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MOTHERS' MILK AND MEASURES OF ECONOMIC OUTPUT

Julie P. Smith and Lindy H. Ingham

ABSTRACT

Thoughtful economists have long been aware of the limitations of national accounting and GDP in measuring economic activity and material well-being. Feminist economists criticize the failure to count women's unpaid and reproductive work in measures of economic production. This paper examines the treatment of human milk production in national accounting guidelines. Human milk is an important resource produced by women. Significant maternal and child health costs result from children's premature weaning onto formula or solid food. While human milk production meets the standard national accounting criteria for inclusion in GDP, current practice is to ignore its significant economic value and the substantial private and public health costs of commercial breastmilk substitutes. Economic output measures such as GDP thus are incomplete and biased estimates of national food production and overall economic output, and they distort policy priorities to the disadvantage of women and children.

KEYWORDS

Breastfeeding, national accounts, health, food supply and demand analysis, childcare

JEL Codes: I120, J160, E100

INTRODUCTION

Economists have long been aware of the limitations of conventional national accounts in measuring economic activity and material well-being. Feminist economists criticize the failure to count women's unpaid and reproductive work as economic production. This paper examines the treatment of human milk production in national accounting guidelines within a feminist economic framework.

In principle, estimates of gross domestic product (GDP) cover all transactions in economic goods and services.[1] As early as 1941, a pioneer of national accounting, Simon Kuznets, observed, "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" (1941: 10). Since the early 1970s, the conven-

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tional measure of economic output, the United Nations' System of National Accounts (SNA), has come under increasing criticism for providing an inaccurate and misleading measure of economic well-being (William Nordhaus and James Tobin 1971; Maurice Weinrobe 1974; Xenophon Zolotas 1983; Markos Mamalakis 1996; William Nordhaus 2000).

By excluding the value of unpaid work, GDP may understate economic income and overstate economic growth. The shift among women from unpaid work to paid work has been shown to bias estimates of economic growth upward in the United States (Weinrobe 1974) and Australia (Julie Smith 1982). GDP also overstates output in its treatment of the environment: it includes defensive expenditures on remedying or preventing pollution; it counts income from the sale of depletable resources without accounting for depletion; and it fails to account for environmental damage caused by production.

Feminists have criticized the absence of reproductive functions in these supposedly objective measures of economic value (Marilyn Waring 1988). Susan Donath (1995) attributes the invisibility of women and children in economic analysis to the intrinsic sexism of economic theory, and argues that economic theories fail to recognize the role of parental investments in children and in the reproduction of human capital and labor supply. The treatment of paid labor in the national accounting framework – as a factor of production that arises from nowhere – is a case in point.

Some efforts have been made to respond to such criticisms. In the 1970s, economists proposed to adjust GDP for the costs of pollution in the new measure called net national welfare or NNW (Nordhaus and Tobin 1971; Henry Peskin and Janice Peskin 1978). After pioneering work by Duncan Ironmonger (1989) and others, a number of countries now publish official estimates of the value of unpaid work (for example, see Australian Bureau of Statistics 1992) or the value of natural resources (Lindy Ingham 1991, 1993). Rather than extending the production boundary of GDP, alternative measures such as the genuine progress indicator (GPI) propose evaluating welfare with a package of indicators that adjust GDP for costs such as pollution (Clive Hamilton 1999; Clive Hamilton and Richard Denniss 2000). Nonmarket work has been identified as the most important area for further development of national accounting in the US, with production of human capital a high priority for including in "satellite accounts" (Michael Boskin 2000). (Satellite accounts are accounting statements that are separate from, but consistent with, the core national accounts detailing market transactions.) Pointing to the increasingly large share of economic resources devoted to education and health, William Nordhaus (1999, 2000) also emphasizes the need to value human capital properly. For example, between 1900 and 1998 in the US, the value of increased life expectancy alone equaled the growth of all other goods and services put together. Thus, proper

measurement of the value of reduced mortality and morbidity would drastically alter the measured standard of living over the last century.

Despite its substantial economic value and policy relevance, the value of women's reproductive work remains unaddressed by national accountants. Feminist economists have argued that measurement bias towards the paid economy and a prioritizing of "economic" rather than moral or social motivations can result in underinvestment in human capital and a flouting of moral obligations for ensuring children's welfare. According to Nancy Folbre:

> Both moral commitments and social norms are subject to erosion as the price of satisfying them increases. In the long run, failure to remunerate commitments to parental labor may weaken the values, norms and preferences that supply it. (1994: 88)

Because the development of children's capabilities creates a public good that cannot be priced in the market, Paula England and Nancy Folbre (1999) have argued that individuals can free ride on the efforts of parents in general and mothers in particular. Due to the interdependent nature of the paid and unpaid care economies, and the unequal sharing of the costs and benefits of children, policies that disregard parental labor risk unintended and potentially economically inefficient consequences, including the displacement or loss of unpaid caring activities. A perspective that ignores the unpaid economy is likely to distort and diminish the effectiveness of economic policy (Susan Himmelweit 2002).

A significant aspect of the unpaid economy is breastfeeding. Examining women's work in developing countries, Penny Esterik and Ted Greiner (1981) urged a radical feminist perspective calling for "cultural and institutional changes to allow women to combine their productive and reproductive lives."[2] A number of studies during the 1970s estimated the economic cost of the decline in breastfeeding in developing countries (see, for example, Alan Berg 1973 and Ted Greiner, Stina Almroth, and Michael Latham 1979). Since Waring's (1988) critique of national accounting pointed out the neglect of breastfeeding, several estimates of the economic value of human milk production have been published for developed countries, including estimates for Norway (Arne Oshaug and Grete Botten 1994) and Australia (Julie Smith 1999). In keeping with the arguments of Himmelweit (2002), Anne Hatloy and Arne Oshaug (1997) argue in their study of the value of human milk production in Mali that not reporting human milk in food statistics has important strategic consequences, affecting health and other policy decisions of relevance to the status of women and risking the loss of a very important food resource for children. Human milk production is estimated to equal 5 percent of GDP in Mali (Hatloy and Oshaug 1997) and around 0.5 percent of GDP, or 6 percent of food production, in developed countries such as Australia. Victor Aguayo

and Jay Ross (2002) estimate that in Francophone West Africa mothers add over a billion liters a year of human milk to the nation's food supply. However, the significance of breastmilk production to national food supplies and economic output is rarely acknowledged.

Most research on breastfeeding has focused on nutritional and health impacts. In recent decades, research has confirmed that artificial infant feeding in developed countries leads to significantly increased health risks. In 1997, the American Academy of Pediatrics' "Policy Statement on Breastfeeding and the Use of Human Milk" cited epidemiological research among predominantly middle-class populations in developed countries that associates children's premature weaning from breastmilk with significantly increased risk for a large number of acute and chronic diseases (American Academy of Pediatrics 1997).[3] Breastfeeding also enhances cognitive development (Alan Lucas, Ruth Morley, T. J. Cole, G. Lister, and C. Leeson-Payne 1992; Denise Drane and Jeri Logemann 2000; Pat Quinn, Michael O'Callaghan, Gail Williams, Jake Najman, Margaret Andersen, and William Bor 2001; Wendy Oddy, Garth Kendall, Eve Blair, Nicholas De Klerk, Fiona Stanley, Louis Landau, Sven Silburn, and Stephen Zubrick 2003). Because lactation hormones facilitate mother–child bonding, successful breastfeeding also contributes to secure attachments and psychological well-being (John Kennell and Marshall Klaus 1998). Breastfeeding also has long-term benefits for women's health (Miriam Labbock 1999). Recent research, for example, shows that the lack of or short lifetime duration of breastfeeding typical of women in developed countries accounts for around a third of their higher incidence of breast cancer (Collaborative Group on Hormonal Factors in Breast Cancer 2002).

Judith Galtry (1997) reviews the history of feminist debates on breastfeeding in Western countries, and identifies underlying tensions between the goal of equal employment opportunity and the need to accommodate women's reproductive capacity in the workplace. Noting the biomedical recommendations for exclusive breastfeeding to six months, and the rising labor force participation of mothers with young infants during the past decade, Judith Galtry (2002, 2003) criticizes the absence of discussion of child health and the costs and benefits of breastfeeding in debates about labor market and early childhood policy. She argues that supportive labor market policies and practices, especially parental leave provisions, are crucial in developed countries as well as in developing countries if increased breastfeeding rates are to be achieved alongside high female employment rates.

This paper complements feminist scholarship highlighting the implications of reproductive and breastfeeding work for labor market policy by providing a feminist economic perspective on the omission of breastfeeding and breastmilk from measures of economic output such as GDP. Including human milk in food balance sheets represents positive recognition of one

of women's unique contributions to society. While some may find putting a price on mothers' milk offensive, putting no price on it suggests that it has no value.

Taking Australia as a case study, we examine the treatment of human milk production in national accounting and show that human milk meets key criteria for inclusion in GDP. Using previously published estimates of the economic value of human milk supplied in Australia, we show that economic gains from increased breastfeeding are substantial. We then discuss how national accounts should be adjusted to incorporate human milk production and the externalities associated with infant feeding methods. We also estimate the capitalized value of Australia's human milk production capacity, conceptually integrating our estimates of human milk production with the building block for national accounts: national capital stock. The technical argument draws heavily on Julie Smith and Lindy Ingham (2001), but here we also explore the policy implications for women's unpaid caring and reproductive work.

We argue that by ignoring the economic value of human milk production and the health costs of artificial infant formula feeding, national accounting practices produce incomplete and biased estimates of food production, economic progress, and well-being, and they distort public policies.

THE REVISED SYSTEM OF NATIONAL ACCOUNTING (SNA93)

National accountant Richard Stone has commented that the treatment "whereby commercial products are valued at market price, government services are valued at cost and unpaid household activities are simply ignored is not a matter of principle but of practical convenience. It can be defended, therefore, only on practical grounds" (1997: 21).

The exclusion of mothers' milk from national accounts is, likewise, pragmatic rather than principled. Revised international guidelines for compiling GDP estimates, commonly referred to as SNA93, were published in 1993 (System of National Accounts 1993). These guidelines are developed through consensus by national accountants under the auspices of the United Nations. While countries are not required to comply with the guidelines, the usefulness of national accounts depends on adherence to internationally consistent rules for their preparation. The revised guidelines in part reflect the reality that the subsistence economy is large in many countries and in part reflect an acknowledgment of the economic importance of women's unpaid work in households. SNA93 now includes a category for "own account" production of goods by households, which includes agricultural subsistence production. According to the Australian Bureau of Statistics (2000b: 46), "The SNA93 suggests that, in practice,

goods produced in households for own use are to be included within the production boundary if the production is believed to be quantitatively important in relation to the total supply of those goods in the country concerned." In Australia, as elsewhere, the value of homegrown fruit, vegetables, eggs, beer, wine, and meat is included in estimates of final private consumption expenditure and therefore GDP, and in 1997, this amounted to just over A$1 billion. Like its predecessor, SNA93 excludes from the core accounts the economic value of "own account" production of services by households. Recommended for the first time, however, is the incorporation of unpaid work, including household work (such as domestic chores and childcare), volunteer work, and community work, into "satellite accounts."

The distinction between a good and a service in some areas is controversial among national accountants. Breastfeeding can be viewed as both a good and a service: the process of lactation produces a good, and nursing an infant is providing a service. One approach to valuing breastfeeding is to view it as own account household production of a service for own consumption. In that case, breastfeeding would be excluded from the core national accounts, but included in a satellite account. Viewed as a service, production and consumption occur simultaneously. This approach would value breastfeeding mothers' time and give visibility to breastfeeding in the same way as other childcare activities. Keeping breastfeeding outside the core accounts avoids the risk of making welfare evaluations based on the assumption that mothers' milk can be valued using the same *numéraire* as commercially produced baby foods.

However, breastfeeding has economic value both as a good and as a service. Consumption and production of the good, human milk, can be distinguished from provision and consumption of the service provided by the breastfeeding mother.[4] Human milk can therefore be treated as a food commodity or a good for own consumption by households. Human milk falls within the core production boundary under conventional SNA93 definitions. When a mother expresses milk to be fed to her baby in a bottle or for tube-feeding, SNA93 would define it as a good produced for own consumption within households. Despite this, and its significant magnitude compared to total production of food for babies, in practice the national accounts of all countries ignore all milk production by mothers.[5]

We argue that human milk can and should be included in the core accounts, even if most of it is not traded. A commodity like blood, sperm, or human organs can, in principle, be valued for national accounts purposes. The fundamental criterion for inclusion of a good in GDP is that it can be traded in a market. Numerous human milk banks operate around the world, and a market for wet nurses has operated for centuries (Ian G. Wickes 1953; Valerie Fildes 1988).[6] The existence of a market in human milk means there is a price of a closely related or analogous

product – a shadow price – from which to impute its economic value. At the very least, a value should be imputed in GDP for expressed breastmilk produced for own household consumption, as is done for on-farm production of goods.

Many studies estimate the economic value of breastfeeding as the monetary cost of breastmilk substitutes.[7] However, artificial formula milk is not an equivalent product to human milk and various market failures suggest its market price will underestimate the true value of human milk and breastfeeding.[8] It is preferable to explore other ways of deriving a market value for expressed breastmilk and for the services of a breastfeeding mother. Greiner, Almroth, and Latham (1979) and Julie Smith, Lindy Ingham, and Mark Dunstone (1998) show that the economic value of breastfeeding can be conceptualized as the avoided costs of formula feeding, including time, commodity, and health expenditure costs; they then develop empirical estimates for each of these costs, the former for two African countries and the latter for Australia.

Looking at breastmilk solely as a commodity, there are three conventional economic methods for valuing unmarketed products in national accounts (Australian Bureau of Statistics 1990). These are discussed in Smith (1999), a study that estimates the economic value of human milk as a food commodity in Australia. The first method, that of "opportunity cost," values products such as human blood or sperm at the time cost of extracting it. An estimate of the time cost of expressed breastmilk can be derived by estimating the time it takes to express breastmilk, including transportation or traveling costs. The second approach, that of "replacement cost," values the breastfeeding functions of the mother by estimating the cost of employing a wet nurse. The third approach, "market alternative" valuation, establishes the price of human milk prevailing in "the market," such as that supplied by human milk banks.

Human milk production in Australia in 1992 was found to be 33 million kilograms per annum, based on survey data for breastfeeding prevalence and daily milk yields for different ages of infants (Smith 1999). This quantity of human milk had a market value ranging from A$2.0–2.2 billion (US$1.5–1.6 billion),[9] depending on which approach – opportunity cost, replacement cost, or market alternative – was used.[10] That is, the production is quantitatively important in relation to the total supply of infant food, with artificial formula milk estimated to have an annual retail value of around A$135 million (Smith, Ingham, and Dunstone 1998).

Despite its problems,[11] using a market alternative valuation approach facilitates comparison with previous studies and best accords with current national accounting practices. It is also more accurate than the conven-

tional approach of valuing breastmilk at the cost of formula.[12] While the price of banked milk is high (US$50 or A$67 per liter), results from using this valuation method are consistent with results from using the replacement cost or opportunity cost approaches. For example, using a replacement cost approach (A$55 per liter), human milk production was worth A$1.8 billion. Using the opportunity cost approach, with a price of A$77 per liter, human milk production in 1992 was valued at A$2.5 billion.[13]

The value of national food output in Australia would have been A$3.5 billion a year higher (0.7 percent of GDP) if Australian infants had been fed in line with World Health Organization recommendations for exclusive breastfeeding for the first six months and continued breastfeeding along with appropriate complementary foods to the age of 2 years and beyond (World Health Assembly 2001). Extensive artificial formula feeding during the 1970s reduced Australia's human milk production by over A$1 billion a year compared to 1992 levels and by around A$5 billion annually compared to the biological potential production (Smith, Ingham, and Dunstone 1998).

ACCOUNTING FOR HUMAN MILK: IMPLICATIONS FOR CURRENT PRACTICE

The ability of women to breastfeed represents a significant economic productive capacity, yet the production flow from this human capital asset is not recorded as contributing to GDP or economic well-being, or even acknowledged as a service in the satellite accounts recommended by SNA93. Ignored as well are the health and cognitive benefits from breastfeeding, which affect the quality of the human capital stock and the productivity of the future labor force.

By excluding human milk, national accounts provide a misleading picture of national food production and consumption activities. Because breastmilk substitutes such as artificial formula milk and commercial baby food sales are included in the core accounts, GDP is apparently raised by fewer mothers breastfeeding. This drastically overstates the gain in economic welfare from the production and sale of commercial breastmilk substitutes.

The increase in GDP from including sales of formula also overstates the gain in economic welfare because it includes the value of expenditures on health services needed to treat illnesses related to formula feeding.[14] The negative externalities or health costs of inappropriate infant feeding are especially high in developing countries (Solveig Francis, Selma James, Phoebe Jones Schellenberg, and Nina Lopez-Jones 2000). Even in developed countries, the public and private health costs of premature weaning from breastmilk are substantial (Mary Broadfoot 1995; Denise

Drane 1997; Jan Riordan 1997; Thomas Ball and Anne Wright 1999; Jon Weimer 2001; Julie Smith, Jane Thompson, and David Ellwood 2002).

Present national accounting practice therefore wrongly implies that the dramatic drop in breastfeeding rates during the 1960s and 1970s improved national food output and economic growth by raising commercial baby food sales and health spending, while increases in breastfeeding during the 1980s reduced economic output.

Mothers' milk is thus rendered invisible to those who use economic statistics and GDP estimates to determine public-policy priorities.[15]

Measuring national product

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 GDP. Unpaid work estimates in the satellite accounts would also treat the value of time spent by households nursing infants ill from artificial feeding as a "defensive expenditure" deducted from the value of GDP: these activities use resources to compensate for, redress, or guard against welfare losses attributable to artificial feeding. Degradation of natural assets (e.g., land) arising from farm milk production for formula would be counted as an added cost of production or as a depletion of assets.[16] Costs of waste disposal attributable to artificial feeding would also be counted as a defensive expenditure. Similarly production externalities arising from the manufacturing, packaging, and transportation of formula and related products, which add to air and water pollution, should be included as a cost of production (Valerie Bundrock 1992; Andrew Radford 1992). On the other hand, any additional time cost of breastfeeding would be offset against the value of human milk output.[17]

To summarize, the economic value of human milk should be reflected in the 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), and
- **deducting** from GDP an amount reflecting any reduction in market output by mothers, which is necessary on account of their lactation status.

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

- **deducting** from measured GDP the public and private health expenditures associated with increased relative risks of infant and maternal ill health 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 milk or cow's milk to infants under two years;
- **deducting** from GDP the attributable reduction in labor productivity and earnings arising from formula feeding's detriment to average cognitive ability and IQ of the human capital stock and labor; and
- **deducting** the pollution and waste disposal costs arising from artificial formula milk production, packaging, distribution, sterilization, 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 by:

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

Measuring national capital stock

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

The unique biological capacity of women to breastfeed can be conceived of as a natural capital asset with a value equal to the capitalized value of its future net income stream.[18] Taking the net economic value of breastfeeding in Australia to be around A$2 billion a year and assuming a fifty-year time horizon and a 5 percent rate of discount, the capitalized value of Australia's breastfeeding capacity in 1992 was around A$37 billion. The value of this human capital asset is comparable to the value of Telstra, Australia's public telecommunications company, which is around A$30

billion (John Quiggin 1995). It greatly exceeds the value of the country's livestock (A$17.9 billion) and plantation forests (A$4.5 billion) (Australian Bureau of Statistics 2000a).

In most developed countries, including Australia, the potential economic value of human milk productive capacity is currently considerably greater than its actual level. For example, in the 1920s in Australia, around 80 percent of infants were reportedly fully breastfed at nine months (Philippa Mein-Smith 1991). According to the World Health Organization, around 95–98 percent of women are physiologically capable of breastfeeding (World Health Organization 1991). The World Health Assembly has recommended that infants be exclusively breastfed to 6 months of age with continued breastfeeding along with appropriate complementary foods to around 2 years or longer (World Health Assembly 2001). At these recommended optimal rates of breastfeeding, the value of human milk production in Australia would be around A$100 billion, nearly three times its current level (Smith 1999) and comparable to the country's subsoil mineral assets, valued officially at around A$152 billion (Australian Bureau of Statistics 2000a).

The above capital stock value estimates are in gross terms, that is, they ignore depreciation of the asset. Physical assets are usually depreciated at a rate that reflects the economic life of the asset. In principle, the economic life of the asset represented by women's biological capacity to produce human milk is indefinite. However, gaining the benefit from this breastfeeding asset requires skill and knowledge that is largely culturally acquired, mother to mother, or through public education and institutional or organizational channels. The ability of any society to maintain current or potential production levels of breastmilk depends on a supportive breastfeeding culture and institutions. Whether Australian breastfeeding capital (or that of any society) is used to its full capacity in nourishing children or whether its value depreciates depends on whether institutional arrangements and cultural values or practices support or undermine breastfeeding. The difference between the potential A$100 billion value of Australia's breastfeeding capital stock at biological maximum production and the estimated current value of A$37 billion reveals the extent to which this important component of natural capital is depreciated or under-employed.

Breastfeeding reduces risks to the long-term health of both mother and child and therefore contributes to a healthy labor force, protecting economic productive capacity through its effects on the quality of the human capital stock, labor force productivity, and economic output.

In addition, high-quality experimental and cohort studies have found artificial formula milk feeding to be associated with an average IQ disadvantage of around 3–7 percent (Lucas *et al.* 1992; Drane and Logemann 2000; Quinn *et al.* 2001; Oddy *et al.* 2003). Many labor market

studies show a positive link between IQ and adult labor market productivity and earnings. This is an important area for future economic research.

POLICY IMPLICATIONS AND CONCLUSIONS

Jon Eliot Rohde writes in his study of mothers' milk in Indonesia's economy:

> 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 labor 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. Mothers' 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. (1982: 166)

Recognizing the economic value of women's nonmarket production is an essential counterpart to enhancing women's economic and social status including through labor market access and employment equity. This article has applied conventional economic logic and officially accepted principles of national accounting to the measurement of human milk production. It has shown that current national accounting practice, which supposedly includes all goods within the "core" production boundary for the national accounts, excludes breastmilk production and its consumption by infants. Even expressed breastmilk, the part of human milk production that is expressed and fed to babies in artificial containers – and is thus completely "commodified" – is presently not counted in GDP. This is despite official imputations being made for comparable goods that are quantitatively important and produced and consumed on-farm but not actually marketed. The treatment of breastmilk is inconsistent with current international guidelines for national accounting, SNA93, and with the Australian Bureau of Statistics' accepted practices. We have shown that because human milk is a commodity that can be stored, marketed, and traded, SNA93 guidelines would mandate that all production of human milk be included in core national accounts. While an argument can be made for also valuing breastfeeding as a service, its value as a food commodity can be accounted

for separately, and the economic value of breastfeeding services is not presently accounted for in SNA93 satellite accounts.

Using the logic of SNA93 and using existing published estimates of the value of human milk supply in Australia, we have shown that large economic gains might be achieved through increased goods production if breastfeeding of infants were more widespread. Exclusion of human milk production distorts the view of economic activity provided by the national accounts and GDP because it significantly mismeasures food production and consumption, and wrongly counts as economic gain the healthcare expenditures associated with consumption of breastmilk substitutes. As a result of excluding human milk production, current national accounting practices measure the precipitous fall in human milk supply during the 1960s and 1970s as a boost to economic growth, despite the fact that it actually reduced national food production (in Australia by more than A$1 billion a year) and infant nutrition and health status. At present, measures of national economic output show a decline if more babies are breastfed and a rise if commercial baby foods displace breastfeeding. These are ridiculous results and severely undermine the public credibility of GDP estimates and other economic data.

Human milk is important enough economically that increasing breastfeeding prevalence would overshadow all government microeconomic reform measures in Australia in raising national output and living standards (Smith, Ingham, and Dunstone 1998). Unlike gains from many other microeconomic reforms, the economic gains from increased human milk production are potentially ongoing. Unlike many efficiency-boosting measures, increasing breastfeeding has the potential to directly improve equity, being equally possible physiologically for virtually all mothers and babies regardless of income (World Health Organization 1991).[19]

Identifying the substantial economic implications of breastfeeding should raise its priority with governments. The economic case for public action to promote, encourage, and support breastfeeding is strong given the existence of significant "externalities," information failure, "agency" problems, and substantial welfare/efficiency and equity gains (Julie Smith 2004).

Over twenty years ago, governments agreed that usual marketing practices were "unsuitable" for breastmilk substitutes because of the risks of inappropriate feeding practices, and they ratified an international agreement on rules to protect breastfeeding against unethical marketing (World Health Organization 1981: 12). But the WHO International Code of Marketing of Breastmilk Substitutes has not prevented the vigorous promotion and sale of artificial milk formulas and commercial baby foods, such as cereals and other weaning foods, that compete with exclusive and ongoing breastfeeding (Gabrielle Palmer 1988; Naomi Baumslag and Dia Michels 1995). The unregulated growth of this market has created a visible

and influential industry lobby that prevents effective implementation of the WHO Code and promotes commercial infant foods at the expense of breastmilk feeding. Notwithstanding the efforts of volunteer breastfeeding support groups in some countries, or the growing number of lactation consultants with a professional interest in breastfeeding promotion, there is no comparably funded industry lobby developing the market for breastfeeding or promoting the wider availability of human milk.

Likewise, Galtry's (2002, 2003) comparison of labor market policies in Sweden, the United States, and Ireland has shown the invisibility of mothers' milk in labor market and childcare policy. Perusal of a recent study on childcare and labor market policies confirms this invisibility (OECD 2002). Protecting the value of a country's breastfeeding capital, or ensuring its full utilization, is not without cost. A wide range of institutional, health, or labor market policy changes are necessary to protect and promote breastfeeding. This necessity is recognized by action plans adopted by countries such as the United States (2000) and New Zealand (2002) and recommended for Australia (2004). Urbanization and industrialization can produce a conflict between employment institutions and breastfeeding. Wider opportunities for paid employment can raise the opportunity costs of breastfeeding unless labor market institutions adapt to the needs of new mothers. The economic cost of maintaining a country's human milk productive potential is difficult to estimate and will vary across countries. Some countries, for example, may need to provide "interventions" such as breastfeeding support services, lactation consultants and peer counselor programs, and breastfeeding education. Regulation of labor and product markets necessary to protect and support breastfeeding also has some economic cost. The cost-effectiveness of such breastfeeding promotion and support programs will determine the overall economic gain from a wider prevalence of breastfeeding.

However, unless the nutritional and health value of breastfeeding is clearly visible to policy-makers, and its policy priority raised, inferior commercial substitutes, resulting from economically detrimental competition in both product and factor markets, will displace women's economic contribution and their production of this unique food and "broad spectrum medicine" (Doren Fredrickson 1995).

As Esterik and Greiner (1981) and more recently Galtry (1997) have highlighted, the additional health risks of group childcare for infants and the absence of maternity protection provisions for breastfeeding suggest the need to re-evaluate labor market and childcare policies affecting mothers of infants. The increasing market rewards for women in the workplace need to be matched by appropriate financial rewards and social protection for the breastfeeding mother's nonmarket production. In particular, this finding suggests the importance of adequate paid maternity leave and workplace support for breastfeeding if the health and well-being

of mothers and babies is to be protected without hindering improved gender equity.

In Australia, for example, measures to support increased breastfeeding have had a low priority with economic policy-makers, despite evidence that the potential economic output gains are comparable with those from major recent reforms, such as the introduction of a goods and services tax or deregulation of telecommunications (Smith, Ingham, and Dunstone 1998), and that the hospital system costs of premature weaning from breastmilk are high (Smith, Thompson, and Ellwood 2002). Viewing households only as consumers rather than as producers of an economically valuable food means that current policy in Australia imposes goods and services tax on breastmilk through a tax on breast pumps, but grants a tax concession to the manufacture and sale of commercial baby foods and milks (Julie Smith 2000).[20] Since the early 1970s, major developed countries have provided substantial fiscal subsidies to maintain highly visible farm sector production of commodities such as milk, sugar, wheat, and wine, yet gave no economic importance to the substantial but unrecorded decline in production of human milk during the 1960s (Berg 1973).

These examples highlight that breastfeeding will not receive the importance it warrants in the formulation of economic, fiscal, labor market, and preventative health policy unless its value is measured in mainstream national and international economic statistics. The invisibility of human milk and breastfeeding reinforces a perspective that undervalues nonmarket activities relative to market activities. This distorts public policy in a way that disadvantages women and children's health and well-being. Including human milk in food production statistics emphasizes the extent of breastfeeding and its value to societies as well as to economies. It would also improve the quality of economic policy-making and help prevent policies from being distorted by a narrow focus on market production and commerce.

Julie P. Smith, National Centre for Epidemiology and Population Health, and Economics Program, Research School of Social Sciences, Australian National University, Canberra, ACT 0200, Australia
e-mail: julie@coombs.anu.edu.au

Lindy H. Ingham, Australian Institute of Health and Welfare, GPO Box 570, Canberra, ACT 2601, Australia
e-mail: ingham@pcug.org.au

NOTES

[1] The term gross domestic product (GDP) used in this paper is interchangeable with gross national product (GNP) for most countries. The main difference is that GNP

adjusts for income earned or remitted overseas. National accounting practice is moving to the use of GDP.

[2] Such changes included attention to working conditions affecting women's ability to combine breastfeeding and work, such as maternity leave and benefits, nursing breaks, and childcare facilities.

[3] This research points to "strong evidence that human milk feeding decreases the incidence and/or severity of diarrhea, lower respiratory infection, otitis media, bacteraemia, bacterial meningitis, botulism, urinary tract infection and necrotizing enterocolitis." The American Academy of Pediatrics (AAP) also cited a number of studies of human milk feeding showing a possible protective effect against sudden infant death syndrome, insulin-dependent diabetes mellitus, Crohn's disease, ulcerative colitis, lymphoma, allergies, and other chronic digestive diseases. Since the AAP study, several important, high-quality epidemiological studies have provided further evidence of the health risks of artificial formula feeding, including long-term risks of obesity, high blood pressure, and heart disease as well as pneumonia, gastroenteritis, respiratory illness, allergies, and necrotizing enterocolitis.

[4] One argument is that the economic value of breastfeeding as a food commodity derives from the nutritional and immunological (biochemical) properties of human milk (Clemens Kunz, M. Rodriguez-Palmero, Berthold Koletzko, and Robert Jensen 1999) and that breastfeeding contributes to the quality of childcare services by enhancing mother–child bonding, security, and attachment (Kennell and Klaus 1998) and advancing jaw and speech development (Miriam Labbock and G. E. Hendershot 1987).

[5] Countries where human milk banks operate are an exception. Here, however, SNA93 would count human milk as the value of production by milk banks, or equivalently what is expended on the milk by households, rather than as a transfer of economic value by households producing and donating a food product to milk banks.

[6] Information on the operation of human milk banks in North America, Europe, and Asia is provided in the following: Mary Rose Tully (1991); Armida Fernandez, Jayshree Mondkar, and Ruchi Nanavati (1993); Lois Arnold (1994, 1996); Skadi Springer (1997); D. Gutierrez and J. A. de Almeida (1998); Human Milk Banking Association of North America (2003); United Kingdom Association for Milk Banking (2004).

[7] For example, to estimate the cost of replacing human milk from recent declines in breastfeeding in Chile, Kenya, Singapore, and the Philippines, Alan Berg (1973) used data on breastfeeding prevalence to estimate national human milk output. He then measured its economic value using a price of US$240 per ton of formula. The study by Ted Greiner, Stina Almroth, and Michael C. Latham (1979) for Ghana and the Ivory Coast estimated the value of national human milk production by calculating the local cost of the formula and bovine milk that would be necessary to provide the equivalent caloric value if breastfeeding mothers switched to artificial feeding. Likewise, Jon Eliot Rohde (1974) used the avoided cost of purchasing cow's milk for Indonesia's 1- and 2-year-olds to calculate that the value of extended breastfeeding equaled 80 percent of the country's health budget.

[8] The market price of artificial formula milk will be an underestimate of its true price unless consumers possess perfect knowledge about the nutritional and health impacts of not breastfeeding and make informed choices; the infants' feeding "preferences" are meaningful, forward looking, and faithfully reflected in decisions taken by their caregivers; and there are no societal "externalities" in the production or consumption of breastmilk. Many health risks of not breastfeeding are borne by the community (and the infant), not the parent. Gaps or time lags in accumulation of knowledge about the adverse health and development consequences of formula feeding mean that the market price will understate the true cost. The mother or

caregiver, as "agent" for the baby, may also not properly reflect the infant's preferences or "willingness to pay" in her purchasing decisions. On the other hand, the price of formula may be inflated by the market power of commercial baby food companies. But given that the health costs of formula feeding are very large, it is more likely that the market price of artificial formula understates its economic cost than overstates it.

[9] All exchange conversions in this study are at a rate of A$1 = US$0.75.

[10] The preferred estimate, using the market alternative approach, is based on the value of human milk traded by milk banks in Norway of US$50 per liter (Oshaug and Botten 1994). A similar figure resulted from using alternative valuation approaches (Smith 1999). The economic value of breastfeeding also depends on how the time and commodity cost of breastfeeding is assessed. For example, breastfeeding mothers may consume more food, or formula feeding may reduce the time she needs to spend with her infant. For a full discussion of these issues and estimates based on time-use surveys of infant feeding and lactation energy needs, see Smith, Ingham and Dunstone (1998).

[11] For a discussion of valuation issues, see Smith (1999: 76–80), which acknowledges that the price of banked milk reflects the costs of supply and the particular economic and institutional characteristics of a small and restricted market.

[12] Using this method, Smith (1999) could compare estimates of the value of Australia's human milk production with those for Norway for the same year. While the price of expressed breastmilk used in the study has some practical and conceptual problems, it is a more accurate representation of the economic value of human milk than the price of formula: the price that health providers will pay for human milk is likely to reflect a relatively informed view of its health benefits. The market alternative method is also most consistent with national statistical procedures for valuing market production, and results can be directly compared with national accounting aggregates such as GDP (Australian Bureau of Statistics 1992) and with estimates of the economic value of unpaid work in accordance with the international convention for "satellite accounts" of unmarketed household production (Australian Bureau of Statistics 1990).

[13] For replacement cost valuation, the study used the official wage for childcare workers in Australia in 1992 of around A$13 per hour. The cost of employing three such workers for an eight-hour day and estimates for a wet nurse's average daily milk production per shift of 1.875 liters (Wickes 1953) implied an approximate cost per liter of replacing mothers' milk of A$55. For the opportunity cost estimate, the study took the wage rate of A$11.16 per hour to approximate the value of nursing mothers' time; this is the wage rate used by the Australian Bureau of Statistics (1992: 23) for valuing "other housework." In this case, the shadow price for donated human milk in Australia would be around A$75 per liter. For detailed discussion of these assumptions, see Smith (1999: 79–80).

[14] While there are welfare gains from treating illness, the high resource costs of treatment make this an inefficient way of achieving good health compared to prevention through human milk feeding.

[15] While risks of toxins in breastmilk, HIV infection, or drug use do not generally override health recommendations for exclusive breastfeeding, acknowledging women's milk productive capacity as an asset also reinforces the economic harm from environmental damage and public health problems.

[16] For example, an increase in dairy herds to provide bovine milk supplies represents an unnecessary resource cost. In Australia, each dairy cow typically requires 0.77 hectares of land to produce around 5,000 liters of milk annually. Hence replacing the 32 million kilograms estimated annual production of human milk with artificial formula

milk powder, equivalent to 238 million liters of milk, requires the use of around 37,000 hectares of prime farming land, which could be used for other productive purposes.

[17] Many mothers combine continued lactation with paid employment, especially those with sufficient maternity leave to allow proper establishment of lactation, those with flexibility in their working arrangements and/or in their timing of return to work, or those with an older baby requiring less frequent milk feedings. However, there is clear evidence that a return to work before six months reduces the average duration of breastfeeding (see Judith Galtry 2002 for a succinct review). Galtry points out that inequality in access to either family or medical leave is a barrier to increased breastfeeding rates in the United States, while welfare reform, which forces lone mothers back into the workforce soon after birth, further reduces breastfeeding among lower income and disadvantaged groups. For mothers who wish or are compelled to return to work soon after childbirth, workplace measures (such as "phasing back," part-time work, shorter working days, and flexitime) are also necessary to allow integration of work and family commitments.

[18] The conceptual basis for such a calculation is implicitly acknowledged in research by the Australian Treasury on the nation's public investment performance (Peter Depta, Frank Ravalli, and Don Harding 1994), which proposes that increased public investment in human capital through certain health and education expenditures be seen as an offset to the slower expansion of public investment in physical capital in recent years.

[19] Realizing this potential gain, however, would require institutional and policy change to ensure that mothers in disadvantaged socio-economic groups have comparable access to breastfeeding support and flexible employment. Although rural poor mothers in developing countries are more likely to breastfeed than urban middle-class mothers, the reverse is generally true in Australia (Susan Donath and Lisa Amir 2000).

[20] The newly introduced goods and services tax (GST) applies to the hire or sale of lactation aids such as breast pumps, which are used by employed mothers, those with premature babies, or those with breastfeeding problems to maintain the production of milk for their babies, or by some mothers to donate milk for others. That is, expressed human milk is "input taxed." On the other hand, commercial baby foods and formulas are free of GST at all stages of production and sale. Baby food and formula manufacturers can also claim input tax credits for GST against GST paid on-farm milking machinery or infant food manufacturing equipment.

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