregone health producing effects of artificial feeding and disease producing or harmful effects of breastfeeding (H_{af} , D_{bf})

Any possible harm from breastfeeding relates to possible transfer of illness via milk, for example, HIV/AIDS, or Hepatitis B, or from harmful drugs or chemicals transmitted through breastmilk (Popkin, Lasky et al. 1984, 53). Following Greiner, Almroth et al. (1979) we assume that in practice, these have trivial public health or economic significance.

Time Costs or Benefits of Breastfeeding

Time is an important element of the cost of production of breastmilk as time has an "opportunity cost". The time a mother spends feeding a baby is part of the resource cost of an infant feeding method.

There are problems defining time spent "feeding". Especially in developed countries, different infant feeding methods may be associated with different parenting styles or practices. For example, many breastfeeding mothers offer the breast for comfort as well as nutrition. Many breastfeed their baby to sleep. The breastfeeding mother would be measured as spending more time "breastfeeding", but she may spend less time on other childcare activities - "settling baby", "soothing" a fractious child. Comparisons of the time-intensity of breastfeeding may be thereby distorted.

Mothers using artificial formula milk introduce solids earlier (Hitchcock and Coy 1988; Lilbourne, Oates et al. 1989). This gives misleading comparisons of time spent on different

feeding methods as most researchers assume artificially feeding mothers and breastfeeding mothers spend equal time feeding solids.

The likelihood of "joint production" is also a problem for comparisons of time spent breastfeeding or bottlefeeding. Breastfeeding is often compatible with simultaneous undertaking of other tasks. Night feeds and sleeping are an important example of joint production as breastfeeding may occur with less disturbance to the mother's sleep than for artificially fed infants. This "joint production' is less possible with artificial feeding. (Popkin 1978; Greiner, Almroth et al. 1979).

Then there is the question of what costs to include. Some studies only include direct time costs, that is time holding the baby. However, preparation and sterilisation costs are significant for artificial feeding. Some mothers save time by propping the baby up with the bottle rather than holding it to feed, a practice not recommended by health professionals for early infancy. With increasing evidence of higher illness in artificially fed infants in developed countries such as Australia, additional time spent nursing a sick infant, including seeking and receiving medical assistance should also be counted as a time cost of artificial feeding. On the other hand, some researchers include time breastfeeding mothers spend preparing extra food, or in breast and nipple care, or in learning breastfeeding.

A second key issue is whether paid employment is incompatible with breastfeeding, or whether the possible loss of employment opportunities is a cost of having a baby. Levine and Huffman (1990) and Meershoek (1993) for example list possible loss of mothers' employment opportunities as a cost of breastfeeding. Butz (1978, 1981) suggests urbanisation brings increased opportunities for mothers to engage in activities that are incompatible with breastfeeding. Breastfeeding may decline because mothers may substitute artificial formula feeds for breastfeeding if increased economic opportunity raises the value of their time and the opportunity cost of breastfeeding. Difficulties in combining breastfeeding with working for some groups of low income or ethnic women have been noted in several studies. This is seen to show that "to many women and their families, the infant feeding choice is a matter of economics, not nutrition" (Morrow and Barraclough 1994).

Only a very limited number of studies have compared the time associated with different infant feeding methods (Popkin, Lasky et al. 1984). These studies are all for developing countries, although with some application to developed countries. While some studies (eg Popkin, Lasky et al. 1984) conclude breastfeeding is time intensive, this conclusion is not universally accepted (eg Greiner, Almroth et al. 1979, 38; Rohde 1982). As noted above, there are problems in defining breastfeeding and feeding time, and distinguishing feeding from other childcare activities. Virtually all surveys measure "feeding" as time holding the baby. Most do not specify whether observations are limited to daylight hours, yet a substantial part of breastmilk intake and feedings occur at night (Greiner, Almroth et al. 1979, 19).

- Popkin (1978) surveyed 17 bottlefeeding mothers and 33 breastfeeding mothers in the Philippines and found the former held their child for 22-29 minutes per day[32] compared to 69-116 minutes per day by the latter. However, this took no account of preparation and sterilisation time or other indirect time costs (Popkin, Lasky et al. 1984).
- Greiner, Almroth et al. (1979, 38) report small scale surveys in the Philippines, Mexico, Kenya, and Ghana which suggested time spent breastfeeding infants aged two weeks to around 8 months varied from around 100 minutes a day to 200 minutes a day. Infants aged 1 to 23 months "breastfed" for between 33 and 91 minutes during a 12 hour observation period.
- Greiner, Almroth et al.'s own survey of breastfeeding mothers in Ghana found they spent 40-48 minutes a day breastfeeding, with longer times (50-79 minutes) for exclusively breastfed, ie younger babies.[33] By comparison, bottlefeeding mothers spent around 27 minutes per day holding the baby, but preparation and washing to minimum safe standards required an additional 135 minutes a day.[34] Other costs were time spent nursing a sick infant, and obtaining food and fuel supplies (39 minutes daily) making a total of 211 minutes a day.[35]
- Huffman (1980) found rural Bangladeshi women spent 2-3 hours a day breastfeeding, often simultaneously with other tasks, while Leslie (1988) found artificial feeding was three times as time intensive as breastfeeding, taking into account time for preparing artificial feeds.

Data do not exist to evaluate the relative time costs and values for breastfeeding and formula feeding in Australia,[36] although there is the opportunity to gather such data in the next ABS Time Use Survey.

There is also debate on the method of valuing such time (Smith 1982; ABS 1990). Using a pure "opportunity cost" measure, ie the wage foregone by the mother, may not accurately represent opportunity costs for women engaged in unpaid household work where that group has different

[32] Most such studies exclude night time feeding.

[33] This included time for breastfeeding education, breast and nipple care and preparing additional food for the mother.

[34] Judging the observed practices to be unacceptable for safe artificial formula feeding, the study (Page 38) included assumptions about the minimum time needed for safe preparation and sterilisation.

[35] The time cost of artificial formula feeding was adjusted for assumed additional time costs of home nursing for a sick infant, two hours per day for one week on three separate occasions per year.

[36] Some indication of the time costs of preparing artificial formula feeds in Australia - and of what consumers are prepared to pay for increased convenience and reduced preparation time - is given by the relative prices of ready-mixed artificial formula feeds. Price data obtained by Bundrock (1990) indicate that ready-to-feed formula is 2-5 times the price of powdered formula.

characteristics to those in the paid labour force. It also results in the same work being valued differently for a mother who is an engineer to say one who is a shop assistant. Using the "replacement cost" approach raises some similar issues. It is also suggested that time spent feeding at night should be valued differently from its value during the day when labour is available for work (Popkin, Lasky et al. 1984, 194, 199). As breastfeeding time during the night may not reduce the mother's time, the time cost of night feeds for breastfeeding infants should be treated differently from night feeds for those requiring prepared artificial feeds.

The approach the ABS (1990, 1992) favours for valuing such unpaid household services is an "input cost" approach, the market alternative-individual cost (MAIFC) method. Unpaid work is broken down into its separate components and the cost of hiring a suitably qualified person to perform those tasks is estimated for each component. In the case of infant feeding, the nearest market equivalent to a breastfeeding mother would be a childcare worker with adequate training to hygienically prepare and feed expressed breastmilk (EBM). The hourly wage of a childcare worker in 1992 was around $12.

While firm data on the relative time costs are unavailable for Australia, and existing studies are inconclusive, it is possible to speculate. Using data reported in Popkin, Lasky et al. (1984), we assume that breastfeeding in Australia during the first year of the baby's life takes 75 minutes a day on average. Artificial formula feeding is assumed to take 72 minutes a day - 40 minutes a day for acquisition, preparation and sterilisation, 25 minutes a day holding the baby to feed. Following Greiner, Almroth et al. (1979), we also assume 7 minutes a day on average for home nursing costs associated with illness in an artificially fed infant (see Jones and Matheny 1993; Cohen, Mrtek et al. 1995). In the absence of any data for older babies, we assume no difference in time costs of feeding an infant beyond 12 months.

Our estimates, summarised in Table 8, are highly sensitive to the assumptions used. This pattern of time use may or may not be an accurate reflection of Australian infant feeding patterns or practices. As observed earlier, there are also major conceptual difficulties with such estimates. Nevertheless, if these assumptions about the relative time intensity of breastfeeding hold in practice, the time cost of breastfeeding (T_{bf}) in Australia in 1992 was around $690 million, while the time cost of formula feeding avoided by breastfeeding (T_{af}) was $660 million.

The net time cost of breastfeeding in 1992 would therefore be around $27 million.

Table 8. Time costs of infant feeding

	1992	*National Health Target levels of breastfeeding*	*Optimal (WHO) levels of breastfeeding*
Time cost of artificial feeding	$660 million	$888 million	$1,319 million
Time cost of breastfeeding	$687 million	$925 million	$1,374 million
Net time cost of breastfeeding	$27 million	$37 million	$55 million

Source: Statistical Appendix, available from the authors on request

The Net Economic Value of Breastfeeding in Australia

In the Greiner, Almroth et al. model, the net economic value of breastfeeding is estimated as the costs avoided by breastfeeding ($G_{af}+T_{af}+H_{bf}+D_{af}$) minus the costs of breastfeeding ($G_{bf}+T_{bf}$).

We have estimated that breastfeeding in Australia in 1992 avoided a goods cost of formula feeding (G_{af}) of $65-130 million pa. We have also estimated a goods cost of breastfeeding of around $15 million, and suggest a net time cost of breastfeeding of around $28 million, a total goods and time cost of breastfeeding in 1992 of $50 million.

However, as Greiner, Almroth et al. (1979, 9) comment,

> *"Paradoxically, those aspects of the economic value of breastfeeding that are quantifiable in monetary terms (the cost of goods and time) are those which are of least economic significance at the national level".*
>
> *The major costs of illness associated with artificial formula feeding have yet not been fully quantified in Australia or elsewhere. Only two limited studies of potential health cost savings from breastfeeding (H_{bf}) or disease costs of artificial feeding that were avoided (D_{af}) were identified by this study.*

As noted in earlier sections, using the price of artificial formula as a "shadow price" of breastmilk inevitably undervalues breastmilk because the products are not equivalent; the health costs of artificial formula are substantial. In the absence of full knowledge of the health risks and costs of illness due to not breastfeeding, a more accurate approach to estimating the economic value of breastmilk incorporating the value of many of its health effects is to price human milk at the value of expressed breast milk (EBM) rather than using the price of artificial milk formula. That is, the most relevant "shadow price" for human milk is the market price of EBM, rather than artificial formula milk, and the "cost avoided" by breastfeeding in the Greiner, Almroth et al model is then measured as the avoided cost of purchasing EBM.

Taking this approach accounts for many of the health benefits of breastfeeding. Assuming there was perfect knowledge about the health benefits of human milk, a socially appropriate discount rate of future benefits, and if all such future impacts were internalised, the market price of EBM would reflect the economic value of human milk produced by Australian women in 1992.

It does not encompass all the benefits from breastfeeding, as some effects arise from the process of milk production or consumption, as distinct from the milk itself. Nevertheless, this approach can provide a more realistic estimate of the economic value of breastfeeding because in principle it reflects society's valuation of avoiding a wide range of infant illnesses through consuming human milk

Using this method, of valuing human milk at its market price, and deducting the cost of inputs (in time and goods) is also consistent with ABS methods for valuing market production and comparing with national accounting aggregates.

Hence, the "net economic value of breastfeeding' in Australia in 1992 was:

- the avoided cost of purchasing EBM, equal to the gross production value of human milk of $2.2 billion pa

plus

- the avoided time cost of sterilising, preparing and giving bottled EBM feeds ($660 million),

minus

- the costs of additional foods for mothers producing the supply of human milk ($15 million),

minus

- the time cost of breastfeeding ($687 million)

plus

- the other presently **unmeasured** but quantifiable health benefits from breastfeeding to babies and mothers.

On this basis, the economic value of breastfeeding in Australia in 1992 was a minimum of **$2.1 billion**.

The issue of incorporating such estimates into Australia's national accounts and GDP is discussed in the following section.

BREASTFEEDING AND THE AUSTRALIAN NATIONAL ACCOUNTS

"The economic wealth of a nation is calculated in terms of a wide variety of assets ranging from raw materials and capital goods to the value added to natural resources through industrial processing. Human labour is a major economic resource and valued for its role

in producing wealth through work, such as farming, extraction of raw materials or manufacturing. The lactating mother is an exceptional national resource, for not only does she process coarse cheap foods to produce a unique and valuable infant food, but also the production process (lactation) provides immeasurable benefits to health ... In contrast to virtually all processing industries, the lactating woman requires no capital outlays and the direct benefits are enjoyed uniquely and fully by the producer and her child. Mother milk production is the ultimate in economic equity, with "right-to-work" enjoyed by all, direct and immediate value to the producer and far reaching benefits affecting all of society." (Rohde 1982)

Thoughtful economists have long been aware of the limitations of conventional National Accounts in measuring economic activity and material wellbeing (Smith 1982). In principle, estimates of Gross Domestic Product (GDP) attempt to cover all transactions in economic goods and services. As early as 1941, a pioneer of national accounting, Simon Kuznets, observed that:

"Exclusion of the products of the family, characteristic of virtually all national income estimates, seriously limits their validity as measures of the scarce and disposable goods produced by the nation" (Kuznets 1941, 10).

Since the early 1970s, the conventional measure of the economy, the United Nation's System of National Accounts has come under increasing criticism for providing an inaccurate and misleading measure of economic well being (Nordhaus and Tobin 1972; Peskin and Peskin 1978; Weinrobe 1974; Mamalakis 1996[37]).

Feminist economists have also criticised the failure to include reproductive functions and breastfeeding in measures of economic value (Waring 1988).

By excluding the value of unpaid work, GDP may understate economic income and overstate economic growth. For example increased participation of women in the paid workforce over recent decades highlights the possibility of a shift in the economy from unpaid work which is not measured, to paid work which is measured. This biases estimates of economic growth upward, and gives misleading indications of economic well-being (Weinrobe 1974; Smith 1982).

As conventionally measured, GDP also overstates economic growth because present procedures count the costs of cleaning up pollution as adding to economic production, but do not discount the value of production where it results in pollution or depletion or depreciation of natural assets.

- Expenditures on remedying damage from pollution, etc, are included in GDP but are more properly measured as "defensive expenditures" (which are made to compensate for,

[37]See discussion of Zolotas (1981) and others who make various deductions from national accounting aggregates to obtain better indicators of economic welfare.

redress or guard against losses resulting from production) or degradation of the value of natural resource assets.

- The national accounts exclude the value of (non-economic) environmental assets and hence take no account of the depletion of assets such as the wilderness, air and water. However, the income received from sale of the products is included. This means the nation's economic income is wrongly estimated. Receipts from selling assets should take account of a fall in the nation's assets, not just counted as a flow of current income.
- Where production which is included in the national accounts causes pollution or damage to natural assets which is not remedied, the full resource costs of that production are not measured, so GDP overstates growth in economic welfare.

The Revised System of National Accounting (1993)

Moves have been made to respond to such criticisms. Economists attempted during the 1970s to adjust measures of Gross National Product to account for the costs of pollution in reducing "Net National Welfare" or "NNW" (Nordhaus and Tobin, 1972; Peskin and Peskin, 1978). A number of countries including Australia now publish estimates of the economic value of unpaid work (ABS 1992). In the early 1990s, work began at the ABS to estimate the value of Australia's natural resource assets and include them in balance sheet accounts (ABS 1990; Ingham 1991; Ingham 1993).

In 1993, revised international guidelines were published for National Accounting (commonly referred to as **SNA93**) (Commission of the European Communities, IMF, OECD, UN and World Bank 1993). SNA93 describes how to compile estimates of GDP, broadly comprising paid or marketable goods and services.

Like its predecessor, SNA93 excludes from the core production boundary for GDP all "own account" production of **services** within households. It recommends incorporating estimates of unpaid work, including unpaid household work (such as domestic chores and childcare) and volunteer and community work, into an expanded boundary of production through "satellite accounts". Satellite accounts are accounting statements which are separate from, but consistent with the core national accounts detailing market transactions. SNA93 makes no mention of reproductive work in either the core accounts or in satellite accounts. Reproductive work covers a range of women's activities, including childbearing, and breastfeeding.

However, SNA93 continues to include in the measured boundary of production the "own account" production of **goods** by households. This includes agricultural subsistence production, such as sowing, planting, tending and harvesting field crops; growing vegetables, fruit and other trees and shrub crops; gathering wild fruits, medicinal and other plants; tending, feeding or hunting animals mainly to obtain meat, milk, hair, skin or other products; and storing or carrying to some basic processing of this produce. The ABS already includes the value of home grown fruit, vegetables, eggs, beer, wine and meat in estimates of final private consumption expenditure and therefore GDP.

Continuing present practice, SNA93 includes in the core accounts the value of agricultural produce consumed on the farm.

This means the national accounting framework includes all non-marketed **goods**, including the production, processing and storage of food by households, within the production boundary for GDP. According to the ABS, the core accounts now include "the own account production of all goods retained by their producers for their own final consumption or gross capital formation" (ABS 1992, 6-7)

SNA93 thus places production of **services** for own final consumption within households, including breastfeeding, outside the core accounts, in satellite accounts. However, the value of breastfeeding services and human milk production can be considered separately. Human milk is a food commodity or **good**, and should therefore be included in estimates of national food production, consumption and GDP.

In one sense human milk does qualify for inclusion in the national accounts, in that it is "own account" production of a good for "own consumption". In national accounting language, it is a **good** because it can be produced, stored, sold on markets, and thus be valued (SNA93 para. 6.7).

One might argue that it does not satisfy the fundamental criteria for inclusion - that it can be traded in a market. However, it is a good, it is traded, and it can be valued:

- human milk is a commodity, like blood, sperm or human organs;
- human milk is traded, with numerous milk banks around the world buying and selling it, so there is a price of a closely related or analogous product - a shadow price - from which to impute its economic value; and
- human milk is a food commodity comparable with other home-produced and consumed goods such as on-farm production and use of milk, eggs and meat which are included in the core accounts and GDP, or artificial milk formula for infants, also included in GDP.

In another sense, breastfeeding (which includes human milk production) can be viewed as own account production of a **service** for own consumption, which is excluded from the national accounts. In national accounting language, a breastfeeding mother (the producer) is providing an output (human milk) to the consuming unit (her child). By the time the production is completed the "service" is consumed. Unlike a good, a service cannot be stored or resold; production and consumption occur simultaneously (SNA93 para. 6.3)

This means that when a mother expresses milk to feed her baby, for example in a bottle or for tube-feeding, SNA93 defines it as a **good,** but when she breastfeeds her baby, it is excluded from both the core and satellite accounts of the national accounting framework.
There is clearly a very fine line between what is a good and what is a service for national accounts purposes, particularly regarding "own-account" consumption within households. The distinction between a good and a service is controversial among national accountants.

National accounts nevertheless continue to exclude human milk. GDP estimates include the manufacture and sale of artificial formula milk, as well as expenditures on health which are needed to treat infant illnesses attributable to artificial feeding.

This practice has the startling result that increased breastfeeding and human milk production **reduces** national food output and GDP, because it lowers artificial formula sales and reduces health expenditures.

This is in spite of the substantial economic efficiency gains from using a virtually free food resource, human milk, and the resource savings from maintaining good health and reducing illness without the need for use of medical services or products.

Equally questionable is the corollary that the dramatic drop in breastfeeding rates during the 1960s and 1970s improved national output and economic growth by expanding production of formula and adding to national health expenditures. As shown in the previous section, the extent of artificial feeding in 1972 meant a loss of over $1 billion annually in the value of human milk production compared to 1992 levels, and around $5 billion annually compared to productive potential.

The ability of women to breastfeed represents a significant economic productive capacity. Because the production flow from this human capital asset is not recorded as contributing to GDP or economic well-being, it is rendered invisible to policymakers who use economic statistics and GDP estimates to determine economic priorities.

Properly applying existing definitions of the goods production boundary for GDP would mean including estimates of human milk production within the core accounts and in GDP.

For meaningful and conceptually consistent measures of economic well being, the attributable health costs of formula feeding would be deducted from measured GNP.

The estimate of unpaid work would treat the value of time spent by households nursing infant's ill from artificial feeding as a "defensive expenditure"[38] not an increase in imputed income. Costs of waste-disposal attributable to artificial feeding would be deducted from the value of GDP and counted as another "defensive expenditure". The degradation of natural (eg land) assets arising from the additional production of animal milk supplies, would be counted as an added cost of production, or as a depletion of assets as appropriate. For example, increased dairy herds to provide bovine milk supplies represents an unnecessary resource cost.[39]

[38] That is, expenditures made to compensate for, redress or guard against losses due to artificial feeding.

[39] Each dairy cow typically requires 0.77 ha of land to produce around 5000 litres of milk annually. Hence producing the 32 million kg estimated annual production of artificial formula milk powder, equivalent to 238 million litres of milk, requires the use of around 37,000 ha of Australia's prime farming land which could be used for other productive purposes.

Similarly by-products of the manufacturing process for artificial formula, and associated products, packaging, transportation, etc, will add to air and water pollution (Bundrock 1992; Radford 1992). To the extent the costs of these production "externalities" are not borne by the manufacturers, they should be treated as a cost of production or as "negative production".

That is, the economic value of human milk should be reflected in the Australian National Accounts by

- **adding** to measured GDP the annual market value of human milk produced, after
- **deducting** the goods cost of human milk production (additional food consumption for lactating mothers is already included in final consumption expenditures but should be counted as intermediate consumption).

In principle, accounting for the economic value of human milk requires adjusting for the negative externalities of artificial formula manufacture, distribution and use:

- **deducting** from measured GDP the public and private health expenditures associated with increased relative risks of infant and maternal ill heath from current levels of artificial feeding;
- **deducting** from GDP and national natural capital stock estimates, the attributable waste and degradation of economic land assets from dairy production to supply manufactured formula milks or cows milk to infants under two years old;
- **deducting** the pollution and waste disposal costs arising from artificial formula milk production, packaging, distribution, sterilisation, preparation and disposal.

A full accounting for the economic implications of breastfeeding would also be reflected in satellite accounts for household services where time assumed to be economically unproductive or unnecessary should be deducted:

- **reducing** estimates of the value of unpaid household work to reflect any additional time cost of breastfeeding compared to artificial feeding;
- **deducting** the additional home nursing and other unpaid time costs attributable to artificial formula feeding.

Capital Stock estimates

A basic building block of SNA93 is estimates of a nation's capital assets. These assets, of physical ("man-made") capital, and natural resources such as land, (along with, theoretically, human capital), produce a production and income flow. Increases in that income flow are measured as economic growth.

The capacity of Australian women to breastfeed yields a potential annual flow of economic income. Breastfeeding is a skill that is largely culturally acquired. Our society's ability to sustain breastfeeding, and therefore to maintain current or potential production levels of breastmilk and its beneficial health "externalities", depends on a supportive breastfeeding culture. This

"culture" or knowledge of breastfeeding, passed on from mother to mother, or through public education and institutional or organisational knowledge, is therefore a valuable economic asset.

To maintain consistency between estimates of annual contributions to national income from breastfeeding and estimates of the capital stock underpinning such production, it is necessary to value this underlying human capital asset.[40]

Taking the net economic value of breastfeeding of around $2 billion a year, the capitalised value of Australia's current breastfeeding capacity is around $37 billion over a 50 year time horizon, and a 5% rate of discount of future benefits.

The current value of this human capital asset is therefore comparable with the value of Telstra at around $30 billion, Australia's plantation forests ($6 billion) and its livestock ($28 billion).

The potential according to WHO criteria for optimal breastfeeding is more than three times that value. Increasing the prevalence of breastfeeding and human milk production raises the value of this capital asset towards the physiological maximum, around $100 billion, standing alongside Australia's mineral assets valued by the ABS at $145 billion in 1992.

SUMMARY AND CONCLUSIONS

> *"We have to invent wisdom for a new age. And in the meantime we must, if we are to be any good, appear unorthodox, troublesome, dangerous, disobedient to them that begat us." (Keynes, 1931)*

Human milk is important enough economically in Australia that increasing breastfeeding overshadows all government microeconomic reform measures in raising national output and living standards. Yet governments continue to devote enormous effort to reforming relatively low return sectors of the national economy (see Table 9).

Human milk production, at 33 million kg, or $2.2 billion a year, could be increased by $500 million annually (0.1% of GDP) by meeting the unambitious National Health Target for breastfeeding in the year 2000. Making human milk available to virtually all Australian infants would increase output by some $3.5 billion a year (0.7% of GDP).

[40]The conceptual basis for such a calculation is implicitly acknowledged in research by the Commonwealth Treasury on Australia's public investment performance, which suggests increased public investment in human capital in the form of certain health and education expenditures as an offset to slower expansion of public investment in physical capital in recent years (Depta, Ravalli et al. 1994).

Table 9 Micro-Economic Reform

Reform	Estimated Economic Gain
Deregulating statutory marketing for dairy producers	$50 million
Waterfront reform	$15 million
Deregulating telecommunications or public utilities	$500 million - $3 billion (0.1-0.6% of GDP) annually over 5 to 10 years[41]
Introducing a Goods and Services tax (GST)	$1 billion (0.2% of GDP)[42]
Achieving National Breastfeeding Targets	$500 million (0.1% of GDP) annually

Unlike for many other microeconomic reforms, the economic gains from increased human milk production are potentially ongoing. Unlike other efficiency boosting measures, increasing breastfeeding would improve equity, being equally possible for all mothers and babies regardless of income.

As well as being a major economic issue, infant feeding practices are significant to public health. Increasing pressures to lower health costs are leading to a focus on preventing health problems, rather than treating illness and disease after it occurs. Breastfeeding is a key preventative measure.

Making human milk more widely available would produce immense savings in national health costs, including costs met by taxpayers. Most studies of breastfeeding vastly understate its economic value because of difficulties quantifying health costs of artificial feeding.

Until now, human milk has been invisible in Australian economic statistics. This has contributed to a distorted perspective of economic reform priorities and changes in material living standards. Human milk is not counted in national production statistics, while artificial formula milks and related products are. Measures of national output also include the costs of treating illnesses which result from not breastfeeding.

If more women breastfeed, or if more babies consumed human milk instead of bovine milk formulas, measured GDP would decline. Present national accounting conventions mean the precipitous fall in human milk availability during breastfeeding declines of the 1960s and 1970s boosted economic growth in spite of representing a fall in national food production of more than

[41] IC (1995a); IC (1995b); Quiggin (1996)

[42] Chisholm 1993

$1 billion a year. These are ridiculous results and severely undermine the public credibility of GDP estimates and other economic data.

The value of human milk would be included in GDP if mothers expressed it to give to their babies in bottles or other containers. However, present national accounting conventions exclude it because most breastfeeding mothers give their babies milk in the original containers. National accountants make no attempt to estimate the value of that part of human milk production which is expressed and fed to babies in artificial containers, although this neglect appears contrary to international accounting guidelines.

Breastfeeding is an activity with elements of a "public good", with a strong tendency to be under-produced if infant feeding choice is left to market forces alone. As the Australian Panel on Marketing of Artificial Infant Formulas commented in 1994 (ADMAIF 1994):

> *"Breast milk does not have the marketing resources of commercial products. Its superior nutritional, immunological and health advantages are not well known. Industry promotion has contributed to the belief held by many health professionals that infant formula resembles breast milk so closely that it does not really matter which is used".*

There are enormous commercial pressures promoting artificial milk formulas as an alternative to breastfeeding. There is no comparable industry lobby promoting breastfeeding, or wider availability of human milk. Nor is there any powerful force redressing the negative cultural images, misinformation and mythology about human milk and breastfeeding management that became prevalent during the 1960s.

It would be a major human rights incident with significant political and legal consequences if inmates of mental institutions or residents of nursing homes were fed a diet which doubled their risk of illness, and dramatically increased their risk of cancer, diabetes, and mental disability. Yet few question even the ethics of the public sector health system tolerating, and sometimes actively defending, the provision of such a diet to Australian babies.

Making human milk more widely available to Australian babies depends on the active and energetic commitment of government and the health professions. Acknowledging the economic implications of breastfeeding should raise its priority with governments, which presently pay lip service to the value of human milk. Political leadership and commitment of resources comparable with that on the vaccination issue is necessary to overcome entrenched attitudes, widespread ignorance, and inappropriate practices which hinder breastfeeding and the consumption of human milk.

The economic case for public action could not be stronger - the existence of significant "externalities", information failure, and substantial welfare/efficiency and equity gains. But what can governments do?

Increasing breastfeeding requires a range of strategies, the first of which is to give the economic value of human milk production and breastfeeding the recognition it warrants by including it in national food production statistics. The value of breastmilk expressed by mothers should be

estimated and included in GDP, and the practice of excluding non-expressed breastmilk from both the core accounts and satellite accounts should be reviewed. This would signal to the wider community the public importance of breastfeeding, and give human milk the same statistical treatment as other food commodities. Preparing such estimates would also require the collection of comprehensive and reliable national breastfeeding statistics, presently lacking.

State governments have a major role in the provision of health services for mothers and babies. Through the Medicare agreement with the states, the Commonwealth government exerts enormous influence on these services. The Medicare agreement is presently being renegotiated for the next 5 years. An immediate first step in ensuring the wider availability of human milk in Australia would be to make Commonwealth health payments to the states conditional on all state health institutions and public hospitals:

- establishing human milk banks for all babies unable to receive their own mother's milk;[43]
- abiding by WHO guidelines barring free or subsidised supply of formula and related products to hospitals and health institutions, thereby helping to ensure a financial incentive to use human milk rather than artificial formulas;
- introducing practices which support breastfeeding by qualifying all public hospitals and maternal and infant care facilities for Baby Friendly Hospital Status under the WHO/UNICEF Baby Friendly Hospital Initiative;
- requiring the parent's specific, written informed consent to giving any formula to babies in hospital or institutional care, by introducing a consent form like that recommended by the New Zealand College of Midwives (NZCOM 1992).

The Commonwealth can also play a direct role.

- For example, it should take an active role in altering attitudes to breastfeeding by implementing and enforcing the spirit and letter of the WHO International Code on Marketing of Breastmilk Substitutes, including the promotion and supply of bottles and teats, and foods used as breastmilk substitutes, such as follow-on milks and commercial baby food, and retailers as well as manufacturers of such products. All such products should be clearly labeled to inform parents that not breastfeeding significantly increases their baby's risk of illness and hospitalisation.
- A promotion campaign to the public and health professionals akin to the vaccination promotion is also needed. Medical professionals also need an accurate and regular source of information and education on breastfeeding and breastfeeding management from sources other than commercial formula or pharmaceutical companies. Health professionals also need to be made aware that

[43] Maintaining a breastmilk bank that meets appropriate standards is one of the "Eleven Steps to Optimal Feeding in a Pediatric Unit", developed in Australia by the National Taskforce on Baby Friendly Hospitals under the auspices of the UNICEF Committee of Australia (Minchin, Minogue et al. 1996).

giving advice "*that infant formula resembles breast milk so closely that it does not really matter which is used*", could leave them open to future legal action given the existing scientific evidence on the relative health risks of artificial feeding.

- Directing its research funding to investigating the risks to infants and maternal health from not breastfeeding.

Rather than breastfeeding promotion campaigns haranguing mothers about the benefits of breastfeeding, which most mothers are aware of, policies should be developed to help women **do** it. This would help avoid the present situation where some mothers feel real grief and loss at having given up breastfeeding. Such grief produces resentment and guilt at the breastfeeding message, a reaction which is counterproductive to achieving the policy objective.

Governments could also actively support breastfeeding and availability of human milk by:

- Practical support for mothers establishing breastfeeding, including ensuring all mothers have access to the resources of community-based breastfeeding support groups such as the Nursing Mothers' Association, and perhaps providing paid home help for mothers in the early weeks after birth, as occurs in other countries such as the UK and New Zealand.
- Breastfeeding support programs developed for all mothers identified as at risk of having difficulties breastfeeding, including mothers of premature babies, some ethnic groups, adolescent mothers and mothers from lower socioeconomic groups.
- Making laws that would give mothers in the paid labour force the legal right to breastfeeding breaks as set down by ILO Convention No 103 (Maternity Protection), along with uniform national laws entrenching the legal right of mothers to breastfeed their baby including in public places. This would also influence community attitudes and provide practical support for breastfeeding.
- Ensuring entitlement to adequate paid maternity leave for at least the 12 weeks it takes to establish breastfeeding properly, to protect breastfeeding from financial pressures on families.

Government programs which increase breastfeeding are likely to produce significant economic and financial benefits, in terms of health care benefits and health cost savings. A cost utility study by Drane (1997) suggests even when a very expensive cost model is used for breastfeeding, it is still cheap compared to other interventions. Programs to increase breastfeeding among mothers of premature babies, for example, cost around $15-58 for each quality-adjusted life year (QALY) gained. By comparison, the cost per QALY gained is around $15,680 for a heart transplant, $11560 for breast cancer screening, $540 for GP advice on stopping smoking, and $440 on cholesterol and diet therapy (Drummond 1993).

Likewise, supporting establishment of a network of milk banks would make human milk more widely available where mothers are temporarily unable, or unwilling to breastfeed, and would

support continued breastfeeding. Such a market exists in many other countries, although medical indifference has delayed the development of Australian guidelines for milk bank operations, and closed Australian milk banks since the AIDS scare of the 1980s. Public support for the establishment of human milk banks in Australia should be a high priority.

Policies to support milk banking should also involve ensuring hospitals have a financial incentive to supply human milk instead of artificial formulas to babies unable to breastfeed from their own mothers.

There are obstacles to commercial research into breastfeeding or milk banking, as no particular company could expect to profit from the results of research which would quickly enter the public domain. For example, bovine milk based "fortifiers" often added to human milk for very premature babies could be replaced by fortifiers developed from human milk. Other commercial uses of human milk might also be considered. Publicly initiated and supported research to catalyse private entrepreneurship in this area would also provide high payoffs in terms of better nutrition, and lower public and private health costs.

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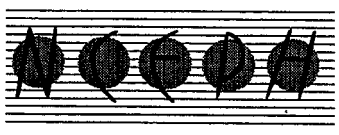

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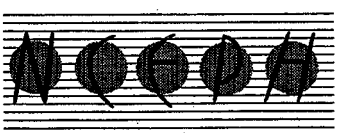

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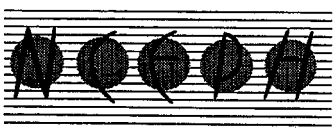

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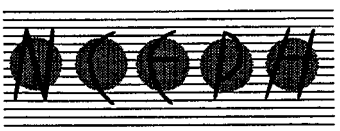

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